PKVY Seed Project

TECHNOLOGY INVENTORY - II

AGROTECHNOLOGIES




Edited by

S.V.Sarode
P.G. Ingole
A. H. Nagone
S.G.Wankhade

DIRECTORATE OF RESEARCH
DR. PANJABRAO DESHMUKH KRISHI VIDYAPEETH, AKOLA
P.O. Krishinagar, Akola 444 104 (M.S.)
www.pdkv.ac.in

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S. V. Sarode
Ex. Director of Research

P. G. Ingole
Director of Research

A. H. Nagone
Asstt. Director of Research

S. G. Wankhade
Associate Director of Research

DIRECTORATE OF RESEARCH
Dr. Panjabrao Deshmukh Krishi Vidyapeeth,
P.O. Krishi Nagar, Akola - 444 104 (M.S.)

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Dr. R. G. Dani
Vice Chancellor
Dr. PDKV, Akola

FOREWORD

Research and technology development have been the foundation of impressive productivity gains in the agricultural sector. In fact innovations in agricultural science and technology have made possible the reality of Green Revolution. Many technologies, already developed and being developed, have the potential, not only to further increase farm productivity but also to reduce the environmental and resource costs associated with agricultural production. Dr. Panjabrao Deshmukh Krishi Vidyapeeth through 16 Subject Matter Divisions, 19 Agriculture Research Stations, 25 All India Co-ordinated projects has developed, over a period of time, a large number of agricultural technologies. These include technologies that enhance agricultural crop/livestock performance, conserve land and water, protect environmental quality, increase yields with the same or fewer inputs, focus on post harvest process, value addition, unconventional energy use, socio-economic aspects etc. This compendium presents information on about 415 technologies with 1-2 pages, 425 recommendations released by the university. Presentations made in this document convey the best-bet agricultural technologies and approaches generated through efforts of research networks, programmes and projects. In fact, these agricultural technologies have emerged as a key differentiator of the farming occupation in Vidarbha region, helping to deliver higher yields and greater consistency in farming outcomes across the region. Besides the farmers, the compendium of technologies enable interface between the University, farmer entrepreneurs, agro industries and other related agencies for enhanced technology transfer surely to improve the agricultural scenario in the region.

Continuous efforts put forth by many scientists over the years have enabled development of these technologies. Nevertheless, it should not be summed to be complete, because more technologies would be required to develop to suit new need based situations of agriculture in the region. I am sure that scientists of this University will continue to strive hard in this direction for the benefit of the farming community and other beneficiaries in the years to come. I am sure that the compendium will be well welcomed by all individuals and institutions interested in field worthy technologies for the benefit of the farmers, entrepreneurs and consumers to increase agricultural production, productivity and income. I appreciate efforts put in by Dr. S.V. Sarode, Director of Research and all the scientists who have contributed towards collection and collation of this valuable information.

R. G. Dani

Dr. S. V. Sarode
Director of Research
Dr. PDKV, Akola

PREFACE

The multi-faceted integrated research and development efforts of Dr. PDKV always aimed at developing need specific, area-specific, crop specific suitable agricultural technologies aimed to enable the farmers improve their farming methods and boost agricultural production. Hitherto number of improved agricultural technologies have been developed and effectively transferred by the University. There has been a need to have a compendium that presented the best bet agricultural technologies developed under the aegis of the University to the farmers, farm entrepreneurs, agro industries, developmental agencies and individuals. Thus this compilation depicting agricultural technologies evolved at the University level, it represents a collection of related 425 technologies and approaches that are available for uptake, transfer and even upscaling to improve agricultural productivity and livelihoods. The technological abstracts, which have been grouped into different thematic clusters, give brief introductory account of the technology, its area of application and advantages to the intended end-users.

Production technology cluster describes improved agricultural practices for enhanced performance of field crops including horticultural crops and medicinal plants. The technologies cover areas such as improved sowing/planting/grafting techniques, water and soil fertility management, weed management and the proper use of improved crop varieties within the context of cropping system. The cluster on Soil Science focus on soil quality and nutrient management , amelioration of problem soils, use of sewage water and improved composting methods. Forestry cluster has approaches for developing teak based plantation and wasteland aforestation. Under plant protection cluster (Entomology and Plant Pathology) technologies focus on new chemical molecules, ecofriendly and biological management of pests, and mass production technology of bio-pesticides and biofertilizers. Animal Husbandry and dairying presents technologies for improvement in quality of cattle feed, quality and quantity of milk and value addition of dairy products. Seed Technology cluster has approaches for better seed germination and seed quality, safe processing, better grading and storage of crop seeds. Agricultural engineering cluster focuses on technologies for improved tillage, planter, inter-row cultivator, micro-irrigation, harvester, post harvest process and *in-situ* soil and water conservation measures. The Social Sciences mainly focus on yield and price risk in crop production and social security, and economics as related to farming system and credit system.

I deeply appreciate the concerted efforts and technical help rendered by all scientists towards this publication. Comments and suggestions to further improve the quality of document are welcome. This publication would not have been possible without the painstaking efforts of the staff members of this Directorate of Research. Lastly, I appreciate the efforts of all the contributors to this valuable publication and hope the compilation will serve the agriculture in a better manner.

The financial assistant provided for publication of this book from the grants of Rashtriya Krishi Vikas Yojana is greatfully aknowledged.

S. V. Sarode

CONTENTS

FIELD CROPS

Production Technologies

Name of Technology	**:**	**Optimization of sowing time**
Crop	**:**	**Cotton**
Background	:	Among the various production factors of cotton, sowing at proper time is most important. Maximum area of cotton is under rainfed and only limited area is under irrigation. Determination of optimum time of sowing of pre-monsoon cotton is necessary to obtain higher seed cotton yield and better use of available irrigation water.
Recommendation	:	It is recommended that pre-monsoon cotton should be sown in last week of May (25 -30) for higher seed cotton yield in Vidarbha
Year of Release	:	1984
Applications	:	Availability of irrigation water in the month of May .
Advantages	:	• Higher yield • More net returns • Better and efficient use of available water • Provides the work to the labours

Name of Technology	**:**	**Proper time of fertilizer application**
Crop	**:**	**Cotton**
Background	:	For a healthy growth and better yield, cotton crop needs timely and sufficient supply of essential nutrients. Optimum nutritional requirement of cotton is of primary importance to boost up its production. Generally, farmers avoid basal application of fertilizers and apply it after emergence of crop. If fertilizer applications are properly timed, more nutrient is available for use when crop requirements are highest. Properly timed nutrient applications have the potential to increase yields and economic returns. Because, fertilizer is also a costly input and scarcely available in the market. Hence, it is felt necessary to find out proper time of fertilizer application in cotton crop for better yields and economic returns.
Recommendation	:	Recommended dose of fertilizer should be applied as basal for higher seed cotton yield. If application is delayed by 15 and 30 days, there was reduction in yield by 6.0 and 14.3 per cent respectively.
Year of Release	:	1990
Applications	:	Rainfed cotton in medium black soil
Advantages	:	• Higher seed cotton yield • Saving in cost of cultivation • Increase fertilizer efficiency

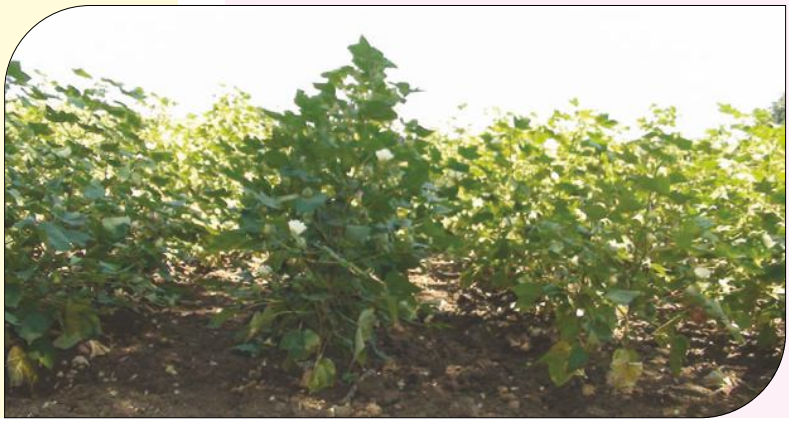
Name of Technology	:	**Better method of fertilizer application**
Crop	:	**Cotton**
Background	:	For hybrid cotton quantity of fertilizer applied is more as compared to varieties. As fertilizer is a costly input, maximum fertilizer use efficiency should be the target for high economic returns. Among agronomic practices that influence the efficiency of applied fertilizer, time and method of application are critically important. Hence, various methods of fertilizer application (broadcasting, ring method and spot application at three places near plant) were evaluated to find out the best method of fertilizer application.
Recommendation	:	Fertilizer application by ring method or spot application at three places is recommended for obtaining 12.2 and 10.5 per cent higher yield respectively as compared to broadcasting method
Year of Release	:	1990
Applications	:	Suitable for hybrid cotton in medium black soil
Advantages	:	• Increase efficiency of fertilizer • Higher seed cotton yield • Precise application

Name of Technology	**:**	**Plant spacing for arboreum spp.**
Crop	**:**	**Cotton (Deshi)**
Background	:	Deshi cotton is grown on about 3 to 4 lakh ha area. It is deep rooted and suitable for medium to heavy soil under rainfed condition. Due to short supply of such cotton, the offered market support price has been comparatively more. Plant population has been identified as one of the major factors governing the productivity level in cotton. Therefore, optimization of plant population is primary under agronomic evaluation for obtaining higher yield from arboreum varieties.
Recommendation	:	Sowing of arboreum cotton at 60x15cm is recommended for getting maximum seed cotton yield under rainfed condition.
Year of Release	:	1994
Applications	:	Suitable for medium to deep soil under assured rainfall zone
Advantages	:	• Higher yield of deshi cotton • Saving of seed • Stability in yield of deshi cotton .

Name of Technology	**:**	**Fertilizer requirement for seed production**
Crop	**:**	**Cotton (Seed production)**
Background	:	Yield potential of hybrid cotton is more than straight varieties. Cost of seed production is higher in conventional hybrid seed. As such imbalanced crop nutrition is among the major causes of low cotton productivity under rainfed condition. Optimization of fertilizer nutrients would allow better crop nutrition and hence higher yield level.
Recommendation	:	A fertilizer dose of 100:50:50 NPK kg/ha is recommended for getting maximum seed production of CMS based hybrid.
Year of Release	:	1994
Applications	:	Suitable for medium to deep soil under assured rainfall
Advantages	:	• Higher seed production of hybrid cotton • Saving in cost of seed production • Saving of chemical fertilizer

Name of Technology	**:**	**Intercrops for maximization of production**
Crop	**:**	**Cotton (Deshi cotton)**
eshi cotton)		
Background	:	Average yield of deshi cotton is low as compared to hirsutum cotton. Its cost of production / unit area is less hence, growing of deshi cotton on medium black soil is profitable to marginal farmers. Deshi cotton variety AKA-8401 is long duration and has very good yield potential. Initial growth rate of deshi cotton is slow as compared to hirsutum cotton. Therefore, it is better to adopt intercropping in deshi cotton for obtaining maximum yield and net returns/unit area. Oilseed and legumes crop viz. groundnut, soybean, greengram and blackgram were studied as intercrops.
Recommendation	:	Sowing of green gram and black gram as intercrop in wider spacing (90 x 20 cm) of deshi cotton variety AKA- 8401 are recommended for maximization of production and net returns under rainfed condition
Year of Release	:	1994
Applications	:	In medium deep black soil for marginal farmers
Advantages	:	• Higher yield potential/ net returns • Stability in yield • Efficient use of available resources

Name of Technology	**:**	**Spacing and fertigation for PKV Rajat**
Crop	:	**Cotton**
Background	:	Cotton Research Unit Akola had released a genotype PKV Rajat (Straight variety) for rainfed condition in Vidarbha region. It is resistant to sucking pest and having good yield potential with high ginning percentage (38-39%). For obtaining maximum yield from this variety, its agronomic package of practices need to be optimized.
Recommendation	:	It was recommended that the hirsutum cotton variety PKV Rajat should be sown at 60 x 30 cm (55,555 plants/ha) spacing with 50:25:0 NPK kg /ha for getting maximum yield under rainfed condition.
Year of Release	:	1995
Applications	:	Rainfed condition in medium black soil
Advantages	:	• Higher seed cotton yield • Saving of cotton seed • Saving of fertilizer



Name of Technology	**:**	**Optimization of plant density and fertilizer**
Crop	**:**	**Cotton**
Background	:	Plant density is an important factor in hybrid cotton. The seed cotton yield is directly related to plant population per unit area. Number of hirsutum hybrids has been released by different private and public sector. The optimum row to row and plant to plant spacing depends upon the growth habit of cotton plant and soil type. To find out optimum spacing for hybrids an experiment on CMS cotton hybrid was conducted at Cotton Research Unit, Akola.
Recommendation	:	Sowing of cotton at 60 x 60cm with fertilizer dose of 50:25:25 NPK kg/ha are recommended to hirsutum cotton hybrid under rainfed condition.
Year of Release	:	1998
Applications	:	Suitable to medium black soil
Advantages	:	• Higher yield with optimum fertilizer dose. • Efficient use of land and fertilizer

Name of Technology	**:**	**Suitable variety of cotton for shallow soil**
Crop	**:**	**Cotton**
Background	:	Number of cotton varieties is available in the market for rainfed condition .There is no recommendation of variety as per soil type. Most of the farmers sow cotton under shallow soil. If long duration varieties are grown on shallow soil, there may be drastic reduction in yield due to less availability of moisture at later critical stages. Hence, it is necessary to find out a variety of suitable duration for shallow soil.
Recommendation	:	Dwarf and early variety AKH-081 is most suitable for shallow soil for obtaining better yield.
Year of Release	:	1998
Applications	:	Suitable for shallow soil
Advantages	**:**	• Most suitable variety for shallow soil • Higher seed cotton yield on shallow soil

Name of Technology	**:**	**Intercropping in hirsutum cotton**
Crop	**:**	**Cotton**
Background	:	Yield stability in seed cotton yield is not often obtained due to erratic and uneven distribution of rainfall. Low average yields necessitate developing an intercropping technology for increasing net income per hectare without doing much damage to the base crop. It is better to sow cotton with intercrops instead of sole crop for stability in yield and higher monetary returns. The magnitude of the agro-economic advantages depends upon the type of intercrop and potential intercrops include blackgram, greengram and soybean.
Recommendation	:	For obtaining higher gross monetary returns per unit area the intercrops greengram and blackgram in hirsutum cotton are recommended.
Year of Release	:	1998
Applications	:	Suitable for medium to deep soil under assured rainfall zone
Advantages	:	• Higher yield • Better use of natural resources. • Higher monetary returns per unit area • Improves soil fertility

Name of Technology	:	**Foliar application of nutrients**
Crop	:	**Cotton**
Background	:	Productivity of rainfed cotton in Maharashtra State is low mainly due to non availability of nutrients at proper time. Top dressing in cotton is not feasible at critical stages of cotton due to less moisture content in soil. Remarkable reduction in crop yield was noticed, if top dressing is not done. Some times top dressing may not be effective because the nutrients cannot reach the active root zone of crop due to inadequate soil moisture status. Foliar application of nutrient seems to be an alternative substitute to fulfill the nutrient requirement of crop. It is necessary to evaluate the efficacy of nutrient through foliar spraying on yield of cotton.
Recommendation	:	Foliar spraying of 2% urea and 2% DAP at 45 and 75 DAS is recommended for higher yield under rainfed condition.
Year of Release	:	2000
Applications	:	Rainfed as well as irrigated conditions.
Advantages	:	• Increase in seed cotton yield • Balanced nutrition • Saving of fertilizer • Stability in yield under rainfed condition

Name of Technology	**:**	**Intercropping for sustainable yield**
Crop	**:**	**Cotton**
Background	:	The rainfall distribution during *kharif* season is uneven and erratic in nature which adversely affects the seed cotton yield under rainfed condition .About 30% area of cotton is under shallow soils which has low average yield per hectare. To obtain the sustainability in yield and high returns, it is necessary to find out suitable intercropping system under rainfed condition. Green gram, blackgram and soybean crops are potential intercrops in cotton with different planting patterns.
Recommendation	:	Sowing of blackgram and greengram as intercrops in early dwarf cotton variety AKH-081 are recommended to get higher monetary returns.
Year of Release	:	2001
Applications	:	Suitable for shallow soil
Advantages	:	• Higher total productivity on shallow soil • Yield stability under rainfed condition. • Better use of available natural recourses

Name of Technology	**:**	**Optimum spacing and fertilizer for deshi hybrid**
Crop	**:**	**Cotton (Deshi hybrid)**
Background	;	Deshi cotton is deep rooted and well suited for medium to heavy soil under rainfed condition. Among deshi, only varieties are available for cultivation. Recently in deshi cotton, hybrids have been released like hirsutum cotton which has very good yield potential with desirable fibre properties. It was felt necessary to find out suitable spacing and fertilizer to exploit full yield potential of the hybrids.
Recommendation	:	Sowing distance of 60 x 45 cm (37037 plant/ha) and a fertilizer dose of 50:25:25 N PK kg/ha are recommended to deshi cotton hybrid PKDH-1 for getting maximum seed cotton yield under rainfed condition.
Year of Release	:	2002
Applications	:	In medium deep soil in deshi cotton tract
Advantages	:	• Exploit yield potential of deshi hybrid • Efficient use of land • Efficient use of available resources • Saving of seed and fertilizer

Name of Technology	**:**	**Foliar application of nutrients**
Crop	**:**	**Cotton**
Background	:	Application of nutrients through soil is the best method for obtaining higher yield and better use efficiency. Cotton is long duration crop hence application of nitrogen in split is essential .But split application of nitrogen through top dressing to cotton crop is not possible at later stages of cotton due to less moisture content in the soil. Foliar application of nutrient is an alternative method to readily meet out the nutrient requirement of crop In above situation. It is necessary to find out effect of foliar spraying of different nutrients on yield of cotton .
Recommendation	:	Foliar spraying of 2% Urea at flowering and 2% DAP at boll development stage are recommended for increasing seed cotton yield.
Year of Release	:	2003
Applications	:	Rainfed cotton in medium deep soil
Advantages	:	• Increase in seed cotton yield under rainfed condition. • Application of foliar nutrient • Saving of fertilizer • Increase net monetary returns • Stability in yield under rainfed condition

Name of Technology	**:**	**Fertilizer management in shallow soil**
Crop	**:**	**Cotton**
Background	:	Cotton is major cash crop of the region .The hirsutum hybrids and arboreum varieties are cultivated on heavy to shallow soils. The crop grown on shallow soil has less productivity and it was felt necessary to find out the fertilizer requirement of varieties grown on shallow soils.
Recommendation	:	Application of FYM @ 5t /ha along with fertilizer dose of 25:12.5 N and P_2O_5/ha is recommended for cotton variety, AKH-081 grown on shallow soil depth (less than 25 cm) to get maximum monetary returns under rainfed condition.
Year of Release	:	2003
Applications	:	Rainfed cotton in shallow soil
Advantages	:	• Increase in seed cotton yield on shallow soil • Saving of chemical fertilizer • Increase in monetary returns • Yield stability under rainfed condition.

Name of Technology	**:**	**Integrated nutrient management**
Crop	**:**	**Cotton**
Background	:	The soil fertility is depleting day by day due to intensive cropping and higher use of chemical fertilizers. The cost of fertilizer is also increasing and it becomes necessary to partly substitute inorganic fertilizer through use of organic sources. Application of organic manures improves physical, chemical and biological properties of soil. Hence , it is essential to evolve and adopt a strategy of integrated nutrient management by using a judicious combination of chemical fertilizers and organic manures which may not only increase production but also improve soil health for sustaining the productivity of cotton
Recommendation	:	For obtaining higher yield of pre monsoon cotton and improvement in soil status application of 2.5 t FYM + 75 : 37.5 : 37.5 kg NPK /ha is recommended.
Year of Release	:	2003
Applications	:	Rainfed as well as irrigated conditions
Advantages	:	• Higher seed cotton yield • Balanced nutrient application • Saving of fertilizer • Improvement in fertility status of soil

Name of Technology	:	**Integrated nutrient management**
Crop	:	**Cotton**
Background	:	In cotton production, fertilizer management is the key factor for obtaining higher yield. The newly developed varieties are more responsive to higher doses of fertilizer. Continuous and sole application of chemical fertilizers is causing increased pH, EC and bulk density and decrease in organic carbon content of the soil. Thus to sustain crop productivity and soil fertility status, it is necessary to supply plant nutrients through organic and inorganic sources.
Recommendation	:	Application of 50% RDF (25:12.5 kg N and P/ha) and either FYM or glyricidia green lopping at 30 days after emergence @ 5t/ha is recommended to get higher seed cotton yield and net monetary returns, with added benefit of improving physico-chemical properties of soil under rainfed condition.
Year of Release	:	2005
Applications	:	Cotton under rainfed condition
Advantages	:	• Higher seed cotton yield • Increase organic carbon in soil • Decrease in soil pH, EC and bulk density • Increase the moisture retension capacity of soil • Reduce the evaporation losses

Name of Technology	**:**	**Application of nutrients through organics**
Crop	**:**	**Cotton**
Background	:	The global market for organic cotton is growing fast each year. The new organic cotton agency has itself set the task of preparing road map to increase the production of organic cotton. Recently released varieties of cotton gave good response to inorganic sources of nutrients. However, feedback from extension agencies demanded basic agronomic recommendations for organic cotton. With this objective and experiment for four years was conducted at Akola to find out substitute to inorganic fertilizers to sustain cotton production.
Recommendation	:	An application of FYM 10t/ha to rainfed hirsutum cotton is recommended as substitute for recommended dose of inorganic fertilizer (50:25:00 NPK kg/ha) in order to sustain the production of cotton.
Year of Release	:	2009
Applications	:	• Dryland /Rainfed area • Medium soil type • Assured rainfall zone of 650 to 750 mm
Advantages	:	• Use of available organic manures on the farm • Improvement in soil fertility • Sustainable yield • Saving in cost

Name of Technology	:	**Cotton production technology**
Crop	:	**Cotton**
Background	:	Recently about 90 percent area is occupied by Bt cotton hybrids in Vidarbha under rainfed conditions. University has not given any recommendations for spacing and fertilizer dose to Bt cotton hybrids. Hence, the investigation was undertaken.
Recommendation	:	It is recommended that Bt cotton hybrid should be sown in medium deep black soil at 90 x 45 cm spacing and fertilized with 60:30:30 kg NPK / ha for obtaining higher seed cotton yield and monetary returns under rainfed conditions.
Year of Release	:	2011
Applications	:	Bt. cotton under rainfed conditions
Advantages	:	• Increase in seed cotton yield • Saving of fertilizers and reducing cost of fertilizer • Higher monetary returns.

Name of Technology	**:**	**Optimization of time for application of basal fertilizer dose**
Crop	:	**Sorghum**
Background	:	Application of basal dose of fertilizers is often delayed by farmers for about 7 to 15 days after sowing. However, for efficient use of fertilizers timely application is very important because the yield decreases with delayed application of basal dose. Hence, optimization of time for application of basal dose for efficient use of fertilizer is essential.
Recommendation	:	Application of fertilizers at the time of sowing should be done in order to harvest maximum yield of sorghum. The delayed application by 7 days resulted in reduction of yield by 17 per cent in grain and 10 per cent in fodder.
Year of Release	:	1989
Applications	:	kharif sorghum
Advantages	:	• Efficient use of fertilizers. • Increase in grain and fodder yield.

Name of Technology	**:**	**Nutrient management in crop sequence**
Crop	:	**Rainfed *rabi* sorghum**
Background	:	Sequence crop of wheat and gram in *rabi* after short duration *kharif* legume is the commonly followed practice in the region. However, under rainfed condition, growing of *rabi* sorghum being economical is becoming popular among the farmers because of increasing demand of *rabi* sorghum due to its better quality grain and fodder, and higher prices offered. Hence, the experimentation was carried out to make the cropping sequence more economical through saving of fertilizers under green gram-rabi sorghum sequence.
Recommendation	:	For green gram - *rabi* sorghum crop sequence, application of 40:20:20 NPK kg/ha to *rabi* sorghum under rainfed condition is recommended which saves about 20% fertilizers.
Year of Release	:	2000
Applications	:	Rabi sorghum growing area.
Advantages	:	• Higher net monetary returns • Higher yield of sorghum grain and fodder • Saving of nitrogenous fertilizers • Better quality produce

Name of Technology	**:**	**Intercropping for higher production**
Crop	:	**Sorghum and soybean**
Background	:	Sorghum + pigeon pea intercropping is most commonly adopted intercropping system by farmers. However, with the introduction of soybean; most of the area under sorghum has been replaced by soybean crop. But sorghum is a major source of fodder. To overcome such situation, it was felt necessary to accommodate both crops in a suitable row intercropping system for higher yields and net returns.
Recommendation	:	Intercropping system of soybean and sorghum in the planting ratio of 2:1 is recommended for stable and high productivity under rainfed farming system.
Year of Release	:	2001
Applications	:	Rainfed farming system in medium black soil .
Advantages	:	• Higher stability • Higher productivity • Improve soil health • Higher net returns per unit area

Name of Technology	**:**	**Integrated nutrient management**
Crop	:	**Sorghum**
Background	:	Continuous application of only chemical fertilizers is causing increased pH, EC and bulk density and decrease in carbon content of the soil. Hence, appropriate integration of organic manures and chemical fertilizers is essential to provide the crop with sufficient nutrients while improving the chemical and physical properties of the soil for sustaining productivity.
Recommendation	:	Application of poultry manure @ 1.5t/ ha. + seed treatment with Azospirillum and PSB (250 g each) + 50% RDF (40:20 kg N & P_2/ha) is recommended to kharif sorghum for higher yield.
Year of Release	:	2001
Applications	:	Rainfed sorghum
Advantages	:	• Higher net monetary returns • Sustainability in crop production • Higher input output ratio • Improve soil properties and fertility status

Name of Technology	**:**	**Integrated nutrient management**
Crop	**:**	**Sorghum**
Background	:	Organic manures besides improving soil physical condition and adding large quantities of NPK do play a significant role in correcting the micronutrient imbalance under intensive cereal cropping where heavy fertilization with primary nutrients has led to accelerated micronutrient depletion. Under such scenario, integrated use of different potential sources of plant nutrients seems to be the only option to maintain soil fertility and crop productivity.
Recommendation	:	Application of 3 t FYM and 100% RDF (80:40 kg. N and P/ha) with seed treatment of Azatobacter and PSB (250g each / 10 kg seed) is recommended for higher yield.
Year of Release	:	2005
Applications	:	Medium deep black soil
Advantages	**:**	• Higher grain and fodder yield • Higher net monetary returns • Maintain nutrient balance in soil • Improves soil physical and chemical properties

Name of Technology	**:**	**Nutrient management**
Crop	:	**Wani Sorghum**
Background	:	The future demand for sorghum is going to be a different from the demand pattern observed at present and in the past. The demand for sorghum grain as food is expected to decline in the future, while its demand may increase as poultry feed, flour, ethanol (Bio- fuel) alcoholic beverages and to some extent fast table purpose etc. Green grains of parching sorghum i.e. *hurda* are used for consumption as roasted grains possessing scented flavour and sweet taste than the grain sorghum , which makes it popular as table purpose sorghum Hence, the present experiment was planned to determine response of wani sorghum genotypes to different fertilizer levels to obtain higher grain yield of parching sorghum.
Recommendation	**:**	Application of 100 : 50 kg. N and P kg/ ha (½ of the N and full P at sowing and remaining ½ N at 30 DAE) is recommended for higher yield.
Year of Release	:	2008
Applications	:	Kharif parching sorghum in medium deep black soil
Advantages	:	• Higher yield of green grain • Useful enterprunership • Higher net returns

Name of Technology	:	**Nutrient Management**
Crop	:	**Paddy**
Background	:	Among the various possible genetic approaches to achieve the national target of rice requirement, hybrid rice technology is the most potential, feasible and readily adaptable one. As such the average productivity of rice varieties is only 13 q/ha. To increase the productivity of rice crops in the region , cultivation of hybrid rice is the possible option. However, hybrid rice differs in utilization of soil and fertilizer sources of nutrients than varieties. The fertilizer requirement of hybrid rice (Sahyadri) needs to be standardized for recommendation to the rice growers.
Recommendations	:	The fertilizer dose of 125:62.5:62.5 NPK kg/ha is recommended to the rice hybrid KJTRH-1 (Sahyadri) and high yielding varieties of paddy in eastern Vidarbha zone for optimum economic returns.
Year of Release	:	2001
Applications	:	Rainfed, medium black soil of eastern Vidarbha zone
Advantages	:	• Higher grain yield • Higher monetory return

Name of Technology	:	**Optimization of spacing and number of seedlings per hill**
Crop	:	**Paddy**
Background	:	Crop husbandry practices such as plant density significantly affect the rice crop at initial growth and development and ultimately grain yield. The maximum yield of rice crop could be possible through optimum spacing between the hills and number of seedling per hill. The hybrid rice varieties have higher yield potential over the conventional high yielding varieties. Therefore, there was a need to identify optimum spacing and number of seedlings/hill in hybrid rice for maximum crop productivity.
Recommendation	:	The paddy hybrid KJTRH-1 (Sahydri) is recommended to transplant one seedling per hill at 20 x 20 cm for maximum economic returns in eastern Vidarbha zone.
Year of Release	:	2001
Applications	:	Rainfed, medium black soil of eastern Vidarbha zone
Advantages	:	• Higher productivity • Maximum net economic returns • Optimum plant population

Name of Technology	:	**Water management**
Crop	:	**Paddy**
Background	:	Paddy crop is mainly grown as a rainfed crop during *kharif* season. Even though the rainfall (average 1200 to 1500 mm) is adequate for paddy crop during the season, its distribution is erratic and uneven during the growth period. Therefore, the average productivity of paddy crop is low in major rice growing areas of eastern Vidarbha region. Adequate water supply is one of the most important factors in any crop's production. In paddy crop, grain and straw yields are known to improve due to continuous submergence as compared to soil saturated to field capacity. Hence, scheduling irrigations to maintain the required soil water regime may prove beneficial in realizing the potential productivity of paddy crop.
Recommendation	:	The protective irrigations at 10 days interval during dry spells is recommended to paddy crop for higher yield in eastern Vidarbha zone.
Year of Release	:	2001
Applications	:	Rainfed, medium black soil of Eastern Vidarbha zone
Advantages	:	• Higher yield in eastern Vidarbha zone • Higher monetary returns • Efficient use of nutrients

Name of Technology	:	**Integrated nutrient management**
Crop	:	**Paddy**
Background	:	Paddy is mostly grown as mono crop with intensive use of chemical fertilizers. Intensive and continuous use of inorganic fertilizers leads to degradation of soils and reduction in crop productivity. Though nutrient deficiencies could be met largely through chemical fertilizers, desirable soil physical properties and efficient use of applied fertilizers could be maintained by addition of organic manures. Hence, nutrient management system of paddy crop must incorporate organic sources for sustainable soil and crop productivity. The green manures are a good source of nitrogen (2-3%) that can partly substitute inorganic N fertilizer.
Recommendation	:	Application of 25% N through glyricidia alongwith recommended dose of phosphorus and potash at transplanting and 75% N through urea is recommended for higher production and net monetary returns of paddy.
Year of Release	:	2003
Applications	:	Rainfed, medium black soil
Advantages	:	• Saving 25 % N through organic matters • Higher production • Higher net monetary returns • Enrich soil fertility

Name of Technology	:	**Integrated nutrient management**
Crop	:	**Paddy**
Background	:	The use of organic manuring integrated with application of fertilizers is essential for any sustainable crop production system. In this regard, use of garadi leaves as manure in nutrient management system of paddy assumes great importance. Garadi leaves are from the predominant tree species *Cleistonthus collinus,* found abundantly in forest areas of eastern Vidarbha region. Garadi leaves contain insecticidal property as well as it is organic manure source for improvement of physico-chemical properties of paddy soils.
Recommendation	:	Application of garadi leaves @ 1.5 t/ha along with recommended dose of fertilizer at the time of transplanting is recommended for maximum yield and net monetary returns.
Year of Release	:	2003
Applications	:	Rainfed medium black soil
Advantages	:	• Maximum yield • Higher net returns • Improvement in soil properties

Name of Technology	:	**Performance of sprouted seed under puddle condition**
Crop	:	**Paddy**
Background	:	The rainfall pattern of eastern Vidarbha zone is erratic and distribution uneven during paddy crop growth period. Due to this weather constraint, average productivity of paddy crop is low. Aberrant weather often creates contingency situation in the months of June, July and August. Events of continuous rainfall or long dry spell affect paddy nurseries. Under such situation normal sowing of paddy seedling is not possible and pre-sprouted seeds may directly be sown under puddle condition.
Recommendation	:	Broadcasting of 50 kg/ha sprouted seed is recommended on puddle field when transplanting is not possible under normal condition i.e. for contingency planning.
Year of Release	:	2004
Applications	:	Rainfed, Medium black soil
Advantages	:	• Useful for contingency planning • Higher monetary returns • Useful when transplanting is not possible

Name of Technology	:	**Nutrient management**
Crop	:	**Paddy**
Background	:	In paddy under low land situation, urea conventionally applied is inefficiently used by rice crop largely because of serious losses via NH_3 volatilization, denitrification, leaching, and/or runoff. Nitrogen use efficiency has been estimated to be about 30-50% and in many cases even less. Thus, it becomes necessary to increase the N-use efficiency at least to the level of more than 50 per cent by resorting to deep placement of modified fertilizer material. Urea-DAP briquettes dissolve slowly and maintain higher level of NO_3 in soil across maximum period of crop growth and are found beneficial in transplanted paddy under anaerobic condition. Similarly, placement of phosphorus in briquette form improves its utilization efficiency by crop. Hence, placement Urea DAP briquettes holds promise in increasing nutrient use efficiencies.
Recommendation	:	Application of 170 kg/ha Urea-DAP briquettes each of 2.7 gm at the time of transplanting is recommended to save 40% nitrogen and phosphorus for efficient use of fertilizer
Year of Release	:	2004
Applications	:	Rainfed, medium black soil
Advantages	:	• Urea- DAP briquettes work as a slow release fertilizer. • Reduce weed intensity • Saving of 40% N & P results in saving of cost of fertilizers • Increases fertilizer use efficiency

Name of Technology	:	**Organic farming**
Crop	:	**Paddy**
Background	:	Paddy crop is mostly grown as mono crop with intensive use of chemical fertilizers. It leads to degradation of soils and decline in crop productivity. So, better nutrient management system of paddy is essential including organic sources of nutrients for sustaining crop productivity and soil fertility. Use of different organic resources is a practicable approach for supply of plant nutrients to the paddy crop.
Recommendation	:	Application of 50% RDF with biogas slurry @ 5 t/ha is recommended for higher yield and net monetary returns and for improvement in soil properties for paddy crop in eastern Vidarbha Zone.
Year of Release	:	2005
Applications	:	Rainfed, medium black soil
Advantages	:	• Higher yield • Higher net monetary returns • Improvement in soil properties

Name of Technology	:	**Organic farming**
Crop	:	**Paddy**
Background	:	Continuous application of sub-optimal doses of chemical fertilizers to soil has resulted in the deterioration of soil health and stagnation or decrease in crop productivity. Thus, use of organic manures is the need of the day that will not only improve the nutrient status and soil health but has the potential in stabilizing crop yields over a period of time. Hence, nutrient management of paddy crop including organic resources of nutrients could sustain crop productivity and soil health.
Recommendation	:	The application of Glyricidia foliage @ 10 t/ha is recommended for higher production and net monetory return in Basmati rice in eastern Vidarbha zone
Year of Release	:	2005
Applications	:	Rainfed, Medium black soil
Advantages	:	• Higher productivity in EVZ • More net monetary returns • Improvement in soil properties

Name of Technology	:	**Integrated nutrient management**
Crop	:	**Paddy**
Background	:	Paddy crop is mostly mono-cropped with continuous application of chemical fertilizers that has in the long run degraded the soil health and lowered crop productivity. Nutrient management of paddy crop must incorporate organic manures for desirable soil properties and efficient use of applied inorganic fertilizers thus sustaining long term soil health and crop productivity.
Recommendation	:	Application of FYM @ 6 t/ha along with 50% RDF (50:25:25 kg NPK/ha) is recommended for higher yield, net monetory returns and improvement in soil properties in eastern Vidarbha zone.
Year of Release	:	2006
Applications	:	Rainfed, Medium black soil
Advantages	:	• Higher yield in EVZ • Higher monetary returns • Improvement in soil properties

Name of Technology	:	**Water management**
Crop	:	**Pigeonpea**
Background	:	Traditionally pigeonpea is grown in rainfed condition. Being a long duration crop, it generally exhibits stress at critical stages of growth owing to which drastic reduction in yield is observed. Few showers in October- November are very beneficial to medium and late maturing genotypes. Therefore, efforts were made to conserve late monsoon rains through appropriate water conservation measures like planting on ridges and furrows or raised bed or opening furrows. The recent and common experience is that, if one or two irrigations were applied at critical stages of plant growth improves yield of pigeonpea considerably.
Recommendation	:	Application of two irrigations, one at bud formation and another at pod formation stage resulted in 54 per cent rise in productivity. Under limited water availability, single irrigation at either bud formation or pod formation stage raised the yield by 31 to 37 per cent.
Year of Release	:	1985
Applications	:	Irrigated, Medium black soil
Advantages	:	• Higher productivity • Higher monetary returns • Efficient use of nutrients

Name of Technology	:	**Moisture conservation practices**
Crop	:	**Pigeonpea**
Background	:	Pigeonpea is predominantly grown in rainfed conditions. The drought situation may arise during flowering and pod formation stages particularly in medium and late maturing cultivar of pigeonpea which may result in partial failure of crop. Drought situation caused due to aberrant weather and erratic rainfall has been routine crises. To cope up with such crunch, it is necessary to find out the possibilities to save the crop under contingent condition by using some of the method of water conservation.
Recommendation	:	Pigeonpea should be planted on ridges and furrows for maximum yield or opening of furrows 30 days after sowing is recommended for efficient water conservation.
Year of Release	:	1995
Applications	:	Rainfed, medium black soil
Advantages	:	• Conserve soil moisture • Check soil erosion • Increase in yield

Name of Technology	:	**Nutrient management**
Crop	:	**Pigeonpea**
Background	:	Nitrogen, phosphorus and sulphur are important nutrients for growth and yield of pigeonpea depending upon the applications rates. The combined application of phosphorus and sulphur may have synergistic or antagonistic effect on the nutrient uptake and ultimately the crop yields. Nitrogen fixation in pigeonpea starts 20 DAS therefore for initial growth period nitrogen is essential. Though a lot of information on nitrogen and phosphorus in combination is available, that of sulphur in conjunction with nitrogen and phosphorus is lacking.
Recommendation	:	In sulphur deficit Vertisols, for obtaining higher economic return and quality seed yield of pigeonpea as well as improving fertility status of soil, it is recommended to apply 25 kg N + 50 kg P/ha along with 20 kg S/ha through elemental sulphur as basal dose.
Year of Release	:	2006
Applications	:	Rainfed, Medium black soil
Advantages	:	• Higher grain yield • Improves quality of seed • Improving fertility status

Name of Technology	:	**Optimization of sowing time and nutrient management**
Crop	:	**Mungbean / Greengram**
Background	:	Although a number of factors govern mungbean productivity, but optimum sowing time under particular agro-climatic situation is the important in realizing the yield potential which is further governed by their response to application of nutrients particularly nitrogen and phosphorus. On the contrary, mungbean is generally sown with the onset of monsoon from June to July. Both early and late plantings have adverse effect on the performance of mungbean. Early sown crop may be caught by the monsoon rains at harvesting time which may create a problem for harvesting and threshing and ultimately the yield is reduced and late sown crop suffer due to poor growth and disease infestation. Hence, it is necessary to optimize sowing time and fertilizer dose for kharif mungbean.
Recommendation	:	For obtaining higher grain yield, early sowing i.e. during 26th MW (last week of June) with basal application of 20 kg N and 40 kg P/ha is recommended.
Year of Release	:	1975
Applications	:	Rainfed, medium black soil of central and western Vidarbha zone
Advantages	:	• Higher productivity • Higher net monetary returns

Name of Technology	:	**Seed inoculation and nutrient management**
Crop	:	**Summer Mungbean**
Background	:	Biofertilizers enhance soil fertility and crop yield by solubilizing unavailable sources of elemental nitrogen into available form in order to facilitate the plant to absorb them. Inoculants of efficient nitrogen fixing Rhizobium have established their capability in augmenting the productivity of mungbean and may fulfill the nitrogen needs and increase the efficiency of applied inorganic nitrogen fertilizer considerably.
Recommendation	:	The seed treatment with Rhizobium (25g/kg seed) with basal application of 25 kg N + 50 kg P/ha for summer mungbean is recommended.
Year of Release	:	1986
Applications	:	Irrigated, medium black soil of eastern Vidarbha zone
Advantages	:	• Higher productivity • High net returns • Lower weed incidence

Name of Technology	:	**Seed inoculation and nutrient management**
Crop	:	**Rabi Mungbean**
Background	:	Biofertilizers enhance soil fertility and crop yield by solubilizing unavailable sources of elemental nitrogen into available form. Inoculants of efficient nitrogen fixing Rhizobium have established their capability in augmenting the productivity of mungbean and may fulfill the nitrogen needs and increase the efficiency of applied inorganic nitrogen fertilizer considerably.
Recommendation	:	For obtaining higher yield of Rabi mungbean, sowing should be done between 25th October to 25th November with seed treatment of Rhizobium (25 g/kg seed) and 25 kg N +50 kg P/ha.
Year of Release	:	1987
Applications	:	Irrigated, Medium black soil of Eastern Vidarbha Zone
Advantages	:	• Higher productivity • Higher net returns • Bio-inoculants improves soil fertility

Name of Technology	:	**Optimization of sowing time and plant density**
Crop	:	**Horse gram (Kulthi)**
Background	:	Horse gram being a non-traditional crop of the region, the agronomic practices needed to raise productivity has not been largely explored. Growing of the crop outside its optimum sowing window may expose the crop to different abiotic and biotic stresses resulting in low productivity. So optimizing the sowing window under a particular agro-climatic situation is important for realizing the full yield potential of the crop. Similarly, population density also needs to be optimized for maximum yield under a particular growing and environmental condition.
Recommendation	:	For getting higher yield, horse gram variety D 40-1 should be sown by the end of July with 4.40 lakh/ha population at 22.5 x 10 cm spacing and for August variety Selection-37 should be used with low plant population of 2.22 lakh/ha at 45x10 cm spacing .
Year of Release	:	1990
Applications	:	Irrigated, Medium black soil
Advantages	:	• Higher productivity • Higher monetary returns

Name of Technology	:	**Optimization of sowing time and plant density**
Crop	:	**Rabi Mungbean**
Background	:	Although a number of factors are responsible for mungbean productivity, but suitability of varieties to optimum sowing time under particular agro-climatic situation is important in realizing the yield potential. The optimum level of plant population seems to differ depending upon the environmental conditions and the plant type. Hence the sowing time and plant density needs to be standardized for obtaining higher productivity of rabi mungbean.
Recommendation	:	The optimum sowing time for Rabi mungbean varieties (TAP-7 and TARM-2) with pre-sowing irrigation should be first week of November, optimum plant population of 2.2 lakh/ha should be maintained with 45x10 cm or 30x15 cm spacing.
Year of Release	:	1992
Applications	:	Irrigated, Medium black soil of central Vidarbha zone
Advantages	:	• Higher productivity • Higher net returns

Name of Technology	:	**Seed inoculation of biofertilizers**
Crop	:	**Mungbean**
Background	:	Biofertilizers enhance soil fertility and crop yield by solubilizing unavailable sources of elemental nitrogen and bound phosphate into available forms in order to facilitate the plant to absorb them. Inoculants of efficient nitrogen fixing Rhizobium and phosphate solubilizing bacteria (PSB) which have established their capability in augmenting the productivity of mungbean may fulfill the nitrogen and phosphorus and increase the efficiency of applied inorganic fertilizer considerably.
Recommendation	:	Application of Rhizobium + PSB @ 250 g each for 10-12 kg seed is recommended to reduce the application of chemical fertilizer to the extent of 50% of RDF (20 kg N + 40 kg P/ha).
Year of Release	:	1997
Applications	:	Rainfed, medium black soil
Advantages	:	• Stability in yield • Reduces cost of fertilizers • Higher net returns • Improvement in soil health

Name of Technology	:	**Optimization of sowing time and nutrient management**
Crop	:	**Urdbean**
Background	:	Potential yield of urdbean can be achieved through optimum use of inputs and agronomic practices. Among the various agronomic practices, optimum sowing time and nutrient management are of primary importance for potential yield. Both early and late plantings have adverse effects on the performance of urdbean. In early sowing, crop may suffer by the monsoon rains at harvesting consequently affecting threshing and ultimately the yield. Late sown crop suffers due to poor growth and disease infestation. Hence, optimization of correct sowing time and fertilizer dose is a prerequisite towards realization of higher yield of kharif urdbean.
Recommendation	:	Early sowing i.e. in 26th MW (last week of June) with basal application of 20 kg N and 40 kg P/ha is recommended for getting highest grain yield.
Year of Release	:	1976
Applications	:	Rainfed, Medium black soil of central and western Vidarbha zone
Advantages	:	• Higher productivity • High net returns

Name of Technology	:	**Optimization of sowing time and nutrient management**
Crop	:	**Rabi Urdbean**
Background	:	Sowing time is one of the non-monetary input affecting the growth and yield of urdbean crop.Optimum sowing time under particular agro-climatic situation is important in realizing the yield potential which is further governed by response to applied fertilizer nutrients particularly nitrogen and phosphorus.
Recommendation	:	For obtaining higher productivity, the optimum sowing time for rabi between 25th October to 9th November with seed treatment of Rhizobium (25 g/kg seed) and basal application of 25 kg N+50 kg P/ha is recommended.
Year of Release	:	1987
Applications	:	Irrigated, Medium black soil of eastern Vidarbha zone
Advantages	:	• Higher productivity • High net returns

Name of Technology	:	**Optimization of sowing time and plant density**
Crop	:	**Summer Urdbean**
Background	:	Biofertilizers enhance soil fertility and crop yield by solubilizing unavailable sources of elemental nitrogen into available form in order to facilitate the plant to absorb them. Inoculants of efficient nitrogen fixing Rhizobium have established their capability in augmenting the productivity of urdbean may fulfill the nitrogen needs and increase the efficiency of applied inorganic nitrogen fertilizer considerably.
Recommendation	:	For obtaining higher grain yield, urdbean should be sown in the last week of October at 30x10 cm spacing in eastern Vidarbha zone.
Year of Release	:	1988
Applications	:	Irrigated, medium black soil of eastern Vidarbha zone
Advantages	:	• Higher productivity • High net returns

Name of Technology	:	**Water and fertilizer management**
Crop	:	**Chickpea (Desi)**
Background	:	As most of the chickpea crop is grown on residual soil moisture and faces acute moisture stress during their terminal growth phase, the crop responds favourably to supplemental irrigation. Therefore, one or two irrigations at the critical growth stages are very useful to increase the yield substantially. Beside this, fertilizers also play a significant role in boosting up the production level of chickpea. So the critical growth stages for irrigation and best fertilizer management practice for higher chickpea yield have been find out.
Recommendation	:	For obtaining higher yield of chickpea, application of irrigations at pre-flowering and another at early pod initiation stage under limited water availability or application of single irrigation at early pod initiation or pod filling stage or pre-flowering stage with inoculation of Rhizobium culture along with basal application of 25 kg and 50 kg P/ha is recommended.
Year of Release	:	1979
Applications	:	Irrigated , Medium black soil
Advantages	:	• Higher productivity • Higher monetary returns • Efficient use of nutrients

Name of Technology	:	**Optimization of sowing time and plant density**
Crop	:	**Chickpea (Kabuli)**
Background	:	Genotypic differences in response to date of planting and optimum level of plant population have been frequently observed. An ideal date of planting has unique significance in influencing crop growth and yield. The optimum level of plant population seems to differ depending upon the environmental conditions and the plant type. In a congenial environment that permits an adequate period for vegetative and reproductive growth, most of the genotypes show little change in yield with large variations in population. Considering above, investigation was initiated for maximum productivity of desi chickpea.
Recommendation	:	For getting higher yield, early planting of kabuli chickpea variety ICCV-2 up to 20th October with closer spacing of 30x10 cm and for late sowing up to 20th November at 45 x 10 cm spacing with 100 kg/ha seed rate is recommended.
Year of Release	:	1979
Applications	:	Irrigated, Medium black soil
Advantages	:	• Higher productivity • High net returns • Higher market price

Name of Technology	:	**Nutrient and water management under late sown condition**
Crop	:	**Chickpea (Kabuli)**
Background	:	Although number of factors are responsible for low productivity of chickpea, imbalanced fertilization and lack of protective irrigation are among the major ones. Hence, balanced nutrient management and proper irrigation schedule need to be developed for maximizing productivity of late sown kabuli chickpea. Water productivity as such increases with improved fertilizer management.
Recommendation	:	It is recommended that, the late sowing be done up to the last week of December for kabuli chickpea (variety ICCV-2) with the basal application of fertilizer dose of 25 kg N +50 kg P/ha with irrigations at the flowering and pod formation stages for higher production.
Year of Release	:	1996
Applications	:	Irrigated, medium black soil
Advantages	:	• Bold seeded • Higher market price • Higher productivity

Name of Technology	:	**Planting on broad bed furrow**
Crop	:	**Chickpea (Kabuli)**
Background	:	Improving productivity of chickpea under limited irrigation poses serious challenge for higher production of the crop. Broad bed furrow planting has recently emerged as a potential water conservation technique, which creates a favourable soil moisture environment for maximizing yield by conserving moisture, reducing weed growth and improving crop growth and yield promotional factors. Hence , study was undertaken for higher productivity of kabuli chickpea by resorting to BBF planting.
Recommendation	:	In heavy black soil, two row broad bed furrow is recommended for higher productivity of kabuli chickpea.
Year of Release	:	1996
Applications	:	Irrigated, medium black soil
Advantages	:	• Provide surface drainage • Increased soil porosity over flat planting • Reduced bulk density • Saving of irrigation water

Name of Technology	:	**Seed priming and foliar nutrition**
Crop	:	**Chickpea**
Background	:	Poor stand establishment due to drought, lack of irrigation facilities is a major constraint in chickpea cultivation under rainfed condition. Speed of germination and emergence was an important determinant of successful establishment. Priming of seeds is economical, simple and safe technique for improving germination, seedling growth, crop production that would be appropriate for all farmers irrespective of their socio-economic status. Nitrogen may not be available adequately at flowering and pod formation stages of crop and results in shedding of flowers and pods. The crop needs more nitrogen at the reproductive phase, and the nutrient uptake after flowering either becomes slow or stop due to inactivation of roots. It is revealed that foliar application of nitrogen through urea sustained foliar activity and root nitrogen absorption leading to a higher utilization of available nitrogen.
Recommendation	:	Under rainfed condition of desi chickpea soaking of seed for 4 hrs in water before sowing and two sprays of 2% urea at flowering and 10 days thereafter is recommended for obtaining higher grain yield.
Year of Release	:	2007
Applications	:	Rainfed, Medium black soil
Advantages	:	• Seed priming is economical, simple and safe technique for faster emergence of seedlings, better stands. • No risk of re-sowing, more vigorous plants • Sustained foliar activity and root nitrogen • Nitrogen is adequately available at flowering and pod formation stages · • Higher grain yield, net returns and B:C ratio

Name of Technology	:	**Optimization of plant density and fertilizers**
Crop	:	**Soybean**
Background	:	Plant density and fertilizer are among the few vital factors that must be considered for soybean or any other crop for potential production. On the basis of duration of variety i.e. early or late maturing, spacing and fertilizer dose also vary. It is important to achieve the desired plant density and optimum fertilization to get maximum yield of crop.
Recommendation	:	It is recommended that the early maturing soybean genotypes (75 to 85 days) should be sown at 30 x 9 cm or 30 x 6 cm whereas late maturing genotypes (95 days) should be sown at 30 x 12 cm along with 40 kg N + 80 kg P /ha for optimized yield of soybean.
Year of Release	:	1998
Applications	:	Rainfed, medium black soil
Advantages	:	• Optimum plant stand • Higher yield • Higher monetary returns

Name of Technology	:	**Intercroppong soybean genotypes with cotton**
Crop	:	**Soybean**
Background	:	Cotton is a major crop of Vidarbha region, possesses unique characteristics and fetches good price of the end. Cotton crop is well suited to the environmental condition of Vidarbha region which is rightly called cotton belt of Maharashtra state. However, across the last decade area under soybean has increased significantly. As such wider row spacing of cotton facilitates intercropping with soybean being the most preferred crop after cotton being a legume crop of comparatively shorter duration, it can be accommodated in cotton based intercropping system.
Recommendations	:	It is recommended that in cotton + soybean intercropping an early maturing soybean genotype (75 days) should be used.
Year of Release	:	1998
Applications	:	Rainfed, medium black soil
Advantages	:	• Higher yield • Higher monetary returns • Assured income

Name of Technology	**:**	**Integrated nutrient management**
Crop	:	**Soybean**
Background	:	Though soybean is a leguminous crop, it responds to fertilizer N besides high P requirement. Injudicious use of inorganic fertilizer often poses problems of land degradation and environmental pollution. Fly ash though regarded as a problematic solid waste, however, it is a useful ameliorant that may improve the physical, chemical and biological properties of problem soils and is a source of readily available plant macro and micronutrients. In conjunction with organic manure, fly ash can enhance plant biomass production from degraded soils. Therefore, integrated nutrient management, consisting use of organic and inorganic fertilizer and fly ash can avoid soil resource deterioration and increase crop production.
Recommendation	:	Soybean grown in ill drained clay soil be applied with Fly Ash @ 5 t ha^{-1} or FYM @ 2.5 t ha^{-1} alongwith 15:37.5 kg N:P ha^{-1} to cut down the fertilizer dose by 50%.
Year of Release	:	1999
Applications	**:**	Rainfed , Medium black soil
Advantages	**:**	• Saving of fertilizers • Increase of productivity

Name of Technology	:	**Foliar fertilization of urea**
Crop	:	**Soybean**
Background	:	Soybean crop has good potential but often factors like rainfall, soil constraint and insect pest plays major role in hampering the productivity of soybean. One limitation to higher soybean yield is flower abortion, resulting in reduced pod set. Soybean plant's nutrient use is characterized by a sharp decline of root activity during seed development and increased translocation from leaves and pods into the seeds. If nutrients are applied directly to the foliage at this time, grain yield might increase. Hence, an alternative way to increase the yield of soybean was tried through foliar spray of urea .
Recommendation	:	Foliar application of 2% urea at 50 and 70 DAS along with recommended dose of fertilizers is recommended for getting highest yield and quality of soybean.
Year of Release	:	2000
Applications	:	Rainfed, medium black soil
Advantages	:	• Higher yield • Higher net returns • Increased protein content • Easy availability of N to the plant system

Name of Technology	:	**Integrated nutrient management in pulse based intercropping**
Crop	:	**Soybean**
Background	:	Improvement of components of agro-technologies for management of intercrops with integrated nutrient management for pigeonpea + soybean (1:2) cropping system was conducted for three years on farmer's field as a adaptive trial to examine the sustainability of the production system in terms of economic viability and social acceptability.
Recommendation	:	Seed inoculation of bio-fertilziers (Rhizobium + PSB, 20g each/kg seed) + 50% RDF (15 kg N + 37.5 kg P_2O_5/ha) is recommended for the intercropping system of pigeonpea + soybean (1:2) for higher economic returns.
Year of Release	:	2004
Applications	:	Rainfed, medium black soil
Advantages	:	• Saving of fertilizer • Higher yield • Higher monetary returns

Name of Technology	:	**Nitrogen management**
Crop	:	**Soybean**
Background	:	Soybean crop is capable of fixing its own nitrogen via root nodulation. However, the ability of soybean to fix atmospheric N is not always adequate for maximum yield. Further, N fixation may be affected by soil N levels. Sites with low soil N respond to N fertilization for higher yields. Secondly, soybean has high export value; seed protein content is one of the important characters for export value of the crop. Nearly 38 to 40 per cent protein content is desirable protein content, which gets affected due to nitrogen nutrient constraint to the crop. This can be managed by supplementing the crop with N fertilization.
Recommendation	:	Application of 30 kg N + 75 kg P / ha as basal dose followed by urea spray (2%) at 40 DAS is recommended.
Year of Release	:	2005
Applications	:	Rainfed, medium black soil
Advantages	:	• Increase seed protein content • Increase NR activity • Absorption of soil nitrogen and its reduction in leaves • Reduced symbiotic 'N' fixation • Higher yield • Higher monetary returns

Name of Technology	:	***Insitu* moisture conservation**
Crop	:	**Soybean**
Background	:	Vidarbha contributes 65% share of soybean area of Maharashtra because of the climatic condition is very much suited to this crop. Moreover, this crop best suited in intercropping and requires low inputs for its cultivation. Therefore, area under this crop is increasing year by year in Vidarbha. In consequences of climatic change, like erratic behaviour of rainfall, gradual rise in temperature, occurrence of dry spells during critical growth stages and heavy rainfall, which creates unfavourable phenomenon in soybean cultivation, and results into low production. Heavy rainfall causes water logging cultivation in field which severely hampers intercultural operations in the vertisol soils of Vidarbha. To overcome this problem, research work was undertaken *In situ* moistures conservation practices for management of water stress to increase the productivity of soybean.
Recommendation	:	In Soybean for getting higher productivity, monetary returns and better moisture conservation, opening of furrow after every three rows at about 30 days after sowing is recommended
Year of Release	:	2011
Applications	:	Soybean growing areas in Vidarbha region
Advantages	:	• Conserve the moisture in dry spell condition • Helps to drain out excess water in the field during heavy rainfall. • To increase the productivity of soybean • Higher monetary returns • Avoid water logging condition under vertisol soils

Name of Technology	:	**Optimization of sowing time**
Crop	:	**French bean**
Background	:	French bean is a dual purpose crop grown as pulse and vegetable crop. The crop is catching up and found to suit well for rabi planting. However, its agronomic practices are not well studied. Yield potential of a crop depends on the environmental conditions prevailing during its growth. The positive effect of environmental factors on growth and yield could be harnessed if the information on optimum time of sowing is made available.
Recommendation	:	For getting higher yield, optimum sowing time of french bean is last week of October for cv. PDR-14, HUR-15 and HUR-137 while under late sowing during November, cv. HUR-137 is recommended.
Year of Release	:	1989
Applications	:	Irrigated, medium black soil
Advantages	:	• Short duration • Better market price • Higher productivity

Name of Technology	:	**Optimization of planting density and seed rate**
Crop	:	**French bean**
Background	:	French bean, a non-traditional grain legume, has shown tremendous production potential during rabi season. Among the various factors that contribute towards the attainment to potential yield of french bean, optimum plant spacing or plant population is one of the important factor. Optimization of plant density for high yielding genotypes by following suitable inter as well as intra row spacing is essential.
Recommendation	:	For obtaining higher yield of french bean, the spacing 45x10 cm for cv VL-63 and HUR-137 with the seed rate of 90 kg/ha and for closer spacing of 30x10 cm for variety PDR-14 with the seed rate of 120-135 kg/ha is recommended.
Year of Release	:	1991
Applications	:	Irrigated, Medium black soil
Advantages	:	• Short duration • Better market price • Higher productivity

Name of Technology	:	**Nitrogen management**
Crop	:	**French bean**
Background	:	French bean is poor nodulating crop with low nitrogen fixing capacity. Therefore, it responds to higher doses of nitrogen as compared with other legumes. Hence, its fertilizer requirement is different from other legumes which may also vary with genotypes. Keeping this in view, investigation was carried out to study the response of french bean varieties to different levels of nitrogen.
Recommendation	:	For getting higher yield of Rajma var. HUR-15, under irrigated condition, should be sown in the first fortnight of November at fertilizer level of 120 kg N, 60 kg P & 20 kg K/ha.
Year of Release	:	1994
Applications	:	Irrigated, medium black soil
Advantages	:	• Higher productivity • Higher net returns

Name of Technology	:	**Evaluation of intercropping system**
Crop	:	**French bean**
Background	:	French bean is grown under different cropping systems as monocropping and intercropping. The planting pattern and spatial arrangement considerably influence the competition among component crops. It is, therefore, imperative to adopt an appropriate plant geometry which minimizes competition and at the same time enhance total productivity.
Recommendation	:	It is recommended to grow french bean variety VL-63 as a sole crop for better yield than intercropping under irrigated condition
Year of Release	:	1995
Applications	:	Irrigated, Medium black soil
Advantages	:	• Perform better under sole cropping • Higher monetary returns

Name of Technology	:	**Integrated nutrient management**
Crop	:	**French bean**
Background	:	French bean responds well to fertilization. It requires large quantity of nitrogenous fertilizer. Studies revealed that 90 kg N was found sufficient in recording maximum yield of frenchbean. However, heavy fertilization increases the cost on fertilizer input. In order to reduce the cost on chemical fertilization and sustaining the productivity, it is essential to integrate organic sources of nutrients. FYM and vermicompost can provide essential nutrients to plant with beneficial effect on physico-chemical and biological properties of soil. It necessitates determining the effective and economic nutrient management practice in French bean for maximum productivity.
Recommendation	:	French bean be manured with 2.5 t FYM or vermicompost ha^{-1} to reduce the fertilizer dose of 90:60:0 kg NPK/ha by 50%.
Year of Release	:	1999
Applications	:	Irrigated, medium black soil
Advantages	:	• Higher productivity • Saving of fertilizer • Improves soil fertility

Name of Technology	:	**Water and nutrient management**
Crop	:	**Field Pea**
Background	:	Field pea needs relatively better moisture regime than chickpea. Moisture stress at early stage drastically cuts the biological nitrogen fixation which is ultimately reflected in to poor yield. Starter dose of nitrogen may be needed in N deficient soils to meet the needs of the developing field pea plant until nodulation becomes fully effective. Excess nitrogen will promote vegetative development over reproductive seed production. Field pea response to applied phosphorus also varies depending upon the P availability in soil and moisture availability. Adequate phosphorus fertility is important for optimizing seed yield.
Recommendation	:	Application of two irrigations one at branching and at bud or pod formation recorded maximum yield. Under limited irrigation, one irrigation either at branching or bud formation along with basal fertilizer application @ 30:60 kg $N:P_2O_5$/ha is recommended.
Year of Release	:	1995
Applications	:	Irrigated, Medium black soil
Advantages	:	• Higher productivity • Higher monetary returns

Name of Technology	:	**Optimization of sowing time and nutrient management**
Crop	:	**Lablab bean**
Background	:	Lablab bean is a nutritive crop grown for the consumption of green pods, green seeds and dry seeds as pulse also. Regional preferences are predominant, playing an important role in its cultivation. It is well-adapted to tropical and subtropical regions. High temperature and humidity favour plant growth, whereas fruiting starts when the temperature and humidity are low generally with the onset of winters. Although a number of factors govern its productivity, primarily correct sowing time under particular agro-climatic situation and nutrient management are important agronomic practices to be explored for realizing the yield potential of this crop.
Recommendation	:	It is recommended that, for higher production sowing of lablab bean should be done in last week of October along with basal dose of 25 kg N + 60 kg P/ha.
Year of Release	:	1997
Applications	:	Irrigated, Medium black soil
Advantages	:	• Higher productivity • Higher monetary returns

Name of Technology	:	**Optimum sowing and nutrient management**
Crop	:	**Popat wal (*Dolischus lablab*)**
Background	:	In eastern Vidarbha Zone, the sowing of rabi crop is delayed due to growing of mid-late rice varieties. After harvest of paddy, land preparation is a difficult proposition and soil moisture also gets depleted. Under such circumstances, popatwal (*Dolichos lablab*) as a sequence crop holds promise in rice based cropping system. Hence, it is necessary to optimize the sowing time and fertilizer requirement of the crop.
Recommendation	:	The popatwal is recommended to sow in the last week of October with application of 25 kg N and 60 kg P/ha at the time of sowing.
Year of Release	:	2004
Applications	:	Rainfed, medium black soil
Advantages	:	• Higher productivity • More net monetary returns

Name of Technology	:	**Water management**
Crop	:	**Wheat**
Background	:	In general, wheat crop requires minimum six to eight irrigations at critical stages. Under circumstances of limited water supply, irrigation has to be skipped at some of the crop growth stages. So it is necessary to assess the per cent loss in yield by deletion of irrigations at some of the critical crop growth stages and find out the most important critical stage for irrigation.
Recommendation	:	Application of irrigations at crown root initiation and flowering stages are recommended to prevent loss in wheat yield
Year of Release	:	1990
Applications	:	Irrigated, medium black soil
Advantages	:	• Better and efficient use of resources • Higher productivity

Name of Technology	:	**Nutrient management**
Crop	:	**Lentil**
Background	:	Adequate and balanced supply of nutrients hold key of successful lentil production. Lentils will not fix atmospheric nitrogen if excess nitrogen is available in the soil also excess nitrogen will cause excessive vegetative growth, reducing seed yield. Phosphorus application is equally important under rainfed conditions, mainly due to three reasons firstly, the growth and proliferation of roots would enable the plants to extract moisture from deeper layers, secondly, improved supply of P might reduce the transpiration ratio and thirdly, raising concentration of soluble P in the moisture film increases the P supply to plant roots under restricted moisture conditions. Hence, correct dose of nitrogen and phosphorus needs to be applied for optimum productivity of lentil.
Recommendation	:	For higher productivity of lentil, basal application of 25 kg N + 50 kg P/ha is recommended.
Year of Release	:	2005
Applications	:	Irrigated, Medium black soil
Advantages	:	• Higher productivity • Higher monetary return

Name of Technology	:	**Standardization of sowing method, seed rate and fertilizers for lathyrus.**
Crop	:	**Lathyrus**
Background	:	Lathyurs is an important pulse crop grown in eastern Vidarbha region under utera condition during Rabi season in paddy cropping system. No information is available on the effect of sowing methods and fertilizer levels on growth and yield of lathyrus as well as various seed rates on yield of lathyrus and therefore the studies have been conducted.
Recommendation	:	Utera method of cultivation with 70 kg/ha seed rate and fertilization of 20:40:00 kg/ha NPK is recommended for Lathyrus crop after paddy for higher economic return.
Year of Release	:	2011
Applications	:	Lathyrus growing areas in eastern Vidarbha zone
Advantages	:	• To increase productivity of Lathyrus crop • To optimize the use of inputs • Higher monetary returns

Name of Technology	:	**Organic groundnut production in kharif variety AK-303**
Crop	:	**Groundnut**
Background	:	Groundut (*Arachis hypogea* L.) is an important and popular crop of the region for various uses. Hand Picked Selection (HPS) or large seeded groundnut (AK-303) also refered as a confectionary groundnut gaining much more importance in recent years in view of it's export potential to earn foreign exchange and also to fetch premium price in the market. In organic agriculture, manure, crop residues, compost, animal waste (dung, urine) are important components of organic manure. FYM is one of the most practicising organic manure for all major crops including oilseeds.
Recommendation	:	Application of 5 t FYM/ha + Neem cake (0.5 t/ha) with seed inoculation of biofertilizers Rhizobium and PSB (250 g each/10 kg seed) is recommended for productivity and economic return of organically grown groundnut.
Year of Release	:	2011
Applications	:	Under protective irrigation in kharif season.
Advantages	:	• Higher pod yield • Higher halum yield • Improve fertility status of soil

Cropping Systems

Name of Technology	:	**Nutrient management in soybean based cropping system**
Crop	:	**Soybean, wheat, chickpea and mustard**
Background	:	Soybean is now an integral part of the cropping system. Soil related constraints (physical and chemical) is common under any cropping systems due to intensive cropping and, indiscriminate and imbalanced use of chemical fertilizers. Integrated nutrient management practices through organic and inorganic sources can effectively minimize soil related constraints and provide long term productivity and sustainability to the system.
Recommendation	:	1. Application of 7.5 t FYM /ha along with 50% RDF is recommended for getting maximum yield and monetary returns in soybean 2. To get higher economic returns, sowing of wheat or chickpea or mustard after soybean is recommended.
Year of Release	:	1995
Applications	:	Rainfed as well as irrigated conditions of eastern Vidarbha zone, medium black soil
Advantages	:	• Balanced nutrition and saving of fertilizer • Higher monetary return, yield sustainability and improves soil fertility

Name of Technology	:	**Integrated nutrient management**
Crop	:	**Sorghum-Wheat**
Background	:	Sorghum is commonly grown in *kharif* season for grain and fodder purpose. After harvest of sorghum, wheat crop is sown in *rabi* season under availability of irrigation water. As both the crops require higher doses of fertilizer for better production, It is necessary to find out efficient nutrient management system for sorghum-wheat sequence. INM system is the key to get assured sustained crop production. Cereal based crop sequence involving more efficient use of inorganic fertilizers in conjunction with organic manures may sustain productivity of the system without deteriorating the long-term soil fertility.
Recommendation	:	In sorghum-wheat cropping system, recommended dose of NPK fertilizer could be reduced by 50% to *kharif* sorghum by substituting 50 % N through FYM (10 t/ha) or leucaena loppings (9 t/ha) and in *rabi,* recommended dose of fertilizer should be applied to wheat for sustainable and high yield of both the crops with remarkable improvement in soil fertility status.
Year of Release	:	1997
Applications	:	Western & central Vidarbha zone of medium-black soil
Advantages	:	• Reduce the quantity of chemical fertilizers. • Higher total productivity • Improve quality of produce • Restore fertility and environmental safety

Name of Technology	:	**Risk minimizing intercropping system**
Crop	:	**Cotton, Sorghum and Pigeonpea**
Background	:	Cotton, sorghum and pigeonpea are major crops in Vidarbha region. Traditionally farmers follow an intercropping system of cotton + pigeonpea in 8:2 row ratio. Sorghum is also grown as a sole crop. These systems have low yield potential with high risk factor due to erratic rainfall pattern of the region. An intercropping system with more than two crops could provide better stability and sustainability of yield under aberrant weather condition .
Recommendation	:	An intercropping system of cotton + sorghum + pigeonpea (paired row) + sorghum at 60 cm spacing for better stability and sustainability of yield is recommended.
Year of Release	:	1999
Applications	:	Western Vidarbha zone of Maharashtra state under dryland condition in medium to heavy soils.
Advantages	:	• Efficient use of available moisture • Stability in yield

Name of Technology	:	**Multitier cropping system**
Crop	:	**Sorghum, pigeonpea, soybean**
Background	:	Soybean, sorghum and pigeonpea are the best suited to rainfed conditions of Vidarbha region, but sole cropping of any of these crops would not always fulfil the multiple demands of food grain, fodder and good returns. Therefore the studies have been made on multitier cropping system based on soybean crop under rainfed condition to meet out the demands of food grain and fodder.
Recommendation	:	In rainfed condition, three tier intercropping system soybean + sorghum + pigeonpea 6:2:1 or 9:2:1 row proportion is recommended to meet out the demand of fooder, feed and pulse grain.
Year of Release	:	2000
Applications	:	Rainfed, medium black soil
Advantages	:	• Higher yield • Higher monetary returns • Assured income

Name of Technology	:	**Integrated nutrient management in maize-wheat crop sequence**
Crop	:	**Maize and wheat**
Background	:	Maize-wheat crop sequence is an exhaustive cropping sequence which depletes soil nutrients extensively. Fertilizer application through inorganic source does not sustain soil fertility and productively under continuous cropping. Therefore, to maintain soil fertility in this sequence, integrated nutrient management is an option. Under INM the carry over effect of the organic manures or crop residues applied to preceding crop also needs to be considered. Integrated nutrient management involving conjuctive use of organic and inorganic sources improve soil productivity and also develop sustainable system productivity.
Recommendation	:	In maize –wheat cropping system, application of 200 kg FYM as a starter + 5 tones of wheat straw + recommended dose of NPK to maize and application of recommended dose of NPK to succeeding wheat crop are recommended.
Year of Release	:	2002
Applications	:	Irrigated medium black soil
Advantages	:	• Improvement in organic matter of soil • Improvement in microbial flora • Increased available of nutrient to the plant

Name of technology	:	**Application of organic manure and bioculture**
Crop	:	**Pearl millet – Chickpea Cropping System**
Background	:	Among available means to achieve sustainability in agricultural production, organic manure and bio-fertilizer play an important and key role because they possesses many desirable soil properties and exerts beneficial effect on soil physical, chemical and biological characteristics. To make biofertilizers more useful by introducing in proper cropping system and to make it more popular, combined use of nitrogen fixers, phosphate solubilizers and addition of organic matter is necessary to sustain the crop productivity and maintain soil fertility.
Recommendation	:	Seed treatment of Azospirillum + PSB (20 gm each /kg seed) to pearl millet is recommended under pearl millet-chickpea cropping system.
Year of Release	:	2003
Applications	:	Rainfed, medium black soil
Advantages	:	• Combined inoculation is more beneficial • Application of bio-fertilizers along with organic matter found more effective

Name of Technology	:	***In-situ* incorporation of biomass**
Crop	:	**Cotton+sunhemp/mungbean**
Background	:	Low organic matter and poor fertility are common features of rainfed soils. Besides, continuous application of only inorganic fertilizers caused more deterioration of soil health thereby stagnating agricultural productivity. Build-up of organic matter is crucial to maintain sustainable production on these soils. In order to stabilize yield and sustain soil health, the possibility of on-farm generation of legume biomass and its *in-situ* incorporation is an option which can also facilitate reduction in the use of chemical fertilizers.
Recommendation	:	Application of 75 % of recommended dose of fertilizer to cotton+mungbean intercropping and *in-situ* incorporation of mungbean biomass after picking the pods save 25 % fertilizer and improve the soil fertility status.
Year of Release	:	2003
Applications	:	Rainfed, medium-black soil
Advantages	:	• Higher seed cotton yield • Saving of inorganic fertilizer • Improves soil health

Name of Technology	:	**Multiple cropping**
Crop	:	**Cereal - legume – oilseed(Sorghum-Soybean-Chickpea - Safflower /Sunflower)**
Background	:	For maintenance of soil fertility, adoption of crop rotations is the best method under irrigated farming. In multiple cropping adoption of one crop sequence every year is not desirable for soil health. It is necessary to find out two to three years rotational crop sequence for higher productivity, net returns and maintenance of soil health
Recommendation	:	Considering the monetary returns, benefit: cost ratio, comparable total grain productivity and maintenance of soil fertility, a two years crop rotation of sorghum - chickpea, in the first year and maize - wheat or soybean - wheat or soybean - sunflower in the second year should be adopted with recommended package of practices.
Year of Release	:	2004
Applications	:	Western & central Vidarbha zone of medium-black soil
Advantages	:	• Diversification of crops • Increases the yield • Improve soil health • Reduce Incidence of pest, disease and weeds • Prevent soil erosion • Meet various needs of the farmer

Name of Technology	:	**Double cropping**
Crop	:	**Soybean – Chickpea / Rabi Sorghum**
Background	:	Recently the area under soybean crop is increasing tremendously. For higher production per unit area, it is not desirable to take single crop in one season. Under limited availability of irrigation water, it is necessary to findout suitable sequence crop in rabi season after harvest of soybean. Chickpea and rabi sorghum crops require limited irrigation. Hence, it is felt necessary to evaluate the desirable double crop sequence in Vidarbha region.
Recommendation	:	It is recommended to adopt Soybean – Chickpea or Soybean-*rabi* Sorghum sequence with two to three irrigations at primordia initiation (30-35 DAS), flowering (70-75 DAS) and /or grain filling (85-95 DAS) stages to sorghum to increase productivity, monetary return, water use economy and improvement in soil fertility
Year of Release	:	2006
Applications	:	Western & central Vidarbha zone of Medium black soil
Advantages	:	• Low cost management crop sequence • Higher productivity and net monetary returns • Improved soil fertility, reduced runoff and soil loss • Quality grains of sorghum • Meet out food and fodder requirements

Name of Technology	:	**Three tier intercropping system**
Crop	:	**Sorghum : Pigeonpea : Sorghum**
Background	:	Two crop intercropping system is commonly adopted practice by rainfed farmers. But to meet the multiple needs of food, fibre, fodder and fuel of rainfed farmers an intercropping system which included more than two crops might prove more adoptable. Cotton, sorghum and pigeonpea are the major crops in the cropping scenario of Vidarbha region. These are the crops that fulfill the basic needs of food grain requirement and ensure financial security to the farmers and also meet the fuel and fodder requirement.
Recommendation	:	For higher total productivity and net returns, three tier intercropping cotton + sorghum + pigeonpea + sorghum (6:1:2:1) is recommended.
Year of Release	:	2006
Applications	:	Rainfed, medium black soil
Advantages	:	• Higher yield stability • Higher total productivity and net returns • Low incidence of pest and diseases • Better and efficient use of resources • Meet the various needs of the farmers

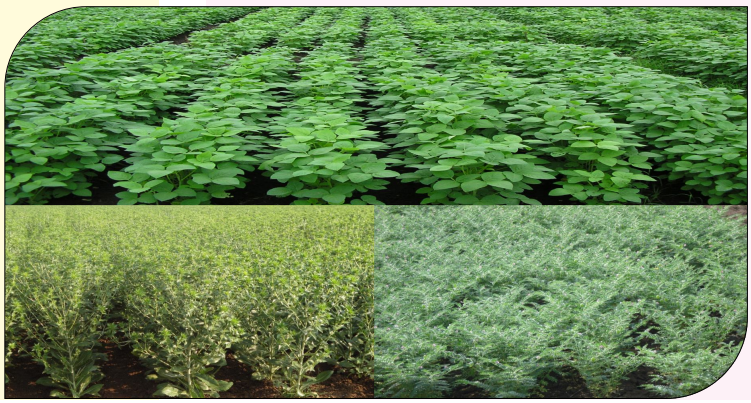
Name of Technology	:	**Nutrient management through green gram intercropping**
Crop	:	**Cotton and greengram**
Background	:	Farmers cultivate cotton as sole crop and depend only on chemical fertilizers as the source of nutrients. The cost incurred on fertilizer suffers losses during drought years due to less productivity. The practice of introducing a short duration legume component crop not only gives bonus yield and impart stability to the system but also improves soil nutritional status and physical condition through incorporation of its residues.
Recommendation	:	Cotton is sown at 60 cm row spacing without affecting plant population of cotton with one row of greengram between two rows of cotton. After picking of greengram pods, the biomass of greengram be incorporated into the soil for sustaining yield and fertility of soil .
Year of Release	:	2007
Applications	:	Rainfed, medium to heavy soil
Advantages	:	Higher productivity, improve soil health, efficient use of nutrients, saving of fertilizer and better land utilization.

Name of Technology	:	**Pearl millet + pigeon pea (1:1)intercropping system**
Crop	:	**Pearlmillet + pigeon pea (1:1)**
Background	:	Pearl millet is emerging as sustainable crop in the present climate changed scenario as it is tolerant to both drought and excess moisture. About 90% area of pearlmillet is under dryland agriculture but due to erratic nature of monsoon, growing of sole pearl millet is always risky. To minimize the risk under these conditions, different pulses as intercrop are tested with pearl millet under dryland conditions.
Recommendation	:	For obtaining higher productivity and monetary returns, intercropping of pearlmillet + pigeonpea (1:1) at 30cm row spacing is recommended for shallow soils under dryland conditions.
Year of Release	:	2011
Applications	:	In pearl millet grown areas
Advantages	:	• Good productivity of pearl millet and pigeon pea • Highest pearl millet grain equivalent yield • Highest monetary returns • Maximum B : C ratio

Name of Technology	:	**Intercropping of pigeon pea and soybean in cotton**
Crop	:	**Cotton, Soybean, Pigeon pea**
Background	:	Cotton + pigeon pea intercropping is being adopted traditionally on large scale in Vidarbha region. However, the productivity of this system is very low. Soybean is gaining popularity in the region due to its high yielding ability under dryland condition and better market price. Thus, in oruci to minimize the risk, it was thought worth to test these intercrops in cotton with varying planting geometry (3:2:2:2), so that systems should be less susceptible to aberrant weather condition of the region and able to utilize the natural resources more efficiently.
Recommendations	:	For minimizing the risk in rainfed agriculture and obtaining higher monetary returns, intercropping of cotton : soybean : pigeonpea : soybean (3:2:2:2) at 45 cm row spacing is recommended.
Year of Release	:	2012
Applications	:	Cotton growing areas
Advantages	:	• Risk minimization • Higher sustainable yield index • Highest gross and net monetary returns

Name of Technology	:	**Upscaling of cotton + sorghum + pigeonpea + sorghum (6:1:2:1) intercropping system**
Crop	:	**Cotton, Soybean, Pigeon pea**
Background	:	Cotton : Sorghum : Pigeonpea : Sorghum (6:1:2:1) intercropping was recommended by the university, however, its adoption in recommended row proportion was not observed on farmers field. During extension programme, it was reported that during sowing operation, it is difficult to maintain recommended row proportion at farmers level. Hence, it was decided to upscale the recommendation for feasible row proportion.
Recommendation	:	For ease in sowing and getting monetary returns comparable to risk minimizing intercropping system 6:1:2:1 (cotton : sorghum : pigeonpea : sorghum) and to meet the requirements of food, fodder and fuel of the farmers, 3:1:1:1 (cotton : sorghum : pigeonpea : sorghum) is recommended under dryland condition.
Year of Release	:	2012
Applications	:	Cotton growing areas
Advantages	:	• Risk minimization • Ease in sowing

Name of Technology	:	**Broad bed furrow**
Crop	:	**Soybean, Safflower, Chickpea, Mustard, Sorghum**
Background	:	In semi-arid climate of Akola, intense rains causes soil erosion, runoff , ill drainage in barren or less covered vertisols. This zone is characterized by erractic, intense rains with ate onset or early cessation and with intermittent dry spell, creating moisture stress during important growth stages. Broad bed and furrow layout technology consists of flat bed of 90 to 105 cm width alternated with furrow of 30 cm width and 15 cm depth aims at *in-situ* conservation of rainfall in furrows that protecting the crop at dry spell and simultaneously taking excess rains out of the field through furrows and their by protecting the crops from ill drainage. Hence the broad bed and furrow layout was used for soybean (kharif) followed by chickpea, safflower, sorghum, and Indian mustard (rabi) which are the most common and less water utilizing crop of this region.
Recommendation	:	For getting higher soybean equivalent yield and monetary returns, it is recommended to adopt the broad bed furrow land layout, for soybean (kharif) followed by either safflower chickpea, mustard and sorghum (rabi) crop sequence in rainfed condition of Vidarbha.
Year of Release	:	2012
Applications	:	For dryland and rainfed ecosystem
Advantages	:	• *In-situ* moisture conservation, moisture stress mitigation, increase water use efficient • Easy for intercultivation, suitable for mechanization, flexible for varied, row spacing • Higher yield energy, time and cost saving



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Weed Management

88A

88B

Name of Technology	:	**Integrated weed management**
Crop	:	**Chickpea**
Background	:	Weeds are a serious constraint to increase production and easy harvesting in chickpea. Chickpea, however, is a poor competitor to weeds because of slow growth rate and limited leaf area development at early stages of crop growth and establishment. Weeds emerge with the crop and create severe competition unless controlled timely and effectively. Yield losses due to weed competition vary between 40 to 94% depending on the level of weed infestation and weed species prevailing.
Recommendation	:	For getting maximum yield of chickpea, it is recommended to keep the crop weed free up to 45 DAS with pre-emergence application of pendimethalin @ 0.75 kg a.i./ha and one hand weeding at 45 DAS for effective weed control under irrigated condition.
Year of Release	:	1994
Applications	:	Irrigated, Medium black soil
Advantages	:	• Effective weed control • Overcome the problem of paucity of labour • 33% higher productivity • High net returns • Efficient use of nutrients

Name of technology	:	**Weed control schedule**
Crop	:	**Sorghum**
Background	:	Critical period of weed absence beginning at crop emergence is necessary and therefore the weed control must be maintained to prevent crop yield losses. Sorghum crop is very sensitive for the crop weed competition, when the crop is young and growing slowly. Time of removal and period of management are used to determine critical periods of weed presence and absence.
Recommendation	:	Weed control studies indicated that, crop must be kept weed free for first 40 days from emergence for higher yields.
Year of Release	:	1976
Applications	:	Medium to deep black soils
Advantages	:	● Increase in grain and fodder yield ● Avoid crop weed competition

Name of technology	:	**Management of striga weed**
Crop	:	**Sorghum**
Background	:	Striga, as a root parasite, literally sucks the life of sorghum plants. In doing so, growth is stunted and yields are greatly reduced. Depending upon the extent of infestation, 30-60% of reduction in grain yield can occur. Every plant of striga produces about 50,000 seeds that remain viable for about 18 years. Once a severe infestation is developed, it may take many years to reduce striga population in the field to non-damaging level. Hence, timely control of striga is very important.
Recommendation	:	Single application of Gramaxone (paraquat 20% W/V) 1.5 lit/ha or Fernaxone (80% Na salt of 2,4-D) 2 kg/ha post emergence application on striga plant before flowering is effective and economical. They should not be used in sorghum where dicots are taken as intercrops.
Year of Release	:	1983
Applications	:	For striga weed in sorghum
Advantages	:	• Control of striga • Decrease loss in yield due to striga

Name of Technology	:	**Integrated weed management**
Crop	:	**Pigeonpea, mungbean/urdbean and chickpea**
Background	:	Weeds compete with crop plants for various production resources such as nutrients, moisture, sunlight and space and consequently reduce yield. Emergence of weeds and crops are generally simultaneous in the field .But weeds on account of their better adaptation and survival mechanism under adverse conditions and fast growing habit supersede the crop plants. Pulses being poor competitor to weeds especially during initial growth stages, suffer substantial yield reduction. The degree of loss varies from 18-90 % depending upon the growing conditions, crop species and management practices. Hence, it is essential to evolve and adopt a strategy of integrated weed management in pulses.
Recommendation	:	Pre-emergence application of pendimethalin @ 0.75 kg a.i./ha followed by one hand weeding at 30,15 and 45 DAS in case of pigeonpea, mungbean/ urdbean and chickpea, respectively is recommended for effective weed control.
Year of Release	:	1995
Applications	:	In the area of shortage of labour
Advantages	:	• Ensure timely control of weeds • Higher productivity • High net returns • Conserve moisture/nutrients

Name of Technology	:	**Integrated weed management**
Crop	:	**Pigeonpea**
Background	:	In pigeonpea, the wider row spacing and sowing of the crop with the onset of monsoon provide favourable environment for weed growth and help them to absorb more nutrients over the crop plants, apart from offering competition for light, space and moisture. Pigeonpea being poor competitor to weeds especially during initial growth stages suffer substantial yield reduction. Therefore, it is essential to find critical crop-weed competition period and optimum dose of herbicides for effective control of weeds.
Recommendation	:	For getting maximum yield of pigeonpea, field should be weed free upto 75 DAS with pre-emergence application of pendimethalin @ 0.75kg a.i./ha in 600 to 700 liters of water within one to two days after sowing followed by one hand weeding at 30 DAS for effective weed control.
Year of Release	:	1995
Applications	:	Rainfed, medium black soil
Advantages	:	• Effective weed control • Overcome the problem of paucity of labour • Higher productivity, higher monetary returns and efficient use of nutrients

Name of Technology	:	**Integrated weed management**
Crop	:	**Mungbean**
Background	:	Mungbean being poor competitor to weeds especially during initial growth stages suffer substantial yield reduction. The degree of yield loss varies from 18-90% depending upon the growing conditions, crop species and management practices. Therefore, it is essential to find critical crop-weed competition period and optimum dose of herbicides for effective control of weeds.
Recommendation	:	For getting maximum yield, it is essential to keep the mungbean crop weed free upto 45 DAS with pre-emergence application of pendamethalin @ 0.75 kg a.i./ha in 600 to 700 liters of water within one to two days after sowing followed by one hand weeding at 15 DAS for effective weed control.
Year of Release	:	1995
Applications	:	Rainfed, medium black soil
Advantages	:	• Effective weed control • Overcome the problem of paucity of labour • Higher productivity and net returns • Efficient use of nutrients

Name of Technology	:	**Integrated weed management**
Crop	:	**Urdbean (Blackgram)**
Background	:	Urdbean being poor competitor to weeds especially during initial growth stages suffers from substantial yield reduction. The degree of yield loss varies from 18-90% depending upon the growing conditions, crop species and management practices. Therefore, it is essential to find critical crop-weed competition period and optimum dose of herbicides for effective control of weeds.
Recommendation	:	For getting maximum yield of urdbean, pre-emergence application of pendamethalin @ 0.75 kg a.i./ha in 600 to 700 liters of water within one or two days after sowing followed by one hand weeding at 15 DAS for effective weed control is recommended.
Year of Release	:	1995
Applications	:	Rainfed, medium black soil
Advantages	:	• Effective weed control • Overcome the problem of paucity of labour • Higher productivity • High net returns • Efficient use of nutrients

Name of Technology	:	**Integrated weed management**
Crop	:	**Soybean**
Background	:	Weed infestation in soybean cultivation is one of the major hurdles, which limits its production levels.Under the present conditions of non availability of labour for weeding and high cost involved therein, it has become extremely difficult to maintain crops free from weeds. Chemical method of weed control and particularly integration of such method with cultural practices have assumed greater importance. Kharif soybean suffers severely due to competition stress of weeds with yield reduction to the tune of 20 to77% depending on nature and density of weeds. The effect of herbicides alone and in combination with mechanical control of weeds and yield of soybean needs to be studied.
Recommendation	:	Pre-plant incorporation of Fluchloralin or pre-emergence application of Pendimethalin or Oxadiazon @ 1.0kg/ha followed by one hoeing plus one hand weeding at 30DAS is recommended for effective weed control and maximize the yield of soybean
Year of Release	:	1997
Applications	:	In soybean crop under medium soil
Advantages	:	• Effective weed control • Saving in cost of cultivation and increase yield

Name of Technology	:	**Integrated weed management in rice under SRI method**
Crop	:	**Paddy**
Background	:	Amongst several factors for low productivity of rice, weed is one and to major concern. The SRI method of paddy cultivation can not be successful without the management of weeds. Hence, investigation was conducted to study the effect of weed control on growth and yield of paddy under SRI method.
Recommendation	:	Application of Butachlor @ 3.75 L/ha (75 ml/10 l of water) within 5 days after transplanting followed by weeding with Cono weeder at 30 days after transplanting is recommended for higher economic returns in SRI method of paddy cultivation.
Year of Release	:	2011
Applications	:	Weed management in SRI method of Paddy cultivation
Advantages	:	• Management of weed • Increase productivity of paddy • Higher monetary returns

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Natural Resource Management

98A

98B

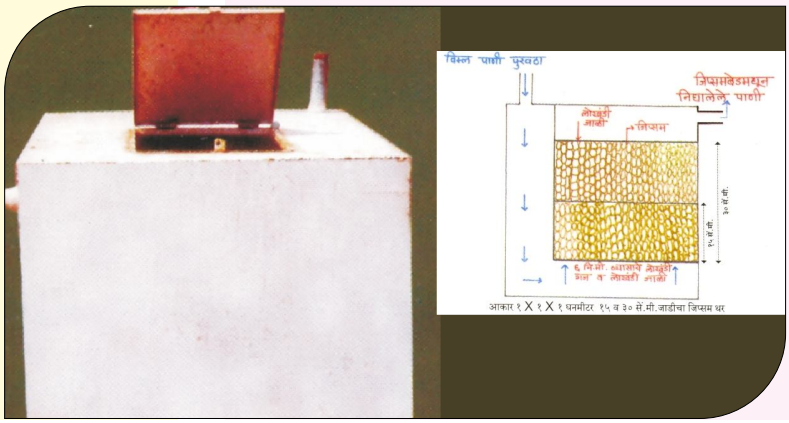
Name of Technology	:	**Amelioration of salt affected soils of Purna valley by gypsum application**
Crop	:	**Cotton, sorghum and greengram**
Background	:	The soils in Purna valley suffer from salinity and sodicity resulting in reduction of crop productivity. Sodic nature of soils show structural problems causing decrease in water uptake by plants; seedling emergence and root penetration and imbalanced plant nutrient supply in such soils affect plant growth. Saline-sodic and sodic soils need a source of soluble calcium (Ca^{2+}) to replace excess sodium (Na+) from cation exchange sites. The use of chemical amendments like gypsum is beneficial for improving soil physical and chemical properties thus sustaining productivity of common crops of the region like cotton, sorghum and green gram besides improvement in soil physical and chemical properties.
Recommendation	:	Broadcasting of gypsum in powder form @ 2.5 t/ ha (50% GR) before sowing of crop and mixing it with surface soil is recommended for increasing the productivity of cotton, sorghum and greengram as well as improving the physical and chemical characteristics of sodic soils of Purna valley.
Year of Release	:	1996
Applications	:	Salt affected soils of Purna valley of Vidarbha, semi-arid tropics.
Advantages	:	• To reduce the sodicity of soil • To improve the soil physical & chemical properties • To enhance crop productivity

Name of Technology	:	**Amelioration of salt affected soils of Purna valley**
Crop	:	**Cotton**
Background	:	Soil salinity and sodicity are among the serious concerns to agriculture in Purna valley soils. Presence of excessive soluble salts manifests its impact mainly by hindering plants' ability to extract water from the soil. Gypsum is commonly applied chemical for reclamation of saline-sodic soils; however, total improvement may fail because of the already degraded soil suffering from low hydraulic conductivity caused by dispersion.Organic amendments such as manures and compost are also useful for remediation of saline-sodic soils. However, organic amendments have a very little effect on amelioration when applied alone. Otherwise, even small amounts of organic matter addition to the soil have a positive effect on the physical and biological soil properties including water stable aggregates, water holding capacity and plant nutrition elements. Hence, combination of organic manures and gypsum may result in better amelioration of salinity and sodicity and sustain crop yields.
Recommendation	:	1. Broadcasting of gypsum in powder form @ 2.5 t /ha (50 % GR) + FYM @ 5 t or pressmud cake @ 2.5 t/ ha before sowing of crop is recommended for increasing the productivity of cotton, sorghum and greengram as well as improving the physical chemical characteristics of sodic soils of Purna valley. 2. Application of gypsum @ 2.5 t/ha once in two years is recommended for improving the physical and chemical characteristics of Purna valley soils.
Year of Release	:	1999
Applications	:	Salt affected soils of Purna valley of Vidarbha, Semi-arid tropics.
Advantages	:	• To improve the salt affected soils • To reduce the sodicity of soils • To improve soil physical and chemical properties

Gypsum @ 2.5 t ha^{-1} (50% GR) + FYM @ 5 t or pressmud cake @ 2.5 t ha^{-1} before sowing of crop

Name of Technology	:	**Management of salt affected soils of Purna valley through amendments and land configuration**
Crop	:	**Cotton and greengram**
Background	:	The soils in Purna valley are characterized as saline and sodic containing high levels of both soluble and exchangeable sodium. The excessive soluble and exchangeable sodium has a profound impact on chemical and physical properties of soil and on crop growth. The use of soil amendments along with land configuration that can provide better drainage and moisture conservation as well can encourage improvement in soil physical and chemical properties favouring crop growth and yield.
Recommendation	:	Application of gypsum @ 2.5 t/ha before sowing and opening of deep furrows after two rows of crops at 30 DAS, is beneficial for reducing the sodicity of soil.
Year of Release	:	2001
Applications	:	Salt affected soils of Purna valley of Vidarbha, semi-arid tropics.
Advantages	:	• To reduce the soil sodicity • To improve the soil physical and chemical properties of soil • To improve the crop productivity

Name of Technology	:	**Techniques for management of salt affected soils of Purna valley using gypsum and alkali water irrigation**
Crop	:	**Cotton**
Background	:	For improving and sustaining productivity in a saline environment various options are mediated through irrigation water, chemical amendments and other cultural practices but all must be integrated as per the site specific needs and achieving higher yields on sustainable basis. Some important interventions also include blending alkali and fresh water or salt affected soils irrigated by alkali water with treatment of gypsum to keep the salinity below threshold.
Recommendation	:	It is recommended to incorporate gypsum @ 1.25 t /ha (25 % GR) in soil and pass the alkali water through gypsum bed of 30 cm thickness for getting higher yield and B:C ratio of irrigated cotton with improvement in characteristics of sodic Vertisols of Purna valley.
Year of Release	:	2002
Applications	:	Salt affected soils of Purna valley of Vidarbha, Semi-arid tropics.
Advantages	:	• To manage salt affected soils • To improve the quality of irrigation water • To improve the soil physical & chemical properties



Gypsum @ 1.25 t ha^{-1} and irrigation with alkali water passing through 30 cm thick gypsum bed

Name of Technology	:	**Integrated nutrient management in rainfed cotton**
Crop	:	**Cotton**
Background	:	Growing high yielding varieties of cotton under intensive cultivation year after year depletes soil organic carbon and available nutrients. Moreover, nitrogen and phosphorus are the most limiting nutrients in black cotton soils because of its low organic carbon content and high phosphorus fixation tendency. Hence, integrated use of organics with inorganic can restore and sustain soil organic carbon, soil fertility and crop productivity.
Recommendation	:	For cotton under rainfed condition, 50 per cent recommended dose of fertilizer 25 kg N + 12.5 kg P /ha in combination with FYM @ 5 t /ha or application of green loppings of glyricidia at 30 DAS should be applied for getting higher productivity, B : C ratio and improvement in soil physical and chemical properties.
Year of Release	:	2003
Applications	:	Central and western Vidarbha zones, rainfed, Vertisols and Inceptisols, semi-arid tropics.
Advantages	:	• To maintain the soil organic carbon and fertility • To improve the soil physical and chemical properties • To enhance the crop productivity

FYM @ 5 t ha^{-1} + 50 % RDF

Name of Technology	:	**Conservation of soil, nutrients and moisture through land configuration**
Crop	:	**Cotton**
Background	:	Soil and moisture integrately link with nutrient utilization by crops. Thus water-soil-nutrient management is vital to sustainable agriculture. In watersheds on slopping land, nutrients and water are lost by erosion during rainy season. These losses can be reduced by land configuration prior to sowing of crops and inter cultivation during crop growth. Land configuration has the potential to improve the productivity of soil and crop.
Recommendation	:	Deep ploughing once in two years is recommended for reducing the loss of soil, nutrients and water from 1.5 per cent slopy deep black soils
Year of Release	:	2003
Applications	:	Central and western Vidarbha zones, rainfed, Vertisols and Inceptisols, on sloppy lands, semi-arid tropics.
Advantages	:	• To conserve soil, nutrients and moisture on slopy land • To improve crop productivity

Deep ploughing once in two years

Name of Technology	:	**Nutrient management in cotton through drip irrigation**
Crop	:	**Cotton**
Background	:	Fertilizer application method is one of the important factors in addition to fertilizer dose amongst different agronomic practices, which influence the growth and yield of cotton considerably. Soil application of NPK fertilizers to cotton crop poses the problems of nutrient losses due to leaching, volatization etc. Nutrient use efficiency (NUE) tends to increase if applied through drip system. Micro-irrigation systems and fertigation have many benefits as they help to control water and nutrients in the root zone. Moreover, with drip irrigation, all nutrients can be applied whenever needed.
Recommendation	:	The fertilizer dose can be reduced to 50 per cent recommended dose of fertilizers through fertigation in 3 to 5 splits to cotton for achieving the yields comparable with 100% recommended dose of fertilizer through conventional method (soil application).
Year of Release	:	2004
Applications	:	Central and western Vidarbha zones, irrigated, Vertisols and associated medium deep black soils, semi-arid tropics.
Advantages	:	• Saving of fertilizers • To improve the nutrient use efficiency • Reducing the nutrient losses

RDF in 3 splits RDF in 5 splits

Name of Technology	:	**Micronutrient management in cotton**
Crop	:	**Cotton**
Background	:	Intensive cultivation, introduction of high yielding varieties and enhanced use of micronutrient free fertilizers such as nitrogen and phosphorus have resulted in deficiency of micronutrients in soils. As a result, widespread deficiencies of zinc and iron are observed in cotton growing soils. Zinc sulphate is now included as part of the fertilizer recommendation in deficient areas. Iron deficiency could occur in cotton growing calcareous soils due to presence of excess Ca and Mg. Micronutrient deficiencies can be corrected through soil application of salts of micronutrients based on the soil test.
Recommendation	:	1. Soil application of zinc sulphate @ 10 kg/ha is recommended to cotton grown on Vertisols if available zinc content of soil at the time of sowing is below 0.64 ppm. 2. Foliar application of 0.5 per cent zinc sulphate alongwith 0.4 per cent lime is recommended for cotton grown on Vertisols if zinc concentration leaf index is below 21 ppm. 3. For cotton crop, critical limit of iron in soil and plant (fully mature leaves) is found to be 4.5 ppm for soil and 281 ppm for plant.
Year of Release	:	2004
Applications	:	Central and Western Vidarbha zones, Vertisols and Inceptisols, Semi-arid tropics.
Advantages	:	• To identify the micronutrient deficiency (Zinc & Iron) • Application micronutrient • To increase the crop productivity

100 % NPK + 10 kg $ZnSO_4$ ha^{-1}

Name of Technology	:	**Nutrient application through fertigation**
Crop	:	**Cotton**
Back ground	:	Irrigation and fertigation are the most important management factors deciding the crop yield. The loss of nutrients by volatilization of N and leaching can be minimized due to fertigation. Fertilizer is a costly input of productivity and profit for unit use of fertilizer. It is necessary to apply the primary and micronutrients for increasing its efficiency through drip irrigation system.
Recommendation	:	For obtaining higher seed cotton yield, monetary returns, nutrient use efficiency and improvement in soil fertility, application of 75% recommended dose of fertilizers (75:37.5:37.5 NPK kg ha^{-1}) along with micronutrients (3 kg Zn ha^{-1} + 3.75 kg Fe ha^{-1}) in the form of water soluble fertilizers through drip in five splits (at sowing, 35, 55, 75 and 95 DAS) is recommended for hybrid cotton in vertisols.
Year of Release	:	2012
Applications	:	In the cotton growing areas of Maharashtra
Advantages	:	Nutrient application through drip helps to reduce the fertilizer dose by 25 percent which ultimately save the costlier inputs like fertilizer.

Name of Technology	:	**Application of potassium**
Crop	:	**Cotton**
Back ground	:	Application of potassium along with recommended dose of N and P improve soil fertility under rainfed condition. Potassium application is beneficial for enhancing the quality of produce. It improves the efficiency of Nitrogen.
Recommendation	:	In deep black soils (Vertisol) for obtaining higher yield of American improved *hirsutum* seed cotton, net monetary return and improving soil fertility under rainfed condition, application of 25 kg K_2O ha^{-1} along with recommended of N and P_2O_5 (50:25:0 NPK kg ha^{-1}) is recommended
Year of Release	:	2012
Applications	:	In deep black soils (Vertisol) for obtaining higher yield of American improved *hirsutum* seed cotton, net monetary return and improving soil fertility under rainfed condition, application of 25 kg K_2O ha^{-1} along with recommended N and P_2O_5 (50:25:0 NPK kg ha^{-1}) is recommended
Advantages	:	• Higher yield of American improved *hirsutum* seed cotton • Improve the fibre quality and resistance to insets • Helpful for creating drought tolerance in crops

Name of Technology	:	**Nutrient management in rainfed cotton on Vertisols**
Crop	:	**Cotton**
Background	:	Boron and zinc are essential plant nutrients for normal plant growth but their positive influence is restricted by a narrow range of boron and zinc concentration in the soil. Boron (B) is one of the essential micronutrient required for normal growth and development of plants. Original source of boron in most of the soil is tourmaline which contains 3-4 percent B. It is quite resistant to weathering, hence the release of boron from it is quite slow. Zinc is known to occur in soil in a number of discrete chemical forms, the relative distribution of which however depend upon several factors, such as inherent ability of soil to supply the element, soil management practices and various physico-chemical characteristics of soil. Soil samples collected revealed that these soils were observed to be low in soil fertility and deficit in Zn and B. Hence, it was planned to study the response of cotton to these limiting nutrients under rainfed condition.
Recommendation	:	For obtaining higher yield and economic returns, it is recommended to apply 125% RDF (60:30:00 NPK kg/ha) to rainfed American cotton grown in Vertisols. Further, the application of 25kg Zinc sulphate and 5kg Borax/ha, respectively is recommended for zinc and boron deficient Vertisols.
Year of Release	:	2011
Applications	:	Zinc and boron deficient Vertisols in Maharashtra under rainfed cotton.
Advantages	:	• Higher cotton productivity • Build up of soil fertility • Higher monetory returns

Name of Technology	:	**Micronutrient management in rice**
Crop	:	**Rice**
Background	:	Rice has been reported more prone to Zn deficiency than upland crops like wheat. In submerged calcareous soils the availability of zinc becomes low hence its deficiency has been reported widely in rice soils. As such intensive cultivation of high yielding varieties of rice years together is depleting micronutrients in soil. If the micronutrients are below the critical level, it is imperative to apply micronutrients to such soils in addition to major nutrients for obtaining maximum yields. Application of zinc to soil is the most satisfactory way to cure zinc deficiency on alkaline soils. Zinc deficiency is the most common nutrient disorder constraining rice productivity and is effectively controlled by field application of zinc sulphate.
Recommendation	:	1. The critical level of available zinc in paddy soils of eastern Vidarbha zone was found to be 0.62 ppm and in index leaf at tillering in paddy was 32 ppm zinc. Below this critical level, a soil application of $ZnSO_4$ @ 10 kg/ ha is recommended. 2. On zinc deficient soils, in paddy nursery the soil application of $ZnSO_4$ @ 10 kg/ ha before sowing and two foliar sprays of $ZnSO_4$ @ 0.5 per cent one at tillering and another at panicle initiation stage are recommended.
Year of Release	:	1996
Applications	:	Eastern Vidarbha zones, rice growing soils
Advantages	:	• To identify Zinc deficiency in paddy soil • To correct micronutrient deficiency • To improve crop productivity

Name of Technology	:	**Sulphur management in rice**
Crop	:	**Rice**
Background	:	Rice needs adequate sulphur like other crops. Sulphur deficiency will not allow the high-yielding varieties to do their best only with NPK. Since last decade, sulphur deficiency is emerging in rice soils which are unable to furnish adequate sulphur required for high rice yields and this deficiency can be corrected by supplementation of sulphur along with recommended NPK.
Recommendation	:	The application of 100 kg gypsum per ha alongwith recommended dose of fertilizers 100:50:50 kg NPK/ ha is recommended for rainfed kharif paddy.
Year of Release	:	1997
Applications	:	Eastern Vidarbha zones, Rice growing soils.
Advantages	:	• To improve the soil fertility • Application of secondary nutrients, Sulphur to crop • To enhance crop productivity

Name of Technology	:	**Nutrient management in rice**
Crop	:	**Rice**
Background	:	Rice crop responds to higher levels of nitrogen, phosphorus and potassium. Hence, evaluating nutrient application is needed to produce optimum rice grain yields. Exploitation of the production potential of high yielding rice varieties demands judicious use of fertilizer inputs that can sustain yield levels.
Recommendation	:	For obtaining maximum yield and higher B : C ratio, a fertilizer dose of 125 : 62.5 : 62.5 kg NPK/ ha through chemical fertilizer to rice on medium soil is recommended.
Year of Release	:	2002
Applications	:	Eastern Vidarbha zones, Rainfed and irrigatted paddy crop
Advantages	:	• Judicious use of fertilizer • To enhance crop productivity

Name of Technology	:	**Nutrient management in rice through green manuring**
Crop	:	**Rice**
Background	:	Sustainability of soil productivity has become a question with continuous use and cost of inorganic fertilizers. Hence, alternate sources to supplement inorganic fertilizers are thought. Green manuring is low cost and effective technology in minimizing cost of fertilizers and safeguarding productivity. In rice growing region, lining field boundaries and roads with glyricidia that tolerate regular lopping can provide green manure as a potential source of N. Conjunctive use of green leaf manures of glyricidia with inorganic fertilizer can have a better impact on soil properties and crop growth.
Recommendation	:	For obtaining maximum yield and higher B : C ratio of kharif rice crop, recommended dose of P and K during transplanting and 25 per cent N through glyricidia and 75 per cent N through urea is recommended.
Year of Release	:	2003
Applications	:	Eastern Vidarbha zones, rainfed paddy crop
Advantages	:	• To improve the soil health • To enhance crop productivity

Name of Technology	:	**Integrated nutrient management in rice**
Crop	:	**Rice**
Background	:	Under integrated nutrient management, use of organics in rice crop increases higher uptake of all nutrients when used along with inorganic fertilizers. Chemical fertilizers are better utilised in the presence of organic manures. The availability of nutrients in organic manures is stimulated by increased microbial activity and complementary through chemical fertilizers. Application of organic manures would also improve the soil physical properties, increase microbial activity, enhance the response per unit of nutrient added, facilitate slow release of nutrients, reduce nutrient losses and provide a long term build up of soil fertility for obtaining sustainable yield. As an organic source, well-fermented biogas slurry improves the physical, chemical and biological properties of the soil resulting qualitative as well as quantitative yield of crops. Slurry from the biogas builds good soil texture, provides and releases plant nutrients and it is highly recommended for use in farming.
Recommendation	:	For maximum yield and higher B : C ratio in rice and improving characteristics of soil, biogas slurry @ 5 t/ ha should be applied with 50 per cent recommended dose of fertilizer (47 : 23 : 25 kg NPK/ ha).
Year of Release	:	2005
Applications	:	Eastern Vidarbha zones, Rainfed, paddy crop
Advantages	:	• To maintain soil health and fertility • To enhance crop productivity

Biogas slurry @ 5 t ha^{-1} + 50 % recommended dose of fertilizer (47 : 23 : 25 kg NPK ha^{-1})

Name of Technology	:	**Nutrient management in soybean**
Crop	:	**Soybean**
Background	:	Soybean crop requires high amount of NPK fertilizers. The soybean plant's nutrient use is characterized by a sharp decline of root activity during seed development stages and increased translocation of nutrients from leaves and pods into the seeds. Researchers theorized that if nutrients were applied directly to the foliage at this time, grain yield might be increased. Hence, foliar application of nutrients at seed formation may benefit soybean crop towards higher yield.
Recommendation	:	Spraying of urea @ 2 per cent at 50 and 70 DAS alongwith recommended dose of nitrogen and phosphorus is beneficial for obtaining maximum yield of soybean.
Year of Release	:	2001
Applications	:	Central and Western Vidarbha zones, vertisols and inceptisols, semi-arid tropics.
Advantages	:	• To improve the soil fertility • To increase crop productivity

Name of Technology	:	**Micronutrient management in soybean**
Crop	:	**Soybean**
Background	:	In soybean, adequate phosphorus fertilization is important and optimum response especially to phosphorus, is not possible unless the plant has an adequate supply of molybdenum. Also molybdenum and bacteria, which form and live in nodules on soybean roots, work in partnership to provide the majority (70 to 90 %) of the soybean plant's nitrogen requirements. Molybdenum enables the symbiotic nitrogen-fixing bacteria to convert nitrogen gas from the air into a form that plants can use. So seed fortification with molybdenum based on soil test and bacterial inoculation can enhance the potential for profitable responses.
Recommendation	:	It is recommended that soybean seeds should be treated with Rhizobium + PSB (each 25 g/kg seed) and 4 g ammonium molybdate per kg seed alongwith recommended dose of chemical fertilizers to enhance the productivity.
Year of Release	:	2003
Applications	:	Central and Western Vidarbha zones, Vertisols and Inceptisols, Semi-arid tropics.
Advantages	:	• Application of biofertilizers & Micronutrients in deficient soils • To enhance crop productivity

Name of Technology	:	**Micronutrient management in crop sequence**
Crop	:	**Soybean – Mustard crop sequence**
Background	:	Now a days increased interest has been shown towards micronutrients due to induced deficiencies from higher crop yields, greater removal from long-time cropping, use of micronutrient free fertilizers and greater concern over crop quality and nutritional value. The deficient micronutrients are essential to be corrected through soil application in addition to recommended dose of fertilizers based on the soil test to enhance the nutrient use efficiency and productivity of crop.
Recommendation	:	For obtaining maximum yield and higher B:C ratio of soybean - mustard cropping sequence on zinc deficient soil, FYM @ 3 t /ha + 50 per cent recommended dose of chemical fertilizers (15:37.5 kg N and P) + 10 kg $ZnSO_4$ /ha with Rhizobium and PSB to soybean and 50 kg N + 20 kg P/ ha + PSB should be applied to mustard crop.
Year of Release	:	2004
Applications	:	Central and western Vidarbha zones, Vertisols and inceptisols, semi-arid tropics.
Advantages	:	• Application of micronutrients to improve use efficiency of major nutrients • To improve crop productivity

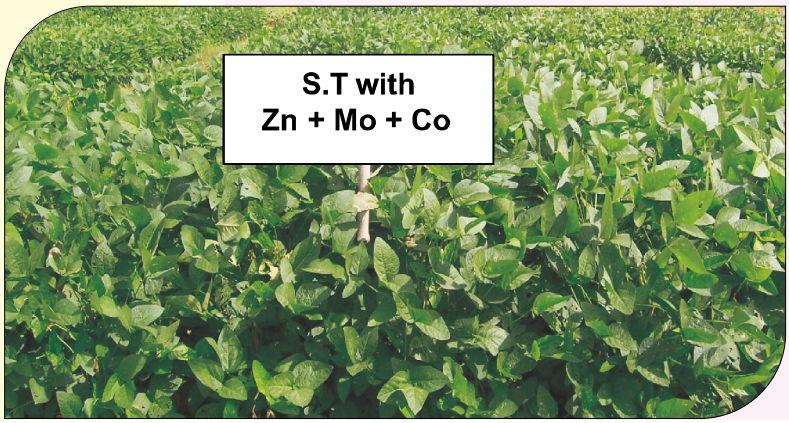
Name of Technology	:	**Sulphur management in crop sequence**
Crop	:	**Soybean-wheat crop sequence**
Background	:	Sulphur deficiency has been observed due to increased cropping intensity and use of sulphur free fertilizers (urea and diammonium phosphate) and no application of organic manures. It is more pronounced in legumes than cereals due to comparatively higher S requirement. Emerging sulphur deficiency can be corrected by supplemental application of sulphur.
Recommendation	:	The application of sulphur 20 kg/ ha through gypsum along with recommended dose of NPK should be applied for obtaining higher yield and B : C ratio under soybean – wheat crop sequence on sulphur deficient soil.
Year of Release	:	1999
Applications	:	Central and western Vidarbha zones, Vertisols and Inceptisols, semi-arid tropics.
Advantages	:	• Application of sulphur in deficient soil • To improve the crop productivity

100 % NPK + S

Name of Technology	:	**Nutrient management in soybean – wheat crop sequence**
Crop	:	**Soybean – wheat crop sequence**
Background	:	Soybean has witnessed a phenomenal growth in the last two decades and it is an integral part of cropping system in the region. Presently, soybean–wheat is one of the most dominant cropping systems on the Vertisols. Besides nitrogen and phosphorus deficiencies, zinc and sulphur deficiencies are also holding back the potential of rainfed crops. So in a legume- cereal sequence like soybean-wheat for balanced nutrition, combined use of available organic sources along with chemical fertilizers including secondary and micro nutrients may prove beneficial for long-term productivity and sustainability of the system.
Recommendation	:	The application of 50 per cent N through organics and remaining 50 per cent N through chemical fertilizer along with 20 kg sulphur and 2.5 kg Zn /ha to soybean with recommended dose of fertilizer to wheat is recommended for sustaining the productivity and fertility of soils under soybean – wheat crop sequence.
Year of Release	:	2004
Applications	:	Central and Western Vidarbha zones, Vertisols and associated medium deep black soils, semi-arid tropics.
Advantages	:	• Application of nutrients through organic and inorganic sources • To improve the physical and chemical properties of soil

NPK + (50 % N through fertilizer + 50 % N through Leucaena loppings) + S + Zn

Name of Technology	:	**Seed treatments with micronutrients**
Crop	:	**Soybean**
Back ground	:	Management of nutrient through seed treatment with micronutrient is beneficial for improving use efficiency of major nutrients by enhancing the enzymatic activity and nitrogen fixation in the nodules which ultimately improve the yield and quality.
Recommendation	:	For obtaining higher yield of soybean and enhancing use efficiency of N and P the seed treatment with Zinc sulphate (9.5g) + ammonium molybdate (1.8 g) + cobalt sulphate (2.5 g) per kg seed before sowing is recommended for zinc, molybdate and cobalt deficient soils.
Year of Release	:	2012
Applications	:	1. Seed treatment with zinc sulphate (9.5 g) + ammonium molybdate (1.8 g) + cobalt sulphate (2.5 g) per kg seed of soybean. 2. Inseptisols and Vertisols of central and western zones of Vidarbha.
Advantages	:	Use of micronutrient through seed treatment along with RDF is beneficial for increasing yield and quality of soybean besides enhancing nitrogen fixation in nodules of leguminous crops.



Name of Technology	:	**Conservation of soil, nutrients and moisture through contour cultivation and live hedge rows**
Crop	:	**Sorghum and Cotton**
Background	:	Loss of top soil due to erosion can reduce the productivity of soils and crop. Land-use planning should aim for minimal soil loss. Contour cultivation on slopes can reduce soil loss and run off compared to traditional, up-and-down ploughing. Similarly hedge rows may be the simplest physical structure for reducing water movement and controlling erosion on slopes. Thus soil, nutrients and moisture can be conserved during rainy season by contour cultivation and planting hedge rows on the contour lines in the watershed.
Recommendation	:	Application of FYM @ 10 t/ ha+ 50 percent RDF with contour cultivation alongwith established vetiver or leucaena hedge rows is recommended to cotton-sorghum rotation grown on Vertisols for obtaining higher monetary returns and reducing surface runoff and losses of soil and nutrients.
Year of Release	:	2003
Applications	:	Central and Western Vidarbha zones, Rainfed crop grown on Vertisols and Inceptisols and sloppy lands in Semi-arid tropics.
Advantages	:	• To reduce the surface runoff and conserve soil, nutrients and moisture • To improve the physical and chemical properties of soil • To enhance crop productivity

Contour cultivation along vetiver hedgerows

Name of Technology	:	**Integrated nutrient management in sorghum – wheat crop sequence**
Crop	:	**Sorghum – wheat crop sequence**
Background	:	Sorghum and wheat are exhaustive feeders of nutrients. Under continuous cropping of sorghum and wheat on Vertisols, integrated nutrient management involving conjunctive use of organic manures and inorganic fertilizers may sustain soil physico-chemical status and system productivity in the long run.
Recommendation	:	On Vertisols under sorghum-wheat sequence for obtaining maximum yield of sorghum and wheat and to maintain soil fertility status in long run, a fertilizer dose of 100: 50: 40 kg NPK /ha + FYM @ 10 t/ ha to sorghum and 120: 60: 60 kg NPK /ha to wheat (irrigated) is recommended.
Year of Release	:	2004
Applications	:	Central and western Vidarbha zones, Vertisols and associated medium deep black soils, Semi-arid tropics.
Advantages	:	• To improve the physical and chemical properties of soil • To enhance crop productivity

FYM @ 10 t ha^{-1} to sorghum only + recommended NPK to sorghum and wheat

Name of Technology : **Ferilizer recommendation based on prediction of post harvest soil test value**

Crop : **Sorghum – wheat crop sequence**

Background : Soil testing crop response research is being extended to different crops by suitable soil and plant analysis methods for recommending fertilizers and manures. For efficient use of fertilizers and manures, integrated soil test crop response studies quantifying the level of stored available fertility level would provide the scope for efficient use of fertilizer inputs. Thus, targeted yield of crops can be achieved by using the ferilizer recommendation based on prediction of post harvest soil test value. The soil available nutrients and nutrients added through chemical fertilizers and organic manures are considered.

Recommendation :

1. The regression models for predicting post harvest soil available nutrients under integrated nutrient supply system should be used as below.
   a. After sorghum
      N = 65.02 + 0.676 SN + 0.298 FN + 0.558 SY
      P = 6.048 + 0.774 SP + 0.057 FP + 0.080 SY
      K = -18.34 + 0.992 SK + 0.532 FK - 0.621 Sy
   b. After sorghum-wheat crop sequence
      N = 39.04+0.677 SN+0.346 FN+0.059 SY – 0.400 WY
      P = 3.41 + 0.505 SP + 0.082 FP + 0.188 SY + 0.086 WY
      K = 51.73 + 0.674 SK + 0.115 FK + 1.209 SY + 0.557 WY
2. The regression models for predicting post harvest soil available nutrients under continuous use of inorganic fertilizers should be used as below.
   a. After sorghum
      N = 130.18 + 0.356 SN + 0.522 FN - 0.212 SY
      P = 9.088 + 0.542 SP + 0.070 FP - 0.043 SY
      K = 20.667 + 0.806 SK - 0.37 FK + 1.075 SY
   b. After sorghum-wheat crop sequence
      N = 66.398+0.488 SN+0.311 FN+0.579 SY+0.422 WY
      P = 4.392+0.424 SP+0.028 FP+0.035 SY + 0.281 WY
      K = 43.439+0.751 SK+0. 281 FK+0.428 SY+0.053 WY

Where, SN, SP and SK are initial soil available N, P and K respectively in kg/ ha, and SY is grain yield of sorghum, WY is wheat yield in q/ ha.

Year of Release : 2004

Applications : Central and Western Vidarbha zones, Rainfed, Vertisols and Inceptisols, Semi-arid tropics.

Advantages :
- To determine the nutrient requirement of crops
- To achieve the targeted yield

Name of Technology	:	**Soil quality management in sorghum-wheat crop sequence**
Crop	:	**Sorghum –wheat crop sequence**
Background	:	Sorghum-wheat crop sequence is among the major cropping systems on vertisols. However, both sorghum and wheat is heavy feeder of nutrients, besides on vertsols major constraint to normal crop husbandry includes unfavourable texture and tilth, shrinkage cracks and low infiltration rate. Hence a greater emphasis has to be laid on application of organic materials along with inorganic fertilizers to sustain the soil health and the productivity of the system for longer period. Organic source of nutrients supplementing the inorganic fertilizers applied to the preceding crop also benefits the succeeding crop to a great extent and system productivity can become sustainable.
Recommendation	:	In sorghum- wheat cropping sequence, on the basis of 20 years results of long term fertilizer experiment on Vertisols, for sustaining soil quality and crop productivity, application of recommended dose of fertilizer along with FYM @ 10 t /ha is recommended.
Year of Release	:	2008
Applications	:	Central and western Vidarbha zones, vertisols and associated medium deep black soils, semi-arid tropics.
Advantages	:	• Application of nutrients through organic & inorganic sources • To improve the physical & chemical properties of soil • To enhance the crop productivity

FYM @ 10 t ha^{-1} to sorghum only + recommended NPK to sorghum and wheat

Name of Technology	:	**Integrated nutrient management in sunflower**
Crop	:	**Sunflower**
Background	:	Imbalanced crop nutrition is among major factors for limiting or static productivity level of sunflower crop. Sunflower crop requires high amount of NPK fertilizers. Secondary nutrient sulphur is directly involved in the process of oil synthesis and helps increasing seed and oil yield. As such sulphur is becoming increasingly deficient in soils for various reasons. Among micronutrients, boron is the most important for sunflower as it increases bloom size and seed set. Hence, balancing crop nutrition through combined use of organic manures and NPK fertilizers along with sulphur and boron is essential for getting highest sustainable yields of sunflower.
Recommendation	:	Application of 15 t FYM /ha + 40:60:40 kg NPK/ ha + 25 kg sulphur/ ha through gypsum alongwith 0.2 per cent borax spray during flowering is recommended for obtaining maximum yield of sunflower.
Year of Release	:	1996
Applications	:	Central and western Vidarbha zones, Vertisols and Inceptisols, Semi-arid tropics.
Advantages	:	• To improve the soil organic content & fertility • Application of secondary nutrients, Sulphur & Boron • To increase crop productivity

FYM @ 15 t ha^{-1} + 40:60:40 kg NPK ha^{-1} + 25 kg S ha^{-1} 0.2 % borax spray

Name of Technology	:	**Techniques for management of salt affected soils of Purna valley using alkali water irrigation and crop residue application**
Crop	:	**Green gram and safflower**
Background	:	The salt affected soil condition can be mitigated by alkali water irrigation with proper treatment of gypsum to keep the salinity below threshold. Apart from this, incorporating crop residues improves soil tilth, structure, and improves water infiltration which provides safeguard against adverse effects of salinity. Thus salinity amelioration through alkali water irrigation practice integrated with crop residue application can contribute towards sustaining crop productivity.
Recommendation	:	For improving the characteristics and maximizing the yield and higher B:C ratio of greengram–saffower on sodic Vertisols of Purna valley, it is recommended to incorporate crop residues @ 2 t/ ha+ PSB @ 10 kg / ha alongwith 50 per cent recommended dose of fertilizers with irrigation of alkali water passed through 30 cm thick gypsum bed.
Year of Release	:	2005
Applications	:	Salt affected soils of Purna valley of Vidarbha, Semi-arid tropics.
Advantages	:	• To improve the irrigation water in salt affected soils • To improve the physical & chemical properties of soil • To increase the crop productivity

Name of Technology	:	**Sulphur management for enhancing productivity and soil fertility**
Crop	:	**Pigeonpea**
Background	:	Sulphur is becoming increasingly important as a plant nutrient due to its widespread deficiency and crop response. Intensive cultivation of high yielding crop varieties, extensive use of high analysis sulphur-free fertilizers and no application of organic manures have led to such conditions. In recent years, wide spread deficiency of sulphur has been noticed in pulse and oilseed growing regions, which constrains productivity. As such sulphur plays an important role in the formation of S-containing essential amino-acids, synthesis of protein and promotion of nodulation.
Recommendation	:	For maintaining soil fertility and obtaining maximum yield of pigeonpea on sulphur deficient soils, application of 20 kg sulphur /ha is recommended along with 25 kg N and 50 kg P/ha.
Year of Release	:	2005
Applications	:	Central and Western Vidarbha zones, Vertisols and Inceptisols, Semi-arid tropics.
Advantages	:	• Application of secondary nutrient to soil for improving soil health and fertility • To enhance crop productivity

Name of Technology : **PDKV compost method**

Background : The application of organic matter is necessary to maintain the soil organic carbon at optimum level to sustain the crop productivity. Organic matter, crop residues and farm waste decompose very slowly under natural condition. To hasten the microbial decomposition of organic matter, crop residues and farm waste and preparation of good quality compost, suitable composting method is essential.

Recommendation : Flow chart of PDKV compost method

Prepare trench of size 3.05 m X 1.83 m X 0.91m.

↓

Construct a chimaney in the centre (0.30 m x 0.30 m x 1.37 m) with small opening for air circulation.

↓

Fill the pit with 15 cm layer of organic waste.

↓

Spread 90 lit. cow dung slurry on each layer.

↓

Fill the pit upto 30 cm above the ground level.

↓

Cover the pit with cow dung + soil slurry.

↓

Good quality compost will be ready within 120-150 days.

Year of Release : 2007-08

Applications : Central, Western and Eastern Vidarbha zones, Semi-arid tropics

Advantages :

- Simple method for decomposting the organic material
- Fast method over other methods
- Good quality compost


PDKV compost method

Quality of compost: pH (Neutral, 6.34-7.03), C:N ratio (14.61-15.95), Nitrogen (0.81-1.06 %), Phosphorus (0.61-0.69 %), Potassium (0.85-0.95 %)

Name of Technology	:	**Irrigation using screened sewage water**
Crop	:	
Background	:	The city sewage water contains essential plant nutrients alongwith some heavy metals. An increasing need for water has spurred the use of sewage to water crops and in many cases it is the only form of irrigation in areas that lack clean water. It is mostly used to produce vegetables. Direct use of sewage water to irrigate crops can pose health risks so treatment of sewage water is a prerequisite. At the field level , it can be used for irrigating the crops after proper treatment or screening through live beds of grasses to reduce the harmful heavy metal load.
Recommendation	:	It is recommended that, the sewage water should be screened through 20 x 3 m^2 *Cynadon dactylon* strip to reduce the heavy metal load and then it can be used for irrigation.
Year of Release	:	2004
Applications	:	Vidarbha zone, area of Peri urban cities
Advantages	:	• To use the sewage water for irrigation after treatment • To reduce the heavy metals from irrigation water • To increase the crop productivity

Name of Technology	:	**Impact of sewage effluent irrigation on nutrients and heavy metal accumulation in soils and crops**
Crop	:	**Vegetable and field crops**
Background	:	The farmers are using the sewage effluent for irrigating the field and vegetable crops in the peri urban area in Maharashtra. The organic carbon content and electrical conductivity of soil irrigated with sewage effluent water was found higher. Irrigation with sewage effluent also lead to accumulation of heavy metals in soils and plants.
Recommendation	:	The irrigation using untreated sewage effluents leads to accumulation of heavy metals in soil and crops, hence the use of untreated sewage effluent for irrigation to the vegetable and field crops in Maharashtra is not recommended.
Year of Release	:	2012
Applications	:	To avoid untreated sewage water for irrigation to field and vegetable crops in the areas near the city.
Advantages	:	Use of untreated sewage effluent for irrigating the field and vegetable crops increase the heavy metals in crop and vegetables which may lead to accumulation of heavy metals in animal and human beings, which cause cancer and other skin disease.

Horticulture

Fruit Crops

Name of Technology	:	**Fruit drop management in Nagpur mandarin with plant growth regulators**
Crop	:	**Nagpur mandarin**
Background	:	The production of mandarin orange is concentrated in Vidarbha region where this fruit has got typical taste which is not found in other part of world. The fruit drop is one of the major problem of the mandarin industry. The fruit drop is caused due to either nutritional, physiological, pathological or combination of them. Preharvest fruit drop of Ambia is mainly due to above reasons, whereas Mrig bahar fruit drop takes place due to rise in temperature. Looking to the severity of this problem, the technology has been developed.
Recommendation	:	For management of pre-mature and pre-harvest fruit drop in mandarin, two sprays of 10 ppm 2,4-D + 1 % Urea in 1st week of June and second week of October or 2-3 sprays of either Gibberellic acid or NAA (10 ppm) each in the month of August, September and October is recommended to reduce the fruit drop by 10- 30 per cent.
Year of Release	:	1977-78
Applications	:	Mandarin growing areas of Vidarbha region
Advantages	:	• Efficient management of fruit drop • Less expensive and cost effective • High fruit yield • Higher monetary returns

Name of technology	:	**Mulching in Nagpur mandarin**
Crop	:	**Nagpur mandarin**
Background	:	The water conservation in Citrus can be achieved by different means like mulching, tillage practices, recycling of waste water, use of drip irrigation systems or by constricting water harvesting structures. Mulching can be either of organic materials like wheat, paddy straw, dry leaves or of polyethylene sheets. Mulch material reduces the loss of water due to evaporation and thereby increase the irrigation interval.
Recommendation	:	It is recommended to follow mulching in Nagpur mandarin with wheat/paddy straw of about 5 cm thick layer to conserve about 17.6% more moisture in upper 22 cm layer of soil. Mulching with dried leaves also conserved 12.14% soil moisture.
Year of Release	:	1977-78
Applications	:	The mandarin growing areas of Vidarbha region
Advantages	:	• Mulching has beneficial effect on decreasing soil temperature. • Mulching reduces the loss of water due to evaporation and thereby increases the irrigation interval. • Mulching suppress the weed growth and improve soil organic matter content.

Name of Technology	:	**Root stock for Nagpur mandarin**
Crop	:	**Nagpur mandarin**
Background	:	Vidarbha is known for production of Nagpur mandarin. Citrus industry is flourished mainly in Amravati and Nagpur districts. Enhancement of productivity and production of quality fruit is needed so as to compete in market. In the recent years, citrus industry in this region is declining. The soil borne diseases are the major cause for decline. Of that Phytophthora is the major threat. As the mandarin is propogated by budding, taking the advantage of root stock the technology was ascertained to gauge the performance of root stock for betterment of yield and quality as well as resistant to soil borne disease.
Recommendation	:	While studying the efficiency of rootstock of mandarin, it was observed that the Rangpur lime found to be a promising rootstock for Nagpur santra and hence recommended.
Year of Release	:	1982
Applications	:	The mandarin growing areas of Vidarbha region
Advantages	:	• Higher fruit yield and quality • Higher economic return • Resistant to Phytophthora and soil borne diseases • Reduction in cost of production

Name of Technology	:	**Weed management in mandarin**
Crop	:	**Mandarin**
Background	:	Citrus industry is mainly flourished in the Vidarbha region of Maharashtra. As the citrus is irrigated crop, the weed management is problem. The weed in the orchard acts as alternative host for the citrus pest. The mechanical weeding have limitation where orchards having plants with big canopy. So also manual weeding is cumbersome & labour intensive. To tackle problem of weed management as well as to reduce cost of production, technology is developed.
Recommendation	:	For management of weed in santra orchard, Dalphon 5kg/ha in 500 lit. of water followed by a spray of Gramaxone (2.5 lit.) + Fernoxon (1.25 kg) in 500 lit. of water per ha, 10 days after first spray and two repeat sprays of Gramoxone and Fernoxone at monthly interval is recommended.
Year of Release	:	1984
Applications	:	The mandarin growing areas of Vidarbha region
Advantages	:	• Efficient weed management • Higher fruit yield • Less labour intensive • Higher monetary returns

Name of Technology	:	**Root stock for Nagpur mandarin**
Crop	:	**Nagpur mandarin**
Background	:	Vidarbha is known for production of Nagpur mandarin. Citrus industry is flourished mainly in Amravati and Nagpur districts. Enhancement of productivity and production of quality fruit is needed so as to compete in market. In the recent years, citrus industry in this region is declining. The soil borne diseases are the major cause for decline of that *Phytophthora* is major threat. As the mandarin is propogated by budding, taking the advantage of root stock the technology was ascertained to gauge the performance of root stock for betterment of yield and quality as well as resistant to soil borne disease.
Recommendation	:	Rough lemon (Akola Jamberi) and Rangpur lime (Akola) are recommended for Nagpur mandarin as the trees on these root stock produce significantly more yield.
Year of Release	:	1989-90
Applications	:	The mandarin growing areas of Vidarbha region
Advantages	:	• Higher fruit yield and quality • Higher monetary returns • Resistant to *Phytophthora* and soil borne diseases • Reduction in cost of production

Name of Technology	:	**Root stock for Nagpur mandarin**
Crop	:	**Nagpur mandarin**
Background	:	Vidarbha is known for production of Nagpur mandarin. Citrus industry is flourished mainly in Amravati and Nagpur districts. Enhancement of productivity and production of quality fruit is needed so as to compete in market. In the recent years, citrus industry in this region is declining. The soil borne diseases are the major cause for decline of that Phytophthora is major threat. As the mandarin is propagated by budding, taking the advantage of root stock the technology was ascertained to gauge the performance of root stock for betterment of yield and quality as well as resistant to soil borne disease.
Recommendation	:	On the basis of performance of various rootstocks, it is recommended to use rootstock of Rangpur lime for Nagpur santra.
Year of Release	:	1990
Applications	:	Mandarin growing areas of Vidarbha region
Advantages	:	● Higher fruit yield and quality ● Higher monetary returns ● Resistant to *Phytophthora* and soil borne diseases ● Reduction in cost of production

Name of Technology	:	**Root stock for Nagpur mandarin**
Crop	:	**Nagpur mandarin**
Background	:	Vidarbha is known for production of Nagpur mandarin. Citrus industry is flourished mainly in Amravati division. In the recent years, citrus industry in this region is declining. The soil borne diseases are the major cause for decline of that *Phytophtheora* is major threat. As the mandarin is propagated by budding, taking the advantage of root stock, the technology was ascertained to gauge the root stock against the soil borne disease.
Recommendation	:	Root stock, Akola Jamberi and Rangpur lime Akola are recommended for control of *Phytophthora* root rot in mandarin nursery.
Year of Release	:	1990
Applications	:	Mandarin growing area of Vidarbha region
Advantages	:	• Resistant to *Phytophthora* and soil borne diseases • Production of good quality planting material • Reduction of rate of mortality of bud grafts • Reduction in production cost of buddings

Name of Technology	:	**Use of micronutrient in mandarin production**
Crop	:	**Nagpur mandarin**
Background	:	Nagpur mandarin is grown commercially as a major citrus fruit crop in Vidarbha region. Symptoms of micronutrient deficiencies Zn, Fe and Boron are observed in the trees of middle and old orchards. Due to boron deficiencies, mid rib and vein spitting of young leaves and coupled with water soaked spots resulted in poor growth and yield. Looking to severity of the deficiency of boron and importance of this micronutrient in accelerating the various physiological activities, the technology has been developed.
Recommendation	:	Application of Boracol @ 250 g/tree is in three doses (June, October, February) with FYM and recommended dose of nitrogen and phosphorus is recommended to main trees above 10 years on medium clay /loam soil under Vidarbha conditions.
Year of Release	:	1991
Applications	:	Mandarin growing areas of Vidarbha region
Advantages	:	• Reduced chlorosis • Healthy vegetative growth • High fruit yield • Better quality fruits • Higher monetary returns

Name of Technology	:	**Regulation of flowering in Nagpur mandarin**
Crop	:	**Nagpur mandarin**
Background	:	Nagpur mandarin is one of most important citrus fruits grown in Vidarbha and adjoining areas. It produces two distinct flowering flushes in a year (Bahar) viz., Ambia (Jan-Feb) and Mrig (June-July). Ambia is natural flush (Bahar) in mandarin, where as for mrig bahar flowering, water stress treatment (withholding of water) prior to flowering flush for a period of 50 days is essential and for initiation of mrig bahar popularly known as bahar treatment, is necessary. Keeping in view the importance of bahar (Regulation of flowering), the technology has been developed
Recommendation	:	It is recommended that 50 days soil moisture stress should be given to mandarin trees growing on medium type of soil (1 m depth) for obtaining maximum yield from mrig bahar
Year of Release	:	1996
Applications	:	Mandarine growing areas of Vidarbha region
Advantages	:	• Regulation of flowering in desired Bahar • High fruit yield • Quality fruits • Higher monetary returns

Name of Technology	:	**Irrigation management in Nagpur mandarin**
Crop	:	**Nagpur mandarin**
Background	:	Irrigation is the most important aspect in mandarin cultivation for commercial and export oriented production. Similarly, the availability of water for irrigation, non-availability of surface water and lowering down the ground water table are the major bottleneck to Mandarin fruit production. Judicious application of water through drip protect the crops against moisture stress, increase the water use efficiency, reduced the weed infestation and ultimately saves 30% to 40% of water compared to flood irrigation. Keeping in view, the importance of irrigation in Mandarin, the technology has been developed.
Recommendation	:	Drip method of irrigation is recommended for significantly maximum yield of bigger size fruits with more juice and TSS content and ensured 30 % saving of irrigation water over traditional method of irrigation. Further, it is recommended that the Nagpur mandarin trees grown on medium type of soil (1 m depth) should be irrigated at 40% soil moisture depletion (coinciding with 60 mm CPE) for getting more yields of quality fruits
Year of Release	:	1996
Applications	:	Mandarin growing areas of Vidarbha region
Advantages	:	• Water use efficiency enhanced • Saves 30% irrigation water • Higher fruit yield and quality • Higher monetary returns

Name of Technology	:	**Role of zinc in mandarin production**
Crop	:	**Nagpur mandarin**
Background	:	The use of high analysis fertilizers free from micronutrient has resulted widespread micronutrient deficiency. It is reported that 40 -45% orchards of Nagpur mandarin in Vidarbha region is deficient in Zn. The deficiency of micronutrient including Zn. leads to altered metabolism and subsequently resulted in physiological changes. Considering the importance of micronutrients, in mandarin production, the technology has been developed.
Recommendation	:.	Soil application of 200 g $ZnSO_4$ per tree is recommended to Nagpur Mandarin as it gives maximum yield (number and weight of fruits) of superior quality.
Year of Release	:.	1996
Applications	:	Mandarin growing areas of Vidarbha region
Advantages	:	• Higher yield • Superior fruit quality • Higher monetary returns

Name of Technology	:	**Protection of planting material of Nagpur mandarin by using shade net**
Crop	:	**Nagpur mandarin**
Background	:	Citrus industry is flourished mainly in Amravati and Nagpur district of Vidarbha region. Demand for quality planting material is increasing day by day. The planting material of Nagpur mandarin is mainly produced in the nurseries located in Amravati and Nagpur district, from where planting material distributed to the Maharashtra & adjoining states. However, extreme hot summer prevailing during period form March to June is one of the major cause for mortality as well as retardation of growth of budlings.To check intense sunlight and temperature the technology is developed.
Recommendation	:	Seventy per cent agro-net is recommended for covering the bud grafts of Nagpur mandarin budded on Rough lemon (Jamberi) and Rangpur lime root stocks for getting the highest vegetative growth and reducing the mortality of bud grafts. The net should be covered on budlings immediately after budding in February till onset of rains.
Year of Release	:	2001-02
Applications	:	Citrus nurseries in Vidarbha region
Advantages	:	● Production of good quality planting material ● Reduction of rate of mortality of bud grafts ● Reduction in Production cost of budlings ● Protection from adverse climatic conditions

Name of Technology	:	**Fertilizer requirement of Nagpur mandarin**
Crop	:	**Nagpur mandarin**
Background	:	Nagpur mandarin is one of the best mandarins in the world. Production of this crop is mainly dependent on the meeting of nutritional requirements of the crop. Timely application of the nutrients on the particular physiological stages of crop results in higher fruit production and fruit quality. Therefore the studies were undertaken.
Recommendation	:	Fertilizer dose of 1200: 400:400 g NPK/plant is recommended for higher yield and superior quality fruits of Nagpur mandarin. Full dose of P and K and half dose of N should be given at the time of release of stress and remaining half dose of N, two months after fruit setting .
Year of Release	:	2002
Applications	:	The mandarin growing areas of Vidarbha region
Advantages	:	• Higher yield and superior quality of fruits • Efficient use of nutrients • Higher monetary returns

Name of Technology	:	**Management of diseases in rough lemon (Jamberi) nursery**
Crop	:	**Nagpur mandarin**
Background	:	Nagpur mandarin is mainly propagated by budding on root stock of Rough lemon (Jamberi) and Rangpure lime. The soil borne pathogen is one of the major cause for mortality of Rough lemon (Jamberi) root stock seedlings in nursery. To check the mortality of transplanted Rough lemon (Jamberi), the above technology has been developed.
Recommendation	:	To check the mortality of transplanted Rough lemon (Jamberi) seedlings, soil solarization for 45 days during May and June with drenching of Metalaxyl MZ 0.2% during August, December and June and its foliar spraying during October, February and April is recommended.
Year of Release	:	2002
Applications	:	Citrus nurseries in Vidarbha region
Advantages	:	• Maximum survival by reducing mortality rate of rough lemon (Jamberi) seedlings • Healthy growth of seedlings results in early attainment of budding stage • Reduces the cost of production of saplings • Soil Solarization helps to reduce Soil borne pathogen and weed seeds

Name of Technology	:	**Weed management in citrus nursery**
Crop	:	**Citrus**
Background	:	Citrus industry is mainly flourished in the Vidarbha region of Maharashtra. Management of weed is one of the problem in citrus nusery as the soil moisture is prevailing around the year. The mechanical weeding has limitation. So also manual weeding is cumbersome and labour intensive. To tackle the problem of weed management as well as to reduce cost of production of planting material, above technology has been developed.
Recommendation	:	For control of monocot weeds in citrus nursery, use of Diuron @ 2-3 Kg/ha in 600 lit. water is recommended.
Year of Release	:	1984
Applications	:	Citrus growing nurseries
Advantages	:	• Efficient weed management • Healthy seedling growth • Less labour intensive • Reduce the cost of manual weeding • Higher monetary returns

Name of Technology	:	**Foliar application of growth regulators for better growth of root stock seedlings**
Crop	:	**Citrus Jamberi rootstock**
Background	:	Longevity and Productivity of any budded fruit tree depend upon the vigorous and vitality of rootstocks at the time of budding. Most of the seedlings of root stock do not attain buddable size within a normal budding period after transplanting and such seedlings are not useful for budding and cause economical loss to nurserymen. Therefore, foliar spray of growth regulators and nutrient after post planting have been advised for growth acceleration of root stocks in citrus
Recommendation	:	Spraying of GA_3(10 ppm) or Thiourea (0.1%) four times at monthly interval starting from 45 days after transplanting is recommended for Jamberi rootstock seedlings.
Year of Release	:	1996
Applications	:	Mandarin growing areas citrus nurseries
Advantages	:	• Attain buddable size early • Growth acceleration is faster • Good growth and development

Name of Technology	:	**Rejuvenation of old/declining/senile citrus orchards**
Crop	:	**Citrus**
Background	:	Maharashtra leads in area under citrus cultivation. Though Maharashtra and Vidarbha region, particularly Amravati and Nagpur districts are famous for the quality production of mandarin. However, mandarin industry is phasing various decline syndromes and plants become unproductive due to scarcity of water, negligence of scientific management, poor and faulty site, *Phytophthora* diseases and pests and aging of the orchards. The techniques have been developed to rejuvenate the senile orchards.
Recommendation	:	The following PDKV module constitutes following steps is recommended for rejuvenation of senile orchards ➢ Removal of infected, dried shoots along with 5 cm healthy portion, ➢ Pruning of shoot 30-45 cm from top in the month of June. ➢ After the judicious pruning fungicides and insecticides spraying needs to be undertaken. ➢ Application of Bordeaux paste (1:1:10.) to tree trunk and on pruned portion. ➢ Soil application of 50 kg well decomposed FYM + 7.5 kg Neem cake /plant. ➢ Application of 500gm N + 500 gm P in the month of October. ➢ From the next year manage the orchards scientifically ➢ Rejuvenation of orchards may be done once in the life span of senile orchards.
Year of Release	:	1996
Applications	:	The mandarin growing pockets of Amravati, Nagpur and Yeotmal districts.
Advantages	:	➢ The life span of plant/orchard can be extended ➢ The unproductive plant/orchard converted in to productive orchard. ➢ Citrus grower benefited economically

Name of Technology	:	**Weed management in acid lime nursery**
Crop	:	**Acid lime**
Background	:	Acid lime is emerging as an important fruit crop in Vidarbha region. It is commercially propagated by seeds. Sowing is done on raised beds from August to September. Seed takes about 22 to 30 days for germination. During this period, there is always a problem of weeds which results in poor germination and growth. Weed management through manual method becomes difficult due to rains and slower germination of acid lime seedling. Since this is a critical period in acid lime nursery, it becomes necessary to use herbicides for weed management. Present studies were therefore, undertaken for effective weed control in acid lime nursery.
Recommendation	:	Pre-emergence application at Atrazine @ 0.5 kg/ha plus Parquet @ 0.4 kg/ha at 10 days after sowing is recommended for effective control of weeds in acid lime nursery .
Year of Release	:	1985
Applications	:	Acid lime nursery areas
Advantages	:	• Effective control of weeds in nursery of acid lime • Results in maximum germination and growth of acid lime seedlings • Cost effective and profitable

Name of Technology	:	**Inter cropping in acid lime orchard**
Crop	:	**Acid lime**
Background	:	Citrus industry is mainly located in Vidarbha region of Maharashtra State. The Nagpur and Amravati districts are famous for Nagpur mandarin while Akola district is known for quality acid lime production. The juvenile period for acid lime orchard is around five years from planting, there after orchard comes to bearing & fruit production starts regularly after this period. During this juvenile period, grower remains deprived of economic returns, so also land, labour and other infrastructure remains underutilized. To overcome this constraint, technology has been developed taking advantage of wider spacing and low canopy volume so that farmer could get subsidiary income during pre-bearing period of orchard by growing intercrops.
Recommendation	:	In the pre-bearing acid lime orchard intercropping of onion (Seed production) or green gram is recommended.
Year of Release	:	2005
Applications	:	Acid lime growing areas in Vidarbha region
Advantages	:	• Grower can earn during pre-bearing period of orchards • Source of additional income • Labour, land and other assets can be utilized efficiently. • Green gram as a intercrop, improves fertility status of soil

Name of Technology	:	**Hasta bahar management in acid lime**
Crop	:	**Acid lime**
Background	:	Acid lime is important fruit crop in Maharashtra and nearly 40,000 ha area is under acid lime cultivation. Excluding Kokan region Acid lime is cultivated in all the districts of Maharashtra State.Where Solapur, Akola, Buldhana, Amravati, Wardha and Nagpur are important districts. Acid lime bears fruits in all three bahars (Ambia 60%,Mrig 30% and Hasta 10%). Fruits of Ambia and Mrig fetches very low prices in the market but hasta bahar's fruits harvested in the month of April, May fetches 6-8 time more prices compared to Ambia and Mrig bahar fruits. Acid lime trees force to hasta bahar by water stress followed by growth regulator treatments. A complete technology developed at AICRP (TF), Dr.PDKV, Akola.
Recommendation	:	Following steps have been recommended to obtain the bahar. ● Mrig bahar's fruit should be thinned. ● Water stress should be given during 15 September to 15 October ● If rains during stress period, application of 50 ppm ascorbic acid ● Application of 1000 ppm Cycocil in August and September ● After stress period application 300 g N,300 g P and 300 g K ● Remaining 300g N after 15 November ● Light irrigation after breaking stress period ● Application of neem cake 7.5 kg/plant
Year of Release	:	2006
Applications	:	Balapur, Wadegaon, Patur area of Akola and Buldana, districts
Advantages	:	● 6-8 times more prices than Ambia bahar fruits ● 3-4 times more prices than Mrig bahar fruits ● Availability of fruits in summer season

Name of Technology	:	**Fertigation in acid lime production**
Crop	:	**Acid lime**
Background	:	Water and fertilizers plays an important role in Acid lime production. Efficient water management improves growth, yield and quality. Judicious use of water and fertilizers are required for better productivity and good quality fruits and now a days, it is essential in acid lime especially in water scarce areas.
Recommendations	:	An application of 450 g N + 225 g P + 225 g K (75 % of RDF)+Biofertilizers(VAM 500 g +PSB 100 g + *Azospirillum* 100 g + *T. harzianum* 100 g) per plant is recommended to acid lime trees for obtaining maximum fruit yield of superior quality.
Year of Release	:	2007
Applications	:	Acid lime growing areas in Vidarbha region
Advantages	:	• Accurate amount of fertilizer can be applied along with uniform irrigation water to root zone of plants • Fertigation saves time, labor, equipment and energy. • Fertigation saves 30-50 per cent fertilizers • Quality fruits • Higher monetary returns

Name of Technology	:	**Use of biofertilizer in acid lime production**
Crop	:	**Acid lime**
Background	:	Nutritional management organically and inorganically in Acid lime Production is important aspect. Biofertilizer means using living organisms as fertilizer, either to fix atmospheric nitrogen or to solublize mineral nutrient like phosphorus or to exchange potassium in adequate quantities. Besides, these organisms also produce many growth promoting substances like GA, IAA and some vitamins. There are two types of biofertilizers viz. nitrogen firing and Phosphorus solubilizing biofertilizers that are used in acid lime production.
Recommendation	:	Application of 450 g N + 225 g P + 225 g K (75 % of RDF) + Biofertilizers(VAM 500 g +PSB 100 g + *Azospirillum* 100 g + *T. harzianum* 100 g) per plant is recommended to acid lime trees for obtaining economical maximum fruit yield of superior quality.
Year of Release	:	2008
Applications	:	Acid lime growing areas in Vidarbha region
Advantages	:	• Better fixation of nitrogen • Solubilsation of insoluble phosphate • Production of growth promoting substances • Saving of fertilizers • Higher monetary returns

Name of Technology	:	**Enhancing the growth of rangpur lime seedling**
Crop	:	**Rangpur lime**
Background	:	Rootstock is most essential component of grafted plant that provides support to root system and imparts other characteristics like resistant to abiotic stresses, resistance to soil borne diseases, early cropping, more yield, etc. Rangpur lime has been recommended as the best rootstock for mandarin. The growth of the Rangpur lime rootstock needs to be accelerated for better grafting success in nursery and hence the investigation.
Recommendation	:	Four sprays of GA_3 at 25 ppm or urea 1% on Rangpur lime at monthly interval from 45 days after transplanting are recommended for obtaining seedlings of better vegetative growth and more percentage of seedlings of budable size.
Year of Release	:	2002
Applications	:	The mandarin growing areas of Vidarbha region
Advantages	:	• Rapid vegetative growth of rootstock • Higher number of seedlings with budable size will be available for grafting • Accelerate grafting programme of mandarin

Name of Technology	:	**Ready to serve beverage**
Crop	:	**Lime**
Background	:	Kagzi lime plantation has been increased substantially in Vidarbha region particularly in Akola, Buldhana, Nagpur and Yavatmal districts which is representing the major kagzi lime tract in Maharashtra state. At present, kagzi lime occupies an area of about 5500 to 7000 hectare area in Vidarbha region. The yield of kagzi lime is about 2000 to 2500 tonnes of fruit per hectare from each bahar. The rainy season harvest does not fetch any disirable prices and as such nearly 30% of the total fruits get wastage. Efforts have been made to standardized the ready to serve beverage by utilizing these fruits to establish agri processing industries.
Recommendation	:	Lime ready-to-serve beverage is recommended for maximum storability (75 days) under ambient storage condition.
Year of Release	:	2012
Applications	:	Acid lime growing areas
Advantages	:	• To establish the small scale processing units in the rural areas. • Diversion of excess production for value addition • Farmers can get additional monetary income

Name of Technology	:	***In-situ* softwood grafting in mango**
Crop	:	**Mango**
Background	:	Water scarcity in Vidarbha region is considered as a important hurdle which put the limitation for increasing the area under fruit plantation. In case of mango, irrigation is necessary initially two to three years for better survival of grafts and its establishment. However, it is seen that, when mango orchards are raised by grafts, greater mortality was found. If the plantation is done by adopting in- situ softwood grafting, maximum plant stand will obtain in the field. In order to achieve the maximum success in in- situ grafting, just germinated and cracked stones should be selected and therefore this technology has been developed.
Recommendation	:	To ensure uniform and good stock seedlings for *in-situ* softwood grafting, use of just germinating / cracked stones of mango is recommended.
Year of Release	:	1996
Applications	:	Mango growing areas of Vidarbha region
Advantages	:	• Maximum plant stands in the field • Reduces irrigation interval • Easy and economical

Name of Technology	:	**Mango varieties for Vidarbha region**
Crop	:	**Mango**
Background	:	The soil and climatic conditions of Vidarbha are congenial for mango growth. However, this region is not considered as traditional mango growing region. The soils are heavy black with relatively high pH (7.8 - 8.2), wide temperature fluctuation observed during different season (7°C and 48°C) and between day and night hours (l0°C and 45°C) and extremely low relative humidity (as low as 13 %) during summer, are the climatic features of this region. Establishment of mango orchards of grafted types in black soil met with varying success in such situation. However, once established the crop grows well. Since there was no specific variety recommended for this region, the research was conducted for identification of commercial varieties.
Recommendation	:	On the basis of performance in old orchards and the studies conducted in recent years, the varieties Kesar, Dashhari, Amrapali and Pairi are recommended in Vidarbha region for getting highest yield of fruits per tree and monetary returns.
Year of Release	:	2003
Applications	:	Mango growing areas of Buldhana, Akola, Amravati, Yeotmal, Chandrapur, Nagpur districts.
Advantages	:	• Identified suitable mango varieties for commercial cultivation in Vidarbha region • Higher fruit yield with good market quality • Assured prizes in market since no fruits from North and South region are available. Thus, extending the longer availability of these fruits in market.

Name of Technology	:	**Weed management in mango**
Crop	:	**Mango**
Background	:	Mango is a commercial fruit crop of Vidarbha region. Since it grows under protected irrigation in black cotton soils, the orchards are heavily infested with monocot and dicot weeds throughout the year. Hand weeding is found to be time consuming, laborious, not effective and uneconomical. The chemical weed control with herbicides will be of great help to growers in reducing the cost of weeding. Considering the importance and necessity of weed control in mango orchard, the said investigation was undertaken.
Recommendation	:	The per-emergence application of Diuron @ 2.4 kg/ha + Glyphosate @ 0.8 kg/ha each at 35 and 70 DAP was recommended for effective weed control in mango orchard.
Year of Release	:	2003
Applications	:	Mango growing areas of Vidarbha region
Advantages	:	• Most effective method for the control of weeds • Increase in fruit yield and quality of mango • Cost effective and economical

Name of Technology	:	**Nutrient management in mango**
Crop	:	**Mango**
Background	:	Though mango is a very important fruit crop in India, little information is available on the nutrient requirement of this crop relating to its various stages of growth and development. By adopting appropriate placement method and time of application of fertilizers to mango, the efficiency of nutrients can be enhanced by preventing the loss.
Recommendation	:	An application of 50 kg FYM + 600 g N + 750g P + 250 g K + 12.5 g PSB per plant is recommended higher yield of mango.
Year of Release	:	2005
Applications	:	Mango growing areas of Vidarbha region
Advantages	:	• Higher plant growth and fruit yield of mango • Better availability and efficiency of nutrients • Helpful to increase the production and productivity of mango orchards

Name of Technology	:	**Propagation of sapota**
Crop	:	**Sapota**
Background	:	Sapota is a tropical fruit tree valued for its sweet and delicious pulp. In last few years, the sapota cultivation has spread rapidly because of its better adaptability. High demand for quality planting material could not met due to traditional multiplication methods resulted in inadequate availability of grafts. Traditional methods resulted in longer period of establishment and hence industry was facing difficulty. Looking to the need of advanced method of propagation, this research was carried out.
Recommendation	:	Soft wood grafting of sapota is recommended during July to September on 12-15 months old khirni root stock of about 15 cm height and 0.4 cm diameter with 8 days defoliated scion shoot under Akola condition.
Year of Release	:	1987
Applications	:	Irrigated area of Vidarbha region
Advantages	:	• Maximum success of grafts and survival • Rapid establishment., more growth rate (one and half times) than inarching method • Grafts become ready in short period as compare to inarching, hence 40to50% nursery time is reduced • Large scale multiplication can be possible with ease • Vigorous grafts • For rapid area expansion

Name of Technology	:	**Weed management in sapota**
Crop	:	**Sapota**
Background	:	The sapota orchards are heavily infested with both monocot and dicot weeds which compete with the main crop for water, nutrients and space. Besides, it also harbors the insect pests. The weed roots also secrete toxins which adversely affect the growth and fruit bearing in sapota. Hand weeding is found to be time consuming, laborious and not effective against perennial weeds and also not economical. The chemical weed control with use of herbicides may be great help to the growers in reducing the cost of weeding in sapota orchards. Considering the importance and necessity of weed control by herbicides in sapota orchards, the said trial was conducted.
Recommendation	:	The pre- emergence application of Diuron, 2.4 kg/ha and post-emergence application of Glyphosate 0.8 kg/ha each at 35 and 70 DAS are recommended for control of the weed flora in sapota orchards.
Year of Release	:	2004
Applications	:	Sapota growing area of Vidarbha region
Advantages	:	• Most effective method for the control of weeds • Increased fruit yield and quality of sapota • Economical and cost effective

Name of Technology	:	**Enhancement of life of bud sticks of sapota used for propagation of sapota**
Crop	:	**Sapota**
Background	:	Sapota is propagated by soft wood grafting on khirni root stock. Selection of scion and its preparation is very important to obtain maximum survival of grafts. The defoliated and detached scion bud could not stored for longer time. Hence to extend the storage life of scion -bud sticks, the investigation was carried out.
Recommendation	:	It is recommended to treat the scion bud stick of sapota with COC, 0.2 % for enhancing the active life of defoliated bud sticks of sapota.
Year of Release	:	2004
Applications	:	Sapota growing area of Vidarbha region
Advantages	:	• Maximum success • Scion bud sticks can be stored for more time

Name of Technology	:	**Nutrient management in sapota**
Crop	:	**Sapota**
Background	:	Sapota has a long bearing period and it has also considered as heavy feeder crop. It gives better response to the timely application of fertilizers and manures. For healthy growth and yield of good quality sapota fruit, its required nutrient should be applied in required doses. In sapota, inadequate supply of nutrition resulted into the poor fruit set. In order to provide the proper dose of manure and fertilizers to the full bearing trees, this technology has been developed.
Recommendation	:	For getting higher yield of fruit in sapota, 75 kg FYM+ 1500 g N+ 1000 g P+ 500 g K + 12.5 g PSB per tree is recommended
Year of Release	:	2004
Applications	:	Sapota growing area of Vidarbha region
Advantages	:	• The nutrient management will help to develop healthy plant growth • Maximum fruit yield per unit area • Better quality fruits • Better efficiency of nutrients • More net profit to growers

Name of Technology	:	**Pruning in guava**
Crop	:	**Guava**
Background	:	Guava is an important fruit crop of Vidarbha region. Pruning is older cultural practice for fruits like grape, fig and phalsa to bring a balance between vegetative and reproductive functions of the plant. The deterioration of old guava orchards is generally observed with the decreasing fruit yield and quality. Therefore, present investigation was undertaken to find out the effect of time and severity of pruning on growth and yield of guava variety Sardar.
Recommendation	:	It is recommended that 25th April is suitable time of pruning and 60 cms severity of pruning for obtaining maximum growth and fruit yield of old guava trees.
Year of Release	:	2001
Applications	:	Guava growing areas of Vidarbha region
Advantages	:	• For old and senile guava orchards • Productivity of old guava orchards can be increased • Growth of plant, fruit yield and quality is increased • Overall life of the orchard is extended

Name of Technology	:	**Polybag method of ground layering in guava**
Crop	:	**Guava**
Background	:	Guava is considered as one of the most important fruit crops of Vidarbha region. Its plantation is mostly concentrated in Buldhana and Washim District. The area under this crop is increasing day by day and it has now became a crop of commercial importance in Vidarbha region. The availability of true to type planting material of guava is one of the constraints. The propagation of guava by polybag method of ground layering using growth regulators is one of the avenue for the maximum production of good quality planting material. In view of this, the technology has been developed.
Recommendation	:	For the production of good quality seedlings, polybag method of ground layering with or without growth regulator treatments of IBA or NAA(300 ppm) is recommended.
Year of Release	:	1996
Applications	:	Guava growing areas of Vidarbha region
Advantages	:	• Production of true to type planting material in a short period of time • Less expensive and cost effective • Large scale nursery production is possible • Early bearing and maximum yield

Name of Technology	:	**Pruning in old guava**
Crop	:	**Guava**
Background	:	Guava is one of the most important fruit crops of Vidarbha region. As the flowers and fruits are borne on current season growth, the light annual pruning is necessary to encourage the new shoots after the harvest. In guava, two fruit bahars (Ambia and Mrig) are taken by the farmers but for maximum net return and better quality fruits,Mrig bahar is usually preferred. The flowers of Mrig bahar appeared in the month of June-July and if the pruning is done before one month of flowering, maximum current season growth will be appeared which resulted into more number of flowers and good quality fruits. Hence, the technology has been developed
Recommendation	:	For obtaining the highest fruit yield with maximum monetary returns, the pruning at 3.0 cm thick shoot from tip during first fortnight of May is recommended for twenty years old guava trees.
Year of Release	:	2004
Applications	:	Guava growing areas of Vidarbha region
Advantages	:	• Equal distribution of fruit load on the tree • Maintain canopy of the old plant • Maximum fruit yield and better fruit quality

Name of Technology	:	**Nutritional management in banana**
Crop	:	**Banana**
Background	:	Banana is one of most important commercial fruit crops. Basrai is the popular variety of banana grown in Vidarbha. Banana requires adequate amounts of fertilizers throughout its growth phases for satisfactory yield. The recommended practice in the region is to apply fertilizers in four splits in five months from planting. There are several farmers who apply more than four splits. The present studies were therefore, undertaken to confirm the doses in split application for banana under Vidarbha condition.
Recommendation	:	Application of full doses of P and K, (40 g P and 200 g K per plant) and 1/4 dose of nitrogen applied after one month of planting and remaining 3/4 nitrogen in three equal splits at 2^{nd}, 3^{rd} and 4^{th} month from planting is recommended.
Year of Release	:	2003
Applications	:	Banana growing areas of Vidarbha region
Advantages	:	• Better vegetative growth • Higher yield and quality • Efficient use of fertilizers

Name of Technology	:	**Spacing in papaya**
Crop	:	**Papaya**
Background	:	The papaya is one of the important fruit crop of the region. Because of its fast growing nature, early bearing habit, nutritious value, low input requirement, the cultivation of papaya in this region is becoming popular. Cultivators are adopting different spacing for different varieties of papaya. To find out the suitable spacing for papaya cultivation for obtaining high fruit yield, present investigation was carried out.
Recommendation	:	It is recommended to adopt 2 x 2 m spacing for obtaining optimum plant growth and higher fruit yield of papaya under Akola conditions.
Year of Release	:	2004
Applications	:	Papaya growing areas of Vidarbha region
Advantages	:	• Maximum plant growth and higher fruit yield • Suitable for intercultural operations • More number of plants per unit area

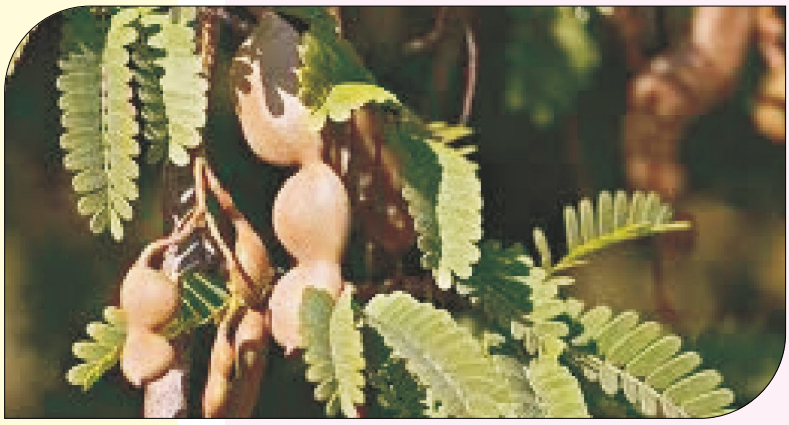
Name of Technology	:	**Foliar application of MH for increasing the fruit yield in papaya**
Crop	:	**Papaya**
Background	:	The papaya cultivation is growing popularity in irrigated areas of Vidarbha region. It is ease in cultivation and fruits can be produced within short period and it is now recognized as highly nutritive, economic and important medicinal crop. A number of value added products can also be prepared from the raw and ripe papaya. Looking to the increasing demand for the papaya in domestic as well as international market, it is necessary to increase the production with better quality fruits. In addition to recommended dose of fertilizer, the foliar application of plant growth regulator will be helpful to increase the number of flowers and thereby increasing total fruit yield of papaya. Hence this technology has been developed.
Recommendation	:	For obtaining higher fruit yield of papaya foliar spray of MH 400 ppm at 45, 75 and 105 days after transplanting of papaya seedling is recommended
Year of Release	:	2005
Applications	:	Papaya growing areas of Vidarbha region
Advantages	:	• Low cost technology • Maximum fruit yield • Better quality fruits

Name of Technology	:	**Grape pruning**
Crop	:	**Grape**
Background	:	The grape crop has established well in some geographic pockets in Buldana and Yavatmal districts and showed good promise by giving high monetary benefits to the farmers. The time and severity of pruning are deciding factors for fruit yield as well as quality. Since, no information was available on time and severity of pruning under Vidarbha conditions, the said investigation was carried out.
Recommendation	:	For obtaining higher fruit yield with good quality, it is recommended to prune the grape vines during 20th and 30th September by retaining 7 or 8 buds.
Year of Release	:	1996
Applications	:	Grape growing pockets of Buldhana and Yeotmal districts.
Advantages	:	• Higher fruit yield with good quality • Early bearing • Early crop fetches more prize in the market

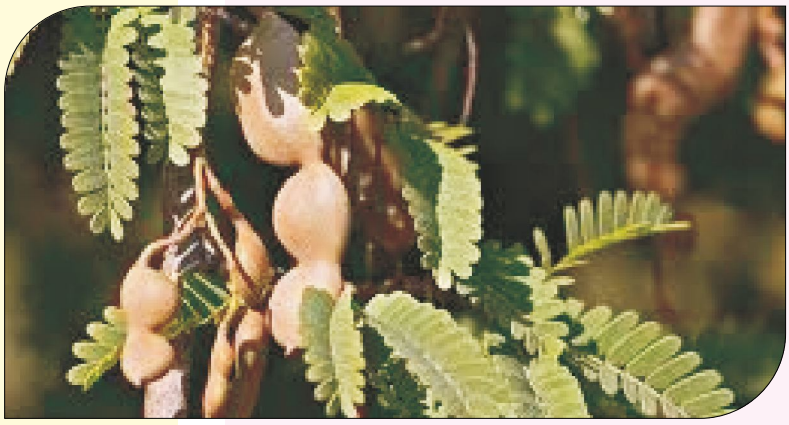
Name of Technology	:	**Evaluation of varieties of aonla for commercial cultivation in Vidarbha region**
Crop	:	**Aonla**
Background	:	Aonla is important dry land fruit crop grown in Akola, Amravati, Buldana, Washim, Yeotmal and Nagpur districts. The yield potential of local varieties is very low as well as the quality of the fruits is also very inferior. Therefore it was felt necessary to recommend improved varieties for commercial cultivation in Vidarbha region.
Recommendation	:	For commercial cultivation of Aonla, varieties NA-7, Chakaiya, Kanchan and NA-10 are recommended for Vidarbha region.
Year of Release	:	2005
Applications	:	Aonla growing area of Vidarbha region
Advantages	:	• Replacement old varieties with improved and high yielding varieties • Commercial plantation on large scale • High yield with better fruit quality • High returns • Production of quality fruits for processing

Name of Technology	:	**Aonla propagation through soft wood grafting**
Crop	:	**Aonla**
Background	:	Aonla is widely grown as dryland fruit crop and also used in agro- forestry and social forestry planting programmes. Aonla is commonly propagated by seed. However, due to poor seed germination, the raising of seedlings becomes difficult. Aonla, being a cross-pollinated crop which leads to heterozygosity in plants and hence it requires propagation by vegetative method to produce true to type and genetically uniform planting material. Traditionally; anola is propagated by budding methods i.e. patch budding on one year old seedling rootstock in July-August in Uttar Pradesh. In Maharashtra conditions, the union of roots stock with scion is successful but scion bud do not sprout for several months though it remain green even up to 6-8 month after budding.
Recommendation	:	For obtaining better success in softwood grafting in aonla, the January month and 8-9 months old rootstock is recommended.
Year of Release	:	2006
Applications	:	Aonla growing area of Vidarbha region
Advantages	:	• True to type multiplication • Maximum survival of grafts • Large scale production of grafts is possible • Early bearing

Name of Technology	:	**Soft wood grafting in tamarind**
Crop	:	**Tamarind**
Background	:	Tamarind is gaining popularity as an important dry land fruit crop due to its hardy nature, sustainability to adverse climatic conditions. It has great scope to increase the area under cultivation. Tamarind fruit and its processed products have a commercial value in domestic as well as international market. Tamarind generally propagated by seeds and hence it has long juvenile phase and not true to type. Adoption of vegetative means of propagation can reduce the juvenile phase, early and higher yield. The availability of the grafts is also one of the constraints in tamarind. Looking to the better success in soft wood grafting during the hot months of year, this technology has been developed.
Recommendation	:	For the production of maximum graft with better success, propagation of tamarind by soft wood grafting during March to April under Akola condition is recommended.
Year of Release	:	1997
Applications	:	Tamarind growing area of Vidarbha region
Advantages	:	• True to type plant characters • Elite or improved types or varieties can now be prepared on large scale • The area under cultivation will be increased • Early bearing • The production and productivity of plants is increased



Name of Technology	:	**Propagation of tamarind**
Crop	:	**Tamarind**
Background	:	Tamarind is one of the important dry land crops of this region. It is emerging as commercial crop for its various domestic use and export use. Traditionally it is raised through seeds. It is highly cross pollinated crop and wide variability is seen. When propagated by seed, considerable variation is observed in growth, bearing, fruit quality and yield as well as these plants bears fruits very late. Looking to these constraints, suitable vegetative method of propagation needs to be employed.
Recommendation	:	Soft wood grafting during March to April is recommended for tamarind under Akola conditions.
Year of Release	:	2006
Applications	:	Tamarind growing areas
Advantages	:	• Useful to accelerate massive commercial production of planting material • To propogate Improved varieties • Avaiiability of Quality planting material • Helpful to increase the area under tamarind • Early bearing of fruits



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Vegetable Crops

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Name of Technology	:	**Use of bio-fertilizers for efficient nutrient management in turmeric**
Crop	:	**Turmeric**
Background	:	Turmeric is an important spice crop of this region. It is a rhizome crop and hence for better vegetative growth and rhizome development, it requires judicious application of nutrients. Use of bio-fertilizers in vegetable and spice crops is advantageous for efficient use of nutrients. Hence to find out suitable dose of N, P and K and bio-fertilizers, experiments were carried out.
Recommendation	:	Application of 200 kg N + 100 kg P + 100 kg K + Bio-fertilizers 5 kg/ha (AZT + PSB each) is recommended for higher yield and net monetary returns of turmeric.
Year of Release	:	2002
Applications	:	Turmeric growing area of Vidarbha region
Advantages	:	• Better vegetative growth and rhizome development • Higher yields with better monetary returns • Better fertilizer use efficiency

Name of Technology	:	**Weed management in turmeric**
Crop	:	**Turmeric**
Background	:	Turmeric is one of the important spice crops in this region. Judicious irrigation is required for better growth and yield of turmeric. Being an irrigated crop, weed population is more in turmeric which competes for water, nutrients and space and other recourses. Hand weeding is found to be time consuming, laborious, less effective and not economical. The chemical weed control with the use of herbicides will be useful in reducing the cost of weeding in turmeric. Considering the importance and necessity of weed control by herbicides in turmeric crop, the research was conducted.
Recommendation	:	The per-emergence application of Pendamenthalin 1.5 kg/ha is recommended for effective control of weeds and production of higher yield of turmeric.
Year of Release	:	2005
Applications	:	Turmeric growing area of Vidarbha region.
Advantages	:	• Effective and timely control of weeds will result in better vegetative growth and rhizome development in turmeric • Cost effective and saving of labours • Higher yield with better monetary returns

Name of Technology	:	**Improved chilli varieties for commercial cultivation in Vidarbha region**
Crop	:	**Chilli**
Background	:	Chilli is important spice and vegetable crop of this region. There is a need of high yielding varieties of chill as per preference of segment to grow in this region. Looking to the demand from the farmers for high yielding good quality varieties, eight varieties have been recommended for Vidarbha.
Recommendation	:	The varieties of chilies viz., CA-960, Pant-C-1, Pant C-3, NP-46 A, Jwala, G-4, G-5 and CA 1068 are recommended for commercial cultivation under irrigated conditions of Vidarbha.
Year of Release	:	1987
Applications	:	Chilli growing area of Vidarbha region
Advantage	:	• Good for green as well as red chilli purpose • Higher chilli yield with good quality • Good for Kharif and summer reason • Better returns to growers

Name of Technology	:	**Use of plant growth regulators for the control of flower drop in chilli**
Crop	:	**Chilli**
Background	:	Chilli is the most important commercial crop grown in Maharashtra. The problem of flower and fruit drop was serious in chilli crop resulting in losses. Spraying of plant growth regulators helps to control flower drop in chilli.
Recommendation	:	Foliar application of planofix or NAA @ 25 ppm at 50 and 70 days after transplanting of chilli seedlings is recommended to reduce down flower drop and also for increasing yield.
Year of Release	:	1990
Applications	:	Chilli growing area of Vidarbha region
Advantages	:	• Helps to reduce down flower drop in chilli • Improve the fruit set • Helps to increase the total yield • Cost effective and higher monetary return

Name of Technology	:	**Suitability of chilli varieties for summer season**
Crop	:	**Chilli**
Background	:	Chilli is the important commercial crop grown in Vidarbha region of Maharashtra. In Chilli crop, the fruit setting is affected if temperature goes beyond 38^0 C. The demand for green chilli in summer season is more. Therefore, there is need to find out suitable varieties of chilli for summer season.
Recommendation	:	For green chillies, the varieties Jwala and NP 46A are recommended for summer planting in Vidarbha region.
Year of Release	:	1990
Applications	:	Chilli growing area of Vidarbha region.
Advantages	:	• Suitable varieties of green chillies in summer season • More fruit yield • More monetary returns

Name of Technology	:	**Nutrient management in chilli**
Crop	:	**Chilli**
Background	:	Chilli is an important condiment grown extensively as a commercial crop in Maharashtra. It is transplanted in the month of June-July and the duration of crop is about 8 to 9 months. Chilli crop respond well to fertilizers. An attempt was made to find out suitable dose of fertilizers for obtaining higher yield of chilli.
Recommendation	:	Application of 150 Kg N, 50 Kg P and 50 Kg K / ha in four equal splits i.e. at transplanting 4,7 and 11 weeks after transplanting for obtaining highest yield of chilli is recommended under irrigated condition.
Year of Release	:	1991
Applications	:	Chilli growing area of Vidarbha region
Advantages	:	• Higher yield of wet red chilli • For better efficiency of nutrients • More net returns to grower

Name of Technology	:	**Management of flower drop in chilli**
Crop	:	**Chilli**
Background	:	Chilli is important vegetable crop of Vidarbha grown for green as well as dry pods.Flower drop is a major problem in chilli resulting in poor fruit set and reduces yield to greater extent. In order to study the effect of different growth regulators in checking the flower drop, the said investigation was carried.
Recommendation	:	Spraying of Planofix or NAA @ 25 ppm at 50 and 70 days after transplanting is recommended to control the flower drop and increase the yield of chilli.
Year of Release	:	2004
Applications	:	Chilli growing area of Vidarbha region.
Advantages	:	• Efficient control of flower drop • Increase the fruit set • Increase fruit yield and quality • Low cost and Increase the net returns

Name of Technology	:	**Weed management in chilli**
Crop	:	**Chilli**
Background	:	Chilli is an important vegetable grown in Maharashtra. Chilli is well known for its flavor, pungency and also form an important source of vitamins. In successful chilli cultivation, weeds constitutes greatest limiting factor in kharif season, weed intensity would be more. Adoption of wider row spacing, slow germination and initial growth coupled with adequate moisture, frequent rains, use of higher doses of fertilizers and intensive cropping system lead to heavy infestation of weeds and severe crop-weed competition. Pre-emerge herbicides are useful to keep the crop free from weed in an early stage. During later stages, mechanical weedings helps to reduce the cost of weeding and to check the weed population.
Recommendation	:	Pre-emergence application of Trifluralin @ 1.0 kg/ha followed by one hand weeding at 45 days after transplanting is recommended to control the weeds and to obtain higher yield of wet red chilli.
Year of Release	:	2008
Applications	:	Chilli growing area of Vidarbha region.
Advantages	:	• Transplanting reduce weed menace and recorded maximum yield of wet red chilli • Reduction of weed flora • Cost effective • Saving of labour

Name of Technology	:	**Inter cropping in brinjal**
Crop	:	**Brinjal**
Background	:	Brinjal is important vegetable crop in Vidarbha region and area under this cop is increasing, If irrigation facilities are available, this crop can be grown throughout the year. To increase the net return from unit land and also to minimize the of crop failure risk, the intercropping in brinjal over sole cropping is good solution. Therefore technology for intercropping in brinjal has been developed for this region.
Recommendation	:	Radish is found to be suitable intercrop in brinjal in kharif season for higher monetary returns and hence recommended for intercropping in brinjal.
Years of Release	:	1989
Applications	:	Brinjal growing area of Vidarbha region.
Advantages	:	• Maximum returns from unit area of land • Reduces risk of crop failure

Name of Technology	:	**Radish varieties for Vidarbha region**
Crop	:	**Radish**
Background	:	Radish is important short duration vegetable crop grown in this region for its roots. It is very popular in rural as well as in urban areas as salad crop. Generally the local varieties are grown by the farmers which are low yielder and of inferior quality. Therefore it was felt necessary to assess the performance of important radish varieties for Vidarbha region.
Recommendation	:	Radish varieties viz, Pusa Himani and Japanese White were found suitable and hence recommended for commercial cultivation in Vidarbha region .
Year of Release	:	1994
Applications	:	Radish growing area of Vidarbha region.
Advantages	:	• Well suited for commercial cultivation in Vidarbha region • Higher yield and good quality • Better returns to growers.

Name of Technology	:	**Time of planting for seed production in radish**
Crop	:	**Radish**
Background	:	It is an important root vegetable crop grown and become ready for use in 3-6 weeks from the time of sowing. There is ample demand for radish seed in the market. Taking the above view into consideration, there is need to standardize the sowing time for seed production of radish to raise the productivity of crop.
Recommendation	:	Sowing of radish seed by *In- situ* method during first week of October for more number of branches, seeds per capsule and maximum seed yield of seed is recommended.
Year of Release	:	2003
Applications	:	Radish seed producing area of Vidarbha region.
Advantages	:	• Suitable time of sowing • Higher seed yield of radish • More profit to grower

Name of Technology	:	**Weed management in onion**
Crop	:	**Onion**
Background	:	Onion is the most important commercial crop grown in Maharashtra. Being a slow growing crop having erect tubular leaves, it suffers heavily from weed competition during establishment of seedlings. Frequent irrigations are required for raising the crop, which promote emergence of weeds in several flushes. Weeds interfere development of onion bulbs thereby reducing bulb yield to the extent of 40-80 per cent. Late emerging weeds hinder bulb development and create the problems in digging operation. Hence, it becomes necessary to control the weeds during later period of crop growth.
Recommendation	:	Pre-emergence application of trifluralin @ 1.0 kg/ha followed by one hand weeding at 45 days after transplanting is recommended to control the weeds and to obtain higher yield of onion bulbs.
Year of Release	:	2008
Applications	:	Onion growing area of Vidarbha region
Advantages	:	• Efficient reduction of weed population • Cost effective • Saving of labour expenses • Maximum yield of onion bulbs

Name of Technology	:	**Use of plant growth regulators in potato**
Crop	:	**Potato**
Background	:	Potato is one of the important tuber crop grown in the country. In Vidarbha, the area under cultivation is increasing rapidly. The production and productivity of potato is depended on various factors like, nutrients, spacing, soil, climate, planting dates etc. The use of plant growth regulators like GA will be helpful to ensure multiple shoots, healthy sprouts, helps in quick germination and uniform plant stand .
Recommendation	:	The soaking of sprouted potato tubers (Kufri Sindhuri) for 5 minutes in 5 ppm GA solution is recommended for higher yield of potato.
Year of Release	:	1977
Applications	:	Potato growing area of Vidarbha region.
Advantages	:	• Multiple sprouts and shoots • Higher germination percentage • Higher plants stand with maximum survival • Higher tuber yield • More net profit to grower

Name of Technology	:	**Weed management in fenugreek**
Crop	:	**Fenugreek**
Background	:	Fenugreek is the most important commercially grown leafy vegetable crop. With ease in cultivation and short duration, it is very popular amongst growers. It is grown for its fleshy edible leaves, which are eaten raw as salad. The crop becomes ready to use in 3-6 weeks from the time of sowing.There is ample demand for fenugreek seed in the market. In fenugreek, control of weeds is the major problem. To overcome this situation, it was decided to study the effect of herbicides in combination with cultural methods for weed control of fenugreek.
Recommendation	:	Pre-emergence application of Pendamethalin @ 1.0 kg active ingredient per hectare is recommended for weed control in seed production of fenugreek
Year of Release	:	2002
Applications	:	Fenugreek growing area of Vidarbha region.
Advantages	:	• Reduction in weed population • Maximum seed yield • Saving of labours • Cost effective

Name of Technology	:	**Nutrient management in seed production of fenugreek**
Crop	:	**Fenugreek**
Background	:	Fenugreek is the most important commercially grown leafy vegetable crop. It is mainly cultivated during winter season. It is grown for its fleshy edible leaves, which are eaten raw as salad. Fenugreek crop become ready for cutting use in 3-6 weeks from the time of sowing. There is ample demand for fenugreek seed in the market. Fenugreek crop respond well to fertilizers and to increase seed yield of fenugreek, an attempt was made to study the effect of fertilizers on seed yield of fenugreek.
Recommendation	:	Application of 37.5 kg nitrogen, 25 kg phosphorus and 25 kg potash at the time of sowing and 37.5 kg nitrogen per hectare after 30 days of sowing is recommended for higher seed yield of fenugreek.
Year of Release	:	2006
Applications	:	Fenugreek growing area of Vidarbha region.
Advantages	:	• Maximum seed yield of fenugreek • Efficient use of nutrients • More profit to grower

Name of Technology	:	**Cowpea varieties for Vidarbha region**
Crop	:	**Cowpea**
Background	:	Cowpea is an important vegetable grown throughout the year for its tender pods. The pods are rich source of protein. Local varieties of cowpea grown by farmers are more fibrous and more over grown as pulse crop. Therefore there is need to identify improved varieties for vegetable purpose. Keeping this view, this university has recommended one variety of cowpea for Vidarbha.
Recommendation	:	Pusa do Fasali variety of cowpea has recorded higher yield of 40 q/ha under Vidarbha condition and hence recommended for commercial cultivation.
Year of Release	:	1975
Applications	:	In cowpea growing area of Vidarbha
Advantages	:	• Good returns • Tender and less fibrous • Good consumer acceptance

Name of Technology	:	**Sowing time for cowpea**
Crop	:	**Cowpea**
Background	:	Cowpea is an important vegetable grown throughout the year for its tender pods. The pods are rich source of protein. Cowpea responds longer sunny days. Therefore to harvest cowpea to its maximum potential, there is need to standardize the sowing time for Vidabha region. Keeping this view, this university has undertaken the studies.
Recommendation	:	The best time of sowing for Pusa Barsati variety of Chawali is from 1st week of June to 2nd week of July in Kharif season and 15th March to 1st April for Summer season.
Year of Release	:	1975
Applications	:	Cowpea growing area of Vidarbha region
Advantages	:	• Higher yields • Good consumer acceptance • Tender and less fibrous • Summer season crop can be possible. • Good returns

Name of Technology	:	**Use of plant growth regulator in pea**
Crop	:	**Pea**
Background	:	Pea has got good attention of vegetable growers due to high market prices. The technology for this crop is not available so far. The use of growth regulators as seed treatment improve germination and rapid vegetative growth. Hence, the efforts were made to use the plant growth regulators like GA as seed soaking in pea.
Recommendation	:	Soaking of pea seeds prior to sowing 12 hours with GA 100 ppm is recommended for maximum yield of pea .
Year of Release	:	1974
Applications	:	Pea growing area of Vidarbha region
Advantages	:	• Higher germination • Rapid plant growth • Increase in pod yield

Name of Technology	:	**Time of sowing of Dolichus bean in kharif fallow area under protective irrigation**
Crop	:	**Dolichus bean (Wal)**
Background	:	Dolichus bean is an important vegetable crop grown in eastern Vidarbha zone. There was urgent need to have technology for kharif fallow area for cultivation of different short duration crops. Beans are popularly grown in the area and hence standardization of sowing time of beans was the priority.
Recommendation	:	In eastern Vidarbha zone sowing of Konkan Bhushan wal should be taken from 1st October to 16th October in kharif fallow area under protective irrigation.
Year of Release	:	1995
Applications	:	For eastern Vidarbha region
Advantages	:	• Ideal sowing time for crop • More survival and early plant stand • Higher yield with more economical return

Name of Technology	:	**Spacing and nutrient management in Dolichus bean in kharif fallow area**
Crop	:	**Dolichus bean (Wal)**
Background	:	Dolichus bean is an important vegetable crop grown in eastern Vidarbha zone. There was urgent need to have technology for kharif fallow area for cultivation of different short duration crops. Beans are popularly grown in the area and hence standardization of sowing time of beans was the priority.
Recommendation	:	In eastern Vidarbha zone, sowing should be done at 45 X 20 cm spacing with fertilizer dose of 75 kg nitrogen and 100 kg phosphorus per hectare as basal dose under protective irrigation on kharif fallow area.
Year of Release	:	1995
Applications	:	For Eastern Vidarbha region
Advantages	:	• Good response to nutrient management • Higher yield • Efficient use of fertilizers

Flower Crops

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Name of Technology	:	**Varietal evaluation of rose**
Crop:	:	**Rose**
Background	:	Rose is one of the nature's beautiful creations and due to its different types having beautiful flowers of exquisite shape, different sizes, bewitching colours and most delightful fragrance has made it important flower for various uses as cut flower for bouquets, flower arrangement, loose flower for garland making, pot plants and for preparation of perfumes and allied products. This rose flower gaining popularity as loose flower in cities for garland making. As region specific, suitable rose variety/varitieties for garland need to be recommended, hence, the said experiment was carried out.
Recommendation	:	Rose varieties Grand Slam, Precious platinum, Europeana, Apogea, Mischief, Peter Franken feld, Elizabeth of Glammis, Devotion, Feberge, Violetcarson, Just Joy, Arhur bell, Fragrant cloud, Montezuma, Bahia, Inge- Hortsman, Banjaran, Neelambari and Maballa have been observed to be promising for garland making hence recommended for commercial cultivation.
Year of Release	:	2003
Applications	:	Flower growing areas Vidarbha region
Advantages	:	• More number of flowers • Higher flower yield • Suitable for garland making

Name of Technology	:	**Rootstock for rose propagation**
Crop	:	**Rose**
Background	:	Roses are propagated by budding which provides better quality and faster growing plants. Budding is generally performed on rootstock and there are different rootstocks available for different region. Rootstock suitable for one region may not be suitable for other region. Hence, this rootstocks study has been undertaken.
Recommendation	:	Under Vidarbha conditions, the rootstock Rosa indica var. odorata has been found superior to others and has been recommended for obtaining higher percentage of rooted cuttings.
Year of Release	:	2004
Applications	:	Rose nurseries of Vidarbha region
Advantages	:	• More percentage of rooted cuttings • Higher yield of quality flower of scion varieties

Name of Technology	:	**Fertilizer management in gladiolus**
Crop	:	**Gladiolous**
Background	:	Gladiolus is one of the important cut flowers gaining popularity in flower growing areas around Akola, Amravati and Nagpur cities. The cut flower of gladiolus is extensively used in flower bouquets and flower arrangements. Gladiolus gives good response to fertilizers. Since the fertilizer requirement has not worked out for Vidarbha region, the said experiment has been carried out.
Recommendation	:	Application of NPK @ 150:200:200 kg/ha is recommended for obtaining good quality flowers and corms. Full dose of P, K and 70 kg nitrogen should be applied at the time of planting and remaining nitrogen in two split doses at 2 and 4 leaf stage.
Year of Release	:	2006
Applications	:	Flower growing areas of Vidarbha region
Advantages	:	• Better use of nutrition efficiency • More number of florets • Higher flower yield and quality • Higher monetary returns

Name of Technology	:	**Fertilizer management in gaillardia**
Crop	:	**Gaillardia**
Background	:	Gaillardia called as 'Blanket flower' is one of the important flower gaining popularity in flower growing areas around Akola, Amravati and Nagpur cities. It is hardy seasonal flower crop grown for loose flower production for garland purpose. It gives good response to fertilizers. Since the fertilizer requirement has not worked out for Vidarbha region, the said experiment has been carried out.
Recommendation	:	For getting higher flower yield and monetary returns, fertilizer dose of 100 : 50 : 50 kg NPK/ ha is recommended with application of full dose of P and K and half dose of N should be given at the time of transplanting and the remaining half dose of nitrogen should be applied one month after transplanting.
Year of Release	:	2006
Applications	:	Flower growing areas of Vidarbha region
Advantages	:	• Better use efficiency of nutrition • More number of florets • Higher flower yield and quality • Higher monetary returns

Name of Technology	:	**Fertilizer management in aster**
Crop	:	**Aster**
Background	:	Aster is one of the important flowers used as loose as well as cut flower which is gaining popularity in flower growing areas around Akola, Amravati and Nagpur cities. The flowers of aster are extensively used in flower bouquets, flower arrangements and garlands. Aster gives good response to fertilizers. Since the fertilizer requirement has not worked out for Vidarbha region, the said experiment has been carried out.
Recommendation	:	It is recommended to apply 75 kg N, 50 kg P and 50 kg K/ ha at planting and thereafter 75 kg N at bud initiation.
Year of Release	:	2002
Applications	:	Flower growing areas of Vidarbha region
Advantages	:	• Better use efficiency of nutrition • More number of flowers • Higher flower yield and quality • Higher monetary returns

Name of Technology	:	**Planting time of aster**
Crop	:	**Aster**
Back ground	:	It is an important annual flower crop used as cut flower for decoration and loose flower for garland making. Among annual flowers it ranks next, to chrysanthemum and marigold. It can be grown in various agroclimatic zone. It gives good response to congenial climatic conditions during growth and flowering. Similarly, planting at proper spacing and proper application of fertilizers gives better result. Hence, said experiment has been carried out.
Recommendation	:	For getting higher flower yield and monetary returns of aster, transplanting of 30 days old seedlings in the first week of October at 30 X 30 cm spacing and application of 75 kg N + 50 kg P + 50 kg K /ha at planting and 75 kg N/ha at bud initiation is recommended.
Year of Release	:	2004
Applications	:	Flower growing areas of Vidarbha region
Advantages	:	• Better use efficiency of nutrition • More number of florets • Higher flower yield and quality • Higher monetary returns

Name of Technology	:	**Chrysanthemum variety for Vidarbha region**
Crop	:	**Chrysanthemum**
Background	:	Chrysanthemum occupies leading position in loose flowers trade in Vidarbha region. The flowers are used for making garland and for social as well as religious offerings. Improved and local varieties are grown by the cultivators in this region. There was no specific varietal recommendation in chrysanthemum for Vidarbha region. In view of this, the present study was initiated to find out suitable variety of chrysanthemum for commercial cultivation in Vidarbha region.
Recommendation	:	For higher flower yield of chrysanthemum Zipri vatiety is recommended for planting in Vidarbha region.
Year of Release	:	2002
Applications	:	Flower growing areas of Vidarbha region
Advantages	:	• Higher flower yield with good quality flowers • Suitable for making garlands • More acceptances in the market hence fetch high returns

Name of Technology	:	**Varietal evaluation of chrysanthemum for exhibition and decoration purpose**
Crop	:	**Chrysanthemum**
Back ground	:	Chrysanthemum is a very popular crop. It is valued as a potted plant and widely grown in open fields for their loose flowers. Some of the varieties are also suitable for cut flower production which is used for exhibition and decoration purposes. Hence, the said experiment is carried out to find out the varieties of chrysanthemum for exhibition and decoration purposes suitable for the region.
Recommendation	:	The chrysanthemum varieties Kukubior, Mountainaeer, Snow ball, T-34, Beauty, Kunchit, Mahatma Gandhi, President Vigour, Violet queen, Alfred Simpson, Raja, T-1, Maharaja Sikkim, Goldie, Distinction, Rupasi Bangla, W-14 and Voillent are recommended for growing in the region for exhibition and decoration purpose.
Year of Release	:	2002
Applications	:	Chrysanthemum Flower growing areas of Vidarbha region
Advantages	:	• Dwarf, cluster of 18-20 flowers with different colours • Higher flower yield & monetary return

Name of Technology	:	**Suitability of chrysanthemum variety for region**
Crop	:	**Chrysanthemum**
Background	:	Chrysanthemum is a very popular crop. It is valued as a potted plant and widely grown in open fields for their loose flowers. Hence, the said experiment is carried out to find out the suitable variety of small flower type of chrysanthemum for loose flower production.
Recommendation	:	For obtaining higher flower yield, chrysanthemum (small flower type) Cv. PKV Sel-1 (*Zipri*) is recommended for planting in Vidarbha region.
Year of Release	:	2004
Applications	:	Flower growing areas of Vidarbha region
Advantages	:	• Good quality flowers • High yield • Suitable for garland making • High monetary returns

Name of Technology	:	**Suitability of chrysanthemum variety for region**
Crop	:	**Chrysanthemum**
Background	:	Chrysanthemum is a very popular crop. It is valued as a potted plant and widely grown in open fields for their loose flowers. Hence, the said experiment was carried out to find out the suitable variety of chrysanthemum for loose flower production.
Recommendation	:	For obtaining the higher yield of flowers, PKV Shubhra chrysanthemum is recommended for Vidarbha
Year of Release	:	2004
Applications	:	Flower growing areas of Vidarbha region
Advantages	:	• Good quality flowers • High yield • Suitable for garland making • High monetary returns

Name of Technology	:	**Production technology for chrysanthemum**
Crop	:	**Chrysanthemum**
Background	:	Chrysanthemum is a very popular crop. It is valued as a potted plant and widely grown in open fields for their loose flowers. Some of the growth regulators play a vital role in flower production. Among them GA_3 increase the flower yield and improves the flower quality. Hence, the said experiment was carried out on chrysanthemum variety PKV Shubhra.
Recommendation	:	Spraying of 100 ppm GA_3 at 30 and 70 days after planting is recommended for maximum flower yield of chrysanthemum variety PKV Shubhra.
Year of Release	:	2005
Applications	:	Flower growing areas of Vidarbha region
Advantages	:	• Good quality flowers • High yield • Suitable for garland making • High monetary returns

Name of Technology	:	**Planting time for annual chrysanthemum**
Crop	:	**Annual chrysanthemum**
Background	:	Annual chrysanthemum is an important winter seasonal flower crop grown in this region. Due to its elegant flower shape and colour, it is used for garland making. Since the planting time has not worked out for Vidarbha region, the said experiment has been carried out.
Recommendation	:	Planting of annual chrysanthemum (Bijli) should be done between 5th to 15th October for obtaining higher yield of flowers
Year of Release	:	2005
Applications	:	Flower growing areas of Vidarbha region.
Advantages	:	• Good quality flowers • High yield • Suitable for garland making • High monetary returns

Name of Technology	:	**Planting time for PKV shubhra**
Crop	:	**Chrysanthemum**
Background	:	Chrysanthemum is a very popular flower crop. It is valued as a potted plant and widely grown in open fields for their loose flowers. As it is a light sensitive crop, exact time of planting gives better and quality flower yield. Hence, the said experiment was carried out to find out the suitable planting time.
Recommendation	:	Chrysanthemum variety PKV Shubhra should be planted in first fortnight of July for maximum flower yield.
Year of Release	:	2005
Applications	:	Flower growing areas of Vidarbha region.
Advantages	:	• Good quality flowers • High yield • High monetary returns

Name of Technology	:	**Fertilizer management in annual chrysanthemum**
Crop	:	**Annual chrysanthemum**
Background	:	Gladiolus is one of the important loose flower gaining popularity in flower growing areas around Akola, Amravati and Nagpur cities. The loose flower of annual chrysanthemum is used for garland making. It gives good response to fertilizers. Since the fertilizer requirement has not worked out for Vidarbha region, the said experiment has been carried out.
Recommendation	:	For getting better flower yield and high monetary returns, fertilizer dose of 150 : 50 : 50 kg NPK / ha is recommended. The application of full dose of P and K and half dose of N should be given at the time of transplanting and the remaining half dose of nitrogen be applied at one month after transplanting .
Year of Release	:	2006
Applications	:	Flower growing areas of Vidarbha region.
Advantages	:	• Better use efficiency of nutrition • More number of flowers • Higher flower yield and quality • Higher monetary returns

Name of Technology	:	**Fertilizer management in tuberose**
Crop	:	**Tuberose**
Background	:	Tuberose is important flower crop grown for loose flower for garland and cut flowers for bouquets and table decoration in vase. The flower remains fresh for longer time and stands long distance transportation due to their waxy nature. It gives good response to fertilizers. Since the fertilizer requirement has not worked out for Vidarbha region, the said experiment has been carried out.
Recommendation	:	For getting higher flower spike yield of tuberose (single), fertilizer dose of 70 : 300 : 200 kg NPK/ha at planting and 65 kg N/ha each at 45 and 90 days after planting is recommended.
Year of Release	:	2003
Applications	:	Flower growing areas of Vidarbha region.
Advantages	:	• Better use efficiency of nutrits • More number of florets per spike • Higher yield of spike • Higher monetary returns

Name of Technology	:	**Fertilizer management in marigold**
Crop	:	**Marigold**
Background	:	Marigold is most commonly grown flower and used extensively in religious and social function in different form like garland, cut flower edging, hanging basket etc. It gives good response to fertilizers. Since the fertilizer requirement has not worked out for Vidarbha region, the said experiment has been carried out.
Recommendation	:	For getting higher flower yield and monetary returns, fertilizer dose of 100 : 50 : 50 kg NPK/ ha is recommended. The application of full dose of P and K and half dose of N should be given at the time of transplanting and the remaining half dose of nitrogen should be applied one month after transplanting.
Year of Release	:	2003
Applications	:	Flower growing areas of Vidarbha region
Advantages	:	• Better use efficiency of nutrits • More number of florets • Higher flower yield and quality • Higher monetary returns

Name of Technology	:	**Suitability of Mogra variety for the region**
Crop	:	**Mogra**
Background	:	Mogra is a perennial bushy plant. Flowers are used for making garlands, personal adoring by women and religious offering. Flowers are known for their fragrance hence used for extraction of the essential oil. For the region, there is no any specific variety which stand in the market on commercial foundation. Hence, the said experiment was carried out to find out the suitable variety of Mogra for the region.
Recommendation	:	Variety Khoya was found high yielding and hence recommended for planting in Vidarbha region.
Year of Release	:	2005
Applications	:	Flower growing areas of Vidarbha region.
Advantages	:	• More number of flowers • Higher flower yield • Higher monetary returns

Medicinal and Aromatic Plants

Name of Technology	:	**Seed rate for ashwagandha**
Crop	:	**Ashwagndha (*Withania somnifera* Dunal)**
Background	:	The roots of ashwagandha are commercial produce and having pharmaceutical value. The roots contain alkaloids (withanine, somniferin, etc.) and steroidal lactones (withanolides) and being used traditionally for rheumatic pain, general debility and gynecological problems. The roots are sold in the market on the basis of root quality. Roots with pencil thickness varied in between 6-11 mm are the good quality roots, fetches fair prices in the market. In Madhya Pradesh, where this crop is being taken on large scale and broadcasting method of seed is adopted to obtain the desired quality roots. For getting the good quality roots, the seed rate play a prime role and therefore the present investigation was conducted to study the effect of seed rates on the root yield and quality of ashwagandha.
Recommendation	:	The seed rate of 9 kg /ha is recommended for obtaining the higher root yield and monetary returns from ashwagandha.
Year of Release	:	2006
Applications	:	For dry land agriculture, light to medium soils
Advantages	:	• Optimum seed rate • Desired quality roots • Higher monetary returns

Name of Technology	:	**Proper Harvesting period for ashwagandha**
Crop	:	**Ashwagandha (*Withania somnifera Dunal*)**
Background	:	Ashwagandha roots contain alkaloids (withanine, somniferin, etc.) and steroidal lactones (withanolides). The roots are being used for rheumatic pain, general debility, mental disorders and gynecological problems. Also used as tonic for hiccup, cold, cough, female disorders, as a sedative, in care of ulcers etc. The time of planting and harvesting of medicinal and aromatic plants are most crucial factors for synthesis of secondary metabolites i.e. alkaloids. Therefore, to determine the stage of harvesting for maximum root yield and alkaloid content of ashwagandha, the investigation was undertaken to study the effect of time of harvest on root yield and quality of ashwagandha .
Recommendation	:	It is recommended to harvest aswagandha crop at 100 per cent flowering stage to get the highest dry root yield and total alkaloids yield.
Year of Release	:	2006
Applications	:	For dry land agriculture and Light to medium soil
Advantages	:	• Higher root yield and total alkaloids yield • Higher monetary returns

Name of Technology	:	**Nutritional management of ashwagandha**
CROP	:	**Ashwagandha (*Withania somnifera* Dunal)**
Background	:	Roots having finger thickness with less fiber fetches more prices in the market. To obtain the good quality roots, the nutritional management through organic manure (FYM) is having major role and therefore the present investigation was conducted.
Recommendation	:	For obtaining higher root and alkaloids yields and better monetary return from ashwagandha, the application of 5 t FYM per ha is recommended.
Year of Release	:	2007
Applications	:	For dry land and Light to medium soils
Advantages	:	• Higher root yield of ashwagandha • Better quality produce • Economic returns

Name of Technology	:	**Seed treatment for safed musli**
Crop	:	**Safed musli (*Cholorophytum borivilianum*)**
Background	:	Safed musli is a small perennial herb extensively used in the medicines on general debility due to its aphrodisac property and the roots of *C. borivilianum* have great medicinal value due to saponin content and are used extensively in Ayurvedic medicines. Safed musli usually propagated by fasciculated roots. The shy flowering and poor setting of viable seeds, the species has low rate of regeneration through seed. The requirement of planting material (fasciculated roots) per hectare is too high (3.33 lakh sprouted roots), ultimately increases the cost of cultivation. The roots produced by means of seed propagation in the first year are not vigorous enough, however could be used as planting material and hence experiment was undertaken to have the seed treatment for enhancing the seed germination.
Recommendation	:	For enhancing the germination percentage of safed musli, the seed soaking in GA_3 1000 ppm or humic acid 0.5% for 24 hours is recommended.
Year of Release	:	2003
Applications	:	Under assured rainfall zone and Irrigated well drained and Medium- clay loam soil
Advantages	:	• Low cost for generating planting material to be used for second year. • For increasing germination

Name of Technology	:	**Root propagation rate for safed musli**
Crop	:	**Safed musli (*Cholorophytum borivilianum*)**
Background	:	Safed musli (*Chlorophytum borivilianum*) is partly a herb with sub erect lanceolate leaves, belongs to the family Liliaceae. The economic part of the herb is fasciculated roots. In recent years, the roots fetches an attractive price and hence large number of farmers are coming forward for its cultivation. Normally, the planting of 3 to 4 roots bunch having 15-20 grams weight are being used by the farmers and thereby the requirement of planting material per unit area is too high, ultimately increasing the cost of cultivation. In view of above, the study was undertaken to assess the yielding potential of safed musli as influenced by number and weight of roots at planting time.
Recommendation	:	Planting of safed musli with one root per hill is recommended for getting highest economic returns.
Year of Release	:	2003
Applications	:	Assured rainfall zone, Irrigated, Soil type of well drained and medium- clay loam
Advantages	:	• Low cost of planting material • Higher net returns

Name of Technology	:	**Management of chlorosis in safed musli**
Crop	:	**Safed musli (*Chlorophytum borivilianum*)**
Background	:	Chlorosis is frequently appeared on safed musli at early stages of growth, particularly in Safed musli grown on calcareous soils. Chlorosis is primarily associated with iron deficiency and it affects the growth and photosynthesis in the plants. Among the factors, the presence of $CaCO_3$ in soils is considered to be the most important factor responsible for Fe deficiency. The local farmers have queries about its control measures and therefore, the present investigation was carried out.
Recommendation	:	Two foliar applications of humic acid (0.05%) + urea(1.0%) or humic acid + ferrous sulphate (0.5%) or humic acid + zinc sulphate (0.5%) or humic acid (0.05%) at an interval of 15 days is recommended to control the chlorosis in safed musli.
Year of Release	:	2003
Applications	:	Under assured rainfall zone, Irrigated, well drained and medium-clay loam soil
Advantages	:	• Reduction in losses due to chlorosis • High yield and returns

Name of Technology	:	**Spacing and organic requirement for safed musli**
Crop	:	**Safed musli (*Cholorophytum borivilianum*)**
Background	:	Safed musli being lucrative, high income generating medicinal crop, tremendous response is being received from farmers for its cultivation, resulting into increase in area under cultivation. In view of the package of practices for cultivation of safed musli, the present study was undertaken to study the appropriate plant geometry and organic manuring on its root yield.
Recommendation	:	For getting higher yield and monetary returns, it is recommended that the planting of safed musli be done at 30 x 10 cm with the application of FYM 20 t or 5 t vermicompost per hectare.
Year of Release	:	2004
Applications	:	Under assured rainfall zone, Irrigated, well drained and medium- clay loam soil
Advantages	:	• Production of higher root yield • Improvement in quality

Name of Technology	:	**Storability of safed musli roots**
Crop	:	**Safed musli (*Chlorophytum borivilianum*)**
Background	:	It is necessary to process a crude drug so as to preserve it for a longer period and also to acquire better pharmaceutical elegance. Drying and storage methods and also period of storage are of prime importance in reference to the active principles present in the processed product. Hence, the study was undertaken to assess the storability of safed musli roots.
Recommendation	:	It is recommended that, safed musli powder prepared from the roots dried under sunlight (for three days) or oven (at 60°C for 24 hours) could be stored for 12 months period in airtight container to retain the saponin content.
Year of Release	:	2005
Applications	:	Useful for processing purpose
Advantages	:	• Significant retention of saponin • Extended shelf life • Retains economic viability

Name of Technology	:	**Optimum harvesting period for quality root yield of safed musli**
Crop	:	**Safed musli (*Chlorophytum borivilianum*)**
Background	:	The roots of *C. borivilianum* have great medicinal value due to saponin content and are used extensively in Ayurvedic medicines The root of Safed musli contains the saponin (4-17%), steroid sapogenin (1 to 2 %), carbohydrates (40 %), proteins (10 to 12 %) and calcium to some extent with some water-soluble minerals. Sapogenins are used in the commercial preparation of steroidal harmones. The time of planting and harvesting of medicinal and aromatic plants are most critical factors for synthesis of secondary metabolites. Besides, it is necessary to process a crude drug so as to preserve it for a longer time with quality and also to acquire better pharmaceutical elegance. Hence to determine the optimum stage of harvesting for maximum root yield and saponin content in roots of Safed musli, the present investigations was undertaken.
Recommendation	:	It is recommended to harvest safed musli at 180 days after planting to get higher dry root yield and total saponin.
Year of Release	:	2006
Applications	:	Under assured rainfall zone, Irrigated, well drained and medium- clay loam soil
Advantages	:	• Optimum harvesting time for safed musli • Higher dry root yield with saponin content • More economic returns

Name of Technology	:	**Impact of peeling on quality of safed musli**
Crop	:	**Safed musli (*Chlorophytum borivilianum*)**
Background	:	Safed musli roots after harvesting are usually peeled and washed with water for whiteness and dried in sun. The peeling of roots is not only expensive but also laborious and time consuming. White product fetches more price than dull white or pale yellow musli and therefore the present laboratory study was undertaken to evaluate the saponin content in peeled and unpeeled musli, as the saponins are water soluble.
Recommendation	:	It is recommended to use the unpeeled musli for medicinal use in view of the reduction of saponin contents due to peeling of safed musli roots.
Year of Release	:	2008
Applications	:	Useful for processing purpose
Advantages	:	• Reduction in processing cost • Retention of active principle Saponin

Name of Technology	:	**Planting and harvesting period for kalmegh**
Crop	:	**Kalmegh (*Andrographis paniculata)***
Background	:	Kalmegh is a bitter annual (perennial if maintained) herb, erect, 60 cm to 100 cm in height, stem quadrangular and much branched; self-pollinated crop usually propagated by seed. The active bitter principle present in it is Andrographolide ($C_{20}H_{30}O_5$, a diterpene lactone). It is used in the treatment of intermittent and remittent fevers, torbid liver, jaundice, dermatological diseases and dyspepsia. The time of planting and harvesting of medicinal and aromatic plants are most crucial and important factors for synthesis of secondary metabolites i.e. alkaloids. The present investigation was therefore undertaken to study the effect of time of planting and harvesting on the foliage yield and andrographolide content in Kalmegh.
Recommendation	:	The planting time around 1st July and harvesting between 1st to 16th November are recommended for obtaining maximum dry foliage yield as well as yield of total andrographolide and iron.
Year of Release	:	2002
Applications	:	Under assured rainfall zone and Irrigated, well drained and medium soil
Advantages	:	• Production of higher foliage yield with quality • Higher economic returns

Name of Technology	:	**Storage period for kalmegh**
Crop	:	**Kalmegh *(Andrographis paniculata)***
Background	:	Kalmegh is a bitter annual (perennial if maintained) herb, erect, 60 cm to 100 cm in height, stem quadrangular and much branched; self-pollinated crop usually propagated by seed. The active bitter principle present in it is andrographolide ($C_{20}H_{30}O_5$, a diterpene lactone). It is used in the treatment of intermittent and remittent fevers, torbid liver, jaundice, dermatological diseases and dyspepsia. Before marketing a crude drug, it is necessary to process it properly, so as to preserves it for a longer time and also to acquire better pharmaceutical elegance. Drying of the herb, storage methods and also period of storage are of prime importance in reference to the active principles.
Recommendation	:	It is recommended to store kalmegh herbs powder for 10 months period for maximum andrographolide content.
Year of Release	:	2004
Applications	:	For processing purposes
Advantages	:	• Storage of kalmegh powder up to 10 months • Ensures quality of produce • More economic returns

Name of Technology	:	**Plant spacing and harvesting time for shatavar**
Crop	:	**Shatavar (*Asparagus racemosus*)**
Background	:	Shatavar (*A. racemosus*) is a perennial, prickly climber having tuberous roots contains saponin, phosphorus, riboflavin, thiamin, potassium, calcium and other chemical compounds. According to recent chemical investigations, it contains four saponins, shatavarin I - IV and are steroid saponins. The tonic prepared from shatavar roots is best for women. It is being commonly used to increase the milk secretion, for fever, urinary problems, and as a blood purifier. The drug has no toxicity and has great reputation in ayurveda. In view of the package of practices for cultivation of Shatavar, the present study was undertaken to study the impact of plant geometry and harvesting period on root yield of shatavar.
Recommendation	:	For getting higher root yield, it is recommended to plant shatavar seedlings at 60x60 cm spacing and harvest the crop after 24 months.
Year of Release	:	2006
Applications	:	Under assured rainfall zone, Irrigated, well-drained and medium soil
Advantages	:	• Higher root yield with closer spacing • More economic returns

Name of Technology	:	**Storage management of shatavari roots**
Crop	:	**Shatavari *(Asparagus racemosus)***
Background	:	The tonic prepared from shatavar roots is best for women. It is being commonly used to increase the milk secretion, for fever, urinary problems, and as a blood purifier. The drug has no toxicity and has great reputation in ayurveda. It is necessary to process a crude drug so as to preserve it for a longer time and also to acquire better pharmaceutical elegance. The storage forms and period of storage influence the active principles present in the processed product and therefore to study the post harvest deterioration of saponin content in shatavar roots as influenced by storage forms and storage period, the present investigation was carried out.
Recommendation	:	It is recommended to store the dried roots of shatavari as such for maximum retention of saponin content during the period of 10 months,.
Year of Release	:	2008
Applications	:	For processing purposes
Advantages	:	• Increased storage retention of saponin content in shatavar roots for longer period • Ensures economic returns

Name of Technology	:	**Cultivation of Isabgol under crop rotation**
Crop	:	**Isabgoal (*Plantago ovata*)**
Background	:	Isabgol is one of the crop grown as a Rabi crop in Gujarat state having high export potential because of its highest utility in the western countries. For further export promotion, there is need to increase its productivity and to extend its cultivation to new areas under various crop rotation with nutritional management. To test the performance of isabgol after harvest of short duration kharif crops, a field experiment was conducted with six treatments comprising of black gram, green gram, soybean, ground nut and pigeon pea and *kharif* fallow.
Recommendation	:	It is recommended to grow the isabgol in rabi season after harvesting of ground nut, soybean or pigeonpea (short duration).
Year of Release	:	1999
Applications	:	Under assured rainfall zone, irrigated, well drained and medium soil type
Advantages	:	• Higher monetary returns • Proper crop rotation

Name of Technology	:	**Nutritional management of isabgol**
Crop	:	**Isabgoal (*Plantago ovata*)**
Background	:	Isabgol is an important medicinal crop mainly grown in Gujarat and adjoining parts of Madhya Pradesh and Rajasthan. The seed husk (epicarp of seed) is having medicinal value and mostly used against constipation, irritation of digestive tract, etc. The demand for isabgol in national as well international markets has increased in recent years indicating the scope of spread up in the areas under this crop. The production technologies although have been developed for the traditional, location specific to assessing areas, it was felt necessary to study the nutritional requirement of isabgol when grown under Vertisols of Vidarbha (Maharashtra) region.
Recommendation	:	It is recommended to apply 50 kg N and 30 kg P_2O_5 to isabgol for obtaining maximum seed yield and monetary return.
Year of Release	:	2000
Applications	:	Under assured rainfall zone, Irrigated, well drained and medium soil type
Advantages	:	• Higher seed yield • More economic returns

Name of Technology	:	**Sowing time and seed rates for isabgol**
Crop	:	**Isabgol (*Plantago ovata*)**
Background	:	Isabgol is an important medicinal crop mainly grown in Gujarat and adjoining parts of Madhya Pradesh and Rajasthan. The seed husk (epicarp of seed) is having medicinal value and mostly used against constipation, irritation of digestive tract, etc. Isabgol is grown as a *Rabi* crop in adjoining Gujarat State having high export potential because of its highest utility in the western countries. For further export promotion, there is a need to increase its productivity and to extend its cultivation to new areas. In view of finding, suitable sowing time and seed rate for obtaining maximum yield under Vidarbha agroclimatic conditions, the present investigation was undertaken.
Recommendation	:	It is recommended to sow isabgol crop between 10th -20th November with seed rate of 4 kg/ha for getting higher seed yield and monetary returns.
Year of Release	:	2005
Applications	:	Under assured rainfall zone, irrigated and well drained and medium soil
Advantages	:	• Higher seed yield • Maximum monetary returns

Name of Technology	:	**Nutritional management of kastur bhendi for higher seed production**
Crop	:	**Kastur bhendi *(Abelmoscus moschatus)***
Background	:	Kastur bhendi is an erect, branching shrub of 1 to 1.5 m height, resemblance to ladies finger. The seeds of kastur bhendi possess delicate musk like odour and are valued for the volatile oil present in the seed coat. It is also used as flavoring agent in tobacco products like zarda. Its oil is used in high-grade perfumery. Seeds are used to protect woolen garments against moths**.** Usually seed known commercial seed products are ambrette concrete, absolute, oil and tincture. In spite of its wide application and utility, not much work has been done on agrotechniques particularly on nutritional requirement to enhance the productivity and therefore, the present investigation was undertaken.
Recommendation	:	It is recommended that application of 75 Kg N and 50 Kg P_2O_5 per ha be applied to kastur bhendi (Musk dana) for getting higher seed yield and monetary returns. Full dose of P_2O_5 and half dose of N at the time of sowing and remaining half dose of N after 45 days are to be applied.
Year of Release	:	2003
Applications	:	Under assured rainfall zone, well drained and medium to heavy soils
Advantages	:	• Higher seed yield • More economic returns

Name of Technology	:	**Plant spacing and nutritional requirement for palmarosa**
Crop	:	**Palmarosa *(Cymbopogan martinii)***
Background	:	Aromatic grasses (Cymbopogans) are widely adapted to different agroclimatic zones. Plant spacings, both row to row and plant to plant, play an important role in the production of aromatic grasses. It is governed by various edapho-climatic factors to a large extent leading to varying results. They are also very sensitive to environmental conditions (rainfall, humidity, temperature and soil fertility) under which they are grown. Therefore, there is wide variation in both yield and quality of oil produced at different locations. Being perennial crop, periodic replenishment of nutrient is essential to keep the plantation viable for 4-5 years. With this view points, the study was undertaken.
Recommendation	:	A spacing of 60 x 30 cm and fertilizer dose of 75 kg N / ha is recommended to obtain maximum herbage and oil yield of palmarosa
Year of Release	:	1992
Applications	:	Under assured rainfall zone, well drained and medium to heavy soils
Advantages	:	• Higher herbage and oil yield • Better economic returns

Name of Technology	:	**Weed management in palmarosa and lemongrass**
Crop	:	**Palmarosa/ Lemongrass *(Cymbopogan Spp)***
Background	:	Weeds are major constraints for successful cultivation of aromatic grasses. Generally, aromatic grasses are planted at the onset of monsoon and hence face severe competition with kharif season weeds. Once these grasses are established, they can very well compete with the weeds. Therefore, the initial period during the first harvest is considered very critical when the field should be maintained free of weeds. With this view, the present investigation was carried out.
Recommendation	:	On the basis of herbage yield of palmarosa and lemon grass with higher net monetary return, it is recommended to keep the field weeds free manually or apply atrazine 1.5 kg/ha before transplanting.
Year of Release	:	1994
Applications	:	Under assured rainfall zone, irrigated conditions, well drained and medium to heavy soils
Advantages	:	• Higher herbage yield • Better monetary returns.

Name of Technology	:	**Varietal performance of dorli**
Crop	:	**Dorli (*Solanum virum*)**
Background	:	*Solanum virum* locally known as dorli and in hindi khasikateri is a stout, branched, woody shrub, 1.0-1.5 m tall with spines on stem and leaves. The berries of Khasikateri contains glyco-alkolide, solasodine a nitrogen analogue of diosgenine. Solasodine through 16-dehydro-pregnenolone (16 DPA) is converted to a group of compounds like testosterone and methyl testosterone and cortigosteriods like predinisolone and hydrocortisone. These steroidal compounds have anti-inflammatory, anabolic and antifertility properties and hence, the crop has commercial value. In order to promote these crops, the performance of two different varieties with their nutritional requirement, the studies were undertaken.
Recommendation	:	It is recommended to grow dorli (wild brinjal) variety Akra mahima (Tetrploid) with spacing of 30 x 30 cm and fertilizer dose @ 90:60:60 NPK kg/ha.
Year of Release	:	2000
Applications	:	Under assured rainfall zone, well drained and medium to heavy soils
Advantages	:	• Higher dry berries yield • Better monetary returns

Name of Technology	:	**Nutritional management of periwinkle**
Crop	:	**Periwinkle *(Catharanthus roseus)***
Background	:	The roots and foliage are the pharmaceutical important plant parts of the periwinkle The plant has gained commercial importance since early 1980's due to its alkaloids; specially vinblastine and vincristine, present in leaves having importance in cancer therapy. The roots of the plant contain important alkaloids ajmalcine that has anti-fibrillic and hypotensive properties. The plant also contains glycosides; act as intermediates in the biosynthesis of indole alkaloids and thus commercial production of crop need to be taken. In order to assess the nutritional requirement of the crop the present investigation was carried out.
Recommendation	:	A fertilizer dose of 10 kg N and 30 kg P/ha is recommended to get maximum dry foliage and root yield of rainfed periwinkle (Sadaphuli) with monetary returns.
Year of Release	:	1995
Applications	:	Under assured rainfall zone, well drained and medium to heavy soils
Advantages	:	• Higher foliage and root yield production • Better economic returns

Name of Technology	:	**Performance of varieties of periwinkle**
Crop	:	**Periwinkle (*Catharanthus roseus*)**
Background	:	Periwinkle locally known as sadabahar/sadaphuli is a perennial herb having height of 30-90 cm. It is found throughout India in all warmer parts on wasteland and sandy tracts, especially in the costal areas. The plant has gained commercial importance since early 1980's due to its alkaloids; specially vinblastine and vincristine, present in leaves having importance in cancer therapy. The roots of the plant contain important alkaloids ajmalcine that has anti-fibrillic and hypotensive properties. The plant also contains glycosides; act as intermediates in the biosynthesis of indole alkaloids. Under the genetic amelioration programme, the varietal performance of periwinkle was tested for their suitability in the region.
Recommendation	:	It is recommended to grow periwinkle (Sadaphuli) variety selection-1 and M-153 for obtaining maximum root foliage and alkaloid yield.
Year of Release	:	2000
Applications	:	Under assured rainfall zone, well drained and medium to heavy soils
Advantages	:	• Higher foliage and root yield • Better economic returns

Name of Technology	:	**Impact of shade of orchards on the yield potential of periwinkle**
Crop	:	**Periwinkle *(Catharanthus roseus)***
Background	:	The roots and foliage are the pharmaceutical important plant parts of the periwinkle. The plant has gained commercial importance since early 1980's due to its alkaloids; specially vinblastine and vincristine, present in leaves having importance in cancer therapy. The roots of the plant contain important alkaloids ajmalcine that has anti-fibrillic and hypotensive properties. In the context of diversification in agriculture, it felt necessary to evaluate yielding potential of Periwinkle under fruits orchards with a view to generate additional income from such multi-storied plantations and hence, the present investigation was undertaken.
Recommendation	:	The adverse shade effect of fruit orchards on the root and foliage yields were observed, However growing periwinkle in orchards can think an additional source of income. Among the varieties tested selection-1 and M-153 have performed better in respect of root and foliage and alkaloid yields.
Year of Release	:	2000
Applications	:	Under assured rainfall zone, well drained and medium soils
Advantages	:	• Additional income

Name of Technology	:	**Performance of babchi genotypes**
Crop	:	**Babchi *(Psoralea corylifolia)***
Background	:	Babachi is an erect annual herb. The seeds of the babchi and its oil are used in the indigenous system of medicine, in the treatment of leprosy, leucoderma, and psoriasis. The seeds are surrounded by a sticky, oily pericarp, which contains coumarins, of which psoralen and iso-psoralen are therapeutically important. It is also used in the treatment of intestinal amoebiasis and healing of wounds and ulcers. The babchi is naturally found as weed in most of semi arid climatic zones. The seeds are to be collected in 4-5 picking during December to February months. Under the genetic amelioration programme, the genotypic performance was tested for their suitability in the region.
Recommendation	:	On the basis of the seed yield and psoralen content, varieties IC-111228 and IC-111238 of babchi are recommended for cultivation
Year of Release	:	2000
Applications	:	Under assured rainfall zone, well drained and medium to Heavy soils
Advantages	:	• Higher seed yield • Better economic returns

Forest Crops

Name of Technology	:	**Vegetative contour bunds for teak plantation**
Crop	:	**Teak (*Tectona grandis*)**
Background	:	Increasing population is mounting pressure for supply of food, fodder, fuel and timber for human and animal consumption. Therefore in addition to increase production form agricultural land, degraded lands and wastelands need to be utilize for generating additional resources. These areas can be used successfully adopting appropriate measures like vegetated contour bund for establishing teak plantation for higher timber production.
Recommendation	:	In Agroforestry for maximum wood production in teak, establishment of narrow based contour bunds along with vegetative barrier at horizontal interval of 30 m is recommended.
Year of Release	:	2004
Applications	:	For Teak plantation in degraded soils
Advantages	:	• For conservation of water • To manage soil erosion • To maintain soil fertility

Name of Technology	:	**Intercrop for teak plantations**
Crop	:	**Main crop : Teak (*Tectona grandis)*** Intercrop : Blackgram (*Vigna mungo*)
Background	:	Teak is the most preferred timber species. Large scale teak plantations were carried out in the region on wastelands and farm lands. Agricultural land was also brought under teak plantation to some extent. Therefore it was necessary to asses the suitability of crops as an intercrop in the teak plantation.
Recommendation	:	Black gram can be taken as intercrop in teak planted at 8 x 2 m distance
Year of Release	:	2004
Applications	:	Agroforestry, wasteland management, watershed development programme, eco-restoration of degraded lands.
Advantages	:	• To improve soil fertility • To increase income

Name of Technology	:	**Suitability of teak clone for the region**
Crop	:	**Teak (*Tectona grandis*)**
Background	:	Teak is most preferred timber species. The increased demand for quality teak has attracted farmers for growing it on farm and wastelands. However, teak being slow growing species, it is a delayed paying crop. Therefore need was felt to evaluate the suitability of teak clone for early maturity for growing under afforestation programmes.
Recommendation	:	The Teak clone PDKV/AF/1 is recommended for cultivation in Vidarbha.
Year of Release	:	2005
Applications	:	Agroforestry, wasteland management, watershed development programme, eco-restoration of degraded lands.
Advantages	:	• Potential for producing more timber • Economical

Name of Technology	:	**Developing teak based Agri-Silviculture system for wasteland afforestation**
Crop	:	**Teak (*Tectona grandis*)**
Background	:	Agroforestry has been traditionally a part of a small holder farm system as a source of fuel, small timber, and agricultural implements and restore soil fertility. Areas where agricultural productivity is poor, demand for agricultural output is going up. Teak is the most preferred timber species. The wasteland in the region is brought under teak plantation in recent years. Therefore it was necessary to develop the agrisilviculture system with teak as tree component.
Recommendation	:	For the afforestation of wasteland in Vidarbha region through agro-forestry system and for higher economic benefit, planting of teak at 8 x 2 m spacing along with black gram as inter-crop and thinning of alternate tree in row (when girth is 25-30 cm) at the age of 7th year is recommended.
Year of Release	:	2008
Applications	:	Teak plantation in the areas of Agroforestry, wasteland management, watershed development programme, eco-restoration of degraded lands.
Advantages	:	• Production of both agricultural crops and timber from the wasteland. • To improve soil fertility • More monetary returns

Name of Technology	:	**Cultivation of eucalyptus for production of poles**
Crop	:	**Eucalyptus (*Eucalyptus teretocornis*)**
Background	:	Eucalyptus is one of the fast growing tree species. Its suitability as raw material for production of paper and pulp, agriculture implements, mine probes, construction industries provides wide opportunities for growing eucalyptus on large scale. Therefore a systematic research was needed to evolve suitable cultural practices especially spacing for growing eucalyptus.
Recommendation	:	For harvesting large size poles of Eucalyptus, the planting distance of 2 X 1 meter is recommended.
Year of Release	:	2004
Applications	:	Agroforestry, wasteland management, watershed development programme, eco-restoration of degraded lands.
Advantages	:	• Production of large size poles of eucalyptus. • To increase the yield of eucalyptus poles

Name of Technology	:	**Suitability of timber for ill drain soils**
Crop	:	**Sisoo (*Dalbergia sisoo*)**
Background	:	Timber is a essential commodity in civilian society. Increasing population as well as rising standard of living demands for quality timber many folds. This has necessitated to bring more land under timber production in addition to forest and cultivated land.
Recommendation	:	Planting of Sisoo at 40-60 cm isobath in ill drained soil is recommended.
Year of Release	:	2004
Applications	:	Ill drain soils having water table 40-60 cm below the ground surface are suitable for planting Sisoo (*Dalbergia sisoo*).
Advantages	:	• Plantation for ill drain soil. • Utilization of waste land.

Name of Technology	:	**Gabion check dam with clay blanketing**
Crop/Method	:	**Gully control measures**
Background	:	Concentration of runoff from higher areas leads to develop enlargement and deepening of gullies leading to loss of productive soil. These networks of gullies can be stabilized constructing series of check dams. Watershed areas up to 20 ha and length of gully from 100 – 1000 m should be provided with one gabion dam with clay blanketing and one counter dam for storing runoff and control of erosion.
Recommendation	:	Construction of Gabion check dam with clay blanketing for storage of runoff and control of gully erosion is recommended.
Year of Release	:	2004
Applications	:	Gabion check dams with clay blanketing are constructed in the gully across the slope of land. It is suitable for areas where there is no stable foundation since it offers flexibility for settlement.
Advantages	:	• Control soil erosion • Storage of water • Recharge of ground water

Name of Technology	:	**Fertilizer requirement for bamboo**
Crop	:	**Bamboo (*Dendrocalmus strictus*)**
Background	:	Bamboo is most commonly used woody material. It is fastest growing perennial grass . Its wide applications in agriculture, wood based industries, handicrafts, packaging and cottage industries make it suitable for cultivation on farm and wastelands. Therefore for meeting the growing demand of bamboo as raw material, bamboo production is required to be increased. Therefore it was necessary to develop technology for increasing bamboo production.
Recommendation	:	To get higher number of harvestable bamboo (5m x 6m) it is recommended to apply 50 Kg N/ha at the start of monsoon every year to bamboo plantation.
Year of Release	:	2004
Applications	:	Bamboo plantation area in Agroforestry, wasteland management, watershed development programme, ecorestoration of degraded lands.
Advantages	:	• To increase bamboo production • More monetary returns

Name of Technology	:	**Development of silvipasture system**
Crop	:	**Trees : Babul (*Acacia nilotica*), Sitaphal (*Annona quamosa*)** **Pasture : Anjan grass (*Cenchrus ciliaris*),** **Stylo (*Stylosanthes hamata*)**
Background	:	Wastelands are abundantly found in the region. For meeting the fodder requirement of cattle in the region it is necessary to produce more quantity of fodder from the wastelands by adapting suitable silvipastoral system.
Recommendation	:	For establishment of silvipasture system, *Acacia nilotica + Cenchrus ciliaris + Stylo hamata* for light soils and *Annona quamosa + Cenchrus ciliaris + Stylo hamata* for medium soil in rainfed area is recommended.
Year of Release	:	2005
Applications	:	Wasteland management, watershed development programme, eco-restoration of degraded lands.
Advantages	:	• To establish silvipasture system • To obtain additional fodder • More monetary returns

Plant Protection

Entomology

Name of Technology	:	**Economic threshold level for cotton bollworms**
Crop	:	**Cotton**
Background	:	Spotted, american and pink bollworms are known to be major pests of Cotton. They cause damage to the green fruiting bodies (Squares, flowers and bolls) by boring and feeding inside. They are active throughout the season and cause losses to the tune of 30-80 per cent. The lowest number of insect or their damage that cause economic loss is referred as Economic Injury Level. The population density at which control measures should be initiated against an increasing pest population to prevent economic damage and to suppress the pest population below EIL, is often referred as Economic Threshold Level (ETL). ETL is the best known and most widely used index in making pest management decisions, effective to overcome the problems like insecticide resistance, adverse effect on non-target organism and environment. Concept of EIL is developed to overcome the problems.
Recommendation	:	It is recommended that 5 per cent bollworm damage to the green fruiting bodies should be considered for application of chemical insecticides against bollworm on cotton.
Year of Release	:	1983
Applications	:	Cotton growing area of Vidarbha
Advantages	:	• Timely application of control measures, cost of cultivation conserves the biotic fauna • To apply pesticides judiciously and to reduce pesticides load • To reduce the cost of cultivation • To conserve the biotic fauna

Name of Technology	:	**Pyrethroides for management of cotton bollworms**
Crop	:	**Cotton**
Backgrond	:	Bollworms are known to be the economically important pests of cotton crop which includes spotted, american and pink bollworms. They damage the green fruiting bodies (Squares, flowers and bolls) leading to shedding and thereby resulting in reduction in yield This is the unique and simplest way of pest management tactic that the foliar application of chemical insecticides used by the farmers frequently. Knowledge about chemical insecticides, their efficacy and doses for bollworm control is mandatory. Indiscriminate use of chemical pesticides by farmers resulted bad effects on environment, hence, their judicious use is essential for eco friendly pest management.
Recommendation	:	For effective management of cotton bollworms and to obtain higher yield, foliar spray of flucythrinate (0.005%) followed by decamethrin 2.8 EC (0.002%) and fenpropathrin 50 EC (0.015%) is recommended.
Year of Release	:	1986
Applications	:	Cotton growing area of Vidarbha
Advantages	:	• Highly effective and judicious use • Net monetary returns

Name of Technology	:	**Alphamethrin for the cotton bollworm management**
Crop	:	**Cotton**
Background	:	Spotted bollworm, *Earias* spp.; american bollworm, *Helicoverpa armigera* and pink bollworm, *Pectinophora gossypiella* are important pests of cotton crop causing 80 per cent loss to cotton crop under unprotected condition. Timely management of these pests by a chemical insecticides is the simplest way to achieve the targeted yield. Specific knowledge about efficacy of chemical insecticides and their doses is essential for their judicious use in effective management of cotton bollworms.
Recommendation	:	For effective management of cotton bollworms and to obtain higher yield of seed cotton, a foliar application of alphamethrin 25 g active ingredient per hectare is recommended.
Year of Release	:	1994
Applications	:	Cotton growing area of Vidarbha
Advantages	:	• Highly effective against targeted pests.Cost effective • More economic returns

Name of Technology	:	**Integrated approach for cotton pest management**
Crop	:	**Cotton**
Background	:	Cotton is important cash crop of India which covers about 5% of the total cultivable area, however, this crop comsumed 45.5% of the total pesticides used in India for pest management. Indiscriminate use of chemical pesticides for pest management posed several problems like killing non-target insects, resurgence of pests, development of resistance, secondary pests becoming major pests, environmental pollution etc. Hence integrated pest management in cotton need to have the integrated approach for economic and friendly pest management to obtain sustainable cotton production.
Recommendation	:	For effective, efficient and economical pest management in rainfed cotton, following IPM module is recommended. (1) Thaimethoxam 70 WS seed treatment @ 4.28 g/kg seed before sowing, (2) One spray of Acetamiprid 20 SP @ 1.5 per 10 litre of water for sucking pests based on economic threshold level (ETL), (3) Two releases of *Trichogramma chilonis*, egg parasitoid @ 1.5 lakh per hectare, (4) For bollworms, ETL based one spray of azadirachtin 300 ppm @ 5 ml, spinosad 45 SC @ 2.25 ml and beta-cyfluthrin 2.5 EC @ 10 ml per 10 litre of water.
Year of Release	:	2004
Applications	:	Cotton growing area of Vidarbha
Advantages	:	• Reduction in pesticide use • Eco-friendly pest management • Minimize environmental pollution • Higher seed cotton yield • Higher monetary returns

Name of Technology	:	**Stem smearing application for sucking pests management at early stage**
Crop	:	**Cotton**
Background	:	Chemical control is playing vital role in pest management. The cultivators are using different chemicals for the management of different pests through spraying or dusting, which requires high quantity of insecticides, water and more skilled workers for application. Also it has to be used number of times, which posses the number of problems like resistance, resurgence, environmental pollution and hazards to natural enemies. Therefore it felt necessary to find out alternative for the spraying and dusting techniques, which will be useful to manage the pests and reduce the use of chemical. Stem smearing applicator was thought to be the best alternative to this problem.
Recommendation	:	Stem application of oxydemeton methy 125 EC + water 1:1 (volume) proportion with stem applicator is recommended for effective management of aphids and thrips during early growth stage of cotton crop.
Year of Release	:	2004
Applications	:	All cotton growing areas
Advantages	:	• Easy to handle and application • Simple mechanism, only one male or female labour require for application for one ha. • Little quantify of water and insecticide is required • Ecofriendly and economical

Name of Technology	:	**New molecules for effective management of cotton bollworms**
Crop	:	**Cotton**
Background	:	As many as 1326 insects have been recorded on cotton crop in the world, and over 160 species of insects and non insects pests are recorded in India on cotton. Amongst these insect pests, spotted, american and pink bollworms are economically important and can cause damage up to 80% to the cotton crop. Many new chemical insecticides are available in the market. To have specific knowledge about newly introduced insecticide, their efficacy against particular pest and required dose for judicious use of insecticides for the management of bollworms is necessary.
Recommendation	:	For effective management of cotton bollworms, foliar application of spinosad 45 SC @ 2.25 ml per 10 litre of water against american and spotted bollworm and beta-cyfluthrin 2.5 EC @ 10 ml per 10 litre of water against pink bollworm is recommended.
Year of Release	:	2004
Applications	:	Cotton growing area of Vidarbha
Advantages	:	• Highly effective • To obtain maximum yield • More monetary returns

Name of Technology	:	**Midge SAC duster for midge fly management in sorghum**
Crop	:	**Sorghum**
Background	:	The sorghum midge fly is a serious pest of sorghum. It is widely distributed in India as well as other sorghum growing tracts of the world. The seriousness of the pest is that it can keep the complete village without a grain of sorghum. The attacks of the midge fly on tall growing cultivars are difficult to control by conventional duster. Therefore, for effective management of this pest, this Midge Sac Duster has been developed
Recommendation	:	The midge sac duster was found to be of practical utility and hence recommended for the use of the management of midge fly on sorghum.
Year of Release	:	1974
Applications	:	Maharashtra State
Advantages	:	• High monetary returns • Easy to operate • Effective than commercial duster • Low cost technology

Name of Technology	:	**Carbofuran seed treatment for sorghum shoot fly management**
Crop	:	**Sorghum**
Background	:	The shoot fly *Atherigona soccata* Rondani causes damage at the seedling stage by killing central shoot damaging the crop up to 90%. The spray formulation are not much effective and therefore the seed treatment provides a good alternative.
Recommendation	:	Carbofuran 50 SP @ 5% seed treatment to sorghum is recommended for control of shoot fly.
Year of Release	:	1975
Applications	:	Sorghum growing area of Maharashtra
Advantages	:	• Cost effective control • Enhances early growth in plants (Vigour) • Higher grain yield • High monetary returns

Name of Technology	:	**Shootfly management by sowing timing of sorghum**
Crop	:	**Sorghum**
Background	:	Sorghum shoot fly is widespread pest that attack sorghum crop in Maharashtra. The importance of this pest was realized after introduction of hybrids and high yielding varieties in 1964. Cultural practices can greatly affect the level of attack of shoot fly. It is known that sowing date in particular affect the damage by the pest.
Recommendation	:	Sowing of Sorghum before 7th July for escaping shootfly attack, is recommended.
Year of Release	:	1975
Applications	:	Sorghum growing area of Maharashtra
Advantages	:	• Higher Productivity • Higher net returns • No need of pesticide application

Name of Technology	:	**Control of sorghum shootfly and aphids**
Crop	:	**Sorghum**
Background	:	Sorghum is one of the most important cereal crops in the Semi arid tripics. Grain yields are generally low and insect pests are one of the major factors limiting Sorghum production. Nearly 32% of actual produce is lost due to insect pests in India and therefore the plant protection schedule for the control of pest of hybrid sorghum was developed
Recommendation	:	Phorate 10% granules @ 15 kg/ha at sowing was found effective in reducing the damage of shoot fly and Malathion @ 0.05% (applied 40 days after sowing) was found effective for controlling aphids, hence recommended.
Year of Release	:	1976
Applications	:	Sorghum area of Maharashtra state
Advantages	:	• Cost effective control • Higher grain yield • More monetary returns

Name of Technology	:	**Insecticidal package for control of sorghum pests**
Crop	:	**Sorghum**
Background	:	Sorghum commonly known as Jowar is an important dual purpose crop in the state of Maharashtra. This crop suffers heavy losses due to the various insect pests. Over 150 insect pest species have been reported on sorghum. The major pests of sorghum on global basis are shoot fly, stem borer, army worm, midge fly, aphid, delphacides, hairy caterpillar and ear head worm which start damaging the plant from seedling to harvest stage. For the management of these pests, the plant protection schedule was introduced.
Recommendation	:	Carbofuran 50 SP 100 g/kg seed followed by Carbaryl 10% @ 20 kg/ha in equal proportion were found to be very effective for controlling different pest of sorghum, hence recommended.
Year of Release	:	1980
Applications	:	Sorghum growing area of Maharashtra
Advantages	:	• Cost effective pest control • Higher grain yield • More monetary returns

Name of Technology	:	**Phorate management of sorghum shootfly**
Crop	:	**Sorghum**
Background	:	Sorghum shoot fly is a wide spread pest has significant importance. It attack sorghum seedlings during 1 to 4 weeks. The shootfly is not a pest of early sown kharif crop in Maharashtra.. It is found that the pest incidence is maximum on rabi and the late sown crop in kharif.
Recommendations	:	Phorate 10 G @10 kg/ha as soil application at the time of sowing for the control of shoot fly is recommended
Year of Release	:	1991
Applications	:	Sorghum area of Maharashtra state
Advantages	:	• Cost effective control • Easy to apply • Higher yield • More monetary returns

Name of Technology	:	**Chlorpyriphos for effective management of sorghum stem borer**
Crop	:	**Sorghum**
Background	:	Sorghum stem borer *Chilo partellus* has been recorded as economically important pest of sorghum. 55 to 83 per cent losses were recorded due to this pest. In order to have cost effective result management the experiment was conducted for control of stem borer in sorghum crop.
Recommendation	:	Spraying of chlorpyriphos 20% EC at 0.05% concentration at 25th day after emergence is recommended.
Year of Release	:	1998
Applications	:	Sorghum growing area of Maharashtra
Advantages	:	• Cost effective control • Higher grain yield • More monetary returns

Name of Technology	:	**Seed dresser for rabi sorghum shoot fly management**
Crop	:	**Sorghum**
Background	:	Shoot fly is a widespread pest of significant importance. The incidence of shoot fly was noticed on late sown crop and in rabi season as compared to kharif and there is no specific and economical control in rabi sorghum. To keep the incidence below ETL, it was, felt necessary to test the newer insecticides as seed treatment against sorghum shoot fly for rabi sorghum.
Recommendation	:	On the basis of incremental cost benefit ratio and for effective control of sorghum shoot fly and to obtain the maximum grain yield in rabi, the seed treatment of Imidacloprid 600 FS @ 10 ml/kg, seed is recommended.
Year of Release	:	2005
Applications	:	Sorghum growing area of Maharashtra
Advantages	:	• Effective management of pest • Higher grain yield • Higher monetary returns

Name of Technology	:	**Thiamethoxam seed treatment against sorghum shootfly**
Crop	:	**Sorghum**
Background	:	Sorghum is an important food and fodder crop in Maharashtra. More than 150 insect species have been reported as a pests of sorghum of which shoot fly is a serious pest particularly in late sown crop. Grains yield losses due to shoot fly alone were reported to be 2000 tonnes per annum.
Recommendation	:	For effective management of shoot fly of sorghum and obtain higher yield, monetary returns, ICBR, seed treatment of Thiamethoxam 70WS @ 5 g/kg seed is recommended
Year of Release	:	2008
Applications	:	Sorghum growing area of Maharashtra
Advantages	:	• Cost effective control • Higher grain yield • Higher monetary returns

Name of Technology	:	**Egg Parasitoid for management of sorghum stem borer**
Crop	:	**Sorghum**
Background	:	Stem borer is a major pest of sorghum. It causes significant damage to sorghum crop during kharif and rabi also. Among many insect parasitoids, *Trichogramma* are very effective egg parasitoid against lepidopterous pests affecting cotton, sugarcane, sorghum, vegetable crops, etc.
Recommendation	:	For the economic management of sorghum stem borer and to obtain higher grain yield, application of egg parasitoid *Trichogramma chilonis* @ 1.5 lakh eggs/ha on 30th and 40th day after emergence of crop is recommended.
Year of Release	:	2008
Applications	:	Sorghum growing area of Maharashtra
Advantages	:	• Cost effective control • Economical and Ecofriendly • Higher grain yield • Higher monetary returns

Name of Technology	:	**Spinosad for effective management of sorghum shootfly**
Crop	:	**Sorghum**
Background	:	The importance of this pest was realized after the introduction of hybrids and high yielding varieties in 1964. However, the incidence was more in rabi season as compared to Kharif. It is observed, that the pest incidence was maximum on the late sown crop in kharif.
Recommendation	:	For effective management of shoot fly on sorghum, to obtain higher yield and net profit, two sprays of spinosad @ 0.01% at 7^{th} and 17^{th} days after sowing are recommended.
Year of Release	:	2008
Applications	:	Sorghum growing area of Maharashtra
Advantages	:	• Effective control of shootfly • Higher seed yield • Higher monetary returns

Name of Technology	:	**Management of aphids on hybrid sorghum**
Crop	:	**Sorghum**
Background	:	Aphids, *Rhopalosiphum maidis* often found on Sorghum leaf whorls in huge numbers. Large populations of this species which is also a vector for Maize dwarf mosaic virus, can cause plant death and cause losses at the seedling stage.
Recommendation	:	For effective management of Aphids on hybrid Sorghum, spraying of Chlorpyriphos 20 EC @ 0.05% or Imidacloprid 17.8 SL @ 0.003 % is recommended.
Year of Release	:	2008
Applications	:	Sorghum growing area of Maharashtra state
Advantages	:	• Cost effective control • Higher grain yield • Higher monetary returns

Name of Technology	:	**Chemical based management of pigeonpea pod borer complex**
Crop	:	**Pigeonpea**
Background	:	Pigeonpea is the major kharif pulse crop. Low productivity in pigeonpea is attributed to the ravages of pod borer complex causing economic loss. Prevailing practices for the management of pod borer complex involve application of insecticides but selection of proper insecticide is a crucial aspect in pest management.
Recommendation	:	Two applications of Monocrotophos 0.04 per cent or Quinalphos 0.07 per cent or Dimethoate 0.03 per cent or Neem Seed Kernel Extract 5 per cent at 50 per cent flowering and 15 days after first spraying were found effective and economical in management of pod borer complex, , hence recommended.
Year of Release	:	1982
Applications	:	General pigeonpea growing areas
Advantages	:	• Cost effective with high monetary returns • Ensures rapid control • Prevents further crop losses due to immediate control

Name of Technology	:	**Pyrethroids for the management of pigeonpea pod borer**
Crop	:	**Pigeonpea**
Background	:	Most damaging pests of pigeonpea are those attacking the flowers and pods of these most important by far is the pod borer, *Helicoverpa armigera*. They strongly attack to pigeonpea when the flowers appear. The calendar based applications of insecticides is widely practiced in pigeonpea areas where *H. armigera* is a major problem. Thus, cautious decisions have to be made on proper choice of insecticide, the dose, and method of application and level of infestation (ETL). Timely application of insecticide is a major factor in effective economic management of pigeonpea pod borer.
Recommendatin	:	For effective control of pod borer of pigeonpea, four sprays of Fenvalerate 0.01 per cent be applied at an interval of 10 days right from initiation of flowering.
Year of Release	:	1983
Applications	:	General Pigeonpea growing areas
Advantages	:	• Fast and reliable method of pest management • Cost effective with high monetary returns • Prevents further crop losses due to immediate control

Name of Technology	:	**Integrated pest management in pigeonpea**
Crop	:	**Pigeonpea**
Background	:	Ravages of pigeonpea pod, *H. armigera* is the major constraint in achievement of desired productivity of pigeonpea. *Helicoverpa* larva has an immense potential to inflict damage. One *helicoverpa* larva damages 7-16 pigeonpa pods. The pod borer inflicts damage to the tune of 2.7 - 35.90 per cent in pigeonpea. Although, there is little doubt that insecticides are needed to ensure profitable increase in pigeonpea production but they must be used judiciously or in combination with other components of pest management. Pigeonpea pod borer can be managed effectively by an integrated approach which involves application of plant products, biopesticides and insecticide in sequence.
Recommendation	:	For effective control of pod borer, application of Neem Seed Extract 5 per cent or HaNPV 250 LE/ha or dusting of Methyl Parathion 2 per cent @ 20 kg/ha be taken at ETL at an interval of 15 days.
Year of Release	:	1983
Applications	:	General Pigeonpea growing areas
Advantages	:	• Cost effective with high monetary returns • Judicious use of insecticides • Effective pod borer management technique

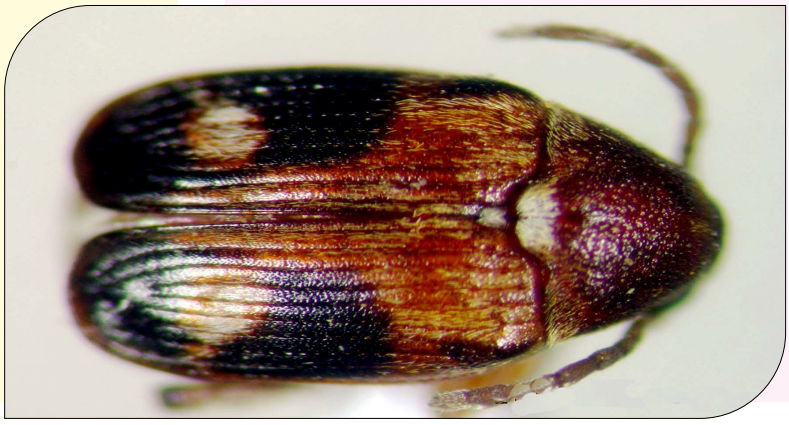
Name of Technology	:	**Biorational management of pod borer in pigeonpea**
Crop	:	**Pigeonpea**
Background	:	For effective management of *Helicoverpa,* emphasis was given mainly on agrochemical. This pest is relatively difficult to control by single plant protection component. Thus, instead of pest management with single component, it is imperative to follow an integrated approach. This integration involves use of biopesticides, natural plant products along with judicious use of chmical pesticides as the former components have shown great potential for the management of *Helicoverpa armigera* when used in combination with semilethal dose of insecticide when applied at Economic Threshold Level (ETL).
Recommendation	:	Two sprays of HaNPV 250 LE/ha at ETL (5% pod damage) or NSKE 5 per cent effectively manage the incidence of *Helicoverpa* and hence recommended.
Year of Release	:	1985
Applications	:	General pigeonpea growing areas
Advantages	:	• Judicious use of insecticides • Cost effective and safer to the environment • Comparatively safer to the natural enemies

Name of Technology	:	**Integrated management of pod borer complex of pigeonpea**
Crop	:	**Pigeonpea**
Background	:	Over the years pigeonpea pod borer complex is the major bottleneck in achievenent of higher productivity in pigeonpea. Also, the management of polyphagous pests like *Helicoverpa* with high level of resistance to various insecticides, adoption of single management tactic does not give satisfactory level of control. Although, there is little doubt that insecticides are needed to ensure profitable increase in pigeonpea production, but they must be used judiciously or in combination with other components of management. This integrated approach involves application of plant products, biopesticides and insecticide along with cultural practices.
Recommendation	:	For integrated management of pigeonpea pod borer complex with or without maize as an intercrop (3:1), application of 5 per cent NSKE or HaNPV 250 LE/ha or dusting of Methyl Parathion 2 per cent @ 20 kg/ha be taken starting from ETL at 15 days interval for the management of pod borer complex of pigeonpea.
Year of Release	:	1985
Applications	:	General pigeonpea growing areas
Advantages	:	• Cost effective with high monetary returns • Judicious use of insecticides • Effective pod borer complex management technique • Safe economical and environmental friendly

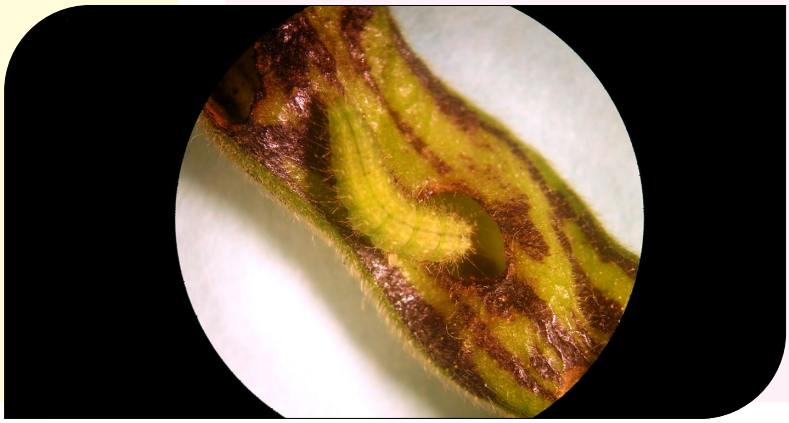
Name of Technology	:	**HaNPV for the management of pigeonpea borer**
Crop	:	**Pigeonpea**
Background	:	Most damaging pest of pigeonpea is the pod borer, *Helicoverpa armigera*. One *helicoverpa* larva damages 7-16 pigeonpea pods. The pod borer inflicts damage to the tune of 2.7 - 35.90 per cent in pigeonpea. Insecticides form the first line of defense against pod borer, *Helicoverpa armigera*, a polyphagous pest with a high damage potential. Often the application of conventional insecticides results in failures in management of pests. Thus, various alternatives are tried and one such management tactic employed is the use of HaNPV. In pulse crops like pigeonpea very few biocontrol agents are effective in managing the populations of *H. armigera* but applications of HaNPV showed great potential as the most promising biopesticide.
Recommendation	:	Foliar application of HaNPV 250 LE/ha at 50 per cent flowering for the control of pigeonpea pod borer was found effective and economical, hence recommended.
Year of Release	:	1997
Applications	:	General pigeonpea growing areas
Advantages	:	• Safe economical and environmental friendly • Self propogating and safe to natural enemies and human beings • Viable and sustainable alternative to conventional chemical insecticides • An effective component of IPM

Name of Technology	:	***Helicoverpa* management in pigeonpea, chickpea and cotton crops**
Crop	:	**Pigeonpea, Chickpea and Cotton**
Background	:	*H. armigera* is a major insect pest of pigeonpea, chickpea and cotton, the most important pulse and fiber crop of our region. The pod borer inflicts damage to the tune of 2.7 - 39.7 per cent in chickpea. Single, larval damage is up to 7-16 pods in pigeonpea and up to 30-40 pods in chickpea. The incidence is generally evident from bud initiation as they have special attraction for flowering and fruiting bodies. This pest is relatively difficult to control through pest management tactics, however in order to achieve quick and effective by a single control in a stipulated time, main emphasis on agrochemicals was given. Use of pesticide was employed for the management of pod borer, traditionally. Indiscriminate use of insecticides mostly as a prophylactic measure is uneconomical, wasteful, harmful to natural enemies and results in development of insecticide resistance and environmental pollution.
Recommendation	:	For the effective management of pod borer, on chickpea, pigeonpea and cotton need based application of NSE 5 per cent is recommended.
Year of Release	:	1999
Applications	:	Pigeonpea, Chickpea and Cotton growing areas.
Advantages	:	• Cost effective with high monetary returns • Ensures rapid control • Low cost of inputs

Name of Technology	:	**Management of pulse beetle in storage**
Crop	:	**Pigeonpea**
Background	:	A large proportion of post harvest losses are reported in pulses. The losses can be quantified in terms of deterioration of seed quality, loss in mass, nutritive value and hygienic status. These losses are evident especially in pulse crops when seeds stored are often rendered unsuitable for the sowing purpose. Pulse beetle, *Callosobruchus* spp. is the major store grain pest of pulses. Often improper storage structures and methods results in post harvest losses.
Recommendation	:	Repeated application of Aluminium phosphide (4 times at one month interval) at a dose of 2-3 tablets @ 3 g each per cubic meter space and an exposure period of 7 days for efficient protection of pigeonpea seeds without affecting the seed viability is recommended.
Year of Release	:	2002
Applications	:	General pigeonpea growing areas (Storage/godowns)
Advantages	:	• Fast and reliable method of pest management • Cost effective • Effective in storage of bulk quantities



Name of Technology	:	**Microbial management of pod borer in pigeonpea**
Crop	:	**Pigeonpea**
Background	:	Increased level of resistance of *H. armigera* to various insecticides emphasize the full reliance upon chemical pest control. Thus, effective alternatives like biopesticides are employed for economical management of pod borer. Entomopathogenic fungi have for time being recognized as important natural enemies of *H. armigera*. 15 fungal pathogens species have been reported to be most promising mycoinsecticides. *Metarhizium anisopliae*, a green muscardine fungus is prominent amongst them.
Recommendation	:	For effective control of *H. armigera* application of *Metarrhizium anisopliae* 10^{10}or 10^{9} conidia/ml alongwith Ranipal (0.1%) 1 ml/lit of water is recommended.
Year of Release	:	2007
Applications	:	General pigeonpea growing areas.
Advantages	:	• No resistance problem • Safe, economical and environmental friendly • Self propogating • Viable and sustainable alternative to conventional chemical insecticides • An effective component of IPM



Name of Technology	:	**Calendar based application of newer insecticides for the management of pod borer complex of pigeonpea**
Crop	:	Pigeonpea.
Background	:	The pod borer complex of pigeonpea. Viz., Gram pod borer, *Helicoverpa armigera*, Tur plume moth, *Exelastes atomosa* and Tur pod fly, *Melanagromyza obtusa are* the major biotic constraint in attainment of desired productivity levels in pigeonpea production. The productivity levels are often low on account of ravages of these pod borer targeting fruiting bodies leading to higher losses.
Recommendation	:	For the management of pod borer complex of pigeonpea and getting higher monetary returns, first spraying of Azadirachtin 10000 ppm @ 10 ml per 10 liter of water at 50 per cent flowering phase and after every 15 days interval, the second spraying of Emamectin Benzoate 5 WDG @ 3.0 g per 10 liter of water and the third spraying of (Deltamethrin 1% EC + Triazophos 35% EC) ready mix formulation @ 25 ml per 10 liter of water is recommended.
Year of Release	:	2011
Applications	:	Pigeonpea growing areas
Advantages	:	• Most effective module of pest management • Increase in productivity • Higher monetary returns

Name of Technology	:	**Management of gram pod borer through chemicals**
Crop	:	**Chickpea**
Background	:	The gram pod borer has an immense damage potential as they have special attaraction for flowering and fruiting bodies. The pod borer inflicts damage to the tune of 4.2 - 39.7 per cent in chickpea with single larval damage up to 30-40 pods. Use of chemical pesticides is still the most prevalent practice to manage gram pod borer, *Helicoverpa armigera* especially in high value crops. The calendar based applications of insecticides is very popular practice in chickpea areas where *H. armigera* is a major problems. Thus, cautious decisions have to be made on proper choice of insecticide, the dose, method of application and level of infestation (ETL).
Recommendation	:	Spraying of insecticides like Fenvalerate 0.01 per cent or Cypermethrin 0.006 per cent or Monocrotophos 0.04 per cent or Decamethrin 0.04 per cent or Neem Seed Extract 5 per cent at 50 per cent flowering and second application after 15 days was found effective and economical, hence recommended.
Year of Release	:	1983
Applications	:	General chickpea growing areas
Advantages	:	• Cost effective with high monetary returns • Ensures rapid control • Effective management tactic • Prevents further crop losses due to immediate control

Name of Technology	:	**Chemical based management of gram pod borer**
Crop	:	**Chickpea**
Background	:	Gram pod borer is the major pest of economic importance in chickpea. Insecticides form the first line of defense against gram pod borer *Helicoverpa armigera*, a polyphagous pest with high damage potential. Reports of crop losses to the extent of 54 per cent in chickpea necessitate the initiation of management measures of pod borer at economic threshold level.
Recommendation	:	Two applications of any of the insecticides viz., Permethrin 0.01 per cent, Monocrotophos 0.04 per cent, Phosalone 0.05 per cent and Quinolphos 0.05 per cent also dusting of Carbaryl 10 per cent dust, Phenthoate 2 per cent dust and Malathion 5 per cent dust at the rate of 20 kg/ha at 50 per cent flowering and 15 days after first spraying were found effective and economical in management of pod borer, hence recommended.
Year of Release	:	1985
Applications	:	General chickpea growing conditions.
Advantages	:	• Fast and reliable method of pest management • Cost effective with high monetary returns • Prevents further crop losses due to immediate control

Name of Technology	:	**Microbial management of chickpea pod borer**
Crop	:	**Chickpea**
Background	:	Viable and sustainable control of *H. armigera* using conventional insecticidal approach of relying primarily on chemical insecticides has become increasingly expensive and unreliable over the last two decades. Increased level of resistance of *H. armigera* to various group of insecticides is the primary cause for increased cost of plant protection with reports of crop failures. Biopesticides offer potentially effective and safe techniques for pest control as biopesticides like *Bacillus thuringiensis* shows high specificity towards *H. armigera* making them safer to the natural enemies with high efficacy.
Recommendation	:	The foliar application of Bt @750 ml/ha at ETL gave higher cost benefit ratio and reduced level of pod borer damage, hence recommended.
Year of Release	:	1997
Applications	:	General chickpea growing area
Advantages	:	• Specific to pod borer safer to natural enemies, human beings and environment • Viable and sustainable alternative to conventional chemical insecticides • An effective component of IPM

Name of Technology	:	**Efficacy of cow dung and urine for chickpea pod borer management**
Crop	:	**Chickpea**
Background	:	High damage potential of gram pod borer in chickpea compels the farmer to try every management for successful management of pod borer. Although, insecticides form the first line of defense against pod borer, *Helicoverpa armigera*, a polyphagous pest with a high damage potential. Results in failures in management of pests in crops of economic importance. Thus, various alternatives are tried and adopted by different agencies. One such management tactic employed is the use of natural products like cow dung and urine.
Recommendation	:	Application of 5 per cent cow dung and 5 per cent cow urine in the management of gram pod borer, *Helicoverpa armigera* was ineffective when compared with Neem Seed Kernal Extract 5 per cent in combination with recommended insecticides.
Year of Release	:	2001
Applications	:	General chickpea growing areas
Advantages	:	• Unsatisfactory levels of pest management specially insect *H. armigera.*

Name of Technology	:	**Calender based application of newer insecticides for the management of pod borer of chickpea**
Crop	:	Chickpea
Background	:	The Gram pod borer, *Helicoverpa armigera*, menace is the major biotic constraint in attainment of desired productivity levels in chickpea. The productivity of high yielding deshi and kabuli chickpea genotypes is under threat on account of higher levels of pod borer especially during flowering and pod formation stage. Hence, the investigation of the pod borer management with never chemicals.
Recommendation	:	For the management of gram pod borer, *Helicoverpa armigera* on chickpea and obtaining higher monetary returns, the first spraying of Deltamethrin 1 % EC + Triazophos 35 % EC ready mix formulation @ 25 ml per 10 litre of water and the second spraying of Emamectin Benzoate 5 WDG @ 3 g per 10 litre of water 15 days after first application is recommended
Year of Release	:	2011
Applications	:	Chickpea growing areas
Advantages	:	• Most effective module of pest management of pod borer • Increase in the productivity • Higher monetary returns

Name of Technology	:	**Effective management of stem fly on soybean**
Crop	:	**Soybean**
Background	:	Soybean crop was considered to be the safest crop as regard to the insect pest attack, but recently the situation has changed and it is recorded as pest prone crop in India. Among various insect pests, stem fly *M. Sojae* is one of the major insect pest of soybean. Yield losses in soybean caused by *M. Sojae* ranged 18.6 to 40.1 per cent. Owing to the seriousness of this insect pest, some synthetic insecticides were evaluated for its management.
Recommendation	:	Soil application of Phorate 10 g @ 10 kg/ha at the time of sowing or foliar spraying with Triazophos 40 EC @ 0.04%, Chlorpyriphos 20 EC @ 0.04% or Acephate 75 SP @ 0.07% is recommended on noticing the incidence, for management of stem fly on soybean.
Year of Release	:	2000
Applications	:	Soybean growing area of Vidarbha region
Advantages	:	• Effective pest control • Increased productivity • Higher yield • Higher monetary returns

Name of Technology	:	**Integrated management of leaf defoliator of soybean**
Crop	:	**Soybean**
Background	:	Soybean is the most important and valuable oilseed crop worldwide. Although area under soybean has been increasing rapidly in India every year, but it does not commensurate with the productivity which is very low. Among many biological factors responsible for lowering the yield, insect pest and diseases are the most important. Soybean suffers about 30-50 per cent yield losses due to insect pests. Among the various insect pests of soybean, leaf defoliators viz. Tobacco caterpillar, *Spodoptera litura* (Fabricus) and Semilooper *Chrysodeixis acuta* (Walker) are most important in our area. During severe outbreaks, they cause wide spread defoliation and devour the flowers and pods of soybean crop.
Recommendation	:	For the effective management of leaf defoliator of soybean and higher yield, two sprayings at an interval of 15 days with NSE 5% followed by Quinalphos (0.05%) or *Beauveria bassiana* 1 lit/ha followed by NSE 5% or Azadirachtin 1500 ppm 2.5 ml/lit followed by NSE 5% at the initiation of the pest are recommended.
Year of Release	:	2006
Applications	:	Soybean growing area of Vidarbha region
Advantages	:	• Ecofriendly and economical • Effective pest control • Higher monetary returns

Name of Technology	:	**Pest management**
Crop	:	**Soybean**
Background	:	Soybean is one of the major crop grown in Vidarbha. Recently pest problems are being major concerns in production. Girdle beetle is one of the might pest problems rising and hard to management because of its nature of damage. Hence the effots were made for its management.
Recommendation	:	For management of girdle beetle on soybean and to obtain maximum yield and higher monetary return, two sprays of Lamda cylohathrin 5 CS @ 0.005% (i.e. 10 ml per 10 lit water) at fortnight interval after initiation of infestation of girdle beetle are recommended
Year of Release	:	2012
Applications	:	For soybean crop area
Advantages	:	For effective management of girdle beetle on soybean

Name of Technology	:	**Management of leaf hopper on sunflower**
Crop	:	**Sunflower**
Background	:	The infestation of Sunflower Leaf hopper (*Amrasca bigutulla bigutulla*) prevailed throughout season. Stunted growth of plant, cupped and crinckled leaves, burnt appearance of leaf margins are the symptoms of damage. Leaf hoppers appears in serious form causing crop loss up to 46 per cent.
Recommendation	:	For effective management of leaf hoppers on sunflower, Dimethoate @0.3% or Demeton-S-Methyl 0.03% or Monocrotophos 0.03% or Phosphamidon 0.03% or Formothion 0.03% is recommended.
Year of Release	:	1989
Applications	:	Sunflower growing area of Maharashtra
Advantages	:	• Cost effective management • Higher grain yield • Higher monetary returns

Name of Technology	:	**Management of thrips and whitefly on sunflower**
Crop	:	**Sunflower**
Background	:	Several species of thrips are associated with sunflower crop at different phenological stages but none of the species causes direct damage as pest but causes enormous loss indirectly as vector of necrosis disease in Sunflower. *Scirtothrips dorsalis* (Hood), *Frankliniella schultzai* (Tryboon), *Thrips palmi* Karny, *Thrips hawaiiensis* (Morgan) were found to be associated with sunflower necrosis disease. In recent years, white fly *Bemisia tabaci* Gemn. reported as a new insect pests on sunflower.
Recommendation	:	For the management of thrips and white fly on sunflower, seed treatment with Imidacloprid 70 WS @5g/kg seed or two sprays of Imidacloprid 200 SL @ 0.5 ml/l or Azadirachtin 1500 ppm @2 ml/l at 15 and 30 days after emergence (DAE) are recommended.
Year of Release	:	2008
Applications	:	Sunflower growing area of Maharashtra
Advantages	:	• Cost effective • Quick and effective control • High yield • Higher monetary returns

Name of Technology	:	**Management of gall fly and capsule borer on sesamum**
Crop	:	**Sesamum**
Background	:	Sesamum is grown in Kharif & Rabi season and mostly attacked by Sesamum gall fly, *Asphondylia sesame* and capsule borer, *Antigastra catalaunalis*. Pests cause damage to foliar part and to the developing overy causing galls and malformation of sesamum leading to heavy losses.
Recommendation	:	For control of sesamum gall fly, Fenvalerate 0.01% or Dimethoate 0.05% is recommended. For control of sesamum capsule borer, NSKE 5% is recommended in addition to earlier recommended synthetic insecticide For avoiding maximum yield losses of sesamum due to gall fly and capsule borer, to obtain higher yield, more ICBR and net gain; two sprays at 35 and 50 DAS or one spray at 35 DAS with Fenvalerate 0.01% are recommended
Year of Release	:	2001
Applications	:	Sesamum growing area of Maharashtra state
Advantages	:	• Avoid yield losses • Effective and fast control of pests • Higher yield • Higher monetary returns

Name of Technology	:	**Management of aphids on safflower**
Crop	:	**Safflower**
Background	:	Eight species of aphids are reported to infest Safflower in India of which *Uroleucon carthami, Uroleucon compositae* and *Macrosiphum carthami* are the important species
.		An average of 37 per cent loss in seed yield due to aphids was reported at all India level. Besides the loss in seed yield, aphid incidence also results in low oil content in damaged seeds.
Recommendation	:	For the control of aphids on Safflower, Phosalone 4.0 per cent or Methyl parathion 2.0 per cent dust @ 20 kg/ha are recommended. Plant protection measures against safflower aphid be adopted when economic threshold level of aphid colonies on 30% plant is reached.
Year of Release	:	1985
Applications	:	Safflower growing areas of Maharashtra state
Advantages	:	• Effective control • Higher grain yield • Higher monetary returns

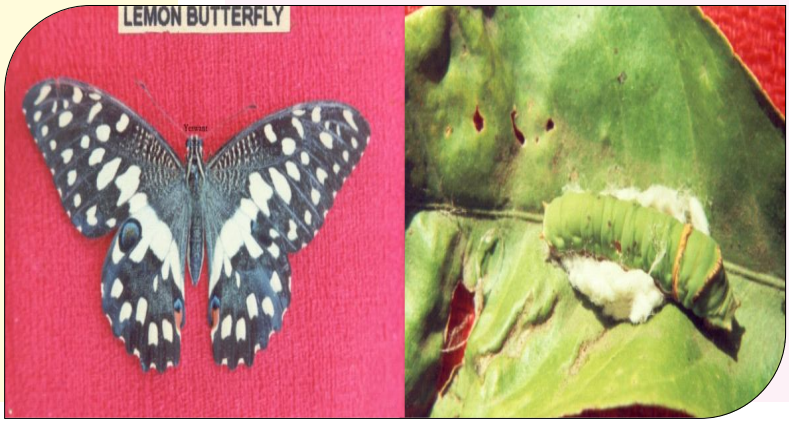
Name of Technology	:	**Management of jassid and thrips on groundnut**
Crop	:	**Groundnut**
Background	:	Groundnut thrips *Scirtothrips dorsalis* (Hood) and Jassids *Amrasca bigutulla bigutulla* are generally of minor importance as direct pest but they have been recognized as vectors of virus disease, for example, thrips transmit bud necrosis disease (BDN) and peanut stem necrosis disease (PSND). Therefore, timely control of these pests is very important.
Recommendation	:	For effective management of thrips and Jassid on groundnut, to obtain maximum yield, net profit and ICBR; first spray of NSKE 5% or Azadirachtin 1500 ppm @ 2ml/lit at ETL and subsequent second spray after fortnight are recommended.
Year of Release	:	2002
Applications	:	Groundnut growing area of Maharashtra
Advantages	:	• Cost effective control • Obtained maximum yield • Higher monetary returns

Name of Technology	:	**Eco-friendly management of citrus black fly / white fly**
Crop	:	**Citrus**
Background	:	Black fly *Aleurocanthus woglumi* is a serious pest of Nagpur mandarin. Adult and nymphs suck the cell sap from underside of the leaves and excrete the sugary substance on which black sooty mould develop which affect the photosynthetic activity, leading to the stunting of growth of new fresh. In 80's and 90's decade, high incidences of blackfly was reported from citrus belt of Vidarbha particularly Katol, Warud and Morshi and caused Rs. 200 crores losses of the citrus growers. Study showed that, 50% eggs hatched in first fortnight of April, second fortnight of July and first fortnight of December corresponding to Ambia, Mrig and Hasta bahar. For effective and appropriate control measures, early nymphal population is the most vulnerable stage and from these views, the studies were undertaken.
Recommendation	:	Spraying of insecticides be undertaken in the first fortnight of April, second forthnight of July and in the first forthnight of December to cover respective bahar. If necessary, second spraying be undertaken after 15 days. For first spraying, monocrotophos 36 EC @ 7 ml + Neem oil @ 100 ml and second spray of Neem oil @ 125 ml on each flush (while dissolving Neem oil in water, add 10-12 g of soap powder) is recommended for management of black fly / white fly. For management of nymphal population of citrus blackfly, two releases of 4 to 6 eggs of *Mallada boninensis* per shoot during hasta bahar is also recommended
Year of Release	:	1983
Applications	:	Citrus growing area in Maharashtra
Advantages	:	• Safer to the environment • Economical • Effective against insect pests • Higher economic returns

Name of Technology	:	**Management of citrus psylla**
Crop	:	**Citrus**
Background	:	Citrus psylla, *Diaphorina citri* Kuwayama is economically important pest of citrus. The adult and nymph suck the sap from buds and soft young leaves causing leaf distortion and curling, whereas in severe case, even dropping of buds and soft leaves. Losses due to psylla infestation ranged form 83-95 per cent, moreover, psylla is an active vector of deadly "Greening diseases". In order to have effective control for this pest, the field study was carried out.
Recommendation	:	Monocrophos @ 0.02% spraying has given highest mortality followed by 0.03% dimethote and 0.3% methyl parathion. The spraying should be undertaken as soon as incidence of pest is noticed. If necessary second spray application should be repeated after 15 days from the first spraying.
Year of Release	:	1984
Applications	:	Citrus growing area in Maharashtra
Advantages	:	• Quick and effective control • Higher economic returns

Name of Technology	:	**Management of citrus leaf miner**
Crop	:	**Citrus**
Background	:	Citrus leaf miner, *Phyllocnistis citrella* stainton is a major pest of citrus orchards, suffers heavily throughout life span from seedling stage. The larva feed on the epidermis of tender leaves making silvery serpentine mines. The affected leaves become distorted, crumpled and curled-up from the margin towards inner side. In nursery, leaves dried and fall down leading to heavy losses.
Recommendation	:	For the management of citrus leaf miner, foliar spray of malathion @ 0.07 % or Neem oil @ 1% at the time ot initiation of the pest incidence is recommended.
Year of Release	:	1999
Applications	:	Citrus growing area of Maharashtra
Advantages	:	• Effective and easy for adoption • Higher economic returns

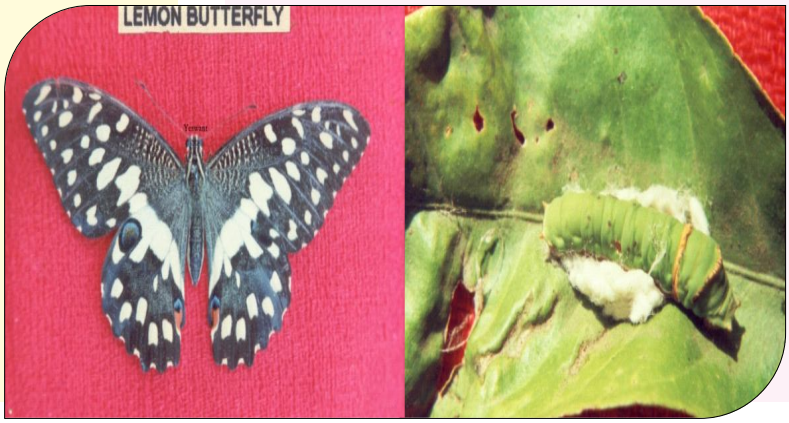
Name of Technology	:	**Management of bark eating caterpillar in citrus orchards**
Crop	:	**Citrus**
Background	:	Bark eating Caterpillar, *Inderbella quadrinotate* Moore is widely distributed throughout the citrus belt of Vidarbha region. Old and neglected orchards suffer relatively greater damage (55 to 77 %) by this pest. Caterpillar make hole in the stem and climbs at the joints for hiding. Caterpillar feeds on the bark during night by constructing a tunnel which is made with help of bark, silken thread and excreta of larva thereby supply of food from the root to the leaves through phloem vessels hinders and due to which severely infected branches dried. Infested plants have short life span with low productivity. Studies were therefore undertaken to find out control measures for this insect pest.
Recommendation	:	For effective management of bark eating caterpillar, spot application of the solution of DDVP 76 E.C. @0.05% (7 ml/10 lit. of water) in the bore made by the caterpillar and closing with the mud is recommended.
Year of Release	:	2004
Applications	:	Citrus growing area in Maharashtra
Advantages	:	• Effective against insect pests • Easy for application • Increase the life of the orchard • Economical



Name of Technology	:	**Management of fruit sucking moth in citrus**
Crop	:	**Nagpur mandarin and sweet orange**
Background	:	Fruit sucking moth, *Eudocima materna* Linn., is a devastating pest of Nagpur mandarin often caused economic damage in October-November (i.e. ambia bahar) causes fruit drop upto 60%. Adult moth during night puncher the fruit and suck the juice. From this hole, saprophytic bacteria get entered in to fruit leads to fruit drop. Fruit sucking moth is a nocturnal in habit, strong flyer and other stages are completed on larval host gulwel (*Tinospora candifolia*), so it is very difficult to control this pest. Spraying of chemical insecticides at harvesting stage is not normally recommended as it leaves pesticide residues on fruits, Therefore, The studies were undertaken to have safer option for its management.
Recommendation	:	Spraying Neem seed extract 5 per cent or Fish oil rosin soap 2 per cent or Karanj oil 1 per cent or Azadirachtin 1500 ppm or Neem oil 1 per cent is recommended to reduce the fruit drop to the extent of 50 per cent.
Year of Release	:	2004
Applications	:	Citrus growing area of Maharashtra
Advantages	:	• Safer to natural enemy • No residual toxicity • Cost effective and easy for application

Name of Technology	:	**Management of citrus mites**
Crop	:	**Citrus**
Background	:	Citrus mite *Eutetranychus orientalis* Klein is one of the important pest of citrus. Protonymph and adult suck the sap of leaves from upper surface which causes pale strips. The affected leaves become chlorotic and finally drop down. They also arrest fruit development in early season causing grey patches besides damage fruits are underdeveloped and fetches lower prices due to ugly appearance and hence the investigation for its control measures.
Recommendation	:	For management of citrus mites and maintaining the quality of citrus fruits, two spraying of Neem Seed Extract 5% Propergite 0.15% or sulphur 80 WP @ 0.25% at an interval of month is recommended.
Year of Release	:	2007
Applications	:	Citrus growing area of Maharashtra
Advantages	:	• Quick and effective control • Cost effective and easy to application • Higher economic returns

Name of Technology	:	**Management of lemon butterfly in nursery**
Crop	:	**Citrus**
Background	:	Lemon Butterfly *Papilio demoleus* Linn. causes considerable damage to citrus seedling in nursery. Larva of Lemon butterfly feeds on foliage and causes severe damage leading to complete defoliation of seedlings and therefore seedlings could not be ready for budding and faces heavy economical losses. From this view point research work on management of lemon butterfly was conducted.
Recommendation	:	For effective control of lemon butterfly in nursery spraying of Thiodicarb 75 WP 0.075% or *Bacillus thuringiensis* (2 x 10^9 CFU/ml) 0.1% at the initiation of infestation is recommended.
Year of Release	:	2008
Applications	:	Citrus growing area in Maharashtra
Advantages	:	• Quick and effective control • Cost effective and easy for application • Higher monetary returns



Name of Technology	:	**Management of insect pests of chilli in nursery and crop**
Crop	:	**Chilli**
Background	:	Chilli is one of the vegetable spice crop in Maharashtra. It is good source of vitamin C, contents capsicin, capsanthin & solanine also has medicinal value. Chilli is attacked by three major pests viz., thrips, (*Scircothrips dorsalis*) bud borer (*Goethella* spp.) and mite. The combined damage caused by thrips and mites is called "churda-murda".
Recommendation	:	For raising chilli seedlings, soil application of phorate 10 G @ 70 g/m^2l 55 m at the time of sowing in nursery bed is recommended. Spraying of Dimethoate 30 EC 0.03% at 15th and 30th day after seed emergence in nursery. At the time of transplanting - dip the seedling in NSE 5% + copper oxichloride 0.03% solution) after the initiation of flowering spraying of Monocrotophos 0.25%, followed by NSE % + wettable sulphur 0.25% followed or Oxydemeton methyl 0.02% + Mancozeb 0.25% alternated with NSE 5% + wettable Sulphur 0.25% are recommended.
Year of Release	:	2000
Applications	:	Dry and Irrigated farming of chilli growing areas of Vidarbha region
Advantages	:	• Gives healthy seedling • Manages all the pests of chilli • Full yield potential of the variety is harvested • Higher monetary returns

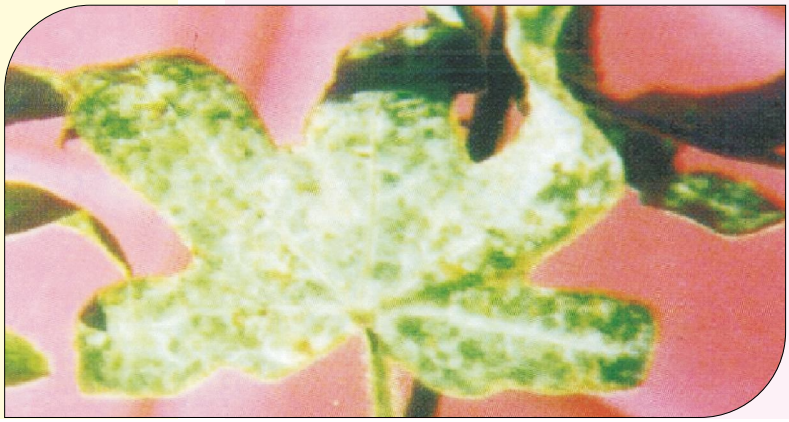
Name of Technology	:	**Biorational management of shoot and fruit borer in okra (*Earias vitella*)**
Crop	:	**Okra (Bhendi)**
Background	:	Okra commonly, known as bhendi and ladies finger, is one of the important vegetable crop. This crop suffers heavy losses due to shoot and fruit borer *Earias vitella*. As well as the chemical sprays have to be avoided as the fruits are taken at young stage and alternative methods need to be searched out. Therefore, studies were undertaken for timely management of this insect pests.
Recommendation	:	For the effective management of okra fruit borer with higher yield, net profit and ICBR, three sprays of spinosad 0.005% or NSE 5% at an interval of 15 days, commencing from pest incidence is recommended.
Year of Release	:	2006
Applications	:	Okra growing areas of Maharashtra
Advantages	:	• Effective pest control • Ecofriendly and residue free fruits • Higher monetary returns

Name of Technology	:	**Management of brinjal shoot and fruit borer**
Crop	:	**Brinjal**
Background	:	In Maharashtra, Brinjal is cultivated on an area of 32,000 ha with an annual production of 5,12,600 tonnes with a productivity of 16.3 m tonnes/ha. Today it is one of the major vegetable consumed by all strata of the community. Brinjal is the rich source of vitamin A & B. Whenever there is large scale cultivation of Brinjal, it is attacked by a major pest i.e. Brinjal shoot and fruit borer (*Leucinodes orbonalis*) causing heavy losses. Use of chemical is alternative to this but presence of residue in fact is limiting factor and hence alternative methods needs to be developed.
Recommendation	:	Three applications of Azadirachtin 1500 ppm 2 ml + Trichogramma 1.5 lac/ha at an interval of 15 days commencing from the pest incidence is recommended for getting higher yield and net profit of brinjal fruits.
Year of Release	:	2006
Applications	:	In Vidarbha region
Advantages	:	• Safe to human consumption and eco-system • Residue free fruits • Higher monetary returns

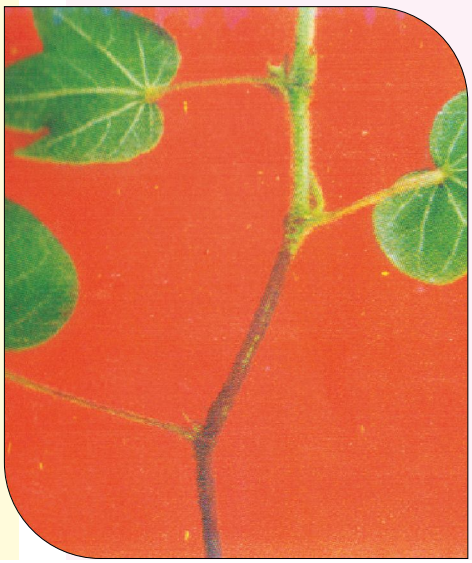
Name of Technology	:	**Management of tomato leaf miner with chemicals**
Crop	:	**Tomato**
Background	:	Leaf miner larvae tunnel through the lamina of the tomato leaf, eating the chlorophyll-rich mesophyll cells as they go. This leaves an irregular track of dead tissue that eventually causes the leaf to stop functioning. High levels of damage on tomato cause stunted growth and reduce yield. Therefore, its timely management is very important.
Recommendation	:	For the management of tomato leaf miner, spraying of monocrotophos 36 WSC @ 0.05 % or phosphamidon 85 SL @ 0.02 % or cypermethrin 25 EC @ 0.01 % or neem seed extract 5 % at an interval of 15-20 days on initiation of infestation after transplanting is recommended
Year of Release	:	2005
Applications	:	Tomato growing areas of Maharashtra
Advantages	:	• Fast and reliable method of pest management • Cost effective, high monetary returns • Prevents further crop losses due to immediate control

Plant Pathology

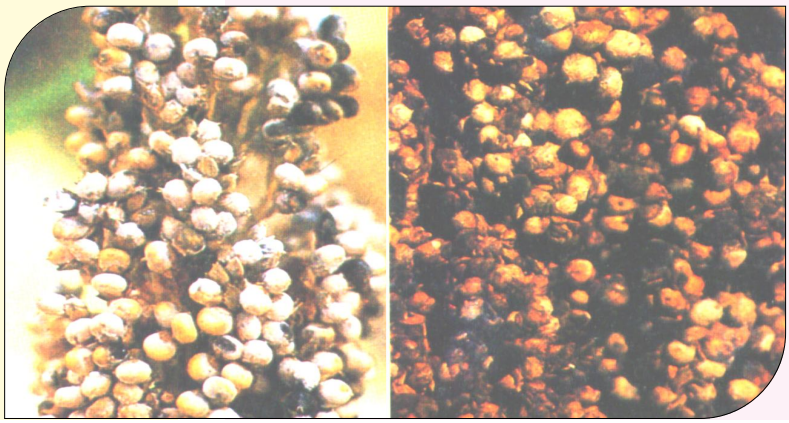
Name of Technology	:	**Management of grey mildew of cotton through fungicides**
Crop	:	**Cotton**
Background	:	Grey mildew disease of cotton (*Gossypium* spp.) incited by *Ramularia gossypii* is one of the most serious disease of arborium cotton grown in Vidarbha region of Maharashtra. The disease was found principally to affect Asiatic Cotton (*G. arborium* and *G. herbaceum*) in India. However, it has been observed that it affects *G. hirsutum* cotton causing heavy losses in yield due to defoliation of leaf, flowers, boll resulted in low yield.
Recommendations	:	Grey mildew in cotton is managed by dusting 300 mesh sulphur @ 20 kg/ha during morning or evening hours spray as soon as the disease appear
Year of Release	:	1973
Applications	:	Cotton growing areas
Advantages	:	• Easy for application • Provide secondary element to the crop • Increase in yield • Higher monetary returns



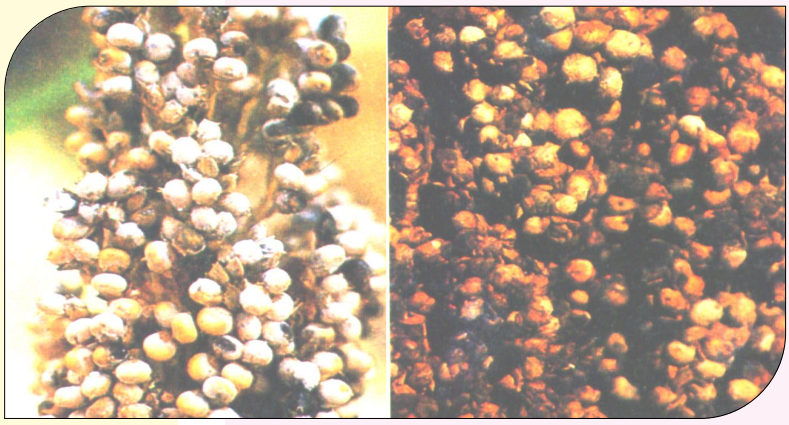
Name of Technology	:	**Effect of fungicides and antibiotics for control of black arm of cotton**
Crop	:	**Cotton**
Background	:	Black arm of cotton caused by *Xanthomonas axonopodis* pv. *malvacearum* is an important disease in cotton growing areas of India. It attacks the crop from seedlings to maturity and causes heavy damage. The extent of losses are in the range of 11 to 34% in all growing varieties in our region. The disease is also difficult to manage because of capability of pathogen to produce races against resistance gene in cotton. Management of disease is possible by intergrating resistant varieties, chemical and biological methods.
Recommendations	:	Copper oxychloride 0.25% followed by streptomycine 100 ppm spray or three spraying of 5% neem seed extract or Seed treatment of *Pseudomonas fluorescens* (pf.I) @ 10 g/kg seed and three foliar sprays @ 20 g /10 lit water at 30, 60 and 90 DAS is recommended as soon as the disease appears.
Year of Release	:	1995
Applications	:	Cotton growing areas
Advantages	:	• It is cheaper and safer in disease management • It is ecofriendly and non hazardous • Higher monetary returns



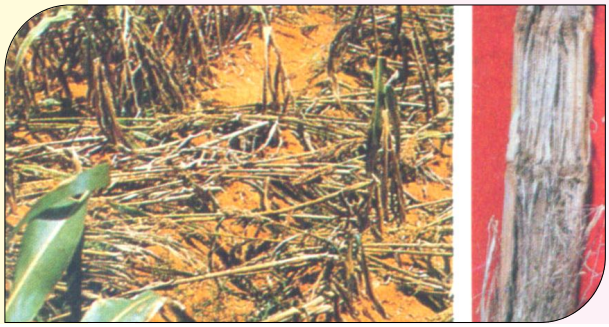
Name of Technology	:	**Plant products / extracts for management of sorghum grain mould**
Crop	:	**Sorghum**
Background	:	Sorghum is one of the main stable food crop of the world. Sorghum is cultivated widely throughout Semi Arid Tropics countries. 42% of the total sorghum produced world wide was utilized for food and 48% as fodder. Grain mould infection appearances on developing grain by complex of fungi and become a major problem which reduces yield and acceptability of grain and viability of seeds. The experiment was conducted during 1997-98 to 1999-2000 on susceptible variety MS-296B The neem seed karnel, neem leaves, tulsi leaves, ginger, garlic (cloves), Eucalyptus leaves and the measured quantity of thirum and carbendazim were used. Two sprays were undertaken, first after complete anthesis and second spray 15 days after the first spray.
Recommendation	:	Management of grain moulds and to maintain germination in seed production of sorghum, spraying of 5% garlic extract or 5% ginger extract or spraying of thirum (0.2%) + carbendazim (0.07%) first at complete anthesis and second 15 days after first spray, is recommended.
Year of Release	:	2001
Applications	:	Dryland and irrigated sorghum growing areas
Advantages	:	• Reduce the fungal load of fungi and ultimately improve the threshed grain mould rating(TGMR) • Maintain seed germination of sorghum and quality • Higher monetary returns



Name of Technology	:	**Management of losses due to grain mould to sorghum**
Crop	:	**Sorghum**
Background	:	Grain mould has become a major and wide spread sorghum disease problem, because it significantly reduces yield and acceptability of grain and viability of seed. Grain mould fungi have repeatedly been associated with losses in seed mass, grain density and germination and other damage relating to storage quality, food and feed processing quality, and market value of the grain. More specifically, the effects of fungi in quality loss in stored grains are, decrease in germinability, discolouration of part or whole seed or kernel, heating and mustiness, various biochemical changes and production of toxin which may be injurious to humans and to domestic animals.Diseased appearance of sorghum grain resulting from the infection of the developing grain by one or more parasitic fungi, grain moulds are common if rain occurs during flowering and grain filling stages and hence important to manage the losses
Recommendation	:	Reduction in loses due to grain mould and to improve seed germination, harvesting of sorghum at physiological maturity stage is recommended.
Year of Release	:	2002
Applications	:	Sorghum growing areas
Advantages	:	• Reduce losses due to grain mould • Improve seed germination • Increase quality and market value of grain



Name of Technology	:	**Development of IPM modules for management of grain mould and charcoal rot of sorghum**
Crop	:	**Sorghum**
Background	:	Sorghum is one of the main stable food and fodder crop. Grain mould caused by complex of fungi. The disease become severe when grain matures during wet weather. The grain mould disease reduce yield and acceptability of grain and viability of seed. It causes due to drought, obstacles in photosynthesis, more infestation of sucking pest, low soil moisture, high temperature and low sugar content at the basal portion of hosts etc are the congenial conditions for invasion by pathogen. This disease is more pronounced at grain filling stage. Loadging at the maturing plant is conspicuous external symptoms of the disease.
Recommendations	:	Management of charcoal rot, grain mould of sorghum and for more grain and fodder yield, following IPM components in additions to farmers practices is recommended. Seed treatment with *Azotobacter* 25 g + *Trichoderma* 4 g + PSB 25 g/kg seed, seed treatment with imidacloprid 7 g/kg seed (for late sown crop only), spraying with bioagent *B. bassiana* and *M. anisoplae* 1.5 kg/ha at 8 days after emergence, application between rows with *Trichoderma* 2 kg with 2.5 q FYM/ha during second hoeing and harvesting at physiological maturity of crop.
Year of Release	:	2006
Applications	:	Dryland / irrigated areas of sorghum
Advantages	:	• Effective management of charcoal rot and grain mould of sorghum • Increase grain and fodder yield • Higher monetary returns



Name of Technology	:	**Fungicidal seed treatment to manage black point disease in wheat**
Crop	:	**Wheat**
Background	:	Black point infection in wheat seed is characterized by blackish discolouration, usually at the end of the seed. The kernels are infected by *Alternaria* spp., *Herminthosporium* spp. and *Fusarium* spp. During the dough stage of crop, if humid weather prevails for a few days to a week just prior to harvest, the incidence of infection increases. Black point disease is well known which affect the seed viability (germination) of the seed, grain quality and also market value of the product. It is prevalent on some varieties viz., Lok-1, HD-2189, Kalyan- sona, MACS-2496 etc. in Vidarbha. Therefore, an experiment was undertaken to find out suitable fungicidal seed treatment which prevent the adverse effect of black point on seed.
Recommendation	:	Seed treatment with carbendazim 0.1% is more effective in improving the seed vigour of black point infected seeds. Other fungicides viz. thiram @ 0.25% also effective to improve the germination, shoot and root length in black point infected wheat seed.
Year of Release	:	1997
Applications	:	All wheat growing areas
Advantages	:	• Improve seed germination, vigour and seed quality • Decrease the infection of black point disease • Higher monetary returns

Name of Technology	:	***Alternaria* leaf blight management in irrigated wheat crop**
Crop	:	**Wheat**
Background	:	Leaf blight caused by *Alternaria triticina* is the major disease in irrigated wheat in our area. It is found to cause losses in grain yields of irrigated wheat upto 26 to 40 per cent when infection occurs at 20 to 40 days after sowing, respectively. The disease initially appears as small chlorotic and irregularly scattered lesion on the leaves. The affected leaves show distinct brown oval spots which become irregular and a yellow marginal zone is seen round the spots. In severe stage, spots coalesce and convert the whole or part of the leaf giving it a blighted appearance. High humidity or irrigation as well as warmer temperature (20 to 25^{0}C) favour the infection and further development of disease.In recent years, the regular occurrence of the disease was observed in irrigated wheat.
Recommendation	:	Spraying of Mancozeb 0.25% is effective for control of Alternaria leaf blight of wheat, hence recommended.
Year of Release	:	1998
Applications	:	Applicable to irrigated wheat crop
Advantages	:	• Increase in grain yield • Improve quality of seed grain • Higher monetary returns

Name of Technology	:	**Management of rust in irrigated wheat**
Crop	:	**Wheat**
Background	:	Rust of wheat is regarded as the most important disease which cause considerable losses. During rabi season of 1997-98, severe incidence of brown rust was observed on Lok-1 MACS-2496 and Kalyan sona in Vidarbha region. Therefore, the efforts were made to study the effect of fungicides against rust in irrigated wheat.
Recommendation	:	Sprays of Mancozeb 0.25% is recommended at 10 days interval for control of rust in irrigated wheat. Spraying should be done as soon as appearance of the disease
Year of Release	:	2002
Applications	:	In irrigated wheat sown areas
Advantages	:	• Improve quality of grain • Increase in yield • Higher monetary returns

Name of Technology	:	**Fungicidal management of powdery mildew of pea**
Crop	:	**Pea**
Background	:	Powdery mildew (*Erysiphe polygoni*) of pea is the most devastating disease commonly occur in India. It appears in epidemic form almost every year late in the cropping season resulting in drying of leaves, premature defoliation and forced maturity leading to heavy yield losses especially in dry weather. The characteristic white floury patches is most commonly observed on the upper side of leaves but in severe intensity it also affects the undersurface of leaf, young shoots, stems, buds, flowers and pods. To avoid the huge economic yield losses, application of fungicides form the first line of defence and hence the investigation.
Recommendations	:	Application of three sprays of calixin 0.3 per cent or karathane 0.1 per cent or thiovit 0.5 per cent or sulphane 0.25 per cent or carbendazim 0.1 per cent at an intervals of 10 days were found effective for management of powdery mildew of pea, hence recommended.
Year of Release	:	2002
Applications	:	Pea growing areas
Advantage s	:	• Fast and reliable method of disease management • Cost effective with high monetary returns • Prevent further crop losses due to immediate control

Name of Technology	:	**Biological management of wilt / root rot of pigeonpea and chickpea**
Crop	:	**Pigeonpea and chickpea**
Background	:	Wilt is the most destructive fungal disease of pulse crops. It is very severe and destructive disease from seedlings to the maturity stage. More pronounced symptoms are observed towards maturity. The yield losses could go as high as 100 per cent. Wilting is characterized by gradual or sometimes sudden yellowing, withering and drying of leaves and plants. Some branches start drying when plant is suffering from water shortage even in presence of moisture in soil.Wilt pathogen are mainly soil borne and are very difficult to control. Although chemicals based management is the first choice, factors like cost of plant protection, fungicide resistance, higher persistence and detrimental nature of fungicides to non target organisms oriented for safer alternative. Biological control is an important component of integrated disease management as one of the cost effective and eco-friendly method of disease management.
Recommendations	:	Seed treatment with bioagent viz. *Trichoderma harzianum* or *Trichoderma viride* @ 4 g/kg seed was found effective in reduction of disease in pigeonpea and chickpea
Year of Release	:	1983
Applications	:	Pigeonpea and chickpea growing areas
Advantages	:	• Reduce seed and soil borne fungi • Improves germination, plants stand and yield • It is cheap and ecofriendly • Higher monetary returns

Name of Technology	:	**Management of wilt / root rot of chickpea with fungicides**
Crop	:	**Chickpea**
Background	:	Wilt and root rot is the most destructive seed and soil borne fungal disease of chickpea. It is very severe and destructive disease from seedling to the maturity stage. The most pronounced symptoms are observed towards maturity. Wilting is characterized by gradual or sometimes sudden yellowing, withering and drying of leaves and plants.Infected plants also show the symptoms of suffering from water shortage even in presence of moisture in soil.Wilt and root rot pathogen are mainly soil borne and are rather difficult to control. Chemical based management strategy is employed to avoid the economic losses.
Recommendations	:	Seed treatment with captan @ 3 g/kg or chlorothalonil @ 2 kg/kg seed or thiophenate methyl @ 2 g/kg seed is recommended against wilt/root rot of chickpea
Year of Release	:	1993
Applications	:	Chickpea growing areas
Advantages	:	• Fast and reliable method of disease management • Cost effective with high monetary returns • Prevents further crop losses due to immediate control

Name of Technology	:	**Management of powdery mildew and crecospora leaf spot of green gram and black gram with fungicides**
Crop	:	**Green gram and black gram**
Background	:	Powdery midew *(Erysiphe polygoni)* of green gram and black gram is the most devastating disease of common occurrence in India. It appears in epidemic form almost every year late in the cropping season resulting in drying of leaves. Premature defoliation and forced maturity leading to higher yield losses especially in dry weather. The characteristic white floury patches is most commonly observed on the upper side of leaves but in servere intensity it also affects the undersurface of leaf, young shoots and stems, buds, flowers and pods. The losses inflicted are proportional to the disease intensity and the stage at which disease occurs. Cercospora leaf spots is common foliar fungal disease producing angular lesions and resulting in severe yield losses. Cercospora leaf spots are relatively small and separate or may enlarge and coalease resulting in leaf blight. The spots are typically brown roughly circular with reddish border and ash grey center. Intensification of disease results in large necrotic areas translating in defoliation.
Recommendations	:	Spraying of wettable sulphur 0.25%, penconazole 0.1%, found effective against powdery mildew of green gram and black and application of Dithane M 45 0.25% reduced the intensity of *Cercospora* leaf spot.
Year of Release	:	1996
Applications	:	Green gram and black gram growing areas
Advantages	:	• Fast and reliable method of disease management • Cost effective with high monetary returns • Prevents further crop losses

Name of Technology	:	**Biological management of wilt / root rot of green gram**
Crop	:	**Green gram**
Background	:	Wilt and root rot is one of the important disease of mungbean. In the initial stages, the soil borne fungus causes seed rot, seedlings blight and root rot symptoms. The disease occurs commonly at podding stage. The leaves turn yellow and brown, irregular lesions appear which coalescence to form big blotches and the affected leaves start drying prematurely. The affected plants dry up gradually resulting in yield losses. Although, chemicals based management is the first choice, factors like cost of plant protection, fungicide resistance higher persistence and detrimental nature of fungicides to non-target organisms oriented for screening for safer alternative. Biological control is an important component of Integrated Disease Management as the cost effective and eco-friendly method of disease management.
Recommendations	:	Seed treatment with *Trichoderma harzianum or Trichoderma viride* @ 4 g/kg seed is recommended for the management of wilt/root rot of green gram.
Year of Release	:	1996
Applications	:	Green gram growing areas as well as wilt /root rot sick soil and susceptible high yielding varieties
Advantages	:	• Reduce seed and soil borne fungi • Improves germination, plant stand and yield • It is economical and cheap • Ecofriendly

Name of Technology	:	**Effect of *Rhizobium* and phosphate solubilizing bacteria on green gram**
Crop	:	**Green gram**
Background	:	Green gram is an important pulse crop in India. Biomass produce after harvest of the crop play an important role to increase nutrient status of the soil. As it is a very short duration and low yielding crop, fertigation through chemicals is discouraged.Dual application of *Rhizobium* and phosphate solubilizing bacteria found useful to maintain the nutritional availability of such low input crop. In view of this, the efficiency of local strains of *Rhizobium* and PSB were tested to maintain biological status and nutritional requirement. An experiment was undertaken to study the efficiency of local strains of *Rhizobium* and PSB individually and dual inoculation for increase in yield and quality of the grain.
Recommendation	:	Application of *Rhizobium* + PSB 250 g each for 10 kg of seed is recommended for green gram to reduce 50% dose of recommended chemical fertilizers.
Year of Release	:	1998
Applications	:	Green gram sowing areas
Advantages	:	• Reduce 50% dose of chemical fertilizer • Ecofriendly and non hazardous • Higher monetary returns

Name of Technology	:	**Seed inoculation of locally isolated *Rhizobium* strains AMR-17 in green gram**
Crop	:	**Green gram**
Background	:	Green gram is an important pulse crop in India. Biomass produce after harvest of the crop play an important role to increase nutrient status of the soil. Application of *Rhizobium* found useful to maintain the nutritional availability of such low input crop.The goal of this research is to obtain profitable and healthy food by introducing new type of legume *Vigna mungo* applying effective strains of *Rhizobium* in the form of microbiological N fertilizers, which would enable a reduction or avoidance of nitrogen fertilizers in their agricultural production.
Recommendation	:	Rhizobium isolates AMR-17 is recommended for seed inoculation in green gram
Year of Release	:	2001
Applications	:	Green gram growing areas
Advantages	:	• Ecofriendly and non hazardus • Cheaper and effective • Higher monetary returns

Name of Technology	**:**	**Response of summer black gram *to Rhizobium* culture and NP fertilizer**
Crop	:	**Black gram**
Background	:	Black gram is a highly priced pulse and very rich in phosphoric acid. Manuring with 25 to 40 kg /ha of P and 25 kg /ha of N should be given at the time of sowing. Also seed treatment with bio-fertilizer viz. *Rhizobium* @ 25 g/kg of seed is beneficial being kharif crop. It is not required irrigation unless there is dry spell during the kharif season. Irrigation needs to be given according to soil type. The present study is to know the response of summer black gram to *Rhizobium* and NP fertilizer.
Recommendation	:	The seed of summer black gram be treated with *Rhizobium* culture before sowing and crop be fertilized with 25 kg N and 50 kg P to get 30% more yield.
Year of Release	**:**	1995
Applications	:	Black gram growing areas
Advantages	:	• Ecofriendly and non hazardus • Cheaper and effective • Higher monetary returns

Name of Technology	:	**Seed inoculation of locally isolated *Rhizobium* strains AUBR-10 in black gram**
Crop	:	**Black gram**
Background	:	Back gram, a member of the Asian vigna crop group, is annual pulse crop native to central Asia. It is staple crop in central and south east Asia. It is used for human food, green manure, cover crop and forage, although it is grown mostly for food seed production. Reduction in the cost of production can be achieved and environment can be protected through seed inoculation with *Rhizobium*. They are known to influence nodulation, symbiotic N fixation and growth and yield of pulses. Seed inoculation with *Rhizobium* bacterium prior to sowing allows a reduction in N fertilization and decreases susceptibility to environmental stress. The aim of this research was to evaluate the native *Rhizobium* isolated from root nodule from black gram
Recommendation	:	Seed treatment of AUBR-10 *Rhizobium* isolates is recommended for higher grain yield of black gram
Year of Release	:	2001
Applications	:	Black gram growing areas
Advantages	:	• Ecofriendly and non hazardus • Cheaper and effective • Higher monetary returns

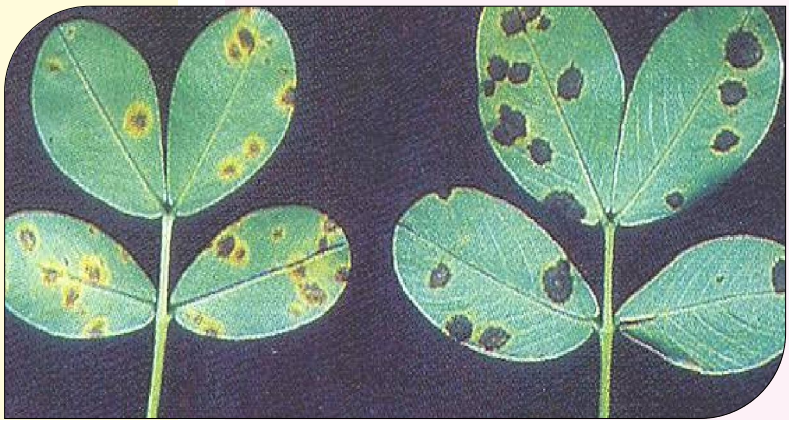
Name of Technology	:	**Management of soil and seed borne diseases of sunflower**
Crop	:	**Sunflower**
Background	:	Sunflower (*Helianthus annuas*) is an important oilseed crop and has made significant contribution to India's vegetable oil economy since its introduction in late 1960's. The major limiting factor for sunflower cultivation are *Alternaria* leaf spot, downy mildew, rust and necrosis virus. Sunflower downy mildew (*Plasmopara halstedii*) a destructive disease occurring world wide is reported to be endemic in Marathwada and Vidarbha region in Maharashtra. The major seed and soil borne diseases like downy mildew, *Sclerotium* wilt and charcoal rot also cause severe economic yield lossess and become a limiting factor for expansion of the area under sunflower crop and hence this investigation.
Recommendation	:	Seed treatment with captan, thirum or carbendazim @ 2-3 g/kg sunflower seed, protected the crop from seed and soil borne diseases
Year of Release	:	1983
Applications	:	For sick soil, irrigated and non-irrigated condition of sunflower growing areas
Advantages	:	• Reduce seed and soil borne fungi • Improves germination, plants stand and yield • It is economical and cheap

Name of Technology	:	**Management oF *Alternaria*, *Curvularia* and Bacterial leaf spot of sunflower**
Crop	:	**Sunflower**
Background	:	Sunflower (*Helianthus annuas*) is an important oilseed crop and has made significant contribution to India's vegetable oil economy since its introduction in late 1960's. The major limiting factor for sunflower cultivation are *Alternaria Curvularia* and bacterial leaf spot of sunflower. It causes severe yield losses and become a limiting factor for expansion of the area under sunflower crop.
Recommendations	:	Spraying of Mancozeb 0.25% three times at an interval of 15 days, starting first spray from the appearance of leaf spot disease is recommended
Year of Release	:	1983
Applications	:	Sunflower growing areas
Advantages	:	• Increase in yield • Improves the quality of seed grain • Protected the plants from seed and soil borne fungi • Economical and cheap

Name of Technology	:	**Management of downy mildew of sunflower**
Crop	:	**Sunflower**
Background	:	Sunflower (*Helianthus annuas)* is an important oilseed crop and has made significant contribution to India's vegetable oil economy since its introduction in late 1960's. The major limiting factor for sunflower cultivation are *Alternaria* leaf spot, downy mildew, rust and necrosis virus. Sunflower downy mildew (*Plasmopara halstedii*) a destructive disease occurring world wide is reported to be endemic in Marathwada and Vidarbha region in Maharashtra. The major seed and soil borne diseases like downy mildew, *Sclerotium* wilt and charcoal rot also cause severe economic yield losses and become a limiting factor for expansion of the area under sunflower crop.
Recommendation	:	Sunflower seed should be treated with metalaxyl 30 SD @ 6 g/kg seed as a preventive measure and foliar spray of metalaxyl @ 4 g/lit of water be given at the initiation of disease
Year of Release	:	2002
Applications	:	Sunflower growing areas
Advantages	:	• Increase seed yield • Improve quality of seed grain • Effective management practice • Higher monetary returns

Name of Technology	:	**Management of groundnut rust**
Crop	:	**Groundnut**
Background	:	India is the largest grower and second largest producer of groundnut in the world. Among the foliar diseases, rust is one of the major disease of groundnut which reduces the yield and quality of groundnut. In India losses in yield due to rust estimated at considerable level. Besides the loss in pod and kernel, the value of fodder is also adversely affected due to rust
Recommendation	:	Spraying with vitavax 10 g or mancozeb 25 g /10 litres of water is recommended against groundnut rust
Year of Release	:	1980
Applications	:	Groundnut growing areas
Advantages	:	• Increases yield • Improves the quality of fodder • Less expensive • Higher monetary returns

Name of Technology	:	**Management of *Cercospora* leaf spot (Tikka) of groundnut**
Crop	:	**Groundnut**
Background	:	India is the largest grower and second largest producer of groundnut in the world. The average yields however, are much lower than other major groundnut growing countries. This may be attributed to the rainfed nature of cultivation of this crop coupled with attack by a variety of diseases and insect pests. Among the foliar diseases, late leaf spot (Tikka) disease is one of the major disease of groundnut which reduces the yield and quality of groundnut. In India, losses in yield due to leaf spots have been estimated to be in the range of 15 to 59%. Besides the loss in pod and kernel, the value of fodder is also adversely affected.
Recommendation	:	Cercospora leaf spot (Tikka) of groundnut can be managed by spraying with wettable sulphur 0.3% or mancozeb 0.25 % at an interval of 15 days after appearance of disease, first spray may be taken after appearance of the disease.
Year of Release	:	1984
Applications	:	Groundnut growing areas
Advantages	:	• Increase in seed yield and improves the quality of fodder • Higher monetary returns



Name of Technology	:	**Management of seed and soil borne diseases of groundnut**
Crop	:	**Groundnut**
Background	:	India is the largest grower and second largest producer of groundnut in the world. The average yields however, are much lower than other major groundnut growing countries. This may be attributed to the rainfed nature of cultivation of this crop coupled with attack by a variety of diseases and insect pests. Soil borne pathogen caused heavy loss in yield.
Recommendation	:	Seed treated with thirum + carbandazim 2:1 or thirum / captan 2.5 to 3 g/kg is useful to avoid seed and soil borne diseases of groundnut
Year of Release	:	1984
Applications	:	Groundnut growing areas
Advantages	:	• Minimize the yield losses • Economical and cheaper • Easy for application and less time consuming

Name of Technology	:	**Management of bacterial blight of sesamum**
Crop	:	**Sesamum**
Background	:	Sesame (*Sesamum indicum*) is an important oilseed crop in the world. Oil content of sesame varies from 46 to 52%. Its oil is mostly used for cooking, in manufacturing of perfumed oil and also used to anointing the body and for medical purpose. It suffers due to various diseases caused by fungi, bacteria and viruses which result in the loss of yield.
Recommendation	:	Spraying of macozeb 0.25% + streptocycline 100 ppm is recommended for effective control of the various diseases of sesamum
Year of Release	:	1985
Applications	:	Sesamum growing areas
Advantages	:	• Increase in yield and improves the quality of the seed • Effective control measure • Higher monetary returns

Name of Technology	:	**Management of seed and soil borne disease of sesamum**
Crop	:	**Sesamum**
Background	:	Sesame (*Sesanmum indicum*) is an important oilseed crop in the world. Oil content of sesame varies from 46 to 52%. Its oil is mostly used for cooking, in manufacturing of perfumed oil and also used to anointing the body and for medical purpose. Such widely cultivated sesame crop suffers heavily due to various diseases caused by fungi, bacteria and viruses which result in the loss of yield. Seed and soil borne diseases take a heavy toll of crop in favourable conditions.
Recommendation	:	Seed treatment be done with captan or thirum @ 3 g/kg seed to avoid seed and soil borne diseases of sesamum
Year of Release	:	1985
Applications	:	Sesame growing areas as well as sick soil with high population of pathogen
Advantages	:	• Improves germination • Easy, economical and cheap • Less soil pollutant

Name of Technology	:	**Seed treatment for management of rhizoctonia root rot in soybean**
Crop	:	**Soybean**
Background	:	Soybean is grown in all over the world. Root rot takes a heavy toll of crop and becoming limiting factor in soybean cultivation. Yield losses up to 77per cent have been recorded due to this pathogen. Present study pertains the fungicidal and biological management of *Rhizoctonia* root rot of soybean.
Recommendation	:	Seed treatment with thiram + carbendazim + *Trichoderma* @ (3 + 1+ 4 g/kg seed) is recommended against root rot / collar rot of soybean
Year of Release	:	2008
Applications	:	Soybean growing areas
Advantages	:	• Increase in yield • Lowers the population of seed and soil borne fungi • Retains maximum plant population • Increases the plant vigour, develops the resistance against pathogen • It is economical, cheap and easy for operations

Name of Technology	:	**Control of whip smut in sugarcane**
Crop	:	**Sugarcane**
Background	:	Whip smut is an important disease of this region and cause considerable losses in plant and ratoon crop of sugarcane
Recommendation	:	The deeping of cane set in 0.1% carbendazim for 10 minutes is recommended at planting as it recorded the highest yield of sugarcane.
Year of Release	:	1990
Applications	:	Sugarcane growing areas of Vidarbha region
Advantages	:	• Significant control of sugarcane whip smut disease.- Avoid infection of other soils borne fungal diseases • Higher yield of sugarcane • Higher monetary returns

Name of Technology	:	**Control of *Phomopsis* blight of brinjal by chemicals and Plant products**
Crop	:	**Brinjal**
Background	:	Brinjal (*Solanum melongena* L) is a Indian vegetable grown in every season and is available throughout the year in almost all the parts of the country. Phomopsis blight and fruit rot is a serious disease caused by *Phomopsis vexans*. The fungus attacks on all parts of plants starting from seedling to maturity. The pathogen survive on crop debries present in the soil and attacks the plants under favourable conditions. Although it initiates as a foliage blight, the most destructive phase is fruit rot.
Recommendation	:	Three sprays of carbendazim 0.1 % at an interval of one month starting from fruit settinig is recommended for control of fruit rot of brinjal.
Year of Release	:	1998
Applications	:	Brinjal growing areas
Advantages	:	• Cheap method of disease control • Increase in yield • Higher monetary returns

Name of Technology	:	**Management of *Alternaria* blight of tomato by chemicals and plant products**
Crop	:	**Tomato**
Background	:	Tomato (*Lycopersicon esculentum*) is one of the most important vegetable crop and has nutritive value. Early blight of tomato incited by the fungus *Alternaria solani*, causes severe damage to the foliage and fruits The yield losses may be as high as 50 per cent under favourable conditions. It is more severe in kharif and rabi season.
Recommendation	:	Five sprays of carbendazim 0.05 % or mancozeb 0.25 % at an interval of 15 days after transplanting is effective to control *Alternaria* blight of Tomato
Year of Release	:	1999
Applications	:	Tomato growing areas
Advantages	:	• Restricts further spread of disease • Increase in yield • Higher monetary returns

Name of Technology	:	**Effect of different fungicides against powdery mildew of Fenugreek**
Crop	:	**Fenugreek**
Background	:	Powdery mildew of fenugreek caused by two different pathogens viz., *Leveillula taurica* and *Erysiphe polygony* D.C. is an important disease. It appears in severe form in local cultivation and causes significant loss in quality as well as quantity of grains.
Recommendation	:	Two sprays of propiconazole 0.1 % at 15 days intervals from the appearence of disease were found effective against powdery mildew in seed production of fenugreek and hence recommended.
Year of Release	:	2003
Applications	:	In all seed production areas of fenugreek
Advantages	:	• Useful for producing healthy crop • Higher seed yield of fenugreek • Higher monetary returns

Name of Technology	:	**Soil solarization for management of soil borne diseases in vegetable nursery**
Crop	:	**Chilli, Tomato and Brinjal**
Background	:	The concept of control of soil borne diseases changed over a last decades. Soil disinfection is possible to reduce the harmful organisms. Soil solarisation was developed for the first time in Israel to control many plant pathogenic pests, disease and weeds. Therefore ,the present investigations was made to find out the potential of soil solarization along with chemicals and bioagents as seed dressers against damping off in chilli ,tomato and brinjal in nursery.
Recommendation	:	In order to control the nursery diseases, to improve germination and plant stand of chilli ,tomato and brinjal, soil solarization, followed by a seed treatment with carbendazim 0.1 % or copper oxychloride 0.25 % or captan 0.2 % or Trichoderma 4 g/kg of seed is recommended.
Year of Release	:	2004
Applications	:	Vegetable nursery crops
Advantages	:	• A physical process of management of soil borne disease • Ecofriendly and non- hazardous • Healthy and disease free seedling • Reduces the pre and post mortality

Name of Technology	:	**Management of major diseases of chilli through bioagents, plant exrtacts and fungicides**
Crop	:	**Chilli**
Background	:	Chilli (*Capsicum annum*) is an important condiment grown extensively as commercial crop. The incidence of dieback , fruit rot and powdery mildew cause significant losses in yield. The intensity of these diseases are increasing day by day. The chemicals although are easy approach for management of these diseases, sometimes resistance can be developed with a very short span of time resulting into quantitative and qualitative losses. Bioagents and plant extracts are the ecofriendly approach for effective and economical management of these diseases and hence investigation.
Recommendation	:	1) For the management of chilli die back,fruit rot and powdery mildew,four sprays of carbendazim 0.05 % or cuman L 0.125 % +Neem leaves extract 2.5 % or carbendazim 0.05 % + behada leaves extract 2.5 % at the interval of 15 days from the appearance of the disease is recommended. 2) For reduction of powdery mildew of chilli four spays of wettable sulphur 0.125 % + neem leaves extract or behada leaves exrtact 2.5 % at an interval of 15 days from the appearance of the disease is recommended.
Year of Release	:	2006
Applications	:	In all chilli growing areas
Advantages	:	• Reduses the doses of fungicides • Lowers the possibility of resistance development in pathogen • Economical and cheaper

Name of Technology	:	**Control of major chilli diseases by fungicides**
Crop	:	**Chilli**
Background	:	Chilli (*Capsicum annum*) is an important condiment grown extensively as commercial crop. The incidence of die back , fruit rot and powdery mildew cause significant losses in yield. The intensity of these diseases are increasing day by day and heavy losses are caused to the crop. The chemicals can be easy approach for management of these diseases. and therefore investigation was conducted.
Recommendation	:	For the control of chilli die back,fruit rot and powdery mildew,four sprays of propiconazole 0.1% at an interval of 15 days from the appearance of the disease is recommended.
Year of Release	:	2009
Applications	:	All chilli growing area
Advantages	:	• Reduces the intensity of diseases • Increases the yield of red ripe chilli • Higher monetary returns

Name of Technology	:	**Soil solarization for management of citrus nursery diseases**
Crop	:	**Citrus**
Background	:	*Phytophthora* cause root rot/collar rot and damping off in citrus nursery. *Pythium, Fusarium* and *Rhizoctonia* were also found associated to cause the soil borne diseases in nursery. These diseases are the major constraint in production of disease free planting material. It spread mainly due to supply of diseased planting material from the infested nurseries to virgin area. The study was conducted to minimize the excessive use of fungicides which cause soil and environmental pollution using solanization technique.
Recommendation	:	Plots solarized for 45 days during September to November, using U.V. stabilize clear transparent cross laminated polyethylene sheet and sown with seeds of *Citrus jamberi* treated with thiram + captan 3 g /kg seed (1:1) found useful to control mortality in citrus nursery with added benefit of germination and robust growth.
Year of Release	:	2002
Applications	:	For primary and secondary citrus nursery
Advantages	:	• Non hazardous method of disease control • Environment friendly and non pollutant • Increases water holding capacity and soil porosity and make available N and some secondary elements in soil. • Robust growth of seedlings. • Controls many annual weeds

Name of Technology	:	**Control of gummosis in citrus**
Crop	:	**Citrus**
Background	:	*Phytophthora* spp. are responsible for causing gummosis in citrus. Symptoms of gummosis is very clear. Oozing of gum from the stem of citrus tree is the typical symptom of gummosis in citrus. It also includes roting of roots, cracking of barks, water soaked reddish brown to black bark at the soil line. Further it cause death of the tree, if proper care is not taken. Timely application of fungicides, improvement in drainage manage the disease. Excessive soil moisture favours the disease. Therefore, proper drainage and irrigation is an important factor in disease management.In Vidarbha, almost all gardens are affected with citrus gummosis, Bordeaux paste is also found sometime ineffective to stop the ooze coming out from the trunk. It was felt necessary to have an alternative which can manage the disease. In view of this some new fungicides were tested.
Recommendation	:	Twice application of metalaxyl MZ or fosetyl AL 50 g/lit water (semi liquid paste) at an interval of 30 days is recommended after initiation of disease to control gummosis in citrus. Wash wound on the trunk with 1% potassium permanganate ($KMnO_4$) before application of fungicides.
Year of Release	:	2003
Applications	:	Citrus growing areas
Advantages	:	• Very effective method to stop oozing lesions • Increase bearing life of citrus • Increase in yield and quality of fruits

Name of Technology	:	**Integration of soil solarization and fungicides for disease management in secondary nursery of citrus**
Crop	:	**Citrus**
Background	:	Citrus is one of the important fruit crop in India. Most of the citrus species require rootstocks for raising nursery. *Citrus jamberi* is a popular rootstock but susceptible to soil borne diseases. These diseases appear as soon as seedlings transplanted in the secondary nursery. *Phytophthora* is one of the important pathogen cause heavy losses in nursery. The main cause of spread of the disease in orchard is use of apparently unhealthy planting material, where *Phytophthora* remain associated with this material. It cause spread of the disease from nursery to main orchard. The secondary beds resulted from 5-15 per cent mortality of seedlings/grafts due to *Phytophthora* infection.The experiment was conducted to minimize the disease incidence and to produce *Phytophthora* free planting material.
Recommendation	:	Soil solarization during April/May and drenching of metalaxyl +mancozeb 0.2% during August, December and June and also spraying during October/February and April are recommended to reduce mortality of citrus rootstock
Year of Release	:	2004
Applications	:	Citrus nursery growing areas
Advantages	:	• It is nonhazardous, non pollutant, econfriendly method of disease management • Reduce excessive fungicidal spray • Induces growth response • Suppress pathogenic population in soil • Suppress weeds in nursery

Name of Technology	:	**Integrated management of *Phytophthora* root rot in citrus orchard**
Crop	:	**Citrus**
Background	:	The citrus plants after few years of good growth often start declining with gradual decrease in vigour, productivity and the orchards exhibit a sick look. Root rot and collar rot caused by *Phytophthora* are a common occurrence in the orchards and it is difficult to locate orchards virtually free from these diseases. *Phytophthora* is a soil borne pathogen and it affects the life span of the citrus plants. Being a soil borne pathogen, it can be managed through the integrated management practices. The infected plants shows the initial symptoms as yellowing of leaves and leaf veins followed by falling of leaves, drying of branches and rotting of feeder roots etc.
Recommendation	:	Removal of all fruits from infected plants, pruning of dried branches along with 5 cm healthy portion of branches, pruning of shoots 30-45 cm from top, spraying of 0.1% carbendazim on pruned plants, (4 to 5 lit. per plant), exposure of active root zone and pruning of rotten roots. exposure of active root zone to sunlight for 3-4 days, drenching 0.2% Metalaxyl MZ in the active root zone (10-20 lit solution/ plant depending upon age of the plants), prepare the mixture of well rotten FYM 50 kg + 7.5 kg neem cake + 1 kg of ammonium sulphate + 1 kg single super phosphate + ½ kg murate of potash and keep this mixture 5-6 days and then apply in the active root zone and cover with soil and give the light irrigation,one month after application of fertilizer, spraying and drenching of 0.6% Bordeaux mixture, application of Bordeaux paste (1:1:10) or Metalaxyl MZ or Fosetyl -AL 50 gm / lit of water on tree trunk twice in year i.e. pre and post monsoon and to create the drainage channel in between two rows having the dimension 60 cm width and 30 cm deep for removal of excess water are recommended
Year of Release	:	2004
Applications	:	In *Phytophthora* root rot infested citrus orchards
Advantages	:	• The general health and vigour of the plant is improved. • To increase yield and healthy fruit production. • Life of the plant can be saved which avoid further losses

Name of Technology	:	**Ambia bahar fungal fruit drop management in Nagpur mandarin**
Crop	:	**Nagpur Mandarin**
Background	:	Nagpur mandarin ambia bahar fungal fruit drop observed during rainy season of August, September and October months. Fruit drop is due to many reasons viz. physiological, due to fruit sucking moth and fungal infection. About 10 to 12% fruit drop is observed due to fungal infection in ambia bahar of Nagpur mandarin. Hence, for reducing this fruit drop, some fungicides were tested for controlling fungal fruit drop of ambia bahar.
Recommendation	:	Three sprays of copper oxychloride 0.3% or carbendazim 0.1% at monthly interval starting from July is recommended.
Year of Release	:	2004
Applications	:	Ambia bahar of Nagpur mandarin
Advantages	:	• Reduce the ambia bahar fungal fruit drop of Nagpur mandarin • Increase market value of the fruits • Higher monetary returns

Name of Technology	:	**Integrated management of gummosis in Nagpur mandarin**
Crop	:	**Nagpur mandarin**
Background	:	Nagpur Mandarin suffers from many diseases, Among them the diseases causes by *Phytophythora* are of devastating nature and caused heavy losses. It infects the nursery plants as root rot, foot rot, leaf fall, gummosis and fruit rot. These diseases affect growth and fruit production. Many workers have suggested chemicals and fungicides for control of these diseases. But due to high cost and environmental pollution, now a days bio-agents viz., fungi/bacteria are used for control . Therefore some fungal and bacterial bio-agents are used for management of gummosis in Nagpur mandarin.
Recommendation	:	For the management of gummosis in mandarin, two applications of Bordeaux paste (1:1:10) on trunk in the month of June and October and soil application of *Trichoderma harzianum* + *Trichoderma viridae* + *Pseudomonas fluorescens* (100gm/plant each mixed with 1kg FYM) at the initiation of disease followed by Fosetyl-Al (0.2%) spray are recommended.
Year of Release	:	2011
Applications	:	Nagpur Mandarin growing area of Vidarbha region.
Advantages	:	• Effective control of gummosis • Plants can be saved from future cause of decline • Higher production • Improvement in general health and vigor of the plant • Increase economic life span of the plant

Name of Technology	:	**Management of citrus canker in acid lime**
Crop	:	**Acid lime**
Background	:	Acid lime is an important fruit crop of India. It suffers from many diseases viz. bacterial canker, twig blight, fruit rot and root rot, but more severe and predominant is bacterial canker caused by *Xanthomonas axonopodis* pv. *citri.* The occurrence of disease is world wide, which affect all the aerial parts of the tree. The severe infection leads to loss of vigour, drying of twigs, disfiguring of fruits and low production. Combination of copper fungicide with antibiotics sprays were tested for reducing the citrus canker in acid lime.
Recommendation	:	Pruning followed by first spray of copper oxychloride 0.3% followed by four sprays of streptocyclinc 100 ppm + copper oxychloride 0.3% (COC 30 g streptocycline 1 g + 10 lit water) at an monthly interval starting from July, August, September and February are recommended for reducing acid lime canker infection.
Year of Release	:	1994
Applications	:	In all acid lime orchards
Advantages	:	• The general health and vigour of the plant will be improved • To increase yield and healthy fruit production • To increase market value of the fruits • Higher monetary returns

Name of Technology	:	**Cultivation of oyster mushroom**
Crop	:	**Mushroom**
Background	:	Mushroom cultivation is the most suitable for creating wealth out of agro-wastes. The food value of oyster mushroom is equal to popular button mushroom. The fresh oyster mushroom contains about 2.5 to 3.0 % protein. It is a good source of vitamin B complex, vitamin A,C,D,E and K, it is rich in minerals like potassium, phosphorus, sodium, magnesium, calcium and iron. It can be grown in this region if 85% humidity is provided
Recommendation	:	The mushroom fungus is lignocelluloytic and require 20 to 30^{0}C temperature and 85% humidity for proper growth developement
Year of Release	:	1993
Applications	:	For mushroom production
Advantages	:	• Eco-friendly disposal of agro- wastes • Generation of employment • More production can be achieved by good cultivation practices

Animal Husbandry and Dairying

Name of Technology	:	**Milk processing and value addition**
Background		Lassi is a kind of fermented sweetened milk product. It is generally prepared from curd in summer season, when incubation temperature is higher than other seasons where generally *Streptococcus thermophilus* and *Lactobacillus bulgaricus* are in majority. The growth of these organisms in milk makes it superior in vitamin content, digestibility, as calcium source in effects of its lactic acid microflora in lowering blood serum cholesterol content, in inhibiting growth of cancer cells and in prevention of coronary heart disease. To overcome the problem of whey separation in lassi if some stabilizers are added which are water binding compound the problem may be solved. Therefore, with the view of studying the effect of different added stabilizers on quality of lassi and particularly on whey separation in Lassi the studies were undertaken.
Recommendation	:	Good quality of homogenized lassi could also be produced from buffalo as well as cow skim milk curd having a composition of 8.5% total milk solids 14% sugar with acidity of 1.0 to 1.2% using 0.3% agar agar. Use of gelatine, gum acacia and carboxymethyl cellulose with 0.3% level was also found suitable respectively in decreasing order of their effect on quality of lassi.
Year of Release	:	1990
Applications	:	Dairy/ Food Industry
Advantages	:	• It provides good quality homogenized lassi. • To overcome the problem of whey separation in homogenized lassi. • To generate self employment and enterpreneurship

Name of Technology	:	**Management of bullocks for field work**
Background	:	In India vast majority of the cattle about 75 to 80 per cent are non descript and are low milk producer. Cross breeding of this low producing non descript cow with exotic breed shared promising result. Similarly crossbred male can also be used as bullocks, which provide the power needs locally without additional cost. However, often neglected due to lack of awareness.
Recommendation	:	Working efficiency in summer was significantly higher in crossbred bullocks as compared to Zebu (Indian) bullocks. The bullocks to be used for working from 6.00 to 10.00 a.m. during summer. A rest pause of 15 min should be given after every two hours of ploughing and three hours of harrowing. Do not put the work at a stretch for 4 to 5 hrs. A concentrate mixture containing 16 per cent DCP be fed at 7.5 kg/pair/day to increase work efficiency by 10 per cent and provide of sufficient clean drinking water; thrice a day be provided.
Year of Release	:	1991
Applications	:	Use of Jersey crossbred under Vidarbha.
Advantages	:	• Jersey crossbred is a most ideal for growth, production, milk production and draft purpose, • Crossbred male can be used as bullocks, which provide the power needs locally without additional cost.

Name of Technology	:	**Nutrition management for livestock through subabul**
Background	:	In India there is a acute shortage of forage due to large cattle population. It is reason of low productivity of milch animal. Such animal will not express their genetic potential and produce the expected quantities of milk and meat unless they are fed adequately on feed and fodders of high nutritive value. Considering above situation, the growing demand of forage cannot be made with the production of forage crop on cultivated lands alone. It is therefore, necessary to explore the possibility of growing subabul. Subabul is leguminous plant widely distributed through out the tropics. It is fast growing tree rich in protein and remain green throughout the year. The percentage of protein in it ranges from 37 to 44 per cent with the content of amino acid in balanced proportion. It not only produces forage but also fuel and timber.
Recommendation	:	Subabul possess good potential for producing the fodder; fuel and timber under rainfed condition. It is observed that 24300 quintal of green foliage per hectare per year can be obtained when the plants planted at 1 x 1 topped after one year. The yield potential of subabul is more by 32-35 per cent over topping after 3 years and detopping be made every year.
Year of Release	:	1992
Applications	:	Cattle rearing area and Dairy farms
Advantages	:	• Provide good quality timber • To utilize the waste land and field boundaries for productive purpose

Name of Technology	:	**Utilization of orange promace in cattle feed**
Background	:	Indian livestock sector not only facing acute shortage of dry and green fodder (25 and 65%) but also concentrates, which requires for assured milk production. Vidarbha region has natural heritage of orange production and orange processing industries produces orange pomace as waste. Orange pomace contains 5 to 8% moisture and 14.52, 2.10, 13.85, 60.83, 8.90, 0.86 and 0.15% crude protein, ether extract, crude fibre, NFE, total ash, calcium and phosphorus, respectively. Considering the acute shortage of concentrate and increasing rates of available concentrate in market, the experiments were conducted for orange pomace incorporation in animal ration as a part of reduction in cost of milk production.
Recommendation	:	Orange pomace upto 30% can be incorporated in ration of ruminants without any adverse effect on milk production and health of animal.
Year of Release	:	1993
Applications	:	Animal rearing farmers and dairy farms
Advantages	:	• Use of orange pomace to the farmers in milk production and health of animals • Increase income of santra processors by using orange pomace in animal feed

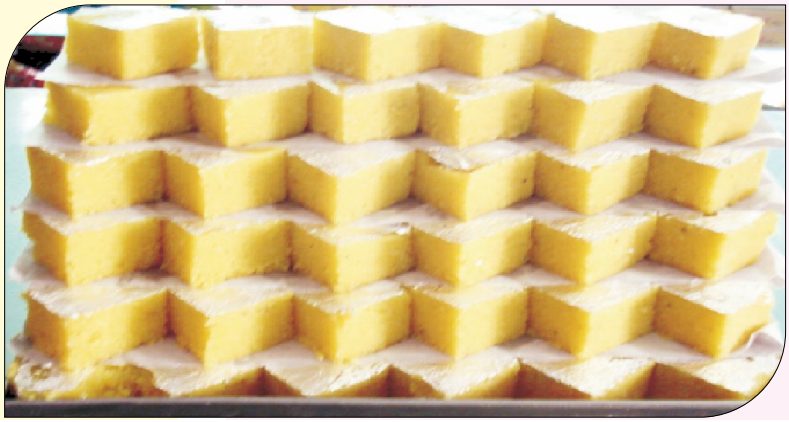
Name of Technology	:	**Milk value addition as icecream with sweet potato**
Background	:	The pulp of sweet potato was used at the different levels to replace milk solid not fat through sweet potato pulp in ice-cream mix. The ice-cream was prepared with partial replacement of milk SNF with sweet potato pulp of keeping the composition of the mix at the constant level as per ISI specification.
Recommendation	:	Ice-cream prepared by replacing 35% MSNF through sweet potato pulp is found suitable in respect of physico-chemical properties, organoleptic evaluations and low cost of its preparation as compared to ice-cream prepared without sweet potato pulp.
Year of Release	:	1996
Applications	:	Dairy food industries
Advantages	:	• Low cost of production • Good organoleptic test • Higher monetary returns

Name of Technology	:	**Milk value addition as icecream with bhendi-gum**
Background	:	The quality of ice-cream is judged by its flavour, body and texture, melting quality and appearance. It is said to be of best quality when it has a firm body, smoother texture and creamier meltdown. The stabilizer when added to ice-cream in small amount produce smooth body and texture. Ice-cream prevent ice-crystal formation and resist melting.
Recommendation	:	The ice-cream prepared by using 8 per cent fat and 3 per cent bhendi-gum is proved to be most suitable considering its total solids content. Flavour body and texture, melting quality, colour and appearance, overall acceptance and cost of its preparation comparable to traditional ice-cream.
Year of Release	:	1997
Applications	:	Dairy and food industries.
Advantages	:	• Overall acceptance and cost of its preparation comparable to traditional ice-cream • Good taste and economical

Name of Technology	:	**Nutrition management of livestock through anjan leaves**
Background	:	In tropical country the addition to grasses and legumes, shrubs and tree fodder are widely available and traditionally used by farmer. An important feature of shrubs trees is that, they are under used in feeding system especially with ruminant. Anjan tree leaves is being used as fodder for cattle in hilly areas of Maharashtra. It is also found in other state Anjan tree producing plenty of foliage is found in forest of deccan peninsular. The chemical composition of anjan tree leaves on dry matter basis : CP- 8.86, EE-4.05, CF-30.39, NFE-49.67, total carbohydrates 80.16, total ash 7.03, Ca -2.28 and phosphorus - 0.13. The studies were undertaken to observe the effect of utilization of Anjan tree leaves on quality as well as quantity of milk in lactating crossbred cattle.
Recommendation	:	Feeding of 5 kg Anjan leaves to milch crossbred cows is advantageous to maintain the milk yield of higher food value.
Year of Release	:	1997
Applications	:	Cattle rearing area and dairy farms
Advantages	:	• Cow maintained on nutritious green fodder. • Beneficial to increase body weight, good source of energy and provide protein to animal • Higher economic returns

Name of Technology	:	**Identification of indigenous buffalo breeds Vidarbha condition**
Background	:	Purnathadi is well recognized buffalo breed in Vidarbha region of Maharashtra found on the bank of river 'Purna' in Akola, Amravati and Buldhana districts.
Recommendation	:	Purnathadi buffalo is economical in Vidarbha region. Effect of climate on milk production, revealed that maximum ambient temperature had negative correlation and maximum humidity levels had positive correlation. Average weekly milk production was higher in winter climate than rainy climate and lowest in summer climate.
Year of Release	:	2001
Applications	:	Purnathadi buffalo is very beneficial in Vidarbha region, as it tolerates Vidarbha climate and can be kept by the farmers for milk and as well as draft purpose.
Advantages	:	• Purnathadi buffalo milk contains higher level of fat (7.5 to 9.0%). • Withstands adverse climate conditions • Cost of maintenance is less • Higher monetary returns

Name of Technology	:	**Milk value addition as burfi with mung flour**
Background	:	Burfi is the most popular khoa based indigenous milk product prepared from using cow or buffalo milk. It is highly nutritious product, as it mainly contains all milk solids. Several variety of burfi are sold in market. It is expected that the incorporation of mung flour in burfi would increase protein content of the product as well as economic. An investigation was therefore planned on "Preparation of mung flour khoa burfi* from standardized 3.5 per cent fat containing cow milk with the addition to 10, 15, 20 and 25 per cent mung flour and 20 to 50 per cent sugar.
Recommendation	:	For preparation of nutritious and economical mung flour khoa burfi, 15 to 20 per cent mung flour and 40 to 50 per cent sugar is recommended.
Year of Release	:	2002.
Applications	:	Dairy and food industries.
Advantages	:	• Mung flour khoa burfi is a highly acceptable and nutritious • Cost of production is cheaper • Higher monetary returns



Name of Technology	:	**Nutrition management for livestock**
Background	:	When good quality green fodder is not available in sufficient quantity, concentrate feeding in large quantities becomes necessary for getting optimum performance from the animal. It is, however, observed during last few years that availability of balanced readymade concentrate mixture at a cheaper rate is far from reality. Since scarcity of good quality feeds will be a persistent problem in India, it has become absolutely essential to exploit newer unconventional feed resources which will be of acceptable quality and economical for livestock feeding.
Recommendation	:	It is recommended that gliricidia alone or in combination with grasses could be converted into good quality silage with 3% jaggery as an additive. Ensiliging decidedly improves the palatability of gliricidia.
Year of Release	:	2003
Applications	:	Cattle rearing areas and Dairy farm
Advantages	:	• Improves palatability of gliricidia. • Feed available throughout the year as well as in scarcity • Economical

Seed Technology

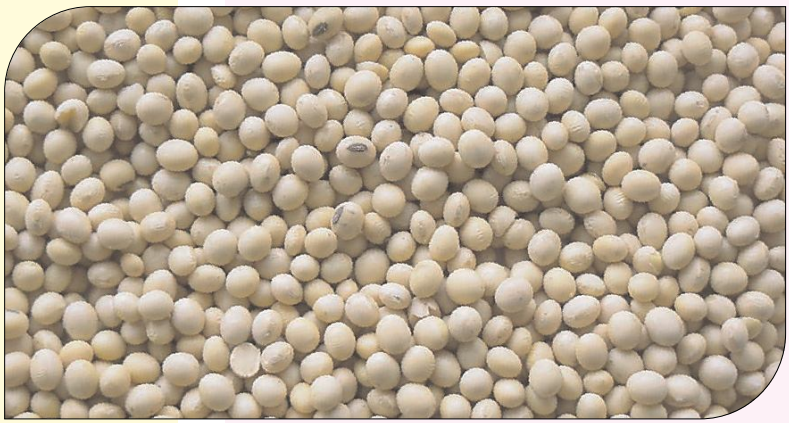
Name of Technology	:	**Germination standard for hybrid cotton seed**
Crop	:	**Cotton**
Background	:	Improvement in seed germination status is a basis for better stand establishment and yield in crops. The present minimum seed certification standard for germination of hybrid cotton is 65%. In recent days, due to quality improvement in hybrid seed production programme, the germination standard has substantially increased, and seed producer and cultivator are using good quality seeds in hybrids of cotton. In hybrid cotton seed the germination and vigour is always higher since several years and also throughout country. The data on germination percentage of hybrid cotton seed sample collected from all the Seed Testing Laboratories of Maharashtra State for three years(2002-2005) indicated that 92.5% of samples had germination above 71%, whereas only 7.5% samples had germination below 70%. Hence it is decided to propose the present standard for germination 65% be elevated to 70% so that high quality seed will be available to farmers for sowing.
Recommendation	:	It is recommended that the presently recommended minimum acceptable limit (MSSC) of germination standard for hybrid cotton i.e. 65 % be elevated to 70 %.
Year of Release	:	2005
Applications	:	In seed industries for deciding the minimum germination standard for cotton crop at national level.
Advantages	:	• High quality seed will be available to farmers. • Helps in increasing the yield of cotton.

Name of Technology	:	**Delinting of cotton seed with sulphuric acid**
Crop	:	**Cotton**
Background	:	Cotton is one of the most important cash crop in India. The seed hairs of cultivated cotton are differentiated into two distinct groups fuzz and fiber. The fuzz forms a short shrubby growth beneath the lint fiber of the seed. The cotton obtained from the ginneries contains about 5 to 8% linters, which makes them cling together. On account of linters, the untreated seed bunch together and create difficulty during sowing. Moreover, the fuzzy seed is unsuitable for mechanical cleaning and grading. Delinting is a process by which the linters are removed from the seed and it becomes free flowing. The delinted seed are better for mechanical cleaning, upgrading, treating and packaging etc. During delinting, the insect/fungi present on seed coat get killed. By using delinted seed, uniform crop stand is obtained. It also reduces the seed rate, volume of storage and cost of sowing. Among the delinting techniques, the wet acid delinting method is commonly used. The quantity of H_2SO_4 solution and also the time of delinting are different from place to place. The parameters are not yet standardized. Due to excessive use of H_2SO_4 solution and longer exposure of seed to acid solution, the seed germinability also affect adversely. Hence, the quantity of H_2SO_4 solution and time of treatment is standardized for effective and safe delinting of cotton seed.
Recommendation	:	For maintaining seed quality and effective delinting, the treatment of 100 ml sulphuric acid (per kg of fuzzy seed) for 10 minutes is recommended for wet acid delinting of cotton seed.
Year of Release	:	2006
Applications	:	For delinting of cotton seed.
Advantages	:	• Easy cleaning, grading and treating of seed. • Reduces volume of seed. • Faster and full germination. • Complete eradication of seed born pathogens

Name of Technology	:	**Seed treatment of pigeonpea for safe storage**
Crop	:	**Pigeonpea**
Background	:	Availability of quality seed is of fundamental importance to farmers. Seed has a catalytic impact in expansion of seed programme in the country. Quality seed is the basic input and all other inputs are contingent upon it for being optimally effective. Therefore protection of seed from insect pests during storage is having a vital role to provide the quality seed at the time of sowing. Stored pigeon pea seed is prone for sever infestation by beetle of the family Bruchidae. The genus Callosobruchus commonly known as pulse beetle invariably attack seeds of pigeonpea during storage causing heavy losses and if the damage is more than 0.5 %, disqualify the seed to satisfy the minimum seed certification standard. For the management of these losses during storage various chemical insecticides are used. But many effective insecticides have been banned for health and environmental reason.
Recommendation	:	For maintaining the insect infestation below 0.5% and germination above 75% of pigeonpea seed as per seed certification standard, the seed treatment of Azadirachtin 300 ppm @ 5ml/Kg seed is recommended, for the storage period of 12 months.
Year of Release	:	2008
Applications	:	In seed industry for safe storage of seed (Pulses) against the attack of pulse beetle (Brouchids)
Advantages	:	• Increase the shelf life of seed • Safe and ecofriendly storage • Reduces losses • Economical

Name of Technology	:	**Safe storage of green gram**
Crop	:	**Green gram**
Background	:	Generally green gram crop is harvested and threshed in the month of September-October when humidity remain high. The seed grower thresh the crop and bring to processing plant for processing. At the processing plant, the seed is stored as such in gunny bag for 3 to 4 months and then processed. Green gram seed is very much susceptible to insect. Then these lots even after processing, fails to meet the acceptible limit of seed quality and get rejected. There is no information available on the extent of damage during this transit period. Similarly no information is available on the effect on seed quality if they are processed, dried immediate effect on seed quality if they are processed, dried immediate after recepit.
Recommendation	:	It is recommended that for proper maintainance of seed quality during storage, green gram seed should be dried properly (up to 9% m.c.) before bringing to processing plant. It should be dried, immediately at processing plant when it is received from farmer.
Year of Release	:	1999
Applications	:	Storage of green gram
Advantages	:	• Increase in storage life • Maintain seed quality during storage • Insect free storage

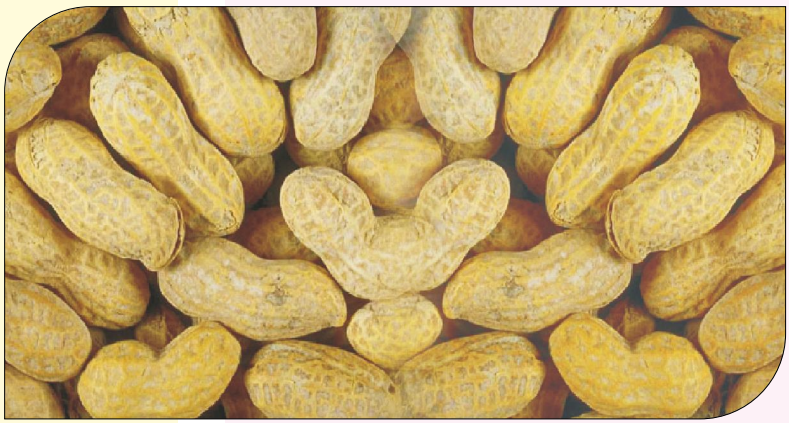
Name of Technology	:	**Standardisation of threshing of soybean**
Crop	:	**Soybean**
Background	:	Soybean possess a delicate and fragile seed coat (especially the seed coat of yellow cultivars) and very much susceptible to mechanical injury during post harvest operations. Among the post harvest operations threshing stage found to be most crucial stage causing 80% of the total damage. Farmers are using multicrop thresher for soybean threshing without any alteration. The multicrop thresher having speed 720 rpm hold good for other crops like wheat, sorghum, paddy, and pulses. When the same is used for soybean, due to high speed of threshing drum the seed receives impact and looses its seed quality. There is no information available on effective method of threshing soybean inorder to get minimum damage alongwith maximum seed quality. Hence the project was undertaken to standardise the threshing parameters for multicrop threshers to threshing soybean in order to minimise the mechanical damage and maintaining the seed quality.
Recommendation	:	It is recommended that for proper maintainance of seed quality soybean should be threshed at 12 to 14% m.c. by multicrop threshers at a speed of 500 rpm.
Year of Release	:	1999
Applications	:	Threshing of soybean
Advantages	:	• Minimum damage to seed • Maintaining seed quality • Increase in good seed recovery



Name of Technology	:	**Safer processing of soybean seed**
Crop	:	**Soybean**
Background	:	Soybean seed possess a delicate and fragile seed coat (especially the seed coat of yellow cultivars), which is relatively thin and highly susceptible to mechanical damage. Due to slight injury, soybean seed looses its germinability. During processing, maximum mechanical damage received to seed during elevating stage. This may be due to the fact that during elevating the seed by bucket elevator, the layer of seed mass is cut off by the edges of cups and while discharge it throws the seed with centrifugal force against a metal surface of discharge pipe causing injury to seed resulting in to loss of seed quality. The mechanical damage can be reduced considerably if inclined belt conveyor is used in place of bucket elevator. In inclined belt conveyor, the seed mass is slowly lifted and discharge to feed hopper thus mechanical damage received to seed is very less and thus reducing the loss of seed quality.
Recommendation	:	It is recommended that for minimizing mechanical damage and maintaining seed quality, inclined belt conveyor should be used in place of bucket elevator while processing of soybean seed at seed processing plant.
Year of Release	:	2008
Applications	:	In seed processing plants
Advantages	:	• Minimize mechanical damage • Improvement in seed quality • Increase in good seed recovery

Name of Technology	:	**Upgrading the seed quality**
Crop	:	**Cotton, Soybean and Safflower**
Background	:	Availability of quality seeds is one of the major constraints in increasing the productivity of all the agricultural crops. There is a wide variation in seed size and seed weight due to poor seed feeling, which affects the uniformity of crops. Optimum plant population is the basic requirement to obtain a higher yield. Adequate plant population density largely depends on seed germinability and seed vigour. In size grading, the separation of mass occurs on the basis of seed size but some size seeds will differ in germinability and seedling vigour both in laboratory and field because of variability in specific weight. Seed weight or specific gravity of seed is closely associated with viability, seedling vigour and growth and subsequently seed yield. It is noticed that even after size grading, large number of marginal seed lots fail to meet the acceptable limit of seed quality and thus these lots are rejected and can not be used as a seed for sowing. Thus considerable quantities of seed are rejected. Such lots are if refined by using specific gravity separator in addition to seed grader, the seed quality of such marginal seed lots can be upgraded to a acceptable limit of seed quality as prescribed by Indian Seed Certification Board. Upto what extent of germination the seed should be taken for processing was not known. Hence the project was undertaken to study the effectiveness of specific gravity separator for upgrading the seed quality of marginal seed lots of different crop seeds.
Recommendation	:	Specific gravity separator is recommended for upgrading marginal seed lots having lower germination percentage by about 10 per cent than MSCS in cotton, soybean and safflower to an acceptable limit.
Year of Release	:	2008
Applications	:	In seed processing of different crop seeds.
Advantages	:	• Improvement in seed quality. • Help in increasing the yield.

Name of Technology	:	**Standardisation drying and storage of groundnut for quality seed**
Crop	:	**Groundnut**
Background	:	The high seed moisture content is key factor of fast deterioration of seed quality. It accelerates the respiration rate of seed as well as activity of microorganism. Subsequently mold growth and heating occurs resulting in to loss of seed quality. The moisture content is frequently higher (38-40%) at the time of harvest of groundnut. To obtain best potential, the moisture content should be at a safe level before packaging and storage. The safe moisture content level is 9% for oily seed. Generally, the groundnut pods are dried in sun which require not only large space but due to the high temperature and ultra- violet rays emitted from sun rays deteriorates the seed quality which results in poor storage life. Groundnut pods if dried in shade or by mechanical dryer at 45^0 C air temperature maintained the seed quality for a longer period during storage
Recommendation	:	The groundnut pods should be dried in shed or by heated air dryer at 45^0 C for safe storage.
Year of Release	:	2009
Applications	:	Drying of groundnut pods for storage purpose
Advantages	:	• Increases the storage life of seed. • Safe and effective drying. • Good quality of seed



Name of Technology : **Standardization of sieve sizes for grading different crop seeds**

Crop : **Sorghum, Green gram, Sunflower, Soybean, Cotton and Safflower**

Background : Seed bulk at harvest contains a wide range of seed sizes, but these may not all be of equal value for sowing. The farmers have always realized the necessity of using plump seed of good viability to obtain high emergence and growth. Present method of grading aims to remove the non-viable seeds and to insure that those, seeds are uniform in shape and size, which will give rise to optimum plant population and high yield. Generally, the lower sieve size limits are set to remove the maximum number of non-viable seeds, while discharging the minimum quantity of good seed. Presently recommended sieve sizes for grading different crop seeds recommended in the Indian Minimum Seed Certificate Standard and adopted throughout the country are decade old and not matching with the popular high yielding hybrids and varieties under cultivation in recent days. By using existing recommended sieves for grading different crop seed, the seed growers are losing considerable quantity of good seed. So there was urgent need to revise the present standards.

Recommendation : For maximum recovery of good seed following recommended sieves be used for grading different crop seeds.

Sr. No	Crop	Variety	Sieve size mm		Rise in recovery % of good seed by using proposed sieve
			Existing	Recommended	
1	Sorghum	CSH-5, CSH-9, CSH-14, SPH-388, SPV-669	3.5 (r)	3.2 (r)	9.0
2	Green gram	Kopergaon,TAP-7,/Pusa Vaishakhi, PKVM-8802,TARM-2, TARM-18, TARM-1	3.2 (s)	2.8 (s)	7.o
3	Sunflower	EC-68414, Surya, Morden, AKSF-9, PKVSH-27	2.4 (s)	2.3 (s)	3.5
4	Soybean	MACS-58, PK4-72, PKV-1, JS-335	4.0 (s)	3.6 (s)	5.0
5	Cotton	AKA-5, AKH-4, AKA-8401, DHY-286, LRA-5166, NHH-44, PKV-Rajat, AKH-081, PKV Hy-2	3.9 (s)	2.8 (s)	59.0
			3.9 (s)	3.2 (s)	21-25
6	Safflower	Bhima, Sharda, Girna, NARI-6, AKS-207	1.2 (s)	2.2 (s)	Improvement in seed quality

r- Round hole screen s- Slotted hole screen.

Year of Release : 2009

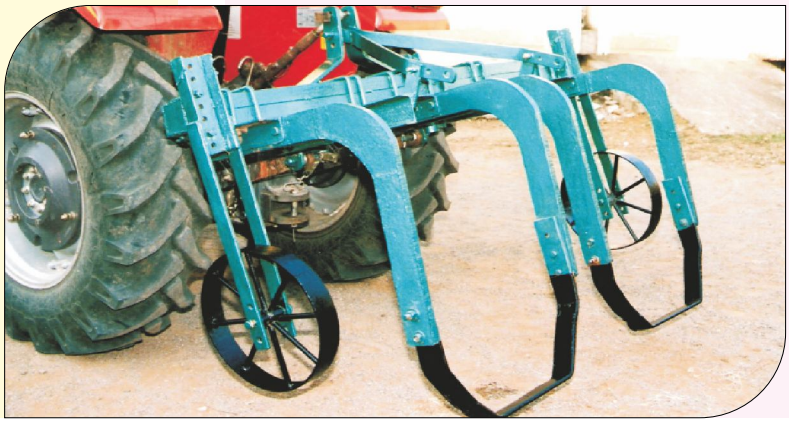
Applications : For effective grading of different crop seeds.

Advantages :
- Increase in recovery percentage.
- Improvement in seed quality
- More good quality seed available for sowing.

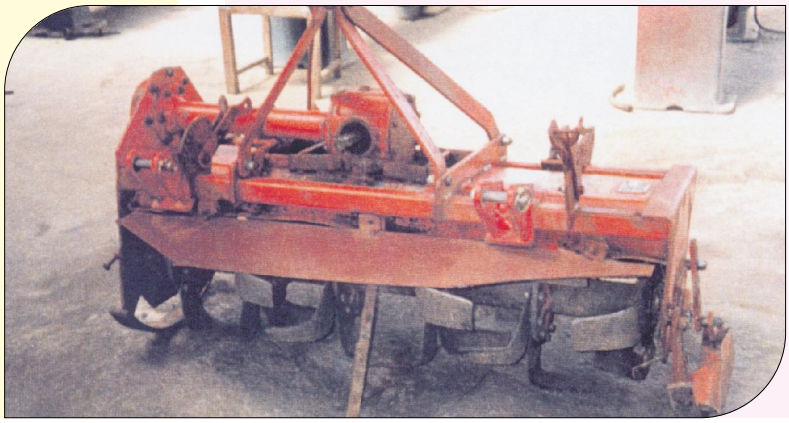
Agril. Engineering and Technology

Implements and Farm Machinery

Name of Technology	:	**Tractor operated cotton uprooter for removal of cotton stalks**
Crop	:	**Cotton**
Background	:	Cotton is essentially grown as kharif crop in Vidarbha region. After the harvest of crop, the cotton stalks needs to be removed immediately from the field. The collection of the cotton stalks, their transportation and disposal is tedious and labour intensive operation. Different methods are adopted by the farmers for this purpose and to make mechanised operation , the investigation was undertaken
Recommendation	:	Tractor operated cotton uprooter is recommended for removal of cotton stalks
Year of Release	:	2003
Applications	:	For uprooting the cotton stalks after harvesting
Advantages	:	It up roots cotton stalks at 10-14 cm depth. The width of operation is 130-140 cm which covers two rows at 90 cm row spacing Quick operation and reduce drudgery.
Economics	:	The cost of operation was found to be Rs.1075 to Rs.1164 per ha for 60 cm row spacing and Rs.778 per ha for 90 cm row spacing



Name of Technology	: **Cotton stalk shredder**
Crop	: **Cotton**
Background	: Cotton is essentially grown as kharif crop in Vidarbha region. After the harvest of crop, the cotton stalks needs to be removed immediately from the field. The collection of the cotton stalks, their transportation and disposal is tedious and labour intensive operation. Different methods are adopted by the farmers for this purpose. Farmers are using rotavator for land preparation and the use of rotavator is increasing. As there is no machine available in the country this could be used as cotton shredder
Recommendation	: It is recommended to use the rotavator after modification in the power transmission system for shredding the cotton stalks up to 12 mm thickness in field itself and mixing them in the soil after the harvest of cotton.
Year of Release	: 2003
Applications	: For shredding of cotton stalks up to 12 mm thickness in field itself and mixing them in the soil after the harvest of cotton.
Advantages	: • The chopping up material could decay faster which could be good organic matter
Economics	: The cost of operation was found to be Rs.526 to Rs.538 per ha. Field efficiency 83 % and fuel consumption 3.50 l/h with speed of 3.99 km/h

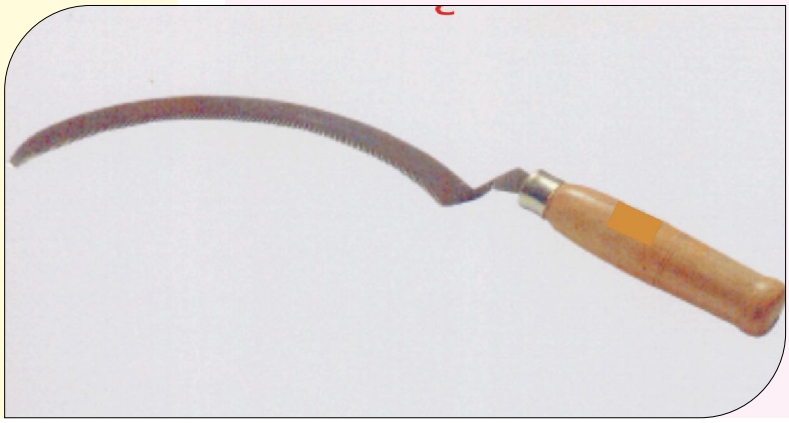


Name of Technology	:	**PKV bullock drawn cotton planter**
Crop	:	**Cotton**
Background	:	The cotton crop is generally sown by drilling or dibbling method. Drilling methods labour oriented and gives unequal spacing between the crop whereas dibbling method is drudgeries, time consuming and labour oriented. Hence the development of planter which is convenient to this farmer.
Recommendation	:	It is recommended to use PKV Bullock Drawn Cotton Planter for sowing of cotton crop
Year of Release	:	2011
Applications	:	Cotton growing areas.
Advantages	:	• Useful for planting cotton seeds of different delinted hybrid deshi varieties • The implement is sturdy, durable and maintenance free. • The power required to pull the implement is less. • A single operator can, plant cotton seeds in 0.33 ha/hr.

Name of Technology	:	**PKV cutter**
Crop	:	**Sugarcane, sorghum and maize**
Background	:	Traditionally sugarcane set is being cut manually with the help of sickle. To reduce drudgery with increase efficiency in set cutting operation the said cutter is developed for small and marginal farmer having one or two cattle, similarly cutting of forage is done with the help of sickle and save 40 per cent wastage of costly forage. This machine helps in making small pieces (Kutti) of the forage.
Recommendation	:	It is recommended to use PKV CUTTER for making sugarcane set and forage cutting operation
Year of Release	:	2007
Applications	:	Cutting of sugarcane set for planting purpose and making small pieces of forage (Kutti)
Advantages	:	• Reduction in drudgery • Ease in making small piece of forage(Kutti) • Quick operation

Name of Technology	:	**PKV modified serrated disc plough for preparation of hard paddy land**
Crop	:	**Paddy**
Background	:	The problem of land preparation after harvest of paddy has always been raised by the farmers of rice growing areas. The soil becomes very hard due to loss of moisture and is very difficult to tilt the land with conventional bullock drawn implements like desi plough, harrow etc. It is reported that even tractor operated MB plough could not be operated in this condition and it is needed to evolve some strategy for land preparation in paddy for rabi crop.
Recommendation	:	It is recommended to use PKV modified serrated disc plough for preparation of hard paddy land by the farmers.
Year of Release	:	2004
Applications	:	For preparation of hard paddy land by the farmers
Advantages	:	• Time saving, • Better performance than conventional tractor drawn disc plough. • Depth of operation achieved by modified plough and conventional disc plough were 12.3 cm and 8.2 cm respectively.
Economics	:	Cost of operation is Rs. 2185/-per ha and fuel consumption is 3.2 lit/h.

Name of Technology	:	**PKV serrated sickle for paddy**
Crop	:	**Paddy**
Background	:	Harvesting of crop is generally a manual operation in Vidarbha region. Among the hand tools which are used for harvesting, the sickle is one of the important tool used by farmers. Since long ago, due to its easy operation, low cost, easy availability, simplicity in construction, can be manufactured by village artisans and its versatility. Due to poor economic condition and small land holdings, majority of farmers are still using sickles for harvesting purpose.
Recommendation	:	It is recommended to use PKV serrated sickle for harvesting of paddy crop.
Year of Release	:	2005
Applications	:	Serrated blade sickle is found efficient for harvesting paddy crop closer to the ground, reduces harvesting time, human labour and drudgery while harvesting
Advantages	:	• Serrated blade sickle requires less cutting energy to cut the stem than plain blade sickle • Cost of harvesting is less as compared to other sickles • It works satisfactorily in the field
Economics	:	Harvesting efficiency and field capacity was 87% and 0.0115 ha/h respectively, cutting energy was found to be 0.0841 kg-m.



Name of Technology	:	**PKV manual drip lateral coiler**
Crop	:	**Field crop and orchard**
Background	:	In drip irrigation system, when the season of the crop is ended then it is necessary to collect the laterals from the field. The collection of the laterals from the field is a very tedious work. Sometime collection affect on the lateral by means of breakage etc. The traditional collection of the lateral from the field require more labour and the time. To reduce the drudgery in such operation, PDKV Manual Drip Lateral Coiler is effective technology for the collection of lateral from the field.
Recommendation	:	It is recommended to use PDKV Manual Drip Lateral Coiler
Year of Release	:	2003
Applications	:	For coiling and de-coiling of drip laterals in field crops and orchards
Advantages	:	• Easy to transport and ease in operation. • Reduce labourer drudgery • Fast in operation
Economics	:	Saving in collection cost and time.

Name of Technology	: **Standardization of rotavator operation for residue incorporation of field crops**
Crop	: **Kharif and Rabi**
Background	: Seed bed preparation in kharif and rabi season of any crop is tedious and time consuming. The land has to be ploughed, harrowed and then leveled which requires three operations but if done by rotavator they will be helpful in reducing the cost of operation. The rotavator is also operated in uneven gear throttle combination which may damage the transmission system of the tractor, also affects the crop residue incorporation in the soil.
Recommendation	: For better crop residue incorporation, it is recommended that rotavator should be operated in L-I gear with full throttle engine and keep the rotavator cover close.
Year of Release	: 2004
Applications	: The rotavator operation can be performed for any kharif and rabi crops
Advantages	: • Better crop residue incorporation • No load on the tractor • Fine aggregates of soil particles
Economics	: Three in one operations are carried in one pass which saves cost of operation and fuel

Name of Technology	: **PKV self propelled multi-crop reaper**
Crop	: **Kharif & Rabi crops**
Background	: Sowing, interculture and harvesting operations need to be done timely. The harvesting operation is done by human labour in bending posture, which is most tedious and drudgerious operation. Delay in harvesting causes heavy losses in yield. Some of the crops are hard to harvest. Harvesting operation consists of cutting and conveying of crops. The harvesters basically designed for wheat crop are not suitable for crop like soybean, chickpea, and gram. The harvesters are difficult to operate in small field. The self propelled multi-crop reaper is found to overcome the difficulties faced in small farming.
Recommendation	: It is recommended to use Self Propelled Multi-crop reaper for harvesting of soybean, black gram, green gram, chickpea, safflower, paddy, wheat, pigeonpea, sorghum, maize, pearl millet and jute.
Year of Release	: 2006
Applications	: For Harvesting of soybean, chickpea, gram etc.
Advantages	: • Low operation and maintenance cost. • Suitable for harvesting of soybean, black gram, green gram, chick pea, safflower, paddy, wheat, pigeon pea, sorghum, maize, pearl millet and jute. • Fast operation
Economics	: Cost of operation is Rs. 380 to 405 per hectare. Saving in cost over traditional operation is 65 to 70 per cent with ease in operation.

Name of Technology	: **PKV self propelled slasher**
Crop	: **Kharif & Rabi crops**
Background	: The residue management in farming system is the emerging issue for the sustainable yield. Presently after harvesting of crops, residues are burn in open field. No in-situ recycling of crop residue practices are followed. The abundant crop residues are available for the recycling and thereby enhancing the soil health. The self propelled slasher, slashes standing crop residue and spreads it over the soil. The use of such machine saves the land preparation operation and provides the *in-situ* management of crop residue.
Recommendation	: It is recommended to use Self Propelled Slasher for slashing all standing crop residues, grasses, bushes etc.
Year of Release	: 2006
Applications	: For slashing all standing crop residues, grasses, bushes etc.,
Advantages	: • Low operation and maintenance cost. • Suitable for slashing all standing crop residues, grasses, bushes etc. • Fast in operation
Economics	: Cost of operation is Rs. 250 to 400 per hectare. Saving in cost over traditional land preparation operation is 45 to 75 per cent with ease in operation.

Name of Technology	: **PKV self propelled pneumatic planter**
Crop	: **Kharif and Rabi crops**
Background	: Sowing is the most important crop production operation. Traditionally, bullock power is mostly use of for the sowing. The precision and timely sowing enhances the yield. Now-a-days, the skill workers are not available for sowing operation. Similarly, the bullock and labour power is decreasing day by day which results in high cost of operation as well as delay in sowing. Some crops can be sown by tractor in dry conditions only. Tractors are also not suitable for sowing some crops according to their sowing system and pattern. Frequent tractor operations in rainy season result high compaction problem in soil. With help of this planter, it is possible to maintain the uniform seed to seed distance within the row. The self propelled pneumatic planter works in various soil conditions which satisfies the farmers sowing needs.
Recommendation	: It is recommended to use Self Propelled Pneumatic Planter for sowing of all seed crops
Year of Release	: 2008
Applications	: For sowing of all seed crops such cotton, soybean, black gram, green gram, chickpea, safflower, paddy, pigeonpea, sorghum, pearl millet etc
Advantages	: • Low operation and maintenance cost. • Suitable for sowing all seed crops. • Early emergence of plants. • As it is the precision planting, it saves cost towards seeds.
Economics	: Cost of operation is Rs. 240 to 300 per hectare. Saving in cost over traditional sowing operation is Rs. 510 per hectare with ease in operation.

Name of Technology	: **PKV self propelled inter-row cultivator**
Crop	: **Kharif & Rabi crops**
Background	: In crop production operations, interculture operation has prime importance for the proper growth and yield of crops. Traditionally, this operation requires more inputs in term of the labour and energy which results in high cost of operation. Traditional interculture operation is fatigue prone with very low *in-situ* moisture conservation. During interculture operation, crops are damaged sometimes by traditional method. Self propelled inter-row cultivator is the highly efficient machine which removes weeds effectively with proper soil tilt required for growth of crops. The self propelled inter row cultivator is enable to work in any row spacing of all stages of crop growing with control on the working depth in soil.
Recommendation	: It is recommended to use Self Propelled Inter-row Cultivator for Interculture operations of all crops.
Year of Release	: 2008
Applications	: For Interculture operations of all field crops.
Advantages	: • Low operation and maintenance cost. • It helps in moisture conservation as it does not invert the soil during weeding operation. • Fast operation
Economics	: Cost of operation is Rs. 170 to 250 per hectare according to crop. Saving in cost over traditional interculture operation is 40 to 70 per cent with ease in operation.

Name of Technology	: **PKV self propelled tiller cum BBF marker**
Crop	: **Kharif and Rabi field crops and orchards**
Background	: Tilling the soil in cloddy field as well as in orchards is generally done by bullock drawn ploughs which is drudgerous and time consuming. There is difficulty for the bullocks to work in the orchards and the quality of work done by traditional methods is less because of the restriction of the movement of bullocks to every corner of the field
Recommendation	: PKV developed power tool bar operated tiller is recommended for tillage in cloddy field, orchard and for marking broad bed furrow (BBF).
Year of Release	: 2009
Applications	: For tilling the soil in cloddy fields, orchard and for marking broad bed furrow (BBF).
Advantages	: • Low operation and maintenance cost. • Saving in time • Reduce manual drudgery
Economics	: The operational cost was Rs. 783/- per hectare. The cost of operation for BBF formation was found to be Rs.280/- per ha.

Name of Technology	: **Tractor operated PKV slasher**
Crop	: **Kharif & Rabi crops**
Background	: The cotton is the major crop of Vidarbha region, after harvesting the cotton stalks/ plants need to be immediately uprooted to avoid the loss of moisture and nutrients from the soil due to standing crop. Most of the stalks are uprooted by using manual fork or use of tractor operated V-blade/ duckfoot cultivator. The uprooted stalks collection, their transportation and storage are very tedious and labour intensive operation.
Recommendation	: PKV developed tractor operated slasher is recommended for slashing of standing crop residue.
Year of Release	: 2009
Applications	: Slashing of standing crop residues of all the crops. Disintegration and incorporation of crop residue can be done easily by rotavator
Advantages	: • Low operation and maintenance cost. • Saving in time • Reduce drudgery
Economics	: The cost of operation was Rs. 346/- per ha. Cost saving was 76.5 % over traditional method.

Name of Technology	:	**PKV disintegrator machine**
Crop	:	**Crop residue**
Background	:	This machine is useful for the disintegration of the crop residue after the post harvest operation. The disintegrated crop residues when kept with moisture for 45 days easily convert in to organic manure or can be used for vermi compost purpose.
Recommendation	:	It is recommended to use PKV Disintegrator Machine for crop residue disintegration
Year of Release	:	2007
Applications	:	For organic manure preparation and Vermi compost purpose
Advantages	:	• Quick in operation • Good disintegrated material for several purpose • Utilization of by products and wastes
Economics	:	Saving in cost of production of organic manure

Name of Technology	:	**Manual citrus fruit harvester**
Crop	:	**Suitable for harvesting acid lime and oranges**
Background	:	The traditional method of harvesting (Acid Lime) is manual plucking or a device commonly called as *khudi* is used. Now-a-days in the country, agricultural labour is shifting towards non-agricultural jobs. Thus, the non-availability of labour is to be bridged by mechanization. In concern with the above fact and to overcome the problem of harvesting of lemon, efforts are being made to develop a manual citrus fruit harvester especially for lemon so that the harvesting of lemon will become easy. Similarly, the orange harvesting is generally done by manual picking. But by the manual picking sometimes the point of the orange where it is detached from the peduncle get opened and the fungal infection starts from that point which reduces the shelf life of the orange. To overcome the problem of the orange harvesting, the manual citrus harvester is modified for orange harvesting. By using this harvester, a short peduncle is left with the orange which enhances the storage life of orange.
Recommendation	:	It is recommended to use PKV citrus harvester for harvesting of citrus fruits
Year of Release	:	2011
Applications	:	Acid lime and Oranges growing areas.
Advantages	:	• Light in weight hence suitable for women • Easy to fabricates, simple in design • For easy and safe harvesting of lemons • For harvesting of oranges without damaging the fruits • A small peduncle is left with harvested orange hence increases the shelf life of the fruits • More economical

Irrigation and Drainage

Name of Technology	:	**Micro-sprinkler irrigation for summer groundnut**
Crop	:	**Summer groundnut**
Background	:	Groundnut is being extensively grown during summer. However, during mid summer the atmospheric evaporative demand is very high, thereby the water requirement of crop is also very high. To increase irrigation potential to some extent, it is necessary to use water judiciously for agricultural production by developing advanced and efficient system of microirrigation.
Recommendation	:	It is recommended to use micro sprinkler irrigation system for summer groundnut to get better yield, quality and higher monetary returns with 24 per cent saving in water over broad bed furrow irrigation.
Year of Release	:	2003
Applications	:	Micro sprinkler irrigation system for summer groundnut.
Advantages	:	• Better yield and quality • Higher monetary returns • 24 per cent saving in water over broadbed furrow irrigation.

Name of Technology	:	**Semi-portable drip irrigation system**
Background	:	Among different systems available, drip irrigation is one of the latest technologies for applying water efficiently and effectively. It has got dominating advantages over other systems, like judicial use of water, uniformity in water distribution, less fertilizer wastage, adequate and calculated supply of water as per the crop water requirements. However, the major constraints of this system are its high initial investment and limited use of system to a particular field, for which it is designed and uncertainty of power to use the system.To overcome these problems, system is modified as semi - portable drip irrigation system. In modified form, a set of system of a particular capacity can be used for number of blocks of the field. This can be achieved by shifting the set of system from one block to another with extended main line. One lateral is provided for irrigation of two crop rows; hence the laterals are shifted manually near to each row till germination. After the germination, laterals are kept in the center of two rows.
Recommendation	:	Use of semi-portable drip irrigation system having considerable reduction in high initial cost is recommended for life saving irrigation to crops, to get better crop yields and higher monetary returns.
Year of Release	:	2004
Applications	:	The semi–portable drip irrigation system of a particular capacity can be used for large area of the same crop in different time for life saving irrigation to crops, to get better crop yields and higher monetary returns
Advantages	:	• The semi–portable drip irrigation system of a particular capacity can be used for large area of the same crop in different time. • The set can be used for life saving irrigation of different crops also.

Name of Technology : **Selection of lateral length of online drip irrigation**

Background : The discharge through the emission device of trickle irrigation depends on tube length, size and operating pressure. Generally, emission devices are designed for pressure of 1.0 kg/cm^2 i.e. 10 m of water column. But in the field, because of various constraints, it is some times very difficult to maintain the desired pressure, which ultimately affects the discharge from emitter. Important elements in trickle irrigation design procedure are lateral length and its size, emitter spacing, land slope and emitter flow rates. Cost of lateral, sub-mains, and emitters constitute the major share in the cost of trickle irrigation. It is therefore very important to select desired lateral length based on acceptable flow variation for selected type of emitter to reduce the cost of sub main pipes.

Recommendation : It is recommended to use the PKV developed ready recknor for deciding optimum length of lateral for selected combination of dripper spacing along lateral, dripper discharge and field slope in design of online drip irrigation system.

Ready recknor for 16 mm lateral length (Inlet pressure-1 kg/cm^2)

Field slope, %	Emitter discharge rate,	Maximum permissible lateral length for different online dripper spacing, lphm					
		0.6	1.2	1.8	2.4	3.0	6.0
+1	4	45	60	65	75	95	125
	8	40	50	60	70	85	110
+2	4	45	65	70	80	100	145
	8	40	55	70	80	95	130
+3	4	50	70	80	90	115	160
	8	45	60	80	85	100	145
-1	4	40	55	60	70	90	110
	8	35	40	55	65	75	95
-2	4	35	50	60	65	80	95
	8	30	35	50	55	65	80
-3	4	35	45	50	60	70	90
	8	25	30	40	45	55	70

+ Indicate down slope - Indicate up slope

Year of Release : 2005

Applications : Design and installation of online drip irrigation system

Advantages :
- The information will be useful to designers, planners and farmers for selecting the desirable lateral length under available pressure to get desirable discharge according to water requirement of crop.

Name of Technology	:	**Irrigation water measuring device – V notch**
Background	:	Accurate measurement of water avoids the delivery of excess water or wastage of water. The modified right-angled V-notch is most suitable device for installation and discharge measurement. The telescopic arrangement is most useful for taking reading at 4H to 6H distances away form the V-notch on upstream side. The modified notch is easy for fabrication with material available in local market. This modified V-notch can measure the discharge ranges from 0 to 23 lps upto maximum head of 19 cm.
Recommendation	:	It is recommended to use PKV 'V' notch (modified 'V' notch) to measure the flow of irrigation water.
Year of Release	:	2006
Applications	:	This modified V-notch can measure the discharge ranges from 0 to 23 lps upto maximum head of 19 cm. The notch gives direct reading of discharge and avoids the tedious calculation of exponent of head.
Advantages	:	• The modified V-notch is cheap, simple, reliable and most accurate irrigation water measuring device.

Name of Technology	:	**Energy efficient and economical use of pump set**
Background	:	There is large scope in agriculture for saving the energy. Pumping system used for the irrigation purpose in agriculture need electricity.Discharge of pump set is varied with type of foot valve and pipe for suction and delivery. Replacement of GI pipe by PVC or HDPE pipes and fittings increases the velocity of flow and discharge of pumping set due to reduction in friction loss. Replacement of GI or CI foot valve by PVC foot valve increases the velocity of flow and discharge of pumping set due to reduction in friction loss.
Recommendation	:	It is recommended to use HDPE pipes and PVC foot valve combination in pumping system to save energy.
Year of Release	:	2007
Applications	:	Pumping system for irrigation purpose
Advantages	:	• Increases discharge capacity of pumping set • Reduces energy index by reducing friction losses • Cost of pumping is reduced • Saving of electric energy

Name of Technology	:	**Response of fertigation and mulching on acid lime**
Background	:	The citrus plant needs good amount of water for high production and its yield is affected under deficit irrigation. The total water requirement of citrus crop is 1400 mm per year. One of the reasons for low yield is lack of concern to irrigation management as the plants are sensitive to availability of soil moisture status. The method of irrigation followed in acid lime orchards affect the distribution and availability of soil water to plants and ultimately to nutrient uptake and growth.
Recommendation	:	Drip irrigation system (6 drippers of 8 lph each for every tree) with mulching is recommended to fertigate acid lime to get precise water distribution, higher application efficiency, fertilizer use efficiency, productivity, biometric characteristics and benefit cost ratio with 20 per cent saving in water due to mulching and 25 per cent saving in fertilizer due to fertigation.
Year of Release	:	2008
Applications	:	Drip irrigation system
Advantages	:	• Drip irrigation system with mulching and fertilization • 20 per cent saving in water • 25 per cent saving in fertilizer • Enhancement in yield

Name of Technology : **Agricultural land drainage coefficient**

Background : Drainage coefficient is important in designing the small and medium hydraulic structure. The rate of drainage is a key factor in establishing the desired capacity of a drainage system. If it is not assessable by direct measurement, indirect methods of its estimation such as analysis of rainfall are used.

Recommendation : It is recommended to use drainage coefficients given in following table for designing agricultural drainage systems for Nagpur and Akola districts.

Name of crop	Basic infiltration rate of soil (mm/day)	Drainage coefficient (mm/hr)	
		Nagpur	Akola
Vegetables	1	106	112
	2	82	88
	3	58	64
	4	34	40
	5	10	16
Oil seed crops	1	68	56
	2	44	32
	3	20	8
Cotton, Sorghum, Maize, Bajra and other similar crops	1	45	33
	2	21	9

Year of Release : 2008

Applications : Estimated drainage coefficients can be used for designing drainage system for agricultural lands at Nagpur and Akola area.

Advantages :

- The information will be useful to designers, planners and farmers for selecting the desirable drainage coefficient in designing the small and medium hydraulic structure as well drainage system for agricultural lands.

Name of Technology	:	**Drip irrigation for garlic**
Crop	:	**Garlic**
Background	:	Garlic (*Allium sativum* L.) is one of the important bulbous crops grown over thousands of year and used as a spice and medicine throughout India. The productivity of garlic is very low as compared to other countries in the world. Unawareness of garlic growers about improved techniques like modern irrigation methods, improved varieties etc. might be the main causes affecting the production of garlic. Traditionally garlic is irrigated with flood irrigation system which wastes considerable amount of water due to low efficiencies. The modern irrigation methods i.e. micro-irrigation methods, provides low adjusted discharge and high uniformity of water application. To increase the irrigation water productivity in terms of yield, it become essential to adopt water saving, more yielding irrigation systems. But most of the time such information is not available on hand with farmers while selecting the irrigation system.
Recommendation	:	It is recommended to use online drip irrigation system for garlic production as it saves 46% water and gives 20% higher yield over traditional check basin irrigation method.
Year of Release	:	2012
Applications	:	Garlic growing areas
Advantages	:	• Saving of water over traditional irrigation method • Increase in production over traditional irrigation method • 25 per cent saving in fertilizer. • Enhancement in yield