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Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola

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CONTENT

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Research Notes :

Influence of Seed Rate, Row Spacing and Phosphate Level on Seed Yield and Economics of Dhaincha (*Sesbania aculeata* L.)

N.D. Parlawar[1], D.G. Giri[2], R.M. Adpawar[3] and P.V. Yadgirwar[4]

ABSTRACT

The field experiments were conducted for the two consecutive *Kharif* seasons during 1999-2000 and 2000-2001 at Department of Agronomy Farm, Dr. PDKV, Akola, to determine the optimum seed rate, row spacings and phosphate fertilization on seed yield and economics of dhaincha crop. The studies revealed that, growth and yield attributes, seed yield ha^{-1}, gross monetary returns, net monetary returns and benefit : cost ratio were recorded significantly higher with 25 kg seedrate ha $^{-1}$, row spacing of 60 cm and 50kg p_2O_5 ha^{-1} during both the years of experimentation and in pooled results. These agronomic requirements can be considered as a optimum management techniqes for increased seedyield and economics of dhaincha crop.

Dhaincha is an ideal green manure crop as it is quick growing, succulent, easily decomposable with low moisture requirements and produces maximum amount of organic matter and nitrogen.

In the present day context, an emphasis is being given on organics in agriculture. Green manure is the cheapest and best source of improving soil fertility and maintaining the health of an agro-eco system. Though the value of green manure crops in supplying nutrients is well proved, green manuring practices have not been widely adopted by the farmers due to multiple factors. Among the constraints, non availability of good quality seeds at the appropriate time when farmers need them is the foremost one. Inclusion of green manures for nutrient supply is gaining momentum in the context of sustainable agriculture. But so far no serious attempt has been made to grow this crop as a seed crop with proper management practices. Hence, the present study was undertaken to evolve optimum management techniques for incresed seed production in dhaincha in Maharashtra state and specially in Vidarbha region.

MATERIAL AND METHODS

Field experiments were carried out in *Kharif* seasons of 1999-2000 and 2000-2001 at Department of Agronomy Farm, Dr. PDKV, Akola. The soil of the experiment field was clayey in nature, low in available nitrogen, available phosphorus and high in potassium. The soil reaction was slightly alkaline. The experiment was laid out on new sites in each season in a split-plot design with three replications. The treatment comprised on nine combinations of three seed rates and three row spacing under main plots and three phosphate levels in sub-plots.

A. Main plots (Nine combinations of three seed rates and three row spacing)

Seed rate (kg ha^{-1})	x	Row spacing (cm)
S_1 - 15 kg ha^{-1}		R_1 - 30 cm
S_2 - 25 kg ha^{-1}		R_2 - 45 cm
S_3 - 35 kg ha^{-1}		R_3 - 60 cm

B. Sub plots (Three phosphate levels)

P_0 - cotrol

P1 - 25 kg P_2O_5 ha^{-1}

P2 - 50 kg P_2O_5 ha^{-1}

The gross and net plot size were 6.0 m x 5.4 m and 5.4 m x 3.6 m respectively. Economics of the treatments viz. GMR, NMR and B:C ratio were worked out by considering the cost of cultivation and market price of produce. While considering the cost of cultivation, cost 'A' was taken into consideration.

RESULTS AND DISCUSSION

Effect of seedrates

Seed yield per hectare was significantly higher with seedrate of 25 kg ha^{-1} during both the year (Table 3). Increased seed yield ha^{-1} with 25 kg ha^{-1} seedrate was an overall effect of optimum number of plants per unit area. This result is in conformity with the work reported by Anonymous (1950) and Ahlawat *et. al.*, (1997-98).

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Table 1. Effect of seed rate, row spacing and phosphate level on growth attributes of dhaincha during 1999-2000 and 2000-2001

Treatments	Plant height (cm) at 150 DAS		Functional leaves $plant^{-1}$ at 90 DAS		Number of branches $plant^{-1}$ at 120 DAS	
	1999-2000	2000-2001	1999-2000	2000-2001	1999-2000	2000-2001
Seedrates						
S_1-15 kg ha^{-1}	290.25	293.02	52.09	44.11	17.71	17.74
S_2-25 kg ha^{-1}	313.29	304.85	50.80	43.14	17.63	17.23
S_3-35 kg ha^{-1}	314.59	312.09	48.01	40.89	16.98	15.40
SE$\pm$	1.23	0.35	0.48	0.08	0.07	0.09
CD at 5%	3.71	1.07	1.45	0.26	0.23	0.29
Row spacings						
R_1-30 cm	315.40	307.04	49.18	41.45	17.01	16.10
R_2-45 cm	306.70	304.33	50.82	43.33	17.50	16.85
R_3-60 cm	295.03	298.59	50.90	43.36	17.80	17.42
SE$\pm$	1.23	0.35	0.48	0.08	0.07	0.09
CD at 5%	3.71	1.07	1.45	0.26	0.23	0.29
Phosphate levels						
P_0 - control	304.74	292.17	47.60	37.07	12.96	13.23
P_1 - 25kg ha^{-1}	304.92	306.73	50.67	42.26	18.97	17.75
P_2 - 50kg ha^{-1}	307.48	311.07	52.64	48.19	20.38	19.38
SE$\pm$	1.00	0.44	0.46	0.13	0.10	0.13
CD at 5%	NS	1.26	1.33	0.39	0.30	0.40

The value of GMR, NMR and benefit : cost ratio were significantly greater with seedrate @ 25 kg ha^{-1} (Table 4) during both the years of study. Higher values on account of these parameters were due to increased seed production, lower cost of cultivation and remunerative price of seed and fibre. Similar results as regards higher benefits : cost ratio were obtained with dhaincha crop by sirajul *et.al.*, (1999).

Effect of row spacings

The values of greater seed yield per hectare was recorded in wider row spacing of 60 cm (R_3). The increased value of yield attributes led to increased pod and seed yield per hectare with less plant population per unit area. Similar results were reported by many workers like Jha *et. al,* (1990), Krishnaswami *et. al,* (1991), Halepyati and Sheelavantar (1993), Kavimani *et. al,* (1997), Thomas and Palaniappan (1998) while working with different row spacings on dhaincha.

The wider row spacing of 60 cm (R_3) recorded higher values of GMR and NMR during 1999-2000 and in pooled analysis due to higher seed yield ha^{-1}. Similar results were also obtained with benefit : cost ratio during 1999-2000 only (Table 4). The greater values of benefit : cost ratio with wider row spacing

Table 3. Seed yield (kg ha^{-1}) as influenced by various treatments during the year 1999-2000, 2000-2001 and in pooled.

Treatments	Seed yield (kg ha^{-1})		
	1999-2000	2000-2001	Pooled
Seedrates			
S_1-15 kg ha^{-1}	1625	1309	1467
S_2-25 kg ha^{-1}	1678	1401	1539
S_3-35 kg ha^{-1}	1564	1220	1392
SE$\pm$	4.32	10.23	7.51
CD at 5%	12.86	30.81	22.63
Row spacings			
R_1-30 cm	1589	1278	1433
R_2-45 cm	1625	1316	1471
R_3-60 cm	1652	1336	1494
SE$\pm$	4.32	10.23	7.51
CD at 5%	12.86	30.81	22.63
Phosphate levels			
P_0 - control	1494	1131	1312
P_1 - 25kg ha^{-1}	1646	1299	1472
P_2 - 50kg ha^{-1}	1730	1501	1615
SE$\pm$	4.01	7.51	7.09
CD at 5%	11.52	21.65	20.37
General mean	1622	1310	1466

Table 2. Effect of seed rate, row spacing and phosphate level on yield attributes of dhaincha during 1999-2000 and 2000-2001

Treatments	Flower cluster plant^{-1} at 90 DAS		Number of developing pods plant^{-1} at 135 DAS		Number of seeds pod^{-1}		Seed yield plant^{-1} (g)		1000 grain weight (g)	
	1999-2000	2000-2001	1999-2000	2000-2001	1999-2000	2000-2001	1999-2000	2000-2001	1999-2000	2000-2001
Seedrates										
S_1-15 kg ha^{-1}	13.87	11.28	48.70	35.60	30.25	29.40	13.69	7.90	15.62	15.38
S_2-25 kg ha^{-1}	13.53	11.60	42.64	35.19	29.56	28.70	13.23	7.61	15.39	15.22
S_3-35 kg ha^{-1}	12.42	10.20	36.43	32.61	28.29	27.11	8.12	7.19	14.87	14.72
SE±	0.24	0.12	0.23	0.35	0.30	0.20	0.07	0.08	0.13	0.07
CD at 5%	0.73	0.38	0.70	1.07	0.91	0.61	0.22	0.24	0.41	0.23
Row spacings										
R_1-30 cm	13.24	10.75	39.80	33.91	29.11	28.37	10.90	7.50	15.13	14.97
R_2-45 cm	13.27	11.01	43.70	34.35	29.44	28.40	12.03	7.57	15.27	15.15
R_3-60 cm	13.30	11.32	44.27	35.12	29.51	28.44	12.10	7.64	15.47	15.20
SE±	0.24	0.12	0.23	0.35	0.30	0.20	0.07	0.08	0.13	0.07
CD at 5%	NS	0.38	0.70	1.07	NS	NS	0.22	NS	NS	NS
Phosphate levels										
P_0 - control	10.39	8.59	30.11	27.13	27.40	26.70	9.60	7.07	14.72	14.59
$_1$ - 25kg ha^{-1}	13.92	11.11	40.21	36.65	29.62	28.56	11.88	7.71	15.31	15.21
P_2 - 50kg ha^{-1}	15.50	13.38	57.45	39.60	31.07	29.96	13.56	7.92	15.84	15.52
SE±	0.22	0.11	0.28	0.35	0.21	0.17	0.07	0.05	0.09	0.06
CD at 5%	0.63	0.33	0.80	01.00	0.62	0.51	0.22	0.17	0.27	0.19

Table 4. Gross monetary returns, net monetary returns and benefit : cost ratio under various treatments during 1999-2000, 2000-2001 and in pooled

Treatments	Gross monetary returns (Rs. ha^{-1})			Net monetary returns (Rs. ha^{-1})			Benefit : cost ratio	
	1999-2000	2000-2001	Pooled	1999-2000	2000-2001	Pooled	1999-2000	2000-2001
Seedrates								
S_1-15 kg ha^{-1}	58056	43432	50744	47798	33272	40535	4.70	3.26
S_2-25 kg ha^{-1}	60619	47631	54125	50151	37184	43667	4.97	3.52
S_3-35 kg ha^{-1}	57875	43278	50576	47119	31129	391.24	4.36	2.85
SE±	105.45	927.98	433.12	120.88	931.58	305.55	0.01	0.09
CD at 5%	316.87	2782.92	918.72	361.62	2794.23	917.18	0.03	0.29
Row spacings								
R_1-30 cm	57587	43565	50576	47145	33114	40129	4.50	3.15
R_2-45 cm	59074	44977	52025	48500	33145	40822	4.63	3.15
R_3-60 cm	59890	45798	52844	49422	35325	42373	4.72	3.32
SE±	105.45	927.98	433.12	120.88	931.58	305.55	0.01	0.09
CD at 5%	316.87	NS	918.72	361.62	NS	917.18	0.03	NS
Phosphate levels								
P_0 - control	54059	38529	46294	43996	27945	35970	4.42	2.81
P_1 - 25kg ha^{-1}	59654	44507	52080	49196	33294	41245	4.70	3.14
P_2 - 50kg ha^{-1}	62837	51306	57071	51874	40344	46109	4.73	3.68
SE±	156.89	478.39	433.12	172.32	479.42	305.55	0.02	0.05
CD at 5%	451.64	1374.99	879.62	495.82	1376.54	878.08	0.04	0.14
General mean	58850	44780	51815	48356	33861	41108	4.62	3.21

on dhaincha were also reported by sirajul *et. al*, (1999).

Effect of phosphate levels

Use of 50 kg P_2O_5 ha^{-1} resulted in significant increase in seed yield (1730 and 1501 kg ha^{-1}) during both the years of study (Table 3). Similar results were also registered in pooled analysis (1615 $kgha^{-1}$). Increased yield attributes and seed yield per plant helped in getting better seed yield of dhaincha in the treatment having higher level of phosphate application. Similar findings were reported by Singh (1971), Kavimani *et. al*, (1997), Thomas and Palaniappan (1998) and Rengalakshmi and Purushothaman (1999).

The GMR (62,837 and 51306 Rs. ha^{-1}), NMR (51874 and 40344 Rs. ha^{-1}) and benefit : cost ratio (4.73 and 3.68) were significantly greater under the treatment of 50 kg P_2O_5 ha^{-1} in both the years of study (Table 4). Similar trend of the results was also noticed in pooled analysis (Rs. 57071 GMR ha^{-1} and Rs. 46109 NMR ha^{-1}). These findings corroborated with the work of Thomas and Palaniappan (1998) and Sirajul *et. al*, (1999).

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PKV Res. J. 25 Vol. (2) : 2001

Microbial Biomass C and N as Influenced by Cropping Systems and Nutrient Management

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ABSTRACT

Effect of irrigated and rainfed cropping systems on soil microbial biomass carbon and nitrogen was studied at Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola in 1997-99. Higher biomass C and N were found under irrigated condition during summer season. These were increased from planting to flowering in all cropping systems and decreased at harvest of the crops. Higher values were observed under sorghum-chickpea-groundnut sequence and under monocropping with legumes. FYM in combination with mineral fertilizer enhanced the SMBC and N under sorghum-wheat sequence. So also the application of recommended doses of fertilizer increased their amount over control. FYM, wheat straw and green manuring application of soybean-wheat increased the SMBC and N content in soil.

Soil microbial biomass constitutes a transformation matrix for organic matter in soil and act as an active reservoir for plant available nutrients such as N, P,S and C (Paul and Voroney, 1980). Seasonal change in soil moisture, temperature and C input from crop roots and crop remains can have a large effect on soil microbial biomass C and N and its activity (Ross, 1987) which in turn alters the ability of soil to supply nutrients to plants through soil organic matter turnover. Microbial biomass responds much more rapidly than does the total organic matter to any change in ecosystem and, thus, it measurement is a valuable tool for understanding and predicting the long term effects. Cultivation leads to a considerable loss of soil organic matter and microbial biomass. However, limited information is available on changes in microbial biomass C and N consequent to cultivation under semi-arid tropical condition.

MATERIAL AND METHODS

Laboratory incubation study was carried out in the Department of Agricultural Chemistry and Soil Science, Dr. PDKV, Akola during 1997-99. For this purpose surface soil sample (0-30 cm) were collected from the different experimental fields of Central Research Station of University under irrigated and dryland cropping system viz. multiple sequence cropping systems, inter cropping and monocropping. The soil was clayey in texture, alkaline in reaction (pH 7.9), medium in available N (180 kg ha^{-1}), low in available P (11.38 kg ha^{-1}), high in available K (340 kg ha^{-1}) and medium in organic C (0.46%).

Soil samples were taken before sowing of first crop, at grand growth and harvest of each crop in sequence. In case of intercropping, grand growth stage value considered as an average value of both crops, while at harvest, soil sample was taken after completion of the cropping cycle. Soil samples were ground and sieved through 2 mm sieve. Fresh samples were used for determining the microbial biomass. Nutrient management details are given in Table 1. In the treatments organics were applied before sowing of the crop and N was applied in two splits (half at sowing and remaining 30 DAS). Full dose of P and K was applied at the time of sowing.

In case of pigeonpea full dose of N and P was given at the time of sowing. Soil microbial biomass C and N was estimated by using chloroform fumigation incubation method (Jenkinson and Powlson, 1976). Moist 25 g soil were fumigated with alcohol free $CHCl_3$ for 24 h at 25°C. The fumigant was then removed by repeated evacuation on next day. All samples were inoculated with 1 g of unfumigated soil sample. Water was added to bring the soil moisture 80 per cent of its field capacity and then incubated for 10 days at 25°C. All flasks were covered with black paper and carefully sealed. CO_2 evolved was trapped in std. alkali solution and determined by back titration as per standard procedure. Soil microbial biomass C was determined by using equation,

$$SMBC = (mg\ CO_2 - C\ kg^{-1}\ soil\ 10\ days^{-1})\ fumigated - (mg\ CO_2 - C\ kg^{-1}\ soil\ 10\ days^{-1})\ unfumig./kc$$

Where, kc = 0.45

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After incubation, soil was analysed for NO_3 - N and NH_4-N and SMBN was determined with the equation.

$$SMBN = [(mg\ NH_4 - N\ kg^{-1}\ 10days^{-1})\ fumig - (mgNH_4 - N\ kg^{-1}\ soil\ 10\ days^{-1})\ unfumig]/k_N$$

Where $k_N = 0.45$

RESULTS AND DISCUSSION

Microbial Biomass C

SMBC content was higher under irrigated condition as compared to rainfed. It was observed that (Table 2) highest biomass C was present under sorghum-chickpea-groundnut sequence, followed by sorghum-wheat-green gram. At the end of these sequences, the SMBC increased over its initial status. It may be conjectured from the data that higher cropping intensity increased the biomass C insoil. However, it is pertinent to putforth that, at the end of soybean-wheat sequence, biomass C increased by 20-26 per cent over its initial content. This can be attributed to the growing of legumes prior to cereal crop and leaving more crop residues in soil which enhanced microbial activities and ultimtely the turnover of nutrients. Sorghum and cotton monocropping under rainfed condition increased the biomass C content in soil but showed less value as compared to legumes. Similar observations were reporte by Franzluebbers *et. al.*, (1995). Intercropping systems have increased the biomass content in soil. Similar results were also noticed by Patil *et. al.*, (1996).

SMBC increased from planting to flowering in all crop sequence. At harvest, it tended to decrease but was slightly higher than initial level. This fluctuation is probably a result of increased input from rhizodeposition to the soil before and during flowering SMBC was consistently maximum in summer and decreased to minimum in the rainy season indicating fast turnover of microbial nutrients in soil (Srivastava, 1992).

While studying the effect of sources of nutrients applied to sorghum-wheat crop sequence, maximum SMC observed in treatment receiving 100% NPK + FYM. Higher biomass C under this treatment may be due to the added effect of organics viz., FYM (Ghoshal and Singh, 1994). Application of recommended doses of fertilizers to crop increased the biomass C content in soil over control. While, in soybean-wheat sequence, highest SMBC content was recorded with application of N through FYM + wheat straw + green manuring, may be because of the organic sources.

Microbial Biomass N

Results (Table 3) indicate that the build up o N was higher under irrigated condition as compared to that of rainfed. Sorghum-chickpea-groundnut and sorghum-wheat-green gram sequences showed

Table 1. Nutrient management ($N:P_2O_5:K_2O$ kg ha^{-1}) under different cropping systems

1.	Sorghum 100:40:40	-	Wheat 120:60:60	-	Green gram 20:40:00
2.	Sorghum 100:40:40	-	Chickpea 25:50:00	-	Groundnut 25:50:00
3.	Sorghum 100:50:40	-	Wheat 120:60:60		
4.	Soybean 30:75:00	-	Wheat 120:60:60		
5.	Sorghum 80:40:00	+	Pigeonpea 20:40:00		
6.	Cotton 50:25:00	+	Green gram 00:00:00		
7.	Sorghum 100:40:40				
8.	Cotton 50:25:00				
9.	Green gram 20:40:00				
10.	Ground nut 25:50:00				

Table 2. Microbial biomass C content ($\mu g\ C\ g^{-1}$ soil) as influenced by cropping systems

S.N.	Cropping systems	Initial	*Kharif*		*Rabi*		*Summer*	
			GG	AH	GG	AH	GG	AH
	Irrigated							
1.	Sorghum-wheat-green gram	294.75	398.65	342.26	381.16	335.62	415.95	364.35
2.	Sorghum-chickpea-groundnut	335.77	420.93	375.47	421.47	375.97	442.12	387.18
3.	Sorghum-wheat							
	I Control	182.09	262.02	223.91	268.79	215.46		
	II 100% NPK	218.00	303.22	229.83	305.74	261.89		
	III 100% NPK + FYM 10 t	283.87	372.87	325.19	-	-		
4.	Soybean-wheat							
	I Control	193.73	280.65	236.50	281.16	245.44		
	II 100% NPK	243.93	328.45	281.79	237.92	293.14		
	III N through FYM, WS and GM	312.13	418.27	371.35	-	-		
	Rainfed							
5.	Sorghum + pigeonpea	214.60	318.21	261.06				
6.	Cotton + green gram	203.66	310.40	258.40				
7.	Sorghum	207.63	302.91	257.43				
8.	Cotton	182.23	275.04	221.18				
9.	Green gram	243.27	347.38	290.73				
10.	Groundnut	224.49	331.00	275.65				

Note : GG - Grand growth, AH - At harvest

Table 3. Microbial biomass N content (µg N g^{-1} soil) as influenced by cropping systems

S.N. Cropping systems	Initial	*Kharif*		*Rabi*		*Summer*	
		GG	AH	GG	AH	GG	AH
Irrigated							
1. Sorghum-wheat-green gram	18.84	22.72	22.52	23.85	20.21	28.01	21.36
2. Sorghum-chickpea-groundnut	20.90	30.32	24.78	26.25	22.04	31.12	23.55
3. Sorghum-wheat							
I Control	9.09	16.67	12.29	13.86	10.36		
II 100% NPK	14.64	24.49	19.43	21.06	15.55		
III 100% NPK + FYM 10 t	19.83	31.86	25.17	-	-		
4. Soybean-wheat							
I Control	9.34	18.28	13.39	16.48	11.46		
II 100% NPK	16.02	28.25	20.99	22.99	17.35		
III N through FYM, WS and GM	19.57	33.84	25.22	-	-		
Rainfed							
5. Sorghum + pigeonpea	10.68	19.39	13.58				
6. Cotton + green gram	8.88	18.47	12.63				
7. Sorghum	10.72	20.44	15.43				
8. Cotton	9.41	18.72	13.96				
9. Green gram	11.77	21.39	16.02				
10. Groundnut	12.60	21.96	16.03				

Note : GG - Grand growth, AH - At harvest higher biomass N content in soil. Maximum biomass N was recorded under groundnut and green gram during summer season. The results are in consonance with those of Srivastava (1999). The decrease in biomass N in rainy seasons is due to the strong demand for N by growing vegetation, whereas increase in dry months indicates the least demand. Higher values were found under soybean-wheat as compared to sorghum-wheat sequence. This is probably be due to the residual effect of preceding soybean crop which added narrow C:N residues, besides N fixation. Under rainfed situation, amongst the monocropping systems, the highest biomass N was recorded in respect to groundnut, followed by green gram. Intercropping with legumes enhanced the SMBN content.

In all cropping systems, SMBN increased steadily from planting to grand growth period and threafter, it gradually declined upto maturity of the crop. It is, thus, quite apparent that there exists greater turnover and microbial activity at grand growth period when nutrient assimilation is optimum.

In sorghum-wheat sequence, highest SMBN was observed in the treatment receiving NPK and FYM. Biomass N contributes to crop productivity by releasing nutrients and application of manures with fertilizer promoted this effect more strongly than the application of NPK alone. Under soybean-wheat crop sequence, application of N through FYM, wheat straw and grěen manuring increased the biomass N. Combination of wheat straw and green manuring sustained the increase inSMBN (Malik *et. al.*, 1997).

Based on the results obtained it can be concluded that permanent agriculture systems mostly two or three crop sequence and intercropping always harbours higher microbial biomass due to more concentration of nutrients organic matter recycling and sufficient availability of soil moisture. The soil microbial biomass indeed appears to contribute to crop productivity by releasing nutrients. Thus, legumes shall be included in cropping systems to promote this effect and reap the advantage of build of SMBN in soil.

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Urban Forest - A Solace For Concrete Jungle

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ABSTRACT

Urban forests are all the trees and other vegetation that grow in places where people live, work and play from small communities in rural areas to large metropolitan cities. Efficient, effective management of urban vegetation is essential to the environmental and social well being of all our citizens. High density populations living and working on land that is steadily being compacted, yielding a declining and degrading environment will undoubtedly demand compensating, high quality outdoor experience on residual green space. This will be the urban forester's challenge, to solve the dilemma of meeting urban man's demand and needs for enduring trees and forests in the midst of severe economic and environmental constraints.

The urban forest is important to the city dweller in many ways like climate amelioration, engineering uses, esthetic uses etc. In most instances these benefits are taken for granted. Only recently, however, has the concept of urban tree as a forest generally been recognized and the proper management systems applied. Management of the urban forest is the responsibility of public and private owners.

Trees have been esthetically important to people since earliest civilization. The Egyptians, Ph enicians, Persians, Greeks, Chinese and Romans held trees in high esteem and in certain situation worshipped them. They used trees for their esthetic benefits, developing formal gardens and sacred groves to enhance temple setting. Transplanting of trees was common as early as 1500 B.C. in Egypt (Winters, 1974).

This knowledge continued to develop as civilization advanced. Botanical gardens began to evolve during middle ages with particular emphasis on plants with medicinal properties. The first recording of the term "arborist" can be found in James Lyte's book Dodens in 1578 (Chadwick, 1970). As the use of plants in lawn and street setting became more widespread, so did the science of caring for them. Horticultural societies were organized and numerous books and magnizes about gardening were published. One of the leaders in this movement was Andrew Jackon Downing. He worked with Calvert Vaux and Frederick Olmstead in designing parks and wrote several books on landscaping. The landscape concept grew as a result of increasing industrialization and was used in the development of suburbs during the mid 1800s.

Urban forests are all the trees and other vegetation that grow in places where people live, work and play from small communities in rural areas to large metropolitan cities. This includes trees on public, private land, along streets, in residential areas, parks and commercial development and in other locations within a community. They may be planted by design or grow by accident (Miller, 1988).

Efficient, effective management of urban vegetation, especially trees and forests, is essential to the environmental and social well - being of all our citizens. Although culture and language may vary and climatic vegetation zone differ, urbanites of every region will face similar problems and have comparable requirements for goods and services. High density populations living and working on land that is steadily being compacted, yielding a declining and degrading environment will undoubtedly demand compensating, high quality outdoor experience on residual green space. Unfortunately, municipal budget willbe hard-pressed to respond. This will be the urban forester's challenge, to solve the dilemma of meeting urban man's demand and needs for enduring trees and forests in the midst of severe economic and environmental constraints (Grey and Deneke, 1978).

The benefits of trees and other vegetation in an near cities and towns have long been recognized. A large number of property owners has been generally responsible for the care of individual trees. Only recently, however, has the concept of urban tree as aforest generally been recognized and the proper management systems applied. 'Urban forestry' is the umbrella under which all matters concerning the urban forest environment fall. Management of the urban forest is the responsibility of public and private owners. It involves any combination of property owners, city Park or forestry departments, city tree

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boards or commissions, private tree care firms, nursery people and others.

Early History

The concept of urban forestry was introduced first at the University of Toronto in 1965 (Jorgensen, 1970). Jorgensen stated that urban forestry as developed in Canada does not deal entirely with the city trees or with single tree management, but rather with tree management in the entire area influenced by and utilized by the urban population. This area naturally includes the watershed areas and the recreational areas serving in the urban population, as well as the areas lying between these service areas and politically designated urban areas and its trees. The politically established foundries for municipalities rarely include the entire geographical area influenced by urbanization.

The early texts of the twentieth century dealing with street tree maintenance and arboriculture practice was issued by a forester, B.E. Fernow in his book in 1911 titled "The care of Trees in Lawn, Street and Park". At the turn of century, John Davey, often called as father of modern arboriculture, founded a company that specialized in tree maintenance (Wysong, 1972). International Society of Arboriculture had its beginning in 1924.

Although, urban forestry is still in infancy, it has developed rapidly in response to the expressed needs of the urban populace. It is now emerging as a full - fledged profession and will continue to grow as urban needs become more acute.

Distribution and ownership of the urban forest

The urban forest includes all the woody vegetation with the environs of all populated places, from the tiniest village to the largest cities. In this sense it includes not only trees within city limits but trees on associated lands that contributes to the environment of populated places - for example, green belts, municipal watersheds, recreation sites, and road-sides.

Perhaps the most straightforward way of looking at the distribution of the urban forest is according to public and private ownership and public or private responsibility. It is estimated that 30 per cent of the trees in urban areas are publicly owned. The remainder is in private ownership.

A. Public lands

1. Parks

In the urban setting parks are probably the most relatable areas as forests. Many are magnificent example of man-made forests while other example's have been developed is residual natural wooded areas. Parks vary from tiny green spots in central business districts to large acreages, which are often beyond the city limits. Most public parks are municipally owned and managed. However, there are also recreation areas on lands owned by Temples, Churches, industries and other organizations.

2. Road side plantation

Road side plantations constitute a substantial part of public urban forest lands. These are strips adjacent to steets. They are often called as tree lawns, parkways or parking strips. Street side right - of - way vary in width and often provide space for sidewalks.

4. Highway and rail road

The land adjacent to public highways or railroads often supports a significant art of urban forest. Along state highways, tree situation are similar to those along streets. Railroad rights - of - way make only a minor contribution to the urban forest environment. However, in recent years, abandoned roadbeds and yards areas have been convereted to parks and other recreation areas.

4. Public buildings and grounds

Grounds adjacent to public buildings, for example school and colleges, hospitals, auditoriums, museums, and utility plants are important parts of urban forest. Quite often these grounds are well landscaped with generous planting of trees and shrubs. Other public grounds may be used as military installations, airports, golf courses and nurseries. These segments of the forest may be owned and managed by all levels of government and represented by a myriad of departments and agencies.

5. Extraterritorial lands

The urban forest often goes beyond the populated limits of the city. Green belts, groves, forest preserves and even vegetated landfills, although often removed from the city power must be considered as part of the urban forest. These areas are usually publicly owned and often dedicated to a primary use with secondary multiple uses. These forests are extremely valuable to the urban forest environment as they may provide watershed protection, recreation, scenery, solace, or place for disposal of waste products.

6. Riparian areas

Riverfronts, canals, levees, channel divisions lakeshores, and even seashores are part of urban forest. Quite often these lands are developed as parks or recreational areas. They also serve as green belts and open spaces within cities.

B. Private lands

The urban forest occurs on all kinds of residual, commercial and industrial lands. The largest areas are in residential districts either in naturally forested areas or where property owners have often created magnificent forests. Trees are a part of the appeal of homeownership and a sturdy shade tree is one of the first introductions to a new house.

Commercial areas make up a less significant part of the urban forest. This is because of the relatively small land area devoted to commercial and the relative lack of trees there. Tree plantings and other landscaping vary greatly but apear to have increased in recent years, perhaps reflecting the growing environmental concern of business.

Industrial districts are often more utilitarian than beautiful. However, many industries contribute substantially to the total urban forest with landscape grounds, screen planting and outdoors parks and recreation areas for employees. Many cities, seeking to attract industry, have developed industrial parks.

Composition of the urban forest

The urban forest can be both natural and man-made. The urban forest also includes a large area of native woodlands both within and adjacent to cities and towns. In many cases, native forests have been urbanized and cities have grown into them. Often in these situations, the original forests have been so altered by the supplemental planting of introduced species that they have taken the characteristics of man made forests.

The composition of urban forests is influenced primarily by physical elements, the limits imposed by nature are personal, social and economic factors that influence human choice. While often interrelated, these factors may be summarized as purpose or function, popular species, public control, socioeconomic factors, mobility and nostalgic.

1. Purpose or function

The composition of urban forest is influenced largely by the purpose its various segments are intended to serve such as for shade, screening and esthetics. For example, a picnic area in a public park would probably have large deciduous shade trees. Street side planting for shade and esthetics are usully colorful deciduous trees.

2. Popular species

The composition of urban forests often reflects the popularity of certain species like *Delonix regia, Cassia fistula, Grewia optiva, Pongamia pinnata, Eucalyptus spp.* Species popularity is often based on practical reasons such as its form and strength. More often, however, it is based on brilliant leaf or blossom colour or other desired characteristics.

3. Public control

Planting programmes instituted by forest department have the most controlling influence on the composition of urban forest. Directed principally to street rights - or - way, parks, and other public grounds.

4. Socioeconomic factors

The composition of urban forests varies greatly according to economic area. In areas of lower residential income, the urban forest is often composed of declining older trees remaining from times of greater economic prosperity. The urban forests of middle and upper income areas are generally well planted and well tended, reflecting the options of affluence.

5. Mobility

Although difficult to separate from socieconomic factors, the mobility also has an influence on composition of urban forests. People who view their residence in a particular location as temporary tend not to plant trees. However, the frequent, resale of property increases the chances of ownership by individuals who will plant trees, often in the hope that such plantings will increase property values.

6. Nostalgia

Nostalgia for the familiar has had a profound influence on the composition of urban forests. Although many species could not tolerate the new sites, may flourish.

Benefits of urban forest

The urban forest is important to the city dweller in many ways. In most instances these benefits are taken for granted. Indeed, the urban dweller may not even be aware of many or even relate to them. The various benefits can be grouped under the following five broad categories.

A. Climate amelioration
B. Engineering uses
C. Architectural uses
D. Esthetic uses
E. Other uses

A. Climate amelioration

The major elements of climate that affect us are solar radiation, air temperature, air movement and humidity, and we have comfort zones associated with the interactions of these four elements. From an engineering aspect, we control this comfort zone very precisely in buildings. With a twist of a knob or push of a button,we can regulate indoor temperature, light, humidity and air movements. To a degree, similar controls could be applied to the out - of - doors environments, by the proper use of trees and shrubs, a microclimate can be created that may ameliorate the climate sufficiently for us to be comfortable.

i) Temperature modification

Trees, shrubs, and grass ameliorate air temperature in urban environment by controlling, solar radiation. Tree leaves intercept, reflect, absorb and transmit solar radiation. Their effectiveness depends on, for example, the density of species foliage, leaf shape and branching pattern. Trees and other vegetation also aid in ameliorating summer air temperatures through evapotranspiration. Tree have been called nature's air conditioners. A single isolated tree may transpire approximately 88 gallons (400 liter) of water per day (Kramer and Kozlowski, 1970). This has been compared to five average room air conditioners, each with a capacity of 2,500 k cal/hr. running 20 hours a day (Federer, 1970). Deciduous trees are very instrumental in heat control in urban settings of temperate regions. During summer they intercept solar radiations and lower temperature. In winter, the loss of their leaves results in the pleasant warming effects of increased solar radiation.

ii) Wind protection and air movement

Air movement, or wind, affects human comfort. Trees screen sunlight and transpire moisture, the area below the forest canopy can be as much as 25^{0}F (14^{0}C) cooler on a still summer day than is an open area. Trees reduce wind velocity and create sheltered zone both leeward & windward. In the winter, trees create insulation zone that prevents heat loss from a building. This could result in a fuel savings of nearly 23% (Robinette, 1972). Trees and shrubs control wind by destruction, guidance, deflection and filtration. Effect and degree of control vary with species, size, shape, foliage, density, retention and the actual placement of the plants.

iii) Precipitation and humidity

Trees intercept precipitation and slow its descent to the soil surface. This can increase infiltration and decrease run off and soil erosion. Trees may also reduce soil moisture evaporation. Interception of pricipitation by coniferous trees is usually greater than that of hardwood. An estimated 60% of the rainfall will reach the ground through a pine canopy as compared to 80% through a hardwood canopy. Branching pattern also affect interception rates, horizontal branching pattern being the most effective. In addition, rough bark slows the movement of water down trees trucks. Resultant runoff will also be affected by the nature of the shrub canopy, ground cover, litter and topography.

B. Engineering uses

In recent years, highly specialized uses for plants in solving environmental engineering problems have been developed. Involved are not only landscape, esthetics but soil erosion control, air pollution, noise abatement, wastewater management, traffic control and glare and reflection reduction. Robinette (1972) has listed the following plant characteristics and their effects that help to solve enrironmental engineering problems.

1. Fleshy leaves that deaden sound.
2. Branches that move and vibrate to absorb and mask sounds.
3. Pubescence on the leaves to entrap and hold dust particles.
4. Stomata in the leaves to exchange gases.
5. Blossoms and foliage that provide pleasant smell to mask odor.
6. Leaves and branches to slow wind
7. Leaves and branches to slow rainfall
8. Spreading root to hold soil against erosion.
9. Dense foliage to block light.
10. Light foliage to filter light.
11. Spiny branches to deter human movement.

i) Erosion control and watershed protection

Since environmental impacts are associated with most construction activities, erosion control is perhaps the most important engineering use of plants. Drastic changes occur in watershed hydrology when agriculture or forested areas are converted to urban land use. The measurement that can improve the hydrology of urban areas are perforation of compact lawns to improve water absroption and infiltration and planting of trees and shrubs. Plants reduce water that causes soil erosion by intercepting rainfall, by holding soil with their roots and by increasing water absorption through the incorporation of organic matter.

ii) Waste water management

Rapid population growth accompanied by an expanding industrial base has greatly increased the demands on our water resources. This growth is also creating ever-increasing waste dispersal problems. Although large blocks of agricultural and forest land may be used for disposal, cities might also use golf courses, recreation fields, forest preserves, parks, greenbelts, scenic parkways, and perhaps even highway medians.

iii) Noise abatement

Noise is commonly though of as excessive or unwanted sound. Experts in the field often refer to noise as "invisible pollution." How effectively plants control sound levels is determined by sound iself, the plating involed, and the climatic conditions. Planting factors included the species, arrangement in relation to the sound source and the receiver, and planting, height and density. The leaves, branches, and twigs of trees and shrubs absorb sound waves. Sound is also deflected and refracted by the heavier braches and the trunks of trees. It has been estimatd that on the average, forests can attenuate sound at the rate of 7db per 100 ft (30m) of distance at frequency of 1000 CPS (Cycle per second) or less (Embleton, 1963). Cook and Van Haverbake (1971) has made specific recommendation for effective screening passenger car noise in Urban residential areas. Deciduous trees help in auto noise reduction by 20%, Truck by 40%. Coniferous trees help in auto noise reduction by 75%, Truck 80%.

Plants can also mask unwanted sound. Plants make their own sound - the whisper of pines, the rustle of oak leaves, or the quaking of aspens. In addition, plants support animals and birds that may make desirable sounds.

iv) Air pollution abatement

Plants perform an important role in reducing air pollution through the process of oxygenation and dilution. Trees, however, are effective in reducing gaseous air pollutants through absorption. A study of ozone pollution and forested areas showed that if an air mass containing 150 ppm of ozone were to stand over a forest for light hours, the vegetation would absorb approximately 80% of it. Taller trees removed more ozone than shorter trees. And the larger and more numbers the leaf stomatal openings, the more effective is the ozone removal (Stevenson, 1970). A recent Russian study has shown that a 1640 ft. (500 m) wide green area surrounding factories will reduce sulphur dioxide concentration by 70% and nitric oxide concentrations by 67% (Robinette, 1972).

Particulate air pollutants can be reduced by the presence of trees and other plants in several ways. They aid in the removal of air borne particulates, such as sound, dust, fly ash, pollen and smoke. Leaves, branches, stems and their associated surface a structure tends to trap particles, that are later washed off by precipitation. Transpiration increases humidity, thus aiding in the settling out of air borne particulates. The results of these processes can be readily observed on trees adjacent to factories or along gravel road.

v) Glare and reflection control

Solar radiation affects our visual comfort as well as our thermal comfort. Plants can be used to screen and soften the glare. The effectiveness depends primarily on their size and density. Sources of glare must be identified before the proper plants can be selected to control it. Plants can block or filter glare any time during day or night. Plants should be selected of proper height and foliage density so that they provide protection throughout their life time. Plants can be used along the highway to control early morning and later afternoon glare. Night light control can be achieved by the proper placement of trees and shrubs around terraces, windows, or even along streets to protect drivers vision.

vi) Traffic control

While adding to environmental esthetics, trees and shrubs may be used to aid in traffic control. This includes not only vehicular traffic but also pedestrians and animal traffic. Plant include the beauty of our area when used to direct people through it in a definite pattern. Robinette (1972) has suggested some important characteristics of trees for their selection in traffic control like thorniness, mature height, spacing and mature width.

C. Architectural uses

Since trees and shrubs have architectural potential, they can be used individual or collectively as architectural elements performing the functions such a space articulation (defining space), screening, privacy control and progressive realization or enticement. Plants can vary in their use potential as they grow or as the seasons change. Because they are alive and growing, trees and shrubs are dynamic with regard to their functionality in architectural design. The trees and shrubs can create a feeling of solitude by their use in breaking up large spaces into smaller ones and create unique settings inthe process of defining. Perhaps one of the major uses we normally associate with trees and shrubs is screening. This involves not only screening for view but also for privacy. Screening hides the unwanted and allows free access to the remainder of the surroundings. Privacy control differs from screening. It is needed in such activities as sunbathing, camping, picnic, reading, relaxation, nature watching and conservation.

D. Esthetic uses

Trees and shrubs provide their own inherent beauty in all settings. They are esthetic elements in our surroundings. They can be beautiful simply because of the lines, forms, colurs and textures they project. Tree and shrubs enframe views, soften architectural lines, enhance and complement architectural elements, unify divergent elements, and introduce naturalness to otherwise stark settings.

They also produce unique pattern through reflection from glass and water surface and can produce beautiful shadow patterns. Trees are also dynamic giving different appearances in the changing seasons and throughout their span of life. They also provide movement and pleasant sounds. We are attracted to plants because of many of these characteristics. In addition, plants are useful for the berries, nut and shelter they provide to birds and animals. Studies have shown that wildlife populations are enhnnced in urban settings because of trees (Cauley and Schinner, 1973).

E. Other uses

Even though length lists of uses of trees in urban settings have been enumerated, certainly many more uses, including products from the urban forest having economic value, have not been mentioned. Such uses would include places for children to play and in which people can walk and contemplate nature and their own problems, trees used as indicators of historical events and memorials and substitutes for the natural environment in inner city (trees on rooftops and balconies). Trees can also provide a vehicle to evoke memories of other times, places and feelings because of the view they present or a familiar sound, odor, or touch. Needless to say, the city would be a forlorn place to live if it were not for trees.

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Suitability of Bamboo (*Bambusa polymorpha*) Dust For Preparation of Particle Board

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ABSTRACT

Bamboo is a promising source of lignocellulosic material used now a days for particle board manufacture. In this study, phenol formaldehyde bonded particle boards were made from bamboo (*Bambusa polymorpha*) dust with resin content of 6, 8, 10 and 12 per cent. Subsequently, they were tested for different physical and mechanical properties according to Indian Standard IS : 3087. The result shows that bamboo (*Bambusa polymorpha*) dust is suitable for manufacturing of particle board. Satisfactory boards were made using 12 per cent phenol formaldehyde resin and 0.5 per cent wax emulsion as sizing agent.

Bamboo is one of nature's most valuable gifts to mankind. Its remarkable growth rate and versatile properties have made it one of the most sought after material, especially in tropical countries. It is a fast growing woody raw material for a variety of products in the tropical regions. In India, bamboos constitute important raw materials for use in the pulp, paper, rayon and bamboo mat board industries, besides numerous other traditional uses (Nadgauda *et. al.*, 1997) Bamboo is one such lignocellulosic material growing in all parts of our country and it is easily available in large quantities. Initially bamboo was only used in paper and pulp industry and constructional purposes. Then it was successfully tried for making building boards (Narayanmurti and Bist, 1948; Narayanmurti, 1956; Narayamurti and Bist, 1963 and Dhamaney, 1967). Fibre board (Narayanmurti, 1957), hard board (Jain and Dhamaney, 1966) erc. Reconstituted wood (Shukla and Prasad, 1988), particle board (Chen *et. al.*, 1991, Hasnin *et. al.*, 1977) and cement bonded board (Rahim *et. al.*, 1996, Chew *et. al.*, 1992) etc. In the present study, the suitability of bamboo (*Bambusa Polymorpha*) dust is evaluated for making particle board.

MATERIAL AND METHODS

Freshly felled culms of bamboo (*Bambusa polymorpha*) with specific gravity of 0.634 gm/cm^3 having moisture content of 85.48 per cent (green basis) were procured from the Assistant Silviculturist,Forest Research Institute, Dehra Dun. The culms of bamboo were 15 to 20 m in length with diameter varying from 8 to 9.5 cm and wall thickness was 0.5 to 1.4 cm. The procured culms of bamboo were cross cut into small pieces about 19 inches long in the round form and then the green cross cut bamboos were converted into flakes in a chipping machine. The flakes were then sun dried for 2 to 3 days to bring down the moisture content to 30-40 per cent. The drying of flakes were done because, for Condux mill requires dry flakes for making small particles. The flakes were then passed through a Condux mill to obtain particles. The bamboo dust particles passing through 10 mesh sieve were used for prepration of particle board The screened dust particles were then sun dried to bring the moisture content about 9.5 per cent.

About 500 g of dried dust particles was taken for preparation of particle board. Particle boards were prepared using 6, 8, 10 ad 12 per cent phenol formaldehyde resin (42 % solid content) on the bais of oven dry dust particles. The resin was spread uniformly onthe dust particles in a glue mixer. Resin blended dust particles were then air dried at low temperature so as to bring down the moisture content to about 10-12 per cent. Then the resin blended dust particles were uniformly laid to form mats in a wooden mould. The dust particle mat was then pressed in a hot press at 150-155°C at 21 kg/cm^2 pressure for 12 minutes. The sizes of the boards were 32.5 x 32.5 cm in each case. Subsequently particle boards were also made taking 0.5 per cent wax emulsion as sizing agents using 10 and 12 per cent phenol formaldehyde resin on weight basis of dry dust particles.

Particle boards thus obtained were conditioned at room temperature for one week before preparation of test specimens and then tested for various physical and mechanical properties such as thickness variation, density, moisture content, water absorption, length and thickness swelling, swelling due to surface absorption, modulus of rupture, tensile

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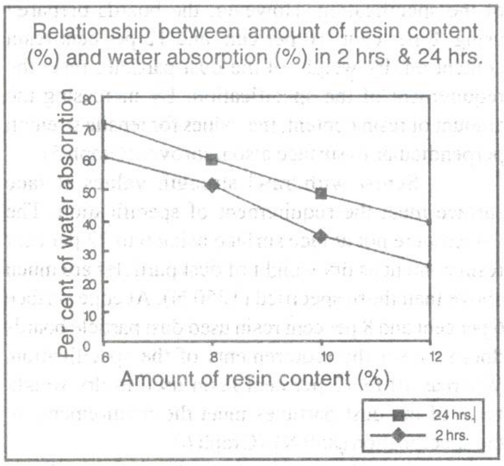
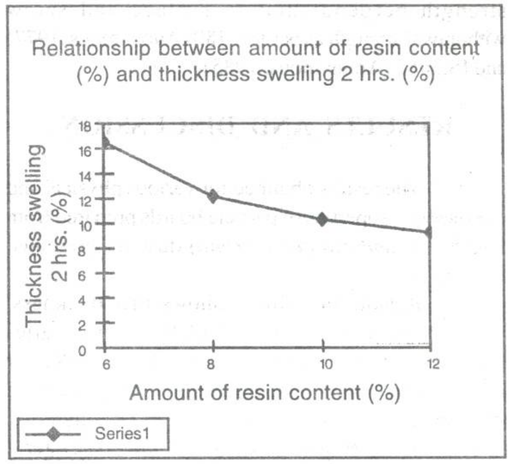
Table 1. Physical and mechanical properties of particle board from bamboo (*Bambusa polymorpha*) dust

S.N.	Amount of resin used (%)	Thickness (mm)	Density (g/cm³)	Moisture content (%)	Water absorption (%)		Length and thickness swelling (%) 2 hr		Swelling due to surface absorption (%) 2 hr	Modulus of rupture (N/mm²)	Tensile strength perpendicular to surface (N/mm²)	Screw withdrawal strength (N)	
					2 hr	24 hr	Length	Thickness				Load at face surface	Load at edge surface
1.	6	8.4	0.72	8.2	62.4	72.3	0.45	17.89	14.94	16.22	0.79	1483.2	638.6
2.	8	8.1	0.75	7.4	54.7	63.8	0.42	15.26	12.19	19.75	1.40	1599.1	779.5
3.	10	8.0	0.78	6.2	44.5	54.1	0.39	13.00	9.42	24.99	1.62	1734.2	1103.0
4.	12	8.2	0.80	5.7	34.6	42.9	0.29	9.00	9.17	28.92	1.70	1959.8	1201.0
5.	10*	7.9	0.79	5.9	30.8	51.4	0.31	9.50	7.06	24.05	1.56	1722.5	1090.0
6.	12*	8.0	0.82	5.5	24.1	40.2	0.22	7.10	5.78	27.34	1.64	1938.7	1178.0
Requirements of IS : 3087-1985			0.5-0.9	5-15	<25	<50	0.5	10	9	11	0.8	1250	850

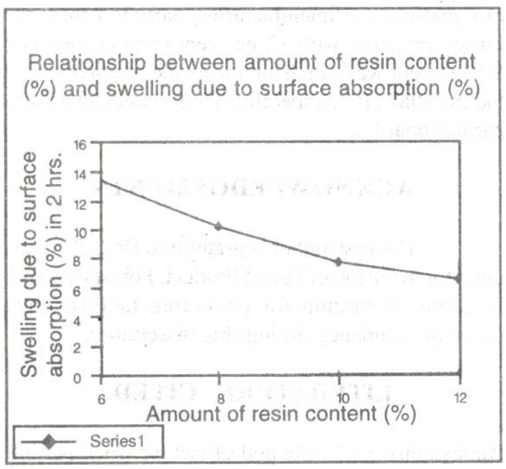
* with 0.5 per cent wax emulsion



Graph No. 1



Graph No. 2



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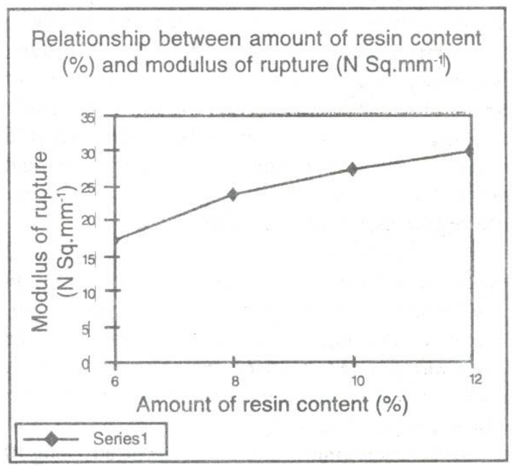

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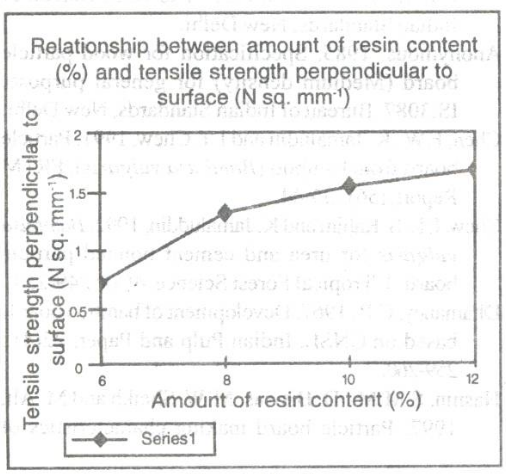

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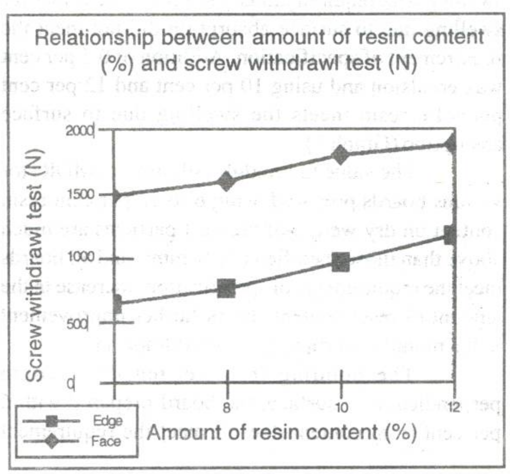

Graph No. 6

strength perpendicular to surface and screw withdrawal strength as per IS:2380 (Anonymous, 1977) and IS:3087 (Anonymous, 1985).

RESULTS AND DISCUSSION

The results obtained for various physical and mechanical properties of particle boards prepared from Bamboo (*Bambusa polymorpha*) dust are presented in Table 1.

Results in Table 1 shows that thickness, density and moisture content of the boards varies from 7.9 to 8.4 mm, 0.72 to 0.82 g/cm^3 and 5.5 to 8.2 per cent, respectively. The boards prepared were in medium density range as per IS:3087 (Anonymous, 1985). The water absorption test of the boards for 2 hours and 24 hours, soaking in water varied from 34.6 to 62.4 per cent and 42.9 to 72.3 per cent, respectively. Boards prepared with 12 per cent phenol formaldehyde resin meets the water absorption for 24 hours. Remaining boards did not meet the requirement of specification. Addition of sizing agent is, therefore, necessary to achieve this property. Boards ‸ repared with 0.5 per cent wax emulsion as sizing agent and using 12 per cent phenolic resin meet the water absorption requirements (Graph 1).

Length-wise swelling of the boards for 2 hours varies from 0.29 to 0.45 per cent and are in confirmation of requirements of specification. Thickness swelling of the boards also exceeded the minimum required standard upto 10 per cent resin content, however requirement as per specification was attained with 12 per cent resin content. Addition of 0.5 per cent wax emulsion as sizing agent and using 10 per cent resin content brought down the thickness swelling with required limits (Graph 2). The values for swelling due to surface absorption did not meet the requirement of specification. Addition of 0.5 per cent wax emulsion and using 10 per cent and 12 per cent phenolic resin meets the swelling due to surface absorption (Graph 3).

The value for modulus of rupture (MOR) for various boards prepared using 6 to 12 per cent resin content on dry weight of the dust particles are much above than those specified (11 N/mm^2) and all boards meet the requirements of specification. Increase in the amount of resin content shows further improvement in the modulus of rupture values (Graph 4).

The bonding test, i.e. tensile strength perpendicular to surface, the board prepared with 6 per cent resin content doesn't meet the requirement of the specification. However, the boards prepared using 8 per cent, 10 per cent and 12 per cent resin content on dry weight of the dust particles meet the requirement of the specification. By increasing the amount of resin content, the values for tensile strength perpendicular to surface also improves (Graph 5).

Screw withdrawl strength values at face surface meet the requirement of specification. The values were not at face surface using 6 to 12 per cent resin content as dry weight of dust particles are much above than those specified (1250 N). At edge surface 6 per cent and 8 per cent resin used dust particle boards doesn't meet the requirements of the specification. Whereas 10 to 12 per cent resin used in dry weight basis of the dust particles meet the requirements of the specification (850 N) (Graph 6).

From the above investigation, it is concluded that bamboo (*Bambusa polymorpha*) dust is suitable raw material for manufacturing particle board. the boards prepared with 12 per cent resin content and 0.5 per cent wax emulsion meets the requirement of the IS : 3087 (1985) specification for medium density particle board.

ACKNOWLEDGEMENTS

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Genotypic, Phenotypic and Environmental Correlation Studies of High Resin Yielders in *Pinus roxburghii* Sargent

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ABSTRACT

Chirpine is the most important species being tapped for the commercial production of resin in the states of Uttaranchal,Himachal Pradesh and Jammu & Kashmir. The present investigation was carried out to know the extent of genotypic, phenotypic and environmental correlation of twenty six high resin yielders and ten check trees of Chirpine (*Pinus roxburghiji*) for some wood and oleoresin characters. Highly significant positive and negative correlation coefficients at genotypic and phenotypic level were observed for different wood and oleoresin traits. The genotypic correlation coefficients were found to be higher in magnitude for all the combinations as compared to those at phenotypic and environmental levels.

Most of the traits of economic importance are complex in inheritance and the component characters may show different types of association with other characters. Therefore, undesirable associations between the desired attributes under selection may result in genetic slippage and limit the genetic advance (Dickerson, 1955). Hence, the knowledge of correlation between such characters is essential while aiming at rational improvement, so that antagonistic correlations do not nullify the expected progress after selection.

The expression of overall merit, is sum total of the contribution of several attributes. Therefore, selection based on various components contributing towards the manifestation of a character is likely to be more effective and rewarding. For this purpose, the understanding of inter-relationship among different components is necessary. The biometrical tool for understanding complex interrelationship is correlation, which gives the degree and magnitude of relationship of one character with other character. But by computing simple correlations, it will be misleading as it is composed of both genotypic as well as environmental correlations, therefore, to avoid this, we go for computing correlation at genotypic level as well as the phenotypic expression is the combination of genotypic and environmental interaction.

Genetic correlation coefficient gives an idea about the extent to which the two characters are under the control of the same set of genes or have the same physiological basis of their expression. If the correlation is high than pleiotropy is more conspicuous, but if the traits are inherited independently then they are under the control of different sets of genes (Jain, 1982).

Genotypic, phenotypic and environmental correlation coefficients are important from the breeding point of view as they provide information about the relative contribution of various characters. The presence of complexity in inheritance of economically important traits and their different types of association with component characters, quite often complicates the selection programme. Further, the efficiency of selection largely depends on the extent of genetic variability and heritability of the desired trait, correlation sutdies need to be carried out.

MATERIAL AND METHODS

The study was conducted on high resin yielders of *Pinus roxburghii* marked at different location in Himalchal Pradesh. The wood and oleoresin samples were collected from these marked trees and ayalyzed for different wood and oleoresin characteristics at College of Forestry, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.). Further, these were statistically analysed for genotypic, phonotypic and environmental correlation coefficients. The experiments were laid out in randomized block design and completely randomized design (for turpentine and rosin analysis) in three replicates for each treatment. Observations were recoded for eighteen parameters, viz. bark percentage

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Table 1. Genotypic, phenotypic and environmental correlation coefficients between wood and oleoresin characteristics of *Pinus roxburghii*

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.	G	0.092	0.110	0.016	-0.064	0.362*	-0.009	0.060	-0.041	-0.102	-0.091	-0.125	-0.332*	0.339*	0.343*	0.363*	0.058	0.369*
	P	0.088	0.110	0.016	-0.063	0.265	-0.009	0.060	-0.040	-0.101	-0.089	-0.122	-0.331	0.326	0.329	0.363*	0.047	0.355*
	E	-0.090	0.093	0.000	0.147	0.158	-0.063	0.172	-0.057	-0.107	0.111	-0.038	0.072	0.149	0.062	0.421*	0.127	0.111
2.	G		-0.029	-0.006	-0.059	0.196	0.202	-0.064	-0.703**	-0.637**	-0.232	-0.449**	-0.503*	0.283	0.277	0.301	0.069	0.260
	P		-0.026	-0.006	-0.057	0.009	0.193	-0.067	-0.670**	-0.617**	-0.226	-0.420*	-0.482*	0.276	0.260	0.290	0.013	0.235
	E		0.091	-0.022	-0.026	-0.209	-0.228	-0.130	0.118	-0.234	-0.117	0.068	0.275	0.194	0.047	-0.159	-0.211	-0.096
3.	G			-0.363**	-0.283	-0.396*	-0.211	0.351*	0.140	0.186	0.247	0.214	-0.188	-0.014	-0.030	0.176	0.032	0.174
	P			-0.362**	-0.282	-0.289	-0.211	0.344*	0.140	0.183	0.246	0.209	-0.187	-0.011	-0.029	0.176	0.020	0.167
	E			-0.212	-0.007	-0.109	0.006	0.015	0.185	0.068	0.195	-0.006	-0.060	0.113	0.003	-0.074	-0.090	0.043
4.	G				0.902**	0.073	0.167	-0.046	-0.308	-0.303	-0.553**	-0.496**	0.033	0.270	0.258	-0.140	-0.016	-0.112
	P				0.901**	0.046	0.167	-0.045	-0.305	-0.299	-0.549**	-0.485**	0.033	0.259	0.248	-0.140	-0.010	-0.108
	E				0.099	-0.246	-0.024	0.039	0.128	-0.029	-0.137	-0.141	0.070	0.062	0.071	-0.010	0.048	-0.029
5.	G					-0.068	0.012	0.076	-0.172	-0.294	-0.548**	-0.444**	0.053	0.303	0.285	-0.149	-0.016	-0.130
	P					-0.053	0.012	0.075	-0.171	-0.289	-0.544**	-0.433**	0.053	0.289	0.274	-0.149	-0.011	-0.123
	E					-0.158	-0.148	0.062	-0.116	0.085	-0.053	-0.033	0.223	-0.063	0.032	-0.211	0.041	0.167
6.	G						-0.158	-0.061	-0.174	0.066	-0.003	0.002	-0.226	0.215	0.225	0.374*	0.049	0.361*
	P						-0.113	-0.039	-0.145	0.048	-0.002	0.025	-0.165	0.143	0.164	0.274	0.061	0.237
	E						0.033	0.036	-0.240	0.013	0.006	0.155	-0.051	-0.028	0.046	0.190	0.076	-0.065
7.	G							-0.670**	-0.224	-0.033	-0.064	-0.207	0.055	-0.193	-0.175	-0.035	-0.007	-0.027
	P							-0.657**	-0.222	-0.032	-0.064	-0.200	0.055	-0.184	-0.169	-0.035	-0.008	-0.024
	E							0.138	-0.086	0.078	-0.075	0.151	-0.104	0.060	-0.071	-0.062	-0.145	0.133
8.	G								0.024	-0.151	-0.354*	-0.194	0.121	0.233	0.217	-0.167	-0.020	-0.181
	P								0.024	-0.143	-0.345*	-0.189	0.120	0.228	0.199	-0.162	-0.025	-0.158
	E								0.046	0.096	0.003	-0.074	0.138	0.168	-0.086	0.298	-0.086	0.241
9.	G									0.651**	0.566**	0.632**	0.266	-0.309	-0325	-0.060	-0.005	0.006
	P									0.636**	0.558**	0.612**	0.264	-0.291	-0.309	-0.061	-0.017	0.007
	E									-0.014	0.030	-0.014	0.046	0.056	0.009	-0.232	-0.163	0.053
10.	G										0.445**	0.546**	0.193	-0.266	-0.255	-0.008	-0.012	-0.013
	P										0.437**	0.520**	0.189	-0.248	-0.246	-0.007	0.006	-0.017
	E										0.120	-0.127	-0.070	0.046	-0.105	0.070	0.132	-0.105
11.	G											0.914**	-0.096	-0.322	-0.315	0.229	0.023	0.244
	P											0.881**	-0.096	-0.307	-0.306	0.228	0.042	0.235
	E											-0.173	-0.170	-0.023	-0.180	0.148	0.305	0.073

Table cont.....

12.	G	0.016	-0.318	-0.304	0.152	0.030	0.163
	P	0.015	-0.302	-0.279	0.148	0.011	0.165
	E	0.005	-0.078	0.089	-0.011	-0.070	0.198
13.	G		-0.522**	-0.509**	-0.889**	-0.156	-0.861**
	P		-0.497**	-0.484**	-0.888**	-0.120	-0.824**
	E		0.132	0.280	-0.215	-0.136	0.132
14.	G			0.996**	0.474**	0.100	0.440**
	P			0.960**	0.453**	0.044	0.391*
	E			0.406*	-0.044	-0.139	-0.155
15.	G				0.463**	0.089	0.416*
	P				0.444**	0.055	0.383*
	E				0.118	-0.043	-0.006
16.	G					0.176	0.994**
	P					0.137	0.955**
	E					0.254	-0.042
17.	G						0.192
	P						0.112
	E						-0.135

1. Bark percentage of wood
2. Specific gravity of wood
3. Tracheid length
4. Cold water soluble extractives
5. Hot water soluble extractives
6. Alcohol-benzene extractives
7. Lignin percentage of wood
8. Holocellulose percentage of wood
9. Number of resin ducts
10. Diameter of resin ducts
11. Needle length
12. Needle thickness
13. Turpentine percentage
14. Specific gravity of turpentine
15. Relative flow rate of turpentine
16. Resin percentage
17. Specific gravity of resin
18. Ash percentage of resin

* Significant at 5% level of significance (r=0.3295)

** Significant at 1% level of significant (r= 0.4223) of wood, specific gravity of wood, tracheid length, cold water soluble extractives, hot water soluble extractives, alcohol-benzene soluble extractives, lignin percentage, holocelloulse percentage, number of resin ducts, diameter of resin ducts, needle length, needle thickness, turpentine percentage, specific gravity of turpentine, relative flow rate of turpentine, rosin percentage, specific gravity of rosin and ash percentage of rosin. Estimates of genotypic, phenotypic and environmental correlation coefficients were calculated as per formula suggested by Searle (1961) and the significance of correlation coefficient was tested as per Fisher and Yates (1963) method.

RESULTS AND DISCUSSION

The data pertaining to genotypic phenotypic and environmental correlation coefficient are presented in Table 1. Out of 153 combinations of genotypic correlation, 21 combinations were found to be positive and significant and 17 combinations were negative and significant. Out of the 21 positive and significant, 12 combinations were obtained to be sifnig :ant at 1 per cent level of significance and 9 combinations were significant at 5 per cent level of significance. In 17 combinations of negative and significant correlations, 13 were significant at 1 per cent level of significance and 4 combinations were significant at 5 per cent level of significance.

Out of 153 phenotypic correlations, 16 combinations were recorded to be positive and significant and 15 combinations were observed to be negative and significant. Out of these 16 positive and significant combinations, 11 correlations were significant at 1 per cent level of significance and 5 correlations were significant at 5 per cent level of significance. Whereas, out of 15 combinations of negative and significant correlation coefficients, 12 correlations were significant at 1 per cent level of significance and 3 were significant at 5 per cent level of signficance. However, in 153 combinations of environmental correlation coefficients, only 2 combinations were recorded to be positive and significant at 5 per cent level of significance. Rest of the combinations were found to be non-significant.

This correlation study shows that for most of the wood and oleoresin parameter pairs, genotypic and phenotypic associations were in the same direction and the genetypic estimates were higher than the phenotypic ones, indicating an inherent association between these characters.

The characters, which are highly correlated, could be directly used for selection of best genotypes. Highly significant and positive genotypic and phenotypic correlation was obtained between specific gravity of turpentine vs relative flow rate of turpentine (G 0.996, P 0960). The highly significant and negative genotypic and phenotypic correlation was obtained between turpentine percentage vs rosin percentage of oleoresin (G- 0.889, P - 0.888). The correlation coeffieicnts at genotypic level were higher than phenotypic and environmental level for various wood characters was reported earlier by Kumar (2000) in *Dalbergia sissoo*, similar type of result were also reported by Singhal (1996) and Murtem (1998) in *Pinus roxburghii*. In general, the genotypic correlation coefficients were more than phenotypic ones, which indicate that this could be either due to modifying effect of the environment or the strong inherent association of these characters at genetic level. Similarly, the correlation coeffieicnts at genotypic level are higher than those at phenotypic and environmental level for various wood and oleoresin parameters.

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Effect of Combined Inoculation of *Rhizobium japonicum* and *Azospirillum brasilense* on Yield and Uptake of Nitrogen by Soybean (*Glycine max* L.)

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ABSTRACT

The present investigation was undertaken during 2000-2001 to study the effect of *Rhizobium japonicum* with Azospirillum brasilense seed inoculation on soybean. The results revealed that *R. japonicum* + *A. brasilense* mixed inoculation and in combination with nitrogen fertilizer influenced yield, N content in shoot, grain, soil and uptake of N significantly.

Seed inoculation with *Azospirillium brasilense* improved the yield of cereal crops (Subbarao, 1980). But very few infomation is available regarding the effect of combined application of *Rhizobium* and *Azospirillum* on growth and yield of pulse crop. Hence, present investigation was undertaken to examine effect of alone and dual inoculation with incombination of N fertilizer on soybean in respect of yield and uptake of N.

MATERIAL AND METHODS

A field experiment was conducted at Department of Plant Pathology field, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *kharif* season of 2000-2001. The experiment was laid out in RBD with four replications. The treatments were :

T_1 - Uninoculated control
T_2 - Seed treatment with *Rhizobium japonicum*
T_3 - Seed treatment with *Azospirillum brasilense*
T_4 - Seed treatment with *R. japonicum* + *A. brasilense*
T_5 - 30 kg N ha^{-1}
T_6 - Seed treatment with *R. japonicum* + 30 kg N ha^{-1}
T_7 - Seed treatment with *A. brasilense* + 30 kg N ha^{-1}

75 kg P_2O_5 ha^{-1} was applied uniformly in all treatment as basal dose. The soil of experimental field was shallow in depth with higher texture having pH7.7 and 0.63 per cent organic carbon, 282.6 kg ha^{-1} available nitrogen, 20.60 kg ha^{-1} available phosphorus and 302.6 kg ha^{-1} available potassium. Bacterial culture *R. japonicum* and *A. brasilense* were obtained from APDRC, Dr. PDKV, Akola, seed bacterization was done (@ 25 g kg^{-1} seed of soybean CV : JS-335) in field just before sowing by treatment carriers based inoculum.

Table 1. Effect of different treatment on yield and N content in shoot, grain, soil and N uptake by soybean

Treatments	Grain yield kg ha^{-1}	N content (%) Shoot	Grain	Soil	N uptake kg ha^{-1}
Uninoculated control	2149	0.51	5.82	0.046	127.37
Rhizobium japonicum	2793	0.59	6.62	0.052	184.60
Azospirillum brasilense	2375	0.54	6.09	0.048	147.65
R. japonicum + *A. brasilense*	2856	0.62	6.63	0.055	192.72
30 kg N ha^{-1}	2502	0.57	6.27	0.050	159.75
R. japonicum + 30 kg N ha^{-1}	2916	0.66	6.71	0.059	208.70
A. brasilense + 30 kg N ha^{-1}	2556	0.60	6.28	0.051	163.31
SE (m $\pm$)	71.33	0.014	0.06	0.002	5.41
CD at 5%	200.35	0.0343	0.17	0.006	15.21

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Soil, plant and grain analysis was done as per method of analysis by Jackson (1967).

RESULTS AND DISCUSSION

The grain yield and N uptake data are presented in Table 1. Significant increase in grain yield due to combine inoculation of *R. Japonicum* + *A. brasilense* (2856 kg ha^{-1}) over *R. japonicum* (2793 kg ha^{-1}), *A. brasilense* (2375 kg ha^{-1}) treatment alone and control (2149 kg ha^{-1}). These observations are similar with the findings of Singh and Rao (1973). However, there was further increase in the crop yield when application of *R. japonicum* + 30 kg N ha^{-1} (2916 kg ha^{-1}) compared to other treatments. These findings are in conformity with the results of Rani and Kodandarmaiah (1997).

Date inrelation to N content shoot, grain, soil and uptake of N showing that combine application of *R. japonicum* + *A. brasilense* (0.062%, 6.63%, 0.055 and 192.72 kg ha^{-1}) greatly affected as compared to alone and over control. These findings are similar with the results reported by Iruthayathas *et. al.*, (1983) in case of soybean. Similarly application of *R. japonicum* + 30 kg N ha^{-1} gave highest N content in shoot, grain, soil and uptake (0.66%, 6.71%, 0.059 and 208.70 kg ha^{-1}). The views expressed by Alam *et.al.*, (1988) are in conformity with the above findings. Hence, it is concluded from the above findings tht dual inoculation of *Rhizobium* and *Azospirillum* help to increased grain yield and N uptake over a *Rhizobium* seed inoculation alone.

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Characterization of Chilli Phyllosphere Bacteria Sugar Utilization and Phosphate Solubilizing Ability

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ABSTRACT

Sugar utilization and phosphate solubilizing ability of seven phyllosphere bacteria collected from Chilli (*Capsicum annum* L.) was tested. All seven isolates were fixed very meager quantity of nitrogen but none of isolate had an ability to fix nitrogen as compared to known ability of *Azotobacter*. Isolate B1 found to fix miximum 'N' (0.437 mg N/g) and EIV found to produce the most prominent 'P' solubilizing zone i.e 5.66 mm. Among seven, six belongs to Gram -ve while one Gram +ve. EIV isolate had an ability to produce acid and gas in the presence of glucose and also hydrolysed the starch.

The application of strong nitrogen fixing strains isolated from phyllosphere of plant may meet to large extent the nitrogen requirements of vegetable and may reduce the cost incurred by farmer on nitrogenous fertilizer (Ruinen, 1961) Phosphorous is an esstntial major nutrient for development of plant. It is a constitutent of nucleic acid, phytin, phospholipids and majority of enzymes. It stimulates the early devleopment and promotes the healthy growth of seedlings. There are some phyllosphere bacteria which solubilize.

Phosphate with this in view the studies were conducted to characterize the isolates on the basis of some physiological, biochemical and ability to utilize the sugar.and phosphate etc.

MATERIAL AND METHODS

Seven isolates of phyllosphere bacteria were collected from chilli (*Capsicum annum* L.) from the experimental farm of Department of Plant Pathology, Dr. PDKV, Akola where the plant protection schedule was applied. Leaf surface of chilli were washed periodically with 10 ml sterilized distilled water and from washing one ml suspension was pipetted and spread on surface of Jensen medium in petriplate and incubated. Distinct vigorous colonies were picked up and streaked on fresh sterilized plates, the colonies were examined microscopically for purity and transferred on slants for further studies.

Some physiological and bio-chemical tests were performed as per the routine procedures as these help in identification of bacteria. The gram staining is the most useful staining procedure employed in bacteriology. That was also performed as per the standard methodology.

Amount of nitrogen fixed per gram of sugar (sucrose) utilized

Suspension 0.5 ml of each isolate were inoculated separately in 50 ml aliquats of broth in 250 ml capacity conical flask. Flasks were replicated thrice and absolute broth was served as control. The flasks were incubated at 28 $\pm$ 2 ^{0}C temperature and shacked 6-8 times every day for 10 days. The amount of fixed nitrogen was determined by kjedahl's method as described by Chopra and Kanwar (1976).

The amount of total unused soluble sugar in the medium was estimated by Anthronej method (Shield and Burnett, 1960).

Assessment of phosphate solubilizing ability of physllosphere bacteria

Pikovaskayas medium was prepared by using tricalcium phosphate. The media was sterilized at 1.04 kg/cm^2 for 15 min. Warm (450c) Pikovaskayas medium (approx 20 ml/plate) was poured in Petriplates. The phyllosphere bacteria were inoculated on solidified media separately and the plates were incubated at 28$\pm$2^{0}C for four days. Phosphate solubilized clear zone were measured in mm.

RESULTS AND DISCUSSION

It is observed from Table 1 that all most all bacterial isolates to Gram negative except EII as Gram positive rod. H_2S production at higher intensity was observed in CIII. Isolate CIII and EIII, had an ability to hydrolyze the starch. Except EIV as positive for gelatin liquefaction other isolates were found to be negative.

Acid and gas production studies were also performed and indicated that the isolate BI, CIII and

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EIV showed positive gas production. Acid production was recorded by all isolates except BI and EII, in glucose containing medium. Tentative identification of phyllosphere bacteria was made by Wani *et.al.*, (1998) on the basis of some physiological and biochemical characters.

Nitrogen fixing ability of phyllosphere bacteria

Efficiency of nitrogen fixation by phyllosphere bacteria is usually assessed from amount of nitrogen fixed per gram of sugar utilized.

The results presented in Table 2 indicate that all the bacterial isolates had an ability to fix very meager quantity of the nitrogen. In general, none of isolate had an ability to fix the nitrogen as compared to known ability of *Azotobacter*. Among the isolates maximum amount of nitrogen i.e. 0.43 mg/g sugar (sucrose) utilized could be fixed by isolate BI, followed by EIV (0.30)

Efficacy of phyllosphere bacteria for 'P' solubilization

Isolate EIV was found to produce the most

Table 1. Biochemical tests of phyllosphere bacterial isolate

S.N.	Isolates	Gram reaction and shape	Acid production glucose	Gas production glucose	H_2S production	Starch hydro-lysis	Gelatin hydro-lysis
1.	AII	- ve Rod	+	-	-	-	-
2.	BI	- ve Rod	-	+	-	-	-
3.	CII	- ve Rod	+	-	+	-	-
4.	CIII	- ve Rod	++	+	++	+	-
5.	EII	+ ve Rod	-	-	-	-	-
6.	EIII	- ve Rod	+	-	+	+	-
7.	EIV	- ve Rod	+	+	-	-	+

Table 2. Amount of nitrogen fixed by phyllosphere isolate g^{-1} sugar utilized after 10 days

S.N.	Isolate	Amount of nitrogen fixed mg g^{-1} sugar
1.	AII	0.09
2.	BI	0.43
3.	CII	0.15
4.	CIII	0.11
5.	EII	0.11
6.	EIII	0.14
7.	EIV	0.30
8.	Control	0.04
	'F' test	Sig
	SE m $\pm$	0.06
	CD (P=0.01)	0.28

Table 3. Efficacy of phyllosphere bacteria for 'P' solubilization

S.N.	Isolates	Radial diameter (mm)
1.	AII	0.0
2.	BI	0.0
3.	CII	0.66
4.	CIII	2.33
5.	EII	0.0
6.	EIII	0.0
7.	EIV	5.66
	'F' test	Sig
	SE m $\pm$	0.213
	CD (P=0.01)	0.599

prominent zone i.e. 5.66 mm followed by CIII 2.33 mm. No other isolate solubilised the phosphate. From the data (Table 3) it is observed that phyllosphere EIV and EII isolate had an ability to solubilise the phosphate.

Ruines (1961) detected the presence of several N2-fixing microorganisms on the leaf surface of plant. In the present studies the ability to fix the nitrogen was estimated and observed to be very meager that BI isolate fix nitrogen by utilizing sugar (0.43 mg g^{-1}), followed by isolate EIV (0.30). It indicates that the Chilli phyllosphere bacteria are unable to fix the nitrogen. Shende *et.al.*, (1975) reported that *Azotobacter combines* about 9 to 13 mg of atmospheric nitrogen g^{-1} of sugar utilized.

Phyllosphere bacteria were able to solubilize phosphate. Pikovaskaya medium was prepared by using tricalcium phosphate. The isolate EIV found to produce prominent zone i.e. 5.66 mm while EIV and CIII also had an ability to solubilize the phosphate. Other isolates were observed to be non-phosphate were solubilizer. Sheshadri *et. al.*, (2000) and Shinde *et. al.*, (1974) has reported the phosphate solubilizing ability by different strains of *Azospirillum sp.* and *Azotobacter*.

Among seven selected bacteria, six belonged to Gram negative and one (isolate EIII) categorized as Gram positive starch hydrolysis by isolate AII, CIII and EIII and acid producing isolates were AII, CII, CIII, EIII and EIV, where as gas producing isolates were BI, CIII and AIV from glucose as a carbohydrate source. Wani *et. al.*, (1998) also made tentative identification of phyllosphere of sorghum.

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Efficacy of Fungicides Against *Alternaria* Leaf Blight of Safflower

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ABSTRACT

In the present investigation nine fungicides were screened *in vitro* against *Alternaria carthami*. Mancozeb, Thiram and Topas were found very effective in which the linear growth of mycelium and sporulation was completely inhibited. Under *in vivo* test, fungicides have minimized the disease intensity and increased the yield of safflower.

Safflower (*Carthamus tinctorius* L.) is one of the important Rabi oilseed crops. It contain about 30 per cent oil and defatted cake contains about 20 per cent protein. Among the various diseases of safflower, the Alternaria leaf blight incited by *Alternaria carthami* (Chowdhary) is an important disease, which causes severe yield losses. Severely diseasd crop produce seeds prematurely and such seed have low volumetric weight and reduced oil content (Jackson *et. al.*, 1982). Therefore, the present study was undertaken to ascertain the efficacy of fungicides both *in vitro* and *in vivo* in controlling the growth of pathogen as well as the disease.

MATERIAL AND METHODS

The experiment was conducted in vitro as well as in vivo. Diseased leaf samples were collected from the field around Akola (M.S.) and pathogen isolated from these leaves by tissue isolation method on autoclaved potato dextrose agar medium. It was purified by hyphal tip method and maintained on autoclaved potato dextrose agar. Fungicides used in present study were Mancozeb, Carbendazim, Thiram, Copper oxychloride (CoC), Topas, Topsin, Chlorothalonil, calixin and Aliette @ 0.1 to 0.3 per cent concentration. Each fungicide was incorporated separately in warm liquefied medium just before pouring the plates (poison food technique). Four plates of each fungi were inoculated centrally with 5 mm disc of young sporulating culture of *A. carthami*. Colony diameter of fungus growth for each plate was recorded on 7th day after incubation 28 $\pm$ 2^{0}C.

For field trial, the above fungicides were used at different concentrations. Bhima variety was sown in randomized block design with four replications in the field of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Disease intensity was recorded before spray and again after 8 days after each spray treatment. To record the disease intensity on leaves, standard scale as suggested by Mayee and Dattar (1986) was used.

RESULTS AND DISCUSSION

In vitro test, it was observed that all the nine fungicides showed inhibitory effect on the growth

Table 1. Effect of different fungicides on growth and sporulation of *A. carthami*

Tr. No.	Fungicides	Av. colony diameter after 8 days (in mm)	% growth inhibition	% spore inhibition	Sporultation
T_1	Control	51	-	-	++++
T_2	Aliette	12	76.47	95.65	+
T_3	CoC	23	54.90	95.65	++
T_4	Mancozeb	00	100.00	100.00	-
T_5	Carbendazim	38	25.49	91.30	++
T_6	Thiram	00	100.00	100.00	-
T_7	Topsin	17	66.66	98.55	+
T_8	Chlorothalonil	17	66.66	97.10	+
T_9	Topas	00	100.00	100.00	-
T_{10}	Calixin	40	21.56	89.85	++++

++++ Abundant sporulation, ++ Moderate sporulation, + Poor sporulation, - No sporulation

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Table 3. Effect of foliar sprays of different fungicides on per cent disease intensity and on yield of safflower for control of leaf blight (*A. carthami*)

Tr. No.	Fungicide and concentration	Per cent disease intensity (PDI)			PDC %	Yield q ha^{-1}	Per cent increase over control
		I_1	I_2	I_3			
T_1	Control (No fungicide)	7.15 (15.37)	19.97 (26.23)	26.97 (31.31)	-	4.29	-
T_2	Aliette (0.1%)	6.54 (14.57)	9.11 (17.38)	13.67 (21.67)	49.31	5.55	29.37
T_3	CoC (0.25%)	6.7 (14.79)	10.06 (18.24)	13.61 (21.63)	49.53	6.14	43.12
T_4	Mancozeb (0.25%)	6.29 (14.22)	7.75 (16.01)	9.33 (17.69)	65.40	7.92	69.93
T_5	Carbendazim (0.1%)	4.64 (12.36)	9.22 (17.57)	13.81 (21.74)	48.79	6.07	41.49
T_6	Thiram (0.3%)	10.28 (18.49)	13.56 (21.53)	15.52 (23.11)	42.45	6.59	53.61
T_7	Topsin (0.2%)	7.72 (15.73)	10.51 (18.68)	12.29 (21.00)	52.16	4.74	10.48
T_8	Chlorothalonil (0.2%)	6.41 (14.30)	10.57 (18.90)	15.20 (22.85)	43.64	6.14	43.12
T_9	Topas (0.05%)	6.12 (14.07)	9.64 (18.03)	13.49 (21.51)	49.98	6.29	46.62
T_{10}	Calixin (0.1%)	8.63 (16.55)	12.66 (20.63)	15.66 (23.19)	41.93	5.33	24.24
		SE m $\pm$ = 0.91 CD at 5% = 2.54			SE m $\pm$ = 5.34 CD at 5% = 7.29		

Table 2. Effect of different fungicides on spore germination of *A. carthami*

Tr. No.	Fungicides	Concentration (%)	Per cent spore germination	Per cent spore inhibition
T_1	Control	--	53	--
T_2	Aliette	0.1	3.16	92.75
		0.2	2.04	95.65
		0.3	2.06	95.65
T_3	CoC	0.1	4.76	89.85
		0.2	4.16	92.75
		0.3	2.60	95.65
T_4	Mancozeb	0.1	0.0	100.0
		0.2	0.0	100.0
		0.3	0.0	100.0
T_5	Carbendazim	0.1	6.75	85.50
		0.2	5.33	88.40
		0.3	3.75	91.30
T_6	Thiram	0.1	0.0	100.0
		0.2	0.0	100.0
		0.3	0.0	100.0
T_7	Topsin	0.1	1.87	95.65
		0.2	1.05	97.10
		0.3	1.00	98.55
T_8	Chlorothalonil	0.1	2.70	94.20
		0.2	1.81	95.65
		0.3	1.81	97.10
T_9	Topas	0.1	1.69	97.10
		0.2	0.0	100.0
		0.3	0.0	100.0
T_{10}	Calixin	0.1	10.90	82.60
		0.2	8.33	85.60
		0.3	6.36	89.85

and sporulation of fungus as compared to control (Table 1 and 2). Among the nine fungicides tested, Mancozeb, Thiram and Topas completely (100%) checked the growth and sporulation of *A. carthami*. The other fungicides viz. Calixin (21.56%), Carbendazim (25.49%), CoC (54.90%), Topsin and Chlorothalonil (66.66%) and Aliette (76.47%) were less effective. Similar findings were reported by Peshney and Moghe (1981).

In the field experiment, it was noted that Mancozeb (0.25%) was found most effective in controlling leaf blight disease of safflower (65.40%), followed by Topsin (52.16%), Topaz (49.98%), CoC (49.53%) and Aliette (49.31%). Test fungicides used for control of leaf blight have also showed its impact on yield of safflower grain yield (Table 3). The most effective was Mancozeb giving 7.92 q ha^{-1} yield and this was followed by Thiram (6.59 q ha^{-1}). Similar findings were reported by Patil and Jadhav (1985) and Majumadar *et. al.*, (1989).

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Efficacy of Fungicides, Botanicals and Varietal Resistance Against Powdery Mildew of Pea (*Pisum sativum* L.)

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ABSTRACT

A field experiment was conducted to manage the powdery mildew (*Erysiphe polygoni* DC) of Pea (*Pisum sativum* L.) by fungicides, plant extract and host resistance. Results indicated that two sprays of Tridemorph and Dinocap @ 0.1 per cent were highly effective in reducing the disease and increasing yield when applied at the initiation and repeated at 10 days interval. Behada (*Terminalia belerica*) leaf extract @ 3% was found effective as compared to other plant extracts. Similarly, *in vitro* maximum inhibition of spore germination was observed in Tridemorph among the fungicides and behada among the plant extracts. Of the 64 varieties under sutdy only three varieties viz. Rachna, HFP-4 and DMR-7 were moderately resistant. However, minimum disease intensity was recorded on cultivar Rachana.

Pea (*Pisum sativum* L.) is important pulse vegetable crop in human diet. Among the various pea diseases, powdery mildew caused by *Erysiphe polygoni* DC is most destructive and widely distributed and cause upto 50% yield loss (Singh and Singh, 1982). Most of the cultivated varieties are susceptible though there may be variation in the degree of their susceptibility. Therefore, keeping in view relative damage caused by this disease, the present study was undertaken to manage the disease by use of fungicides, plant extracts and varietal resistance.

MATERIAL AND METHODS

Effect of fungicides and plant extracts

A field trial was laid out in randomized block design with eight fungicides and three extracts with a susceptible variety T-163 at experimental field of Department of Plant Pathology, Dr. PDKV, Akola during the year 2000-2001. The standard aqueous extracts of plant were made by grinding the appropriate washed plant leaves in morter ad pestle in equal amount of sterile distilled water (W/V) 3 gm in 100 ml water. Prepared plant extracts were filtrated using two layers of muslin cloth. Three replications were laid out with plot size 4.5 x 3.6 m^2 with spacing 45 x 15 cm. Crop was sprayed with eight fungicides and three plant extracts (Table 1). First spraying was takenup as soon as the disease was noticed and the second spray was given after 10 days interval. For per cent disease intensity five plants were selected randomly and six leaves were tagged for the purpose and the per cent disease index was calculated using the formula.

$$\text{PDI} = \frac{\text{Total numerical rating}}{\text{Max. rating given x No. of leaves}} \times 100$$

The grade card used for measuring the magnitude of disease intensity is as follows.

Grade	Description	Classification
0	Plants free from infection	Highly Resistant (HR)
1	Plants showing traces to 10% infection on leaves, stems free from infection	Resistant (R)
2	Slight infection with thin coating of powdery growth on leaves covering 10.1 - 25% leaf area, slight infection on stems and pods usually free	Moderately Resistant (MR)
3.	Dense powdery coating covering 25.1-50% leaf area, moderate infection on stems and slight infection on pods	Moderately Susceptible (Ms)
4.	Dense powdery coating covering50.1-75 % leaf area, stems heavily and pods moderately infected. Infected portion turns greyish	Susceptible (S)
5.	Severe infection with dense powdery growth covering more than 75% area of whole plant including pods and plants, resulting in premature defoliation and drying	Highly Susceptible (HS)

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Table 1. Efficacy of fungicides and plant extracts against powdery mildew of pea

Treatments	Conc. %	Per cent disease intensity (PDI) 1st spray	2nd spray	Average	Per cent disease control**	Yield q ha^{-1}	Per cent increase in yield over control
Dinocap	0.1	24.01 (26.35)*	28.28 (32.47)	26.44	39.84	11.48	102.46
Carbendazim	0.1	24.81(29.83)	30.37(33.43)	27.59	37.27	11.35	100.17
Wett. sulphur	0.3	24.44(29.59)	29.99 (33.20)	27.21	38.12	11.41	101.23
Tridemorph	0.1	23.33(28.84)	25.55(30.31)	24.29	44.23	11.79	107.93
Fenarimol	0.05	29.99 (33.18)	33.70 (35.46)	31.84	27.40	11.11	95.94
Penconazole	0.05	28.14(32.02)	33.32 (35.23)	30.73	30.05	11.71	97.00
Chlorothalonil	0.2	30.36 (33.41)	34.07 (35.67)	32.21	26.55	11.04	94.70
Difenconazole	0.1	26.29(30.80)	31.48(34.11)	28.88	34.28	11.29	99.11
Tapioca	3.0	36.66 (37.24)	40.73 (39.62)	38.69	11.75	8.25	45.50
Behada	3.0	35.92 (36.82)	40.36 (39.40)	38.14	13.05	8.37	47.61
Eucalyptus	3.0	37.03 (37.43)	41.47 (40.09)	39.25	10.51	8.10	42.86
Control	-	41.10 (39.86)	46.66 (43.08)	42.88	-	5.67	-
SE m ±		1.18	1.13				
CD at 5%		3.45	3.31				

* Figures in parenthesis are arcsin values.
** Calculated on the basis of average PDI

Slide germination method

As per concentrations, solutions of different fungicides were prepared. A loopful of spores were added in these solutions which were collected from field. A single drop was pipetted out on series of clean glass coverslips which were later on inverted and placed on the cavity slides in a way that drops remain suspended. The periphery of the cavity was smeared with vaseline to prevent contamination and evaporation of water. After 12 hours, observation for germination were taken and per cent inhibition was calculated. The method was replicated thrice. Formula used was

$$\text{Inhibition percentage} = \frac{C - T}{C} \times 100$$

Where,

C = growth in control

T = growth in treatment

Varietal Resistance

64 varieties (Table 3) were screened for resistance against powdery mildew of pea. Twenty plants of each varieties were grown at the spacing 45 x 15 cm. Disease intensity was recorded on 5 randomly selected plants on leaves per plant at 50% flowering stage of the crop growth under natural epiphytotic condition following the method described earlier.

RESULTS AND DISCUSSION

The results indicated that the application of two sprays with Tridemorph at the interval of 10 days were found most effective for reducing per cent disease (44.23%) and gave higher yield i.e. 11.79 q ha^{-1} followed with Dinocap 11.48 q ha^{-1} (Table 1) Shekhawat *et. al.*, (1981). Maheshwari *et. al.*, (1992) and Upadhyay and Singh (1984) obtained similar results for control of powdery mildew of pea with Tridemorph. Plant extracts were found to be less effective as compared to fungicides. However, among plant extracts, Behada (*Terminalia belerica*) @ 3 per cent had given better control of disease i.e. 13.05 per cent as compared to Tapioca (*Manihot utilissimum*) and Eucalyptus (*Eucelyptus sp*). The finding of Sindhan *et. al.*, (1999) is in line of present investigation.

Differences among the treatments inhibiting the spore germination were significant (Table 2). Minimum spore germination i.e. maximum inhibition was recorded in Trideomorph 0.1% (72.70%), followed by Dinocap 0.1% (67.90%), wettable sulphur 0.3% (61.50%) was also effective in inhibiting the germination and Behada 3% (44.79%) was also effective in inhibiting the spore germination.

It was evident from the result (Table 3) that none, of the varieties of pea was completely resistant to the disease. Out of 64 varieties, only three varieties viz. Rachana, HFP-4 and DMR-7 were moderately resistant to powdery mildew of pea, 46 varieties were susceptible and only one variety viz. Bonnevile was highly susceptible. The present investigation is in conformity with the findings of Khare and Lakhpale (1997) and Kumari and Prasad (1998). Slow mildewing genotypes thus identified can be exploited in resistant breeding programme against this pathogen.

Table 2. Efficacy of fungicides and plant extracts against spore germination (*in vitro*)

Treatments	Concentrations	Mean germination (%)	Per cent inhibition of spore germination over control
Dinocap	0.1	15.50	67.90
Carbendazim	0.1	19.59	59.43
Wett. sulphur	0.3	18.59	61.50
Tridemarph	0.1	13.18	72.70
Fenarimol	0.05	24.09	50.11
Pencomazole	0.05	21.36	55.76
Chlorothalonil	0.2	24.60	49.05
Difenconazole	0.1	20.63	57.27
Tapioca	3.0	28.53	40.91
Behada	3.0	26.66	44.79
Eucalyptus	3.0	30.23	37.39
Control	-	48.29	-
'F' test		Sig	
SE m $\pm$		0.103	
CD at 5%		1.571	

Table 3. Varietal reaction against powdery mildew of pea

Reaction type	Varieties
Highly resistant	-
Resistant	-
Moderately resistant	Rachana, HFP-4 and DMR -7 (3)
Moderately susceptible	T-163, LFP-283, IM-9214-40, HUP-19, HFP-9412, DDR-50, DDR-49, DDR-39, DDR-41, DDR-55, KPM-526, KPMR-497, KPMR-593, KPMR-557, KPMR-551, IPF-98-7, IPF-98-9, IPF-98-1, IPF-98-18, DMR-42, HUDP-17, HUDP-16, HFP-9431, HFP-9510, DMR-569, DMR-583,DMR-39, IPF-27, IPF-14, PM-3, KP-9, NIC-20395, DDFPD-62, KPMR-8, KPMR-171, EC-1, KSP-4, PM-6, ET-45191, HUP-37, KSP-11, KPMR-74, JP-169, KPMR-28, KPMR-151, KPMR-69 (46)
Susceptible	Pomt. - P-11, HUP-2, HFP-9423, HFD-9415, DDR-23, DDR-44, DDR-54, DDR-40, DDR-53, DDR-52, DDR-60, DMR-38, JP-181, K-9. (14)
Highly susceptible	Bonnevile

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Use of Tractor in Agriculture and Non-Agriculture Work Done by Farmers

S.N. Ingle[1], N.A. Gadre[2], D.S. Perke[3], A.A. Bhopale[4] and Kalpana R. Mohod[5]

ABSTRACT

A survey was carried out to study the tractor utilization pattern by farmers in Akola district of Maharashtra state. In all 40 farmers respondents were randomly selected. The data pertained to the year 1999-2000, observed that the tractor was employed for 131.83 days in a year, out of which the extent of work on owners farm and on other farm was 19.64 days (14.90 per cent) and 112.19 days (85.10 per cent) of the total houses, respectively. On an average the tractor was employed for 131.83 days during the year, out of which for agricultural activities it was employed for 128.74 days (97.66 per cent) whereas for non agricultural activities it was employed for 3.09 days only.

Agriculture is the backbone of the Indian economy. Traditionally Indian farmers have been using animal and human power for agricultural activities, which has its own limitations, in terms of multiple cropping and high productivity (Mishra *et.al.*, 1976).

The tractor has capacity to change the tasks as well as the daily routine of farmers. The machine can change the pattern of their work. The adoption of tractors apart from economic consideration, may depends on many other factors such as social and cultural. Tractors are used for agricultual operations, rural transport and in construction industries. Among, the agricultural operation it was mainly used for ploughing, harrowing, levelling, tilling, seed bed preparation, pudling, seed drilling, seed cum fertilizer drill and threshing. The quality of agricultual operations with tractors is also proved better (Balshankari and Salokhe, 1999).

Hence, the present study was conducted with a view to study the utilization pattern of tractors by farmers. This study was conducted with a view to obtain useful information for understanding the practical utility of tractor on agricultural and non-agricultural works.

MATERIAL AND METHODS

The study was conducted in Patur tahsil of Akola district of Maharashtra state. In all five villages Charangaon, Alegaon, Ambashi, Vivra and Sasti in the vicinity of Patur were randomly selected. All the tractor owning cultivators from these villages were selected for the study. A total of 40 farmers were interviewed through personal contact. All the data were collected through structured interview schedule. All the tractor owning cultivators were grouped on the basis of their size of farm holding.

Jakhade and Gadgil (1970) revealed that the working efficiency of tractors, in all, decreases with the increase in the age of tractor. Henceforth, the tractor owned by respondent farmers, were grouped into three categories that is T_1 (New-purchased after 1995), T_2 (Moderatley new- purchased during 1985-1995) and moderately T_3 (old tractor - purchased before 1985).

RESULTS AND DISCUSSION

Study reviewed that use of tractor for agriculture and non-agriculture work during year 1999-2000 of Akola district in Patur Tahsil showed in Table 1.

Data collected from different tractor owned farmers analyse that new tractor (T_1) worked for 134.64 days and 3.95 days, out of which 12.09 per cent share of the work was carried out on owner's farm and 85 per cent on others farm on custom hiring basis in agricultural activities. As far as work on non agricultural activities, it was noticed that the shares of work on owner's farm and on others farm were 1.41 per cent and 1.44 per cent respectively.

It was further noticed that the agricultural and non-agricultural work done by a moderately new tractor (T_2) worked for 126.70 days and 3.11 days in a year, respectively. Out of which 21.76 per cent hire purpose in agricultural activities, respectively.

As regards non agricultural activity, share of work

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Table 1. Use of tractor in agricultural and non-agricultural work in a year

Work done by tractor in a year (in days)

Type of tractors	Agricultural			Non-agricultural			Total		
	Own	Hire	Total	Own	Hire	Total	Own	Hire	Total
T_1	16.76 (12.09)	117.88 (85.06)	134.64 (97.15)	1.95 (1.41)	2.00 (1.44)	3.95 (2.85)	18.71 (13.50)	119.88 (86.50)	138.59 (100.00)
T_2	28.25 (21.76)	98.45 (75.84)	126.70 (97.60)	1.16 (0.89)	1.95 (1.50)	3.11 (2.40)	29.41 (22.66)	100.40 (77.34)	129.81 (100.00)
T_3	6.94 (5.88)	110.14 (93.35)	117.08 (99.23)	0.37 (0.31)	0.54 (0.46)	0.91 (0.77)	7.31 (6.20)	110.68 (93.80)	117.99 (100.00)
Overall	18.24 (13.84)	110.50 (83.82)	128.74 (97.66)	1.40 (1.06)	1.69 (1.28)	3.09 (2.34)	19.64 (14.90)	112.19 (85.10)	131.83 (100.00)

Figures in parenthesis indicate percentage to total on owners and hiring basis was worked out to 0.89 per cent and 1.50 per cent, respectively.

In respect of third group (T_3) i.e. old tractor, the work done for agricultural and non-agricultural work was worked out to 117.08 days and 0.91 days in a year. Out of which 5.88 per cent share on owners farm and 93.35 per cent on custom hiring basis in agricultural activities

On overall basis table further indicate that on an average, tractor was employed for 131.83 of each it was employed for 128.74 days i.e. 97.66 per cent on the agricultural activities where as 3.09 days i.e. 2.34 per cent for non agricultural activities.

CONCLUSION

From above discussion, it can be concluded that agriculture alone can not provide sufficient employment to tractor in a year, because of which the tractor has to be employed for non-agricultural activity.

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Comparative Labour Utilization in Production of Cotton Hybrid Seed and Commercial Hybrid Cotton

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ABSTRACT

The human labour employment assessment for cotton hybrid seed programme and commercial hybrid cotton was carried out mainly with a view to compare the utilization under both the programmes. Data were collected from 60 cotton seed programme growers of variety NHH-44, PKV-2 and H-10 of Yavatmal district of Maharashtra state during the year 1999-2000, revealed that cotton hybrid seed programme consumed 2380.59 human labour days as against commercial hybrid cotton, which accounts to 141.69 days. The extent of excess labour utilization was as high as 1636.38 per cent. Emasculation and pollination, roguing, fertilizer, manures and picking of cotton were the major aspects of labour utilization. Female labour utilization was prominent in cotton hybrid seed programme.

Cotton (*Gossypium* spp) is mainly a cash crop considered as a 'white gold' and generally regarded as king of cultivated crops, contributing major portion of the cultivation income. Cotton has wider adaptability and grown in India from Uttar Pradesh region in the north up to capecamerian region in the south. With the introduction (in the late of 1965) of technological improvements under hybridization programme, various high potentiality hybrid varieties were flooded in Maharashtra state amongst which, hybrid cotton was the prominent one. Subsequent progress in hybrid cotton varieties by the state universities and the private cotton breeding agencies resulted in so many hybrid varieties having improvement in quality and productivity were evolved and commercially launched successfully NHH-44, PKV-2 and H-10. Some of the good quality hybrids evolved recently are amongst them.

Objectives of the study were, to study per hectare labour utilization for (selected hybrids of) cotton seed production and commercial hybrid cotton crop, also to compare the utilization.

MATERIAL AND METHODS

Data in respect of selected varieties under C.H.S. obtained from twenty C.H.S. growers, each of varieties NHH-44, PKV-2 and H-10 from Yavatmal district were considered and compared with the data of commercial hybrid cotton crop from in the vicinity area. The data pertains for the year 1999-2000.

RESULTS AND DISCUSSION

The details of human labours consumed for different operations of cotton hybrid seed programme and commercial hybrid cotton crop are present in Table 1.

It is seen from Table 1 that the cotton hybrid seed programme required 2318.59 human labour days for under taking seed production programme. Whereas, commerial hybrid cotton production consumed only 141.69 human labour days during the year. The cotton hybrid seed production consumed an additional human labour 2176.90 days over commercial hybrid cotton which was as high as 1636.38 per cent.

The emasculation and rouging operations were the main and fertilizer, manures, picking of cotton were the secondary operations for forming a cause of substantial like in the labour utilization in case of cotton hybrid seed programme.

Among different operations carried out for cotton hybrid seed programme and commercial hybrid cotton production, emasculation, pollination and rouging operations are the major part of cotton hybrid seed programme in the human labour utilization accounting 65.33 per cent of the total labour. These operations are not required for growing commercial hybrid cotton production. Intercultural operations, plant protection measures, fertilizer application and picking of cotton were the operations in second rank, the contribution of which ranged between 10.25 per cent to 5.12 per cent in cotton hybrid seed programme.

So far as commercial hybrid cotton production

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Table 1. Statement showing comparative human labour utilization of cotton hybrid seed and commercial hybrid cotton crop

S.N.	Particulars	Cotton hybrid seed production			Commercial cotton			Percentage increase quantity in cotton hybrid seed programme over commercial hybrid cotton crop
		Male	Female	Total human labour	Male	Female	Total human labour	
1.	Preparatory tillage (Ploughing, stubble picking & leveling)	23.30 (12.91)	- -	22.30 (0.96)	15.14 (45.0)	6.46 (5.98)	21.60 (15.24)	0.7 (103.24)
2.	Manuring	8.61 (4.99)	71.77 (3.34)	80.38 (3.49)	1.97 (5.86)	2.02 (1.87)	3.99 (2.82)	76.39 (2014.54)
3.	Sowing	- -	59.12 (2.76)	59.12 (2.55)	3.01 (8.95)	7.1 (6.58)	10.11 (7.14)	49.01 (584.77)
4.	Intercultural operation	60.78 (35.20)	177.12 (8.25)	237.90 (10.25)	4.28 (12.72)	45.09 (41.73)	49.37 (34.84)	188.53 (481.87)
5.	Plant protection	37.80 (21.89)	113.28 (5.28)	151.08 (6.52)	4.42 (13.13)	2.8 (2.59)	7.22 (5.10)	143.86 (2092.52)
6.	Fertilizer application	7.92 (4.59)	114.90 (3.35)	122.82 (5.30)	2.61 (7.76)	2.83 (2.66)	5.49 (3.87)	117.33 (2237.16)
7.	Emasculation & pollination	- -	1491.12 (69.49)	1491.12 (64.31)	- -	- -	- -	- -
8.	Roguing	23.65 (13.70)	- -	23.65 (1.02)	- -	- -	- -	- -
9.	Picking of cotton	- -	118.60 (5.53)	118.60 (5.12)	- -	41.70 (38.59)	41.70 (29.43)	76.90 (284.41)
10.	Transportation	11.62 (6.72)	- -	11.62 (0.50)	2.21 (6.57)	- -	2.21 (1.56)	9.41 (525.79)
	Total	172.68 (100)	2145.91 (100)	2318.59 (100)	33.64 (100)	108.05 (100)	141.69 (100)	2176.90 (1636.38)

was concerned intercultural operations, picking of cotton and preparatory tillage operations consumed major share of human labour, employment having share of 34.84 per cent, 29.43 percent and 15.24 percent respectively.

For both the programme (cotton hybrid seed production and commercial hybrid cotton production), female labour was mainly utilizd for light operations like intercultural operations, plant protection, fertilizer application. In cotton hybrid seed programme the female labour was mainly engaged for emasculation and pollination process which continued for (1491.12 female labour days) longer period.

When all operations viewed comparatively under both the programmes, it is noticed that the increase in the employment of human labour for cotton hybrid programme was significantly higher for almost all operations in which intercultural, plant protection and fertilizer application shared a major part accounting 188.53 days, 143.86 days and 117.33 days, respectively in excess over commercial hybrid cotton production. The corresponding percent changes was worked out to be 2237.16 per cent, 2092.52 per cent, 481.87 per cent, respectivley.

It may be gathered that since cotton hybrid programme is a highly technical programme and needs to be carried out very carefully as per norms and supervision of technical experts. The high consumption of human labour over commercial cotton is justifiable.

CONCLUSION

1. Cotton hybrid seed programme has high potential for human labour employment, specially for female labour
2. In cotton hybrid seed programme emasculation, pollination, rouging and pakcing of cotton, female labour is high potential
3. Cotton hybrid seed programme has significantly higher potential for human labour absorption over commercial cotton crop.

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Effect of Different Levels of Neem Oil on the Performance of Broilers

A.N. Sarag[1], S.P. Pawar[2], D.H. Rekhate[3], G.B. Deshmukh[4] and A.P. Dhok[5]

ABSTRACT

An experiment was carried out to study the effect of neem oil supplementation on the performance of broilers. One hundred eighty broiler chicks were randomly distributed into four treatments of three replications of 15 chicks in each. The treatments were T_1 (control), T_2 (0.25% neem oil), T_3 (0.50 % neem oil) and T_4 (0.75 % neem oil). The diets were maintained isocaloric and isonitrogenous by adding palm oil. The average final body weights at sixth weeks of age were T_1 (1716.44 $\pm$ 31.34 g), T_2 (1747.04 $\pm$ 29.13 g), T_3 (1571.78 $\pm$ 35.18 g) and T_4 (1446.57 + 37.78 g). The body weights gain, average feed consumption and feed efficiency varied significantly ($P < 0.01$). It is concluded that the incorporation of 0.25 per cent neem oil in diet improves the performance of broilers.

Neem oil is a herbal drug containing serveral active ingredients and many pharmaceutical properties and known for curing many diseases and physiological disorders. Neem oil possesses antibacterial, antiviral, antifungal, antihelminthic, antiprotozoal, anti-inflammatory, hepatoprotective, hypoglycemic and other properties without any adverse effects unlike synthetic drugs. It was reported by many researchers that, neem improves growth rate, feed efficiency and control growth of unwanted bacteria in the intestinal tract and helps in growth of beneficial micro flora.

MATERIAL AND METHODS

One-hundred eighty day old broiler chicks were randomly divided into four treatments of three replications of 15 chicks in each and reared up to six weeks on the standard managemental practices. Two different broiler starter and finisher ration were formulated and the neem oil was added in the basal ration at 0.25 per cent T_2, 0.50 per cent T_3 and 0.75 per cent T_4, where as 0.0 per cent T_1 was control without neem oil. The parameters, body weight gain, feed consumption and feed efficiency were recorded and data collected during the experiment were analysed statistically as per (Snedecor and Cochran, 1967).

The body weight gain (Table 1) in treatment T_2 was significantly ($P<0.05$) higher than the other treatment and it was comparable with the control group, however poor performance was recorded in 0.75 per cent neem oil treatment. This suggested that neem oil at 0.25 per cent acts as a growth promoter, however at higher level performance declines. These results are in accordance with those reported by Padalwar (1994), who found growth promoting effect

Table 1. Performance of broilers fed on neem oil supplementation

Parameters	T_1 (control)	T_2 (0.25 % oil)	T_3 (0.50% oil)	T_4 (0.75% oil)
Initial body weights (g)	44.00 $\pm$0.60	44.55 $\pm$0.56	44.00 $\pm$0.51	44.30 $\pm$0.58
Final body weights (g)	1716.44^c $\pm$31.34	1747.04^c $\pm$29.13	1571.18^b $\pm$35.18	1446.57^a $\pm$37.78
Avg. weekly weight gain (g)	281.24^c $\pm$ 9.59	295.07^c $\pm$9.96	261.85^b $\pm$8.90	239.28^a $\pm$10.47
Avg. weekly feed consumption (g)	556.74^b $\pm$70.45	543.65^b $\pm$68.35	550.71^b $\pm$75.58	530.17^a $\pm$78.90
Avg. weekly feed efficiency	2.02^b $\pm$0.16	1.90^b $\pm$0.14	2.10^b $\pm$0.15	2.25^c $\pm$0.13

Common superscripts within the row indicates non significant differences ($P<0.01$)

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of neem leaves powder at 0.1 per cent level than 0.50 per cent level. The increase in body weights at 0.25 per cent neem oil fed group might be due to its antibacterial property as reported by Kher *et. al.*, (1984) and were supported by Chakravarty and Prasad (1991). It may also be due to hepatoprotective and immunomod-ualtory property of neem oil as reproted by Chattopadhyay *et. al.*, (1992) and Upadhyaya *et. al.*, (1993) respectively. The depressed growth in the treatment group with higher level (0.75%) of neem oil corroborates with Reddy *et. al.*, (1988[a]), who found that the growth inhibiting effects of neem oil may be the consequence of severe inhibition of feed intake due to presence of azadirachtin, meliantriol and salanin in neem oil.

The feed consumption and feed efficiency varied significantly ($P<0.05$). The feed consumption in group with 0.75 per cent neem oil was minimum which was in agreement with Reddy *et. al.*, (1988[b]), may be due to the presence of toxic and bitter principles like nimbin, nimbidin in neem oil, which might have affected the palatability of feed. The feed efficiency was found better in diet with 0.25 per cent neem oil.

It was inferred that the incorporation of 0.25 per cent neem oil in the diet improves performance of broilers in terms of body weight gain and feed efficiency.

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Effect of Feed Supplementation of Medicinal Plants *Tinospora cordifolia* and *Leptadenia reticulata* on Performance of Broilers

A.N. Sarag[1], R.S. Khobragade[2], D.H. Rekhate[3] and A.P. Dhok[4]

ABSTRACT

An experiment was conducted to assess the effect of feed supplementaion of medicinal plants powder *Tinospora cordifolia* (Gulvel) and *Leptadenia reticulata* (Jivanti) on performance of broilers. Two hundred and ten, day old brolier chicks were randomly divided into seven treatments of three replications of 10 chicks in each and allotted to dietary treatments as T_2, T_3, T_4, T_5, T_6 and T_7 were 0.5 per cent, 1 per cent *Tinospora cordifolia*, 0.5 per cent, 1 per cent *Leptadenia reticulata*, 0.5 per cent *Tinospora cordifolia* plus 0.5 per cent *Leptadenia reticulata* and 1 per cent *Tinospora cordifolia* plus 1 per cent *Leptadenia reticulata* and T_1 was control. The experiment was carried out for six weeks under standard managemental practices. The average body weights at sixth week of age for T_1,T_2,T_3,T_4,T_5,T_6,T_7, were 1870.00 ± 7.64, 2138.33 ± 16.93, 2195.00 ± 27.54, 2165.00 ± 18.93, 2141.67 ± 54.95, 2145.00 ± 23.63, 2145.00 ± 42.53 g, respectively. The weekly body weight gain showed significant variation and the average weekly feed consumption varied (P<0.01) significantly. The average weekly feed efficiency for the respective treatments were 1.89, 1.72, 1.66, 1.73, 1.72, 1.61 and 1.68. It was concluded that feed supplementation of *Tinospora cordifolia* and *Leptadenia reticulata* has positive effects on body weight gain and feed efficiency in broilers.

The recent restrictions on the use of antibiotics in poultry feed brought up the shift in using herbal products since, synthetic drugs and chemical agents have their inherent disadvantages such as toxicity from prolonged usage, contradiction, development of resistance by pathogens and environmental and health hazards. As an alternative the Ayurvedic plants *Tinospora cordifolia* and *Leptadenia reticulata*, having antistress, hepatoprotective, galactogogue, tonic, antibacterial, immunomodulator and various other properties (Kapil and Sharma, 1997) were supplemented to assess the performance of broilers.

MATERIAL AND METHODS

Two hundred and ten day old broiler chicks were distributed into sevel treatments of three replications of 10 chicks in each and reared up to six weeks under

Table 1. Performance of broilers fed on medicinal plants

Groups	Initial body wt. (g)	Final body wt. (g)	Weekly body wt. (g)	Weekly body wt. gain (g)	Cumulative feed consumptions (g)	FCE
T_1	44.47	1870.00^{a}	817.83^{a}	304.74^{a}	3432.83^{ab}	1.89^{b}
	±0.87	±7.64	±275.46	±66.64	±30.44	±0.19
T_2	44.50	2138.33^{b}	865.08^{b}	350.36^{b}	3679.17^{c}	1.72^{a}
	±1.07	±16.92	±302.83	±75.49	±106.87	±0.17
T_3	42.53	2195.00^{b}	888.88^{cd}	358.74^{b}	3802.50^{c}	1.66^{a}
	±0.47	±27.54	±311.64	±75.21	±31.23	±0.12
T_4	43.73	2165.00^{b}	876.58^{bcd}	353.49^{b}	3825.83^{c}	1.73^{a}
	±0.37	±18.95	±307.70	±75.10	±59.47	±0.17
T_5	41.66	2141.67^{b}	898.83^{e}	353.89^{b}	3774.17^{c}	1.72^{a}
	±1.97	±54.95	±312.85	±73.55	±21.86	±0.17
T_6	41.80	2145.00^{b}	875.09^{bcd}	350.53^{b}	3397.50^{a}	1.61^{a}
	±0.64	±42.53	±305.58	±72.95	±162.58	±0.09
T_7	41.53	2114.29^{b}	865.52^{bc}	350.58^{b}	3627.50^{c}	1.68^{a}
	±2.90	±41.40	±302.02	±72.95	±55.07	±0.15

Common superscripts within the column indicates non significant differences (P<0.01)

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standard managemental practices. The dietary treatments comprised as T2, T3,T4, T5, T6 and T7 were 0.5%, 1% *Tinospora cordifolia*, 0.5%, 1% *Leptadenia reticulata*; 0.5% *Tinospora cordifolia* plus 0.5% *Leptadenia reticulata* and 1% *Tinospora cordifolia* plus 1% *Leptadenia reticulata*, while T_1 was kept as control. The sun dried roots of medicinal plants *Tinospora cordifolia* and *Leptadenia reticulata* were added over the control diet after grinding. The parameters studied were weekly body weight gain, weekly feed consumption and weekly feed efficiency. The data collected during the experiment were analysed as per (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

The body weights gain were significantly ($P<0.01$) higher in T_3 where as lowest in control group (Table 1). The body weights gain were in accordance with the findings of Ishwar and Mohsin (1981[a]) who studied the effect of herbal propertory preparation Leptaden (vet) containing *Leptadenia reticulata* @ 0.25-3.00 gm/kg feed and are in agreement with Jadhav *et al.*, (1994), who fed Morolac (vet) in broilers diet. The body weights gain in T_3 (1% Tinospora cordifolia) were also in agreement with the results of Sud (1982), who reported the significant improvement in weight gain and growth rate on feeding of Liv - 52, a herbal preparation containing *Tinospora cordifolia*, due to improve appetite, digestion, absorption and anabolic effect of herbal drug (Ali *et. al.*, 1994). The increase in the body weights of the broilers in the present study may be attributed to improved metabolic efficiency as a result of hepatoprotective activity of *Tinospora cordifolia* Singh *et al.*, (1984), indicating positive effects of hergal feed supplement of medicinal plants alone or in combination. The feed supplementation at 0.5% level of both the medicinal plants in terms of feed consumption and feed efficiency were found to be superior over other treatments and corroborates with the results of Prajapati (1997). It was therefore concluded that the feed supplementation of medicinal plants *Tinospora cordifolia* and *Leptadenia reticulata* has positvie effects on body weight gain and feed efficiency in broilers.

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RESEARCH NOTES

Estimation of Genetic Parameters Through Generation Mean Analysis in Okra

Generation mean analysis is a simple but useful technique for characterising gene effects for a polygenic character (Hayman, 1958; Jink, and Jones, 1958; Gamble, 1962). The merit of generation mean analysis lies in the estimate of epistatic gene effect viz. additive x additive (i) , additive x dominance (j) and dominance x dominance (1) . The inheritance of yield and six important yield traits was therefore studied using generation mean analysis involving six elite purelines of Okra.

Four diverse cultivars of Okra viz. KS-404, Parbhani Kranti (PK), Punjab -7 (p-7) and Bo-1 were crossed with two testers Arka Ahamika and pusa Sawani in a line x tester fashion. A trial consists of 8 F1 S, 8 F2 S, 8 B1S and 8 B2 S alongwith 6 parents were grown in a randomized block design with three replications at the Vegetable Research Farm, Department of Horticulture, Institute of Agricultural Sciences, B.H.U., Varanasi (U.P.). Each plot of the parents and F1 S had three rows each with ten plants while those of F2S and back crosses had eight and

Table 1. Estimates of gene effects based on analysis of generation means for six characters in okra

Cross	m	d	h	i	j	l	Type of epistasis
			Number of pods plant^{-1}				
KS-404 x Arka Anamika	8.73**	0.97	-0.98	-1.93	1.88**	7.43*	D
Parbhani Kranti x Pusa Sawani	8.77*	1.07	8.87**	6.53**	0.53	-11.73**	D
P-7 x Arka Anamika	9.13**	1.29*	2.37	0.19	2.50**	3.27	C
P-7 x Pusa Sawani	8.77**	1.00*	4.77**	2.13	0.70	-3.93	D
BO-1 x Arka Anamika	7.77*	1.57*	1.08	0.60	2.88**	3.30	C
BO-1 x Pusa Sawani	7.63**	0.43	-0.82	-1.93	0.55	4.96	D
			Length of pod				
KS-404 x Arka Anamika	13.17**	-0.03	-1.33	-1.00	0.53	3.19	D
KS-404 x Pusa Sawani	12.90**	-0.10	1.17	-0.19	-1.17**	-1.27	D
Parbhani Kranti x Arka Anamika	13.47**	0.87	2.19	1.59	1.07	-3.33	D
P-7 x Arka Anamika	13.17**	0.27	-0.58	-0.80	0.58	2.63	D
P-7 x Pusa Sawani	12.67**	0.13	1.92*	0.67	-1.08**	-3.17	D
BO-1 x Arka Anamika	11.27**	-0.50	1.62	2.07	0.78	-0.17	D
			Girth of pod				
KS-404 x Arka Anamika	1.72**	0.06**	-0.04	-0.07	0.05*	0.19	D
Parbhani Kranti x Arka Anamika	1.71**	0.06	0.03	0.01	0.10*	0.15	C
Parbhani Kranti x Pusa Sawani	1.70**	-0.03	-0.03	-0.08	-0.08*	0.15	D
P-7 x Pusa Sawani	1.72**	0.01	0.14	-0.25**	-0.04	0.42**	C
BO-1 x Pusa Sawani	1.80**	0.03	0.12*	0.01	-0.08	-0.14	D
			Number of seeds pod^{-1}				
KS-404 x Arka Anamika	39.30**	2.87*	8.53	13.07**	4.87*	-6.93	D
KS-404 x Pusa Sawani	42.56**	5.43**	-1.08	1.53	4.52	-3.30	C
Parbhani Kranti x Arka Anamika	40.03**	2.97	8.32	8.20*	8.88**	-6.37	D
BO-1 x Pusa Sawani	41.86**	2.60*	-15.27*	-6.27	-4.99**	27.47**	D

Table cont.....

			1000 seed weight				
KS-404 x Arka Anamika	60.37**	2.23	17.37**	12.07**	2.13	-13.13	D
P-7 x Arka Anamika	60.33**	-1.50	4.89	3.67	-4.60*	13.27	D
			Pod yield plant^{-1}				
KS-404 x Arka Anamika	138.33**	14.33	-31.83	-53.99*	28.50**	154.33**	D
KS-404 x Pusa Sawani	124.67**	-2.67	37.00	0.01	-22.00**	9.99**	C
Parbhani Kranti x Arka Anamika	132.03**	9.33	84.67**	65.33**	28.99**	-77.33*	D
Parbhani Kranti x Pusa Sawani	124.33**	12.00	90.67**	57.33**	-6.00	-118.67**	D
P-7 x Arka Anamika	120.00**	25.67**	17.33	-0.67	51.00**	69.33**	C
P-7 x Pusa Sawani	113.00**	3.33	105.67**	81.33**	-2.33	-190.00**	D
BO-1 x Arka Anamika	120.00**	8.33	21.99	16.67	27.33**	37.33	C

*, ** Significant at P = 0.05 and P = 0.01 respectively
D - Duplicate, C - Complementary

five rows, respectively with a inter-row and intra-row spacing of 45 cmx 30 cm. Data were recorded on the 10 plants per plot of the parents and F1s, fifteen plants from each B1 and B2 and forty plants from each F2 in each replication for six quantitative characters like number of pods^{-1} plant, length of pod, girth of pod, number of seeds^{-1} pod, 1000 seed weight and pod yield^{-1} plant. Mather's scaling test was used to identify the interacting crosses (Mather, 1949). The gene effects in the interacting crosses were estimated using the six parameter model of Hayman (1958).

Results revealed that the scaling test indicated six, six, six, five, two and seven crosses to be interacting for number of pods^{-1} plant, length of pod, girth of pod, number of seeds^{-1} pod, 1000 seed weight and pod yield^{-1} plant respectively, while the estimates of epistatic components were significant in four, two, four, three, tow and seven crosses (Table 1). It is thus obvious that the scaling test of Mather (1949) tends to over estimate the number of interacting crosses.

The estimates of gene effects showed that the additive ' d ' gene effects were the most important contributor to the inheritance of number of pods^{-1}plant and number of seeds^{-1} pod. on the other hand, dominance ' h' gene effect was predominant for pod yield^{-1} plant. Among the epistatic interactions, additive x additive ' l ' effect was more pronounced for pod yield^{-1} plant, whereas additive x dominance 'j' effect was important for length of pod, girth of pod and 1000 seed weight. In the presence of epistasis, especially of the complementary type, the additive component is often relatively under estimated, while the dominance effects tends to be over-estimated (Pathak and Singh, (1970). Therefore, it is likely that the additive gene effects were more prominent in these crosses as it is evident from the present study.

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Response of Premonsoon Hybrid Cotton to Moisture Regimes and Plant Densities Under Drip Irrigation

Cotton occupy 32% cropped area of Vidarbha. However, its productivity is quite low (100 kg lint ha^{-1}) as it is grown as a rainfed cro with inadequate fertilization. Productivity can be enhanced by premonsoon sowing and proper irrigation scheduling (Bharad and Pandhare, 1974). With this object the present study was conducted at Department of Agronomy, Dr. PDKV, Akola during 1998-99.

The experiment was arranged in factorial RBD with nine treatments replicated thrice. Treatments consisted of combinations of three irrigation regimes (irrigation's 0.4, 0.6 ad 0.8 ETC) and three plant densities (17,778, 11,850 and 8889 plants ha^{-1}). The experimental plot soil was clay loam having 34.82 and 15.63% moisture at -1/3 and -15 bar tension, respectively with a BD of 1.29 Mgm^{-3}. Hybrid cotton (AHH-468) was dibbled sown on 5th June, 1998 at 75:150 cm inter row distances (Paired planting) and inter row distances of 50 cm (17,778 plants), 75 cm (11,850 plants) and 100 cm (8889 plants). The crop was raised with recommended practices. Laterals were spread in between two rows and emitters of 4, 2+4 and 4+4 LPH were fitted, per two plants, to adjust moisture regimes of 0.4, 0.6 ad 0.8 ETC, respectively. Irrigations were started at 50% depletion of ASM in root zone depth and scheduling was done as per treatments, on alternate days. In all these picking were taken.

Scheduling irrigation's at 0.8 ETC yielded (Table 1) sifnificantly highest. Similarly irrigation's at 0.6 ETC yielded significantly more than 0.4 ETC. Number of monopodial and sympodial branches, picked bolls and seed cotton yield per plant were significantly highest in the treatment of 0.8 ETC which might have resulted in boosting the yield. Similar findings were reported by Khade *et.al.*, (1998). Moisture regimes had no influence on ginning percentage. Consumption of water by the crop has consistently increased by increasing quantum of water supplied. However reverse trend was noticed in case of water use efficiency although not significantly.

Successive decrease in plant densities from 17778 to 8889 plants ha^{-1} has significantly enhanced the number of monopodial and sympodial branches and picked bolls per plant. Seed cotton yield per plant was highest with 8889 plants ha^{-1} but the difference between 17778 and 11850 and between 11850 and 8889 plants ha^{-1} were not significant. Due to enhancement in the yield attributes, significantly highest seed cotton yield was recorded with 8889 plants ha^{-1}. This confirm the findings of Singh and Warsi (1985). The differences in seed cotton yield per hectare due to varied plant densities were although significant but not spectacular. Varied plant densities had no effect on ginning percentage. Consumptive use and water use efficiency were more or less same in all the plant densities.

Table 1. Growth, yield, quality and water use of cotton as influenced by moisture regimes and plant density

S.N.	Treatments	Moisture regimes			Plant densities			CD
	Characters	0.4	0.6	0.8	17778	11850	8889	(P=0.05)
1.	Monopodial branches plant^{-1}	3.85	4.48	5.56	4.24	4.55	5.01	0.13
2.	Sympodial branches plant^{-1}	33.06	35.54	38.71	35.00	35.56	37.75	0.34
3.	Picked bolls plant^{-1}	66.43	67.10	67.60	66.83	67.03	67.26	0.17
4.	Seed cotton yield plant^{-1} (g)	176.22	181.50	195.73	181.16	183.83	188.45	5.21
5.	Seed cotton yield q ha^{-1}	17.73	19.20	20.20	18.66	19.06	19.40	0.12
6.	Ginning percentage	35.18	35.11	35.25	32.25	35.14	35.21	NS
7.	Consumptive use (mm)	874.52	1062.13	1234.53	1056.41	1054.33	1060.43	-
8.	WUE kg ha mm^{-1}	2.02	1.81	1.63	1.78	1.83	1.85	-

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Quantitative Estimation of Gossypol in the Seeds of Cotton Varieties Developed by Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola(M.S.)

Feeding of cotton seed or cotton seed cake to milking animals and bullocks is an age old practice in Vidarbha region of Maharashtra state where cotton cultivation is extensively undertaken. Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola has evolved many varieties of cotton, some of which are pest resistant and therefore high yielding. One of the important factors which makes the cotton crop pest resistant is the higher concentration of a polyphenolic compound-Gossypol-in the various parts of the plant, including the seeds (Bell *et. al.*, 1975). The present samples of cotton seeds or cotton seed cake for animal feeding originates from the high yielding cotton varieties which have been extensively adopted for cultivation. Considering the fact that Gossypol which is toxic to the insects, may prove toxic to the livestock also, the present investigation was undertaken to estimate the Gossypol content quantitatively (Free and Total) in the cotton seeds of different varieties to decide the toxic potential of these varieties in livestock feeding.

The free and total Gossypol content in 15 cotton seeds varieties (Table 1) evolved by Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola was determined by UV Spectrophotometrically as per the standard method (Botsoglou and Kufidis, 1990, Botsoglou, 1991). The bound gossypol content was estimated by substracting the free Gossypol content from the total Gossypol content. The standard pure Gossypol was obtained from M/s. Sigma Chemicals, USA.

Out of 15 varieties tested, free Gossypol conent was not detected in 6 varieties, whereas, in remaining 9 varieties the free Gossypol content ranged between 19.76 ppm to 544.9 ppm. The total Gossypol content in all 15 varieties ranged between 6333 to 26137 ppm. The highest content of total Gossypol was present in the variety AKC-9701 (26137 ppm) and lowest was in the variety AKH-053 (6333 ppm) (Table 1).

Table 1. Estimated free, bound and total gossypol content (ppm) in the seeds of different varieties of cotton evolved at Dr. PDKV, Akola 1975-1995

S.N.	Name of the varieties	Free	Bound	Total
1	AKH-4	44.90	20555.10	20600.00
2.	DHY-286	19.76	21630.24	21650.00
3.	AKA-5	31.40	18118.60	18150.00
4.	AKA-8401	44.01	18905.99	18950.00
5.	AKH-081	-	11400.00	11400.00
6.	AKA-7	32.30	11247.70	11280.00
7.	AKH-545	25.00	23525.00	23550.00
8.	AKH-053	-	6333.33	6333.33
9.	CAHH-98	-	8828.80	8828.00
10.	PKV-Rajat	-	10771.00	10771.00
11.	AKC-9701	25.00	26112.00	26137.00
12.	AKC-9702	-	11080.00	11080.00
13.	AKC-9703	22.30	21877.70	21900.00
14.	AKDH-7	41.75	19058.25	19100.00
15.	AKH-8828	-	16150.00	16150.00

The values presented in the Table 1 indicated that out of 15 varieties tested, the total Gossypol content was below 10000 ppm in 2 varieties (AKH-053 and CAHH-98), between 10000 to 15000 ppm in 4 varieties (AKH-081, AKA-7, PKV Rajat and AKC-9702), between 15000 to 20000 ppm in 4 varieties (AKA-5, AKA-8401, AKDH-7 and AKH-8828) and above 20000 ppm in 5 varieties (AKH-4, DHY-286, AKH-545, AKC-9701 and AKC-9703).

The present findings could not be compared with any other investigation as Gossypol estimation in these varieties has not been attempted earlier. This investigation suggests that the feeding of seeds of cotton varities containing more than 15000 ppm of Gossypol are likely to develop toxicity in livestock. Further research in this regard is contemplated.

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Efficacy of Some Organophosphates in Combination with Neem Seed Against *Helicoverpa armigera* (Hubner)

Due to servere damage caused by *Helicoverpa armigera* (Hubner) Hardwick (Noctuidae : Lepidoptera), to assumed a status of most serious pest in the recent years. Amongst, several alternatives available for management of *H. armigera,* the neem (*Azadirachta indica* A Juss) has been observed very useful for this purpose (Dubey *et. al.*, 1991; Thakur *et. al.*, 1992; Sarode *et.al.*, 1993). The effectiveness of neem seed extract 5 per cent in combination with half dose of recommended insecticides has also been found very promising against cotton bollworms (Sarode *et.al.*, 1995) and pigeonpea pod borer, *H. armigera* (Sachan and Katti, 1993). However, the information on their performances in terms of their toxicity against *H. armigera* is lacking under laboratory condition and hence the present investigation on "Efficacy of some organophosphates in combination with neem seed extract against *H. armigera* (Hubner)" was undertaken.

The experiment was conducted in the laboratory of Department of Agricultural Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the year 2000-2001. The insecticides viz. quinalphos 20 AF, chlorpyriphos 20 EC and aqueous extract of neem seed, constituted as based for the different treatments.

The concentrations of insecticides i.e. quinalphos and chlorpyriphos each at 0.05 per cent and neem seed extract at 5 per cent (full dose) were used as per the recommendations of the Government of Maharashtra (Anonymous, 1998).

The combinations of insecticides with NSE full and half dose were prepared by taking full and half doses of each insecticide. These combinations were tested against early third instar larvae of *H. armigera* through the contact and stomach actions. For contact action, batch of ten larvae of late second instar (30-40 mg) stage of *H. armigera* was taken in a petridish and sprayed directly with one ml. solution of each treatment under Potter's tower at pressure of 25 pounds mercury per square inch. The petridish containing the insects was dried for five minutes. While doing so, utmost care was taken to avoid cannibalism. Later these treated larvae were transferred individually in plastic vials containing artificial diet. All the treatments including untreated control were replicated thrice. In stomach action, the fresh food (leaves of chickpea) were dipped in the insecticide solution and allowed it to dry for five minutes under fan. Then these treated leaves, were transferred into each plastic vial for feeding of insect having one larvae in each vial. Ten larvae for each treatment were taken and the treatments were replicated thrice. The observations were recorded on mortality counts of insect upto 72 hrs. at an interval of 24 hrs. The percentage mortality of larvae in each treatment was worked out and subjected to statistical analysis for interpretation of data.

Mortality data of H. armigera due to different treatment combinations as well as individual treatments are presented in Table 1. All the combination treatments of quinalphos and chlorpyriphos with NSE were proved statistically significant in their effectiveness over their individual treatment in both the sets i.e. contact and stomach actions.

The full dose of quinalphos (0.05%) and chlorpyriphos (0.05%) with full dose of NSE (5%) proved most effective in causing the mortality of larvae of *H. armigera* to the extent of 60.00 and 56.66 per cent, respectively due to contact action. This treatment was followed by the next effective treatments of half dose of quinalphos and chlorpyriphos (each 0.025%) + full dose of NSE (5%). The full dose of quinalphos and chlorpyriphos + half dose of NSE i.e. 2.5 per ent causing the mortality of 43.33 and 40.00 per cent, respectivley. Whereas, the treatment of quinalphos and chlorpyriphos at half doses with half dose of NSE did not perform better as these treatments could not record more than 40.00 per cent larval mortality in contact action, but were found statistically equal to the full doses of the respective insecticidal treatments in recording the mortality.

In stomach action, the full dose of quinalphos and chlorpyriphos with full dose of NSE also proved most effective by recording 83.33 and 80.00 per cent larval mortality of *H. armigera*, respectively. The next effective treatments were half dose of quinalphos and chlorpyriphos with full doses of NSE. These results clearly show that the mixture can be effective even insecticides are used at their half doses with full dose of NSE. The combinations of quinalphos and chlorpyriphos at thgeir half doses with half dose of NSE were statistically at par with their individual

Table 1. Mortality of H. armigera due to combination of organophosphates with neem seed extract (NSE)

S.N.	Doses of combinations	Quinalphos (20 AF)		Chlorpyriphos (20 EC)	
		Contact	Stomach	Contact	Stomach
1.	Full dose of insecticides (0.05%) + NSE full dose (5%)	60.00 (50.77)*	83.33 (66.14)*	56.66 (48.84)*	80.00 (63.93)*
2.	1/2 dose insecticide (0.025%) + NSE full dose (5%)	50.00 (45.00)	76.66 (61.22)	50.00 (44.91)	73.33 (59.00)
3.	Full dose of insecticide (0.05%) + NSE 1/2 dose (2.5%)	43.33 (41.15)	53.33 (47.00)	40.00 (39.23)	50.00 (45.00)
4.	1/2 dose insecticides (0.025%) + NSE 1/2 dose (2.5%)	40.00 (39.23)	50.00 (45.00)	33.33 (35.21)	40.00 (39.14)
5.	Full dose of insecticides (0.025%)	36.66 (37.22)	50.00 (45.00)	30.00 (33.00)	33.33 (35.21)
6.	NSE full dose (5%)	3.33 (6.16)	3.33 (6.16)	3.33 (6.16)	3.33 (6.16)
7.	Control	0.00 (0.025)	0.00 (0.025)	0.00 (0.025)	0.00 (0.025)
	F test	Sig	Sig	Sig	Sig
	SE m±	2.546	3.766	3.646	3.536
	CD at 5%	7.567	11.191	10.833	10.507
	CV%	14.063	17.251	20.300	17.254

* Transformed aresine values

treatments. These results are in comformity with the observations of Lande and Sarode (1993) and Gore (2000) who reported 36.66 to 40.00 per cent larval mortality at recommended dose of quinalphos 0.05 per cent and not observed good response against *H. armigera*. Sarode *et.al.*, (2000) recorded the higher kills of *H. armigera* larvae, due to combination of NSE 5 per cent with half dose quinalphos and as much as 88.88 per cent mortality of the insect was noticed in the laboratory condition. Similar reports in respect of the results of chlorpyriphos with neem was also noticed by Sarode (1995) who reported that the combination of half dose of recommended chlorpyriphos (0.025 %) with neem seed extract was the most effective treatment over others in managing the incidence of *H. armigera* on crops like cotton and pigeonpea. All these reports do confirm the present findings.

On the basis of present findings on toxicity performance of mixture of these two organophosphates with NSE have shown better efficacy through stomach action than contact action against *H. armigera* and quinalphos had slight edge over the chlorpyriphos in causing the mortality.

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