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Full Research Article

Correlation of Seed and Seedling Characters with Yield of Sunflower (*Helianthus annuus* L.) Hybrids

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Abstract

The experiment was conducted at Oilseeds Research Unit and at Seed Testing Research Unit, Dr. PDKV, Akola, Maharashtra, India during *kharif* 2012, to study the correlation of seed and seedling characters with yield of sunflower hybrids. The experiment consisted of eight sunflower hybrids and was laid out in randomized block design with three replications. The character association revealed that the seed characters viz., kernel to hull ratio (0.986), % seed kernel (0.984), volume weight (0.783) and hundred seed weight (0.741) showed highly significant positive correlation with yield plant^{-1}, indicating that yield of sunflower hybrids could be increase by increase in these seed characters. The seed characters like % seed hull (-0.949) and electrical conductivity of seed leachate (-0.407) recorded significant negative correlation with yield plant^{-1}, indicating, decrease in these characters will results in increase in yield. All the seedling characters studied viz., % germination (0.976), root length (0.986), shoot length (0.729), seedling vigour index (0.966) and seedling dry weight (0.841) shown highly significant positive correlation with seed yield plant^{-1} indicating the vital role of these characters towards corresponding gain in yield of sunflower hybrids. The sunflower hybrids shown high value of desirable seed and seedling characters also yielded higher, this may be due to high germination and early vigour of these hybrids. Thus, more emphasis should be given on seed and seedling characters, as an early indicator of yield performance and seed and seedling characters may be used as selection criteria for identification of high yielding sunflower hybrid.

1. Introduction

Sunflower (*Helianthus annuus* L.) was originated in the south western United States-Mexico area (Heifer, 1955). It was introduced in India in 1970 for commercial cultivation. In world trade with an annual production around 9 millions tones, sunflower oil is the fourth important vegetable oil. Russian Federation, Ukraine, India and Argentina contribute more than 50% with respect to world acreage of sunflower crop. (Vollmann and Rajcan, 2009).

Sunflower, despite its superiority in all aspects among oilseeds, has not attained its target productivity. Poor quality of seed is one of the important factors responsible for low productivity of sunflower in India. Improvement in the productivity largely depends on the direction and magnitude of association between yield component and seed quality traits. Correlation coefficient measures mutual relationship between various seed and plant traits and determines the component character on which the selection can be based. Hence, an understanding of degree of association with seed yield and inter-relationship among themselves is essential to bring an improvement in crop productivity (Uttam et al., 2006). Hence, the present investigation was carried out to determine the association of yield of sunflower hybrids with seed and seedling characters.

2. Materials and Methods

The seed (F_0) of eight sunflower hybrids, PKVSH-27, DRSH-1, SH-3322, LSFH-171, PKVSH-952, PKVSH-953, PKVSH-954 and PKVSH-955 was obtained from Oilseeds Research Unit, Dr. PDKV, Akola.. Analysis of variance was done by adopting the model given by Singh and Chaudhary (1977) and Correlation coefficients were calculated between seed and seedling characters with yield of sunflower hybrids following the method of Panse and Sukhatme (1967). The same seed material is also used to carry out field experiment. The experiment was carried out at Oilseeds Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India during kharif 26 July 2012-13 in Randomized Block Design with three replications having net plot size of 1.8×2.4 m. A spacing between 60 cm between rows and 30 cm between plants within a row was maitained. The observations of seed (hundred seed weight, % seed kernel, % seed hull, kernel to hull ratio, volume weight, oil content of seed and electrical conductivity of seed leachate) and seedling characters (% germination, root length, shoot length, seedling vigour index and seedling dry weight) were recorded as per ISTA standards (ISTA, 1999) at Seed Testing Laboratory, Oilseeds Research Unit, Dr. PDKV, Akola, whereas yield plant^{-1} was recorded from field .experiment.

3. Results and Discussion

The analysis of variance for the various characters under study has been presented in Table 1. The ANOVA revealed highly significant differences among the hybrids for all the seed and seedling characters studied and also for yield plant^{-1}. This indicates the presence of substantial genetic variability for these characters. Among the hybrids studied, the hybrid PKVSH-952 recorded highest hundred seed weight (5.49 g), % seed kernel (77.70), kernel to hull ratio (3.49), germination (88.0%), seedling dry weight (253.3 mg) and seed yield plant^{-1} (72.67 g). The hybrid PKVSH-952 also recorded more desirable values for % seed hull (22.30), volume weight of seed (43.48 gm 100 ml^{-1}), electrical conductivity of seed leachate (0.66 μS cm^{-1} g^{-1}), root length (15.40 cm), shoot length (17.87 cm) and seedling vigour index (2928), whereas the hybrid SH-3322 recorded highest (39.61 %) oil content (Table 2).

Table 1: Analysis of variance for various characters in sunflower

Sources of variation		Replic-ations	Treat-ments	Error
Degrees of freedom		2	7	14
Seed Characters				
1	Hundred seed weight (g)	0.02	2.16**	0.02
2	% Seed kernel	3.86	36.22**	7.12
3	% Seed hull	2.43	34.40**	1.36
4	Kernel to hull ratio	0.03	0.70**	0.03
5	Volume weight (gm 100 ml^{-1})	1.46	25.91**	1.08
6	Oil content of seed (%)	0.08	10.35**	0.42
7	Electrical conductivity of seed leachate (μS cm^{-1} g^{-1})	0.03	0.20**	0.02
Seedling Characters				
8	% Germination	13.23	92.96**	10.22
9	Root length (cm)	0.41	2.02**	0.70
10	Shoot length (cm)	2.12	3.68*	1.41
11	Seedling vigour Index	4531.63	273678.45**	34742.86
12	Seedling dry weight (mg)	3950.00	4285.12**	626.19
13	Yield plant^{-1} (g)	130.33	281.90**	62.50

*significant at p=0.05 and **significant at p=0.01.

The genotypic and phenotypic correlations were computed to understand the nature and magnitude of association among the characters studied. It was observed that genotypic correlations were higher in magnitude than the phenotypic correlations. So the results are presented here considering genotypic correlations.

The correlations of seed characters with yield plant^{-1} and correlations among seed characters are presented in Table 3. The seed characters, kernel to hull ratio (0.986), % seed kernel (0.984), volume weight (0.783) and hundred seed weight (0.741) shown highly significant correlations in positive direction with yield plant^{-1}, indicating that yield could be increase by increase in these seed characters. Punia and Gill (1994) evaluated 63 genotypes and reported that seed yield plant^{-1} was significantly correlated with 100 seed weight in sunflower. Doddamani et al. (1997) evaluated 47 genotypes of sunflower and revealed that 100 seed weight and plant height had significant positive correlation with seed yield. Nehru and Manjunath (2003) revealed that hundred seed weight showed significant positive correlation with yield in sunflower. Sharnkumar (2006) studied seed characters of F_1 hybrid seeds and reported highly significant positive correlation of hundred seed weight and kernel to hull ratio with commercial kernel yield in sunflower.

The seed characters, % seed hull (-0.949) and electrical conductivity of seed leachate (-0.407) shown significant correlation with yield plant^{-1} in negative direction, indicating that decrease in these characters will results in increase in seed yield. Uttam et al. (2006) also reported that the seed yield was significantly associated with electrical conductivity of seed leachate in negative direction.

Correlation among seed characters indicate significant positive correlation between hundred seed weight, % seed kernel, kernel to hull ratio and volume weight. Sharnkumar (2006) studied seed characters of F_1 hybrid seeds of sunflower and reported highly significant positive correlation among hundred seed weight and kernel to hull ratio. The significant negative correlation of % seed hull with hundred seed weight (-0.639), % seed kernel (-0.973), kernel to hull ratio (-0.995) and volume weight (-0.472) was observed. Oil content was positively assocoated with % seed kernel (0.581) and kernel to hull ratio (0.554) were as shows negative correlation with % seed hull (-0.639). Giriraj et al. (1979) studied 362 elite progeny lines and the results indicated that seed weight, % seed kernel and kernel to hull ratio were positively associated with oil content in sunflower.

The correlations of seedling characters with yield plant^{-1} and correlations among seedling characters are presented in Table 4. All the seedling characters studied *viz.*, % germination (0.976), root length (0.986), shoot length (0.729), seedling vigour index (0.966) and seedling dry weight (0.841) shown highly significant positive correlation with seed yield plant^{-1} indicating the vital role of these characters towards corresponding gain in yield of sunflower hybrids. The sunflower hybrids shown high value of seedling characters also yielded higher, this may be due to high germination and early vigour of these hybrids. Thus, more emphasis should be given on seedling characters, as an early indicator of yield performance. Thus, seedling characters may be used as a selection criterion for identification of high yielding sunflower hybrid. Similar observations were reported by Herrera (1987), who have noticed decreased grain yield with decrease in germination and seed density in rice. Chaudhary and Anand (1985) reported the positive and significant correlation between kernel yield and seedling fresh and dry weight in sunflower. Sharnkumar (2006) also reported highly significant correlation in positive direction of

Table 2: Variability studies on seed and seedling characters in sunflower hybrids

	Seed characters							Seedling characters					
A	B	C	D	E	F	G	H	I	J	K	L	M	N
PKVSH-27	4.40	71.88	28.12	2.56	39.47	37.23	0.96	80.33	13.83	16.60	2444	206.7	45.64
DRSH-1	4.63	77.57	22.43	3.46	44.49	38.10	1.41	85.00	14.60	16.37	2634	246.7	56.88
SH-3322	4.28	72.67	27.33	2.66	37.27	39.61	0.88	80.00	14.17	15.33	2359	206.7	46.49
LSFH-171	5.01	70.02	29.98	2.34	45.43	34.79	1.16	86.00	13.70	17.15	2654	190.0	52.31
PKVSH-952	5.49	77.70	22.30	3.49	43.48	36.85	0.66	88.00	15.40	17.87	2928	253.3	72.67
PKVSH-953	3.89	74.47	25.53	2.92	41.83	37.17	0.62	89.3	15.60	18.70	3059	246.7	57.67
PKVSH-954	3.47	75.75	28.06	2.71	41.31	35.80	0.84	84.33	14.70	18.20	2778	163.3	53.42
PKVSH-955	2.83	68.12	31.88	2.15	38.33	33.74	1.04	72.00	13.27	16.53	2145	156.7	41.26
Mean	4.25	73.52	26.95	2.79	41.45	36.66	0.95	83.12	14.41	17.09	2625	208.8	53.29
SEm+	0.09	1.54	0.67	0.10	0.60	0.37	0.07	1.85	0.48	0.69	108	14.4	4.56
CD (p=0.05)	0.28	4.67	2.05	0.32	1.82	1.13	0.22	5.60	1.47	2.07	326	43.8	13.84

A: Sunflower Hybrids; B: Hundred seed weight (g); C: Seed kernel (%); D: Seed hull (%); E: Kernel to hull ratio; F: Volume weight (gm 100ml-1); G: Oil content of seed (%); H: Electrical conductivity of seed leachate (µS cm-1 g-1); I: Germination (%); J: Root length (cm); K: Shoot length (cm); L: Seedling vigour index; M: Seedling dry weight (mg); N: Yield plant-1 (g)

Table 3: Genotypic and Phenotypic Correlation coefficient (r) between seed characters and yield plant-1 in sunflower

Source		Hundred seed weight (g)	% Seed kernel	% Seed hull	Kernel to hull ratio	Volume weight (g 100ml^{-1})	Oil content of seed (%)	Electrical conductivity of seed leachate (µS cm^{-1} g^{-1})	Yield plant^{-1} (g)
		1	2	3	4	5	6	7	8
Hundred seed weight (g)	G		0.531**	-0.639**	0.603**	0.638**	0.387	0.037	0.741**
	P		0.349	-0.567**	0.527**	0.561**	0.362	0.029	0.591**
% Seed kernel	G			-0.973**	0.971**	0.487*	0.581**	-0.239	0.984**
	P			-0.863**	0.912**	0.347	0.468*	-0.084	0.783*
% Seed hull	G				-0.995**	-0.472*	-0.636**	0.121	-0.949**
	P				-0.984**	-0.400	-0.592**	0.097	-0.732**
Kernel to hull ratio	G					0.499*	0.554**	-0.100	0.986**
	P					0.423*	0.524**	-0.057	0.727**
Volume Weight (g 100 ml^{-1})	G						-0.199	0.309	0.783**
	P						-0.160	0.244	0.670**
Oil content of Seed (%)	G							-0.100	0.221
	P							-0.086	0.142
Electrical conductivity of seed leachate (µS cm^{-1} g^{-1})	G								-0.407*
	P								-0.295

G: Genotypic correlation coefficient; P: Phenotypic correlation coefficient; *significant at p=0.05 and **significant at p=0.01

Table 4: Genotypic and Phenotypic Correlation coefficient (r) between seedling characters and yield plant-1 in sunflower

Source		% Germination	Root length (cm)	Shoot length (cm)	Seedling vigour index	Seedling dry weight (mg)	Seed yield plant^{-1} (g)
		1	2	3	4	5	6
% Germination	G		0.986**	0.735**	0.975**	0.838**	0.976**
	P		0.732**	0.635**	0.904**	0.669**	0.784**
Root length (cm)	G			0.934**	0.989**	0.987**	0.986**
	P			0.851**	0.832**	0.796**	0.790**
Shoot length (cm)	G				0.872**	0.180	0.729**
	P				0.794**	0.168	0.616**
Seedling vigour index	G					0.739**	0.966**
	P					0.634**	0.839**
Seedling dry weight (mg)	G						0.841**
							0.767**

G: Genotypic correlation coefficient; P: Phenotypic correlation coefficient; *significant at p=0.05 and **significant at p=0.01.

root length, shoot length and seedling vigour with commercial kernel yield of sunflower hybrid.

Correlation among seedling characters shown that, all the seedling characters were highly correlated in positive direction with each other except shoot length with seedling dry weight, which shows non significant correlation.

4. Conclusion

In the present investigation, the hybrid PKVSH-952 recorded highest (72.67 g) yield plant^{-1}. High yield plant^{-1} of PKVSH-952 was attributed mainly due to maximum values of desirable seed and seedling characters and significant positive correlation of these characters with yield in sunflower. Hence, it is suggested that seed and seedling characters must necessarily be given proper weightage during sunflower improvement programme.

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Socio-Economic Impact Assessment of Integrated Crop Management in Chilli Growing Areas in Telangana, India

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Abstract

The present study was on Socio-economic impact assessment of integrated crop management in chilli growing areas, which was conducted in Warangal and Kammam districts, the major chilli producing areas in Telangana. For the study, 30 ICM, 30 IPM and 30 Non- IPM farmers were randomly selected from two districts. Education and farm size were positively related to the adoption of ICM or IPM practices, similarly, the area under chilli was also positively related with the total size of land holding. The cost of cultivation of ICM, IPM and Non IPM farmers in Gudepally village was ₹ 259188.98, ₹ 249834.39 and ₹ 243611.11 hectare^{-1}, respectively. Whereas the same in Damaracherla village was ₹ 237196.15, ₹ 233786.73 and ₹ 224430.04 respectively. The gross returns hectare^{-1} of chilli cultivation for ICM, IPM and Non-IPM farmers were ₹ 463145.24, ₹ 456886.11 and ₹ 318600 respectively in Gudepally village. Whereas, in case of Damaracherla village the same were ₹ 413472.22, ₹ 408100.00 and ₹ 342450.00 hectare^{-1}, respectively. Return on investment for ICM, IPM and Non-IPM farmers were 1.79, 1.83 and 1.31 respectively in Gudepally village. While the same in case of Damaracherla village was 1.74, 1.75 and 1.53 respectively for ICM, IPM and Non-IPM farmers. The overall analysis of the study revealed a positive impact of adoption of ICM and IPM technologies in chilli cultivation in association with ITC. Development of suitable farm machinery and equipment and provision of the same to the needy farmers at affordable prices. The state agricultural department should take initiatives, extension activities and trainings for promotion of the ICM or IPM technologies.

1. Introduction

India is the largest producer, consumer and exporter of chilli, which contributes to about 40% of total world production, followed by China and Pakistan. It is estimated that India produced 1378400 tonnes of chillies from an area of 787530 hectares in 2012-13 (Spice Board of India, 2014). During 2013-14, a total of 8,17,250 tons of spices and spice products valued Rs.13735.39 crore (US$2267.67 Million) has been exported from the country (Spice Board of India, 2014). Integrated Crop Management (ICM) is a pragmatic approach to the production of crops, which combine a range of complementary methods to reduce a pest population below its economic injury level while minimising impacts on other components of the agro-ecosystem, thus taking into account the needs of producers, wider society and the environment (Kogan, 1998). IPM is the integral part of ICM. Insect pests are well recognized as one of the major limiting factors in enhancing and sustaining agricultural production in India. India loses about 30% of its crops every year due to pests and diseases (Sharma and Rao, 2012). The production losses have shown an increasing trend over the years. In 1983, the losses due to insect pests were estimated worth Rs 6,000 crores (Rao and Murthy, 1983) which increased to Rs 20,000 crores in 1993 (Jayaraj, 1993) and to 29,000 crores in 1996 (Dhaliwal and Arora, 1996). Recent interactions with the farming communities revealed that 93% of the farmers in India had adopted chemical control. Majority of the farmers (73%) initiate the plant protection based on the first appearance of the pest, irrespective of their population, crop stage, and their damage relationships. The cost of plant protection on various crops ranged from 7 to 40% of the total crop production cost (Rao and Rao, 2010). It is adopted mainly in Cotton, Chilli, Plantation crops, Rice and Pulses.

Indian Tobacco Company (ITC) shares a century long relationship with the farming community reaching directly to the farm gate, linking the farming community to the global business circuits and international best practices. ITC's foray into the spices business, through its Agri Business Division-International Limited (ABD-ILTD). Spices Crop Development Programme of ITC Limited has transformed from a limited Integrated Pest Management (IPM) approach to sustainable crop production practices, which is called Integrated Crop Management (ICM). The main objective of the study is to study the socio-economic impact assessment of integrated crop management in chilli growing areas in Telangana.

2. Material and Methods

Two villages from two districts i.e., Gudepally village from Warangal district and Damaracherla village from Khammam district were purposively selected wherein the ITC's Integrated Crop Management practices [crop rotations, appropriate cultivation techniques, careful choice of seed varieties, minimum reliance on artificial inputs such as fertilisers, pesticides and fossil fuels, maintenance of the landscape, social aspects and the enhancement of wildlife habitats] are largely adopted by chilli growing farmers, with the sample size of 90 (30 farmers adopting ICM, 30 farmers adopting IPM but not ICM and 30 farmers neither adopting IPM nor ICM) were randomly selected. The necessary observations were socio-economic aspects of sample farmers, such as family size and composition, education level, land holdings, income, source of irrigation, farm machinery and equipment, livestock or animal husbandry etc. The details pertaining to chilli cultivation namely the total cost of production and marketing which was broadly categorized into production cost, post harvest management cost and marketing cost.

Which were collected through pre tested schedules and secondary data from Revenue Office or Mandal Revenue Office, Regional Agricultural Research Station Warangal and the office of ITC. Analysis of the collected data was done by working out simple averages, % and partial budgeting technique.

3. Results and Discussion

The total literacy of the ICM, IPM and Non-IPM farmers was 86.66, 93.33 and 73.33% respectively presented in Table 1. The % of illiterate sample farmers was comparatively more than the other two groups i.e., ICM and IPM. It could be concluded that the level of education will have a significant role in ready adoption of innovative agricultural practices by the farmers.

Among the ICM, IPM and Non- IPM sample farmers, 46.67, 40 and 33.33% of the farmers were in the age group of 31- 40 years. Majority of the ICM farmers i.e., 56.67% had small size of family, 76.67% of IPM and 73.33% of the Non-IPM famers had small size family, indicating the spread of nuclear and small family culture even in rural areas and reduced availability of farm family labour (Table 1).

The average size of holding of ICM, IPM and Non IPM farmers was 4.4, 4.6 and 2.54 ha respectively were presented in the Table 1. The study has found a positive relationship between farm size and adoption of ICM or IPM practices. The results are comparable with the results of Singh et al. (2008). The average area under chilli cultivation was 1.51, 1.74 and 0.91 ha for ICM, IPM, Non IPM chilli farmers respectively. On an average about one third of the total land holding of all three category farmers was under chilli cultivation. The area under chilli was also positively related with the total size of land holding.

It is evident from Table 1 that the sample farm households show maximum preference to hold bullocks (31.90%). This was followed by buffaloes (23.59%) and sheep and goat (21.72%). The number livestock holded by ICM and IPM farmers was more than the Non-IPM farmers.

On an average in all three groups of sample farm families, there was one male and one female labour available for farm work irrespective of the size of the holding (Table 1). This indirectly indicates the increasing scope for farm mechanization in future.

The average total cost of cultivation hectare^{-1} of chilli was ₹ 259188.98, ₹ 249834.39 and ₹ 243611.11 respectively under ICM, IPM and Non-IPM farms in Gudepally village. Whereas the same in Damaracherla village was ₹ 237196.15, ₹ 233786.73 and ₹ 224430.04 respectively. A significant difference between ICM and Non-IPM was observed mainly because ICM farmers incurred more variable cost particularly on human labour than Non-IPM farmers. This is because ICM or IPM farmers have higher awareness on minimum standards of cleanliness. These observations are comparable with the results of Reddy et al. (2011) and similar results were also reported by Rao et al. (2007).

The average yield of ICM, IPM and Non IPM farms in Gudepally village was 65.67, 65.17 and 49.83 q ha^{-1}. Where as, in Damaracherla the average yield was 51.67, 51.50 and 48.23 q ha^{-1} respectively. The gross returns hectare^{-1} of chilli cultivation for ICM, IPM and Non-IPM farmers were ₹ 463145.24, ₹ 456886.11 and ₹ 318600 respectively in Gudepally village. Whereas, in case of Damaracherla village the same were ₹ 413472.22, ₹ 408100.00 and ₹ 342450.00 hectare^{-1}, respectively. The returns from the ICM and IPM sample farms was significantly higher than the Non IPM farmers, because the ICM and IPM farmers realized more yields and received maximum price to their produce by ITC.

Return on investment for ICM, IPM and Non-IPM farmers were 1.79, 1.83 and 1.31 respectively in Gudepally village. While the same in case of Damaracherla village was 1.74, 1.75 and 1.53 respectively for ICM, IPM and Non-IPM farmers. These results were similar with the findings of Reddy et al. (2011) and Pawar (1995).

The estimated net change in profit due to adoption of ICM and IPM techniques worked out using partial budgeting technique was found to be significantly higher. The net change in the profit obtained by the ICM farmers in Gudepally village was observed to be ₹ 132729.5 hectare^{-1} due to adoption of ICM practices in their farms as against the practices adopted by the Non-IPM farmers. The same in case of ICM farmers of Damaracherla village was found to be ₹ 61029.17 hectare^{-1}. The net change in profit gained by IPM farmers in Gudepally village was ₹132926.1 hectare^{-1} due to adoption of IPM practices. The same in case of IPM farmers of Damaracherla village was found to be ₹ 59411.99 hectare^{-1}.

3.1. Overall economics of chilli production and marketing

In abstract, the overall economics of chilli production and marketing by ICM, IPM and Non-IPM farmers in Gudepally village was furnished in Table 2 (Figure 1).

The total cost of production and marketing was broadly categorized into production cost, post harvest management cost and marketing cost. The share of production cost was maximum (>90%) in all the three farm categories. This was followed by post harvest management cost and marketing cost in case of ICM and IPM farms. Whereas, the same was followed by marketing cost (8.52%) and post harvest management cost (1.47%) in Non-IPM farms. These results once again clearly indicated that the ICM and IPM farmers who were tied with ITC benefited more by realizing higher yields, reduced cost of marketing and a higher premium price received for their produce when compared to the Non-IPM farmers.

The economics of chilli production and marketing by ICM, IPM and Non-IPM farms in Damaracherla village is presented in Table 3 and Figure 2. Similar to the farms of Gudepally

Table 1: Social characteristics

Sl. No.		Particulars	Respondents		
			ICM	IPM	Non-IPM
1		Illiteracy (%)	86.66	93.33	73.33
2		Age Group (Years)			
	a	20-30	0 (0.00)	3 (10.00)	5 (16.67)
	b	31-40	14 (46.67)	12 (40.00)	10 (33.33)
	c	41-50	7 (23.33)	8 (26.67)	8 (26.67)
	d	50 above	9 (30.00)	7 (23.33)	7 (23.33)
3		Family size (Number)			
	a	Small (<4)	17 (56.67)	23 (76.67)	22 (73.33)
	b	Medium (4-5)	12 (40.00)	7 (23.33)	8 (26.67)
4		Size of land holdings (Hectare)			
	a	Marginal (<1ha)	0 (0.00)	1 (3.33)	4 (13.33)
	b	Small (1-2 ha)	2 (6.67)	1 (3.33)	7 (23.33)
	c	Medium (2-4 ha)	14 (46.67)	11 (36.67)	14 (46.67)
	d	Large (4-10 ha)	14 (46.67)	17 (56.67)	5 (16.67)
	e	Average land holding (ha)	4.4	4.6	2.54
5		Acreage under Chilli			
	a	Absolute area (ha)	1.51	1.74	0.91
	b	% to average size of holding	34.32	37.83	35.83
6		Livestock population (Number)			
	a	Buffaloes	27 (20.93)	23 (18.70)	38 (31.40)
	b	Bullock	52 (40.31)	52 (42.28)	15 (12.40)
	c	Sheep or Goat	1 (0.78)	30 (24.39)	50 (41.32)
7		Average availability of family labour household^{-1} (Number)			
	a	Men	1.23	1.20	1.20
	b	Women	1.20	1.10	1.30

Note: Figures in parenthesis are %ages to their respective total