Directorate of Research
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(Research Recommendations released during the year 2021-2022)

Research Accomplishments and Recommendations-2022

Seven farm implements/machineries have been released and fourty six research recommendations of various production technologies have been released during the Joint Agresco-2022.

1. Released Farm Implements/Machineries:

Sl. No.	Implement / Machinery	Salient features	
1	PDKV developed cotton stubble uprooter	• Cotton stalks shredding, stubbles uprooting and strip ploughing these three operations are performed in a single pass of tractor. • Two rows are covered by the developed cotton stubble uprooter attachment and maximum field capacity of 0.351 ha/h was observed and which was higher than that of commercially available shredder cum uprooter. • The depth of operation of 200 mm was found sufficient to uproot almost cent percent cotton stubbles • Saving in cost of operation was observed 30.06 % over the traditional practice of cotton stalks uprooting by tractor operated V-blade.	
2	PDKV developed groundnut harvester	• It save the labors and time for harvesting of groundnut crop. • The average field capacity of groundnut harvester is 0.059 ha/h. • Average pod damage percentage was found 4.77%.	
3	PDKV developed two row belt type cotton planter	• This planter is suitable for planting of cotton seeds precisely at 45 cm and 30 cm seed to seed spacing. • There 79.48 per cent saving in cost of operation over traditional method of manual dibbling. • The average effective field capacity of the planter was found as 0.43 ha/h. and time required to cover one hector was found to be 2.32 hours.	
4	PDKV Battery operated electric weeder	• The battery electric weeder was suitable for transverse in between the row crops of 45 cm. spacing as the design is compact. • The average field capacity of battery electric weeder was observed as 0.11 ha/h and the cost of operation was Rs. 654/ha. • It reduces the dependency from costly fissile fuels and promotes the use of green energy and it is usefull for small and marginal formers. • As compare to bullock drown hoe the cost of saving was 27.33% and 73.4% over the manual drawn wheel hoe.	

5	PDKV Multi-Commodity Seed Extractor for Vegetable.	• PDKV Multi-commodity seed extractor for vegetables is suitable for extraction of tomato, cucumber & brinjal seeds. • Capacity of the machine is 300 kg/h. • The seed extraction efficiency of machine is 95 - 98%. • This machine can be operated with 3 hp three phase electric motor • Multi-commodity seed extractor is useful for seed growers.	
6	PDKV UV-Assisted Treatment Device for post harvest decay control in Nagpur Mandarins	• Useful for reducing rotting losses of Nagpur Mandarins under ambient storage and cold storage. • Reduces rotting by eco-friendly UVC treatment without using fungicides during waxing step. • The machine is operated on 3 horse power motor. • It has continuous type operation. • Treatment capacity of machine is 2 tons/day. • The clearance between fruit and UV source can be adjusted according to the size of the fruits. • Maintenance cost of the machine is less and easy for handling.	
7	PDKV solar biomass hybrid drying system	• The time required for drying of agricultural produce like Ginger, Onion and Sprouted Moth Bean sample in continuous type solar biomass drying system was found less as compared to Solar Tunnel Dryer and Open Sun Drying. • Drying efficiency of biomass based air heating system in solar biomass hybrid dryer was 43.00 % • In Continuous type solar biomass hybrid drying system, uniform and faster drying was achieved. • The system was found economically feasible for drying of ginger, onion and sprouted moth bean and can be used for other Agricultural produce.	

2. Crop Production Technologies

2.1 Plant Physiology:

1	Two foliar sprays of 40 ppm Chitosan (40 mg Chitosan dissolved in 8.5 ml 0.1 N HCl or 20-25 ml domestic acid and prepare solution in 1 litre water) at 25 and 40 DAS are recommended for obtaining higher yields and maximum economic returns in Green gram.

2.2 Natural Resource Management

a. Agronomy:

2	In rainfed agro horticulture system for obtaining higher economic returns, intercropping of American improved cotton+ soybean (1:1) in four years per plantation at spacing 6x6 m with pruning every year is recommended.
3	For obtaining higher productivity and monetary returns of Bt cotton under HDPS, it is recommended that sowing of improved American Rajat Bt variety at row to row spacing of 60 cm and plant to plant spacing of 15cm under rainfed condition with recommended dose of fertilizer 60:30:30 Kg N:P2O5 and K2o per hectare.
4	In Eastern Vidarbha for getting significantly higher yield and more economic returns of coarse drilled paddy, drilling of paddy at 30 cm row to row spacing and seed rate of 80 kg ha-1 is recommended.
5	In linseed crop for maintaining optimum plant population, growth and higher productivity in irrigated condition, seed rate of 15 kg per hectare at 30 cm spacing is recommended. After harvesting of paddy crop, sowing of linseed with zero tillage method instead of broadcasting is recommended.

6	In Vidarbha region,under drip irrigated drilled rice-wheat crop sequence for increasing system productivity, economic returns and nutrient use efficiency, it is recommended to apply 100 per cent (100 kg N and 50 kg K2O) in 12 splits at seven days interval through drip and full dose of P (50kg/ha.) as basal through soil application.
7	For direct seeded rice in eastern Vidarbha, application of Pre-em Pretilachlor 50 EC @ 0.75 kg a.i. ha-1 fb Bispyribac sodium @ 25 g a.i. ha-1 at 20 DAS fb 1 hoeing at 40 DAS is recommended for integrated weed management and higher economic returns.
8	It is recommended to adopt 1.00 ha integrated farming system model under irrigated condition for small and marginal farmers of *Vidarbha* region of Maharashtra. The IFS model includes the components of various crops and cropping system (0.70 ha) + Fruits and vegetables (0.25 ha) + Goatary + Backyard poultry + PDKV Compost (0.03 ha) + kitchen garden (0.02 ha) + useful plantation on field boundaries. **IFS model consists of following enterprises.**

S.N	Components			Area (ha)
A)	**Cropping systems**			
	Kharif	***Rabi***	**Summer**	
1	*Deshi* Cotton (HDPS) + Pigeonpea (5:1) + Green gram in additive series (1:1)	--	Cowpea	0.15
2	Soybean + Finger millets (1:1)	Chickpea	Cowpea	0.15
3	Maize + Mesta (2:1) – Fenugreek + Coriander (Trap crop) (2:2)	Wheat	Cowpea	0.15
4	Sorghum fodder	Berseem	Cowpea	0.05
5	Sesame(0.10 ha),Niger (0.05 ha) Clusterbean (0.05 ha)	Linseed	Cowpea	0.20
B)	**Horticulture**			
6	Custard apple + Drumstick	--	--	0.25
C)	**Livestock**			
7	Goat + Poultry + PDKV Compost			0.03
D)	**Others**			
8	Kitchen garden			0.02
9	Boundary plantation of *Glyricidia*, *Karoanda and Hybrid Napier*			**--**
			Total	**1.00**

9	For obtaining higher productivity, sustainable yield and economic returns, it is recommended to adopt the cropping system of Clusterbean+ Maize in *kharif* season and *ajwain* crop in *rabi* season.
10	Vermicompost prepared from soybean straw (75%) + cowdung slurry (25%) or sunhemp stalk (75%) + cowdung slurry (25%) is recommended for production of good quality, highest net recovery and nutrient content (N, P and K) of PDKV vermicompost.
11	For bio-fortification of vermicompost it is recommended to enrich with bio-inoculants consortia of *Azotobacter, Azospirillum* and PSB each @ 10 ml/5 kg bag (10^8 cfu/ml) of vermicompost.
12	Under organic cotton production, intercropping of blackgram in cotton (1:1) with soil application of Neem cake (250 Kgha-1) + seed treatment of recommended biofertilizers (Azotobacter & PSB) + foliar application of Pink-pigmented Facultative Methylotrophs (PPFMs) @ 1% at flowering and boll development stage and in-situ application (mulching) of blackgram residue after pod plucking is recommended for higher monetary returns, improving soil organic carbon, major nutrients availability and physical properties of soil under rainfed condition.
13	Microbial consortia @ 10 ml per 1 kg potting mixture is recommended for organically grown brinjal, tomato, and chilli crop seedling in nursey conditions for better growth and management of soil borne diseases.
14	For integrated pest management of leaf defoliator's infestation on soybean two spray of

	soybean oil based formulation of Metarhizium rileyi @ 250 ml/ha (containing 2.0 x 10^8spores per ml) at 30 days and 45 days of crop stage is recommended.
15	Under paddy-wheat relay cropping for higher wheat yield and more economic return, it is recommended to use wheat 175 kg ha-1seed rate and sown by broadcasting before 12 days of paddy harvest at sufficient moisture in the soil.

b. Soil Science and Agricultural Chemistry:

16	Intercropping of Bt. cotton + greengram / blackgram (1:1) alongwith application of 75% RDF through chemical fertilizers (65:35:35 N, P, K kg ha-1) + 25% compensation through PDKV enriched compost and burying of crop residues of greengram and blackgram after harvest is recommended for productivity of cotton with higher monetary returns and improvement in fertility status of Vertisols under rainfed condition.
17	Application of 100% N through 4 tones Phosphocompost + remaining dose (10 kg P ha-1 and 4 kg K ha-1) through chemical fertilizers to Soybean and 100 % P through 2 tones Phosphocompost + remaining dose (45 kg N ha-1 and 20 kg K ha-1) through chemical fertilizers to Cotton under conservation tillage is recommended for obtaining higher productivity of Soybean and Cotton, monetary returns and improvement in soil health in Soybean-Cotton rotation in Vertisols under rainfed system
18	The application of PDKV enriched compost 3.0 t ha-1 at the time of planting and 0.5 % spray of humic acid 60 & 90 days after planting is recommended for obtaining higher dry root yield, improved quality, higher monetary return of safed musali and enhanced soil fertility.
19	In zinc deficient soils, for obtaining higher yield, monetary returns and improving soil fertility under cotton - soybean rotation, soil application of Zn @ 7.5 kg ha-1 through Zinc sulphate (35 kg ha-1) in alternate year along with recommended dose of fertilizer is recommended.

2.3 Horticulture:

a	**Fruit Crops**
20	For exportable fruit production (fruit length, girth and weight) of Grand Naine banana, retention of 9 hands per bunch is recommended.
21	For successful propagation of Dragon fruit, stem cuttings treated with IBA 2000 ppm concentration for five minutes is recommended
22	Foliar sprays of NAA (10 ppm) or GA 10 ppm or 2-4,D (15 ppm) along with N-ATCA (10 ppm)+ Brassinolide (4ppm) + Folic acid 100 ppm, in the month of July and second spray in August is recommended for higher yield and more economic returns from mandarin in ambia bahar.
23	For preparation of red wine form Nagpur Mandarin which has disease resistant, good digestibility and antioxidant properties, the proportion of Nagpur Mandarin juice, coloured grape juice and honey 4:1:1.025 is recommended.
b	**Vagetable Crops**
24	Application of vermicompost @ 9.2 ton OR neem cake @ 2.5 ton along with azatobacter @ 5 kg + PSB @ 5 kg per hectare is recommended at the time of planting for getting better quality higher yield and economic returns of organic beetroot.
25	For obtaining higher yield and monetary returns of watermelon, transplanting during first fortnight of January at 2.0 X 0.45 m spacing is recommended.
26	For obtaining higher yield and monetary return of capsicum under shade net house conditions, foliar application of 1% potassium nitrate (KNO_3) OR 60 ppm NAA at 30,45,60 and 75 days after transplanting along with RDF(190:115:150 kg NPK ha-1) is recommended.
c	**Agro-forestry**
27	For improving the raw material supply to wood based industries, for higher wood volume production (156.70 m^3 ha^{-1}), higher monetary return (Rs. 1229703 ha^{-1}), higher carbon sequestration (39.17 t ha^{-1}) and for higher B/C ratio (4.93) plantation of progeny of Maharukh (*Ailanthus excelsa)* ACN/MHK/1 is recommended under agroforestry.
28	When *Bamboosa balcooa* (Bhima) is planted at 8 X 4 Mt spacings under agroforestry system and Cowpea is grown as intercrop in kharif season then for higher bamboo biomass production (77.80 t ha^{-1}), higher net monetary returns (Rs 300151/- ha^{-1}) and higher benefit

	cost ratio (3.50), application of 125 percent more dose of fertilizers than recommended dose (25 : 50: 0) to cowpea is recommended .

2.4 Plant Protection:

a	**Plant Pathology**
29	For effective management of greening disease in Nagpur mandarin application of 50% more phosphorus than recommended dose of fertilizer after stress release in three split doses (June, August and October) and recommended dose of Nitrogen and Potassium in five split doses (June, August, October, December and February) and after 15 days of the first split dose of fertilizer, soil application of Zinc Sulphate and Ferrous Sulphate @ 200 g/plant each along with spraying of Tetracycline hydrochloride @ 6 gm / 10 liters of water at an interval of 45 days in the month of October to December is recommended.
b	**Entomology**
30	For the effective management of pod borer complex and for obtaining higher yield in pigeonpea, module Thiodicarb 75 WP 20 gm at 50 per cent flowering followed by Flubendamide 39.35 SC 2 ml at 15 days after first spraying followed by Lambda Cyhalothrin 5EC 10ml in 10 liters of water 20 days after second spraying is recommended.
31	For effective management to getting higher monetary returns against soybean stem fly by using Controll Release Technology (CRT) seed treatment by mixing polykote polymer 4ml @ 4ml water with Thiamethaxon 30FS 10ml per kg seed and then it is recommended to spray Indoxacarb 15.8% EC @ 7 ml or Chlorantroniliprol 18.5% SC @ 3 ml in 10 liters of water after 45 days of sowing
32	Application of custard apple seed powder packed in cotton cloth @ 15g/kg of stored pigeon pea is recommended for management of pulse beetle.
33	For effective and economic management of stem borer, green leaf hopper, brown plant hopper, white backed plant hoppers and getting higher grain yield of rice crop, application of treatment with Chlorantraniliprole 0.4G @ 10 kg/ha at 30 DAT + Cartap hydrochloride 50% SP @ 20g/10 liter of water at 50 DAT + Triflumezopyrim 10% SC @ 4.8 ml/10 liter of water at 65 DAT and in gall midge endemic areas, for effective and economic management of gall midge, stem borer, green leaf hopper, brown plant hopper, white backed plant hoppers and getting higher grain yield of rice crop, application of treatment with Azadirachtin 1% EC @ 20 ml/10 liter of water at 30 DAT +Eucalyptus oil @ 20 ml/10 liter of water at 50 DAT + Cartap hydrochloride 50% SP @ 20 g/10 liter of water at 65 DAT is useful.
34	For effective management of Pigeonpea pod borers and to get higher economic returns, 3 sprays of Bacillus thuringiensis (NBAIR-BTG4 2%) @ 2 ml/L starting at 50 % flowering and subsequent sprays at 15 days interval is recommended.

2.5. Agricultural Engineering & Technology:

35	It is recommended to use the well water after quality analysis from the vicinity area of sewage drain for irrigation in agriculture instead of direct use of raw sewage water to reduce the heavy metal pollution.
36	It is recommended to use biogas purification system containing absorbents viz. laterite soil, NaOH solution, activated carbon and silica gel for reducing quantity of CO_2 and H_2S in order to upgrade quality of biogas and increase the storage capacity.
37	It is recommended to use Scheffler solar collector of aperture area16 m^2 for the extraction of essential oils from medicinal and aromatic plants like 24 hous shade dried Lemon grass and Palmarosa grass by hydro distillation method in sunny days.
38	It is recommended to use extract of Ashwagandha 2.00 g, Shatavari 3.25 g, Gudwel 2.00 g, Kandwel 1.75 g and Bramhi 0.5 g in 100 g wood apple pulp for jelly preparation
39	It is recommended to use Ashwagandha 2.50 g, drumstick leaves powder 5.00 g, Gudwel 2.50 g, Kandwel 2.75 g, ginger 4.00 g and Shatavari 2 g in 1000 g wheat and maize (proportion 9:1) flour for pasta preparation.

40	It is recommended to use Linseed 50 %, 35% of dates and 15% Oats of for preparation of 1 Kg linseed oats shots having 50 days keep quality in glass jar.
41	It is recommended to use Linseed 60%, Dry Dates powder12%, Almond 12%, Cashew 12% and Raisins 4% of for preparation of 1 Kg linseed dry fruit laddu having 50 days keep quality in glass jar.
42	It is recommended to use Linseed 60%, Fennel 12%, Carom seed 8%, Sesame seed 8%, Split Coriander seed 4% and Watermelon seed 8% of for preparation of 100 linseed Mukhwas having 50 days keep quality in glass jar.
43	It is recommended to use PDKV Low Cost Portable On-Farm Cooling Storage Structure with 2 tonnes capacity for short term storage of vegetables (tomato, cucumber, okra, capsicum)

2.6 Animal Husbundary & Dairy Science:

44	Blending of 4 per cent ginger juice and 0.4 per cent turmeric powder in kulfi mix is recommended to produce good quality value added PDKV Herbal Kulfi

2.7 Social Science:

Agricultural Economics:

45	The Agri enterpreneur earned Rs. 5226.98 crores and Rs. 31893.45 crores as net economic benefit and gross economic benefit respectively during last 32 years from PKV Mini Dal mill develop by Dr. PDKV, Akola. Hence, it is recommended that government should increase subsidy on the prevailing subsidy on PKV mini dal mill. It will encourage employment opportunities in rural areas.
46	Dr. PDKV, Akola, developed Katol gold variety provided Gross economic benefit of Rs. 653.09 Crores and Net economic benefit of Rs. 460.04 Crores to the farmers during the fourteen years. Therefore, it is recommended that the government should provide the sufficient funds for expansion and extension of Katol gold variety of Dr. PDKV, Akola.