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HOMAGE



The Editorial Advisory Board and members of Editorial Board deeply mourn the sad and untimely demise of Dr. V.B Bhanumurthy, Formerly Dean of P.G studies and Editor, Journal of Research, ANGRAU. His contribution in improving the Quality of Journal, its periodicity of publication and in it's style of presentation is noteworthy. He was meticulous in going through the draft and suggesting the ways and means of presentation are worth mentioning. The Editorial Board prays to God to rest his soul in peace and give sufficient strength to his family members in this hour of crisis.

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EFFECT OF CROP COVER ON SOIL ENZYME ACTIVITY

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ABSTRACT

A pot culture experiment was conducted on a Vertisol in the greenhouse of Department of Soil Science and Agricultural Chemistry, College of Agriculture, Rajendranagar, Hyderabad, to study the influence of crop cover on soil enzyme activity. The experiment was undertaken with two cereals – sorghum and maize, two oil seeds – groundnut and sesame, two vegetables – bhendi and spinach and two pulses - green gram and black gram. The experiment was conducted using crops as treatments in Completely Randomized Block design with three replications along with the uncropped control. The results obtained with regard to the effect of these crops soil enzyme activity showed that there was an increase in enzyme activity with age of the crop and it varied with plant species grown. The increase in urease activity (expressed as μg of NH^+ released $\text{g}^{-1}\text{soil h}^{-1}$) ranged from 2.89 to 17.6 in groundnut, 2.72 to 17.11 in black gram, 2.56 to 16.92 in green gram, 2.67 to 16.5 in sesame, 2.43 to 15.89 in maize, 2.46 to 15.72 in sorghum, 2.31 to 15.32 in bhendi and 2.59 to 14.15 in spinach for Vertisol. The activity of urease, acid and alkaline phosphatase in Soil I, II, III and IV under different crop coverages followed the order groundnut > black gram > green gram > sesame > maize > sorghum > bhendi > spinach. The presence of plants and the type of plants grown on a soil have shown a marked effect on enzyme activities.

The presence of crops and the type of crops grown on a soil have a marked effect on its enzyme activities. The effect is either direct or indirect. The direct contribution is by way of plant enzymes. In addition to endoenzymes contained in plant residues, extracellular enzymes secreted by living roots make a significant contribution to the total activity. The indirect effect is caused by many factors, basically, however, changes in enzyme activities are related to changes in soil organic matter content and microbial population brought about by the plants (Srinivas, 1993). Mummey *et al.* (2002) suggested that crop cover plays an important role in establishing heterogeneity and regulating ecological processes. The crops contribute to soil heterogeneity by their effects on soil moisture, aeration, pH etc., and by the litter distribution. All these factors can affect enzyme synthesis in microbes and enzyme survival outside the microbial cells. The amount of research on the effect of crop cover and the stage of crop on soil enzyme activity is scanty. Hence the present study was undertaken to study the effect of crop cover and stage of crop growth on soil urease, acid and alkaline phosphatase activity.

MATERIALS AND METHODS

A pot culture experiment was conducted in the greenhouse of Department of Soil Science and Agricultural Chemistry, College of Agriculture, Rajendranagar, Hyderabad during the year 2011 on a Vertisol from College Farm, College of Agriculture, Rajendranagar. The experiment was undertaken with two cereals – sorghum and maize, two oilseeds – groundnut and sesame, two vegetables – bhendi and spinach and two pulses - greengram and blackgram. The experiment was conducted using crops as treatments in Completely Randomized Block design with three replications along with the uncropped control. The crops received recommended agricultural practices during crop growth. The initial soil samples were taken on the date of sowing and subsequent samples were collected at fifteen days interval till harvest. The effect of crop cover and stage of crop growth on urease (Tabatabai and Bremner, 1972) acid phosphatase (Tabatabai and Bremner 1969) and alkaline phosphatase (Eivazi and Tabatabai 1977) activity were studied.

RESULTS AND DISCUSSION

The results obtained with regard to the effect of crop cover and stage of crop growth on urease

activity for soil I are presented in Table 1. Urease activity (expressed as μg of NH_4^+ released $\text{g}^{-1}\text{soil h}^{-1}$) in soils collected under these different crops varied with the crops grown. Enzyme activity in soil increased with plant age up to 60 days after sowing (DAS). The increase ranged from 2.89 to 17.61 in groundnut, 2.72 to 17.11 in black gram, 2.56 to 16.92 in green gram, 2.67 to 16.5 in sesame, 2.43 to 15.89 in maize, 2.46 to 15.72 in sorghum, 2.31 to 15.32 in bhendi and 2.59 to 14.15 in spinach. The increase in soil enzyme activity with age of the crop varied with the plant species grown. The urease enzyme activity of the soils under different crop coverages followed the order groundnut > blackgram > greengram > sesame > maize > sorghum > bhendi > spinach.

The acid phosphatase activities (expressed as μg of 4-nitrophenol released $\text{g}^{-1}\text{soil h}^{-1}$), acid phosphatase value for groundnut ranged from 16.93 to 66.84, black gram from 16.65 to 64.22, green gram from 16.12 to 62.83, sesame from 15.89 to 60.91, maize from 15.56 to 50.41, sorghum from 15.25 to 49.24, bhendi from 15.12 to 46.82 and spinach from 14.89 to 45.31 and are presented in Table 2. Enzyme activity of the soils under different crop coverages

followed the same order as that for urease. For all the plant species grown, the soil acid phosphatase activity increased with age of the crop. For the growth period from 0 to 120 DAS, the acid phosphatase activity was found to be significantly higher than their corresponding controls for all the crop plants.

A close perusal of data indicated that the value of alkaline phosphatase (expressed as μg of 4-nitrophenol released $\text{g}^{-1}\text{soil h}^{-1}$) in uncropped control ranged from 30.52 to 37.99 in Soil I. The activity increased sharply up to 60 days after transplanting and thereafter declined gradually to 0 day level for all the cropped pots. The highest alkaline phosphatase activity was found under groundnut cover which ranged from 32.96 to 120.67 followed by black gram that ranged from 31.57 to 117.53, green gram from 31.39 to 110.32, sesame from 30.84 to 106.89, maize from 30.91 to 100.92, sorghum from 30.24 to 100.56, bhendi from 30.05 to 99.87 and spinach from 30.59 to 98.32 (Table 3). These results are in conformity with the trends reported in literature by various workers (Dinesh *et al.*, 2004; Kumar *et al.*, 2007 and Batra, 2004).

Table 1. Effect of Plant Cover on soil urease (μg of NH_4^+ released $\text{g}^{-1}\text{soil h}^{-1}$)

Treatments	Days after sowing								Mean
	0	15	30	45	60	75	90	105	
Control	2.57	2.89	3.21	3.49	4.67	3.56	3.02	2.85	3.28
Groundnut	2.89	5.92	11.04	15.92	17.61	14.24	8.91	3.21	9.97
Black Gram	2.72	5.63	10.89	15.07	17.11	13.31	8.35	2.98	9.51
Green Gram	2.56	5.21	10.56	14.78	16.92	13.02	7.99	2.75	9.22
Sesame	2.67	4.99	10.01	14.59	16.45	13.51	7.28	2.47	9.00
Maize	2.43	4.32	9.78	14.03	15.89	12.89	7.06	2.32	8.59
Sorghum	2.46	4.2	9.45	13.99	15.92	12.07	6.97	2.44	8.44
Bhindi	2.31	3.89	8.77	13.56	15.32	11.51	6.45	2.65	8.06
Spinach	2.59	3.73	8.51	13.21	14.15	11.06	5.34	2.62	7.65
Mean	2.58	4.53	9.14	13.18	14.89	11.69	6.82	2.70	8.19

Analysis of Variance	C.D at 5%	SEm \pm
Plant Cover	0.117	0.041
Days after Sowing	0.111	0.039
Plant Cover x Days after Sowing	0.332	0.117

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Table 2. Effect of Plant Cover on soil acid phosphatase (μg of 4-nitrophenol released $\text{g}^{-1}\text{soil h}^{-1}$)

Treatments	Days after sowing							
	0	15	30	45	60	75	90	105
Control	12.34	14.71	16.23	16.9	18.41	19.32	17.14	14.25
Groudnut	16.51	25.23	34.14	51.59	45.69	38.84	25.07	17.91
Black Gram	15.84	22.71	32.49	49.67	41.53	34.15	22.65	16.87
Green Gram	14.97	20.25	30.17	44.53	39.19	28.54	20.21	15.02
Sesame	14.41	21.14	30.09	43.09	37.18	28.04	21.83	14.51
Maize	14.02	20.03	30.84	40.14	33.15	25.89	19.84	14.63
Sorghum	13.69	17.51	28.23	35.29	30.47	24.91	18.82	13.94
Bhindi	13.37	17.03	26.14	33.93	30.07	22.97	18.75	13.56
Spinach	12.84	15.45	24.56	30.57	28.18	20.46	14.39	12.89
Mean	14.22	19.34	28.10	38.41	33.76	27.01	19.86	14.84

Analysis of Variance	C.D at 5%	SEm \pm
Plant Cover	0.003	0.001
Days after Sowing	0.002	0.001
Plant Cover x Days after Sowing	0.007	0.003

Table 3. Effect of Plant Cover on soil alkaline phosphatase (μg of 4-nitrophenol released $\text{g}^{-1}\text{soil h}^{-1}$)

Treatments	Days after sowing							
	0	15	30	45	60	75	90	105
Control	30.52	32.56	34.98	35.61	37.99	35.09	34.89	32.99
Groudnut	32.96	45.96	59.97	79.99	120.67	100.32	63.92	40.91
Black Gram	31.57	44.92	58.78	75.65	117.53	92.73	62.87	39.24
Green Gram	31.39	44.53	58.65	74.77	110.32	89.87	60.51	39.07
Sesame	30.84	42.97	57.97	72.69	106.89	88.93	59.84	38.53
Maize	30.91	42.07	55.89	72.91	100.92	78.73	59.32	38.05
Sorghum	30.24	41.99	54.99	70.82	100.56	78.07	58.85	35.32
Bhindi	30.05	41.53	53.89	70.21	99.87	76.32	58.74	35.09
Spinach	30.59	40.98	50.95	69.98	98.32	73.93	57.91	30.01
Mean	31.01	41.95	54.01	69.18	99.23	79.33	57.43	36.58

Analysis of Variance	C.D at 5%	SEm \pm
Plant Cover	0.019	0.007
Days after Sowing	0.018	0.006
Plant Cover x Days after Sowing	0.053	0.019

All the enzymes studied including urease, phosphatase were significantly activated to different degrees in cropped sites than control, reflecting the response of greater organic matter input to soil, which increased carbon turn over and nutrient availability. All the enzymes increased in proportion to the rate of crop residue addition especially with inclusion of legumes in the system due to N substrates in the crop residues.

In a study conducted by Dinesh *et al.* (2004) the phosphomonoesterase activity ranged from 12.5 to 14.9 $\mu\text{mol P-nitrophenol g}^{-1} \text{h}^{-1}$ under cover crops and 7.3 $\mu\text{mol P-nitrophenol g}^{-1} \text{h}^{-1}$ (42 to 51%) in control. The activities of urease were significantly lower (41 to 44%) in control than the respective activity in cover cropped sites. Leguminous plants have the potential for biological nitrogen fixation and this could have stimulated the increased activity of enzymes (urease and phosphatase) involved in nitrogen cycle. Cropping significantly increase the activity of acid and alkaline phosphatase in the soil compared to their activity in soils of fallow lands. Higher alkaline phosphatase activity was reported for legumes than under cereals (Kumar *et al.*, 2007).

Similar findings were also reported by Srinivas *et al.* (2000), that the activity of acid and alkaline phosphatase exhibited significant variations due to differences in plant species and their growth stages. The activities were higher in soils having groundnut and cowpea followed by gingelly, maize and greengram. A significant increase in the activities of both the enzymes was observed from 0 to 45 DAS in all crops and subsequent decrease approaching

to initial levels at harvest. In a study conducted by Balezentiene and Klimas (2003) the legume grass mixtures formed an even cover over the soil during the year of sowing and hence improved the agro-chemical and micro-biological properties of the soil. The grasses form better conditions for organic matter decomposition and hence, urease and saccharase activities were found to be highest in the grass grown soils compared to other crops. In the study, higher dehydrogenase activity under pearl millet – wheat cropping system was because of higher root/shoot ratio for Pearl Millet crop that might have caused greater amount of carbon input and root exudation to the soil (Batra, 2004).

Soil enzyme activities commonly correlate with microbial parameters and have been shown to be a sensitive index of long-term management effects such as crop rotations, animal and green manures and tillage (Dora and Domuta, 2007). They showed that green-manuring of maize led to a significant increase in enzymatic activities. This is because addition of mineralisable organic residues provides substrates for these enzymes and enhances microbial growth (Tiwari *et al.*, 2008). Highest alkaline phosphatase activity was found in forest lands and lowest levels in cultivated soils (Kizilkaya and Dengiz, 2010). It is found that the organic matter content is positively correlated with soil enzyme activities. Higher enzyme activity under cover crops is due to repeated incorporation of organic residues and subsequent stimulation of microbial biomass, enhanced humus content, accumulation/stabilization of organic matter, abundance of carbohydrates coupled with greater microbial activities.

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OCCURRENCE AND DISTRIBUTION OF SUNFLOWER NECROSIS VIRUS DISEASE IN MAJOR SUNFLOWER GROWING AREAS OF ANDHRA PRADSH

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ABSTRACT

Survey was conducted in major sunflower growing areas of Anantapur, Kurnool, Mahabubnagar (*kharif* season) and Nizamabad district (*rabi* season) during 2009-10 and 2010-11 and revealed overall average incidence of 4.66 per cent of sunflower necrosis virus disease during two consecutive seasons with higher incidence in Mahabubnagar (5.34 per cent) followed by Anantapur (4.66 per cent), Kurnool (4.64 per cent) and Nizamabad (3.97 per cent) districts. None of the cultivars (Sunbred- 275, GK-2002, SH-177, SH- 3322, Jwalamukhi, Kaveri- 618, Leader, Advanta- 8699, 64-S-99 and P- Gold) grown in these areas were free from the disease. Occurrence of thrips fauna was recorded in all sunflower growing areas of four districts surveyed. Population of thrips was comparatively higher in Mahabubnagar (4.48 thrips /plant) followed by Anantapur (3.85 thrips/plant). Four species, viz., *Frankliniella schultzei* (Trybom), *Scirtothrips dorsalis* (Hood), *Thrips palmi* (Karny) and *Megalurothrips usitatus* (Bagnall) were identified in the present study. Among them, *T. palmi* was found to be more prevalent in all the areas surveyed.

Andhra Pradesh being the second largest sunflower producing state after Karnataka, occupies an area of 3.51 lakh ha with a production of 2.69 lakh tonnes and productivity of 771 kg ha⁻¹. In Andhra Pradesh, the crop is mainly cultivated in Kurnool (141,000 ha), Anantapur (55,000 ha), Kadapa (54,000 ha), Mahabubnagar (24,000 ha), Prakasham (24,000 ha) and Nizamabad (16,000 ha) districts (Andhra Pradesh Agricultural Statistics at a Glance, 2010).

Sunflower Necrosis Virus Disease (SNVD) is one of the destructive diseases occurring in almost all the hybrids and open pollinated varieties of sunflower. In Andhra Pradesh, SNVD has been reported to occur in almost all the popular sunflower hybrids grown during *kharif*, *rabi* and summer seasons with varied intensity. The disease could cause crop losses to an extent of 100 per cent depending on the cultivar /variety and stage of infection and has become a major limiting factor in sunflower production (Chander Rao *et al.*, 2002). As per DOR Annual Report (1999), SNVD incidence ranged from 30-80 per cent. Fortnightly survey conducted during 2003- 04 in Narkhoda, Kavvaguda and Chevella villages of Ranga Reddy district of A.P. indicated maximum incidence of SNVD during October (38 per cent) and highest average thrips population during March (16.3 thrips/head) in sunflower (Upendhar, 2004).

Information on occurrence and distribution of SNVD including prevalence of thrips fauna is inadequate with special reference to predominant sunflower growing regions of Andhra Pradesh. Keeping these points in view, survey was carried out to assess the natural occurrence of SNVD and thrips vector associated.

MATERIALS AND METHODS

Survey was undertaken in farmers' fields for the incidence of SNVD in major sunflower growing areas of Anantapur, Kurnool and Mahabubnagar districts during 2009-10 and 2010-11 *kharif* seasons, while in Nizamabad district during *rabi* seasons. In each district, three mandals were selected based on the area under cultivation and in each mandal, five fields were selected. In each field, one square metre area in each of the four corners leaving border rows and another square metre area at the centre was selected to record the incidence of sunflower necrosis disease (Arunkumar *et al.*, 2006). Per cent disease incidence was calculated by using the following formula

$$\text{Per cent Disease Incidence (PDI)} = \frac{\text{Number of plants infected}}{\text{Total number of plants}} \times 100$$

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Survey for thrips population was conducted during 2009-10 and 2010-11 *kharif / rabi* season in the same fields selected for recording incidence of SNVD. Monitoring of thrips was done during vegetative to flower head formation stage in sunflower cultivars grown in different districts. For recording thrips population, a total number of 5 terminals/ flower heads were selected at random from each field and the plant was bent aside carefully and tapped gently using white paper. The dislodged thrips on the white paper were counted and recorded location-wise. Later the thrips were transferred to glass vials containing 70 per cent alcohol for identification based on the keys given by Amin and Palmer (1985) and Palmer *et al.*, (1989).

RESULTS AND DISCUSSION

A total of 164 fields (81 in 2009 and 83 in 2010) surveyed spread over 87 villages in four districts revealed wide spread occurrence of SNVD in the crop (Table 1). Different types of symptoms *viz.*, chlorotic spots, mosaic, necrosis of leaves, necrosis of stem and bracts, deformation of stem and flowers and stunting of plants were observed in the fields surveyed. Disease incidence ranged from 0 to 13 per cent, being maximum (6.58 per cent) in Mahabubnagar and minimum in Nizamabad (3.90 per cent) during 2009-10. Anantapur recorded comparatively higher disease incidence (5.30 per cent), whereas, in Nizamabad it was 4.05 per cent during 2010-11.

Sunflower hybrids *viz.*, Sunbred - 275 (Syngenta), GK- 2002 (Ganga Kaveri), Jwalamukhi (Pro Agro), Leader (Kaveri), SH-3322 (Cargill), 64-S-99 (Pioneer), SH-177 (Pioneer), A-8699 (Advanta), P- gold (Paras) and K-618 (Kaveri) were popular in the areas surveyed. Of the eleven sunflower hybrids encountered to grown in different districts surveyed, the incidence of SNVD ranged from 2.9 to 5.75 per cent in Sunbred-275 across the seasons and locations surveyed in Anantapur, Mahabubnagar, Kurnool and Nizamabad districts of A.P. ; whereas, it ranged from 4.20 to 7.0 per cent in GK- 2002 in Anantapur, Mahabubnagar and Kurnool districts (Table 1). Sunflower Hybrid, P-Gold recorded highest disease incidence (7.20 per cent) followed by GK-2002 (6.55 per cent) in Mahabubnagar during 2009-10. Details of sunflower necrosis disease incidence recorded are furnished hereunder district wise (Table 2).

Mandal- wise mean SNVD incidence in Anantapur district during *kharif* 2009-10 ranged from 1.50 in Peddavadam mandal to 5.33 per cent in Yadki mandal. While, Peddoddi village of Gooty mandal recorded least 0.5 per cent disease incidence as against 10.5 per cent incidence in Yerragudi village of Gooty mandal. During *kharif* 2010-11, mean SNVD incidence was highest (5.5 per cent) in Tadpatri mandal and lowest (5.0 per cent) in Yadki mandal. Disease incidence ranged from 0-7.5 per cent in Veerapalli and Kishtipadu villages of Peddavadam mandal, respectively.

In Kurnool district, maximum disease incidence (6.33 per cent) was observed in Kallur mandal and minimum (2.33 per cent) in Atmakur mandal during *kharif*, 2009-10. Of the 22 fields surveyed during 2009-10, the per cent disease incidence ranged from 0.5 per cent (Krishnapuram village of Atmakur mandal) to 10.5 per cent (Bollavaram village of Kallur mandal). The incidence of SNVD during *kharif*, 2010-11 was in the range of 0 per cent (Vempanta village, Atmakur mandal) to 10 per cent (Doralapadu village, Kallur mandal). Perusal of mandal-wise mean SNVD incidence ranged from 3.16 per cent (Atmakur mandal) to 7.75 per cent (Kallur mandal).

In Mahabubnagar district, the incidence of sunflower necrosis disease was in the range of 0-13 per cent with an overall average of 6.58 per cent during *kharif*, 2009-10. Maximum incidence was noticed in Chinna Chintakunta mandal (8.12 per cent) and minimum at Devarakadra mandal (4.25 per cent). During *kharif*, 2010-11, the disease incidence ranged from 0-10 per cent, with overall average of 4.15 per cent of the 3 mandals surveyed. The incidence was least (2.14 per cent) in Kalvakurti mandal, while it was highest (6.2 per cent) in C. Chintakunta mandal.

In Nizamabad district, sunflower hybrids Sunbred-275, 64-S-99, Jwalamukhi, and SH-3322 constituted major area in different mandals of the district. Mandal-wise mean incidence of sunflower necrosis disease during *rabi*, 2009-10, ranged between 3.6 per cent (Nandipet) to 4.2 per cent (Balkonda). The per cent disease incidence was lowest (2.0 per cent) in Rangerla, Kammarapally mandal as against 6.5 per cent in Bodepally village of Balkonda mandal. During *rabi*, 2010-11, mandal-wise mean per cent

Table. 1. Incidence of sunflower necrosis disease in different districts of Andhra Pradesh during Kharif, 2009-10 and 2010-11

Districts	Year	mandals	villages	No. of fields surveyed	Per cent disease incidence		Per cent disease incidence in major cultivars		
					Range	Average	Cultivar	Range	Average
Anantapur	2009-10	3	11	20	0-11	4.03	Kaveri - 618 S-275 SH-177	6-7 0-8 0-1	6.50 2.90 0.50
	2010-11	3	11	22	0-10	5.30	S-275 SH-177 SH-3322 GK 2002	0-9 4-8 4-7 5-9	3.50 5.60 6.00 7.00
Kurnool	2009-10	3	11	21	0-13	4.05	S-275 GK 2002 A-8699	0-9 1-13 0-1	4.63 5.71 0.50
	2010-11	3	11	20	0-12	5.24	S-275 GK 2002 SH-177	0-12 2-10 4-6	5.70 5.80 5.0
Mahabub Nagar	2009-10	3	12	24	0-13	6.58	S-275 GK 2002 P- Gold	0-13 2-12 5-12	5.75 6.55 7.20
	2010-11	3	11	21	0-10	4.15	S-275 GK 2002 Leader	0-9 0-10 1-5	4.22 4.20 3.66
Nizamabad	2009-10	3	9	16	0-9	3.90	S-275 64-S-99 Jwalamu khi	0-8 2-6 5-9	3.60 2.87 6.0
	2010-11	3	10	20	0-7	4.05	S-275 64-S-99 Jwalamu khi	0-8 2-6 5-9	3.60 2.87 6.0
Total		24	87	164	0-13	4.66			

disease incidence ranged from 3.22 (Balkonda mandal) to 5.33 per cent (Kammarapally mandal). Maximum disease incidence (6 per cent) was recorded in Vanil village of Kammarapally mandal, while Marempally village of Nandipet mandal recorded minimum (0.5 per cent) disease incidence.

In the present study, natural occurrence of SNVD was found to be similar in two consecutive years during *Kharif* season. The incidence of the disease varied within the mandals of a district and among the districts surveyed. Further, the survey results clearly indicated that the infestation of thrips was higher in those cultivars, in which maximum

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Table 2. Incidence of sunflower necrosis virus disease and thrips population in different districts of Andhra Pradesh during *kharif/rabi*, 2009-10 and 2010-11 seasons

Districts	Mandal	2009-10				2010-11			
		Per cent SNVD incidence		No. of thrips/plant		Per cent SNVD incidence		No. of thrips/plant	
		Range	Average	Range	Average	Range	Average	Range	Average
Anantapur	Gooty	0-11	5.25	0-12	4.87	1-9	5.0	1-8	4.0
	Yadki	1-8	5.33	0-5	3.83	1-9	5.5	2-8	5.0
	Peddavadagur	0-6	1.50	0-4	1.0	0-10	5.42	1-8	4.42
		0-11	4.03	0-12	3.23	0-10	5.30	1-8	4.47
Kurnool	Kallur	0-13	6.33	1-8	3.77	4-12	7.75	4-12	6.12
	Emmiganuru	0-5	3.50	0-4	2.33	3-6	4.83	3-6	4.16
	Atmakur	0-6	2.33	0-3	2.5	0-7	3.16	0-7	1.83
		0-13	4.05	0-8	2.87	0-12	5.24	0-12	4.04
Mahabubnagar	Devarakadra	0-10	4.25	0-6	2.62	2-10	6.20	1-8	5.0
	Narva	5-12	7.37	3-11	5.87	2-6	4.12	1-6	3.9
	C.Chinta kunta	2-13	8.12	1-9	6.87	0-5	2.14	1-5	2.6
		0-13	6.58	0-11	5.12	0-10	4.15	1-8	3.83
Nizamabad	Kammarapally	0-6	4.0	1-5	2.8	5-7	5.33	5-9	6.5
	Balkonda	2-9	4.2	1-6	2.66	1-5	3.22	1-6	3.3
	Nandipet	1-8	3.6	0-6	3.8	0-6	3.62	0-8	2.87
		0-9	3.9	0-6	3.08	0-7	4.05	0-9	4.22
Total		0-13	4.64	0-12	3.57	0-12	4.68	0-12	4.14

incidence of SNVD was recorded. Maximum incidence of SNVD under field conditions was only 13 per cent across the locations and cultivars surveyed in two consecutive years in major sunflower growing areas.

Upendhar (2004) carried out fortnightly survey in Ranga Reddy district of A.P. and reported low disease incidence of SNVD during *rabi* months corresponding with less thrips population in sunflower cv. Morden. Lokesh *et al.* (2008) and Katti *et al.* (2009) also reported that the disease and thrips were least during *rabi* months and more in *kharif* sown crops in farmers' fields.

Occurrence of thrips population

Irrespective of the cultivars and locations, thrips infestation was lower during *kharif*, 2009-10 (3.57 thrips /plant) than 2010-11 season (4.14 thrips /plant) in different surveyed districts of A.P. (Table 2). During 2009-10, thrips population was maximum (5.12 thrips /plant) in Mahabubnagar district and minimum (2.87 thrips /plant) in Kurnool district;

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- whereas Anantapur district recorded highest population (4.47 thrips /plant) and it was least (3.83 thrips /plant) in Mahabubnagar district during 2010-11. In general, mean population of thrips per plant was less in 2009-10 compared to 2010-11 in different districts of A.P. Nevertheless, differences in thrips population were negligible between the districts and among the cultivars in both the years of study.
- Four species of thrips *viz.*, *Frankliniella schultzei* Trybom, *Scirtothrips dorsalis* Hood, *Thrips palmi* Karny and *Megalurothrips usitatus* Bagnall were found on sunflower. Among them, *T. palmi* was predominant in the surveyed sunflower fields. Infestation of *M. usitatus* was observed during flower head formation stage, while infestation of other three species during vegetative growth stage. Prevalence of *F. schultzei*, *S. dorsalis*, *M. usitatus* and *T. palmi* in sunflower was reported by Chander Rao *et al.* (2002). Upendhar *et al.* (2009) reported five species of thrips *viz.*, *F. schultzei*, *S. dorsalis*, *T. palmi*, *M. usitatus* and *H. gowdeyi* in sunflower in Ranga Reddy district of A.P.
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INFLUENCE OF INTEGRATED NITROGEN MANAGEMENT PRACTICES ON GROWTH AND YIELD OF OKRA (*Abelmoschus esculentus* L.) cv. ARKA ANAMIKA

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ABSTRACT

The effects of organic manures in combination with nitrogenous fertilizers on growth and yield of Okra cv. Arka Anamika were studied for three consecutive years at JVR Horticultural Research Station, Malyal, Andhra Pradesh. Plant height, fruit length and yield were influenced by different treatments. Shortest plants and tallest plants were recorded with treatments – Neem cake @ 1.5 t/ha + 50 % RDNF and Neem cake @ 1.5 t/ha + 75 % RDNF respectively. Longest fruits were produced by full RDNF, while shortest fruits were from the treatment of Neem cake @ 3 t/ha + 50 % RDNF. Fruit girth was not influenced significantly by the different treatments. Highest yields were obtained with Neem cake @ 3 t/ha + 50 % RDNF and least yield was with the treatment that received Vermicompost @ 10 t/ha + 50 % RDNF. Neem cake in combination with nitrogenous fertilizers proved to be better than Vermi compost along with nitrogenous fertilizers.

Okra (*Abelmoschus esculentus* L.) is an important vegetable crop, which is grown throughout the country under conventional chemical fertilization and plant protection measures. However, because of detrimental effects of chemical fertilization and chemical pesticides often residues are detected in the fruits beyond tolerance level. Organic farming prohibits the use of chemical fertilizers and pesticides, though organic farming is recommended in general for all agricultural crops and it has more relevance to horticultural crops. Okra is largely consumed as a fresh vegetable among all the vegetables after harvest. More over, there is a great demand for organically grown produce in the market. In view of this, an investigation was undertaken on the effect of organic manures in combination with nitrogenous fertilizers on growth and yield of okra cv. Arka Anamika over three consecutive years from 2007 to 2010.

MATERIALS AND METHODS

The investigation was carried out at JVR Horticultural Research Station, Malyal, Andhra Pradesh during *rabi* seasons of 2007 to 2010 under irrigation. The station is located at an altitude of 192.02 m above mean sea level on 78.66 East longitude and 19.57° North latitude. The experimental

soil was alfisols with good drainage, with a P^H of 6.3. The experiment was laid out in Randomized Block Design, replicated thrice with eleven treatments consists of 100 % RDF @ 200 kg N/ha (T₁), 75 % RDNF (T₂), 50 % RDNF (T₃) and combination of Neem cake (NC) @ 3 t/ha + 75 % RDNF (T₄), NC @ 1.5 t/ha + 75 % RDNF (T₅), NC @ 3t/ha + 50 % RDNF (T₆), NC @ 1.5 t/ha + 50 % RDNF (T₇), Vermi compost (VC) @ 10 t/ha + 75 % RDNF (T₈), VC @ 5 t/ha + 75 % RDNF (T₉), VC @ 10 t/ha + 50 % RDNF (T₁₀), VC @ 5 t/ha + 50 % RDNF (T₁₁).

All the manures were applied as basal during land preparation along with full dose of phosphorous, 1/2 dose of potassium and one third of N during land preparation. The remaining two thirds of N and 1/2 dose of potassium were applied in two equal splits at 20 and 40 days after planting.

Observation on growth (plant height) and yield attributes (fruit length, fruit girth) and yield were recorded on 10 randomly labelled plants in each plot. At the end of the experiment and after disposing of the produce in the local market, the cost-benefit ratio (C:B) was worked out by the following formula: C:B ratio = Gross income – Cost of cultivation

Pooled data of three years were considered. The data were statistically analysed as per the procedures of Panse and Sukhatme (1989).

RESULTS AND DISCUSSION

The pooled data of three years presented in Table 1 indicated that different treatments have significantly influenced all the parameters recorded except fruit girth. It was further showed that combination of organic sources and nitrogenous fertilizers was better. Okra plants were shortest under T_7 treatment (NC @ 1.5 t/ha + 50 % RDNF) and it was significantly different from all other treatments. Though plants receiving Neem cake @ 1.5 t/ha + 75 % RDNF (T_5), were tallest, they did not differ significantly with all treatment except T_3 , T_8 and T_7 . The plants were of medium height in all other treatments between the two extremes.

Fruit length is an important yield trait which market demands. Longest fruits were produced by T_1 (RDNF), which is significantly superior to all other treatments, followed by T_8 (Vermi compost @ 10 t/ha + 75 % RDNF), shortest fruits were recorded with

T_6 (Neem cake @ 3 t/ha + 50 % RDNF) and it is statistically different from all other treatments. Remaining treatments have produced fruits of medium long between the two extremes.

Thinner fruits are preferred in the market. Fruit girth was not influenced significantly by various treatments. However, maximum fruit girth was observed with the application of RDNF at 75 % (T_2) and Vermi compost @ 10 t/ha in combination with 50 % RDNF (T_{10})

The aim of farmer would be not only be producing organic produce but also higher yields. This has been observed in the present study. T_6 treatment (Neem cake @ 3 t/ha + 50 % RDNF) recorded highest yield (97.32 t/ha) closely followed by T_4 (Neem cake @ 3 t/ha + 75 % RDNF) (97.20 t/ha). Yields were less with T_{10} , T_{11} , T_9 , T_7 and T_3 in that order in ascending order. The yields ranged between 97.32 t/ha (highest) and 79.96 t/ha (lower) in the study.

Table 1. Cumulative effect of organic manures along with 'N' fertilizer on growth and yield of okra cv. Arka Anamika (3 years pooled data)

S.No.	Treatments	Plant height (cm)	Fruit length (cm)	Fruit girth (cm)	Yield (q/ha)
1.	T_1 -RDNF	154.11	18.08	2.24	88.94
2.	T_2 -75 % RDNF	152.25	16.01	2.27	87.90
3.	T_3 -50 % RDNF	151.04	15.54	2.08	84.97
4.	T_4 -NC @ 3 t/ha + T_2	156.51	15.67	2.08	92.20
5.	T_5 -NC @ 1.5 t/ha + T_2	156.52	15.41	2.17	87.55
6.	T_6 -NC @ 3 t/ha + T_3	154.29	14.51	2.21	97.32
7.	T_7 -NC @ 1.5 t/ha + T_3	141.07	15.44	2.18	84.94
8.	T_8 -VC @ 10 t/ha + T_2	147.88	17.02	2.23	91.86
9.	T_9 -VC @ 5 t/ha + T_2	155.90	15.63	2.24	83.84
10.	T_{10} -VC @ 10 t/ha + T_3	154.56	15.78	2.27	79.96
11.	T_{11} -VC @ 5 t/ha + T_3	153.04	16.24	2.06	82.19
	C.D. at 5 %	4.72	0.78	NS	6.83

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A further perusal of the data (Table 1) indicated that the influence of various treatments is not in a clear trend. However, Neem cake has a slight edge over Vermicompost. Organics were also slightly better with RDNF. The better performance of organic manures in combination with inorganic nitrogen may be attributed to the fact that organic manures, besides providing major nutrients, might have provided micronutrients (Zn, Fe, Cu, Mn etc.), growth hormones etc. Supply of micronutrients and growth hormones etc. might have helped the plant metabolism effectively, which might have encouraged

vegetative growth, resulting in taller plants (Barani and Anburani, 2004, Bairva *et al.*, 2009). The significant interaction between organic manures and nitrogenous fertilizers at different levels might have increased the nutritional status of the soil for plant uptake, which might have increased the plant biomass production leading to higher yields. Neem cake not only supplies nutrients but also provides control of insect and nematode pests. While Vermicompost not only provides nutrients, but also growth hormones and certain enzymes. Thus the two organics might have helped in growth and yield of okra in combination with nitrogen.

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EVALUATION OF POPULAR *KHARIF* RICE (*Oryza sativa* L.) VARIETIES UNDER AEROBIC CONDITION AND THEIR RESPONSE TO NITROGEN DOSE

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ABSTRACT

A field experiment was conducted at Regional Agricultural Research Station, Warangal during *kharif*, 2008 and 2009 to optimize the nitrogen dose to the popular *kharif* rice varieties and to assess their performance under aerobic condition in Central Telangana zone of Andhra Pradesh. The rice varieties WGL-32100 and MTU-1001 performed better than WGL-14 and Keshava. Application of 240 kg N ha⁻¹ recorded higher grain yield of rice but 180 kg N ha⁻¹ was found to be the economical dose for aerobic rice in sandy clay loam soils.

Rice is the single largest user of fresh water consuming about 30% and more than 45% of total fresh water used in world and Asia, respectively (Barker *et al.*, 1999). Water is becoming scarce with time and its declining availability and cost threatens traditional irrigated rice production system. On the other hand, the lack of sufficient rainfall and its uneven distribution over the growing season are among the major constraints to rainfed rice culture. In this context, the aerobic rice which is a new system of cultivation is gaining importance. Aerobic rice cultivation reduces water use as much as 50% compared to lowland rice (Tuong and Bouman, 2003).

The differences in soil N dynamics and pathways of nitrogen losses in dry sown rice system may result in different fertilizer nitrogen recoveries. With even high nitrogen applications in aerobic rice, grain filling may be limited by a low contribution of post anthesis assimilates (Zhang *et al.*, 2009). Hence, the present study was conducted for standardization of nitrogen dose to the popular *kharif* rice varieties and assessment of their performance under aerobic condition in Central Telangana zone of Andhra Pradesh.

MATERIALS AND METHODS

Field experiments were conducted during *kharif*, 2008 and 2009 at Regional Agricultural Research Station, Warangal, Andhra Pradesh. The soil was sandy clay loam with a pH of 8.0 and EC of

0.3 d S m⁻¹, medium in organic carbon (0.42 %) and low in available nitrogen (220 kg/ha), medium in available P₂O₅ (24.2 kg/ha) and low in available K₂O (252 kg/ha). The experiment was laid out in randomized block design with factorial concept consisting of four varieties (V) i.e. V₁: MTU-1001, V₂: WGL-32100, V₃: WGL-14 and V₄: Keshava and three nitrogen doses (N) i.e. N₁: 120 (Recommended dose), N₂: 180 (150 % of the recommended dose) and N₃: 240 kg ha⁻¹ (200 % of the recommended dose) replicated thrice.

A range of mean minimum temperature of 22.0–26.0 °C and 21.0–27.0 °C and mean maximum temperature of 29.0–32.0 °C and 29.6–38.0 °C were recorded during 2008 and 2009, respectively. Different rice varieties were sown at a spacing of 22.5 cm x 22.5 cm rows. The plot size was 4.5 x 4.0 m. The calendar of operations taken up during the crop growth period and rainfall details is furnished in Table 1. Nitrogen was applied as per treatments in three splits (½ as basal, ¼ at maximum tillering and ¼ at panicle initiation). A recommended dose of 60 kg P₂O₅ and 50 kg K₂O ha⁻¹ was applied uniformly to all plots as basal in the form of single super phosphate and muriate of potash, respectively. All the other recommended practices were followed. Nitrogen uptake (kg ha⁻¹) was calculated by considering nitrogen content (%) in grain / straw at harvest. Available nitrogen in the soil after harvest of the rice crop in each year is presented in Table 6.

was significantly higher with WGL-32100 than other varieties followed by MTU-1001 during both the years. At 60 DAS, WGL-32100 and MTU-1001 were at par with each other and superior to other two varieties.

Yield attributes of rice were also significantly different with different rice varieties under aerobic condition. The number of panicles/m² recorded with WGL-32100, MTU-1001 and WGL-14 were significantly higher than Keshava during 2008, while WGL-32100 was superior to all the three varieties

during 2009 (Table 3). More number of filled grains/panicle was recorded with WGL-32100 significantly superior to other varieties during 2008 and WGL-14 and Keshava during 2009. The number of chaffy grains was higher with WGL-32100 during 2008 and Keshava during 2009. The chaffiness was consistently lower with MTU-1001 during both the years. Similarly, significantly higher test weight was recorded with MTU-1001 compared to WGL-32100 and WGL-14 but at par with Keshava variety.

Table 3. Yield attributes of different rice varieties as influenced by nitrogen doses under aerobic condition

Treatment	Panicles/m ²		Filled grains / panicle		Chaffy grains / panicle		1000-grain weight (g)	
	2008	2009	2008	2009	2008	2009	2008	2009
Varieties (V)								
MTU-1001	275	212	161	118	14	18	29.67	28.67
WGL-32100	262	228	250	130	22	14	20.00	19.00
WGL-14	263	208	230	115	18	22	20.67	20.33
Keshava	230	205	169	104	10	23	28.67	28.00
SEm±	7.7	15.4	5.5	4.4	2.2	1.8	0.41	0.47
CD at 5%	22.7	15.8	16.0	13.0	6.6	5.3	1.20	1.38
Nitrogen doses (N)								
120 kg ha ⁻¹	227	190	186	106	17	21	24.00	23.25
180 kg ha ⁻¹	254	217	206	116	16	19	25.00	24.00
240 kg ha ⁻¹	291	233	215	132	14	18	25.25	24.75
SEm±	6.7	4.7	4.7	3.8	1.9	1.6	0.35	0.41
CD at 5%	19.6	13.6	13.9	11.2	NS	NS	1.03	NS
Interaction (VxN)								
SEm±	13.4	9.3	9.5	7.7	3.9	3.1	0.71	0.81
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS

The grain yield produced by MTU-1001 was superior with all the three varieties during 2008 and they were at par with each other (Table 4). But during 2009, significantly higher grain yield was obtained with WGL-32100 compared to other three varieties which were again at par with each other. Patel *et al.* (2010) identified the rice variety 'Sahsarang 1' as the better choice under aerobic condition and it exhibited the moderate values of photosynthetic rate, transpiration rate and WUE. Katsura and Nakaide

(2011) found that the varieties with greater sink activity and source capacity per plant during the ripening period could produce larger grain weight under aerobic culture. The difference in straw yield of different varieties was not significant during 2008 but it was higher with WGL-32100 followed by MTU-1001. However, WGL-14 and Keshava were at par with each other with respect to straw yield. Nitrogen uptake by the grain was significantly higher with MTU-1001 but the uptake of N by straw was not

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statistically different during 2008 (Table 4). However, during 2009 WGL-32100 registered significantly increased uptake of N both by grain and straw followed by MTU-1001.

Table 4. Yield and nitrogen uptake of different rice varieties as influenced by nitrogen doses under aerobic condition

Treatment	Grain yield (kg/ha)		Straw yield (kg/ha)		N uptake (kg/ha)			
	2008	2009	2008	2009	2008		2009	
					Grain	Straw	Grain	Straw
Varieties (V)								
MTU-1001	4614	2496	6237	4122	48.40	25.89	25.43	16.26
WGL-32100	4272	3616	5828	5273	43.80	23.02	34.46	19.74
WGL-14	4118	2356	5659	3952	39.92	22.16	22.16	14.65
Keshava	4222	2198	5790	3825	41.74	23.21	21.10	14.32
SEm±	107.0	78.8	224	84.8	1.33	1.03	0.78	0.41
CD at 5%	313.0	231.0	NS	248.8	3.90	NS	2.29	1.20
Nitrogen doses (N)								
120 kg ha ⁻¹	3842	2414	5387	3994	35.75	20.56	20.73	14.34
180 kg ha ⁻¹	4339	2647	5896	4299	44.51	23.28	26.41	16.02
240 kg ha ⁻¹	4739	2939	6353	4587	50.15	26.88	30.22	18.37
SEm±	92.5	68.2	194	73.5	1.15	0.89	0.67	0.36
CD at 5%	271.2	200.00	568	215.5	3.37	2.61	1.96	1.05
Interaction (VxN)								
SEm±	184.9	136.4	387	147.0	2.30	1.78	1.35	0.72
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS

The net returns (Rs. /ha) and B: C ratio was more with MTU-1001 during first year and WGL-32100 during the second year. But, WGL-32100 was the only variety which gave the B: C ratio of more than one during both the years (Table 5). In general the benefit cost ratio was very less which might be due to increased cost of cultivation and lower yields recorded.

Nitrogen dose

The aerobic rice responded to the nitrogen dose. The number of tillers/m² recorded at 30 DAS was significantly higher with the application of 240 kg N ha⁻¹ over 180 kg N ha⁻¹ which in turn was superior to 120 kg N ha⁻¹. At 60 DAS also, application of 240 kg N ha⁻¹ recorded significantly higher number of tillers/m² than 120 kg N ha⁻¹ but at par with 180 kg N ha⁻¹ (Table 2). However, the difference in tillers/m² was not significant at 30 DAS during 2008 and 60

DAS during 2009. The SPAD meter reading recorded at 30 and 60 DAS did not differ statistically during both the years.

Significantly higher number of panicles/m² was recorded with 240 kg N ha⁻¹ over 180 kg N ha⁻¹ which in turn was superior to 120 kg N ha⁻¹. Similar trend was followed with respect to number of filled grains/panicle (Table 3). But the chaffyness recorded did not significantly differ with different nitrogen doses. The test weight recorded with 240 kg N ha⁻¹ was significantly higher in 240 kg than 120 kg N ha⁻¹ and at par with 180 kg N ha⁻¹ during 2008 but these doses did not differ during 2009.

The grain yield obtained with the application of 240 kg N ha⁻¹ was significantly superior than the other two doses of nitrogen. Supply of 180 kg N ha⁻¹ was again superior to 120 kg N ha⁻¹. Similar trend

was recorded with straw yield during 2009, even though the successive increment of nitrogen dose could not significantly increase the straw yield during 2008 (Table 4). The rice crop took significantly more nitrogen (both grain and straw) at 240 kg N ha⁻¹ than 180 kg N ha⁻¹ which in turn was superior to 120 kg N ha⁻¹ during both the years of study. In aerobic systems, the dominant form of N is nitrate which is prone to leaching. Further, alternate moist-dry soil conditions may stimulate nitrification-denitrification processes, resulting in a loss of nitrogen through N₂ and N₂O (Belder *et al.*, 2005), which might be attributed to the response of rice varieties to the higher dose of nitrogen than the recommended to the flooded rice. Ganga and Sumathi (2011) also reported the response of scented rice upto 150 kg N ha⁻¹ under aerobic condition. Latheef Pasha (2010) and Sandhya Rani (2012) also obtained response of aerobic rice to 180 kg N ha⁻¹.

In general, the yield levels recorded were lower during 2009 compared to 2008. This might be attributed to the scanty rainfall (55 % less than decennial average) coupled with high temperatures

and low relative humidity which coincided with the reproductive period of the crop growth. Peng *et al.* (2006) also observed yield decline when aerobic rice was continuously grown and the decline was greater in dry season than in wet season.

The net returns (Rs. / ha) realized with the application of 240 kg N ha⁻¹ were higher than the other two doses but the benefit cost ratio was positive only during 2008 wherein 180 and 240 kg N ha⁻¹ were equal (Table 5).

The data on the available nitrogen status of the soil after harvest of rice crop (Table 6) revealed that the status was not changed with different varieties or nitrogen doses even though a marginal increase of 6 to 8 kg ha⁻¹ was recorded with the application of 180 and 240 kg N ha⁻¹.

The experimental results revealed that the rice varieties WGL-32100 and MTU-1001 performed better than WGL-14 and Keshava under aerobic condition. Application of 240 kg N ha⁻¹ recorded higher grain yield of rice but 180 kg N ha⁻¹ was found to be the economical dose for aerobic rice in sandy clay loam soils of Central Telangana region of Andhra Pradesh.

Table 5. Economics of different rice varieties as influenced by nitrogen doses under aerobic condition

Treatment	Net returns (Rs./ha)		B:C ratio	
	2008	2009	2008	2009
Varieties (V)				
MTU-1001	26,638	11,504	1.26	0.59
WGL-32100	22,933	24,010	1.07	1.24
WGL-14	21,384	9,677	1.00	0.50
Keshava	22,451	7,939	1.05	0.40
SEm±	-	-	-	-
CD at 5%	-	-	-	-
Nitrogen doses (N)				
120 kg ha ⁻¹	19,466	11,140	0.95	0.60
180 kg ha ⁻¹	23,657	13,099	1.11	0.68
240 kg ha ⁻¹	26,932	15,608	1.12	0.77
SEm±	-	-	-	-
CD at 5%	-	-	-	-
Interaction (VxN)				
SEm±	-	-	-	-
CD at 5%	-	-	-	-

Price (Rs./kg) - Grain: 9.0 (2008), 9.8 (2009); Straw : 1.0 (2008), 1.5 (2009)

Table 6. Soil available nitrogen (kg/ha) after harvest of *kharif* rice under aerobic condition.

Treatment	After <i>kharif</i> 2008	After <i>kharif</i> 2009
Varieties (V)		
MTU-1001	220.2	221.3
WGL-32100	222.3	224.2
WGL-14	221.3	223.1
Keshava	223.4	225.3
Nitrogen doses (N)		
120 kg ha ⁻¹	221.1	222.2
180 kg ha ⁻¹	224.3	225.8
240 kg ha ⁻¹	225.8	228.4

Initial soil available Nitrogen (kg/ha): 220.0

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EVALUATION OF MAIZE GENOTYPES AGAINST BANDED LEAF AND SHEATH BLIGHT DISEASE INCITED BY *Rhizoctonia solani* f. sp. *sasakii* (KUHN) EXNER

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ABSTRACT

Banded leaf and sheath blight of maize incited by *Rhizoctonia solani* f.sp. *sasakii* (Kuhn) Exner was studied in sixteen maize genotypes including five popular varieties and twelve inbred lines at Maize Research Centre, Agricultural Research Institute, Rajendranagar during the period *rabi* 2010-11 and *kharif* 2011-12 for evaluating resistance under artificial inoculation conditions. None of the genotypes were found tolerant. However, of the popular varieties tested, Pinnacle was found to be moderately resistance while BPC44 was most susceptible. Out of 12 inbred lines, BH11 showed moderate resistance to the disease and it is suggested for breeding work for incorporating resistance into the popular high yielding varieties.

Banded leaf and sheath blight (BLSB) is an important disease in South and South-East Asian countries (Lee *et al.*, 1989; Sharma *et al.*, 1993). In India, the disease is prevalent during *kharif* season and favours temperature of 25-30°C and relative humidity of 100% (Ahuja and Payak, 1981). It causes considerable amount (23.9 to 31.9% or more) of crop yield loss at favorable condition (Lal *et al.*, 1980). Further, it is estimated that 1% of total grain yield of India is lost by the disease (Payak and Sharma, 1985). Perusal of literature indicates that considerable amount of work has been done on management of the disease using chemicals, biological agents, modified cultural practices and host resistance (Sharma and Hembram, 1990; Qing *et al.*, 1994; Puzari *et al.*, 1998; Sharma and Rai, 1999; Sharma *et al.*, 2003, 2005, Subrata *et al.*, 2007). Since the mechanical control through stripping of lower leaves is labour- intensive, and is also not cost and time-effective and chemical control is expensive and less environment friendly, increasing emphasis is currently being laid on host- controlled resistance to BLSB. However, information on resistant material towards the disease reported was scarce in the published literature. Hence, present investigation was undertaken to identify the sources of resistance against BLSB of maize.

MATERIALS AND METHODS

A set of sixteen maize hybrids belonging to different maturity groups *viz.* extra early, early, medium and full season maturity inbred lines, comprising twelve selected genotypes from Maize Research Centre, five lines developed by various public sector units in India were chosen for study.

Field experiment

The experiment was laid out at maize research center, ARI farm, Rajendranagar Hyderabad during *rabi* 2010-11 and *kharif* 2011-12. Each hybrid was planted in three rows with 60x15cm spacing in 4x5 m plot. The plots were arranged in randomized block design with three replications. Standard agronomic practices were followed to raise the crop.

Multiplication of Inoculum

Rhizoctonia solani f.sp. *sasakii* was multiplied on sorghum grains following the method devised by Ahuja and Payak, (1978) wherein the sorghum grains were soaked in water for 24 hours and after thorough washing in running tap water, the soaked grains of about 40g were filled in 250 ml of Erlenmeyer flask after removing excess water. These flasks were tightly plugged with non-absorbant cotton

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and aluminum foil and were then autoclaved at 15lb psi for 30 minutes. Each flask was shaken to remove formation of grain clots. These flasks were inoculated with 5 mm discs of actively growing culture of *R.solani* in PDA plates and then the flasks were incubated at 27+2°C for 10 days. During incubation, the grains in flasks were shaken to provide uniform fungal growth on all grains and to prevent cracking. These grains were then used for artificial inoculation in field experiments wherever required (Ahuja and Payak, 1978).

Inoculation method

The air dried sorghum grains with fungal growth were used for field inoculations as per the procedure outlined by Ahuja and Payak (1978), on 55 day old plants (depending on the maturity group of the maize genotypes) by inserting four grains coated with fungal growth and sclerotial bodies gently between the rinds of stalk and enclosing leaf sheath of each plant at the second and third basal internodes. High humidity (>90%) was maintained throughout the disease development period by frequent irrigations. The disease incidence was studied on 10 plants in the middle row of each plot for each entry.

Observations on disease rating were recorded 30 days after inoculation on a standard 1-5 disease rating scale (Ahuja and Payak, 1983). The details of the scale are:

Scale

- 1.0- Disease on the leaf sheath only; few small, non coalescent lesions are present.
- 1.5- Disease on two sheaths: lesions large and coalescent.
- 2.0- Disease up to four sheaths: lesions many and always coalescent.
- 2.5- As in 2.0, plus rind discolored with small lesions.
- 3.0- Disease on all sheaths except two internodes below the ear.
- 3.5- Disease upto one internode below the ear sheath; rind discoloration on many internodes with large depressed lesions.
- 4.0- Disease up to the internode bearing ear sheath but shank not affected.
- 4.5- Disease on the ear; husk leaves show bleaching, bands and caking among themselves as also of

silk fibers; abundant fungal growth between and on kernel rows; kernel formation except being lusterless; ear size less than normal; some plants prematurely dead.

5.0- In addition to 4.5, shrinkage of stalk; reduced ear dimensions; wet rot and disorganization of ear; kernel formation absent or rudimentary; premature dead plants common; abundant sclerotial production on husk leaves, kernels, ear tips and silk.

Percent Disease intensity (PDI) was calculated by using the formula:

Per cent Disease Index (PDI) =

$$\frac{(\text{Sum of all individual disease ratings}) \times 100}{(\text{Total no. of plants assessed} \times \text{maximum rating})}$$

Disease score given by Anshu *et al.*, (2007)

Disease Score	Reaction
0-30	Resistant
>30-60	Moderately resistant
>60-90	Susceptible
>90-100	Highly Susceptible

RESULTS AND DISCUSSION

Evaluation of different maize genotypes for resistance to BLSB disease under artificial inoculation conditions revealed that the disease intensity was higher during *kharif* in comparison with *rabi* season. The hybrids showed variation with regard to PDI.

The genotypes 5366x5338 and Pinnacle showed moderate reaction during *rabi* while susceptible reaction during *kharif*. However during *rabi*, out of 16 hybrids screened for disease resistance, it was found that all the hybrids were more or less affected by the disease and the pooled data of two seasons (*rabi* 2010-11 and *kharif* 2011-12) revealed that none of the hybrids were found immune against the disease (Table). However the hybrids BH15 with 56.66 and Pinnacle with 59.58 PDI were found moderately resistant against BLSB.

Germplasm evaluation was extensively carried out in the past using a large number of maize varieties, hybrids and inbred lines in order to find out

source material resistant to BLSB but the success in achieving the absolute resistance seems to be of distant possibility. As of now, the genetic variability for resistance to BLSB has been found to be limited which is a bottleneck for an effective resistance breeding programme. However, the lines reported in this study as promising can be utilized as such or their resistance can be transferred into commercial varieties using cyclic breeding scheme to meet the challenges posed by BLSB. Entries identified as promising in this study need to be evaluated against more number of isolates at one location and also in

multi-location trials to find out sources of stable resistance against most isolates prevalent in different areas.

Anshu *et al.*, (2007) analyzed 29 inbreds of maize and only one genotype CA00106, recorded moderate resistance to BLSB at all the three locations *i.e* at Udaipur (Rajasthan, Western India), Pantnagar (Uttarakhand, North-Eastern India), and New Delhi (North India) and the remaining were highly susceptible. The pooled data of three years (2003 - 2005) revealed that the genotypes, DRLT-180 IC324207, G-RS-7, RKU-193 IC309233 and MZ-80

Table 1. Reaction of maize hybrids to BLSB caused by *R. solani* f. sp. *sasakii* during *rabi* 2010-11 and *kharif* 2011-12

S.No	Name of the Isolate	PDI		Latent Period (days)		PDI (%) pooled mean	
		<i>kharif</i> 2011-12	<i>rabi</i> 2010-11	<i>kharif</i>	<i>rabi</i>		
1	30 V 92	82.50 (65.30)	80.00 (63.54)	2.66	3.66	81.25	(64.36)
2	BH-11	75.83 (60.56)	61.66 (51.74)	3.33	3.66	68.75	(56.15)
3	BH-15	57.50 (49.31)	54.16 (47.39)	4.33	5.33	56.66	(48.83)
4	BPCH-44	86.66 (68.60)	83.33 (65.95)	2.33	3.00	85.00	(67.25)
5	BSCH-60	80.83 (64.04)	78.33 (62.40)	3.00	3.66	79.58	(63.15)
6	BPCH-68	83.00 (65.66)	80.83 (64.11)	2.00	2.33	82.08	(64.98)
7	BSCH-59	79.16 (62.87)	67.50 (55.25)	3.00	3.33	72.91	(58.79)
8	DHM111	77.50 (61.70)	66.66 (54.74)	3.33	3.66	72.08	(58.21)
9	DHM115	78.33 (62.26)	63.30 (52.76)	3.33	4.00	70.89	(57.50)
10	DHM-117(MRC)	81.33 (64.40)	74.16 (59.45)	2.66	3.00	78.33	(62.32)
11	DHM-117(NSP)	80.83 (64.11)	77.50 (61.96)	2.66	4.00	79.16	(62.86)
12	5318X193	73.33 (58.97)	60.83 (51.25)	3.00	3.66	67.08	(55.08)
13	5366X5338	65.83 (54.23)	56.66 (48.83)	3.33	4.66	61.25	(51.53)
14	HISHELL	76.66 (61.12)	75.83 (60.68)	3.33	4.00	76.25	(60.85)
15	PINNACLE	63.33 (52.73)	58.33 (49.79)	4.66	5.00	59.58	(50.54)
16	900M GOLD	66.66 (54.74)	63.33 (52.74)	3.00	4.66	65.00	(50.73)
	SEm \pm	0.94	1.58				0.41
	CD at 5%	2.69	4.87				1.64

Values in parenthesis are angular transformed

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IC339731 of National Bureau of Plant Genetic Resource Station, Shillong were resistant (with disease rating 10. to 2.0), while, RS-9 and RKU-113 IC309153 were susceptible (4.1 to 5.0) and the rest were intermediate (2.1 to 4.0) in disease reaction of BLSB (Subrata *et al.*, 2007).

Maize inbred lines, CA003134, CA00396 and CA00310 (CML 465) showing intermediate reaction were also found to have higher degree of tolerance against BLSB than other lines. It has also been found that inbred lines CA14510 (CML 428), CA14524 (CML

474) and Suwan 1 (S) C# f-f possessed high degree of tolerance to BLSB (Sharma *et al.*, 2005). Five inbred lines of maize (15648, 15649, 15650, 15651 and 15653) and full season maturity genotypes, ganga-11, prabhat and x-1266 were found resistant to BLSB disease, under field conditions by Sharma *et al.*, (2003). Remaining hundred entries showed moderate resistant, susceptible and highly susceptible reactions to the banded leaf and sheath blight disease of maize. Sharma *et al.* (2002) reported the presence of limited genetic variability for resistance to maize sheath blight disease in India.

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EFFECT OF ORGANIC AND INORGANIC SOURCES OF NITROGEN ON GROWTH, YIELD, ECONOMICS AND NUTRIENT STATUS IN RICE-GREENGRAM CROPPING SYSTEM

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ABSTRACT

A field experiment was conducted at Agricultural Research Institute, Acharya N.G.Ranga Agricultural University, Hyderabad to study the effect of organic manures and inorganic fertilizers on growth, yield, yield attributes and productivity of rice-greengram cropping system. Green manuring with in-situ incorporation of sunhemp sown @ 50 kg seed ha⁻¹ increased the yield and yield attributes, rice productivity and economics of rice-greengram cropping system. Application of 200% RDF to rice followed by no fertilizer to greengram recorded significantly highest system productivity, economic returns and B:C ratio compared to 100% RDF and was on par with 150% RDF

Suitable rice based cropping has to be evaluated, to assess the stability in production. Inclusion of pulses or vegetable in the cropping system is more beneficial than cereal after cereal (Kumpawat, 2001). The response of component crops in cropping system is influenced by the preceding crops and the input applied to them. Use of organic manures alone, as a substitute to chemical inorganic fertilizer is not profitable and will not be enough to maintain the present levels of crop productivity of high yielding varieties. Use of organic manures along with inorganic fertilizers lead to increase in productivity of the system and also sustain the soil health for a longer period (Gawai and Pawar, 2006). Green gram (*Vigna radiata* L Wilczek) is an important pulse crop popularly grown in rotation with rice. The present experiment was conducted to study the effects of application of organics in combination with fertilizers on productivity of rice and its residual effect on subsequent greengram crop.

MATERIALS AND METHODS

Field experiment was carried out during 2006-07 at Agricultural Research Institute Farm, Rajendranagar, Hyderabad during *kharif* (June to Oct) and *rabi* (Nov to Jan) seasons. The geographical location of the research institute has the reference to 17°19' N Latitude, 78°23' E Longitude

and 542.3 m above mean sea level. The annual rainfall received during crop growth period was 508.3 mm. The soil was sandy loam in texture, medium in available N (280 kg ha⁻¹) and high in available P₂O₅ (66.5 kg ha⁻¹) and K₂O (314.5 kg ha⁻¹).

The experiment was laid out in split plot design with three replications. Treatments consisted of no organic manure (M₀), FYM @10 t ha⁻¹ (M₁), Vermicompost @3 t ha⁻¹ (M₂), in-situ incorporation of sunhemp sown @ 50 kg ha⁻¹ (M₃) as main-plots and inorganic fertilizers i.e recommended dose of fertilizers @120-60-40 kg NPK ha⁻¹ (S₁), 150% of RDF (S₂), 200% RDF (S₃) as sub-plots.

Rice (variety BPT-5204) was transplanted on 15 July, 2006 at 20 cm x 10 cm spacing and the succeeding crop greengram was sown on 25 November after harvest of *kharif* rice. Greengram was grown on residual fertility without any fertilizer application. All the organic material was applied to rice one week before transplanting. Crops were irrigated as and when required. Data on growth, yield components and yield were recorded. System productivity in terms of rice equivalent yield (REY) was calculated. Benefit – cost ratio was also calculated. Available Nitrogen, Phosphorus and Potassium were estimated before and after experimentation.

RESULTS AND DISCUSSION

All organic manure treatments recorded significantly higher panicle length, panicle weight, number of panicles m^{-2} , number of grains per panicle and grain yield of rice compared to no organic manure application (Table 1). Higher grain yield ($5.74 t ha^{-1}$) was recorded with sunhemp *in-situ* green manuring followed by vermicompost ($5.55 t ha^{-1}$) and FYM application ($5.34 t ha^{-1}$) over control ($4.36 t ha^{-1}$).

Improved rice grain yield with these organic manures might be attributed to release of nutrients into soil slowly for longer duration after decomposition resulting in better plant growth and yield attributing characters. Panda and Patel (2008) reported similar effects of organic matter incorporation in rice.

The inorganic nitrogen levels had a significant effect on all growth, yield attributing characters and yield of rice. All these parameters recorded higher with 200% RDF application over 100% RDF but on par with 150% RDF. Straw yield was not influenced by inorganic and organic nutrient applications.

Significantly higher seed yield ($805 kg ha^{-1}$) of greengram was recorded with residual effect of *in-situ* application of sunhemp sown @ $50 kg seed ha^{-1}$ over control ($621 kg ha^{-1}$). Significant carry over effect due to integrated use of mineral nitrogen with higher proportions of organic sources to rice crop on the succeeding crops was also reported by Thimmegowda and Devakumar (1994). Application

of inorganic nutrient sources to *Kharif* rice did not show any remarkable influence on yield of greengram. Similar results reported by Ramaseshaiah *et al.*, (1985) in rice - groundnut cropping system.

Highest rice equivalent yield of ($7501 kg ha^{-1}$) was recorded with *in-situ* incorporation of sunhemp sown @ $50 kg seed ha^{-1}$. All these organic sources were comparable in their residual effect on availability of N in the soil. Lower soil nitrogen was observed with control plot (Table 2). However, negative balance was observed with all these treatments as the amount of soil N content was less than its initial status ($280 kg ha^{-1}$). This result confirms that rice-greengram rotation may deplete the soil nutrients and create negative balance (Krishna, 2010). There was a buildup of available P and K due to organic manures. Increase in levels of inorganic fertilizers from 100% to 200% did not influence the soil N, P and K status.

In the present investigation, higher net returns (Rs. $29610 ha^{-1}$) and benefit cost ratio (2.0) were registered with *in-situ* incorporation of sunhemp sown @ $50 kg seed ha^{-1}$ and similarly with 200% RDF.

Green manuring with sunhemp and use of higher doses of fertilizers was found the best integrated nutrient management package for rice-greengram cropping system for higher productivity and economic returns.

Table 1. Effect of organic manures and fertilizers on rice (*Kharif 2006*)

Treatments	Plant height (cm)	Panicle length (cm)	Panicle weight (g)	Panicles / m ²	No. of grains / panicle	Test weight (g)	Grain yield (t ha ⁻¹)
Main plots							
M ₀	96a	20.97b	1.58b	295b	67c	22.9a	4.36b
M ₁	97a	22.19a	1.91a	361a	73b	24.1a	5.34a
M ₂	97a	22.42a	2.01a	376a	75ab	24.4a	5.55a
M ₃	99a	22.53a	2.09a	385a	76a	24.9a	5.74a
Sub plots							
100% RDF	94b	21.33c	1.73b	321c	68c	23.5a	4.83b
150% RDF	98a	22.05b	1.92ab	355b	73b	24.1a	5.27a
200% RDF	98a	22.70a	2.05a	387a	77a	24.5a	5.64a
Interaction	NS	NS	NS	NS	NS	NS	NS

Means sharing different letters in a column differ significantly at P = 0.05

Table 2. Yield, economics and soil nutrient status of rice-greengram cropping system after harvest.

Treatment	System productivity (kg ha ⁻¹ year ⁻¹)			Economics (Rs ha ⁻¹)					Nutrient (kg l)	
	Rice	Greengram	System yield	Gross returns	CC	Net returns	B:C ratio	N	F	
Main plots										
M0	4360b	621b	5718	45748	27898	17850	1.6	170b	89	
M1	5340a	712ab	6898	55180	32898	22283	1.7	208a	95	
M2	5550a	764ab	7221	57770	35398	22373	1.6	210a	77	
M3	5740a	805a	7501	60008	30398	29610	2.0	212a	80	
Sub plots										
100%RDF	4830b	624	6195	49560	27898	21663	1.8	205a	88	
150%RDF	5270a	769	6952	55618	29373	26245	1.9	196a	78	
200%RDF	5640a	783	7353	58823	30845	27978	1.9	199a	89	
Interaction	NS	NS						NS	NS	

Means sharing different letters in a column differ significantly at P = 0.05

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CONSTRAINTS FACED BY RURAL WOMEN IN PROCUREMENT AND UTILIZATION OF CREDIT FACILITIES IN HISAR DISTRICT

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ABSTRACT

The present study was conducted in Hisar district of Haryana state to identify the constraints faced by rural women in procurement and utilization of the credit. Total 100 women respondents were randomly selected for the survey and interviewed. Majority of the respondents belonged to middle age group; male headed family, belonged to medium caste, nuclear families of small size and were illiterate with medium level of family education. Majority of the respondents (49%) procured credit for starting entrepreneurship, 36 percent respondents procured credit for buying animals like buffaloes and 9 percent for crop loan and remaining due to economic pressure and construction of house. For procuring the credit, respondents face the constraints like, excessive documents (84%) followed by repeated visits to banks (62%), complex and long procedure (62%), delay in sanctioning (43%) etc. 47 percent respondents faced the problems in utilization of credit like not utilized for the specified purposes (28%), investments in other purposes (22%), insufficient amount (20%) and not control over utilization (18%).

In a developing country like India, where resources have no match for the demand, any developmental programme cannot be successful without adequate cooperation from the beneficiaries, which they extend by making timely and regular repayment of their dues to the commercial banks. Further recycling of funds is possible only when the recovery position of the loan is satisfactory. Studies at various levels have indicated that recovery position of commercial bank's loan in rural India has remained very much discouraging and disappointing. (Biswas and Dash, 1997).

Keeping these considerations in view, the present study was undertaken to find out detailed and specific information on the constraints faced by rural women in procurement and utilization of credit in Hisar district of Haryana state.

MATERIALS AND METHODS

The present study was carried out in the Haryana state by covering Hisar district purposively. Four leading banks of Hisar district which provide credit to rural women were selected purposively.

A list of rural beneficiaries who procured credit from above mentioned leading banks was prepared and from the prepared list, 100 respondents from various villages of Hisar district were selected randomly. Four blocks, Hisar-I, Hisar-II, Hansi-I and

Adampur were selected for the study with the help of random sampling technique. Two villages namely, Mangali, Nalwa, from Hisar- I Aryanagr, Newlikala from Hisar-II and one village each Umra from Hansi-I and Modakhera from Adampur were selected randomly.

RESULTS AND DISCUSSION

Majority of the respondents belonged to middle age group (48%), followed by young (46%) and old (6%). Majority of the family (86%) was male headed and the reason was the death of the husband. As regards caste, again majority of the respondent (45%) belonged to medium caste, followed by low caste (33%) and high caste (22%). In aggregate, majority of the respondents were middle aged, having male-headed family and belonged to medium caste. Majority of respondents were from nuclear family (66%) and having small family size (62%), followed by medium (29%) and large (9%). 69 per cent of the respondents were illiterate and 52 percent respondent's families had medium level of education followed by low (32%) and high (16%). It can be concluded from the table that majority of the respondents belonged to middle age group; male headed family, belonged to medium section of caste, nuclear families of small size and were illiterate with medium level of family education

Table 1. Personal profile of the respondents

N=100

S. N.	Characteristics	Category	Frequency	Percentage
1.	Age	Young (Upto 36)	46 *	46 *
		Middle (37 to 53)	48	48
		Old (Above 53)	06	06
2.	Head of the family	Male	86	86
		Female	14	14
3.	Reasons for female head	Death of husband	14	14
4.	Caste	Low (Chamar, Bhangi, Doom, Jhimar, Dhobi, Badi)	33	33
		Medium (Lohar, Kumhar, Nai, Khati, Baniya, Sunar, Ahir, Julaha, Saini, Arora)	45	45
		High (Brahmin, Jat, Rajput, Bishnoi)	22	22
5.	Family type	Nuclear	66	66
		Joint	34	34
6.	Family size	Small (Upto 4 members)	62	62
		Medium (5 to 7 members)	29	29
		Large (Above 7 members)	09	09
7.	Education of the respondent	Illiterate	69	69
		Primary	13	13
		Middle	08	08
		High school	10	10
8.	Educational status of family	Low (Upto 1.55)	32	32
		Medium (1.56 to 3.02)	52	52
		High (3.03 to 4.50)	16	16
9.	No. of children	Only girls	09	09
		Only boys	26	26
		Both girls and boys	65	65

* Frequency and percentage are same as N=100

Economic profile of the respondents

Majority of the respondent's families (40%) had agriculture as their main occupation, while thirty-five percent were labour followed by business (5%). As regards land holding, most of the respondents (35%) fell in the category of marginal (less than 2.5

acres) and 20 percent fell in the landless category. Again 20 percent respondents had land on lease upto 2.5 acres to 20 acres. Average family monthly income of the respondents was upto Rs. 1000. Majority fell into marginal land size. Hence, it can be concluded that majority of the respondents had low to medium economic status.

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Table 2. Economic profile of the respondents

N=100

S. No.	Characteristics	Category	Frequency	Percentage	
1.	Family occupation	Labour	35	35	
		Agriculture	40	40	
		Business	05	05	
		Service	10	10	
		Any other	10	10	
2.	Land holding				
a.	Own land	Landless	32	32	
		Upto 2.5 acres	38	38	
		2.5 acres to 5.0 acres	20	20	
		Above 5.0 acres	10	10	
3.	Material possession				
a.	Domestic items	Gas	20	20	
		Sewing machine	05	05	
		Refrigerator	15	15	
		Washing machine	05	05	
b.	Transportation and communication means	Bicycle	45	45	
		Telephone	18	18	
		Scooter/motor cycle	12	12	
		Radio	43	43	
		TV.	22	22	
c.		Agricultural implements	Tractor	05	05
			Desi plough	23	23
	Bullock cart		02	02	
	Camel cart		01	01	
	Chaff cutter		78	78	
	Sickles		68	68	
	Baskets		68	68	
4.	Type of house	Kachcha	14	14	
		Kachcha-pucca (mixed)	40	40	
		Pucca	46	46	
5.	Monthly income	Upto 1000	71	71	
		1001 to 5000	27	27	
		5001 to 10,000	02	02	
6.	Herd size	Upto two animals	57	57	
		2 to 5 animals	31	31	
		Above 5 animals	12	12	

Frequency and percentage are same as N=100

Psychological profile of the respondents

Majority of the respondents (65%) had medium level of innovation proneness, high level of risk orientation (53%), medium level of achievement

motivation (54%) and medium level of self-esteem (50%). Therefore, their psychological profile can be inferred as medium to high. This is a very good indicator as higher psychological attributes help in faster adoption of credit facilities.

Table 3. Psychological profile of the respondents

N=100

S. No.	Characteristics	Category	Frequency	Percentage
1.	Innovation proneness	Low (10-15)	07	07
		Medium (16 to 21)	65	65
		High (22-27)	28	28
2.	Risk orientation	Low (10-12)	11	11
		Medium (13 to 15)	36	36
		High (16-18)	53	53
3.	Achievement motivation	Low (10-12)	12	12
		Medium (13 to 15)	54	54
		High (16-18)	34	34
4.	Economic motivation	Low (10-12)	09	09
		Medium (13 to 15)	34	34
		High (16-18)	57	57
5.	Self-esteem	Low (7-10)	08	08
		Medium (11 to 14)	50	50
		High (15-18)	42	42

Frequency and percentage are same as N=100

Reasons perceived by respondents to procure credit

Table 4 revealed that the reasons for which credit were procured. It is clear from the Table that

that out of 49 per cent respondents, 5 percent respondents procured credit for general shop and remaining 44 percent for making beads. Another 36 percent respondents procured credit for buying

S. N.o	Reasons	Frequency	Percentage
1.	Economic pressure/poverty	04	04
2.	Starting entrepreneurship	49	49
3.	Construction of house	02	02
4.	Crop loan	09	09
5.	Buying animals	36	36

Frequency and percentage are same as N=100

majority of the respondents (49%) procured credit for starting entrepreneurship. It can be further inferred

animals like buffaloes and nine percent for crop loan and remaining due to economic pressure and

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construction of house. So, it can be concluded from the table that majority procured credit for starting entrepreneurship and buying animals.

Constraints faced by the respondents in procurement, utilization and repayment of the credit

Constraints faced by respondents in procuring credit

Table 5 revealed the different categories of constraints, which respondents faced, in procuring credit.

Under organizational credit, excessive documents was the major constraint, followed by repeated visits to banks (62%), complex and long procedure (62%), delay in sanctioning (43%) etc.

Against situational constraints, majority of the respondents (86%) faced credit not for all purposes as the major constraint, followed by non-cooperative attitude (53%) another major constraint.

Not sufficient Govt help (74%) and lack of credit orientation (58%) were the constraints under economic constants and malpractices (69%) were under the socio-personal and psychological constraints.

For the communication constraints, lack of awareness about the credit schemes (87%), followed by lack of knowledge about procedures (85%) and lack of procurement knowledge (74%) were the major constraints.

Table 5. Constraints faced by respondents in procuring credit*

N =100

S. No.	Constraints	Category	Frequency	Percentage
1.	Organizational	Complex and long process	53	53
		Corruption	07	07
		Lack of proper guidance by bank personnel	18	18
		Delay in sanctioning of loan	43	43
		Repeated visits to bank	62	62
		Lack of motivation to adoption	30	30
	Excessive documents	84	84	
2.	Educational	Borrower's illiteracy	69	69
		Difficulty in completion of formalities	56	56
		Lack of procurement knowledge	87	87
3.	Situational	Not for all purposes	86	86
		No cooperative attitude	53	53
4.	Economic	High interest rate	56	56
		Not sufficient Govt help	74	74
		Lack of credit orientation	58	58
5.	Socio-personal and psychological	Transparency / Bribery	55	55
		Malpractices	69	69
6.	Communication	Lack of proper communication	12	12
		Lack of procurement knowledge	79	79
		Lack of awareness about credit schemes	87	87
		Lack of knowledge about procedures	85	85

* Multi response Table

The findings are nearly similar to the study done by Lalrinlienna and Kanagaraj (2005). They found that lack of Government attention was the first and foremost problem. More than one - third of the respondents felt high rate of interest on the loan as a problem. Insufficiency of loan for income generation was reported by one third of the respondents. Inability to repay the loan was also reported by one third of the respondents. High price of raw material as reported by more than one fourth of the respondents. Conflicts over loan sharing were reported by more than one fifth of the respondents. Marketing of the products was reported by more than one fifth of the respondents. Delay in disbursement by the banks was reported as a problem by more than one fourth of the respondents.

Singh et al (2004) found the problems perceived by majority of groups (65%) that time is

required in conducting meetings, going door to door for conduction meetings (60%) and conflicts in the groups (65%).

Problems in utilization of credit

It is inferred from the Table.6 that 47 percent respondents faced the problems in utilization of credit viz. not utilized for the specified purposes (28%), investments in other purposes (22%), insufficient amount (20%) and not control over utilization (18%). Major reasons for defaults include - crop failure/ drought and not being able to get remunerative prices for the produce to earn adequate income. Other reasons included overburdened with other commitments, misguiding by influential persons and expectation of loan waiver announcements. (AFC research bureau, finan. Agri. 2006)

Table 6. Problems in utilization of credit*

N=100

S. No.	Problems	Frequency	Percentage
1.	Yes	47	47
2.	No	53	53
1a	Insufficient amount	20	20
1b	No control over utilization	18	18
1c	Not utilized for specified purpose	28	28
1d	Investment in other purposes	22	22

*Multi response Table

Problems faced by respondents in repayment of credit

Regarding repayment of credit the major constraints were organizational, situation, economic, socio-personal and psychological and communication constraints.

Under organization constraints, lack of motivation to repay (80%), lack of facilities (40%) and lack of proper guidance (35%) were the major organizational constraints

Less profit in the project (74%) and natural calamities (45%) were the main constraints under the situational constraints.

With regard to economic constraints, high interest rate (86%) was the main constraints followed by lack of repayment orientation (23%).

Under socio-personal and psychological constraints, stress was found the major constraint, followed by other priorities (62%), transparency (29%) and malpractices (22%) adopted by the bank. As far communication problems, lack of knowledge about bank procedures (90%) and lack of communication skills (56%) were the major constraints faced by respondents.

Table 7. Problems faced by respondents in repayment of credit*

N=100

S. No.	Constraints	Category	Frequency	Percentage
1.	Organizational	Lack of proper guidance	35	35
		Lack of facilities	40	40
		Lack of motivation to repay	80	80
3.	Situational	Natural calamities	45	45
		Less profit in project	74	74
4.	Economic	High interest rate	86	86
		Lack of repayment orientation	23	23
5.	Socio-personal and psychological	Corruption	29	29
		Malpractices	22	22
		Stress	90	90
		Other priorities	62	62
6.	Communication	Lack of proper communication	56	56
		Lack of knowledge about procedures	90	90

* Multi response Table

Sivaloganathan (2004) found that the problem of recovery of rural credit has become a constraint source of anxiety for financial institutions ad a large chunk of banks, funds remain unloaded

the basic causes include weather conditions, drought and floods as well as the socio-political involvement in which the rural credit institution functions.

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COMPARISON OF FARMERS' CROP PRODUCTION PRACTICES WITH INDIAN NATIONAL PROGRAMME FOR ORGANIC PRODUCTION STANDARDS

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ABSTRACT

The study was conducted in three districts of Andhra Pradesh namely Warangal, Chittoor and East Godavari in the year 2008-09. An exploratory research design was adopted to compare the crop production practices of the organic and conventional farmers with the prescribed organic crop production standards. The findings of the study revealed that the crop production practices of the organic farmers were matched Indian NPOP standards to the extent of 56.0 per cent only and some of the important principles of organic crop production were not taken care of. Hence it is essential for the promoters to educate and create awareness among the organic farmers about the organic crop production standards to ensure that they could reap the benefits of certification. In case of conventional farmers, it was observed that, only 22.0 per cent of their crop production practices were organic by default.

In the era of globalisation, WTO opened the opportunities for earning foreign exchange even in agriculture exports and emerging areas. Indian Agriculture must become efficient, competitive, low cost and sustainable and the possible alternatives available to the farming community and country are organic farming and integrated use of organic and inorganic farming methods. Agriculture exports mainly concentrating on the pesticide free or chemical residue free food because of the increased health consciousness among the consumers. In this direction, nowadays agriculture is shifting from modern to organic farming. Organic agriculture system is based on ecological principles and applying ecological practices to maintain soil fertility to manage crop and animal health and to keep soil and water in a good condition without the use of chemical inputs (Siddaraju and Rajendran, 2006).

With this background an effort was made to study and report the status of organic farming in the state with the following objectives:

- To compare the agricultural production practices of the respondent farmers with the prescribed organic crop production practices as per standards and to assess the extent to which conventional farmers are adopting these practices by default.
- To know the extent of adoption of organic farming practices by the organic farmers.

MATERIAL AND METHODS

An exploratory research design conducted in the present study in six mandals comprising 12 villages of Warangal, East Godavari and Chittoor districts of Andhra Pradesh. A total of 120 farmers, 60 organic and 60 conventional farmers were selected by stratified random sampling method i.e. 20 organic and 20 conventional farmers from each district.

An interview schedule was developed in congruence with the Indian organic crop production standards developed by the NPOP (2005) to compare the practices of the farmers with that of set standards. The farmers were interviewed on their farms about the practices they follow and the researcher's observations with respect to organic production standards were also recorded.

To quantify the organic crop production practices followed by the respondents the overall responses regarding each practice were put on a 3 point continuum. Practices which closely followed organic standards (within 20% limit) were graded with 2 points, practices which were opposite to the prescribed standards (within 20% limit) were graded with 0 point, practices in between these two were graded with 1 point.

As for example- According to Indian NPOP standards, seed material used must be from organic source or conventionally produced but chemically not treated. So, if 80-100 percent farmers use organic

seed or conventionally produced but chemically not treated seed, grade point will be 2. If, 21-79 percent farmers adopted the above standard, grade point will be 1, if, 0-20 percent farmers adopted then, grade point will be 0. As such, overall score for all practices was calculated. Maximum possible score was arrived by multiplying the number of practices compared with Two i.e., Maximum possible score = number of practices compared x 2.

To study the extent of adoption of organic crop production practices by the organic farmers, a semi structured interview schedule was developed by using standards developed by NPOP (2005). The instrument consisted of organic crop production practices under different management practices which were given in two point continuum i.e. adopted or not adopted. Based on the responses of the farmers, frequencies and percentages were calculated. To study the adoption quotient, the scores for all the recommended practices in each district were added up for each respondent and then the adoption quotient for each individual was worked out by using the following formula as used by Sengupta (1967).

Adoption quotient =

$$\frac{\text{Number of organic crop production practices adopted}}{\text{Number of organic crop production practices recommended}} \times 100$$

The adoption quotient was used to find out the overall adoption of the organic crop production practices by the organic farmers in each of the selected districts. Based on the adoption quotient values, the organic farmers were grouped as Low, Medium and High based on class interval method.

RESULTS AND DISCUSSION

The existing practices of organic and conventional farmers were compared with the Indian National Standards for Organic Production (NPOP 2005).

Only twenty per cent of organic farmers maintained conversion plan which contained details related to basic data of the farm, farm map, soil analytical data, crop production practices, plant protection measures, animal husbandry details, crop rotation plan and details on seed and planting materials. The trend might be due to the fact that,

sample selected in Warangal district was in their 3rd year of conversion plan, where as in case of other districts farmers were in their first year of conversion. There may be lack of knowledge about the "conversion plan details" maintenance and lack of proper instructions from the promoting agencies.

Whereas in case of conventional farmers, it was observed that, 70.0 per cent of them have maintained only soil analytical data of their farm and have not maintained details related to farm map, production details, input and output flow etc.

Majority of the organic farmers have not adopted the bio-fencing practice. The sample selected for the study hail from tribal community and entire village was practicing organic farming. Hence, it was not necessary to adopt bio-fencing and isolation distances for controlling contamination from external inputs / outside etc.

Majority (78.3%) of the organic farmers constructed the cattle shed, compost yard at a comparatively higher elevation than the cropped area to prevent water logging inside the cattle shed. However, no organic farmer had constructed the office to maintain farm records required for proper inspection and certification of the farm by the certifying agencies. Forty- eight per cent of organic farmers have planted the boundary of the farm with MPTs like Neem, Daincha, Subabul, and Pongamia. Majority of the organic farmers were marginal and small farmers with low annual family incomes.

Twenty-six per cent of conventional farmers have constructed cattle shed, compost yard and twenty-three per cent planted MPTs like neem etc, on their farm boundaries.

Cent per cent of organic as well as conventional farmers have adopted standards set forth for the land preparation under organic cultivation like summer ploughing, in-situ incorporation of crop residues and proper cleaning of the farm implements before use in the plots. Operations / practices like summer ploughing and incorporation of crop residues are traditional practices among the farming community in the study area.

Sixty-six percent of the organic farmers used organically certified or chemically untreated inorganic seed material. In case of Warangal, Super spinning mill from Chennai has supplied the certified seed on buy back agreement and in case of East Godavari

and Chittoor districts non availability of certified seed made the farmers to depend on locally available material. Majority (70.0%) of the organic farmers followed biological seed treatment with *Trichoderma viridi*, *Rhizobium*, *Pseudomonas* spp. Cent per cent organic farmers have adopted the uniformity in sowing/planting, proper spacing and population stand was maintained by the farmers.

In case of conventional farmers, cent per cent of them used chemically treated seed and 25 per cent of them adopted seed treatment with biological sources.

Majority (68.3%) of the organic farmers adopted inter cropping with crops like cowpea, red gram, and maize and 40.0 per cent of organic farmers adopted crop rotation with green gram, bengal gram, cow pea, sunflower, ground nut and sesame.

Similarly, 38.0 & 26.0 per cent of conventional farmers adopted intercropping and crop rotation practices respectively.

Cent per cent organic farmers adopted only manual weeding methods and 45.0 per cent of organic farmers adopted intercropping for smothering weeds. Weeds were used as biomass for composting.

Moreover, 76.0 per cent of conventional farmers adopted hand weeding for the effective management of weeds.

Cent per cent of organic and conventional farmers adopted appropriate irrigation methods and intervals based on their soil type and crops cultivated. Farmers adopted flood irrigation, ridge & furrow and drip (surface) methods.

Majority (70.0%) of the organic farmers adopted the incorporation of crop residues, green manuring, green leaf manuring and composting practices during the land preparation and majority of them depended on on-farm sources for the supply of nutrients to the soil. It was also found that majority (48.3%) of the organic farmers depended on various products like, bio-fertilizers, egg aminos, certified organic fertilizers, ghanajeevamruth and panchagavya for growth promotion in crops. Organic farmers of East Godavari (40.0%) and Chittoor (60.0%) adopted the practice of split application of organic manures i.e. 75% at basal and 25% at later stages.

Twenty-eight per cent of conventional

farmers were adopting green manuring, green leaf manuring, vermicompost application for the management of soil health and fertility status. Farmers depend on both organic and inorganic nutrients to the extent of 25 and 75 percent respectively.

Cent per cent of organic farmers adopted the physical/mechanical methods of pest management, followed by botanicals / plant preparations (83.3%) and bio pesticides (68.3%). In organic farming pest control strategies are largely preventive, rather than reactive. The balance of cropped and uncropped areas, crop species and variety choice, and the temporal and spatial pattern of the crop rotation seeks to maintain a diverse population of pests and their natural enemies and disrupt the life cycle of pest species.

In case of conventional farmers also, 38.0 and 8.0 per cent adopted physical / mechanical methods and bio pesticides for the pest and disease management.

Thirty-three per cent of organic farmers adopted suitable buffer zone and majority (73.3%) used all the by-products available on the farm for composting. Twenty eight per cent of conventional farmers were also used by products available on their farms for composting purposes.

Cent per cent organic farmers carried out separate harvesting, processing and storage operations for organic and conventional produces. To avoid the possible contamination from outside and to maintain the product integrity farmers adopted this practice.

Majority of the organic farmers adopted the biodegradable packaging material such as white cloth bags and majority (66.6%) followed proper labelling procedure to convey the clear and accurate information to the consumers. Organic farmers of Warangal district were in the third year of conversion and they exported their produce to the European Union with the help of the Oorvi, marketing agency of MARI NGO. In East Godavari and Chittoor, most of the organic farmers were in their first year of conversion and majority sold their produce in common agricultural markets along with conventional produce. Chittoor district, majority of the organic farmers were selling their produce in the Organic Bazaar established by WORD NGO in collaboration with IIRD. Remaining farmers were selling their produce along with the

COMPARISON OF FARMERS' CROP PRODUCTION PRACTICES WITH INDIAN NPOP

conventional one.

Over all, the practices of organic farmers in 56.0 per cent cases, matched with that of prescribed organic crop production standards. The findings were in line with that of Promila (2004), Subrahmanyeswari and Chander (2008).

Majority of organic farmers of all the three districts were under medium category of organic farming (Table 1).

Ironically, even with following 56 per cent prescribed standards, the farmers of study area would not qualify as certified organic producers since some of the important principles of organic crop production were not taken care of. As for example, maintenance of farm record and conversion plan is essential for certification and conversion to organic farming, but the organic farmers of East Godavari and Chittoor did not adopt the farm record keeping. Bio fencing and suitable buffer zone should be maintained according to NPOP, (3.1.1.2 & 3.1.1.5 standards of

NPOP) which was not taken care by the organic farmers of East Godavari and Chittoor districts. Other practices like crop diversity (40.0%) (NPOP 3.2.3.1), use of bio pesticides (3.2.5.1 NPOP) were adopted by only forty-five per cent of East Godavari & sixty per cent of Warangal district farmers but not by cent per cent of the farmers. Similarly, there are some necessary practices, which were not adopted by the organic farmers. Hence it is essential for the certifying agencies and Department of Agriculture, Andhra Pradesh to educate and create awareness and improve the knowledge among the organic farmers about organic crop production standards.

In case of conventional farmers it was observed that, their crop production practices were organic by default to the extent of only 22.0 per cent. Conventional farmers may be educated about the some of the important practices viz. green manuring, BIPM etc to maintain stability in their production and productivity levels and to improve & protect the soil health.

Table 1. Distribution of organic farmers according to their adoption of organic crop production practices

S.no.	Category	Warangal (N=20)		East Godavari (N=20)		Chittoor (N=20)		Total (N=60)	
		F	%	F	%	F	%	F	%
1	Low adoption	04	20.00	08	40.00	07	35.00	19	31.67
2	Medium adoption	11	55.00	10	50.00	09	45.00	30	50.00
3	High adoption	05	25.00	02	10.00	04	20.00	11	18.33

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KNOWLEDGE LEVEL OF FARMERS FIELD SCHOOL AND NON - FFS FARMERS ABOUT INTEGRATED CROP MANAGEMENT PRACTICES OF COTTON IN ANDHRA PRADESH

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ABSTRACT

The study was conducted in three districts of Andhra Pradesh i.e. Guntur, Warangal and Kadapa in the year 2009-2010. An Ex-post-facto research was followed for studying the knowledge levels of a total of three hundred and sixty farmers (180 Farmers Field School and 180 Non- FFS farmers) about Cotton Integrated Crop management [ICM] Practices. With the help of pre - tested questionnaire data was collected from respondents. The study revealed that majority of FFS farmers were under medium category of knowledge followed by high and low levels, whereas Non- FFS farmers were under medium followed by low and high knowledge categories.

INTRODUCTION

FFS is a participatory approach to adult education adopted by Indian government since 1990 towards the achievement of ecologically sound, profitable and socially sustainable small-scale farming. FFS is based on the assumption that farming communities have an infinite resource of indigenous knowledge, skills and experience on which they can build their future. Participatory extension approaches such as farmer to farmer extension and Farmers Field School encourage farmers to utilize their resources, retain knowledge, skills while integrating new expertise; enhance farmers position as manager of their own land and resources. FFS mainly focuses on decision-making. The main objective was to find the knowledge levels of FFS farmers and Non- FFS farmers regarding Cotton integrated crop management [ICM] practices.

MATERIALS AND METHODS

Expost-facto research design was followed and the study was conducted in Warangal, Guntur and Kadapa districts of Andhra Pradesh during the year 2009-2010. Two Mandals from each district were selected purposively based on number of organized Cotton FFS. From each mandal two villages were selected where FFS's were conducted on Cotton crop. A total of three sixty farmers -180 FFS and 180 Non-FFS were the respondents. As a part of questionnaire, a Knowledge Test was developed with the help of primary data, experts in FFS, Researchers,

Extension specialists, Master trainers [who train the farmers] of FFS of Dept. of Agriculture, Advisory Committee of the study and experienced farmers in Cotton cultivation. Data was collected from FFS and Non- FFS farmers on Cotton ICM through the pre-tested questionnaire.

All the 30 items in the knowledge test were read out to the respondents after establishing rapport with them. The respondents were asked to answer the items by themselves. A score of one and zero is given for correct/true/yes and incorrect/false/no answer for each item respectively and the total number of correct responses given by a respondent out of the 30 items was the knowledge score obtained by him or her. Thus the maximum and minimum possible score for a respondent was 30 and Zero respectively. After arriving knowledge scores, the respondents were grouped into three categories based on mean and standard deviation i.e. Low, Medium and High Knowledge farmers.

RESULTS AND DISCUSSION

It could be observed from the Table 1 that majority (57.77%) of FFS farmers had medium knowledge level about Cotton ICM practices followed by 24.44 per cent in high and 17.77 per cent in low categories. In case of Non- FFS farmers nearly half (46.66 per cent) were in the category of medium knowledge level followed by low (36.11%) and high (17.22%) knowledge about Cotton ICM practices.

Table 1. Distribution of FFS and Non- FFS farmers respondents based on their Knowledge on ICM Cotton

S.No	Farmer's Category	FFS		Non - FFS	
		Frequency	%	Frequency	%
1.	Low	32	17.77	65	36.11
2.	Medium	104	57.77	84	46.66
3.	High	44	24.44	31	17.22
	Total (360)	180		180	
	Mean	19.03		11.2	
	S.D	3.81		2.06	

It is evident from Table 1 that majority of FFS respondents belonged to medium knowledge level followed by High Level. In Non- FFS category majority had medium knowledge about Cotton ICM. The probable reason could be Pre seasonal orientation training on Cotton ICM practices, frequent interactions with Experts, Agril. Dept. Officers. FFS farmers practice the acquired knowledge in their fields. Weekly FFS classes might also enrich the knowledge level of FFS farmers when compared to Non- FFS farmers. The positively significant relationship of independent variables i.e. Education, Mass Media Exposure and Innovativeness with knowledge of FFS farmers confirms the result. Educated farmers had more information seeking habits and better access to all types of communication media. Exposure to Newspaper, agriculture magazines, television, radio, Village knowledge centres and mobile phone based advisory services enhanced the respondent knowledge level on several aspects of the Cotton ICM practices. Innovativeness predisposes the individual for better acquisition of technology in terms of knowledge about Cotton ICM practices. This finding is in consistent with Murthy and Veerabhadraiah (1999), Obaiah (2004) and Jaswinder Singh and Kuldip kumar (2006)

Response analysis of knowledge items by FFS and Non- FFS farmers

It is clear from the response analysis Table 2 that majority of FFS farmers know about Deep summer ploughing and destruction of crop residue help to reduce pest/diseases (91%), Number of Bird perches per acre of cotton, Selection of suitable hybrid will give good yields(88%), Insecticide used for Stem application(87%), Neem oil is anti- feedent (82%), Indiscriminate spray of insecticides is prime reason for increase in cost of cultivation, Sticky traps are used against white flies and NPV solution is sprayed against Heliothis (81%).FFS farmers lack knowledge about Seed treatment chemical for wilt disease (60%) and Refugee Bt rows around Bt Cotton(58%).They know about Indiscriminate spray of insecticides is prime reason for increase in cost of cultivation(64%),Selection of suitable hybrid will give good yields(58%), Neem oil(57%), Deep summer ploughing (54%) and destruction of crop residue help to reduce pest/ diseases, Cotton + Greengram intercropping ratio (54%) and crop rotation (52%). On the contrary most non- FFs farmers were not aware of the seed treatment chemical for wilt disease (82%), Reason for Boll cracking (81%). The weekly FFS classes, knowledge sharing among farmers and practicing the acquired knowledge in their field condition facilitated the FFS farmers to gain additional information about Cotton ICM.

Table 2. Response analysis of knowledge items by FFS and Non- FFS farmers

S.N	Knowledge item	FFS farmers [N=180]				Non Farmers [N=180]			
		Correct		Incorrect		Correct		Incorrect	
		Fre- quency	%	Fre- quency	%	Fre- quency	%	Fre- quency	%
1	Cotton+ Greengram intercropping ratio is a]. 1: 3 b] 1: 6 c] 2:6 d] 1: 8	123	68	57	32	98	54	82	46
2	Neem oil is a] Insecticide b]Repellent c] Anti feedent d] All	148	82	32	118	102	57	78	43
3	Reddening of leaves from border is symptom of a] Zn deficiency b] Mg Deficiency c] Jassids d] Boran deficiency	132	73	48	27	56	31	124	69
4	Insecticide used for Stem application a] Endosulfan b] Chlorpyriphos c] Monocrotophos d] all the chemicals	156	87	24	13	74	41	106	59
5	Cotton should only be grown on ----- soils for better yields. a] Black soils b] Red light soils c] Sandy soils d]Any soil	125	69	55	31	88	49	92	51
6	Pest and defender ratio in FFS is a] 4:1 b] 1:2 c] 3:1 d] 5:1	132	73	48	27	45	25	135	75
7	NPV Virus solution is sprayed against a] Heliothis b] Pink boll worm c] Stem borer c] None	145	81	35	19	72	40	108	60
8	Bt formulation should be sprayed during a] Morning b] Noon time c] Evening d] Any time	128	71	52	29	69	38	111	62
9	Stem application is done up to ----days a] 90 b] 30 c] 60 d] any time	112	62	68	38	76	42	104	58
10	Latest concept of FFS is a] ICM b] IPM c] INM d] None	136	76	44	24	62	34	118	66
11	Refugee Bt is sown in ---- rows around Bt Cotton.	105	58	75	42	45	25	135	75
12	Trap crop for Spodoptera is -----	124	69	66	31	69	44	111	56
13	Potassium fertilizer is applied for better ----- quality	138	77	42	23	48	27	122	73
14	Dose of Zinc sulphate per acre is-----	122	68	58	32	58	38	112	62
15	Boll cracking is due to deficiency of -----.	118	66	62	34	32	18	148	82
16	Sticky traps are used against -----	145	81	35	19	46	26	134	74
17	No. of Bird perches per acre of cotton-----	158	88	22	12	82	46	98	54
18	Deep summer ploughing and destruction of crop residue help to reduce pest/ diseases. T/F	164	91	16	9	98	54	82	46
19	Selection of suitable hybrid will give good yields. T/F	158	88	22	12	105	58	75	42
20	Indiscriminate spray of insecticides is prime reason for increase in cost of cultivation T/F	145	81	35	19	115	64	65	26
21	Timely sowing helps in overcoming pest problem T/F	124	69	56	31	78	43	102	57
22	Sowing of Cotton in light soils is risk taking T/F	136	76	44	24	85	47	95	53
23	Better drainage is required for Cotton cultivation T/F	128	71	52	29	74	41	106	59
24	Crop rotation helps in maintaining soil fertility T/F	115	64	65	36	95	53	85	47
25	Stem application conserves natural predators T/F	125	69	55	31	46	26	134	74
26	Do you know the inter crops of cotton Yes/No. If Yes please mention a few	116	64	64	36	56	31	124	69
27	Do you know the seed treatment chemical for wilt disease Yes/No. If Yes name one chemical	108	60	72	40	35	19	145	81
28	Do you know about pheromone trap action Yes/No. If Yes what is the use	142	79	38	21	46	26	134	74
29	Do you know the boarder crops grown in Cotton Yes/No. If Yes mention few	118	66	62	34	58	32	122	68
30	Do you know about soil testing Yes/No. If Yes mention the weight of Soil sample to be sent to STL	142	79	38	21	56	31	124	69

Conclusion

FFS programme is participatory approach to adult education, providing a platform to gain knowledge on Integrated Crop management practices and helps to utilize available local resources without

disturbing the eco system. More over, decision making is in the hands of farmers through FFS. Keeping this in view, more number of FFSs need to be conducted in future.

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EFFECT OF PHYTOSTEROL - FORTIFIED SOY MILK ON CHOLESTEROL LEVELS IN HEALTHY INDIVIDUALS

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ABSTRACT

Functional foods have had a large impact on the role of diet and health. Cardiovascular disease (CVD) is the major killer in the world today accounting for over 80% death worldwide. Phytosterols are an established non-pharmacological means to reduce total and LDL (Low Density Lipoprotein) blood cholesterol concentrations. Soy based foods are common throughout the world. Yet, there is little evidence supporting the efficacy of phytosterols in soy-based foods. Soy milk samples were formulated by incorporating phytosterols powder at 2.0%, 2.5% and 3.0% level. Soy milk with 2.0% incorporation of phytosterols was selected by sensory panel for further studies. A randomized double-blind parallel study was conducted to evaluate the effect of phytosterol incorporated soy milk on the cholesterol levels in human subjects. 12 subjects were supplemented with 100 ml of soy milk either enriched with 2.0 g phytosterols (experimental) or without phytosterols (control) for 30 days. Significant ($P < 0.05$) decrease in serum total cholesterol (9.5%), triglycerides (10%) and LDL cholesterol (13%) was seen in experimental group compared to control group. The use of phytosterols as supplement can lower the total and LDL cholesterol levels, thereby reducing the risk of CVD.

Cardiovascular diseases, especially coronary heart disease (CHD), are the leading causes of death in the world today. According to WHO estimates, by 2030 the number of annual deaths caused by CVD will rise to almost 23.6million (WHO, 2010). The incidence of chronic diseases such as heart disease, cancer and diabetes mellitus has steadily increased over the past few years causing the Indian public to gain interest in disease prevention, mainly through diet and exercise. Functional foods have come into the spotlight for this reason.

Phytosterols were found to lower serum cholesterol both in animals and in humans. The ingestion of phytosterols in proper amounts prevented intestinal resorption of cholesterol, which was undoubtedly one of the key steps towards today's growing markets of cholesterol lowering phytosterol-enriched functional foods (Soupas, 2006).

Initially, phytosterols were used as pharmacological agents (Kritchevsky and Chen, 2005). For a long time, however, these compounds were considered to be of little practical interest mainly due to their poor solubility and difficulties in their

administration (Miettinen and Gylling, 1999; Moreau *et al.* 2002). A real breakthrough was with the recognition of use of these cholesterol-lowering compounds as a part of the normal human diet. A series of events leading to this recognition started in 1986 with the observation that sitostanol administration at a dose of 1.5 g/d resulted in significant lowering of human total cholesterol (Heinemann *et al.* 1986). Finally Benecol® margarine (Raisio Plc. Raisio, Finland), in Finland, in November 1995 launched the first commercial phytosterol-enriched food application. In addition, as alternatives to the first commercial food application, margarine, other food types, including low-fat and even nonfat products, have been introduced to the market throughout the world.

The effects of dietary phytosterols on lowering cholesterol in a wide variety of subjects, leading to the conclusion that, in general, a reduction of 10-15 percent in serum low-density lipoprotein (LDL) cholesterol can be achieved by a phytosterols intake of 1.5-3 g/d (Normen *et al.* 2004). The US Food and Drug Administration (FDA) has granted GRAS (Generally Recognized As Safe) status to many phytosterol ingredient (FDA, 2006a) and the European

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Union Scientific Committee on Food (SCF) has thoroughly reviewed the safety of phytosterols and their esters and sanctioned them for use in a variety of foods (SCF, 2003c).

Soy milk is one of the nutritious drink and incorporation of phytosterols in soy milk could be a good choice for people seeking to lower their LDL and triglycerides. Soy milk by itself also may reduce the potential for heart disease. The growth of "Functional/Nutraceutical/Wellness Foods and Beverages" has been attributed to several factors such as consumer's interest in maintaining better health. A much older, and far more relevant, approach is to categorize functional ingredients according to the kinds of problems they help to treat. However, it is best to view the actions as attributes of the functional foods as a whole and can be used in

treatment of variety of conditions like CVD, cancer and diabetes mellitus.

Therefore an attempt was made to incorporate phytosterols into soy milk which could be used as a functional beverage to reduce the risk of CVD by reducing the total and LDL cholesterol levels in normocholesterolemic and mildly hypercholesterolemic human subjects.

Materials and methods

Soybean, (*Glycine max L.Merri*) belongs to family leguminosae and sub-family *Papilionadae*. Soy milk was processed at Samhitha Food industry, Hyderabad and phytosterol powder (Reduacol™ Original Powder) was obtained from Forbes Medi-Tech Inc, USA. Soy milk samples were standardized incorporating phytosterols powder at various levels (2, 2.5 and 3 %) (Table 1).

Table 1. Various levels of phytosterols incorporated in soy milk

Products	Phytosterols Percent in soy milk (100 ml)
T ₁ (Control)	-
T ₂	2.0
T ₃	2.5
T ₄	3.0

T₁: Soy milk without phytosterols (Control), T₂: Phytosterols (2.0%) incorporated soy milk, T₃: Phytosterols (2.5%) incorporated soy milk T₄: Phytosterols (3.0%) incorporated soy milk

The organoleptic scoring was done by a panel of 10 members in the sensory evaluation laboratory of Post- Graduate and Research Centre using a five point hedonic scale (Amerine *et al.* 1965) score card developed for the purpose. The best combination and level of incorporation of phytosterols powder was identified.

A randomized double- blind parallel study was conducted on 12 normocholesterolemic and mildly hypercholesterolemic human subjects after the ethical committee approval. They were divided into experimental (n = 10) and control (n = 6) groups for the purpose of the study. The experimental group (10 subjects) were supplemented with phytosterols

(2%) incorporated soy milk (100 ml per day) for a period of 30 days. The control groups (6 subjects) were supplemented with soy milk without phytosterols (100 ml per day) for a period of 30 days trial. Biochemical analysis (Lipid Profile) was estimated at 0 and 30 days for control and experimental groups.

5ml of venous blood specimen was collected from subjects after a 12 hour overnight fast into vacutainer collection tubes. Serum was separated immediately and stored at -20°C and were analysed for lipid profile (Total, HDL and LDL cholesterol and triglycerides) using the kit method (Herbet *et al.* 1984).

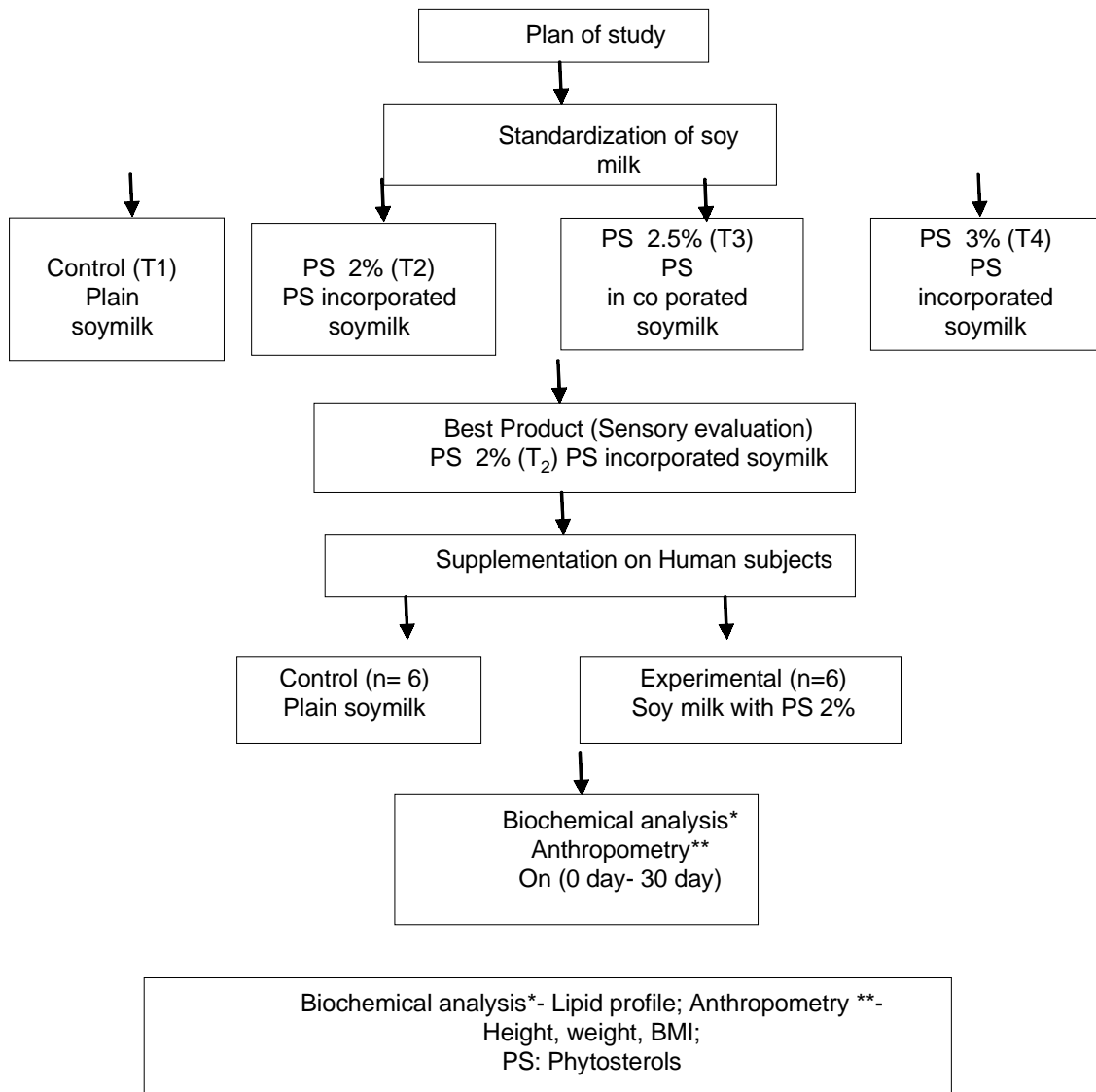


Fig. 1 Plan of Study

Statistical Analysis

All the reported values are the mean of duplicates and experimental results were subjected to two way analysis of variance at $P < 0.05$ (Snedcor and Cochran, 1983).

RESULTS AND DISCUSSION

Phytosterol powder was incorporated into the soy milk at various levels from 2-3% i.e., T_1 (Control), T_2 (2.0% PS), T_3 (2.5% PS) and T_4 (3.0% PS). Results from sensory analysis on attributes like colour and appearance, flavour, taste, consistency and overall acceptability scores on 5 point hedonic scale showed that T_2 (2.0% PS) had highest overall acceptability

score of 4.4 compared to other samples (Table 1). Addition of phytosterol powder to soy milk improved the consistency and mouth feel of the milk. The control milk had water like consistency whereas 2% phytosterol milk had a creamy consistency which was liked by all the panel members. Richard and Yoko (2008) reported that addition of phytosterols gave an enhanced creamy texture to low fat dairy products (yoghurt/ drinking yoghurt). They also improve the taste of food products by masking bitterness and hence reduce the amount of sugar or other sweetener required to obtain a pleasant taste and mouth feel (e.g. in soy drinks).

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Table 2. Acceptability scores obtained for control and experimental samples

Treatments	Colour and appearance	Flavour	Taste	Consistency	Overall acceptability
T ₁ (Control)	3.76	3.61	3.38	3.15	3.30
T ₂ (2% PS)	4.30	4.30	4.15	4.23	4.46
T ₃ (2.5%PS)	3.23	3.38	3.61	4.07	3.53
T ₄ (3% PS)	3.38	3.61	3.15	3.84	3.76
SE.d	0.256	0.233	0.310	0.281	0.208
CD (0.05)	0.516*	NS	0.625*	0.567*	0.420*

Mean values are significantly different (P< 0.05). Values are mean of three measurements; PS- Phytosterols; NS- Non significant

Effect of supplementation of phytosterols

The effect of supplementation of phytosterols for a period of thirty days on serum total cholesterol and

LDL cholesterol was assessed in human subjects and the mean total cholesterol values of the study are given in Table 2.

Table 3. Effect of phytosterols supplementation on lipid profile of selected subjects

Parameter	Total Cholesterol (mg/ dl)		Triglycerides (mg/ dl)		HDL cholesterol (mg/ dl)		LDL cholesterol (mg/ dl)	
0 th day	211± 6.8		167± 4.8		39± 1.7		120± 3.4	
Control								
Experimental	218± 6.2		172± 3.1		40± 1.2		141± 3.0	
30 th day	210± 7.9		164± 4.5		39± 1.6		117± 5.0	
Control								
Experimental	199± 7.2		156± 4.6		41± 1.6		123± 4.8	
	SE.d	CD at 5 %	SE.d	CD at 5 %	SE.d	CD at 5 %	SE.d	CD at 5 %
For Groups	2.8658	3.7638*	2.6531*	4.3892*	0.6677	1.3931*	1.7042	3.5556*
For Periods	2.8720	5.9923*	2.721	5.5355*	0.6677	NS	1.7042	3.5556*
For G* P	4.0617	8.474*	3.7520	7.828*	0.9443	NS	2.4101	5.028*
% increase or decrease (0th – 30th day)								
Control	-0.47		-1.8		0		-2.5	
Experimental	-9.54		-10.05		5		-12.7	

Mean values are significantly different (P< 0.05), Values are expressed in mean ± standard deviation NS - Non Significant

The results showed a marked decline of 9.5% in serum total cholesterol levels, 10% decline in triglyceride levels, 5% increase in HDL levels and 13% decline in LDL levels in the subjects supplemented with phytosterol enriched soy milk as compared to control group. This change was significant ($P < 0.05$) in the experimental group who were supplemented with 2gm of phytosterols incorporated soy milk. In the control group there was a decrease of 0.5% in serum cholesterol levels, 1.8% decrease in triglyceride levels, with no changes in HDL levels and 2.5% decline in LDL levels. These results show that consumption of phytosterols may help prevent the onset of cardiovascular diseases or bring down the hypocholesterolemic condition. Similar results were reported by John et al. (2006). Use of a novel phytosterols- enriched snack bar (1.5gm per day) effectively decreased total and LDL cholesterol by 4.7% and 6.0% levels in a population with hypercholesterolemia.

The consumption of 1.2 to 2.0 g plant sterols per day has shown to have a favorable effect on total cholesterol and LDL cholesterol levels. Phytosterols-enriched foods can be used to reduce total and LDL cholesterol levels, as well as to improve the ratio of LDL to HDL (Patch *et al.* 2005). Jenkins et al. (2003) reported that soy protein rich in isoflavones led to a decrease in the susceptibility of LDL particles to oxidation in healthy subjects.

Iwona Rudkowska *et al.* (2008) has developed and evaluated that the consumption of a single dose, low-fat yogurt rich in Phytosterol (1.6 g/d) with a meal over an afternoon snack will lead to favorable changes in plasma lipids, plasma phytosterol concentrations, and cholesterol synthesis without negatively affecting α -tocopherol or

carotenoids levels. The use of phytosterols for serum cholesterol-lowering purposes in humans was conducted by Heinemann *et al.* (1986). They administered sitostanol at a dose of 1.5 g/d for 4 weeks to 6 patients with hypercholesterolemia and observed that total Cholesterol was reduced by 10% and 15% after 3 and 4 weeks, respectively. Christiansen *et al.* (2001) demonstrated the efficacy of microcrystalline free phytosterols; serum total and LDL-cholesterol levels were reduced by 7.5-11.6% by consuming phytosterol-enriched margarine (1.5 or 3.0 g of phytosterols per day) during a 6-week run-in and a 6-month experimental period. Clifton *et al.* (2004) demonstrated that phytosterol in all food forms tested for lower serum LDL cholesterol, with low-fat milk being the most effective vehicle with a 16% lowering with 1.6g/day of phytosterol.

CONCLUSION

Plantsterols have gained a prominent position in strategies to lower CHD risk because of their serum LDL-Cholesterol lowering effects, as consistently demonstrated in numerous placebo controlled trials in different population and patient groups. The results of the present investigations are fully consistent with these observations. It was found that plantsterols also lowered serum triglyceride concentrations and slightly increased the HDL cholesterol levels in the experimental subjects of the study. It is evident from the foregoing discussion that phytosterol- enriched soy milk can be used effectively to reduce plasma total and LDL cholesterol levels in hypercholesterolemic individuals. The data suggest that the incorporation of phytosterol enriched soy milk into a balanced diet represents a practical dietary strategy in the management of serum cholesterol levels.

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EFFECT OF PRESERVATIVE TREATMENTS ON THE QUALITY OF FREEZE DRIED ANTHURIUM

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ABSTRACT

The study was conducted during 2010-2011 to explore the effect of selected preservation treatments on the quality of Anthurium flower in floral freeze dryer. Preservation of flowers in freeze drying process retains its pigment (colour) and structural parts (cells) and thus remains as fresh bloom for years. Prior to freeze drying process, flowers were treated with set of chemical compounds for retaining the inherent qualities in preserved flowers. The qualitative characteristics of flowers were evaluated by expert panel. Flowers treated with a chemical compound that had a blend of exchange medium colour preservatives, colour fixatives, buffers, modifiers, pH regulator, and shatter resistant compound (Ethyl vinyl acetate) resulted in flower that was more close to natural.

Exotic flowers hold a special place in the hearts of flower lovers due to their breathtaking fragrance and exquisite beauty. Exotic flowers are stunning visually and these are used to produce best floral arrangements. Anthurium, an exotic flower originated in tropical Hawaii and is the messenger of hospitality and is used to indicate happiness and abundance. In Anthurium, the flower is the spathe of the plant that is thick and stiff and has waxy feel. In the middle of the spathe is an upright organ called the spadix. Colour of flower ranges from whites to pinks and reds.

Fresh flowers may be preserved by drying, but these methods drastically alter the appearance of the flower and increase its frailty. Moreover, dried flowers do not last in areas of high humidity. To preserve the best quality of cut-flowers after harvest and to make resistant to fluctuations in environmental conditions, treatment with floral preservatives is recommended (Zencirkiran, 2010). Freeze drying flowers technique is an advanced technology and absolutely new to India. For floral preservation in freeze dryer, pre-treatment is recommended. The main advantage of freeze-drying is that it results in products that appear almost like the fresh ones (Nilsback and Zisserman, 2006). The objective of this study was to explore the effect of preservation treatments on Anthurium flowers in freeze drying process, using Floral Freeze dryer.

MATERIALS AND METHODS

Experimental research design was adopted for conducting the study. Red colour Anthurium, an exotic flower was selected. To produce a high quality freeze dried flower, pre-treatment was found to be necessary. A set of fourteen different chemicals cited in US free Patent 4349459, which fall into the category of exchange medium, biological fixatives, preservatives, environmental fixers, buffers, mordant's, pH modifiers, were used in this study and were tested on the flower individually and in combination. Spathes of the flower were immersed in each solution for five seconds to study the effect of these chemicals. Each of these chemical solvents was found to play a crucial role on colour, texture, form and appearance of flower. These chemical solvents were blended into different compositions in the on-going Freeze dried flowers research project of the department (Reddy and Kumari, 2010). Five compositions were selected for use in this research for pre-treatment of flowers. Composition I and II had three solvents having a blend of dehydrant, pigment fixative and colour fixative with pH value of 5-5.5. Composition III and IV had 6-7 solvents consisting of blend of harsh and mild dehydrant, pigment fixative, colour preservative and pH buffers with pH value between 5.5 – 6.0 and composition V had all the blend of fourteen solvents consisting of blend of harsh and mild dehydrant, pigment fixative, colour

preservatives, environmental and biological fixatives, mordents, modifiers, and buffers with pH of 6.6-7.0. These five basic compositions were tested in Experiment I. To overcome the brittleness and shatter resistance, each of these combinations was blended with a co-polymer and these improvement compositions were used for Experiment II. Each flower was dipped individually in the selected composition and was kept for evaporation in the floral trays before transferring to freezing chamber for dehydration. Each cycle of final experiment in floral freeze dryer took 10-12 days. On completion of freeze drying cycles, flowers were removed from floral freeze dryer and analyzed for measuring the qualitative characteristics such as colour, form, texture and appearance. These four parameters were fixed as variables for evaluation of flowers.

Colour analysis: Anthurium was photographed and the flower colour was measured before and after freeze-drying using colour Adobe Photoshop (Pantone colour system) and HSB values were recorded. These were used in HSB colour model to explore the change in hue. HSB (Hue, Saturation, Brightness), defines a colour space in terms of three components. **Hue (H)**, the color type ranges from 0 to 360 degree; **Saturation (S)** i.e. "purity" of the colour ranges from 0 to 100%. The lower the saturation of a colour, the more "grayness" is present and the more faded the colour will appear and **Brightness (B) / Value (V)**, the colour ranges from 0 to 100%.

Moisture analysis: Moisture content and colour of the flower was measured before and after each freeze drying treatment. The percentage of weight loss of flowers was assessed in percentage.

Measurement of qualitative characteristics of flower: Physical Observation tool was developed to observe and to score the freeze dried exotic flowers to assess the effect of different treatments. The following parameters were taken for evaluation which aided in assessing the overall qualitative characteristics of Anthurium.

Change in Colour in terms of hue, value and intensity

Change in Texture in terms of feel, pliability and suppleness

Form : Change in size, shape, assembly of petals

Appearance: Wrinkle, shrinkage, wilting, fading, deformation.

The three point scale was used for scoring the variation in each of these qualities. The scores obtained for each of these variables were subjected to analysis of variance-one way classification to study the effect of treatments on keeping quality of flower.

RESULTS AND DISCUSSION

Characteristics of flowers prior to preservation:

Red Sunset colour Anthurium with the HSB value of H-349, S-68 per cent, B-75 per cent was selected for study. The flowers had smooth, stiff and leathery texture on the spathe and appeared waxy with fuzzy bumps. Flower had bright yellow green coloured spadix and weighed between 6-8 gms. on an average depending on the size of the flower.

Effect of selected solvents on Anthurium: The effect of 14 chemicals identified in this study, were tested on the spathe to observe the reaction of these on colour, texture and appearance of the flower. The observations recorded are presented in Figure 1. It was found that each chemical had an influence on over all physical appearance of the Anthurium.

Tertiary butyl alcohol which is proved to be a harsh dehydrant, turned the red colour spathe into brown (H-312, S-47%, B-54%) and looked pale. 1-propanol was less harsh but turned red colour to darker shade (H-347, S-84%, B-65%). The petal treated with 2-propanol was more close to natural red (H-351, S-60%, B-73%) but lost its luster and found to be dull, though it has retained the natural texture of the flower. Sodium phosphate turned red colour to darker shade (H-353, S-84%, B-92%) and shrinkage, wrinkle in spathe was found. Black patch was formed due to accumulation of excess of chemical in the bumps. The petal treated with Sodium formaldehyde sulphonylate was more close to natural red (H-350, S-61%, B-68%) and retained shine and leathery texture of the flower. Reaction of Citric acid (H-348, S-56%, B-72%) was also similar to Sodium formaldehyde sulphonylate.

Treatment with Thiourea caused patches, turned the colour darker (H-349, S- 52%, B-64%) and also shrinkage was observed. Lee (2000) revealed

that the solution to preserve flowers will normally contain additives depending on the flower species such as Thiourea, Cysteine hydrochloride, Peracetic acid or Polyvinyl alcohol in various combinations.

Aluminium sulphate caused spots and the colour has turned darker (H-350, S- 56%, B-66%). Sodium citrate which is alkaline has turned the colour darker (H-348, S- 48%, B-72 %,) and a patch was found due to excess of chemical.




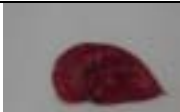









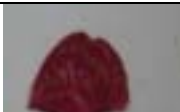

Fresh Flower			H-349 S-68% B-75% Red (Sunset)
	H-312 S-47% B-54%		H-350 S-56% B-66%
t-butyl alcohol	Brown (Lotus)	Aluminium sulphate	Red (Hippie Pink)
	H-347 S-84% B-65%		H-348 S-48% B-72%
1-propanol	Red (Fire Brick)	Sodium citrate	Red (Blush)
	H-351 S-60% B-73%		H- 11 S-36% B- 44%
2-propanol	Red (Blush)	Cupric sulphate	Brown (Quincy)
	H-353 S-84% B- 92%		H-356 S-48% B-64%
Sodium phosphate	Red (Falu red)	Silicone fluid	Red (Vin Rouge)
	H-350 S-61% B-68%		H-350 S-90% B- 63%
Sodium formaldehyde sulphonylate	Red (Hippie Pink)	Silicone resin	Red (Fire Engine Red)
	H-348 S- 56% B-72%		H-348 S- 46% B-49%
Citric acid	Red (Blush)	Phenol	Red (Solid Pink)
	H-349 S- 52% B-64%		H-10 S-70% B- 58%
Thiourea	Red (Cadillac)	Propionic acid	Orange (Fire)

Fig. 1. Effect of solvents on spathe of Anthurium.

Treatment with Cupric sulphate, turned the red colour into brown (H- 11, S- 36%, B- 44%) and flower appeared to be wilted. Silicone fluid treatment retained red colour (H-356, S-48%, B-64%) and the glossy effect. With Silicone resin formed dark patches (H-350, S-90%, B- 63%) and burns, but petal was thick and swollen. Treatment with Phenol, turned red colour into deep red (H-348, S-46%, B-49%), while Propionic acid has changed red colour to orange shade (H-10, S-70%, B-58%). These results coincided with results revealed in US free Patent 4349459 which tested these chemicals on red Roses. According to this study, propionic acid tends to darken a red bloom while phenol tends to lighten a red bloom. A mixture of propionic acid and phenol tends to make the colour more vivid. Ito *et al* (2007) reported on the methods for preserving fresh flowers with natural pigments and texture. It was stated that petals were dehydrated by various dehydration treatments, and then petal physical properties were determined by observing the petal sections and

epidermal cells under a microscope. Most pigments leached out of the petal, but some diffused and were retained in the petals of a preserved flower

This analysis indicated that this ment on he ower originates Citric acid, Sodium formaldehyde Sulphoxylate and Silicone fluid were suitable to retain colour pigments while t-butyl alcohol, 1-propanol and 2-propanol were found suitable for dehydration. Silicon fluid retained colour and texture while the resin turned the petal fluffy. As all these characteristics are most desired in dried Anthurium, the blend compositions were tested to study their effect on flowers after freeze drying.

Effect of treatment on flowers with basic compositions (Experiment I)

The physical observation scores on different variables identified for studying the effect of different basic treatments on freeze-dried Anthuriums as influenced by different treatments are given in Table 1.

Table 1. Physical Observation score for Experiment I (Basic Composition) of Freeze Dried Anthurium

Physical Observation Score	Comp-I	Comp-II	Comp-III	Comp IV	Comp V
Colour	13	13	13	17	20
Texture	14	14	14	14	17
Form	19	18	18	18	21
Appearance	20	21	21	23	30
Total	66	66	66	72	88

SEm + = 0.71, CD_{0.05} = 2.18

Colour: Retention of colour of freeze dried Anthurium flowers were affected by different compositions (Figure 2). Flowers treated with composition IV and V attained higher score as these retained red hue while the others changed the hue to brown. According to Chen *et al* (2000) one of the main benefits of freeze-drying flowers is preservation of fresh colours, but the process does change colour. It was reported that freeze drying had a greater effect on the colour values of the red flowers and the reds often become unattractively dark and muddy.

Texture: It was also observed that irrespective of composition, all the flowers appeared dull, dry and brittle. Scores were equal in all except in Composition V. Probably the presence of Silicone fluid and resin had an influence on the score.

Form: Retention of shape, size and change in physical form was observed. Composition V influenced the form significantly and thus attained higher score. This proves that Citric acid and Silicone resin present had a strong influence on the form of flower.

Appearance: Flowers were found to have creases with shrinkage in edges and also appeared papery in few treatments. The physical observation scores for appearance revealed that these compositions influenced the appearance significantly. Better appearance of freeze dried flowers was noticed in flowers treated with composition V. This further strengthened the effect of different chemicals on flower preservation quality.

Moisture: The moisture loss of flowers in Experiment I is given in Figure 2. The moisture loss percentage varied between 86%-88%. The flowers used for the experiments varied with respect to fresh weight and this could be the reason for minor variation in percentage of moisture retention. It can be noticed that there is almost an equal percentage of moisture loss due to Freeze drying temperature and vacuum pressure.

The statistical analysis proved that there was significant effect on the quality of flowers with different

treatments. From these observations in Experiment I, it can be said that flower qualities were influenced by different blends of chemical. With regard to scores, the texture of flowers attained least score in all. Hence in experiment II, these basic compositions were blended with shatter resistant polymer in the ratio of 1:1 and re-tested (Reddy and Kumari 2011). The observations emerged out of Experiment II are presented in Table 2.

Quality of flowers treated with Improved Compositions in Experiment II

Colour: The red hue of Anthurium was retained in all the compositions with minor variation in saturation and brightness values. Flowers appeared brighter than Experiment I. There was considerable difference in the score values between treatments and composition V scored (27) higher for colour retention as compared to others. This proves that change in preservation composition had an influence on retaining the colour pigments in flowers.

Table 2. Physical Observation score for Experiment II of Freeze Dried Anthurium

Physical Observation Score	Comp-I	Comp-II	Comp-III	Comp-IV	Comp-V
Colour	18	16	12	25	27
Texture	20	22	21	21	23
Form	27	25	26	27	27
Appearance	42	40	39	44	41
Total	107	103	98	117	118

SEm + = 1.32, CD_{0.05} = 4.06

Texture: Flowers treated with composition V obtained maximum score (23 points) for retention of good texture and this may be due to the presence of Silicone fluid and Silicone resin in combination with shatter resistant polymer. Spathe was slightly thick, smooth and glossy to feel. A US Patent 4349459 indicated that the silicone fluid had the effect of reducing the brittleness of the bloom caused by the use of the alcohol dehydrating agents. They also aided in giving glossy appearance to the flower in addition with other solvents.

Form: Among different treatments, the form of Anthurium was better in flowers treated in composition I, IV and V, which recorded maximum scores (27).

Form was found to be good in Experiment II and this may be due to the presence of shatter resistant polymer. Jain (2011) stated that Vinyl Acetate-Ethylene Emulsion having been developed as a powerful adhesive base offers adhesive strength, high wet tack, good creep resistance, water resistance, alkali resistance, good thickening response, and safety in operations.

Appearance: The appearance of Anthurium was better in flowers treated with improved compositions (Figure 2). Among these, Composition IV and V had higher score as they appeared more close to real flowers and this may be due to the presence of desired

EFFECT OF PRESERVATIVE TREATMENTS ON THE QUALITY OF FREEZE DRY













Fresh Flower				Freeze Dried
	H-349 S-68% B- 75%		H-357 S-74% B- 64%	
	Red(Sun set)		Brown	
Experiment -I			Experiment -II	
	H- 356 S -33% B -34%	Comp-I	H-344 S-53% B- 40%	
	Brown (Van Cleef)		Red (Persian Plum)	
	M-87%		M-94%	
	H- 354 S- 46% B- 27%	Comp-II	H-345 S-72% B-36%	
	Red (Red wood)		Red(Pohutukawa)	
	M-87%		M-89%	
	H- 354 S- 52% B- 24%	Comp-III	H-342 S-68% B-35%	
	Brown (Cocoa)		Red (Red Oxide)	
	M-86%		M-93%	
	H- 346 S -63% B- 33%	Comp-IV	H-344 S-75% B-58%	
	Red (Bordeaux)		Red (Bright Red)	
	M-87%		M-85%	
	H- 346 S- 56% B- 36%	Comp-V	H-343 S-59% B-53%	
	Red (Jazz)		Red(Camelot)	
	M-88%		M-86%	

Fig. 2.Changes in the Physical appearance of freeze dried Anthurium after Pre-treatments

chemicals in the composition like Phenol, Propionic acid and Silicone fluid and resin in addition to shatter resistant compound.

Moisture: The moisture loss percentage varied between 85%-94%. The vast variation may be due to influence of shatter resistant compound or due to

variation in weight of flowers which was difficult to standardise.

The results of Experiment II indicated that the quality of the flowers was further improved and flowers appeared close to natural due to the inclusion of shatter resistant compound. The analysis proved the

significant difference in scores between the two experiments. From this it can be inferred that quality of flowers was better in experiment II when compared to Experiment I.

Among the four variables selected for the study, the texture of flowers scored the least in both experiment I and II. Research to overcome the constraint with texture is desired for further improving the qualities of freeze dried Anthurium

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CHARACTERIZATION AND CLASSIFICATION OF SOIL AND LAND RESOURCE ENVIRONS OF NAGARJUNA SAGAR LEFT BANK COMMAND AREAS OF NALGONDA DISTRICT

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The varied geological, physiographic and vegetational characteristics resulted in the development of variety of soil types in Nagarjuna Sagar Left Bank Command area. Knowledge of the these soils in respect to their characteristics and classification is extremely important for optimizing land use. Such soil data base is of limited availability in Nagarjuna Sagar Left Bank Command area.

This area is located between 16p 422 09.113 and 16p 522 17.83 North latitudes and 79p 252 25.53 and 79p 252 25.53 East. Physiographically, the study area is located at an average elevation of 185 m above the mean sea level (MSL). It is characterized by semi arid climatic condition, with the average rainfall of 788.5 mm of which 86% is received during southwest monsoon, 5% during northeast monsoon and 9% during summer season. The general slope of the land is from north to south. Based on variation in relief factor, lands were characterized in to uplands, midlands and lowlands and were studied in detail and their characteristics are presented in Table 1. The detailed morphological features of these six pedons were described as per the procedure outlined in soil Survey Manual (Soil Survey Staff 1951). The soil samples representing each horizon of the pedons were collected and characterized for important physical and physico-chemical properties using standard procedures, during 2011.

The pedons Thummadam and Nandipadu were developed on upland, pedons Regulagada and Jappathiveerapagudam on midlands and pedons Molkacherla and Wadapalli on low land area. Soils on low land are very deep and poorly drained whereas

the soils on upland and midland are deep to shallow and are well drained. The colour of the soils varied from dark brown (7.5YR3/2) to strong brown (7.5YR5/6) in upland, very dark grayish brown (10YR3/2) to very pale brown (10YR7/3) in midlands and very dark grayish brown (10YR3/2) to brown (10YR5/3) in lowlands. In midland the colour did not differ much between horizons in different pedons. Further, the variation of colour from dark grayish brown to dark brown in midland was due to admixture of organic matter and iron oxides. The colour varied from very brown to very dark grayish brown in lowlands, which might be influenced by the topography and impeded drainage in the sub-surface layers.

The texture of soils was found to vary from loamy sand to clay. The texture of lowland physiographic units was finer than upland (except Nandipadu pedon it has finer texture due inert parent material) and midlands mainly due to lateral movement of finer fractions from uplands and midlands, difference in parent material, physiography, insitu weathering and the tranlocation of clay (Basava Raju *et al*, 2005). The structure of the study area varied from weak to strong, fine to medium and granular to sub angular blocky. The variation in soil structure is a reflection of physiographic position of the pedons (Singh and Agarwal, 2003). The consistency of the soils of upland and midlands varied from loose to very hard(dry), loose to friable (moist) and slightly sticky and slightly plastic to very sticky and very plastic (wet). Whereas the soils in low land exhibited slightly hard to hard (dry), firm to friable moist and sticky and plastic to very sticky and very plastic.

The pH of the soils varied from 6.1 to 7.7 (uplands), 7.5 to 8.2 (midlands), 6.66 to 8.1 (lowlands). The lowland and midland pedons have relatively high pH values than that of upland pedons (Table 2). This increase in soil pH down the slope could be due to leaching of bases from higher topography and getting deposited at lower elevations. The electrical conductivity of pedons ranged from 0.08 to 1.21 dS m⁻¹ indicating moderate salt content in these pedons. The upland pedons showed a less EC. The EC was slightly higher in the horizons of midlands and lowland pedons. In lowlands, slightly higher EC was recorded compared to midlands. This can be attributed to accumulation of salt in lowlands.

The lowland pedons were higher in organic carbon content than other pedons. The distribution of organic carbon in these profiles is mainly associated with physiography and land use. The CEC in soils ranged from 6.9 to 50.8 C mol (p+) kg⁻¹, which corresponds to clay content in the horizons. The base saturation was found to vary from 76.9 to 100 per cent.

Based on morphological, physical, physico-chemical characteristics of the soils and climate data, the soils were classified according to keys to Soil Taxonomy (Soil Survey Staff 1998) into the order Entisols (Thummadam and Nandipadu pedons) which do not have any diagnostic horizon. Thummadam pedon had loamy sand or sand texture, did not have any diagnostic horizons and not permanently saturated with water. Hence these pedon was keyed out as "Psammments" at sub-order level. Nandipadu was classified as "Fluvents" at the sub-order level because they did not have a dense, lithic or paralithic contact within 25 cm of the mineral soil surface and either 0.2 per cent or more organic carbon of Holocene age at a depth of 125 cm below the mineral surface. The Thummadam and Nandipadu pedons had an ustic soil moisture regime. Hence it is keyed out as "Ustipsammments" and "Ustifluvents" respectively at great group level. Thummadam and Nandipadu pedons did not show inter-gradation with any other taxa or any extra gradation from the central concept. Hence, it is logically classified as "Typic Ustipsammments" and "Typic Ustifluvents" respectively at sub-group level. The Regulagada and Jappthiveerapagudam pedons were classified under

the order Inceptisols because of the absence of any other diagnostic horizon other than Cambic horizon. These soils had ustic soil moisture regime, hence these pedons were classified as "Ustepts" at this category. The Regulagada, and Jappathi veerapagudam pedons was classified as Calcustepts at great group level because of the presence of a horizon with more than 15 % calcium carbonate. The Regulagada pedon was classified as Vertic Calcustepts at sub group level because of having cracks within 125 cm of mineral soil surface that are 5mm or more wide for some time in normal year and having Slickensides in a layer of 15 cm or more thick that has its upper boundary within 15cm of mineral soil surface. The Jappthiveerapagudam pedon was classified as Typic Calcustepts at sub group level because of absence of lithic contact within 50 cm of mineral soil surface and absence of petrocalcic, gypsic horizon within 100 cm of mineral soil surface. The Molkacherla and Wadapalli pedons were classified as Vertisols at order level because of the having clay texture, more than 30 % clay in fine earth fraction of all the horizon and cracks that open and close periodically. These soils had ustic soil moisture regime, hence these pedons were classified as "Usterts" at this category. The Molkacherla and Wadapalli pedons were classified as Haplusterts at great group level because these pedons did not have either salic, gypsic and petrocalcic horizons within 100 cm depth. The pedons had EC less than 4 ds m⁻¹ and pH more than 4.5. The Molkacherla and Wadapalli pedons were classified as Chromic Haplusterts at subgroup level because more than 50 % colours are having a colour Value moist of 4 or more or a colour Value dry of 6 or more and Chroma of 3 or more.

The results indicated that the soils of Nagarjuna Sagar Left Bank Command area were shallow to very deep, well to poorly drained, neutral to slightly alkaline, low to high in organic carbon, low to medium in CEC, moderate to high base saturated and loamy sand to clay with variation in relation to physiography. Regarding nutrient status the soils were low to medium in available nitrogen, phosphorous and available potassium, low to medium in available sulphur and low in available zinc. Different landforms of Nagarjuna Sagar Left Bank Command area of Nalgonda district were classified up to sub-group level.

CHARACTERIZATION AND CLASSIFICATION OF SOIL AND LAND RESOURCE

Table 1. Summary of the Morphological features of the pedons *

Pedon No	Horizon	Depth	Colour		Texture	Structure G S T	Consistency			Other salient features
			Dry	Moist			D	M	W	
Pedon 1: Typic Ustipsamments (Upland)										
	Ap	0-8	7.5 YR 5/6	7.5 YR 5/6	LS	1 f gr	l	fr	sopo	
	Cr	8-45+	7.5 Y R 5/6	7.5 YR 5/6	LS	2 m gr	sh	fr	sopo	
Pedon 2: Typic Ustifluvents (Upland)										
	Ap	0-10	7.5 YR. 3/3	7.5YR 3/2	C	1 f sbk	l	l	sopo	
	Cr	10- 55+	7.5 YR 5/6	7.5YR 5/6	C	m 2 sbk	l	l	sopo	
Pedon 3: Vertic Calcustepts (Midland)										
	Ap	0-20	10 YR 3/3	10 YR 3/2	C	2 m sbk	h	fi	ssps	
	Bw ₁	20-64	10 YR 3/3	10 YR 3/3	C	2 m sbk	h	fi	sp	
	Bw ₂	64-90	10 YR 3/4	10 YR 3/4	C	2 m abk	h	fi	sp	
	Ck	90+	10 YR 3/5	10 YR 3/5	C	3 m abk	vh	fi	sp	
Pedon 4 : Typic Calcustepts (Midland)										
	Ap	0-10	10 YR 4/4	10 YR 3/4	CL	1 m sbk	sh	fi	sssp	
	Bw	10-28	10 YR 5/4	10 YR 4/4	C	1 m sbk	sh	fi	sssp	
	Bck	28+	10 YR 7/3	10 YR 6/6	C	2 m sbk	h	vfi	vsvp	
Pedon 5 : Chromic Haplusterts (Lowland)										
	AP	0-18	10 YR 4/3	10 YR 4/3	C	2 f sbk	sh	fi	vsvp	Cracks are observed
	BW1	18-36	10 YR 4/3	10 YR 4/3	C	3 f sbk	h	fi	vsvp	
	Bwss ₁	36-51	10 YR 3/3	10 YR 3/2	C	3 f abk	h	fi	sp	
	Bwss ₂	51- 85+	10 YR 3/2	10 YR 3/2	C	3 f abk	h	fi	sp	
Pedon 6 : Chromic Haplusterts (Lowland)										
	Ap	0-24	10 YR 5/3	10 YR 5/3	C	2 f abk	h	fi	sp	Cracks are observed
	Bw	24-42	10 YR 4/3	10 YR 4/3	C	2 f abk	h	fi	sp	
	Bss	42-89	10 YR 4/3	10 YR 4/3	C	3 f sbk	vh	fi	sp	
	C	89- 120+	10 YR 4/3	10 YR 4/4	C	3 f abk	vh	fi	sp	

* Symbols used are according to Soil Survey Manual (Soil Survey Staff 1951)

Table 2. Soil-site characteristics of the study area

Pedon.No	Climate				Land form characteristics			Physical and Physico-chemical characteristics(weighted averages)							
	Rain fall (mm)	Max. temp (°C)	Min. temp (°C)	RH (%)	Slope (%)	erosion	drainage	Depth (cm)	S.Coarse fragments (vol %)	texture	pH	EC (dS m ⁻¹)	OC (%)	CEC cmol (p+)/kg	B.S (%)
Upland															
Pedon 1	788	33.1	20.3	79	3-5	Moderate	Well	45+	23	LS	6.1	0.16	0.67	6.9	97
Pedon 2	788	33.1	20.3	79	3-5	Moderate	Well	55+	24	C	7.7	0.20	0.60	8.6	94
Midland															
Pedon 3	788	33.1	20.3	79	2-3	Slight	Mod.well	90+	20	CL	7.5	0.32	0.65	45.1	100
Pedon 4	788	33.1	20.3	79	2-3	Moderate	Mod.well	28+	21	C	7.8	0.24	0.61	38.0	97.8
Lowland															
Pedon 5	788	33.1	20.3	79	2-3	Nil	Poor	85+	18	C	6.7	0.12	0.72	39.1	81.1
Pedon 6	788	33.1	20.3	79	0-1	Nil	Poor	120+	10	C	7.8	0.80	0.71	45.1	84.4

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AN ANALYSIS OF THE NEGATIVE IMPACT OF RETAIL GIANTS INTERVENTION INTO AGRICULTURE: AN EMPIRICAL APPROACH FROM FARMERS POINT OF VIEW

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Entry of large corporate bodies into the agricultural marketing business has attracted the attention of many intellectuals, policy makers and public institutions at large, because whatever change happening to a typical farmer in rural India will have an impact at large on economy of the country as it affects more than 65 crores of the people who are directly dependent on agriculture. During the early stages of the entry, people were divided on the opinion over the impact of retail sector on the farming community. In some states like U.P., there were large scale protests against the organized retail sector's entry into the agriculture as it may make small farmers as victims of the new trend. In the present study, an attempt has been made to identify and analyze the various constraints and apprehensions from the farmer's point of view and conclusions were drawn after analyzing the data.

For the purpose of the present study, a sample of 126 farmers consisting of two groups was selected. Farmers dealing with retail companies were placed in first group and the farmers not dealing with retail companies were placed in second group. Further each group was constituted in such a manner that each group includes equal number of small, medium and large farmers i.e 21 in each sub group and each of the subgroups consist of equal number of different vegetable cultivators viz., tomato, bhendi and green chilli. Thus, the sample represents a wide assortment of farmers and the study was conducted during *Rabi* 2009 covering eight selected villages in Ranga Reddy district of Andhra Pradesh. The requisite data on various constraints and apprehensions from the selected sample farmers was obtained through personal interview schedule. *Kendall's coefficient of*

concordance (w) and *Man-whitney U tests* were employed to analyze the data and draw the conclusions.

Different constraints identified and categorized into 8 groups using various methods viz. preliminary survey in the study area, review of other research findings (Manoj Kumar 2004 and Vijay Kumar 2008) and mass media articles are given below:

1. Non-availability of high quality inputs to meet required standards of the retailers.
2. Skilled labour shortage to perform various farm operations to produce specified quality products.
3. Lack of technical support from the retailers before and after sowing/transplanting the crop.
4. Lack of market intelligence.
5. Lack of grading knowledge.
6. Distance from company's collection centre to the farmer's field.
7. Rejection of low grade products.
8. Lack of procurement facility for all the crops grown by a single farmer.

The sample farmers were asked to rank each constraint based on the "intensity of difficulty" faced by them. It was used to identify the agreement among respondents by calculating the "W" value in Kendal's test, if the calculated value is less than table value that confirms the agreement among respondents is significant. For this, Kendall's coefficient of concordance (W) test was applied and the results were presented in Table 1.

Table 1. Frequency of the ranks assigned to the constraints by the sample farmers

Constraint \ Rank	1	2	3	4	5	6	7	8
1	20	1	4	3	11	6	19	3
2	14	9	8	8	26	12	19	11
3	14	14	14	13	16	9	14	20
4	9	17	16	15	8	13	9	10
5	5	9	11	9	1	10	2	6
6	1	4	7	7	1	7	0	4
7	0	4	2	4	0	3	0	1
8	0	5	1	4	0	3	0	4

Table 2. Sum of the ranks assigned by each farmer to various constraints

Constraint	1	2	3	4	5	6	7	8
Sum of the ranks (ΣR_i)	157	266	245	265	154	246	145	240

$$\Sigma R_i = 157 + 266 + 245 + 265 + 154 + 246 + 145 + 240 = 1718$$

$$\bar{R} = 1718 / 8 = 214.75$$

$$R_i - \bar{R} = -57.75, 51.25, 30.25, 50.25, -60.75, 31.25, -69.75, 25.25$$

$$\Sigma(R_i - \bar{R})^2 = 19571.5$$

$$W = \frac{12 \Sigma(R_i - \bar{R})^2}{K^2(N^3 - N)} = \frac{12 \times 19571.5}{63^2(8^3 - 8)} = \frac{234858}{3969 \times 504}$$

$$= 0.11740$$

The Ψ^2 value was calculated to test the significance of the test.

$$\Psi^2 = k(n-1)w \text{ at } (n-1) \text{ df} = 63(8-1) \times 0.11740 = 51.7734$$

$$\Psi^2 \text{ table value at } \alpha = 0.05 \text{ with } 7 \text{ df} = 14.07$$

Since the calculated value of 51.7734 was greater than the table value of 14.07 at seven degrees of freedom $\alpha = 0.05$ level, it was concluded that the value was significant and that all the interviewed farmers were able to rank the constraints in descending order of intense of difficulty. The constraints viz., rejection of low quality vegetables, lack of grading knowledge and non availability of quality inputs reveal that these were the major problems in successful utilization of retail sector by farmers. Thus, from the present analysis it was

identified that severity of the constraints felt by the farmers varied from one constraint to other and need to overcome the same.

The Mann-Whitney U-test was used to analyze the apprehensions anticipated in the study. The apprehensions anticipated (in vegetable marketing) that may harm the farmers in future if corporate retail companies continue agribusiness with farmers were provided below. The mentioned apprehensions were identified based on the opinions of the farmers during the preliminary visits of the field

survey in the study area. Both the groups of farmers were interviewed to elicit the data on apprehensions.

1. Companies may prefer to tie up only with big farmers who possess larger holdings.
2. Continuous production of high quality vegetables to meet the specified standards may not be possible.
3. Corporate retail companies may intend to hijack whole supply chain and establish a monopoly and as a result retailers may become giant middlemen and dictate the market.
4. Dealing with retail companies may lead to mono cropping which will cause adverse affect on farming.
5. Companies may force to use genetically modified seeds which may be expected to harm the traditional varieties and environment.
6. Extensive use of pesticides and fertilizers to get required quality and quantity may deteriorate the soil health in long run.
7. Cost of cultivation may go up with intensive farming.
8. Companies may import farm products from other areas or abroad at low prices that will cause huge losses to producers who are dealing with the companies and who shifted cropping pattern accordingly. The data related to the apprehensions by the farmers were presented in the table 3.

Table 3. Agreement and disagreement of the farmers with the identified apprehensions

Apprehensions Rank	1	2	3	4	5	6	7	8
1	20	1	4	3	11	6	19	3
2	14	9	8	8	26	12	19	11
3	14	14	14	13	16	9	14	20
4	9	17	16	15	8	13	9	10
5	5	9	11	9	1	10	2	6
6	1	4	7	7	1	7	0	4
7	0	4	2	4	0	3	0	1
8	0	5	1	4	0	3	0	4

To apply Mann-Whitney U-test ranks were assigned to the scores of both groups together, by assigning rank 1 to the score which was algebraically lowest. Ranks range from 1 to N and $N = n_1 + n_2$ and average of tied ranks were assigned to tied observations.

Total ranks are equal to N and N is the sum of total number of first group apprehensions and second group apprehensions.

$$1 \rightarrow N = n_1 + n_2$$

$$1 \rightarrow 16 = 8 + 8$$

Using the formula of Mann-Whitney U-test, the U value can be found.

$$U = n_1 n_2 + n_1(n_1 + 1) - R_1$$

R1 = is the sum of the all the ranks assigned to the apprehensions by the first group.

$$R_1 = 16+2+6.5+3+8+13+10.5+12 = 71$$

$$U = 8 \times 8 + 8(8+1)/2 - 71$$

$$U = 29$$

From the table probability value of U is 0.399. It was more than α (= 0.05), and hence the null hypothesis **H₀** may be accepted in favor of **H₁**.

Thus, the apprehensions studied were felt equally severe by both the groups of farmers that may harm them in future. So it is suggested that initiation of appropriate policies by the government to counter these apprehensions is very

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much required to safeguard the benefits of the farmers in the coming future.

The maximum correlation among the constraints was estimated by *Kendall's coefficient of concordance (w)* test. The constraints like rejection of low grade products, lack of knowledge of grading and non availability of quality inputs revealed that these were the major problems encountered by farmers when they deal with organized retail companies. The ranking done by the respondents to the constraints and the application of Kendall's coefficient of concordance (w) test reveal that there was a need to overcome the above said constraints by farming community to make use of the booming retail sector.

The farmers were asked to mark either agree with the apprehension or disagree with it and the data was analyzed using a non parametric test i.e. Mann-Whitney U-test. All the apprehensions identified were felt severe by both the groups of farmers. From the results it was clear that many farmers were skeptic that companies may tie up only with big farmers and extensive use of fertilizers and pesticides to meet high quality may deteriorate fertility levels of the soils in long run. Exploitative arrangements by firms were

likely to have only a limited duration and jeopardize agribusiness investments (Sunil Phougat, 2006).

The retail boom in the recent past has its own criticism and the negative aspects like constraints and apprehensions of the sector were identified and analyzed in the study area. The constraints like rejection of low quality vegetables, lack of knowledge of grading, non availability of high quality inputs, lack of procurement facility for all the crops grown by a single farmer, lack of technical support from the retailers side before and after sowing/transplanting the crop, accessing the company's collection centre from the farmer's field, lack of outside market information and skilled labour shortage to perform different farm operations to produce specified quality products felt by the farmers are in descending order of intensity. All the identified apprehensions were felt severe and significant by both the groups of farmers. Through an appropriate policy approach towards retail sector to address the identified constraints and apprehensions, a producer can get his right share in the consumer's rupee and a consumer can enjoy a quality product with right price with the new trend of retail booming.

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ASSOCIATION OF GRAIN YIELD AND COMPONENT TRAITS IN SORGHUM

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This study is aimed to analyze and determine the traits having greater interrelationship with grain yield including quality traits utilizing the correlation and path analysis in sorghum.

The experimental material comprising of sixty-three genotypes of sorghum were raised in randomized block design (RBD) with three replications at Directorate of Sorghum Research, Rajendranagar, Hyderabad during *khariif* 2011. Each entry was sown in a single row of 4 m length with a spacing of 60 cm between rows and 15 cm between plants. Observations were recorded on various characters and phenotypic and genotypic correlations were worked out as per method given by Johnson *et al.* (1955). Path analysis was carried out as per method suggested by Dewey and Lu (1959).

Genotypic and phenotypic correlations between yield and its components in the present study were in perfect agreement with each other. However, genotypic correlation exhibited slightly higher magnitude than phenotypic correlation (Table 1).

Grain yield per plant was found to be significantly positive association with plant height, panicle length, panicle weight, number of grains per primary branch, 100-seed weight and number of grains per panicle at both the levels. Chavan *et al.* (2011) and Mahajan *et al.* (2011) also reported that grain yield was to be positively correlated with plant height, panicle length and number of grains per panicle.

Inter character correlations at genotypic and phenotypic levels showed negative and significant correlation of days to 50% flowering with plant height,

panicle length, number of primary branches per panicle and 100-seed weight. However, it exhibited non-significant correlation with grain yield per plant. Iyanar *et al.* (2001) reported similar association between grain yield and days to 50 per cent flowering.

Plant height had positive significant correlation with panicle length, panicle weight, number of grains per primary branch, 100-seed weight and number of grains per panicle at both the levels. It had significant negative association with days to 50% flowering and quality parameters. Panicle length showed significant positive correlation with panicle weight, number of primary branches per panicle, length of primary branch, number of grains per primary branch and number of grains per panicle.

Panicle weight was highly associated with grain yield among all component traits (Deepalakshmi and Ganesamurty, 2007). It also exhibited positive significant association with length of primary branch, number of grains per primary branch, 100-seed weight and number of grains per panicle. Number of grains per primary branch had positive significant correlation with number of grains per panicle, while it had significant negative association with 100-seed weight. Significant positive correlation of this trait with grain yield and panicle weight was reported by Aruna and Adilakshmi (2008).

Panicle length and panicle weight had significant negative correlation with protein content while protein content showed negative association with grain yield at both the levels. Number of grains per panicle exhibited the highest positive significant association with panicle weight among all component traits. Mahajan *et al.* (2011) reported its significant positive correlation with grain yield per plant.

Table 1. Estimates of phenotypic (r_p) and genotypic (r_g) correlation coefficients between yield and yield contributing characters in sorghum

S.No	Character	Days to 50% flowering	Plant height (cm)	Panicle length (cm)	Panicle weight (g)	Number of primary branches / panicle	Length of primary branch (cm)	Number of grains/ primary branch	100-seed weight (g)	Number of grains/ panicle	Starch content in grain (%)	Protein content in grain (%)	Grain yield/ plant (g)
1	Days to 50% flowering	r_p 1.0000	-0.1878**	-0.2664**	-0.0320	-0.1583*	-0.0368	0.0468	-0.3363	0.1123	-0.0319	0.0809	-0.1007
		r_g 1.0000	-0.1657*	-0.3196**	0.0030	-0.2006**	-0.0334	0.0816	-0.4823**	0.2299**	0.0135	0.0672	-0.0841
2	Plant height (cm)	r_p 1.0000	1.0000	0.2501**	0.4118*	0.0341	0.0437	0.2037**	0.4297**	0.2224**	-0.1822	-0.1223	0.4761**
		r_g 1.0000	1.0000	0.1990**	0.6209*	0.0698	0.1049	0.2326**	0.4968**	0.3144**	-0.3103**	-0.1995**	0.6433**
3	Panicle length (cm)	r_p 1.0000	1.0000	1.0000	0.3822*	0.1660*	0.5531*	0.3782**	0.0296	0.3048**	-0.0427	-0.1472*	0.3210**
		r_g 1.0000	1.0000	1.0000	0.2448*	0.2297**	0.7799*	0.4918**	-0.1407	0.2586**	-0.0841	-0.1763*	0.1909**
4	Panicle weight (g)	r_p 1.0000	1.0000	1.0000	1.0000	0.1230	0.3474*	0.5293**	0.1609*	0.7479**	-0.0291	-0.2084**	0.9483**
		r_g 1.0000	1.0000	1.0000	1.0000	0.0012	0.1614*	0.6739**	0.1601*	0.8343**	-0.0577	-0.2085**	0.9981**
5	Number of primary branches/ panicle	r_p 1.0000	1.0000	1.0000	1.0000	1.0000	0.0655	-0.3161**	0.1207	-0.0066	-0.0103	-0.2609**	0.1021
		r_g 1.0000	1.0000	1.0000	1.0000	1.0000	-0.0004	-0.3553**	0.1762*	-0.1315	0.0245	-0.3900**	0.0013
6	Length of primary branch (cm)	r_p 1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.4568**	-0.2205**	0.3018**	0.0143	-0.1222	0.2549**
		r_g 1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.5151**	-0.2638**	0.2448**	-0.0649	-0.0497	0.0959
7	Number of grains/ primary branch	r_p 1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-0.2437**	0.5368**	0.1259	-0.0939	0.4957**
		r_g 1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-0.3353**	0.7475**	0.1713*	-0.0754	0.5998**
8	100-seed weight (g)	r_p 1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-0.2294**	-0.1628*	0.1360	0.2019**
		r_g 1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-0.3583**	-0.2753**	0.1857*	0.2536**
9	Number of grains/ panicle	r_p 1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0264	-0.2793**	0.7393**
		r_g 1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0149	-0.3641**	0.7902**
10	Starch content in grain (%)	r_p 1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-0.0324	-0.0253
		r_g 1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0808	-0.0714
11	Protein content in grain (%)	r_p 1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-0.2355**
		r_g 1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-0.2401**

*Significant at 5% level ** Significant at 1% level

Starch content showed significant negative correlation with plant height and 100-seed weight at both the levels and positive significant correlation with number of grains per primary branch at genotypic level, however, it exhibited non-significant correlation with the rest of the characters.

Simple correlation coefficient is only the measure of the degree of association between two characters and they do not provide causal basis of such an association. So it becomes necessary to study path coefficient analysis, which takes in to account the causal relationship in addition to degree of relationship. Hence, genotypic and phenotypic correlations were partitioned in to direct and indirect effects to know the relative importance of the component traits.

The path coefficient analysis revealed that the direct contribution of panicle weight was maximum on grain yield, number of grains per panicle, plant height, 100-seed weight, number of grains per primary branch and starch content (at phenotypic level). Panicle weight recorded high positive indirect effect on grain yield through number of grains per panicle followed by number of grains per primary branch. Ezeaku and Mohammed (2006) reported the

maximum direct effect of panicle weight on grain yield. Panicle weight exhibiting significant and positive correlation with plant height was reported by El-Naim *et al.* (2012). The indirect contributions of days to 50% flowering and starch content were negligible.

Panicle length and length of primary branch recorded negative direct effect on grain yield at phenotypic level, whereas days to 50% flowering, number of primary branches per panicle and protein content had negative direct effect on grain yield. The negative significant association of protein content was mainly due to its negative direct effect on grain yield (Bohra *et al.*, 1985).

On the basis of correlation and path analysis, it could be seen that panicle weight recorded significant positive correlation co-efficient and contributed to maximum direct effect on grain yield and this might be regarded as the prime character. The direct and indirect effects among component traits like panicle weight, number of grains per panicle, plant height and number of grains per primary branch was positive. Thus, selection based on these traits would result in improvement of grain yield.

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UREASE AND PHOSPHOMONOESTERASE ACTIVITY AS RELATED TO PHYSICO-CHEMICAL PROPERTIES OF SOME SOILS OF SOUTHERN TELENGANA ZONE

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The activity of soil enzyme is important in making the nutrients available for plants. The most important examples for these are mineralization of organophosphorous compounds by phosphatase enzymes and the activity of urease enzyme on hydrolysis of urea. The aim of this research work was to determine urease, acid phosphatase and alkaline phosphatase activity of different soil samples and their interaction between physical and chemical characteristics of soil. An evaluation of the activity of these enzymes was made in soils of Southern Telengana zone during the year 2010.

Forty - five representative soil samples were collected from 0 to 15cm depth, dried in shade, powdered and analyzed using standard procedure. Urease in soil was determined as described by Tabatabai and Bremnar (1972). Procedure of Tabatabai and Bremnar (1969) and Eivazi and

The soil texture varied from clay to sandy loam. The pH ranged from 5.70 to 9.50, electrical conductivity from 0.08 to 1.23 dS m⁻¹ and organic carbon from 0.11 to 1.48 %. The alkaline KMnO₄ - N ranged from 210.0 to 615.8 kg ha⁻¹. The available -P status in the soils ranged from 12.36 to 148.33 kg ha⁻¹. The NH₄OAc - K ranged from 172.97 to 763.89 kg ha⁻¹. Urease activities of the surface soils is expressed as µg of NH₄⁺ released g⁻¹ soil h⁻¹ ranged from 4.26 to 16.09 with an average value of 9.05. Acid phosphatase activities of the soil expressed as µg of 4-nitrophenol released g⁻¹ soil h⁻¹ ranged from 12.23 to 68.86 with an average value of 43.84, while alkaline phosphatase activities (4-nitrophenol released g⁻¹ soil h⁻¹) ranged from 26 to 110.03 with an average value of 57.83.

Simple correlation analysis showed that urease activity was positively and significantly

Table 1. Correlation co-efficient between Urease, Phosphomonoesterases and soil properties

Soil Properties	Correlation Coefficient [r]		
	Soil Urease	Soil acid phosphatase	Soil alkaline phosphatase
Organic Carbon	0.94**	0.50**	0.67**
pH	0.17	0.32	0.06
Clay	0.50**	0.43**	0.33
Silt	-0.12	-0.23	-0.13
Sand	-0.43	-0.30	-0.27
Available Nitrogen	0.32	0.32	0.39
Available Phosphorus	0.37	0.46**	0.41
Available Potassium	0.07	0.24	0.27

Tabatabai (1977) were adopted for assay of acid and alkaline phosphatase respectively.

correlated with organic carbon (0.94**) and clay content (0.50**). Urease showed no significant correlation with silt and pH. Acid phosphatase also

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showed significant correlation with organic carbon (0.50**) and clay content (0.43**) and has shown no significant correlation with pH and silt. These enzyme studies have shown no significant correlation with any of the available major nutrients except acid phosphatase with available phosphorous (0.46**) (Table 1).

The data on soils studied showed variation in enzyme activity, mostly accounted by varying organic carbon content. Since organic soil constituents contribute significantly to the protection of native soil enzymes, increase in phosphatase activity following the increase or addition of organic manures is due to proliferation of phosphate producing microbes in soil which stimulate phosphatase activity.

Similar results were reported by a number of investigators. Tabatabai (1977) also observed positive and significant correlation between urease and organic carbon. Chonkar and Tarafdar (1984) showed a significant positive correlation of soil phosphatase with soil organic carbon and, organic phosphorous and a negative correlation with pH and no correlation with clay. A positive correlation between pH and phosphatase was found by Rastin *et al.* (1988). Sankar Rao (1989) found positive and significant correlation between urease and organic carbon. Urease activity correlated significantly with total nitrogen and clay content also. Urease activity was not correlated with sand, silt, pH and EC in a study conducted by Hussain *et al.* (1990). Significant positive correlation was found between phosphatase and organic carbon; between available nitrogen and organic carbon by Sriramachandrasekharan *et al.* (1997).

Significant correlation was found between phosphatase activity and extractable P in soil by

Zibilske and Bradford (2003). Similar results were found by Gianfreda *et al.* (2005) and Schaller (2009). Moral *et al.* (2008) reported a positive correlation between alkaline phosphatase and available phosphorous. Madejon *et al.* (2007) has found that enzymatic activity and soil organic carbon contents were strongly correlated. Dehydrogenase activity was highly correlated with soil organic carbon and phosphatase was strongly correlated with P content of the soil and soil organic carbon. But a contrasting result was shown by Shi *et al.* (2008) that no effect on urease activity was shown by pH and EC. But urease shows positive correlation with organic matter and clay content. Significant positive correlation coefficient between urease and organic carbon, no correlation with clay and sand (-0.29) was observed by Shilpashree and Kotur (2009). Kizilkaya and Dengiz (2010) found a positive correlation between urease activity, alkaline phosphatase with organic matter content and a non-significant negative correlation between alkaline phosphatase and clay content. It is observed that the changes of land use and land cover associated with organic matter content can alter the soil enzyme activities within a soil profile.

The higher correlation between enzyme activity and organic carbon content is because the later is seat of microbial population and activity. So, it can be concluded that organic matter content of the soil is the main factor controlling variations in enzyme activity, especially urease activity. This investigation with different soil properties and enzyme activities agree closely with the fact that enzyme activities can be increased through addition of energy sources. Increase in the organic carbon and total nitrogen content could serve as a basis for increase in soil enzymatic activities. So, this study helps to find some cause-effect relationship between soil properties and enzyme activities.

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EFFECT OF DRIP IRRIGATION LEVELS AND MULCHES ON GROWTH, YIELD AND WATER USE EFFICIENCY OF TOMATO

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An experiment was conducted on tomato (cv. Arka Vikas) during winter (*rabi*) season of 2011-2012 in sandy clay loam soil, at Water Technology Centre, Rajendranagar, Hyderabad. The experiment was laid out in strip plot design with three irrigation treatments (with drip) viz., I_1 - at 1.0 E pan, I_2 - at 0.8 E pan, I_3 - at 0.6 E pan and four treatments with mulches viz., M_1 : Old gunny bags treated with gourgum powder. (5% gourgum powder thoroughly

mixed in hot water and then gunny bags were dipped and dried under shade) M_2 : Polythene sheet (0.25 i thick dual surface black polythene sheet) M_3 : Paddy straw @ 6 t ha⁻¹ M_4 : without mulch.

Different irrigation levels exhibited highly significant effect on plant height, Dry matter production, Number of fruits per plant, fruit yield per plant and Fruit yield.

Table 1. Effects of different irrigation levels and mulches on the growth, yield attributes, yield and water use efficiency of tomato

Treatments	Plant height (cm)	Dry matter production (kg ha ⁻¹)	Number of fruits per plant	fruit yield per plant (kg)	Fruit yield (t ha ⁻¹)	Amount of water applied (mm)	Water use efficiency (kg ha mm ⁻¹)
Irrigation levels							
I_1	106	5079	505	2.51	33.66	354.1	95.0
I_2	100	4995	47	2.42	31.80	297.5	106.8
I_3	97	4923	45	2.29	29.61	241	122.8
S.Em ±	0.6	33	0.6	0.03	0.36	-	-
C.D at 5%	1.8	91	1.8	0.09	1.02	-	-
Mulches							
M_1	103	5061	49.88	2.49	32.84	297.5	108.9
M_2	106	5114	51.22	2.56	34.03	297.5	112.8
M_3	101	5021	47.55	2.37	31.28	297.5	103.7
M_4	95	4801	43.11	2.15	28.61	297.5	94.9
S.Em ±	0.8	42	0.5	0.02	0.42	-	-
C.D at 5%	1.9	105	1.3	0.06	1.03	-	-

Plant height of tomato was higher with drip irrigation scheduled at 1.0 E pan and similarly with application of polythene mulch lowest plant height was recorded with no mulch (bare soil) at harvest (Table 1). Lourduraj *et al.* (1996) obtained taller plants and more number of laterals in tomato cv. "CO-3" with the application of black LLDPE mulch as compared to organic mulch and no mulch.

Higher dry matter production was recorded with drip irrigation scheduled at 1.0 E pan and it was significantly superior to drip irrigation scheduled at 0.6 E pan.

Application of polythene mulch also resulted in higher dry matter accumulation and it was on par with bio degradable and paddy straw mulches. While the lowest dry matter was recorded by without mulch (Table 1). The higher moisture content maintained under mulches leads to greater plant growth and dry matter production (Deepak and Bhardwaj, 2012).

Number of fruits per plant was higher with application of polythene mulch and also with drip irrigation at 1.0 E pan. Mulching significantly increased the number of fruits per plant compared to the control. (Kayum *et al.*, 2008).

Drip irrigation scheduled at 1.0 E pan resulted in highest fruit yield per plant and per hectare lowest fruit yield (29.61 t ha⁻¹) was recorded in 0.6 E pan (Table 1).

Bar-Yosef and Sagive (1982) reported maximum yield of tomato with drip irrigation equivalent to 80 percent

of pan evaporation and 105 percent of ETo. Mukherjee *et al.*, (2012) also observed better utilization of soil nutrients, higher photosynthetic rate and enhanced translocation of photosynthates under least-water stressed environment. Application of polythene mulch recorded significantly higher fruit yield and it was superior to all other mulch treatments. The lowest fruit yield was recorded with bare soil.

Soil mulching not only reduces the soil evaporation and weed growth but also improves the aerial environment around the plants which facilitate plant growth and yield (Singh and Kamal, 2012).

Among the irrigation levels, drip irrigation scheduled at 0.6 E pan resulted in higher WUE over rest of the treatments (Table 1). The least water use efficiency was recorded at 1.0 E pan. The increase in WUE with drip irrigation scheduling at 0.6 E pan and 0.8 E pan was 29.25 % and 12.43 %, respectively over 1.0 E pan.

Among the mulches, highest water use efficiency was recorded with application of polythene mulch closely followed by bio-degradable mulch and paddy straw while the lowest WUE was recorded with without mulch condition.

Black polythene mulch (BPM) recorded the maximum WUE which was 227% higher over without mulch condition (Mukherjee *et al.*, 2012).

The results of present study indicated that for achieving maximum yield and water use efficiency, tomato crop can be drip irrigated at 1.0 E pan with application of polythene mulch.

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GENETIC ANALYSIS OF BOLL WEIGHT IN COTTON (*Gossipium hirsutum* L.)

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Boll weight is an important yield component in cotton. Six parents were utilized to produce fifteen diallel crosses and sixty three way crosses for study on gene action for seed cotton yield and other characters. Triallel analysis was conducted for boll weight and found that predominance of epistatic component of additive X dominance was playing major role in character governance, followed by additive and dominance X dominance components. Parent order effects in three way crosses were clearly elucidated the order in which crosses will be effected.

Among the different biometrical techniques used to estimate gene action triallel analysis is a potential tool to get information on eistatic components of variance in addition to additive and dominance variances. Triallel analysis also gives the information on order of parents in three way cross combinations for obtaining superior transgressive segregates (Ponnuswamy *et al*, 1974 and Singh and Narayanan , 2000).A three way cross denoted by (AB)C has been defind as cross between line "C" and unrelated single cross (AX B). Lines A and B are called as grand parents and line C as immediate parent or full parental lines (Rawlings and cockerham 1962).In the present study an attempt has been made to obtain information on gene action controlling the boll weight is important trait in cotton.

Field experiments were conducted at Regional Agricultural Research Station, Lam farm Guntur of Acharya N G Ranga Agricultural University. The material comprised of 60 , three way crosses derived from fifteen diallel crosses produced by crossing six diverse parents viz., 241-4-2, G cot 100, RFS 3438, 65-2(s)-3, Hyps 152 and Suvin in triallel mating design (Singh and Narayanan, 2000). During kharif 2009 six parents were mated in half diallel fashion and fifteen single cross hybrids were synthesized. During 2010-11 these 15 single crosses were mated with six parents in triallel fashion and 60 three way crosses were produced. All these three way crosses along with single crosses and parents were evaluated in two sets of experiments in randomized block design in three replications with 105 X 60 cm² containing single row with ten hills.

Five plants were randomly selected from each plot for recording boll weight and other characters. The mean data was subjected to triallel analysis (Singh and Chaudhary, 1985) to draw valid conclusions.

The analysis of variance (Table 1) revealed that general line effects(both first and second) were significant thus indicating the predominance of additive and additive and additive X dominance and dominance X dominance epistatic components in governing the character.

Table 1. Analysis of variance for boll weight(g)in cotton (mean squares)

S.No	Source	df	Mean Squares
1	Replications	2	1.149
2	General line effect of first kind(hi)	5	3.279**
3	General line effect of second kind(gi)	5	6.278**
4	Two line specific effect of first kind(dij)	9	0.839
5	Two line specific effect of second kind(sij)	19	0.424
6	Three line specific effect (Tijk)	21	0.758
7	Crosses	59	1.242
8	Error	118	0.462

General line effects of first kind (hi) was positive and significant for parents 241-4-2 (0.292*) and 65-2(s)-3 (0.220*) and second kind effects for Hys 152 (0.362*) only. When gca effects of diallel and triallel were compared, parents 241-4-2 and Hys 152 were positively significant in diallel analysis and in triallel, parents 241-4-2 and 65-2(s)-3 for general line effect

The two line specific effects of first kind (dij) were positive and significant for two three way crosses i.e., RFS3438 X 65-2(s)-3 (0.537*) and 241-4-2 X G cot 100 (0.325*) indicating their superiority as grand parents in three way crosses. The two line specific effects of second kind (sij) were only positive in six crosses with reciprocal differences observed

Table 2. Estimation on General line effects and two line specific effects for character boll weight in cotton

Line	General line effects		Two line specific effects (dij). Figures in the parentheses are corresponding to estimates of sij(upper half) and sji(lower half)					
	hi	gi	241-4-2 parent 1	G cot 100 parent 2	RFS 3438 parent 3	65-2(s)-3 parent 4	Hys 152 parent 5	Suvin parent 6
241-4-2 parent 1	0.292*	0.186		(-0.113) 0.325*	(-0.003) -0.045	(0.025) -0.290	(0.260) 0.022	(-0.170) -0.012
G cot 100 parent 2	0.071	0.178	0.325* (-0.119)		(-0.047) -0.142	(0.036) -0.153	(-0.075) 0.152	(0.205) -0.182
RFS 3438 parent 3	0.002	-0.256*	-0.045 (-0.217)	-0.142 (0.066)		(-0.043) 0.537*	(0.246) -0.342*	(-0.046) -0.008
65-2(s)-3 parent 4	0.22*	0.107	-0.290 (-0.184)	-0.153 (-0.190)	0.537* (0.241)		(-0.063) -0.063	(0.195) -0.030
Hys 152 parent 5	0.165	0.362*	0.022 (0.120)	0.152 (0.100)	-0.342* (-0.230)	-0.063 (0.195)		(0.184) 0.232
Suvin parent 6	-0.749*	-0.577*	-0.012 (0.400)	-0.182 (0.137)	-0.008 (0.039)	-0.030 (-0.214)	0.232 (-0.362)	

SE(hi)=0.094
SE(tijk)=0.232

SE(gi)=0.009

SE(dij)=0.166

SE(sij)=0.146

SE(hi-hj) = 0.146
SE(dij-dkl)=0.215

SE(gi-gj)= 0.185

SE(hi-gi)=0.126

SE(dij-dik)= 0.263

SE(sij-sjk)=0.261

SE(sik-sik)=0.298

SE(sij-ski)=0.258

SE(sij-skl)=0.255

of first kind and Hys 152 for general line effect of second kind were found to be positively significant. It clearly indicated that parents 241-4-2, Hys 152 and 65-2(s)-3 were good general combiners to produce bigger bolls. The specific combining ability in diallel crosses was positively significant in RFS 343 X Suvin, 241-4-2 X RFS 3438 and RFS 3438 X Hys 152.

for most of the combinations indicating the importance of parent order in three way crosses. The highest significant positive three line specific effects (Tijk) were exhibited by 3X4X2 (Tijk=0.684*) by 3X5X6 (0.645*), 4X6X5(0.552*) and 1X3X4(0.524*).

Three line specific effects were found to be significant and positive in seven three way crosses.

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The triplet 3X4X2 (RFS 3438 X 65-2(s)-3 X G cot 100) had shown highest positive significant three line specific effect ($t_{ijk}=0.684^*$) as well as high per se performance for boll weight. Parent order effect was clearly elucidated in triplet 3X4X2 with high t_{ijk} effect while the alternative forms 2X3X4 and 2X4X3 had negative non significant t_{ijk} effects indicating the importance of order of parents to be used in three way crosses for obtaining highest gain in boll weight. The best triplet 3X4X2 only 65-2(s)-3 is good general combiners the other parents are poor. The two line

specific effects of first kind were positively significant RFS 3438 X 65-2(s)- and the general combining effect of second kind was positive for G cot 100. Hence the best performance can be attributed due to (i) d_{ij} effect (ii) g_i effect and (iii) interaction of three parents used in a particular order.

The observation of related statistics for the trait indicating that both general line effects σ^2_{hi} and w^2_{gij} , specific line effects w^2_{di} were important for all the parents.

Table 3. Three line specific effects (t_{ijk}) for character boll weight in cotton

Three way cross	T_{ijk}	Three way cross	T_{ijk}	Three way cross	T_{ijk}
1X2X3	-0.052	2X3X1	0.148	3X5X1	0.249
1X2X4	-0.261	2X3X4	-0.103	3X5X2	-0.339
1X2X5	0.028	2X3X5	0.105	3X5X4	-0.555*
1X2X6	0.284	2X3X6	-0.151	3X5X6	0.645*
1X3X2	-0.549*	2X4X1	0.075	3X6X1	-0.184
1X3X4	0.524*	2X4X3	-0.378	3X6X2	0.205
1X3X5	0.418	2X4X5	0.002	3X6X4	0.134
1X3X6	-0.393	2X4X6	0.302	3X6X5	-0.155
1X4X2	-0.267	2X5X1	-0.245	4X5X1	-0.014
1X4X3	0.393	2X5X3	0.309	4X5X2	0.086
1X4X5	-0.185	2X5X4	0.371	4X5X3	0.187
1X4X6	0.059	2X5X6	-0.435	4X5X6	-0.259
1X5X2	0.386	2X6X1	0.022	4X6X1	0.153
1X5X3	-0.459*	2X6X3	0.121	4X6X2	-0.503*
1X5X4	0.024	2X6X4	-0.007	4X6X3	-0.202
1X5X6	0.049	2X6X5	-0.135	4X6X5	0.552*
1X6X2	0.431	3X4X1	-0.214	5X6X1	0.009
1X6X3	0.118	3X4X2	0.684*	5X6X2	-0.133
1X6X4	-0.287	3X4X5	-0.368	5X6X3	-0.37
1X6X5	-0.262	3X4X6	-0.102	5X6X4	0.161

* significant at 5 % level

Components of Genetic variance

Components of genetic variance for this trait showed that additive X dominance (2.0758) was predominant followed by additive(0.6624) and dominance X dominance (0.3815) components. It clearly showed that predominance of epistatic gene action playing major role in character governance. Hence it is essential to go for intermating in early generations followed by selection for improvement of the character. Ramalingam (1996) , Laxman (2003)

and Patil et al (2005) also reported the predominance additive X dominance component followed by dominance X dominance of gene action for boll weight in cotton.

Thus, triallel analysis had clearly shown its advantage over diallel analysis by giving additional information on magnitude of all types of epistatic components and order in which parents to be crossed in three way crosses for obtaining superior transgressive segregants.

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EVALUATION OF ONION VARIETIES UNDER CENTRAL TELENGANA CONDITIONS OF ANDHRA PRADESH

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Andhra Pradesh is one of the leading producer of onion (*Allium cepa* L.). However, the productivity of onion is quite low in the country, which could be attributed to improper and inadequate nutrition and its management, higher disease and pest incidence, non-availability of critical inputs like water, besides cultivation of local varieties. Several improved cultivars were released during the past two to three decades in the country, notably from Indian Institute of Horticultural Research, Bangalore, which are claimed to be adaptable in different onion growing regions of the country. The potentiality of these varieties under Central Telangana Zone is not known. As a result the local farmers are not venturing to grow them. Giri *et al.* (2009) evaluated certain onion cultivars during *khari* season in West Bengal. Chandrika and Reddy (2011) evaluated varietal performance during *rabi* season in southern agro climatic zone of Andhra Pradesh but such studies are lacking in Central Telangana Zone of Andhra Pradesh. Central Telangana Zone is one of the important growing zone of the state. In view of this, the present investigation was undertaken to ascertain the production potential of a few cultivars and selections of onion in comparison with a Local White variety for *rabi* season in Central Telangana Zone of Andhra Pradesh. The experiment was conducted at JVR Horticultural Research Station, during *rabi* season for three consecutive years from 2007 to 2010. Central Telangana zone comes under southern plateau and hills region and agro climatic zone of India. The experimental area is located at an altitude of 192.02 m above mean sea level on 78.66°E longitude and 19.57°N latitude. The experiment was conducted on vertisol having sticky nature and good water holding capacity. The trial was laid out in randomized block design with three replications and

six treatments (cultivars). The cultivars included in the study were : Arka Niketan, Arka Pragati, Arka Kalyan, Light red onion, Global White and Local White.

The plot size was 5 x 6 m while a spacing of 30 x 20 cm was adopted during *rabi* season. The recommended package of practices was followed for raising the crop. Ten randomly selected plants in each plot were used for recording observations on plant height, yield parameters (bulb diameter and bulb weight) and yield (q/ha). Yield from plot was utilized for estimating the yield per hectare. The recorded data was subjected to statistical analysis as per the procedure outlined by Panse and Sukhatme (1989). The pooled data of three years was utilized for the analysis as well as to draw conclusion.

A perusal of the pooled data (Table 1) revealed that plant height, bulb weight and unit yield differed significantly, while bulb diameter did not differ significantly among the different cultivars, under the same agro-climatic situation. The plants of Arka Kalyan were the tallest (53.20 cm) closely followed by those of Arka Niketan (51.66 cm) and both are of same order. The rest of the cultivars are at par in plant height. Shortest plants were observed in cv. Local White (44.25 cm), Diameter of bulb did not differ significantly among the different cultivars. However, the bulbs of Arka Pragati had maximum diameter of 5.65 cm followed by those of Arka Pragati (5.31 cm) and Light red onion (5.26 cm). The diameter of bulbs of Local White is 4.71 cm, immediately preceded by those of Global White (4.93 cm). In respect of bulb weight, cultivars exhibited significant differences. Highest bulb weight (90.52 g/bulb) was recorded in case of Arka Pragati, which is significantly superior to all other cultivars. Least bulb weight (50.54 g) was

recorded with cv. Local White, which is significantly different from other. Next in line is Global White with a bulb diameter of 67.21 cm, which differed with Local White. The rest of the cultivars recorded intermediate values of diameter and were superior to cv. Global White and Local White and significantly different from Arka Pragati. More or less similar trend is observed with reference to bulb yield per hectare. All the cultivars were independent of each other except Light red onion and Arka Pragati, which are of same order statistically. Highest yield (198.40 q) was recorded by Arka Pragati, closely followed by Light red onion

(192.02 q/ha). The yield generally depends on the weight of individual bulbs. This is reflected in case of different cultivars of onion in the experiment.

From the above results, it is clear that, out of the six cultivars screened for their yield potential, cv. Arka Pragati, followed by Local red onion and Arka Kalyan has well adapted to the agro-climatic conditions of Central Telangana zone of Andhra Pradesh by recording highest yield. Hence, these cultivars can be recommended in place of local varieties for increased production of onion crop in this zone.

Table 1. Cumulative performance of Onion cultivars from 2007 - 2010

S. No.	Varieties	Plant height (cm)	Bulb diameter (cm)	Bulb weight (g)	Yield (q/ha)
1.	Arka Nikethan	51.66	5.65	85.08	169.35
2.	Arka Kalyan	53.89	5.12	84.49	181.10
3.	Arka Pragathi	46.58	5.31	90.52	198.40
4.	Light Red onion	45.93	5.26	86.27	192.02
5.	Global White	47.25	4.93	67.21	132.60
6.	Local White	44.25	4.71	50.54	123.71
	S.Em.±	0.92	NS	1.15	2.38
	C.D. at 5 %	2.68	NS	3.28	6.82

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EFFECT OF SHADE ON PLANT GROWTH, SPIKE YIELD, FLOWER QUALITY AND VASE LIFE IN *DENDROBIUM* ORCHID HYBRID SONIA-17

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Dendrobium is a shade loving plant which requires shade at all times to get good spike yield. Leaves burn easily when subjected to high light intensities. With a view to quantify the shade requirement for successful raising of orchids. Hence, the study was carried out to quantify the shade requirement and to understand the role of shade and light intensity on plant growth and quality parameters of *Dendrobium* hybrid Sonia-17. The investigation was conducted at orchid farm, Natural Synergies Limited, Nathanallur village, Kancheepuram district, Tamil Nadu. Hybrid Sonia-17 showing sympodial growth with club shaped pseudobulbs containing two leaves has used as planting material. There were 4 shade treatments viz., 25 %, 50 %, 75 % and control (full sun light) each replicated 5 times in a completely randomized block design. Plants were grown under 25, 50 and 75 per cent shade provided by green high density U.V stabilized polythene shade net and data were recorded on various parameters (plant height, number of leaves per plant, number of shoots per plant, number of spikes per plant, number of florets per spike, length of spike, floret pedicel length, longevity of spike on the plant and vase life at room temperature) was subjected to analysis of variance as applicable to Completely Randomized Block Design (CRD).

Plant height was the highest under 75 per cent shade (43.19 cm) compared to 50 per cent (38.08 cm) and 25 per cent shade (26.88 cm), whereas control recorded minimum height (10.28 cm) at 180 days after planting (Table 1). Studies by Arumugam and Jawaharlal (2004) revealed that differences obtained on plant height under 75 per cent shade level

varied much compared to other intensities which are conformity with the present findings.

The effect of shade levels on the number of leaves per plant indicated that the highest number of leaves was recorded under 75 per cent shade (10.62) followed by 25 per cent shade (9.03), 50 per cent shade (8.12), whereas plants grown under full sun light recorded the lowest number of leaves per plant (3.54). This could be explained by the fact that the more the shade, more are the number of leaves mainly as a result of the modified environment and orchid being a shade loving plant. Saravanan (2001) support the present investigation in which the number of shoots per plant was the highest (5.93) under 50 per cent shade level. There is much variation between the shoot number at 25 and 75 per cent shade levels, while open grown plants recorded less number of shoots per plant (1.38) at 180 DAP. The highest number of shoots per plant obtained by George and Mohanakumaran (1999) confirm the present results.

The number of spikes per plant was the highest (2.67) under 75 per cent shade level, whereas 50 per cent (1.70) and 25 per cent shade level (1.22) produced the lowest number of spikes per plant. Similar trend was observed under 75 per cent shade level on other floral characters viz., spike length (32.82 cm), number of florets per spike (8.39) and floret pedicel length (4.09 cm) (Table 2)(Fig 1A,1B). Similar observations in *Arachnis* orchid were also reported by George and Mohanakumaran (1999). Under full sunlight conditions i.e. Open condition, no yield was obtained due to burning of leaves and failure of growth. Increased rate of plant growth and flower production in orchids is the result of reduced light intensity (Kaur *et al.*, 1996).

The longevity of the spike on the plant was the highest (90.20 days) with highest shade (84.39 days) and 50 per cent (79.57 days). Findings of Arumugam and Jawaharlal (2004) support this phenomenon. Vase life in tap water at room temperature was maximum (22.58 days) with spikes from 75 per cent shade level followed by 50 per cent shade (19.73 days) and 25

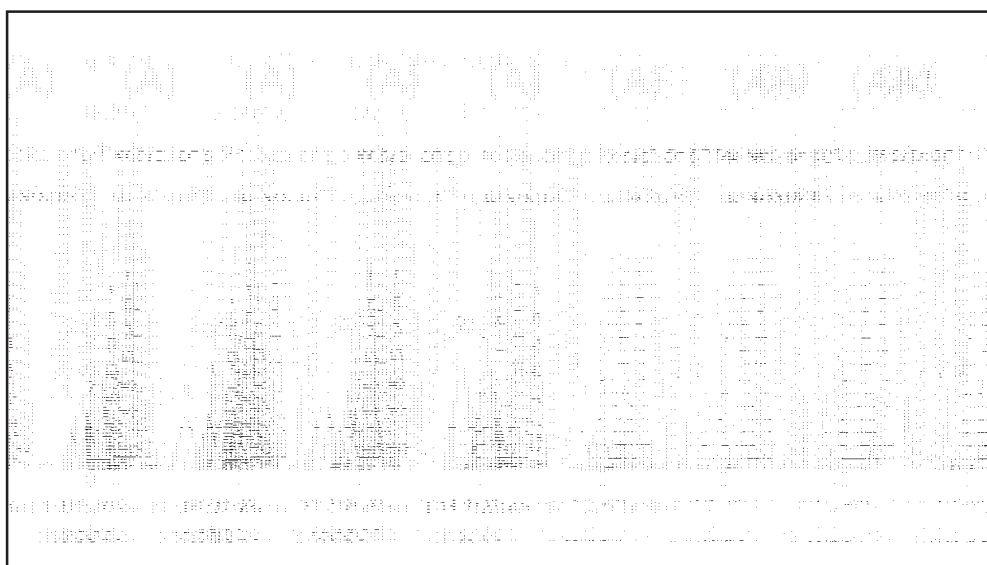
per cent shade (16.81 days) (Fig. 2). Findings of Arumugam and Jawaharlal (2004) confirmed the present results in *Dendrobium* hybrid Sonia 17.

Based on the above results, it is concluded that for growing *Dendrobium* orchids requires 75 per cent shade for successful cultivation under tropical condition of South India.

Table 1. Effect of shade on plant height, number of leaves and shoots at 180 days after planting.

Treatment	Plant height (cm)	No. of leaves/plant	No. of shoots/plant
T ₁ : 25% shade	26.88	9.03	3.62
T ₂ : 50% shade	38.08	8.12	5.93
T ₃ : 75% shade	43.19	10.62	5.57
T ₄ : Control	10.28	3.54	1.38
CD at 5%	4.73	1.57	0.33

Fig.1. Effect of shade on spike yield and quality in *Dendrobium* Orchid hybrid Sonia – 17 at 195 days after planting



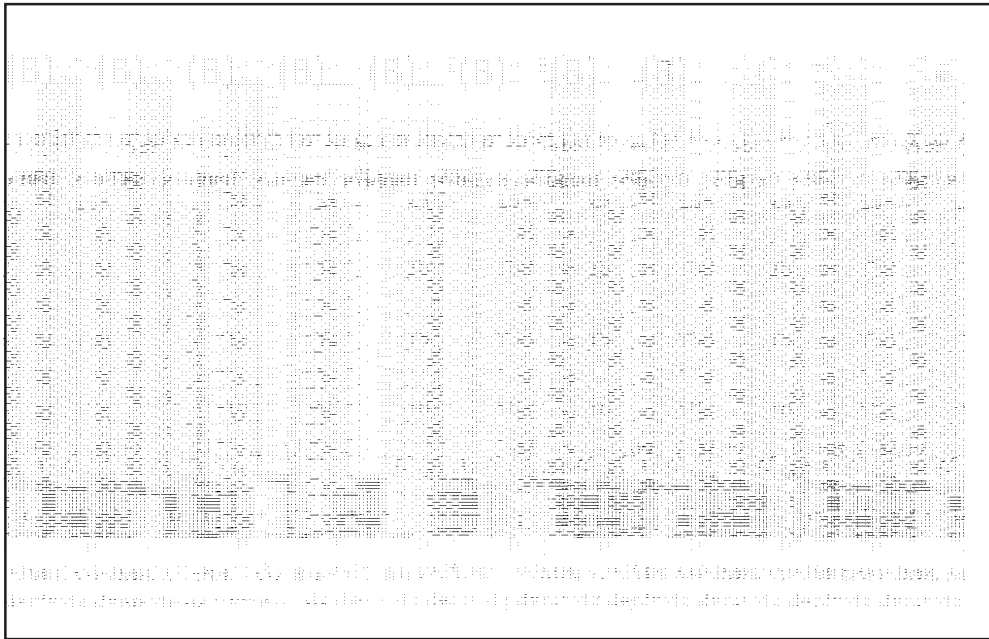
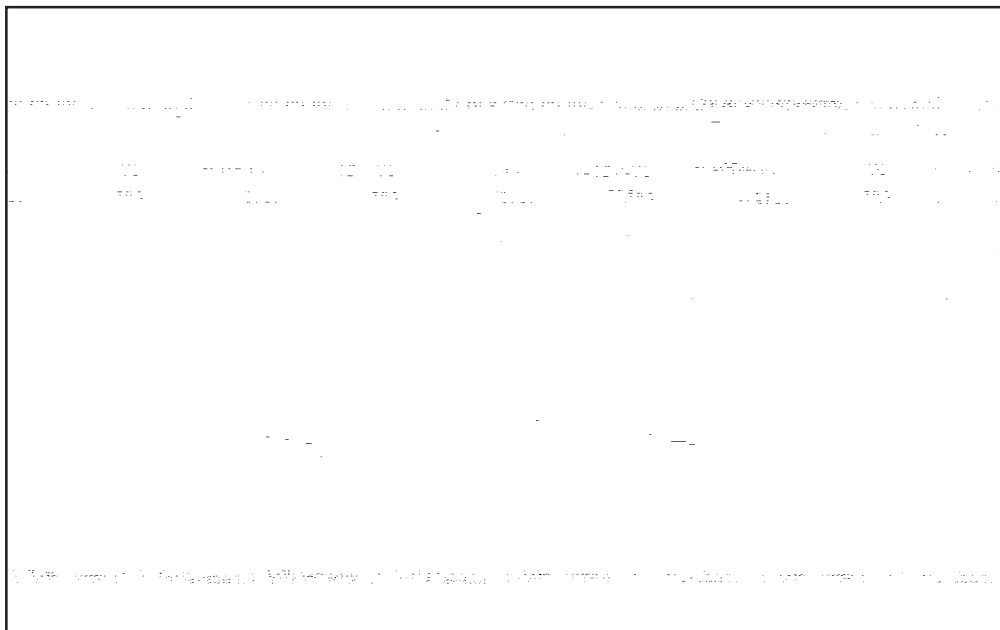


Fig.2. Longevity of flower spike of *Dendrobium* cv.sonia-17 as influenced by shade



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EFFECT OF IRRIGATION METHODS AND IRRIGATION SCHEDULES ON AEROBIC RICE (*Oryza sativa* L.)

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Aerobic rice culture is an emerging technology in which rice is grown on non-puddled, non-flooded fertile soils under irrigation and high external inputs in order to enhance the WUE in rice production. Hence, the present investigations was taken up to study the influence of various irrigation methods and schedules on growth and yield of aerobic rice.

The field experiment was conducted during *kharif*, 2011 in a Strip Plot Design with three replications at Water Technology Center, College Farm, College of Agriculture, Rajendranagar, Hyderabad. Two irrigation methods consisting of Flood irrigation on flat beds (I_1) and Bed – furrow irrigation (I_2) as one factor and four irrigation schedules viz., Irrigation scheduling at 1.0 IW/CPE ratio up to panicle initiation and 1.5 IW/CPE ratio for the remaining period (S_1), Irrigation scheduling at 1.5 IW/CPE ratio up to panicle initiation and 2.0 IW/CPE ratio for the remaining period (S_2), Irrigation scheduling at 1.5 IW/CPE ratio for the entire period (S_3) and Irrigation scheduling based on SMT – 20 kPa to – 30kPa up to panicle initiation and -10 kPa to -20 kPa for the remaining period (S_4) as other factor were studied. The experimental soil was sandy clay loam in texture, alkaline in reaction and non-saline. The fertility status of the experimental soil was low in organic carbon and available nitrogen, medium in available phosphorous and available potassium. The infiltration rate was moderate (2.4 cm h^{-1}) and field capacity moisture content was 17.97 per cent.

Apo (IR 55423-01), a medium duration (120 - 125 days), photo-sensitive, semi-tall rice variety developed at International Rice Research Institute, Philippines recommended for aerobic rice cultivation was used for the study. The crop was sown at 20 cm solid row spacing with 80 kg ha^{-1} seed rate in flat

beds and raised beds and fertilized with $150 \text{ N} + 60 \text{ P}_2\text{O}_5 + 60 \text{ K}_2\text{O} \text{ Kg ha}^{-1}$. The soil moisture content was measured with profile probe soil moisture sensor (PR2). Water meter was fixed at field to quantify the amount of water applied to each treatment and depth of each irrigation given was 50 mm. The required cultural practices and plant protection measures were followed as per recommended package. Data on growth, yield parameters and grain yield were recorded and analyzed.

Significant increase in plant height and dry matter production of aerobic rice was observed under I_2 compared to I_1 at 90 DAS. Irrigation scheduled at S_2 recorded significantly taller plants and higher dry matter compared to other treatments (Table 1).

Significantly higher number of tillers ($316 \text{ tillers m}^{-2}$) were recorded on furrow irrigated raised beds (I_2) compared to $312 \text{ tillers m}^{-2}$ observed on flood irrigated flat beds (I_1) at 90 DAS. Irrigation scheduled at 1.5 IW/CPE up to panicle initiation and 2.0 IW/CPE for the remaining period (S_2) recorded the highest number of tillers ($357 \text{ tillers m}^{-2}$) at 90 DAS and was significantly superior to rest of the irrigation schedules that were studied. The more number of tillers on furrow irrigated raised beds and with irrigation scheduled at 1.5 IW/CPE up to panicle initiation and 2.0 IW/CPE for the remaining period might be due to adequate moisture regimes under raised beds and more frequent wettings at later stages of crop growth period might have facilitated to produce and survive more number of tillers (Shekara and Sharanappa, 2010).

The number of panicles m^{-2} in aerobic rice was not significantly affected by irrigation methods (Table.1). The number of panicles m^{-2} recorded at harvest (349) was significantly higher with S_2 compared to all other irrigation schedules. The higher

number of panicles observed might be due to high moisture regimes which promoted higher number of tillers m^{-2} , dry matter production and nutrient uptake in the S_2 schedule. Ramamoorthy *et al.* (1998) also observed that increased yield attributes might be due to higher dry matter production as a result of frequent irrigations.

The panicle length and grains panicle⁻¹ were not significantly affected by irrigation methods and irrigation schedules. However, significantly higher test weights (19.01 g) of aerobic rice was recorded in furrow irrigated raised beds (I_2) compared to flood irrigated flat beds (I_1), while irrigation schedules did not significantly influence the test weight of aerobic rice.

The grain yield ($3.04 t ha^{-1}$) obtained on furrow irrigated raised beds (I_2) was significantly higher compared to grain yield ($2.95 t ha^{-1}$) recorded on flood irrigated flat beds (I_1). The higher grain yield of aerobic rice on furrow irrigated raised beds might be associated with significantly higher tillers m^{-2} , dry matter production and test weight under better moisture regime. These findings were in agreement

with results of Gupta *et al.* (2003). Significantly highest grain yield ($3.35 t ha^{-1}$) was associated with irrigation scheduled at S_2 compared to other irrigation schedules. The straw yield of aerobic rice also followed the similar trend as that of grain yield. The interaction effect of irrigation methods and schedules on growth and yield attributes of aerobic rice were not significant at any stage during the entire crop growth period.

In aerobic rice, the total water used in different irrigation schedules was in the range of 675 – 775 mm including an effective rainfall of 325 mm. Highest water use efficiency ($4.26 kg ha^{-1} mm^{-1}$) was observed with furrow irrigated raised beds (I_2 w). These results were in line with Kukal *et al.* (2009). Higher WUE was observed with irrigation scheduling at S_3 and S_2 . Decrease in water productivity was observed as irrigation levels increased.

The results indicated that in aerobic rice higher grain yield and water use efficiency is possible through bed-furrow method of irrigation scheduled at 1.5 IW/CPE up to panicle initiation and 2.0 IW/CPE for the remaining period during *kharif* season.

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EFFECT OF PRE-SOWING SEED TREATMENTS ON SEEDLING GROWTH OF JACKFRUIT (*Artocarpus heterophyllus* Lam.)

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Jack fruit is indigenous to India and bears largest edible fruits. It is regarded as "Poor man's food" in Eastern and Southern parts of India. Area under this crop is increasing due to raising consumer interest, despite lack of proper propagation methods and package of practices. According to, Lafont *et al.* (1994) have given that the lectin, jacalin, present in jackfruit interact with CD₄ cell surface and inhibits *in vitro* infection by HIV Type I virus, since they prevent virus binding on host cell.

Jackfruit takes prolonged period for germination, germination per cent is low, seedling growth is slow and it takes time for attaining graftable size. Synchronization and rapid seedling emergence are commonly reported benefits of pre-sowing treatments on germination and seedling growth. There is need for seed treatments in jackfruit to improve seed germination and seedling growth. The significant enhancement of seedling growth was noticed in different pre-sowing treatments by Padma and Narayana Reddy (1998) and Venkatrao and Reddy (2005) in Mango. Hence, an experiment was taken up to enhance the germination and seedling growth in jackfruit with different pre-sowing seed treatments.

The present investigation was carried out during 2010-2011 at Horticultural Research Station, Venkataramannagudem, Andhra Pradesh. Seeds from fully ripened fruits were collected and thoroughly washed with water before imposing treatments. Solutions of gibberellic acid (GA₃) at 100 and 200 ppm, naphthalene acetic acid (NAA) at 25 and 50 ppm and potassium nitrate (KNO₃) at 0.25% and 0.5% concentrations were prepared and used for soaking the seeds for 12 hours and 24 hours period of time along with soaking in distilled water. Seeds were sown in the poly bags of size 7" x 4" (250 gauge) containing potting mixture (red earth, FYM and sand in the ratio of 2:1:1). The observations were recorded for germination and growth parameters. The experimental

design adopted was randomized block design with three replications and 100 seeds per treatment.

The observations recorded on seedling height, seedling girth, absolute growth rate, leaf area and days taken for attaining graftable size in jackfruit seedlings at 90th day after sowing showed significant differences among treatments. Soaking seeds in gibberellic acid (GA₃) 200 ppm for 24 hours recorded tallest seedlings with more absolute growth rate and less number of days taken for attaining graftable size (Table 1). GA has antagonistic effect on germination inhibitors (Brain and Heming 1958; Wareing *et al.*, 1968) and endogenous gibberellins were reported to increase due to soaking (Mathur *et al.*, 1971). GA helps in synthesis of α -amylase which converts the starch into simple sugars. These sugars provide energy that is required for various metabolic and physiological activities. GA₃ treatment apart from improving germination also increased the subsequent growth of seedling. This may be attributed to cell multiplication and elongation of cells in the cambium tissue of internodal region by GA apparently activating the metabolic processes or nullifying the effect of an inhibitor on growth (Barton, 1958). The results are in agreement with the findings of Shanmugavelu (1968) in jackfruit, Gupta (1989) in citrus, and Babu *et al.* (2004) in papaya.

The observations recorded on leaf area per seedling at 90th day after sowing showed significant differences among treatments. Soaking seed in potassium nitrate (KNO₃) 0.5% for 24 hours recorded maximum leaf area per seedling (2526 cm²). This may be due to stimulatory action of KNO₃ to promote leaf growth through the presence of NO₃⁻. Similar opinion was expressed by Sinha *et al.* (1977) in apple, Padma and Narayana Reddy (1998) in mango, Ratan and Reddy (2004) in custard apple and Barche *et al.* (2005) in papaya.

Table 1. Effect of pre-sowing seed treatments on seedling growth of Jackfruit (*Artocarpus heterophyllus* Lam.)

Treatments	Seedling height (cm)	Seedling girth (cm)	Absolute growth rate (cm/day)	Leaf area per seedling (cm ²)	Days attaining
GA 100 ppm 12 hours	68.4	0.73	0.57	1492	
GA 100 ppm 24 hours	70.2	0.75	0.58	1613	
GA 200 ppm 12 hours	69.0	0.77	0.59	1570	
GA 200 ppm 24 hours	72.1	0.78	0.62	1497	
NAA 25 ppm 12 hours	66.8	0.73	0.56	1440	
NAA 25 ppm 24 hours	67.2	0.75	0.6	1832	
NAA 50 ppm 12 hours	66.5	0.71	0.58	1783	
NAA 50 ppm 24 hours	68.6	0.75	0.57	1877	
KNO ₃ 0.25% 12 hours	67.9	0.72	0.55	1921	
KNO ₃ 0.25% 24 hours	69.8	0.76	0.58	2003	
KNO ₃ 0.50% 12 hours	69.8	0.73	0.56	2332	
KNO ₃ 0.50% 24 hours	70.6	0.76	0.59	2526	
Water 12 hours	58.1	0.69	0.51	1258	
Water 24 hours	63.1	0.70	0.52	1574	
Control	57.4	0.63	0.47	1290	
SEm ±	2.8	0.02	0.02	4	
CD at 5%	3.2	0.06	0.06	11	

EFFECT OF PRE-SOWING SEED TREATMENTS ON SEEDLING GROWTH

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CHARACTER ASSOCIATION AND PATH ANALYSIS FOR QUALITATIVE TRAITS IN SWEET SORGHUM (*SORGHUM BICOLOR* L. MOENCH)

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A field experiment was conducted with 68 sweet sorghum genotypes during Rabi 2008-09 in a randomized block design replicated thrice at National Research Centre for Sorghum (NRCS) farm, Rajendra nagar, Hyderabad. The spacing adopted was 60 x 15 cm. Each genotype was sown in 2 rows of 4m length. All the recommended agronomic practices were followed to raise a normal crop. Observations were recorded in each entry on five randomly selected competitive plants for yield and yield attributing characters viz., plant height, days to 50 percent flowering, number of leaves per plant, leaf length, leaf width, number of nodes per plant, stem girth, 100- seed weight, grain yield per plant, green cane yield ton per ha, juice volume litre per ha, juice extraction per cent and brix content. Genotypic and phenotypic correlation coefficients were calculated as per the procedure given by Johnson *et al.*, (1955). The direct and indirect contributions of various characters to yield were calculated through path coefficient analysis as per Wright (1921) and Dewey and Lu (1959).

The phenotypic and genotypic correlation among the yield and its component characters are presented in Table 1. Significant positive association of green cane yield with juice volume followed by days to 50 percent flowering, number of leaves per plant, leaf length, number of nodes per plant was observed. Similarly remaining characters had exhibited moderate positive association with green cane yield whereas brix content had least positive association with green cane yield (Table 1). Similar results were reported by Bangarwa *et al.*, (1989).

Plant height exhibited significant positive association with leaf length, number of leaves per plant, number of nodes per plant, days to 50% flowering, stem girth and moderately associated with

100–seed weight, juice volume and brix while significant positive association was exhibited between grain yield and juice extraction per cent. Leaf length exhibited highly positive association with number of leaves per plant, stem girth, number of nodes per plant, leaf width and juice volume.

Leaf width had shown positive association with stem girth, grain yield, number of leaves, juice volume, number of nodes per plant, 100- seed weight and juice extraction per cent and negative association with brix content. Number of leaves per plant exhibited high significant and positive association with number of nodes per plant followed by stem girth, juice volume and brix. These results are in agreement with the earlier findings of Pandian *et al.*, (1993).

Nodes per plant exhibited positive significant association with stem girth, juice volume and brix where it showed negative association with juice extraction per cent. Stem girth exhibited highly significant positive association with juice volume , grain yield, juice extraction percent and 100- seed weight, whereas, it showed negative association with brix content.

100 seed weight exhibited highly significant positive association with grain yield whereas it showed negative association with brix content. Grain yield exhibited significant positive association with juice volume and juice extraction per cent whereas it showed negative association with brix content.

Juice volume exhibited significant positive association with juice extraction per cent and for brix it showed non significant moderate positive correlation. Juice extraction per cent showed negative association with brix content. Correlation studies revealed that the characters viz., leaves per plant, stem girth, leaf length and nodes per plant are

Table 2. Estimates of path coefficients between qualitative traits in Sweet Sorghum

Character	Plant height (cm)	Days to 50% flowering	Leaf length (cm)	Leaf width (cm)	Leaves /plant	Nodes /plant	Stem girth (cm)	100-Seed weight (g)	Grain yield (g)	Juice volume/ha	Juice extractio n %	Brix content	Green cane yield (T/ha)
Plant height (cm)	0.0339	0.0157	0.0203	0.0069	0.0184	0.0182	0.0117	0.0055	-0.0001	0.0042	-0.0034	0.0007	0.3445***
Days to 50% flowering	0.0319	0.0691	0.0455	0.0228	0.0509	0.0396	0.0305	0.0045	-0.0024	0.0257	-0.0004	0.0168	0.5989***
Leaf length (cm)	0.0058	0.0063	0.0096	0.0045	0.0058	0.0047	0.0052	0.0019	0.0016	0.0030	0.0000	0.0005	0.5340***
Leaf width (cm)	0.0035	0.0057	0.0080	0.0173	0.0050	0.0042	0.0076	0.0041	0.0056	0.0056	0.0033	-0.0009	0.3974***
Leaves /plant	0.0215	0.0291	0.0238	0.0114	0.0395	0.0276	0.0178	0.0039	0.0034	0.0134	0.0010	0.0045	0.5681***
Nodes /plant	0.0468	0.0500	0.0424	0.0210	0.0610	0.0872	0.0266	0.0074	0.0062	0.0203	-0.0007	0.0164	0.4534***
Stem girth (cm)	0.0056	0.0072	0.0088	0.0071	0.0073	0.0050	0.0163	0.0033	0.0062	0.0073	0.0040	-0.0003	0.5386***
100-Seed weight (g)	0.0047	0.0019	0.0057	0.0068	0.0029	0.0025	0.0059	0.0290	0.0112	0.0051	0.0038	-0.0001	0.2200*
Grain yield (g)	-0.0002	-0.0020	0.0096	0.0183	0.0049	0.0040	0.0214	0.0218	0.0566	0.0163	0.0154	-0.0050	0.2889***
Juice volume/ha	0.1426	0.4289	0.3645	0.3722	0.3926	0.2687	0.5171	0.2034	0.3313	0.1536	0.8821	0.1567	0.8624***
Juice extraction %	0.0496	0.0028	-0.0009	-0.0942	-0.0129	0.0041	-0.1226	-0.0650	-0.1364	-0.3833	-0.5013	0.0243	0.4069***
Brix content	-0.0013	-0.0158	-0.0032	0.0033	-0.0075	-0.0123	0.0011	0.0002	0.0058	-0.0089	0.0032	-0.0652	0.1484*

Rsquare : 0.9397,
Residual effect : 0.2455

positively correlated to green cane yield. Hence, selection for these traits would help in achieving highest green cane yield.

The highest direct positive effect on green cane yield was exhibited by juice volume, followed by nodes per plant, days to 50% flowering, grain yield, plant height. Hence a direct selection criterion should be followed for these traits for improvement of green cane yield. At the same time these traits also had significant and positive correlation with green cane yield.

Nodes per plant and days to 50% flowering had indirect positive association with green cane yield through plant height, number of leaves per plant, leaf length while plant height had indirect positive effect on green cane yield through leaf length, leaves per plant, nodes per plant and days to 50% flowering (Table 2). It indicated that there is true association between nodes per plant, days to 50% flowering and plant height. Hence these traits must be considered during selection programme. Similar results were reported by Naphade (1972) and Potdukhe et al, (1994).

Number of leaves per plant had direct positive effect and indirect positive effect through days to 50% flowering, number of nodes per plant

and plant height resulting in positive association with green cane yield. Grain yield had high positive direct effect and significantly high indirect positive effect through juice volume per hectare resulting significant association with green cane yield. Juice volume had high direct positive effect on green cane yield and also high indirect positive effect on green cane yield through other characters. Juice extraction percent had negative direct effect on green cane yield while positive indirect effect only through plant height and days to 50% flowering. Brix content had negative direct effect while indirect positive effects were manifested through juice volume per hectare, juice extraction percent and days to 50% flowering resulting in positive association with green cane yield.

Maximum direct effects of juice volume, number of nodes per plant, days to 50% flowering, grain yield, plant height were observed on green cane yield. Hence, it may be concluded that these traits contributed maximum to higher green cane yield compared to other traits. The residual value (0.24) was high indicating that more characters need to be included in future evaluation programme. Based on the overall performance, the genotypes viz., Urja, IS 11161, IS 18164, IS 14904, SSV 74, NSSV 256, SPV 422, IS 21036, IS 7546 and IS 5352 were found promising for possessing higher green cane yield and brix content.

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RESPONSE OF AEROBIC RICE TO VARYING FERTILITY LEVELS IN RELATION TO IRON APPLICATION

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Aerobic rice is water saving production system in which potentially high yielding, fertilizer responsive adapted rice varieties are grown in fertile aerobic soils that are non-puddled and have no standing water. It is irrigated like any other upland cereal crop (Bouman *et al.*, 2005).

The low and unstable yields of aerobic rice are mainly due to nutrient stresses. Rice is much more susceptible to iron deficiency than other cereals, presumably because it does not have an inducible ferric chelate reductase activity, as do plants that use the reduction strategy to generate ferrous iron from the more abundant ferric iron found in aerobic soils (Mori *et al.* 1991).

A field experiment was conducted during *kharif*, 2011 under aerobic conditions at Agricultural Research Station, Kampasagar, Nalgonda district of Andhra Pradesh, situated at an altitude of 136.0 m above MSL on 16°51'.12.5" N latitude and 79°28'.28.4" E longitude. It is in the Southern Telangana agro-climatic zone of Andhra Pradesh. The experiment was conducted in sandy clay loam soil with moderate drainage. The soil was low in available nitrogen (125.44 kg ha⁻¹), medium in available phosphorus (24.84 kg ha⁻¹), medium in available potassium (164.84 kg ha⁻¹) and low in available iron (2.40 mg kg⁻¹) contents. The pH of the soil was 6.38. A medium slender grain type variety, MTU-1010 of 110-120 days duration was grown. The experiment was laid out in randomized block design with ten treatments.

The tiller number decreased from active tillering to harvest in all treatments. There were no significant differences in tiller number due to treatments. Application of FeSO₄ in aerobic rice has not shown any significant effect on tiller number m⁻². This might be due to involvement of Fe in plant physiochemical activity but it might not be a strong

element to induce a drastic change in the plant growth. These findings are in accordance with the findings of Voigt *et al.* (1982), Kasana and Chaudry (1983) and Singh (1994).

There was an increase in the drymatter production from active tillering to harvest in all the treatments. The treatmental differences were significant at panicle initiation stage. Dry matter production was higher in the treatments designed with 180 kg N ha⁻¹ and 60 kg K₂O ha⁻¹ irrespective of the application of P₂O₅ and iron. During other stages of observations, the treatmental differences were not significant statistically.

Application of 120: 60: 40: kg NPK with or without 25 kg FeSO₄ ha⁻¹ took less number of days for attaining 50 per cent flowering. With the application of 180:60:40 kg NPK ha⁻¹, the crop took more number of days for 50 per cent flowering. Application of iron has not shown any effect on this trait of aerobic rice.

The data on yield attributing characters viz., productive tillers m⁻², panicle length, total grains panicle⁻¹, filled grains per panicle, unfilled grains per panicle and 1000 grain weight as well as the grain yield and straw yield indicated that the differences among the treatments were not significant statistically. Among the treatments, the effective tillers m⁻² ranged between 331 and 381; the panicle length from 19.2 cm to 20.7 cm; the number of filled grains per panicle from 73 to 83; number of chaffy granis from 5 to 8 and test weight from 24.16 g to 26.97 g. In spite of being statistically non-significant, the grain yield was found to vary among treatments to a tune of 680 kg ha⁻¹. The results indicated that aerobic rice yield ranged from 4.28 t ha⁻¹ to 4.96 tha⁻¹ under the experimental conditions at Kampasagar and additional doses of N, P, K and application of Fe did not bring in any significant improvement in the grain yield.

Table 1. Influence of varying fertility levels in relation to iron application on growth parameters at various stages of aerobic rice

Treatments Nutrient levels (kg ha ⁻¹)	Growth parameters									
	Tiller number m ⁻²					Plant dry matter g m ⁻²				
	Active tillering	Panicle initiation	Flowering	Harvest	Harvest	Active tillering	Panicle initiation	Flowering	Harvest	Harvest
T ₁ (N ₁₂₀ P ₆₀ K ₄₀)	423	395	363	353	353	53.3	388	652	1232	1232
T ₂ (N ₁₈₀ P ₆₀ K ₄₀)	476	462	451	438	438	54.4	440	791	1285	1285
T ₃ (N ₁₈₀ P ₆₀ K ₆₀)	506	491	475	462	462	61.2	475	833	1411	1411
T ₄ (N ₁₈₀ P ₉₀ K ₄₀)	491	482	459	442	442	56.4	449	780	1383	1383
T ₅ (N ₁₈₀ P ₉₀ K ₆₀)	528	513	501	483	483	65.6	514	909	1555	1555
T ₆ (N ₁₂₀ P ₆₀ K ₄₀ FeSO ₄ 25)	451	430	415	396	396	54	414	698	1261	1261
T ₇ (N ₁₈₀ P ₆₀ K ₄₀ FeSO ₄ 25)	489	477	460	444	444	59.5	451	793	1287	1287
T ₈ (N ₁₈₀ P ₆₀ K ₆₀ FeSO ₄ 25)	516	497	483	470	470	63.7	504	899	1492	1492
T ₉ (N ₁₈₀ P ₉₀ K ₄₀ FeSO ₄ 25)	498	485	470	456	456	59.9	454	797	1408	1408
T ₁₀ (N ₁₈₀ P ₉₀ K ₆₀ FeSO ₄ 25)	537	523	509	491	491	68.7	524	919	1600	1600
SE m ±	26.6	46.6	37.7	35.7	35.7	6.5	15.9	57.6	164.8	164.8
CD at 5 %	NS	NS	NS	NS	NS	NS	48	NS	NS	NS

NS : Non- Significant

Table 2. Influence of varying fertility levels in relation to iron application on yield, yield attributes and days to 50 % flowering of aerobic rice

Treatments Nutrient levels (kg ha ⁻¹)	Effective tillers m ⁻²	Panicle length(cm)	Number of filled grains Panicle ⁻¹	Number of unfilled grains Panicle ⁻¹	Test weight (g)	Days to 50 % flowering	rain yield (kg ha ⁻¹)	Straw Yield (kg ha ⁻¹)
N ₁₂₀ P ₆₀ K ₄₀	331	19.2	73	5	24.1	82.7	4281	4924
N ₁₈₀ P ₆₀ K ₄₀	338	19.6	74	7	24.5	85.7	4465	5253
N ₁₈₀ P ₆₀ K ₆₀	366	20.0	78	7	25.3	85.0	4767	5530
N ₁₈₀ P ₉₀ K ₄₀	349	19.8	77	6	24.7	84.3	4552	5336
N ₁₈₀ P ₉₀ K ₆₀	375	20.4	81	7	26.5	83.3	4873	5814
N ₁₂₀ P ₆₀ K ₄₀ FeSO ₄ 25	335	19.6	75	5	24.4	82.3	4399	5143
N ₁₈₀ P ₆₀ K ₄₀ FeSO ₄ 25	346	19.7	78	6	24.6	85.3	4534	5327
N ₁₈₀ P ₆₀ K ₆₀ FeSO ₄ 25	374	20.2	81	5	26.2	84.7	4811	5812
N ₁₈₀ P ₉₀ K ₄₀ FeSO ₄ 25	354	19.9	79	6	24.8	84.0	4584	5424
N ₁₈₀ P ₉₀ K ₆₀ FeSO ₄ 25	381	20.7	83	8	26.9	83.0	4960	6034
SE m ±	21.9	0.3	2.6	0.7	0.8	0.5	169.9	253.3
CD at 5%	NS	NS	NS	NS	NS	1.42	NS	NS

NS : Non- Significant

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ON-FARM TESTING OF FCV TOBACCO HYBRIDS (CH-1 & CH-3) IN NORTHERN LIGHT SOIL AREA OF ANDHRA PRADESH- AN ANALYSIS

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Technology transfer is a key step for development of agriculture. On-farm testing has been identified as a tool to refine or modify the technology for better adoption by the farmers. Besides, these trails provide an opportunity for farmer management decisions.

On-farm testing is to test and evaluate the research results at farmers' field. The study was undertaken with the following objectives:

1. To assess the potential characteristics of the new pipeline hybrids CH-1 and CH-3.
2. To analyze the acceptability and suitability of the hybrids and to identify the constraints in recommended situations.
3. To assess the acclimatization of the genotypes to the complexity of social and natural environments in NLS zone.

Three villages viz., Gopalapuram from Lower NLS, Ankalagudem from Middle NLS, and Achiyypalem from Upper NLS were selected to carry out on-farm trials based on purposive random sampling. One hectare was allotted as a representative area for testing of two hybrids viz., CH-1 & CH-3 in comparison with ruling variety, Kanchan at three locations during 2007-08 & 2008-09 crop seasons (Annual Report of CTRI, 2009-10). Observations were recorded on morphological characters, yield parameters and pest and disease incidence.

The recommended production and plant protection practices were scrupulously followed by the farmers in the on-farm trails. The hybrids were planted at 100 cm X 60 cm in one hectare plot each.

Green manuring with sunhemp and application of FYM @ 10-12 tones/ ha was done. Farmers were supplied healthy seedlings as input. The planting was undertaken in October month by following the recommended flat planting. The recommended fertilizer dose i.e. 115:60:120 of NPK ratio was applied by Dollop method. Suckers were controlled with the help of 4% Decanol @ 10 ml per plant. The crop growth and cultural practices were regularly monitored.

a) Yield performance of hybrids in NLS Region

Observations on yield, content of nicotine, reducing sugars, and chlorides in cured leaf, pest and disease incidence besides farmer opinion were recorded for all the three varieties.

At Achiyypalem (upper NLS), the hybrid CH-1 recorded 3000 kg /ha cured leaf with 80% bright-grades, CH-3 yielded 2813 kg/ha cured leaf with 75% bright-grades against the check variety Kanchan, with cured leaf yield of 2375 kg/ha with 70% bright-grades (Table-1). At Ankalagudem (middle NLS) the hybrid CH -1 recorded 2050 kg/ha cured leaf with 68% bright-grades and CH-3 gave 2063 kg/ha cured leaf with 65% bright-grades against the check variety Kanchan, with cured leaf yield of 2000 kg/ha with 60% bright- grades. At Gopalapuram (Lower NLS), the hybrid CH-1 recorded 2765 kg/ha cured leaf with 75% bright-grades, CH-3 yielded 2555 kg/ha cured leaf with 72% bright grades against the check variety Kanchan, with cured leaf yield of 2230 kg/ha with 70% bright-grades. The hybrids produced more number of mean curable leaves (32) than the check variety (28).

Table 1. Yield data of the hybrids in NLS region (2007-08 & 2008-09)

Variety	Upper NLS		Middle NLS		Lower NLS		Average yield & quality	
	Yield (kg/ha)	Bright grades (%)	Yield (kg/ha)	Bright grades (%)	Yield (kg/ha)	Bright Grades (%)	Yield (kg/ha)	Bright grades (%)
CH-1	3000	80	2050	68	2765	75	2605	74.33
CH-3	2813	75	2063	65	2555	72	2477	70.67
Kanchan	2375	70	2000	60	2230	70	2201	66.67

Thus, the hybrids CH-3 and CH-1 recorded 11.7 -17.01 percent higher cured leaf mean yield and 4 - 7.7 percent higher bright mean grade out turn over Kanchan.

b) Quality performance of tobacco hybrids in NLS region

The results revealed that the chemical quality traits like nicotine, reducing sugars, and chlorides in both the hybrids and in check, Kanchan were within the prescribed limits at three locations.

of Cucumber Mosaic Virus (upper NLS) and Tobacco Mosaic Virus (Lower NLS) was observed to be low. However, the incidence of TMV was recorded to an extent of 15-20% in Middle NLS (Ankalagudem).

The farmers exposed to On-farm Trails (OFTs) were convinced with the performance of new pipe line hybrids CH-1 and CH-3 under farm situation. Farmers have shown interest to grow CH-1 and CH-3 hybrids because of their higher vigor, short internodes, more number of curable leaves and high

Table 2. Cured leaf quality of the tobacco hybrids in NLS region (2008- 2009)

Variety	Upper NLS			Middle NLS			Lower NLS		
	Nicotine	Reducing sugars	Chlorides	Nicotine	Reducing sugars	Chlorides	Nicotine	Reducing sugars	Chlorides
CH-1	2.68	18.74	1.71	2.83	7.91	0.25	2.37	15.19	0.53
CH-3	2.69	15.40	0.99	4.12	9.58	0.43	3.12	12.87	0.56
Kanchan	1.88	18.20	0.32	3.57	13.68	0.27	2.45	18.08	0.55

c) Pest and Disease incidence

Observations were recorded on the incidence of pests and diseases. The incidence of stem borer was observed at Gopalapuram in both the experimental as well as in control plots. The incidence of *Spodoptera* was found to be negligible in three plots at three locations. Incidence of bud worm was noticed in middle NLS and lower NLS. However, tobacco aphid was the major pest observed in NLS area. The recommended pest management practices were advocated for adoption by the farmers. The incidence

yielding capacity and higher per cent of bright grade out turn. Among the two hybrids, the farmers preferred CH-1 in NLS region.

There is a need to introduce tobacco hybrids for getting high productivity coupled with higher leaf quality, which improves the net income of tobacco farmers. As the hybrids CH-1 and CH-3 performed better in the field situation, there is a need to introduce these hybrids among NLS area in order to get higher benefit cost ratio to the farmers.

Table 3. Pest and disease incidence in NLS region (2008-09)

Pest /Disease	Upper NLS (%)			Middle NLS (%)			Lower NLS (%)		
	CH-1	CH-3	Kanchan	CH-1	CH-3	Kanchan	CH-1	CH-3	Kanchan
Stem borer	3	3	3	5	5	5	5	5	5
Tobacco caterpillar	2	2	3	5	5	5	5	5	5
Tobacco budworm	-	-	-	5	5	5	2	2	2
Aphids	2	2	2	10	10	10	5	5	5
TMV	-	-	-	15	15	20	5	5	5
CMV	2	2	2	-	-	-	-	-	-
Brown Spot	-	-	-	-	-	-	2	2	2

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RESPONSE OF SWEET CORN HYBRID TO DRIP-FERTIGATION

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Sweet corn (*Zea mays* L. cv. Saccharata) contains 13 to 15% sugar in immature grains and is consumed as an alternative dish to vegetables and has high demand in alcoholic industries. There is an increasing tendency to produce sweet corn at commercial level to increase the income of the farming community.

The response of sweet corn hybrid to nitrogen is spectacular. There was an increase in dry matter production, yield attributes and yield of sweet corn with increasing nitrogen levels from zero to 120 kg N/ha. (Raja, 2001). Though many studies were reported on effect of drip irrigation and nitrogen levels (fertigation) on grain maize, (Ashok Kumar, 2009: Ramulu *et al*, 2010). Only few have been reported on sweet corn with drip irrigation and N fertigation. A field experiment was conducted at Agricultural Research Institute, Rajendranagar, Hyderabad during *rabi* 2011-12. The experiment was laid out in RBD with combination of five irrigation levels and four nitrogen levels and was replicated thrice.

The experimental soil was clay loam low in available nitrogen, medium in available phosphorus and potassium. The drip irrigation and fertigation was scheduled once in two days and six days respectively as per the treatments. The mean bulk density and available soil moisture in 60 cm depth of the soil was 1.417 g cm⁻³ and 121.28 mm respectively.

Sweet corn hybrid HSC-1(Haryana sweet corn-1) was sown on 15-11-2011 at a spacing of 60 x 20 cm. 60 kg P₂O₅ and 50 kg K₂O ha⁻¹ was applied in the form of SSP and MOP as basal to all the treatments. A basal dose of 20 kg N ha⁻¹ was applied and the remaining nitrogen was applied in the form of urea as per the treatments. Fertigation was done using ventury system taking solubility of urea @ 570 g/l.

Nitrogen was applied in 10 splits once in six days. In surface method of irrigation, five irrigations were given based on IW/CPE ratio of 1.0 and nitrogen was applied in three splits at 20, 40 and 60 DAS. Necessary plant protection measures were adopted as and when required for the control of common insect pests of sweet corn during the experimental period. Growth characters (plant height and leaf area index), yield attributes, marketable green cob yield and green fodder yield were measured at harvest.

Among different irrigation levels, maximum plant height and LAI was recorded in drip irrigation scheduled at 120% E pan however it was on par with drip irrigation scheduled at 100% E pan and these were significantly superior to other irrigation levels. The lowest plant height and LAI was recorded in surface irrigation scheduled at IW/CPE ratio of 1.0. Application of nitrogen at 240 kg ha⁻¹ recorded maximum plant height and LAI however it was on par with 200 kg N ha⁻¹ and both were significantly superior to other nitrogen doses. The lowest plant height and LAI was recorded with application of 120 kg N ha⁻¹ at all the growth stages. The results are in conformity with research findings of Amos Kojo Quaye *et al*. (2009).

Yield attributes viz., cob length, fresh single cob weight, number of kernels per row and number of cobs per plant were higher in drip irrigation scheduled at 120% E pan and it was on par with drip irrigation at 100% E pan. Increase in N fertigation increased all yield attributes significantly up to 200 kg ha⁻¹ and further increment was not statistically significant. Cob girth was higher in drip irrigation scheduled at 120% E pan and it was on par with 80 and 100% E pan. Higher cob girth was also recorded at 240 kg N ha⁻¹ but it was on par with 160 and 200 kg N ha⁻¹.

Table 1. Effect of drip irrigation and N fertigation on growth, yield attributes and yields of sweet corn at harvest

Treatments	Plant height (cm)	LAI	Cob length (cm)	Cob girth (cm)	*Single cob weight (g cob ⁻¹)	No. Of kernels row ⁻¹	Number of Cob plant ⁻¹	*Marketable green cob yield (t ha ⁻¹)	(
Irrigation levels									
Drip at 60 % E pan	231	4.32	20.5	13.7	307	38.2	1.1	8.71	1:
Drip at 80% E pan	240	4.67	21.6	14.3	341	39.6	1.3	10.24	2:
Drip at 100% E pan	249	5.1	22.8	14.7	363	41.6	1.4	12.23	2:
Drip at 120% E pan	251	5.27	23.1	14.7	374	41.9	1.4	12.83	3:
Surface irrigation at 1.0 IW/CPE	224	3.48	18.8	12.7	272	33.8	1.1	7.72	1:
SEm±	1.5	0.1	0.3	0.2	6.1	0.4	0.01	0.29	0:
CD at 5%	4.3	0.28	1.0	0.5	17.5	1.1	0.03	0.82	1:
Nitrogen levels (N) kg ha⁻¹									
120	230	4.06	19.8	13.4	302	36.5	1.1	8.42	1:
160	237	4.44	21.1	14.0	325	38.5	1.2	9.32	2:
200	243	4.83	22.2	14.3	346	40.4	1.3	11.66	2:
240	246	4.95	22.4	14.4	352	40.8	1.3	11.99	2:
SEm±	1.4	0.09	0.3	0.2	5.5	0.3	0.01	0.26	0:
CD at 5%	3.9	0.25	0.9	0.5	15.7	0.9	0.03	0.73	1:
I x N interaction									
SEm±	3.0	0.2	0.7	0.4	12.2	0.7	0.02	0.57	1:
CD at 5%	NS	NS	NS	NS	NS	NS	0.07	1.64	2:

*Green cob weight with husk

RESPONSE OF SWEET CORN HYBRID TO DRIP-FERTIGATION

Irrigation levels significantly influenced the green cob yield and fodder yield. Maximum yield per hectare was recorded in drip irrigation scheduled at 120% Epan and 100% Epan which were on par with each other and significantly superior to remaining levels of irrigation. Lowest yield was recorded in surface irrigation at IW/CPE ratio of 1.0. Among the nitrogen levels, application of 240 kg N ha⁻¹ recorded maximum green cob yield and fodder yield which was on par with 200 kg N ha⁻¹ and both differed significantly from remaining dose of nitrogen levels.

At lower levels of drip irrigation (60% and 80% Epan), yield increase due to N fertigation was less indicating that moisture was not sufficient to meet the potential yield of the crop. Significant increase in green cob yield and fodder yield at 120% Epan followed by

100% Epan levels over 80% and 60% Epan was mainly attributed to continuous optimum soil moisture status in the upper 30 cm soil layer consequently higher plant relative water content and less negative leaf water potential (Vishwanatha *et al.* (2002). Nitrogen fertigation with more readily available form at more frequent intervals obviously resulted in higher availability of nitrogen in the soil solution which led to higher growth, uptake and better translocation of assimilates from source to sink thus in turn increased the yield (Anita Fanish and Muthukrishnan., 2011).

For maximizing production of sweet corn, scheduling of drip irrigation at 100% Epan with fertigation of N at 200 kg ha⁻¹ can be recommended in semi arid climate of Andhra Pradesh.

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GROWTH TRENDS OF MAIZE CROP IN TELANGANA REGION OF ANDHRA PRADESH

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Growth models are useful in drawing inferences like the exact relationship between time and growth, the rate of growth at each point of time, the turning points in the growth, etc. Aparna et al., (2008) analyzed trend in growth rates of major vegetables in Visakhapatnam district with the help of compound growth by using exponential function. Dhakre & Amod Sharma (2009) had undertaken the study to measure the growth rates of area, production and productivity of Ginger in north-eastern region by using exponential growth function. Borthakur and Bhattacharya (1998) analyzed trend of area, production and productivity of Potato in Assam for the period of 1951 to 1993 using three different functional forms (linear, quadratic and exponential). Growth models can provide a convenient data summary and be useful for prediction. Srinivasa Rao and Srinivasulu (2006) analyzed growth rates of turmeric and estimated the future projections up to 2020 AD by using the regression equations like linear, quadratic, exponential, logarithmic, compound growth models. Martin and Yeh (1965) predicted the yield of Wheat, Oats and Barley in Manitoba for 1965. Ahuja (1987) calculated the future projections for the production of various crops like Rice, Maize, Jowar, Gram and Groundnut.

Maize is grown in all the regions of Andhra Pradesh. In Telangana region the area of Maize crop is 0.56 million hectares and production is 1.36 million tonnes. In coastal Andhra region the area of Maize crop is 0.18 million hectares and production is 1.24 million tonnes. In Rayalaseema region the area of Maize crop is 0.031 million hectares and production is 0.15 million tonnes.

In this study an attempt has been made to assess the growth rates in area, production and

productivity of Maize crop in Telangana region of Andhra Pradesh by using 41 years of data from 1969 to 2009. Besides, growth rates the projections were also estimated up to 2014 AD. The data of the study for a period of 41 years (1969 to 2009) in Telangana region of Andhra Pradesh pertaining to area, production and productivity of Maize were collected from the website <http://www.Indiastat.com> (Statistical database).

The future projections of area, production and productivity of Maize crop in Telangana region up to 2014 AD were estimated upon the best fitted growth model used for fitting the trend equations. The trend equations were fitted by using different growth models. Among these models the model with least residual mean square (RMS) and significant adj R^2 was considered to be the best fitted model for the projection purpose. Growth models are nothing but the models that describe the behavior of a variable overtime. The growth models taken under consideration are as follows:

1. Linear function:

The linear equation is given by $Y_t = a + bt$

2. Quadratic function:

Quadratic fit is given by $Y_t = a + bt + ct^2$

3. Cubic function:

Cubic fit or third degree curve is given by
 $Y_t = a + bt + ct^2 + dt^3$

4. Exponential function:

The function of this type can be given by
 $Y_t = a \text{Exp}(b_t)$

5. Compound function:

Compound fit is given by $Y_t = ab^t$

GROWTH TRENDS OF MAIZE CROP IN TELANGANA

6. Logarithmic function:

The mathematical equation is given by
 $Y_t = a + b \ln(t)$

7. Inverse function:

Inverse fit is given by $Y_t = a + b/t$

8. Power function:

The fit is given by $Y_t = at^b$

In all the above functions,

Y_t is dependent variable i.e., area / production / productivity

t is independent variable, time in years

a is an intercept

b, c are regression coefficients

Model selection:

In the present study, the model with least residual mean square (RMS) and significant adj R^2 was considered to be the best fitted model.

$$\text{Adj } R^2 (R^2) = R^2 \cdot \frac{K-1}{N-K} \cdot \frac{(1-R^2)^{-1}}{(1-R^2)}$$

Where,

K is the number of constants in the equation

N is the total number of observations

$$\text{Residual mean square} = \frac{\sum Y_i - Y_i^2}{\text{Residual degrees of freedom}}$$

Before choosing a model, one should be certain that the disturbance term satisfies all the conditions of randomness, non-autocorrelation, homoscedasticity and normality. In the present study, an attempt has been made to verify the most important assumption of randomness of residuals. Non-parametric one sample run test can be used to test the randomness of residuals (Siegal and Castellan, 1965).

In case of Maize area, Compound function was found to be the best trend equation for future projection purpose as it has exhibited the least RMS and significant adj R^2 and also satisfied the assumption of randomness of residuals.

In case of Maize production also, Compound function was found to be the best trend equation. Where as in case of Maize productivity, S-curve function was found to be the best trend equation for future projection purpose.

The future projections of area, production and productivity of Maize in Telangana by 2014 AD were calculated. The projection values were 515.12 thousand hectares and 1749.71 thousand tonnes in 2014 AD as per the best fir compound function. In case of productivity S-curve function was found to be the best fitted model for projection purpose with projection value of 3804.97 kg/ha in 2014 AD. The results revealed that the Maize production in Telangana region of Andhra Pradesh may reach to 1749.71 thousand tonnes in 2014 AD.

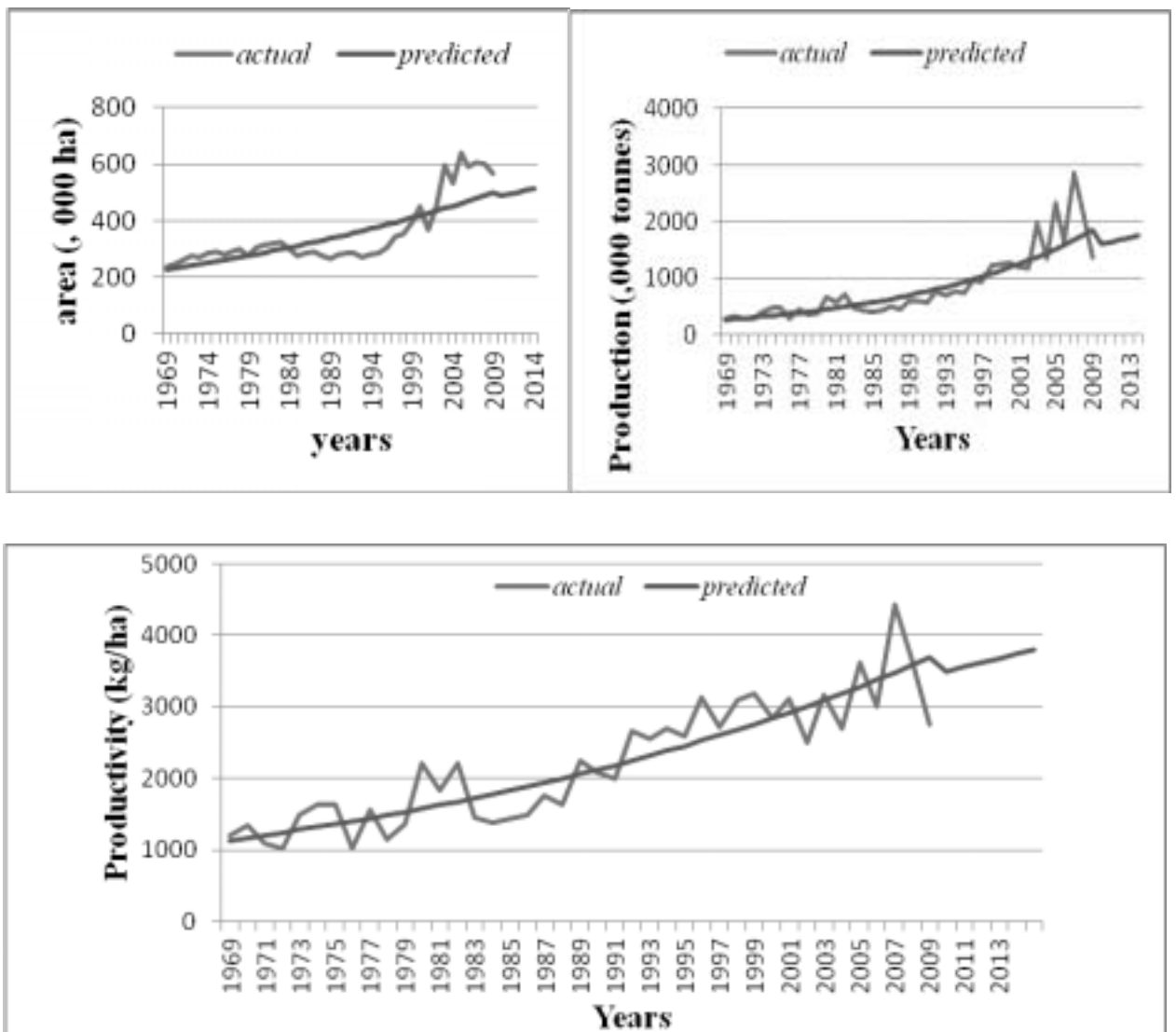
Table 1: Growth models of area production and productivity of Maize crop in Telangana region

	Linear	Logarithmic	Inverse	Quadratic	Cubic	Compound	Power	S
AREA								
Adjusted R ²	0.61368**	0.61166**	0.60965**	0.61569**	0.6177**	0.65132**	0.60965**	0.64759**
RMS	543.72*10 ⁷	546.56*10 ⁷	549.40*10 ⁷	540.89*10 ⁷	538.06*10 ⁷	474.31*10 ⁷	876.30*10 ⁷	126.87*10 ⁸
RUNS	5	5	5	5	5	8	8	8
PRODUCTION								
Adjusted R ²	0.68393**	0.68231**	0.68070**	0.68553**	0.68713**	0.84780**	0.84692**	0.84602**
RMS	120.75*10 ⁹	121.37*10 ⁹	121.98*10 ⁹	120.14*10 ⁹	119.53*10 ⁹	884.55*10 ⁸	199.69*10 ⁹	348.84*10 ⁸
RUNS	10	10	10	10	10	14	14	15
PRODUCTIVITY								
Adjusted R ²	0.78537**	0.78488**	0.78437**	0.78585**	0.78631**	0.79704**	0.79706**	0.79707**
RMS	152384.0	152732.7	153090.5	152044.6	151714.5	149331.9	149077.8	148836.4
RUNS	24	24	24	24	24	19	19	19

Table 2: Projections of area, production and productivity of Maize in Telangana region

YEAR	AREA	PRODUCTION	PRODUCTIVITY
	('000 ha)	('000 tonnes)	(kg/ha)
2009	499.91	1841.7	3683
2010	488.16	1600.1	3492
2011	494.9	1637.5	3555
2012	501.64	1674.9	3617
2013	503.83	1712.3	3679
2014	515.12	1749.7	3804

Fig.1. Projection Graphs Of Area, Production and Productivity of Maize Crop In Telangana Region



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THE BIG FIVE PERSONALITY DIMENSIONS AS PREDICTORS OF JOB PERFORMANCE

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Personality is meaningful to management, because employees' personalities may dictate how well they perform their jobs. The Big Five personality test gives more insight into how one reacts in different situations, which can help to choose an occupation. The relationship between personality and job performance has been a frequently studied topic in industrial psychology in the past century (Barrick & Mount 2002; Judge, 2002). Job performance is a multi-dimensional construct which indicates how well employees perform their tasks, the initiative they take and the resourcefulness they show in solving problems.

Job performance could be affected by situational factors, such as the characteristics of the job, the organization and co-workers and by dispositional factors. Dispositional variables can be described as personality characteristics, needs, attitudes, preferences and motives that result in a tendency to react to situations in a predetermined manner.

Job performance and personality (as measured in the five-factor model) are related. It appears that the relation between job performance and the five factors is more a consequence of the social aspects of the workplace than of ability. Many research studies indicate that extraversion was related positively to salary level, promotions and career satisfaction and neuroticism was related negatively to career satisfaction (Seibert & Kraimer, 2001; John *et al.* 2001).

All persons are not equal or same. Every person has some characteristics which differentiate him from others and forms the basis of different nature of persons. For measuring these personality

differences, so many tests are available and many psychologists explained about personality. Seibert and Kraimer (2001) examined the relationship between the "Big Five" personality dimensions and career success. Results showed that, extraversion was related positively to salary level, promotions and career satisfaction and neuroticism was related negatively to career satisfaction.

The current review of literature especially in India is not focusing on the dimensions of personality among working adults. Hence, the present study is taken up in order to find out the differences of personality dimensions in working adults. This study is useful in understanding whether their personality dimensions are matching with present careers.

To study Big Five personality dimensions of working men and women.

To study the job performance of working men and women.

To study the relationship between Big Five personality dimensions and job performance.

Exploratory research design was adopted for the present study. Twin cities - Hyderabad and Secunderabad were purposively selected for conducting the study. The sample of the study was 150 male and female working as teachers, engineers and Information Technology professionals. The data was collected by using the Big five personality test available on www.outofservice.com/bigfive/ (web site) and Job performance was measured using modified version of Extended Satisfaction with Life Scale by Bernald Gorman (1996). The collected data was scored, tabulated, analyzed and interpreted with appropriate statistical procedures.

THE BIG FIVE PERSONALITY DIMENSIONS AS PREDICTORS OF JOB

The data obtained from the study was coded, consolidated, tabulated and analyzed by using appropriate statistical methods.

Table 1. Relationship between personality dimensions and job performance of teachers

N=50

Big Five Personality Dimensions	Highly Satisfied (31-45 score)			Satisfied (16-30 score)			Not Satisfied (1-15 score)			TOTAL Percentage	
	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women
	%	%	%	%	%	%	%	%	%	%	%
Openness to Experience	-	-	-	-	-	-	8	8	8	8	8
Conscientiousness	-	-	-	4	4	4	12	8	10	16	12
Extraversion	-	12	6	16	4	10	8	4	6	24	20
Agreeableness	4	12	8	4	12	8	4	8	6	12	32
Neuroticism	4	-	2	12	12	12	24	16	20	40	28
										100	100

From the Table 1 it was observed that few of the teachers (20%) with neuroticism personality dimension expressed dissatisfaction in job performance and only 16 percent of teachers with extraversion were satisfied with their job performance. Equal percent (12%) of teachers with agreeableness were highly satisfied and satisfied with job performance. Respondents with conscientiousness personality dimension were not satisfied (10%) and eight percent of teachers with openness to experience were not satisfied with their job performance.

From the above results it was seen that extraversion and agreeableness was related positively and neuroticism, conscientiousness and openness to experience was related negatively to job performance. This could be due to the typical characteristics of neuroticism such as anxiety, low concentration, disorganized behavior and shyness.

From Table 2 it can be observed that the respondents (28%) with extraversion personality dimension were highly satisfied with their job performance and only 6 percent of engineers with neuroticism were not satisfied with their job performance. Sixteen percent of engineers with agreeableness were highly satisfied with job performance. Respondents (8%) with conscientiousness personality dimension were satisfied and only 6 percent of engineers with openness to experience were satisfied with their job performance.

Table clearly indicated that extraversion, agreeableness and conscientiousness were related positively because it could be due to the personality characteristics such as sociability, outgoing, talkative, assertiveness, helpful and good planning and hence, led to high satisfaction on job performance. Neuroticism and openness to experience were related negatively to job performance.

Table 2. Relationship between personality dimensions and job performance of engineers

N=50

Big Five Personality Dimensions	Highly Satisfied (31-45 score)			Satisfied (16-30 score)			Not Satisfied (1-15 score)			TOTAL	
	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women
	%	%	%	%	%	%	%	%	%	%	%
Openness to Experience	-	-	-	4	8	6	4	4	4	8	12
Conscientiousness	4	4	4	12	4	8	4	8	6	20	16
Extraversion	24	32	28	4	12	8	4	-	2	32	44
Agreeableness	16	16	16	-	4	2	8	4	6	24	24
Neuroticism	4	-	2	4	-	2	8	4	6	16	4
										100	100

Table 3. Relationship between personality dimensions and job performance of IT Professionals

N = 50

Big Five Personality Dimensions	Highly Satisfied (31-45 score)			Satisfied (16-30 score)			Not Satisfied (1-15 score)			TOTAL	
	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women
	%	%	%	%	%	%	%	%	%	%	%
Openness to Experience	-	-	-	4	-	2	-	-	-	4	-
Conscientiousness	12	4	8	4	4	4	8	12	10	24	20
Extraversion	24	20	22	4	12	8	4	4	4	32	36
Agreeableness	12	8	10	12	16	14	4	4	4	28	28
Neuroticism	4	4	4	-	-	-	8	12	10	12	16
										100	100

THE BIG FIVE PERSONALITY DIMENSIONS AS PREDICTORS OF JOB

It can be observed from Table 3 that 22 percent of IT professionals with dimension of extraversion were highly satisfied with job performance and 14 percent respondents with agreeableness were satisfied with job performance. Equal percent (10%) of respondents with conscientiousness and neuroticism personality dimension expressed dissatisfaction in job performance. Only two percent of IT professionals with openness to experience expressed satisfaction in their job performance.

This table clearly indicated that neuroticism was negatively related with job performance and extraversion, conscientiousness and agreeableness were positively related with job performance. Openness to experience has a negligible impact on

job performance of IT professionals. Similar results were found by Hertz and Donovan (2000) who pointed that openness to experience was a negligible factor in predicting the job performance.

CONCLUSION

From the above study it could be concluded that the personality dimensions extraversion, agreeableness and conscientiousness were positively related with job performance of engineers and IT professionals, whereas conscientiousness was negatively related with job performance of teacher respondents. Neuroticism was negatively related with job performance and openness to experience had a negligible relation on job performance of all three occupational groups.

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HETEROISIS AND INBREEDING DEPRESSION FOR YIELD AND YIELD COMPONENTS IN PIGEONPEA (*CAJANUS CAJAN L.*)

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Of the various options available, the genetic enhancement is one of the important tools to improve the productivity of any crop. The hybrid technology, a modern approach to enhance the genetic potential, has been widely acclaimed and established in various crop species. In F₂ generation the segregation and reduction in heterozygosity adversely affect the quantity and quality of the produce of pigeonpea. The present experiment was designed to find out the magnitude of heterosis and inbreeding depression in pigeonpea for yield and yield components.

The experimental material comprised 12 F₁s, their F₂s and 10 parents. The experiment was conducted under rainfed condition during kharif 2009 in a randomized block design with three replications. Sowing was done with a spacing of 100 x 20 cm and the plot size was 5 x 5 m for each test entry. Observations were recorded on 8 traits, viz., days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, number of clusters per plant, number of pods per plant, test weight (g) and seed yield (kg/ha). The observations were recorded on plot basis for 50% flowering, and on ten random competitive plants for other characters. Heterosis was calculated over the standard parent-PRG 158, a commercial variety and inbreeding depression (ID) in F₂ generation over F₁s was estimated by using the formulae (Kempthorne, 1957):

$$H = F_1 - CP \times 100 \text{ (Over standard parent)}$$

CP

$$ID = F_1 - F_2 \times 100$$

F₂

The analysis of variance revealed that variances due to genotypes were highly significant for all the traits studied (Table 1). Heterosis was

estimated as per cent increase or decrease of F₁ values over standard variety, PRG 158. The nature and magnitude of heterosis (Table 1) revealed that among 12 hybrids, one exhibited negative heterosis for days to 50% flowering over the better parent. This hybrid, PRG 88 x ICP 89044 is early in duration. Early maturing hybrids are desirable as they produce more yields per day and fit well in multiple cropping systems. Heterosis for earliness over standard varieties has been reported by Shrivastava (1976). Out of 12 hybrids, only three hybrids viz., PRG 100 x ICP 8863, PRG 100 x ICPL 87119 and ICPL 85034 x ICPL 87119 recorded significantly more plant height over better parent. Present observations are in conformity with the earlier findings of Kumar *et al.*, (2002) and Chandarikala and Raveendran (2002) who reported positive heterosis for plant height. Number of primary branches per plant is generally associated with higher productivity. Among 12 hybrids, 5 hybrids showed positive heterosis for number of primary branches per plant as observed earlier by Hooda *et al.*, (1999) Dhameliya and Poshiya (1995). The hybrids with high heterosis for number of primary branches per plant were PRG 100 x ICP 8863, PRG 100 x ICPL 87119, LRG 30 x ICPL 87119 and LRG 30 x ICP 8863 and ICPL 85063 x ICPL 89044. Number of clusters per plant is one of the most important components for seed yield and will be helpful in breaking the yield ceiling. Heterosis for number of clusters per plant in general was relatively low but it was positive over better parent.

The hybrids that exhibited highly significant positive heterosis for this trait were LRG 38 x ICPL 89044 and ICPL 85063 x ICPL 84036. These results are in agreement with the earlier findings of Kumar *et al.*, (2001). Four hybrids viz., PRG 100 x ICP 8863, PRG 100 x ICPL 87119, LRG 30 x ICPL 87119, LRG 30 x ICP 8863 exhibited positive significant

Table.1 Heterosis and inbreeding depression for yield contributing characters in pigeonpea

Hybrid	Days to 50% flowering		Days to maturity		Plant height (cm)		Number of primary branches per plant		Number of clusters per plant		Number of pods per plant		Test weight (g)		Seed yield (g/plant)	
	Het (BP)	ID (%)	Het (BP)	ID (%)	Het (BP)	ID (%)	Het (BP)	ID (%)	Het (BP)	ID (%)	Het (BP)	ID (%)	Het (BP)	ID (%)	Het (BP)	ID (%)
PRG 100 x ICP 8863	11.54**	11.87	6.87**	7.08	14.09**	5.81	24.40**	3.33	4.87	8.33	50.13*	22.61	0.92	10.80	48.78**	25.31
PRG 100 x ICPL87119	28.32**	13.38*	10.09*	10.22*	20.68**	4.98	18.03**	-3.03	2.82	14.04	28.18*	-0.95	-5.02	8.54	25.92**	29.71
PRG 88 x ICP 84036	6.62**	1.90	1.08	-2.82	5.72	6.78	4.66	26.66	-5.60	24.05	5.92	21.25	-2.27	9.66	9.36	21.78
PRG 88 x ICP 89044	-1.99	4.47	2.38**	2.18	7.98	-0.30	-9.33	20.00	-23.37**	20.63	6.34	21.02*	-2.30	7.15	3.04	14.43
LRG 30 x ICPL 87119	6.15**	4.52	5.56**	4.08	8.12	4.92	13.30*	0.00	-0.49	9.04	24.94*	30.45	-4.85	-2.08	33.88**	9.84
LRG 30 x ICP 8863	12.58**	7.75	9.11**	5.11	7.85	2.40	24.16**	10.00	6.47	13.40	49.67*	22.55	-0.31	8.37	53.14**	36.53
LRG 38 x ICPL 89044	5.63**	5.26	3.70**	2.75	3.04	7.01	-0.27	17.24	19.35**	17.48	5.23	13.67	-16.88**	0.24	15.07	0.00
LRG 38 x ICPL 84036	3.17	5.41	2.17**	2.46	7.67	6.63	-3.63	14.28	13.62	21.93	9.70	6.25	-19.30**	-0.36	5.61	19.60
ICPL 85034 x ICP 8863	11.74**	-1.10	11.06*	1.29	15.14	7.35	-5.26	16.00	-22.66**	12.67	4.54	15.85	-19.19**	2.53	1.75	1.71
ICPL 85034 x ICPL 87119	42.61**	5.66	23.10*	1.81	21.61**	8.58	-6.44	15.62	-25.64**	8.55	-16.39*	4.90	-10.53**	7.91	-5.33	22.22
ICPL 85063 x ICPL 84036	17.22**	3.51	5.17**	-2.41	2.75	8.04	10.88	38.71	13.60*	22.72	-8.05	46.67*	-3.01	9.01	1.67	50.65
ICPL 85063 x ICPL 89044	7.64**	4.50	7.56**	2.35	9.75	-4.15	14.89*	27.27	17.55	12.34	-6.92	26.61*	-1.09	9.33	11.67	20.34

heterobeltiosis for number of pods per plant. Heterobeltiosis for test weight varied from -19.30 (LRG 38 x ICPL 84036) to 0.92 (PRG 100 x ICP 8863). Most of the hybrids showed negative heterosis for this trait. Occurrence of negative heterosis estimates was also reported by Gunber (1996).

Heterosis for seed yield varied from 53.14 (LRG 30 x ICP 8863) to -5.33 (ICPL 85034 x ICPL 87119). Four hybrids viz., PRG 100 x ICP 8863, PRG 100 x ICPL 87119, LRG 30 x ICPL 87119 and LRG 30 x ICP 8863 exhibited significant positive heterosis for seed yield over better parent. The hybrid vigour expression occurring in F₁ will be less in F₂ due to segregation. As a result, there is generally a decline in seed yield and also expression of component traits. To assess the extent of decline in performance, the F₂ generation was raised and the extent of inbreeding depression was estimated for the various characters (Table 1).

There was significant inbreeding depression for all the characters studied in the hybrids under the present study. Inbreeding depression in F₂ for days to 50% flowering varied from -1.10 (ICPL 85034 x ICP 8863) to 13.38 (PRG 100 x ICPL 87119). The average value of inbreeding depression was observed to be 4.83 for plant height, 15.51 for number of primary branches per plant, 15.43 for number of clusters per plant, 15.17 for number of pods per plant, 5.92 for test weight and 21.09 for seed yield.

Inbreeding depression was high for the characters viz, number of primary branches per plant, number of clusters per plant, number of pods per plant, test weight and seed yield in F₂ generation. Negative inbreeding depression for seed yield was also reported by Valarmathi and Govil, (1999). The present investigation needs further evaluation under different environments, since genotype x environment interaction also plays an important role in the expression of these traits.

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ON-FARM TESTING OF NATU TOBACCO LINE (L 45-90) IN NORTHERN LIGHT SOIL AREA OF ANDHRA PRADESH – AN ANALYSIS

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Natu tobacco is grown in West Godavari, Krishna, Guntur, Prakasam, Khammam, Kurnool, Mahaboobnagar, Nalgonda, Ananthapur, Visakhapatnam and Srikakulam districts of Andhra Pradesh for cheroot and chewing purposes. Natu tobacco has good aroma and burning quality. Soils growing natu tobacco range from heavy black-clay soils as in Guntur district to sandy and sandy loam soils of West Godavari and Srikakulam districts. Natu tobacco is grown in conserved moisture conditions, mostly as an un-irrigated crop in heavy clay soils of Guntur district. These soils are generally rich in lime. In West Godavari district, this crop is irrigated 5-8 times because of the free draining nature of the soil. This tobacco is used in the manufacture of cheaper brands of cigarettes, cheroots, chewing, pipe mixtures and snuff. It is also blended with Flue-cured Virginia tobacco (FCV) in the manufacture of several brands of cigarettes. Important Natu varieties viz., Prabhat (1977), Natu Special (1992), Pyruvithanam (2001), Bhairavi (NG73) were important natu varieties release by CTRI Research Stations. (Prasad Rao, J.A.V. 2005)

The objective of the on-farm testing is to test and evaluate the research results at farmers' fields and to refine or modify the technologies if required, for better adoption by farmers.

On Farm trials were conducted on Natu line, L 45-90 for two crop seasons, 2008-09 and 2009-10 at two locations viz., Srivarigudem and Palacherla villages in NLS zone based on purposive random sampling. Two farmers were selected from two villages by selecting 1ha for each variety thus totally 4 ha were selected, two each from two villages. All the recommended package of practices (Krishnamurthy, V., 2007) was scrupulously followed by the farmers. The line 45-90 was compared with control- Kommugudem variety.

To improve the soil physical properties, deep ploughing was done in summer with tractor/crow-bar, for conservation of soil moisture. During Kharif season, two or three ploughings and two harrowings were given. In the month of August, groundnut cake was applied and ploughed, ten days before planting for supply of nitrogen (40 kg N/ha). During the midst of October, both the Line and variety were planted at 80 cm x 80cm in one acre plot each. Farmers were supplied healthy seedlings as an input. The recommended fertilizer dose, 40kg N/ha is applied in plough furrows as ammonium sulphate or equivalent nitrogenous fertilizer, and leveled. Gap filling was done a week after planting.

After the establishment of seedlings, inter-culture with blade harrow or tyned harrow was done for 4-6 times. i.e., basal dose (40 kg DAP & 30 kg SOP /acre), First top dressing (150 kg CAN & 30 kg SOP/acre) 25 days after planting, second top dressing (150 kg AmSo₄ & 20 kg SOP/acre) 45 days after planting, third top dressing (Urea 90 kg/acre) 60 days after planting were applied by Dollop method. Six irrigations were given to the crop. Topping was done at 16 leaf stage. Sucker control was done by using 'Decanol (4%)'. The crop growth and cultural practices were regularly monitored.

Topping is done by removing the flower-head, keeping 14-16 leaves on the plant. Matured leaves were harvested in 4-5 primings. Natu tobacco is harvested by cutting each leaf with a small piece of stalk and strung on a jute thread with the help of a needle and cured for a period of one-and-half to two months. The leaves were strung on a jute twine with the help of long iron needles at the rate of 100-150 leaves on each string of 1.5 m to 2.5 m length. These strings were tied on bamboo poles in the open field and sun-cured. Sun-curing was completed the months of March to April in 6 weeks. All the recommended

package of practices were scrupulously followed by the farmers.

After curing, the leaf is taken out, and heaped in bulks in a closed room. The bulks are

turned for getting uniform texture, colour and aroma. The leaf was graded into brights, browns, darks, greens and perished leaf grades. The performance of new line, L 45-90 vs. Kommugudem was given below.

Table 1. Performance of L 45-90 under On-Farm trial at different locations in Northern Light Soil (NLS)

Location	Season	L 45-90			Kommugudem		
		Cured leaf (kg/ha)	Bright Leaf (kg/ha)	Bright Grade (%)	Cured leaf (kg/ha)	Bright Leaf (kg/ha)	Bright grade (%)
Sirivarigudem	2008-09	1920	1250	65	1640	820	50
Palacharla	2008-09	2200	1540	70	1800	1080	60
Sirivarigudem	2009-10	2100	1344	64	1750	910	52
Palacharla	2009-10	2250	1620	72	1850	1073	58

At Sirivarigudem, the line, L 45-90 recorded 1920 kg/ha cured leaf, 1250 kg/ha bright leaf with 65% bright grades in 2008-09 and in 2009-10 the cured leaf yield was 2100kg/ha, bright leaf yield was 1344 kg/ha with 64% bright grade out turn. The check variety, Kommugudem yielded 1640 kg/ha cured leaf, 820 kg/ha bright leaf with 50% bright grades in 2008-09 and in 2009-10, the cured leaf yield was 1750 kg/ha, 910 kg/ha bright leaf yield with 52 % bright grade out turn.

At Palacherla, the variety L 45-90 yielded 2200 kg/ha cured leaf, 1540 kg/ha bright leaf with 70% bright grades in 2008-09 and in 2009-10, the cured leaf yield was 2,250 kg/ha, 1620 kg/ha bright leaf with 72% bright grades. The check variety, Kommugudem yielded 1800 kg/ha cured leaf, 1080 kg/ha bright leaf with 60% bright grades and in 2009-10 the cured leaf yield was 1850 kg/ha, 1073 kg/ha

bright leaf with 58% bright grade out turn. At Sirivarigudem, the line L 45-90 showed 17% (08-09) to 20 % (09-10) increase in cured leaf yield over control - Kommugudem. The line L 45-90 showed 22% increase in cured leaf over control - Kommugudem during two seasons at Palacharla.

Observations were recorded on the incidence of pests and diseases. The incidence of ground beetle and stem borer were found to be negligible in both the plots at both the locations. The incidence of

Aphids was found to be 4-6% in experimental as well as control plots at Sirivarigudem and Palacherla villages. Incidence of black shank was also noticed in both, trial and control plots. The recommended pest management practices i.e., Blitax (0.2%) for management of black shank were advocated for adoption by the farmers.

Table 2. Quality parameters of L 45-90 under On-Farm trial at different locations in NLS Zone

Irrigated Natu variety	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
Kommugudem (check)	4.73	1.35	0.84
L 45-90 (Sirivarigudem)	4.82	1.60	0.91
L 45-90 (Palacharla)	4.82	1.45	0.91

ON-FARM TESTING OF NATU TOBACCO LINE (L 45-90) IN NORTHERN LIGHT SOILS

Quality parameters viz., nicotine, reducing sugars and chlorides in cured leaf were analyzed and found to be well within the desirable limits in both L 45-90 and check, Kommugudem.

Farmers were impressed with the performance of the line, L 45-90 because of its vigorous growth, more number of curable leaves and

high yielding capacity than the check variety, Kommugudem. Farmers opined that the L 45-90 needs more Nitrogen due to its high yielding character. The results are useful for wider adaptability of natu tobacco line, L 45-90 in NLS region of Andhra Pradesh for improving the yield and productivity of non-FCV tobacco farmers.

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STUDY TO ELUCIDATE THE QUALITY PARAMETERS FOR TELECASTING THE AGRICULTURAL PROGRAMMES

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In the present day of information explosion, Television became a powerful and reliable mass medium to reach the rural people. It is effective to disseminate the agricultural technology and motivate the farmers to adopt latest agricultural technologies in a short time. The use and exposure of any media can be improved through involving its real users from preparation to presentation stage of the various programmes for different mass media. In view of this fact, a study was conducted to improve the quality of agricultural programmes telecasted on TV channels.

The study was conducted in Nalgonda district of Andhra Pradesh following descriptive research design in four villages namely Duggepally, Kannekal, Chinthapally and Kamareddigudem of Tripuraram, Nidamanoor and Peddavoora mandals on a random sample of 30 farmers. The data were collected through personal contact method and analyzed by using suitable statistical tools.

Table 1 clearly depicts that majority of the farmers were getting information related to agriculture from other farmers (77%) followed by TV (60%), others Dealers (20%), Agricultural Officers (16%) and Information materials (Books, Journals etc..) (3%). On an average, farmers watch TV for about 2-3 hours per day, preference to news for about one hour, movies for about half an hour, daily soaps for about half an hour and agricultural programmes for about half an hour. They are depending on other farmers' for agriculture related information because they have less credibility about information telecasted on TV channels. Similar results were reported by Irfan *et al.*

Majority of the farmers are watching programmes in E-TV (90%) followed by TV-9 (50%), Gemini (43%), TV-5 (17%), ETV-2 (10%) and

Doordharshan (6%). All the farmers are watching E-TV for agricultural programmes followed by other channels (23%), Doordharshan and TV-5 each 3 percent.

Majority (87%) of the farmers watch agricultural programmes for the purpose of new information followed by market related information (67%) and to get solutions to problems (43%).

It was evident from Table 1 that 77 percent of the farmers stated that agricultural programmes should be telecasted in the form of success stories followed by weather related information (57%) and live programmes (53%) and also opined that agricultural programmes should be telecasted in the evening hours between 6.00-8.00PM, because in morning session they are busy with field activities. Similar findings were reported by Nazari and Hassan (2011).

Farmers expressed that telecast in the form of success stories in their own language is most preferred and respective progressive farmer should be shown (along with his/her crop/technology) while telecasting the programme so that it is understandable and reliable to them.

Majority (56%) of the farmers do not read the bottom information scroll while watching the agricultural programmes. 36 percent of the farmers are observing business advertisements related to agriculture telecasted in the middle of the programme presentation, out of that only 10 percent of the farmers are following the information. None of the farmers consulted scientists in live programmes to know the new information. They are in wrong idea that phone lines will not be connected while telecasting the programme and they are not even interested to make a call to clarify the doubts. Similar findings were reported by Muhammad *et al.*(2004).

STUDY TO ELUCIDATE THE QUALITY PARAMETERS FOR TELECASTING

Table 1. Distribution of respondents according to their perception of different quality parameters

N=30

S. No	Parameters	Frequency	Percentage (%)
1	Sources of Information		
a)	other farmers	23	77
b)	Television	18	60
c)	Others (Dealers)	6	20
d)	Agricultural Officers	5	16
e)	Information materials (Books, Journals etc.,)	1	3
2	Preference of TV Channel		
a)	E-TV	27	90
b)	TV-9	15	50
c)	Gemini	13	43
d)	TV-5	5	17
e)	E-TV2	3	10
f)	Doordharshan	2	6
3	Preference of TV channel for watching agricultural programmes		
a)	E-TV	30	100
b)	Other channels	7	23
c)	TV-5	1	3
d)	Doordharshan	1	3
4	Purpose of watching agricultural programmes		
a)	New information	26	87
b)	Market related information	20	67
c)	Solutions to problems	13	43
5	Preference of interested programmes		
a)	Success stories	23	77
b)	Weather related information	17	57
c)	Live programmes	16	53

Majority (86%) of the farmers do not share the information obtained through TV channels to other farmers, however 23 percent of the farmers share the information rarely.

As far as suggestions (Table 2) for the improvement in television viewing behaviour was concerned, they expressed that local farmers should be involved while formulating the programme for farm

television (90%), more emphasis should be given to local crops (83%), success stories should be telecasted through interview of successful farmers to tell their experiences in their own language (77%), time of telecast should be changed (67%), programme should be repeated frequently (63%) and field/crop of successful farmers should be flashed on television (60%). Similar findings were reported by Chauhan (2003).

Table 2. Distribution of respondents according to the suggestions given by them

N=30

S. No	Suggestions	Frequency	Percentage (%)
1	Local farmers should be involved while formulating the programme	27	90
2	More emphasis should be given to local crops	25	83
3	Success stories	23	77
4	Time of telecast should be changed	20	67
5	Programmes should be repeated frequently	19	63
6	Field of successful farmers should be flashed in TV channels	18	60

The study to elucidate the quality parameters for telecasting the agricultural programmes revealed that majority of the farmers are getting information related to agriculture from other farmers. On an average, they watch TV for about 2-3 hours per day, out of that they watch agricultural programmes for about half- an- hour. All the farmers prefer watching E-TV for agricultural farmers to know new information. None of the farmers consulted scientists in live phone in programmes to know the information or to clarify

their doubts. Farmers suggested including local farmers while formulating the agricultural programmes, emphasis should be given to local crops, success stories should be telecasted; time of telecast should be changed and repeated frequently.

For effective dissemination of agricultural information credibility of agricultural programmes telecasted in TV channels should be increased among the farmers and awareness should be created about the importance of various programmes telecasted in TV.

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MULTIVARIATE ANALYSIS IN SORGHUM (*SORGHUM BICOLOR* L. MOENCH) FOR GRAIN AND FODDER YIELD

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The D^2 classifies the genotypes into homogenous groups / clusters with little diversity within cluster while diversity between two clusters is usually high. Thus representative genotypes from diverse clusters can be earmarked for utilization in hybridization programme depending upon breeding objective. Since, the literature in respect of genetic divergence studies in sorghum is meager, present investigation was undertaken. Traditionally Mahalanobis D^2 statistic to measure genetic divergence as suggested by Rao (1952) has been used by different workers. The PCA technique has been applied in this study to identify divergent genotypes.

The experimental material consisted of 60 diverse genotypes of rabi sorghum which were grown at Agricultural Research Station, Tandur in rabi season, 2009 in randomized block design with three replications. Each genotype was sown in five rows of 5m length with inter and intra row spacing of 45 x 15 cm. All agronomic measures were under taken for getting good crop growth. Observations were recorded on five randomly selected plants from each genotype per replication for the traits *viz.*, days to 50% flowering, days to maturity, plant height, panicle length, test weight, seed yield and fodder yield. Genetic divergence among 60 genotypes was analyzed by using Mahalanobis D^2 statistic (Rao, 1952) and Principal Component Analysis (PCA) as described by Jackson (1991).

On the basis of D^2 values the sixty genotypes (Table 1) were grouped into ten clusters. Based on D^2 values the cluster I was the biggest cluster with 24 genotypes followed by cluster VII with 12 genotypes, cluster IV with 8 genotypes, cluster X with 7 genotypes, and cluster VIII with 5 genotypes while the remaining Clusters II, III, V, VI and IX consisted single genotype.

Based on D^2 values intra cluster D^2 values ranged from zero (clusters II, III, V, VI and IX) to 5.02 (cluster VII) whereas the maximum inter cluster distance was observed between cluster VIII and X (9.29) followed by cluster V and VII (9.17), cluster VII and X (8.36) while the least D^2 values were recorded between cluster III and VI (2.80) followed by cluster V and IX (3.05) and cluster II and IX (3.10) (Table 2)

Maximum contribution towards divergence was by fodder yield (31.75%), days to maturity (27.06%), plant height (23.79%) and grain yield (8.47%). Thus, these four characters altogether accounted for more than 90% of the total divergence in sixty genotypes studied. These results are in agreement with the earlier findings of Joshi and Vashi (1992).

The first four principal components showed eigene values more than 1 and they altogether explained 90.16% of the variability (Table 3). The first PCA explained 41.5% of the total variability in the set of all variables and remaining ones accounted for progressively lesser amount of variation.

Cluster means (Table 4) based on D^2 method revealed that cluster II recorded high mean values for grain yield (2290 kg/ha) and panicle length (22.0 cm). Cluster VI had highest values for days to 50% flowering (74.6) and days to maturity (129.6). Cluster III recorded high mean values for plant height (231 cm) and cluster VII for fodder yield (7.55 t/ha). The above two methods of grouping revealed a single concept of non correspondence of genetic divergence and geographical diversity. Genotypes Selection 4, Selection 5, GPW 2393-4 and SPV 1359 were found divergent on the basis of PCA I and PCA II scores. Arunachalam and Bandopadhyay (1984) have proved experimentally more number of heterotic combinations with higher level of heterosis from the

Table . 3 Eigene values, proportion of the total variance represented by first three principal components, cumulative percent variance and component loading of different characters in rabi sorghum

	PC1	PC2	PC3	PC4
Eigene value (root)	462.21	238.54	189.46	113.33
Percent Var. Exp	41.53	21.43	17.02	10.18
Cumulative variance explained	41.53	62.97	80.00	90.19
Days to 50% flowering	0.11	0.01	0.05	0.77
Days to maturity	0.64	0.42	-0.61	-0.04
Plant height (cm)	-0.44	-0.39	-0.72	-0.12
Panicle length (cm)	0.11	0.15	0.07	-0.46
Fodder yield (T/ha)	0.58	-0.79	0.02	-0.02
Seed Yield (kg/ha)	0.12	-0.03	0.29	-0.41

* PC= Principal component

Table 4. Cluster means for six quantitative traits in rabi sorghum

Cluster	Days to 50% flowering	Days to maturity	Plant height (cm)	Panicle length (cm)	Fodder yield (t/ha)	Seed Yield (kg/ha)
I	72.7	123.0	206.2	14.7	5.85	1625
II	73.0	126.0	227.6	22.0	5.13	2290
III	74.0	128.0	231.0	13.0	6.43	1356
IV	71.2	120.8	159.7	15.5	5.07	1632
V	68.3	118.3	220.0	16.0	4.27	2035
VI	74.6	129.6	201.0	14.0	6.27	1311
VII	74.1	126.5	176.5	16.4	7.55	2044
VIII	61.8	120.6	206.2	19.6	5.98	1777
IX	71.0	121.0	205.0	16.0	5.27	2445
X	57.6	104.6	213.1	17.1	6.33	1650

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EFFECT OF NITROGEN ON YIELD ATTRIBUTES AND YIELD OF SPECIALITY CORN UNDER *PONGAMIA* + MAIZE AGRI- SILVI SYSTEM

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Maize (*Zea mays* L.) ranks next only to wheat and rice as it is considered as third most important cereal crop in the world. Maize has been an important cereal crop because of its greater productivity potential and adaptability to wide range of agro climatic conditions. It can be called as "Natural Agricultural Resource" after sugar cane. Of the various types of maize sweet corn, baby corn and pop corn are the most important. Baby corn is nothing but maize being grown for vegetable purpose. Moreover it is a short duration crop and free from pests and diseases and its nutritive value is comparable with that of several high priced vegetables. Sweet corn is used as a human food in soft dough stage with succulent grain and 13 to 15 per cent sugar. It is gaining popularity because of its high sugar and low starch content. It has emerged as an alternative dish of urbanites viz., vegetable, roasted ears, soups, corn syrup, sweeteners etc. The other type i.e., pop corn is very popular as snack food in many parts of the world. The use of popcorn confectionaries and popcorn products especially in amusement parks, picture theaters etc greatly increased the demand for popcorn products and has made a profitable outlet for those who desire to grow popcorn on a commercial scale. Maize is a highly nutrient exhaustive crop and responds even to higher levels of nitrogen as nitrogen is the major essential element for its productivity. Hence for improved production of these corns efficient nitrogen management is needed besides sustaining soil health. Therefore, the present investigation was conducted to study the effect of different levels of nitrogen on speciality corn in the existing *Pongamia* plantations.

The field experiment was carried out during *Khari*f2011 at the Student's Farm, College of Agriculture, Rajendranagar, Hyderabad. The soil was sandy loam in texture, low in available nitrogen and

medium in available phosphorous and potassium. The experiment was laid out in a randomized block design(factorial concept) with three replications. The treatments consists of three nitrogen levels (60, 90 and 120 kg N ha⁻¹) and three types of corn (baby corn, sweet corn and popcorn) as intercrops in *Pongamia*. The entire quantity of P₂O₅ and K₂O were applied as basal at the time of sowing and N was applied in three splits, first dose as basal and the remaining doses at knee-high and tasseling stages. The test varieties under study were "VL Baby Corn1", "Win Orange Sweet Corn" and "Amber popcorn". The spacings adopted were 50 x 15 cm in baby corn and 60x 25 cm in both sweet corn and popcorn. A total rainfall of 466.1 mm was received in 29 rainy days during crop growth period.

Application of graded nitrogen levels exerted significant influence on the performance of speciality corn types (Table.1). Cob length, cob girth, number of cobs per plant of speciality corn tended to increase with increased levels of nitrogen from 60 to 120 kg N ha⁻¹, with significant disparity between any two levels. Whereas, cob weight (with husk) was found maximum at 120 kg ha⁻¹ but was on par with 90 kg N ha⁻¹. The elevated stature of yield attributes might be presumably due to higher level of biomass accrual and efficient translocation of metabolites to the sink. The results as evidenced in the present study are in conformity with the findings of Singh *et al.*, (2000), Bindhaniet *al.*, (2007) and Ashok kumar (2009). Number of kernel rows cob⁻¹, number of kernels row⁻¹ and 100 seed weight also increased conspicuously with increasing levels of nitrogen levels upto 120 kg N ha⁻¹. This evidently proved that increased availability of nitrogen to crop at higher levels resulted in increased grain filling, that gave more number of kernel rows cob⁻¹, kernels row⁻¹ due to efficient translocation of photosynthates for

EFFECT OF NITROGEN ON YIELD ATTRIBUTES CORN OF SPECIALITY CORN

development of reproductive parts. The cob yield (with husk) and green fodder/stover yield significantly increased with increase in each gradient level of nitrogen upto 120 kg N ha⁻¹ (Table.2 & Fig 1). Adequate nitrogen nutrition has promoted growth stature as well as the enhanced yield structure of speciality corn, resulting in higher cob yield. The present investigation confirms the documented evidence of Pandey *et al.* (2000), Karet *et al.* (2006), Muniswamy *et al.* (2007) and Suryavanshi *et al.* (2008). The increase in the level

of nitrogen from 60 to 120 kg ha⁻¹ also progressively increased the kernal yield and shelling percentage of popcorn (Table.3). These results are in conformity with those of Sahoo and Mahapatra (2005), Choudary and Singh (2006) and Ashok kumar (2009).

All the three types of corn are significantly different from each other with respect to all the yield attributes except cob weight with husk in which sweet corn and popcorn were found comparable with each

Table.1. Influence of nitrogen levels on yield attributes and yield of speciality corn.

Treatments	Cob length (cm)	Cob girth (cm)	Number of cobs plant ⁻¹	Cob weight with husk (g cob ⁻¹)	Number of kernel rows cob ⁻¹	Number of kernels row ⁻¹	100 seed weight (g)	Cob yield (with husk) (kg ha ⁻¹)	Green fodder/stover yield (kg ha ⁻¹)
Nitrogen levels (kg ha⁻¹)									
60	11.58	8.92	1.32	61.3	11.6	30.6	12.1	4294.4	7082.2
90	12.77	9.11	1.44	63.3	12.8	32.3	12.3	4852.5	7487.3
120	13.86	9.87	1.59	68.0	14.5	35.3	13.0	5366.6	8082.5
S.Em±	0.24	0.19	0.03	1.69	-	-	-	70.37	157.35
CD at 5 %	0.73	0.59	0.10	5.07	-	-	-	210.99	471.79
Types of corn									
Baby corn	7.10	4.26	2.13	17.2	-	-	-	4109.1	10817.8
Sweet corn	16.52	13.59	1.10	113.4	12.7	33.0	11.5	7010.6	8453.5
Popcorn	14.60	10.05	1.12	62.0	13.3	32.4	13.4	3393.8	3380.8
S.Em±	0.24	0.19	0.03	1.69	-	-	-	70.37	157.35
CD at 5 %	0.73	0.59	0.10	5.07	-	-	-	210.99	471.79
N x T Interaction									
S.Em±	0.42	0.34	0.06	2.92	-	-	-	121.88	272.53
CD at 5 %	1.26	1.03	NS	NS	-	-	-	365.45	NS

Table. 2 Cob yield (with husk) (kg ha⁻¹) of speciality corn as influenced by varying nitrogen levels and types of corn and their interaction

Nitrogen levels (kg ha ⁻¹)	Types of corn			
	Baby corn	Sweet corn	Popcorn	Mean
60	3387.5	6381.8	3114.1	4294.4
90	4264.5	7093.0	3200.2	4852.5
120	4675.5	7557.2	3867.1	5366.6
Mean	4109.1	7010.6	3393.8	
	S.Em±		CD @ 5 %	
Nitrogen levels (kg ha ⁻¹)	70.37		210.99	
Types of corn	70.37		210.99	
N x T	121.88		365.45	

Table.3. Kernel yield (kg ha⁻¹) and Shelling percentage of popcorn as influenced by varying nitrogen levels

Treatment	Kernel yield (kg ha ⁻¹)	Shelling percentage
60	1994.9	39.7
90	2268.2	40.2
120	2656.3	40.9

other. This variation among the types of corns might be due to their genetic differences among themselves and due to the variations in their potentialities for different growth and yield characteristics.

The interaction effect between types of corn and levels of nitrogen was found significant for cob yield of speciality corn. Baby corn gave significantly

higher cob yield under the application of 120 kg N ha⁻¹ (4675.5 kg ha⁻¹) over remaining two lower doses of nitrogen. Sweet corn & popcorn also recorded higher cob yields at 120 kg N ha⁻¹ (7557.2 & 3867.1 kg ha⁻¹) which were significantly superior to both 60 kg and 90 kg N ha⁻¹. The results suggest that in speciality corn (three types), application of 120 kg N ha⁻¹ is required to achieve maximum cob yield.

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USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) BY PROFESSIONAL STUDENTS OF ANGRAU AT UNDER GRADUATE LEVEL

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Information Communication Technologies (ICTs) are basically information-handling tools-a varied set of goods, applications and services that are used to produce, store, process, distribute and exchange information. ICTs could be used to support and expand existing curricula by increasing the accuracy, presentation, user-friendliness and attractiveness of courses. ICT provides an avenue to improve education outreach and standards. It is a gateway to vast sources of information for teachers and students. The department of higher education realized the tremendous potential of ICT in teaching and learning process and launched a centrally sponsored scheme "National Mission on Education through information and communication Technology" in 2009 with a broad objective of ensuring connectivity of the learners to the world of knowledge in cyber space. ICT in educational sector can greatly enhance the quality of education.

The present study was undertaken to study the ICT profile of the students and to assess the extent of usage of ICTs by Undergraduate students.

Exploratory research design was adopted for the study. The sample consisted of students from faculty of Agriculture and Home Science of Acharya N.G Ranga Agricultural University located in Hyderabad. Simple random sampling procedure was followed for data collection. Total 100 respondents (50 from home science and 50 from agriculture) were choosing for the study for students separately.

The information on inventory was collected in terms of possession of personal computers/laptop, internet connection/data card, e-mail account; face book account and blog account.

Sixty percent students had an e-mail account, followed by face book account (48%) which

is used to communicate with friends, teachers and family members. Very few students possessed personal computers/laptop (7%), internet connection/data card (7%). The reason might be that the ICT facilities were provided by the university in the department and library. Only 4 per cent students had account in blog. The findings were in agreement with Maniar (2002) and Jyothi (2009).

The frequency of usage of search engines namely Yahoo, Google, MSN, Ask, Bing and Excite was studied. The data revealed that 85 percent of the students used Google search engine frequently, followed by Yahoo (19%) and equal proportion were MSN and Bing (3%) and only 1 percent were using Ask. A huge proportion of the students never used the search engines like Excite (99%), Bing (93%), MSN (91%) and Ask (84%) and Yahoo (43%).

Google and Yahoo were found to be most frequently used search engines due to its size of database and link based relevance ranking, simplicity, user friendly, informative and it makes never disappointed for any information looked for. Majority of the students did not know the existence of search engines like MSN, Ask, Bing and Excite.

Majority (92%) of the students learnt ICT skills through guidance from friends followed by course curriculum (88.00%), trial and error method (33%), online tutorial (28%) and only 13 per cent of the students learnt through self financed external course.

The extent of use of ICTs for various purposes under each component of ICT namely, Microsoft word, power point, excel, e-mail and World Wide Web were studied. The respondents were categorized into the low, medium and high level of use.

Forty one per cent of the students fell under medium category in use of ICTs, followed by 39 percent high and remaining 20 percent fell under low category in use of ICTs. The findings were in agreement with Madhubabu (2008)

Internet was used for sending and receiving e-mails. The major reason might be the dependency on e-mails for correspondence with friends and family members as it is the cheap and quick means of communication. And majority of students didn't use

Microsoft excel, the reason might be that at under graduation level the data entering and analysis was not need.

From the results of the study it can be concluded that the usage of ICTs is more in UG level education as it is used as one of the education technology to educate students during their course curriculum and students are frequently using search engine like Google, Yahoo etc for source of information.

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SOIL FERTILITY MAPPING IN MUSI COMMAND AREA OF NALGONDA DISTRICT, ANDHRA PRADESH

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ABSTRACT

A study was conducted during 2011-12 to characterize and map the soils in Musi project command area in Nalgonda district, Andhra Pradesh. About 95 surface (0-15 cm) soil samples were collected during June, 2011 from a study area of 24,906 ha by making a 3x 3 km² grid. Majority of the soils were sandy clay loam (70 %) in texture followed by sandy loam (14 %), sandy clay (7%), loamy (4%), clayey (3%) and clay loam (2 %). The soil reaction ranged from pH of 6.78 to 9.15 and majority were moderately alkaline in reaction (55%), followed by slightly alkaline (29%), strongly alkaline (12%) and neutral (4%). The EC ranged 0.112-3.53 dS m⁻¹ and majority of samples (99%) were non saline and only one percent soils were found to be moderate. All the soils were found to be high in their organic carbon status (12 to 31 g kg⁻¹), low in available N (53-205 kg N ha⁻¹), very high in available K (460-1298 kg K ha⁻¹). The available P was medium (4%) to very high (96%) (18.9 - 209.8 kg P ha⁻¹). The thematic maps on spatial variability of soil fertility maps (pH, EC, available N, P and K) were generated by ordinary krigging method available in the sub mode of interpolation in the spatial analyst tools of Arc map 9.3 GIS software.

Musi project was constructed across Musi river near solipet village (17°15' E and 79°33' N) near Suryapet, in Nalgonda district of Andhra Pradesh. The Musi medium irrigation project supplies wastewater of mixed domestic and industrial origin. It is utilized to irrigate approximately 10,000 ha of rice. The major crop in the sub-basin is rice, followed by vegetables, groundnuts, cotton, chilies, sugar cane, maize and pulses. Despite the importance of the region in the agricultural sector, meager data is available on detailed spatial information showing the nutrient status of soils. Hence the present study was carried out during 2011-12 to characterize the soils of Musi command area and to map them by using the GIS tools which can be used for soil test based , crop specific fertilizer recommendations.

MATERIALS AND METHODS

About 95 composite surface soil samples (0-15 cm) were collected across the command area during June, 2011 by forming a 3x3 km² grid using Arc map9.3 software. The GPS (Global Position System) data at each sample location were collected. The soil samples were air-dried and ground to pass 2 mm sieve and analyzed for pH, EC, organic matter

and available N, P and K by following the standard procedures. The particle size analysis was carried out by Bouyoucos hydrometer method (Piper, 1966)

The Survey of India (SOI) topographical maps of 570₇, 570₈, 570₁₁, 570₁₂, 1:50,000 scale covering Musi command area of Nalgonda district, Andhra Pradesh were used as reference maps and for demarcating the study area. The Musi command area map was vectorised by using Raster to Vector software (ERDAS 9.3 software), and then it was exported into Arc GIS 9.3 Software. Database on soil fertility status of the study area was developed using Microsoft Excel package. Then the database was exported to Arc GIS software, thematic maps (base maps) on spatial variability of soil fertility were generated by ordinary krigging method available in the sub mode of Interpolation in the spatial analyst tools of Arc map 9.3 GIS software.

RESULTS AND DISCUSSION

Soil texture of Musi command area surface samples (0-15 cm) ranged from sandy loam to clayey. Majority of the soils were sandy clay loam (70 %) followed by sandy loam (14%), sandy clay (7%), loamy (4%), clayey (3%) and clay loam (2%) . The

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clay particles deposited while irrigating the crops with Musi water might be responsible for the higher percentage of soils having relatively fine texture. Rattan *et al.* (2005) indicated that fields irrigated with sewage irrigation water around the peri urban areas of Keshopur Sewage Treatment Plant were sandy loam in texture.

The pH of the surface soils of Musi command area varied from 6.78 to 9.15 with overall mean of 7.94. Majority of the soil samples (55%) were moderately alkaline followed by slightly alkaline (29%), strongly alkaline (12%) and very less percentage of samples are in neutral range (4%). The alkalinity of irrigation water in Musi command area (Musi canal / bore wells / open wells) might be responsible for the higher percentage of soils having alkalinity. Tiwari *et al.* (1996) observed that soils irrigated with treated sewage water had relatively higher pH (8.0) and alkaline in reaction as compared with soils irrigated with tube well water (7.5) at Banaras Hindu University, Varanasi, and U.P.

The electrical conductivity of the soils ranged from 0.112 dS m⁻¹ to 3.53 dS m⁻¹, with a mean value of 1.44 d S m⁻¹. Majority of the soils (99%) are non saline, However Tiwari *et al.* (1996) and Ramesh (2003) reported relatively higher total soluble contents in sewage water irrigated fields than soils irrigated with normal water.

Organic carbon content of surface soils in Musi command area ranged from 12 to 31 g kg⁻¹ with overall mean value of 24.32 g kg⁻¹. Musi canal water carrying sufficient loads of suspended organic matter might be responsible for higher organic carbon contents in the study area. It was similarity with the findings of Ramesh (2003), who reported higher organic carbon contents in soils irrigated with sewage water than with normal water.

The available nitrogen content ranged from 53 to 205 kg N ha⁻¹ with overall mean value of 144 kg N ha⁻¹. Soil samples in the Musi command area are low in available nitrogen content which is expected in the existing semi arid climatic conditions of the study area. Azad *et al.* (1987) also reported that the normal soils contained very low amounts of available nitrogen in surface and subsurface layers.

The available phosphorus content of surface soils of Musi command area ranged from 18.9 to 209.8 kg P ha⁻¹ with a mean value of 74.38 kg P ha⁻¹. Majority of the soils are having high available P (96%) and only 4 per cent of soils are found to fall under medium category High available phosphorus content could be ascribed to enrichment of soils with sewage canal water, heavy application of phosphatic fertilizers by farmers through complex fertilizers applied as basal as well as top dressing and organic matter, which favours the solubilisation of fixed phosphorus



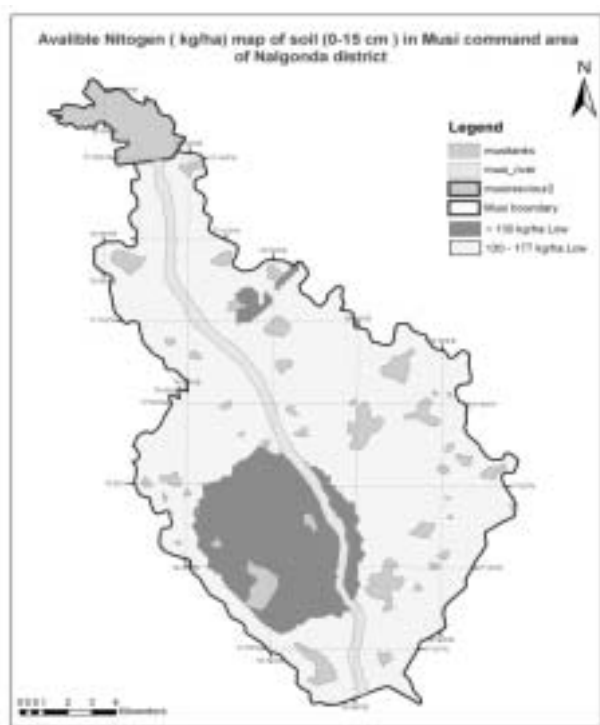


Fig.1. Spatial variability of soil quality maps in Musi command area of Nalgonda district

releasing more quantity to the available pool. Kharche *et al.* (2011) also reported higher available P in sewage-irrigated soils indicating significant addition of P through sewage water.

The available K content of surface soils of Musi command area ranged from 430 to 1298 kg K ha⁻¹ with a mean value of 521 kg K ha⁻¹. All the soils are found to be high to very high in available K status. Additions of potassium by Musi water could be responsible for such higher status of K in these soils.

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The results of high available potassium are in conformity with Priyane amerasinghe *et al.* (2008) and Karache *et al.* (2011).

Hence the soils of Musi command area are sandy loam to clayey in texture, moderately to strongly alkaline in reaction, non saline in majority of soils, high in organic carbon, low in available nitrogen and high to very high in available phosphorus and potassium.

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COMBINING ABILITY ANALYSIS FOR YIELD AND QUALITY TRAITS INVOLVING AROMATIC LINES IN RICE

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Aromatic rice constitutes a small but special group which is considered as the best in quality. Popularity of such rices has been documented in the Orient and now becoming more popular in Middle East, Europe and United States. Although aromatic rices which are popular in world market are long grain types, majority of the Indian indigenous aromatic rices are small and medium grain types. With the advent of "Geographical Indications" under WTO regulations, basmati kind of aromatic rice is accepted internationally when it is produced from North-western part of India due to its location specific eating quality, thus necessitating research efforts to evolve scented rice genotypes suitable to local requirements.

Successful application of biometrical procedures to understand genetics of quantitative characters helped the breeders to systematically plan for result oriented breeding programmes. The challenge of quality improvement also needs to be addressed by evolving cultivar genotypes that combined high yield potential with quality attributes meeting stringent national and international standards.

The material for the present investigation comprised of eight parents and their corresponding 16 F_1 crosses obtained following Line X Tester design (Kempthorne, 1957). The experiment was conducted in randomised block design with three replications at Rice Section, Agricultural Research Institute, ANGRAU, Rajendranagar, Hyderabad during *rabi* 2010-11. All the parents and F_1 S' were planted in rows of 3 m length with 20 x 15 cm spacing. Recommended agronomic, cultural and plant protection practices were followed. Five competitive plants for each parent and F_1 per replication were randomly selected for data generation. Rice grains were used for estimate volume expansion ratio after cooking, water uptake and protein content.

Analysis of variance for combining ability utilizing Line x Tester design for the 10 characters studied, indicated significant mean squares due to genotypes. Further, partitioning of the genotypes into parents and crosses and comparison of parents Vs crosses showed significant differences among themselves indicating that the crosses performed well compared to parents. The differences among lines and testers and the interaction component was also significant.

The results of combining ability variances indicated the predominance of non-additive genetic variance (GCA/SCA of <1.0) for most of the yield and quality characters viz., number of panicles per plant, panicle length, number of filled grains per panicle, grain yield, volume expansion ratio, water uptake, alkali spreading value and protein. Days to 50% flowering and 250 grain weight were under the influence of additive gene action.

The results for yield components indicated that, out of eight parents MTU-1010, MTU-1081 and Pusa-1121 flowered within 102 days and had negative significant gca effects for days to 50 percent flowering projecting their use in breeding for earliness (Table 1). Out of 16 crosses, Pusa-1121 x BM – 71 (HxL), RNR-2354 x MTU – 1010 (LxH) and Yamini x Sye-632003 (LxL) had given highest sca effect in negative direction and were the best specific crosses (Table 2). These crosses were early at 86 days. These specific crosses also exhibited heterosis, heterobeltiosis and standard heterosis of up to -11.50, -15.61 and -17.58 per cent respectively (Table 51. Sanjeev kumar *et al.* (2007) and Dalvi and Patel (2009) reported similar results for this trait.

For manifold enhancement of reproductive sink the ear bearing tillers hold significance. Significant positive gca effects were recorded in MTU-1081, Pusa-1121 for number of panicles per

plant, besides scoring a high *per se* value of more than seven panicles per plant. Crosses viz., RNR-2354 x BM-71 (LxL), Ranbir Basmati x Sye-632003 (LxL), Pusa-1121 x MTU-1010 (HxL) and Yamini x Sye-632003 (LxL) (Table 2) were found to have significant positive sca effects. These crosses had high *per se* of 11 to 13 (Table 1). In all the crosses except Pusa-1121 x MTU-1010, two poor combiners complimented each other to produce a best specific cross. In the remaining cross one of the parents was a good combiner. These crosses registered more than 9.68 per cent heterosis, 30.77 per cent heterobeltiosis and 78.95 per cent standard heterosis (Table 2). Accordingly same parents have performed exceedingly for the improvement of panicle length also. Parents BM-71, MTU-1081, Ranbir Basmati, and Pusa-1121 were identified as potential donors for this trait. For Panicle Length positively significant sca effects were recorded in two crosses Yamini x Sye-632003 (LxL) and RNR-2354 x BM-71 (LxH) which had also expressed highest heterosis of 17.29, heterobeltiosis of 9.06 and standard heterosis of 58.65 per cent respectively (Table 2) indicating their role in spotting good segregants for this trait. Earlier researchers, like Kumar babu *et al.* (2010) and Saidaiah *et al.* (2010) reported similarly non-additive gene action for this trait.

For filled grains per panicle parents Sye-632003, RNR-2354, Ranbir Basmati and MTU-1081 were considered to have contributed maximum favourable genes and possessed highest mean of 138 (Table 2). Ali *et al.* (1993) stated that, mean performance of a variety was a good indicator of gca. In the present study also such relation was noticed. Best specific crosses for this trait were RNR-2354 x Sye-632003 (HxH) followed by RNR-2354 x MTU-1081 (HxH) and Ranbir Basmati x BM-71 (HxL) and recorded mean of more than 100. These crosses also recorded highest heterosis of 14.9 per cent. Another yield component 250 grain weight had parents MTU-1010, Pusa-1121, Yamini and BM-71 which exhibited significantly positive gca effects. The cross Ranbir Basmati x MTU-1010 (LxH) was the best specific combiner and had one parent with high gca. This specific cross had registered 12.98 per cent heterosis, 10.90 per cent heterobeltiosis and 105.60 per cent standard heterosis. Salgotra *et al.* (2009) and Saidaiah *et al.* (2010) reported similar gene action for this trait.

For grain yield per plant Yamini, MTU-1010, Pusa-1121 and MTU-1081 were the best general combiners (Table 3) with high *per se* of up to 19.06 g. Crosses Ranbir Basmati x Sye-632003 (LxL), Yamini x Sye-632003 (HxL), RNR-2354 x MTU-1081 (LxH) and Pusa-1121 x MTU-1010 (HxH) were the best specific combinations. These crosses besides recording high mean values also exhibited more than 51.11 heterosis, 44.42 heterobeltiosis and 63.15 standard heterosis (Table 2). Jayasudha and Deepak Sharma (2010) and Saidaiah *et al.* (2010) reported non-additive gene action for this trait.

For volume expansion ratio lines Yamini and Pusa-1121 exhibited significantly positive gca effects and were identified as the best general combiners for this trait (Table 1). Two crosses exhibited significant sca effects viz., Pusa-1121 x MTU-1081 (HxL) and RNR-2354 x BM-71 (LxL) in positive direction and were the best specific combiners. The study of combining ability effects for water uptake (ml) revealed that, Yamini, Sye-632003 and MTU-1081 recorded significantly positive gca effects (Table 1). Four crosses recorded positively significant sca effects and highest value was observed in case of RNR-2354 x Sye-632003 (LxH), Pusa-1121 x Sye-632003 (LxH), Yamini x MTU-1081 (HxH) and Yamini x BM-71 (HxL). However, the cross Yamini x MTU-1081 which had positive sca effect was a result of High x High parents and can be profitably used in isolating good desirable segregants.

In addition to routine amylose test most of the quality evaluation programmes follow alkali spreading score to determine the gelatinization temperature. A high score of 6 to 7 for alkali spreading is suggestive of low gelatinization temperature and is desirable from cooking quality point of view. In the present study for alkali spreading value Pusa-1121 and MTU-1081 were identified as best general combiners (Table 1). These parents also possessed high mean value of more than 5 (Table 2). Both of these parents were found to possess a high degree of prepotency and transmitted this trait to crosses which turned out to be best specific crosses. For alkali spreading value six crosses recorded positively significant sca effects. Yamini x Sye-632003 (LxL) recorded highest positive sca effect followed by Ranbir Basmati x MTU-1010 (LxH), Pusa-1121 x BM-71 (HxL) and Ranbir Basmati x MTU-1081 (LxH) and were the top ranking specific crosses, with maximum

Table 1. Estimates of general combining ability effects for yield and quality characters

Parent	Days to 50% Flowering	Number of Panicles Plant ⁻¹	Panicle Length (cm)	Number of Filled Grains Panicle ⁻¹	250 Grain Weight (g)	Grain Yield Plant ⁻¹ (g)	Volume Expansion Ratio	Water Uptake (ml)	Alka Spread Value
Yamini	-0.311	-0.042	-0.534*	-0.072	0.463**	2.288**	0.450**	0.724**	-0.01
Pusa-1121	-0.981*	0.542**	0.437*	-11.061**	0.872**	0.924**	0.121*	0.016	0.916
Ranbir Basmati	-0.485	-0.625**	0.634**	4.554**	-0.305**	-1.092**	-0.421**	-1.005**	-0.215
RNR-2354	1.776**	0.125	-0.537*	6.580**	-1.030**	-2.120**	-0.241*	0.266	-0.665
BM-71	1.791**	-0.458*	1.138**	-8.030**	0.292**	-1.058**	-0.259*	-0.401*	-0.185
MTU-1010	-3.053**	-0.042	-0.066	-9.649**	1.056**	2.234**	0.016	-0.901**	0.249
Sye-632003	4.233**	-0.708**	-1.856**	13.357**	-1.211**	-2.096**	0.114	0.661**	-0.297
MTU-1081	-2.971**	1.208**	0.784**	4.322*	-0.136*	0.920**	0.130	0.641**	0.237
SE ±	0.4145	0.1945	0.2025	1.6168	0.0615	0.2115	0.1015	0.1941	0.0255

*and ** significant at 0.05 and 0.01 probability level respectively

Table 2. Top ranking desirable gca of parents, sca of crosses along with their *per se* values and magnitude of heterosis (H_1), heterobeltiosis (H_2) and Standard heterosis (H_3)

Character	Best general combiners	<i>per se</i>	Best specific combinations	<i>per se</i>	gca effect	Heterosis (%)	
						H_1	H_2
1. Days to 50% flowering	MTU-1081	94.35	Pusa-1121 x BM-71	89.29	High x Low	-8.58	-1
	Pusa-1121	91.12	RNR-2354 x MTU-1010	86.60	Low x High	-11.50	-1
			Yamini x Sye-632003	91.19	Low x Low	-5.32	-1
2. Number of panicles plant ⁻¹	MTU-1081	7.66	RNR-2354 x BM-71	13.00	Low x Low	69.57	6
	Pusa-1121	9.33	Ranbir Basmati x Sye-632003	11.33	Low x Low	30.77	3
			Pusa-1121 x MTU-1010	12.66	High x Low	43.40	3
3. Panicle length (cm)	BM-71	27.45	Yamini x Sye-632003	27.07	Low x Low	17.29	
	MTU-1081	24.36	RNR-2354 x BM-71	29.94	Low x High	16.82	9
	Ranbir Basmati	26.70					
4. Number of filled grains panicle ⁻¹	Pusa-1121	27.93					
	Sye-632003	138.22	RNR-2354 x Sye-632003	129.19	High x High	-	
	RNR-2354	135.21	RNR-2354 x MTU-1081	116.18	High x High	-	
5. 250 grain weight (g)	Ranbir Basmati	73.30	Ranbir Basmati x Bm-71	100.54	High x Low	14.90	
	MTU-1081	115.11					
	MTU-1010	5.74	Ranbir Basmati x MTU-1010	6.61	Low x High	12.98	1
	Pusa-1121	6.56					
	Yamini	6.56					
	BM-71	4.79					

Character	Best general combiners	per se	Best specific combinations	per se	gca effect	Heterosis (%)	
						H ₁	H ₂
1. Grain yield plant ⁻¹ (g)	Yamini	13.19	Ranbir Basmati x Sye-632003	21.69	Low x Low	65.03	6
	MTU-1010	19.06	Yamini x Sye-632003	24.70	High x Low	89.25	8
	Pusa-1121	17.38	RNR-2354 x MTU-1081	23.23	Low x High	59.98	5
	MTU-1081	13.86	Pusa-1121 x MTU-1010	27.53	High x High	51.11	4
2. Volume expansion ratio	Yamini	5.06	RNR-2354 x BM-71	4.47	Low x Low	-	
	Pusa-1121	4.31	Pusa-1121 x MTU-1081	5.30	High x Low	11.45	
3. Water uptake (ml)	Yamini	27.50	RNR-2354 x Sye-632003	29.25	Low x High	14.89	1
	Sye-632003	25.58	Pusa-1121 x Sye-632003	28.91	Low x High	7.10	
	MTU-1081	25.58	Yamini x MTU-1081	29.50	High x High	11.15	7
			Yamini x BM-71	28.16	High x Low	-	
4. Alkali spreading value	Pusa-1121	5.59	Yamini x Sye-632003	6.00	Low x Low	19.36	1
	MTU-1010	4.24	Ranbir Basmati x MTU-1010	5.61	High x Low	45.32	3
	MTU-1081	5.60	Pusa-1121 x BM-71	6.00	High x Low	30.01	7
			Ranbir Basmati x MTU-1081	5.25	Low x High	15.43	
5. Protein (%)	Ranbir Basmati	10.36	Pusa-1121 x BM-71	9.62	Low x Low	9.40	6
	MTU-1010	8.75	RNR-2354 x BM-71	9.44	Low x Low	6.09	4
	Yamini	8.00	Ranbir Basmati x MTU-1010	10.66	High x High	11.56	2

per se performance 6.00. All these combinations excepting Yamini x Sye-632003 resulted from High x Low parents. These specific crosses also recorded heterosis to the extent of 45.32 and heterobeltiosis of 32.47 per cent respectively (Table 2). The heterosis observed in these crosses was due to additive x non-additive effect which is not fixable in nature, necessitating heterosis breeding. In continuation with the discussion on chemical quality, it can be stated that information on genetics of protein content is limited. However, preliminary reports by Tsuzuki *et al.* (1985) have indicated polygenic and complex inheritance. In the present study also Ranbir Basmati, MTU-1010 and Yamini exhibited significantly positive *gca* effects for kernel protein content and were identified as best general combiners for protein content (Table 1). Good and Siddiq (1986) inferred that varieties with high protein content generally showed high *gca* effects. Accordingly, in the present investigation the above best general combiners registered high *per se* values up to 10.36 per cent protein (Table 2). Significantly positive *sca* effects were observed in nine crosses in case of protein content. Maximum *sca* effect was recorded in the

crosses Pusa-1121 x BM-71 (LxL), RNR-2354 x BM-71 (LxL) and Ranbir Basmati x MTU-1010 (HxH) in that order (Table 4) and had *per se* up to 10.66 per cent. The complimentary action was observed as Poor x Poor combiners produced high protein specific crosses Pusa-1121 x BM-71 and RNR-2354 x BM-71. These specific crosses expressed maximum heterosis, heterobeltiosis and standard heterosis of 11.56, 6.22 and 9.63 per cent respectively (Table 2). Cross Ranbir Basmati x MTU-1010 was derived from High x High *gca* parents, thus offering scope for spotting protein rich recombinants. Singh and Singh (1982) suggested that improvement of this trait could be quickly realized by certain degree of intercrossing. In the present study also out standing segregants in most desirable crosses may be inter mated to evolve high protein lines.

Considering all the chemical attributes MTU-1010 was identified as potential parent in imparting its superior chemical qualities to the progenies. Among the crosses, Pusa-1121 x BM-71 and Ranbir Basmati x MTU-1010 offered maximum scope in the improvement of these traits.

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PROBLEMS ENCOUNTERED BY SUGARCANE FARMERS AND SUGGESTIONS TO OVERCOME THE PROBLEMS

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The present study was carried out with the objective of finding out the problems encountered by sugarcane farmers and respective suggestions to overcome the problems as perceived by the sugarcane farmers.

Ex-post-facto research design was followed for the study. The investigation was carried out in Chittoor district of Rayalaseema region of Andhra Pradesh during the year 2011. Four mandals were selected in chittoor district purposively having highest area under sugarcane. From each mandal three villages were selected purposively. From each village ten sugarcane farmers were selected randomly thus making a total of one hundred and twenty respondents for the study. The data were collected with the help of personal interview method through structured interview schedule. During the interview, the respondents were asked to enumerate the problems faced by them in the adoption of recommended package of practices of sugarcane.

Based on the response from 120 farmers expressed as percentage, High cost of labour for harvesting (90.83%), Lack of remunerative price (87.50%), and Poor irrigation facilities (80.83%) were the major problems expressed by the sugarcane farmers ranked first, second and third respectively.

Severe incidence of pests and diseases (75.00%), Delayed payments for the produce (73.33%), Irregular supply of power (70.00%), Non availability of improved planting material (65.00%), Less credit facilities (52.50%), Insufficient extension activities (50.00%), Non availability of inputs in time (46.66%), Lack of training (40.80%), Lack of crop insurance (34.17%), Non availability of manures and organic fertilizers (30.88%), Non availability of micronutrients (22.55%)& and Non availability of cost

effective technologies (21.66%) were the other problems perceived by the sugarcane farmers as per the rank order from four to fifteen.

Manual harvest is a laborious process and there is high demand for labour during the harvesting period. Due to increased labour wages harvesting has become more expensive.

Minimum Support Price for sugarcane is fixed by the government based on certain norms. Majority of the farmers expressed that they were not able to get back the expenses with Minimum Support Price and were incurring losses in sugarcane cultivation. These results are in conformity with the findings of Mande and Thombre (2009).

Intervention and popularization of suitable and feasible sugarcane harvesters (93.33%), provision of remunerative price (91.67%), improving irrigation facilities (87.50%) were the major suggestions made by the sugarcane farmers that ranked first, second and third respectively.

Training on identification and control of pests and diseases and pest forecasting measures (83.33%), in time payments for the produce (80.83%), regular power supply (76.67%), provision of improved planting material in time (73.33%), provision of proper institutional finance and crop insurance (70.00%), extension activities and training (65.83%), timely and sufficient supply of inputs (56.67%), development of cost effective technologies (41.67) were the other suggestions expressed by the sugarcane farmers as per the rank order from four to eleven.

The intervention and popularization of suitable and feasible machines for harvesting sugarcane can help the farmers in completing the harvesting work at low cost and also helps in timely

PROBLEMS ENCOUNTERED BY SUGARCANE FARMERS AND SUGGESTIONS

delivery at the factory gate. Providing remunerative price for sugarcane crop will make sugarcane cultivation a profitable enterprise. Irrigation facilities are highly essential for sugarcane crop. The farmers

also expressed that the bore wells and tube wells can be installed at appropriate places on communal basis for supply of irrigation water. Ramu *et al.*, (2010) also made similar observations.

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DEVELOPMENT OF EDUCATIONAL PACKAGES FOR RURAL ADOLESCENT GIRLS

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Adolescent pregnancies (15-19 years) contribute to 19 percent of total fertility in India and record the highest maternal mortality rates. Besides maternal age, lack of education, low socio-economic status, maternal under nutrition and limited access to maternal health services are important determinants of poor pregnancy outcomes. Low birth weight is the major adverse outcome for the infant and an important determinant of increased child mortality. (Sunil Mehra and Deepti Agrawal-2004).

It has been observed that adolescent mothers suffer from higher child loss and also maternal mortality was very high in mothers aged 15 – 19 years. According to WHO Infant Mortality Rate was 49/1000 live births and Maternal Mortality rate was 134/100000 live births.(Pathak and Ram, 1993).The educational intervention program can bring about a desirable change in knowledge among adolescent girls regarding reproductive health.(Rao *et al.* 2008) Hence there is need to formulate various development and health care programmes for rural communities to prevent under nutrition.

With this background present study was taken up to make an attempt to develop the educational package on adolescent related issues for adolescent health for healthy child care.

Information on adolescent health, adolescent balanced diet, early marriages and consanguinous marriages and importance of folic acid was collected from various sources and the topics were developed in Telugu along with appropriate pictures. The content was converted into suitable aids i.e., two folders, one leaflet and one chart were developed. The developed educational package on adolescent related topics was then subjected to content validation to know its effectiveness in terms of presentation style, content coverage, pictures used with 55 experts who are

working in Dept of Women Development and Child Welfare who are directly involved in planning and implementation of educational programmes for rural women.

It is interesting to note that for the folder prepared on the adolescent health, 2/3rd (69%) of the experts felt that the content, content coverage is appropriate and the language used is very good, followed by 49 per cent of the experts who felt that the aid prepared is easily understandable and the topic was closed appropriately.

In terms of appropriateness of pictures, 58 per cent felt it was appropriate to the content only 45 per cent felt the numbers of pictures used were very good and 56 per cent felt that colour combinations used in the package were very good. Similar opinion was given by the experts on presentation style (53%) and on overall appearance of the aid (52%).It was noticed that 64 percent of the experts felt that the language used was appropriate to educate the adolescent girls followed by more than half (58%) of the experts who felt that it was appropriate to understand easily and nearly 2/3rd of (60%) experts felt that concept closing and pictures in the chart on were appropriate. Interestingly nearly 65 percent of the respondents felt very good about appropriateness of pictures, colour combinations used in pictures, presentation style and the overall appearance of the aid.

Feed back for the leaflet on early marriages and consanguinous marriages revealed that only 50 percent of the experts felt that content is appropriate in terms of content coverage,51 percent of the experts felt that the language used in the package is easily understandable and around 48 per cent felt that the closing of the concept was appropriate.

DEVELOPMENT OF EDUCATIONAL PACKAGES FOR RURAL ADOLESCENT GIRLS

Only 50 percent of the experts felt that aid prepared was very good in terms of picture appropriateness, number of pictures, colour combinations, presentation style and overall appearance of the aid.

It is clearly evident from the results that the content in folder was rated as very good by 49 percent. Interestingly 54 percent of the experts felt good for content coverage and more than half of the experts i.e., 51 percent felt that language used was appropriate and the aid is simple and easily understandable and 49 percent experts opined that the concept closing was good. With regard to the picture appropriateness and number of pictures 47 percent felt that the picture used in the folder were very appropriate in terms of suitability and number. Only 49 percent of the judges felt that colour combinations used were very good.

Regarding presentation style and overall appearance of the aid only 40 percent of the judges felt that the presentation style was impressive by giving ranking as very good and 49 percent felt that the overall appearance of the aid is good.

The suggestions given by the experts for improving the quality of aid in terms of content, pictures used and presentation style are :

Adolescent health information should be given to girls from 10 years onwards.

Chart on adolescent balanced diet needs the orderly presentation in the content by reducing the pictures.

For leaflet on early marriages and consanguineous marriages judges expressed to include information about the Acts related to child marriages and its consequences

Folder on importance of folic acid needs improvement in terms of content.

Based on the total appearance of the aids, content coverage and language used and appropriateness of pictures judges gave first preference to chart on adolescent balanced diet; second preference to adolescent health, third preference to early marriages and consanguineous marriages and last preference to leaflet on importance of folic acid.

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Hu, J., Yue, B and Vick, B.A. 2007. Integration of trap makers onto a sunflower SSR marker linkage map constructed from 92 recombinant inbred lines. *Helia*. **30** (46) :25-36.

Books

AOAC. 1990. Official methods of analysis. Association of official analytical chemists. 15th Ed. Washington DC. USA. pp. 256

Federer, W.T. 1993. Statistical design and analysis for intercropping experiments. Volume I: two crops. Springer – Verlag, Cornell University, Ithaca, New York, USA. pp. 298-305

Thesis

Ibrahim, F. 2007. Genetic variability for resistance to sorghum aphid (*Melanaphis sacchari*, Zentner) in sorghum. Ph.D. Thesis submitted to Acharya N.G. Ranga Agricultural University, Hyderabad.

Seminars / Symposia / Workshops

Naveen Kumar, P.G and Shaik Mohammad 2007. Farming Systems approach – A way towards organic farming. Paper presented at the National symposium on integrated farming systems and its role towards livelihood improvement. Jaipur, 26 – 28 October 2007. pp.43-46

Proceedings of Seminars / Symposia

Bind, M and Howden, M. 2004. Challenges and opportunities for cropping systems in a changing climate. Proceedings of International crop science congress. Brisbane –Australia. 26 September – 1 October 2004. pp. 52-54
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