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# EFFECT OF DIFFERENT MEDIA AND MICROWAVE OVEN DRYING ON PRODUCTION OF QUALITY DRY FLOWERS OF CARNATION CV. MASTER

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## ABSTRACT

The present study was under taken in the Department of Horticulture, College of Agriculture, Rajendranagar with Carnation cv. Master during 2007-2008. Efforts were made to standardize the dehydration method for Carnation flowers cv.Master in microwave oven. The flowers were dried in microwave oven at three different drying durations viz., 120 seconds, 150 seconds and 180 seconds after embedding in three media viz., quartz sand, silica gel and borax. The treatments were replicated thrice. Data recorded on different parameters were subjected to statistical analysis with factorial CRD. Maximum flower dry weight was observed with quartz sand (4.24 g) which was on par with silica gel (4.21 g). Maximum dry flower diameter was observed with quartz sand (3.44 cm) which was on par with silica gel (3.43 cm). The maximum score for overall acceptability of dry Carnation flower was recorded with silica gel (4.80) which was on par with borax (4.75).

The beauty and fresh look of cut flowers and cut foliage is lost due to microbial activities and biochemical changes. The fresh look can be retained for a few days in vase following the best techniques of post harvest management as stated by Datta (1999). Dehydrated or dried ornamental plant parts are generally inexpensive and are sought for their ever lasting and attractive appearance. Silica gel drying is expensive but by far it is the best, and can be used repeatedly. Sand is also used for drying. Organic materials and salts are strained from sand before use. Since sand is heavier, it takes longer time for drying compared to other materials. Borax and alum do not weigh heavy as silica gel and there fore considered as the best material for dehydration of Carnation flowers. The charm of dried ornamental plant parts can be maintained from few months to years with less cost, if protected from the damage done by high humidity as in dried flowers, the microbial activities in the aging process comes to stand still at dry state. The main characteristic of dried flowers includes novelty, longevity, aesthetics, flexibility and year round availability (Joyce, 1998). In the present study efforts have been made to standardize the dehydration method for Carnation flowers with microwave oven drying.

## MATERIALS AND METHODS

The present investigations were carried out in the Department of Horticulture, College of Agriculture, Acharya N.G.Ranga Agricultural University, Rajendranagar, Hyderabad during 2007-2008. The flowers of Carnation cv. Master were given drying treatments in microwave oven after embedding them in three media viz., quartz sand (M1), silica gel(M2) and borax(M3). In microwave oven, flowers were dried for three durations viz., 120 seconds (D1), 150 second (D2) and 180 seconds (D3). The experiment was laid out in a Factorial CRD with three replications and ten flowers per replication. The texture of dry flowers was observed by feel method and a score card technique was used to determine the degree of brittleness of the flower and the scale is given as 0 - very high, 1- high, 2- low and 3- very low. Shape of dry flower was observed by feel method and a score card technique was used as 0- very poor, 1- poor 2- moderate 3- good 4- very good. Overall acceptability of flowers was concluded by considering the colour change and retention of structural integrity of visual scores. The details of colour scores are as follows: 0-total change, 1- higher change, 2- moderate change, 3- slight change 4- no change. The details of retention of structural integrity as follows: 0 - very poor, 1- poor, 2- moderate, 3-good and 4- very good.

## RESULTS AND DISCUSSION

Microwave oven drying was quick as it uses both microwave energy and hot air energy in combination as a medium for drying. The Carnation dry flower weight differed significantly due to drying media,

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duration and their interaction. Among the media, quartz sand recorded the maximum dry flower weight (4.24 g) while among the durations, the maximum dry flower weight (6.40 g) was noticed at 120 seconds. The interaction between quartz sand and 120 seconds duration recorded maximum dry flower weight (6.58 g) followed by silica gel at 120 seconds (6.42 g) which were on par with each other. The minimum dry flower weight was noticed with borax at 180 seconds drying duration (2.60 g) (Table 1).The flower dry weight was significantly decreased with quartz sand from 120 seconds duration (6.58 g) to 180 seconds duration (2.72 g). Similar trend was noticed with silica gel (6.42 g and 2.91 g respectively) and borax (6.20 g and 2.60 g respectively). Drying of flowers in microwave oven with silica gel resulted in highest mean percentage of weight loss. This is in accordance with Kumaresan (2000). This may be due to quick release of maximum amount of moisture by agitating water molecules with the help of electronically produced microwaves (Bhutani,1990) and the hygroscopic nature of silica gel (Datta,1999).

The interaction between media and duration of drying was significant on dry flower diameter of Carnation. Maximum dry flower diameter was observed with quartz sand at 120 seconds (3.76 cm) (Table 2) followed by silica gel at 120 seconds (3.68 cm) and the lowest dry flower diameter (3.06 cm) was observed with silica gel at 180 seconds. Highest anthocyanin content (14.44 mg) was observed at 180 seconds duration of drying (Table 3) which was significantly highest over 150 seconds duration (12.89) and 120 seconds duration (11.95) of drying. Among the media silica gel recorded the highest anthocyanin content (14.00 mg). The anthocyanin content increased with increase in temperature. The darkening of flower could be due to increase in temperature, more moisture loss and also increase in concentration of the pigments following water loss (Oren Shamir, 2001).

Maximum number of petals were recorded with quartz sand (60.77) which was on par with silica gel (59.77) (Table 4) while the minimum number of petals were recorded with borax (57.66). The decrease in petal number with borax could be due to the adherence character of borax. With the removed moisture from the flower, borax become wet and sticks to the flower petals. Maximum number of petals were observed at 120 seconds duration (61.88) followed by 150 seconds duration (59.33), while the minimum number was observed at 180 seconds duration (56.88).

Maximum total sugars were observed with silica gel (4.47 mg) (Table 5) followed by borax (3.85 mg) while minimum was observed with quartz sand (3.66 mg). There was significant difference in total sugar content of dry Carnation flower due to duration of drying. Highest total sugar content was observed at 180 seconds of drying (4.62 mg) followed by 150 seconds (3.87 mg) and 120 seconds (3.39 mg).The interaction was found to be not significant. Significantly maximum textural score was recorded with quartz sand (2.51) (Table 6) followed by borax (1.68) and silica gel (1.00). Significant difference in texture of dry Carnation flower was observed due to drying durations. Maximum textural score was recorded at 120 seconds duration (2.86) followed by 150 seconds (1.40) and 180 seconds (0.97) duration. The interaction was found to be not significant. Maximum score for the shape of Carnation dry flowers was recorded at180 seconds duration (3.22) followed by 150 seconds (2.84) (Table 7) and the minimum score was observed at 120 seconds (2.08) duration. The score values steadily increased with quartz sand from initial duration of drying (1.60) to final duration of drying (2.66). Similar trend also noticed with silica gel (2.66 and 3.46 respectively) and borax (2.00 and 3.53 respectively).

The data in table 8 revealed the interaction between media and duration of drying on over all acceptability of dry Carnation flower. Maximum score was observed with silica gel at 150 seconds of drying (5.13) followed by borax at 150 seconds of drying (5.00), while the minimum score was observed with quartz sand at 120 seconds of drying (4.13).The over all acceptability increased from 120 seconds of drying to 150 seconds and decreased there after at 180 seconds of drying in all the media i.e., 4.13,4.66 and 4.20 respectively in quartz sand, 4.80, 5.13 and 4.66 respectively in silica gel and 4.66, 5.00 and 4.60 respectively in borax.

**Table 1. Effect of different media and duration of microwave oven drying on flower weight (g) of Carnation dry flower cv. Master**

| Media | Duration (Seconds) | | | Mean |
|---|---|---|---|---|
| | **120 (T1)** | **150(T2)** | **180(T3)** | |
| Quartz sand (M1) | 6.58 | 3.44 | 2.72 | 4.24$^a$ |
| Silica gel (M2) | 6.42 | 3.30 | 2.91 | 4.21$^a$ |
| Borax (M3) | 6.20 | 3.30 | 2.60 | 4.03b |
| Mean | 6.40$^a$ | 3.34$^b$ | 2.73$^c$ | |
| | **F-Test** | **SEM+/-** | | **CD 5%** |
| Media (M) | ** | 0.05 | | 0.12 |
| Duration (D) | ** | 0.05 | | 0.12 |
| M x D | ** | 0.10 | | 0.21 |

**Table 2. Effect of different media and Duration of microwave oven drying on flower diameter (cm) of Carnation dry flower cv. Master**

| Media | Duration (Seconds) | | | Mean |
|---|---|---|---|---|
| | **120 (T1)** | **150(T2)** | **180(T3)** | |
| Quartz sand (M1) | 3.76 | 3.48 | 3.09 | 3.44$^a$ |
| Silica gel (M2) | 3.68 | 3.54 | 3.06 | 3.43$^a$ |
| Borax (M3) | 3.49 | 3.46 | 3.18 | 3.28$^b$ |
| Mean | 3.64$^a$ | 3.40$^b$ | 3.11$^c$ | |
| | **F-Test** | **SEM+/-** | | **CD 5%** |
| Media (M) | ** | 0.05 | | 0.11 |
| Duration(D) | ** | 0.05 | | 0.11 |
| M X D | ** | 0.09 | | 0.19 |

**Table 3. Effect of different media and duration of microwave oven drying on anthocyanin content (mg/g) of dry Carnation cv. Master**

| Media | Duration (Seconds) | | | Mean |
|---|---|---|---|---|
| | **120 (T1)** | **150(T2)** | **180(T3)** | |
| Quartz sand (M1) | 11.53 | 12.49 | 14.29 | 12.77$^a$ |
| Silica gel (M2) | 13.04 | 13.64 | 15.32 | 14.00$^a$ |
| Borax (M3) | 11.29 | 12.55 | 13.71 | 12.52$^b$ |
| Mean | 11.95$^a$ | 12.89$^c$ | 14.44$^b$ | |
| | **F-Test** | **SEM+/-** | | **CD 5%** |
| Media (M) | ** | 0.11 | | 0.23 |
| Duration(D) | ** | 011 | | 0.23 |
| M X D | NS | 0.19 | | 0.41 |

** Significance at (P<_0.05) NS: Not significant

Figures bearing same letters did not differ significantly

**Table 4. Effect of different media and duration of microwave oven drying on number of petals of dry carnation cv. Master**

| Media | Duration (Seconds) | | | Mean |
|---|---|---|---|---|
| | 120 (T1) | 150(T2) | 180(T3) | |
| Quartz sand (M1) | 63.00 | 60.66 | 58.66 | 60.77[a] |
| Silica gel (M2) | 62.00 | 59.33 | 57.66 | 59.77[a] |
| Borax (M3) | 60.66 | 57.66 | 54.66 | 57.66[c] |
| Mean | 61.88[a] | 59.33[b] | 56.88[c] | |
| | F-Test | SEM+/- | | CD 5% |
| Media (M) | ** | 0.59 | | 1.24 |
| Duration(D) | ** | 0.59 | | 1.24 |
| M X D | NS | 1.03 | | 2.16 |

**Table 5. Effect of different media and duration of microwave drying on total sugars (mg/g) of dry carnation cv. Master**

| Media | Duration (Seconds) | | | Mean |
|---|---|---|---|---|
| | 120 (T1) | 150(T2) | 180(T3) | |
| Quartz sand (M1) | 3.18 | 3.65 | 4.15 | 3.66[b] |
| Silica gel (M2) | 3.96 | 4.26 | 5.19 | 4.47[a] |
| Borax (M3) | 3.32 | 3.71 | 4.52 | 3.85[b] |
| Mean | 3.39[c] | 3.87[b] | 4.62[a] | |
| | F-Test | SEM+/- | | CD 5% |
| Media (M) | ** | 0.06 | | 0.12 |
| Duration(D) | ** | 0.06 | | 0.12 |
| M X D | NS | 0.10 | | 0.22 |

**Table 6. Effect of different media and duration of microwave drying on texture of dry carnation cv. Master**

| Media | Duration (Seconds) | | | Mean |
|---|---|---|---|---|
| | 120 (T1) | 150(T2) | 180(T3) | |
| Quartz sand (M1) | 3.53 | 2.40 | 1.60 | 2.51[a] |
| Silica gel (M2) | 1.66 | 0.80 | 0.53 | 1.00[c] |
| Borax (M3) | 2.86 | 1.40 | 0.80 | 1.68[b] |
| Mean | 2.86[a] | 1.40[b] | 0.97[c] | |
| | F-Test | SEM+/- | | CD 5% |
| Media (M) | ** | 0.12 | | 0.26 |
| Duration(D) | ** | 0.12 | | 0.26 |
| M X D | NS | 0.22 | | 0.46 |

** Significance at ($P \leq 0.05$) NS: Not significant

Figures bearing same letters did not differ significantly

**Table 7. Effect of different media and duration of microwave drying on shape of dry carnation cv. Master.**

| Media | Duration (Seconds) | | | Mean |
|---|---|---|---|---|
| | 120 (T1) | 150(T2) | 180(T3) | |
| Quartz sand (M1) | 1.60 | 2.53 | 2.66 | 2.26[b] |
| Silica gel (M2) | 2.66 | 3.53 | 3.46 | 3.22[a] |
| Borax (M3) | 2.00 | 2.46 | 3.53 | 2.66[b] |
| Mean | 2.08[c] | 2.84[b] | 3.22[a] | |
| | **F-Test** | **SEM+/-** | | **CD 5%** |
| Media (M) | ** | 0.13 | | 0.29 |
| Duration(D) | ** | 0.13 | | 0.29 |
| M X D | ** | 0.23 | | 0.50 |

**Table 8. Effect of different media and duration of microwave oven drying on overall acceptability of carnation dry flower cv. Master.**

| Media | Duration (Seconds) | | | Mean |
|---|---|---|---|---|
| | 120 (T1) | 150(T2) | 180(T3) | |
| Quartz sand (M1) | 4.13 | 4.66 | 4.20 | 4.33[b] |
| Silica gel (M2) | 4.80 | 5.13 | 4.46 | 4.80[a] |
| Borax (M3) | 4.66 | 5.00 | 4.60 | 4.75[a] |
| Mean | 4.53[b] | 4.93[a] | 4.42[b] | |
| | **F-Test** | **SEM+/-** | | **CD 5%** |
| Media (M) | ** | 0.13 | | 0.27 |
| Duration(D) | ** | 0.13 | | 0.27 |
| M X D | ** | 0.22 | | 0.48 |

** Significance at (P<_0.05) NS: Not significant

Figures bearing same letters did not differ significantly.

**REFERENCES:**

Bhutani., J. C 1990. Capturing nature, a way with flower ever lasting. Indian Horticulture 34 (3): 15-19.

Datta. 1999. Advances in ornamental horticulture. Vol 3. Pointer Publishers, Jatpur.

Joyce. 1998. Dehydration of flowers and foliage extension Bulletin, ENS, NBRI, Lucknow, 1-20.

Kumaresan. 2000. Drying and bleaching techniques for Rose. M.sc. Thesis submitted to Acharya N.G. Ranga Agricultural university, Hyderabad.

Oren shamir deborah, A. S 2001. A method of drying Iris flowers with out destroying their natural colour, Botanical Journal of Russia, **50**:1448-1449.

# RESPONSE OF MAIZE (*Zeamays* L.) TO IRRIGATION SCHEDULING AND NITROGEN DOSES UNDER NO TILL CONDITION IN RICE FALLOWS

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## ABSTRACT

Field experiments were conducted during winter season of 2007-08 and 2008-09 in sandy clay loam soils of rice fallows at Regional Agricultural Research Station, Warangal to find out the best irrigation schedule and optimum nitrogen dose to maize crop grown under zero tillage. The experiment was laid out in split-plot design with three irrigation schedules and three nitrogen doses which was replicated thrice. It was found that irrigating maize crop at an IW/CPE ratio of 1.0 was significantly superior to 0.6 but at par with 0.8 regarding plant dry weight (g) at harvest, number of kernels/cob, kernel weight (g)/cob, kernel yield (kg ha$^{-1}$) and stover yield (kg ha$^{-1}$). Higher net returns (Rs. ha$^{-1}$) and nitrogen uptake (kg ha$^{-1}$) were observed with the IW/CPE ratio of 1.0. Further, application of 180 kg N ha$^{-1}$ was found to be optimum for getting higher yields of maize under zero tillage in rice fallows.

Cultivation of maize gained momentum during *rabi* season especially under zero tillage in rice fallows in Andhra Pradesh. Maize yields are influenced by a number of environmental factors such as growing season, weather conditions, water availability and soil conditions. To improve and sustain the productivity of maize in rice fallows, proper irrigation schedule along with the application of optimum dose of nitrogen is imperative. Hence, the present investigation was taken up to study the influence of irrigation schedules and nitrogen doses on growth and yield of maize in rice fallows under no till condition.

## MATERIALS AND METHODS

Field experiments were conducted during winter season of 2007-08 and 2008-09 in rice fallows under no till conditions at the Regional Agricultural Research Station, Warangal, Andhra Pradesh. The soil was sandy clay loam with a p$^H$ of 7.9 and EC of 0.25 d Sm$^{-1}$, medium in available organic carbon (0.44%) and low in available nitrogen (215 kg/ha), medium in available P$_2$O$_5$ (24.6 kg /ha) and low in available K$_2$O (273 kg/ha).The experiment was laid out in split-plot design comprising of nine treatment combinations with Irrigation schedules (3); I$_1$:0.6 IW/CPE ratio, I$_2$: 0.8 IW/CPE ratio and I$_3$:1.0 IW/CPE ratio as main plots and Nitrogen doses (3): N$_1$:120 kg, N$_2$:180 kg and N$_3$:240 kg/ha as sub plots and replicated thrice. The rainy season rice was sown

with puddling during first week of July and harvested during 3$^{rd}$ week of November. A light irrigation was given four days before harvesting of rice. To facilitate good germination and maize was dibbled manually at a depth of 5 cm @ one seed/hill in the rice fallows on 27$^{th}$ and 20$^{th}$ November during 2007 and 2008, respectively. Atrazine + glyphosate @ 2.5 kg/ha and 2.5 l/ha respectively were sprayed immediately after sowing to arrest the regrowth of rice stubbles, kill the emerged weeds and control the unemerged weeds. Maize hybrid, Dekalb Super 900M was used for the study at a spacing of 60 x 20 cm. The plot size was 6.6 x 4.5 m. Phosphorus and Potassium @ 60:60 kg/ha were applied at 15 DAS as pocketing. Maize was harvested on 22$^{nd}$ and 19$^{th}$ March during 2007-08 and 2008-09, respectively. A rainfall of 14.9 mm was received during 2007-08 in two rainy days and no rainfall was received during 2008-09 throughout the crop growth period. A range of mean minimum temperature of 15.3$^o$-23.0$^o$C and 19.2$^o$-22.4 $^o$C and mean maximum temperature of 31.0$^o$ - 35.3 $^o$C and 29.3$^o$-36.0$^o$C were recorded during 2007-08 and 2008-09, respectively. Two common irrigations of 60 mm each were given, one at post sowing for emergence and second at 10$^{th}$ day after sowing for crop establishment. Irrigation water was measured with water meter fixed to irrigation source taking into consideration each irrigation treatment area and depth of water (60 mm). Scheduling of irrigation was started whenever the cumulative pan evaporation (CPE)

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reached the value of 100 mm in 0.6, 75 mm in 0.8 and 60 mm in 1.0 IW/CPE ratios. Rainfall data was taken into account while making calculations for scheduling irrigation based on IW/CPE ratio. The quantity of water applied in $I_1$, $I_2$ and $I_3$ treatments was 220 and 250 mm, 294 and 334 mm, 367 and 417 mm during 2007-08 and 2008-09, respectively excluding the rainfall. All the other recommended practices were followed. Net returns (Rs ha^{-1}) were calculated by deducting the cost of cultivation (Rs ha^{-1}) from the gross returns (Rs ha^{-1}). Water use efficiency (WUE) was calculated by considering economic yield and quantity of water used in each treatment. Nitrogen uptake (kg ha^{-1}) was calculated by considering nitrogen content (%) in kernel /stover at harvest.

## RESULTS AND DISCUSSION

The plant dry weight (g) recorded at harvest was significantly higher when the zero till maize crop was irrigated at 1.0 IW/CPE ratio (215) compared to 0.6 IW/CPE (190) ratio but it was at par with 0.8 IW/CPE ratio (196) during 2007-08 (Table 1). The latter two treatments were also at par with each other. Similar trend was observed during 2008-09 as well. Further, application of 240 kg ha^{-1} registered significantly more dry weight (g)/plant at harvest (214) over 120 kg ha^{-1} (185) but was at par with 180 kg ha^{-1} (202) during 2007-08. However, during 2008-09, the differences among the different nitrogen doses with respect to plant dry weight at harvest were not statistically significant. There was no interaction effect found between the irrigation schedules and nitrogen doses.

Different irrigation schedules differed significantly during both the years with respect to number of kernels/cob. Significantly more number of kernels were recorded when irrigations were scheduled at an IW/CPE ratio of 1.0 (480 and 483) which was superior to 0.6 ratio (445 and 448) and 0.8 ratio (457 and 461) during 2007-08 and 2008-09, respectively (Table 1). The latter two treatments were at par with each other during both the years. Similar observations were reported by Elzubeir and Mohamed (2011). Among the nitrogen doses, application of 240 kg N ha^{-1} was found to increase the number of kernels/cob (481 and 483) compared to 180 (458 and 462) and 120 kg N ha^{-1} (443 and 447) during both

years of experimentation. The other two nitrogen doses of 180 and 120 kg N ha^{-1} were at par with each other. The interaction effect between the irrigation schedules and nitrogen doses was found to be non significant.

The kernel weight (g)/plant recorded with irrigating at 1.0 IW/CPE ratio (142 and 144) was statistically superior to the same recorded with 0.6 IW/CPE ratio (115 and 118) during 2007-08 and 2008-09, respectively (Table 1). It was at par with 0.8 IW/CPE ratio (126) during 2007-08 but superior (126) over the same during 2008-09. Similarly, irrigating at 0.8 IW/CPE ratio was at par with 0.6 IW/CPE ratio during 2007-08 and superior during 2008-09. There was no significant difference observed among the nitrogen doses with respect to kernel weight (g)/plant during 2007-08, but application of 240 kg N ha^{-1} was superior with 136 g/plant than 120 kg N ha^{-1} (123) and was at par with 180 kg N ha^{-1} (130). The nitrogen doses; 120 and 180 kg N ha^{-1} were also at par with each other. The interaction between the irrigation schedules and nitrogen levels with respect to kernel weight (g)/plant during both the years was not significant.

There was no significant influence on the test weight (100-kernel weight) of maize by either irrigation schedules or nitrogen doses or their interaction except the nitrogen doses during 2008-09 (Table 1). Application of 240 or 180 kg N ha^{-1} was found to be superior to 120 kg N ha^{-1} with respect to test weight of maize under no till condition.

The differences due to irrigation schedules and nitrogen doses in yield attributes like number of kernels and kernel weight/cob were also reflected in kernel and stover yields during both the years (Table 2). Significantly higher kernel yield (kg ha^{-1}) was recorded with IW/CPE ratio of 1.0 (6485 and 6629, respectively) compared to 0.6 ratio (4522 and 5640) but was at par with 0.8 ratio (5374 and 6141). The latter two treatments were also at par with each other with respect to the kernel yield of maize grown under zero tillage in rice fallows. Ramulu *et al.* (2010) also observed higher kernel yield of maize (7.46 t ha^{-1}) when it was irrigated at 1.0 Epan. The superiority of 1.0 IW/CPE ratio could be attributed to the fact that frequent irrigation provides the crop with adequate moisture in the surface layer in which most of the maize roots exist, thus resulting in better crop

nourishment and consequently higher yield which was also reported by Elzubeir and Mohamed (2011). Similarly, the kernel yield was increased at 240 kg N ha$^{-1}$ and significantly superior to 120 kg N ha$^{-1}$ but at par with 180 kg N ha$^{-1}$ during both the years of study. Application of 180 kg N ha$^{-1}$ was also found to be superior to 120 kg N ha$^{-1}$ during 2008-09. Similar evidence was reported by Shivay *et al*. (2002), Bhatt *et al*. (2010) and Reddy *et al*. (2010).

The stover yield was also significantly increased with increased frequency in irrigations from 0.6 to 1.0 IW/CPE ratios (Table 2) and with each incremental dose of nitrogen application from 120 to 240 kg ha$^{-1}$. The interaction effect of irrigations schedules and nitrogen doses was not significant both in kernel and stover yield of maize.

Water Use Efficiency (WUE) (kg/ha mm) was found to be highest with an IW/CPE ratio of 0.8 (26.14) during 2007-08 and with 0.6 (22.55) during 2008-09 (Table 2). Irrigating at 1.0 IW/CPE ratio recorded low WUE during both the years (17.32 and 15.88, respectively). These results confirm the findings of FAO (1995) which reported that an irrigation regime that provides soil moisture for maximum crop growth and yield per unit area would be unlikely to produce maximum output per unit of water i.e., field water use efficiency. Although, irrigation water amounts of 1.0 IW/CPE ratio produced the highest kernel yield during both the years, it could not translate this yield into higher field water use efficiency as the relative difference in the kernel yield was compensated for by the relative difference in the seasonal amount of irrigation water applied to this IW/CPE ratio. Ko and Piccinni (2009) also reported the similar results in maize grown under reduced tillage.

The net returns (Rs./ha) obtained with irrigating at an IW/CPE ratio of 1.0 were higher during both the years (31,788/- and 35,605/-, respectively) over the other two irrigation schedules (Table 2). Similarly, more net returns were realized when 240 kg N ha$^{-1}$ was applied (26,870/- and 35,562/- respectively) than the lower doses i.e., 120 and 180 kg N ha$^{-1}$. Tank *et al*. (2006) also observed higher yield and net returns at 180 kg N ha$^{-1}$ in *rabi* maize compared to 120 kg N ha$^{-1}$.

The total nitrogen uptake (kg ha$^{-1}$) by the maize crop was also significantly influenced by the irrigation regimes and nitrogen doses grown in rice fallows under no til condition. Significantly, more nitrogen uptake (kg ha$^{-1}$) was observed when irrigated at 1.0 IW/CPE ratio during both the years (72.7 and 75.2, respectively) compared to 0.8 and 0.6 IW/CPE irrigation schedules (Table 3). These findings are in agreement with Shinde *et al*. (2009). Between the latter two schedules, 0.8 ratio were superior to 0.6 during 2008-09. Similar trend was observed with respect to the nitrogen uptake by the kernel and stover of maize crop individually. Among the nitrogen doses, application of 240 kg N ha$^{-1}$ resulted in significantly higher nitrogen uptake (kernel or stover or total) by the crop during both the years (Table 3) which was significantly, superior to the two lower doses i.e., 120 and 180 kg N ha$^{-1}$. In turn, higher nitrogen uptake was observed with 180 kg N ha$^{-1}$ over 120 kg N ha$^{-1}$ by the kernel, stover and total dry matter during both the years of study. The interaction effect between the irrigation schedules and nitrogen doses was found to be non-significant.

The available nitrogen status of the soil (kg ha$^{-1}$) was slightly improved after harvest of the maize crop which was irrigated at 1.0 IW/CPE ratio (219) compared to the initial status (215) after first year and second year (223) followed by 0.8 and 0.6 IW/CPE ratios. An increase of 15 kg ha$^{-1}$ was observed in soil available nitrogen after the harvest of second year maize crop when it was supplied with 240 kg N ha$^{-1}$ compared to the initial status (Table 3). It was also increased marginally by the other two lower nitrogen doses studied.

Thus, from the findings of the present investigation it can be concluded that in sandy clay loam soils of Central Telangana region of Andhra Pradesh, maize crop grown in rice fallows under zero tillage should be irrigated at 0.8 IW/CPE ratio for getting higher yields and net returns. Further, application of 180 kg N ha$^{-1}$ was found to be optimum to realize higher yields.

**Table 1. Influence of irrigation schedules and nitrogen doses on yield attributes of maize under no till condition in rice fallows**

| Treatments | Plant dry weight at harvest (g) | | Kernel weight (g) / plant | | No. of kernels / cob | | 100-Kernel weight (g) | |
|---|---|---|---|---|---|---|---|---|
| | 2007-08 | 2008-09 | 2007-08 | 2008-09 | 2007-08 | 2008-09 | 2007-08 | 2008-09 |
| **Irrigation schedules (I)** | | | | | | | | |
| 0.6 IW/CPE | 190 | 194 | 115 | 118 | 445 | 448 | 25.30 | 25.12 |
| 0.8 IW/CPE | 196 | 200 | 126 | 126 | 457 | 461 | 25.87 | 25.48 |
| 1.0 IW/CPE | 215 | 219 | 142 | 144 | 480 | 483 | 26.70 | 25.53 |
| SEm± | 5.2 | 5.3 | 6.5 | 2.0 | 5.3 | 4.8 | 1.35 | 0.12 |
| CD at 5 % | 20.5 | 20.7 | 25.6 | 7.8 | 20.6 | 19.0 | NS | NS |
| **Nitrogen doses (N)** | | | | | | | | |
| 120 kg N/ha | 185 | 189 | 121 | 123 | 443 | 447 | 25.17 | 25.05 |
| 180 kg N/ha | 202 | 206 | 128 | 130 | 458 | 462 | 25.80 | 25.52 |
| 240 kg N/ha | 214 | 218 | 134 | 136 | 481 | 483 | 26.90 | 25.55 |
| SEm± | 9.4 | 9.3 | 7.4 | 2.9 | 6.6 | 6.1 | 0.63 | 0.08 |
| CD at 5 % | 28.9 | NS | NS | 9.1 | 20.5 | 18.9 | NS | 0.25 |
| **Interaction** | | | | | | | | |
| SEm± | 16.3 | 16.1 | 12.9 | 5.1 | 11.5 | 10.6 | 1.08 | 0.14 |
| CD at 5 % | NS | NS | NS | NS | NS | NS | NS | NS |

**Table 2. Influence of irrigation schedules and nitrogen doses on yield, WUE and net returns of maize under no till condition in rice fallows**

| Treatments | Kernel yield (kg/ha) | | Stover yield (kg/ha) | | Water Use Efficiency (kg/ha mm) | | Net returns (Rs./ha) | |
|---|---|---|---|---|---|---|---|---|
| | 2007-08 | 2008-09 | 2007-08 | 2008-09 | 2007-08 | 2008-09 | 2007-08 | 2008-09 |
| **Irrigation schedules (I)** | | | | | | | | |
| 0.6 IW/CPE | 4522 | 5640 | 6073 | 7214 | 25.77 | 22.55 | 18,263 | 28,698 |
| 0.8 IW/CPE | 5374 | 6141 | 6962 | 7744 | 26.14 | 18.37 | 24,055 | 32,204 |
| 1.0 IW/CPE | 6485 | 6629 | 8113 | 8282 | 17.32 | 15.88 | 31,788 | 35,605 |
| SEm± | 386 | 163 | 27.4 | 19.6 | - | - | - | - |
| CD at 5 % | 1515 | 639 | 107.6 | 76.9 | - | - | - | - |
| **Nitrogen doses (N)** | | | | | | | | |
| 120 kg N/ha | 5069 | 5560 | 6624 | 7137 | 20.27 | 17.14 | 22,515 | 28,192 |
| 180 kg N/ha | 5463 | 6208 | 7051 | 7814 | 23.84 | 19.16 | 24,720 | 32,753 |
| 240 kg N/ha | 5849 | 6642 | 7474 | 8289 | 25.13 | 20.51 | 26,870 | 35,562 |
| SEm± | 184 | 164 | 54.9 | 49.7 | - | - | - | - |
| CD at 5 % | 720 | 505 | 169.0 | 153.1 | - | - | - | - |
| **Interaction** | | | | | | | | |
| SEm± | 318 | 284 | 95.0 | 86.1 | - | - | - | - |
| CD at 5 % | NS | NS | NS | NS | - | - | - | - |

**Price (Rs/kg):** Maize: 7.5 (2007-08) and 8.2 (2008-09).
**Cost of cultivation (Rs/ha):** $I_1$:15,650, $I_2$:16, 250, $I_3$: 16,850 (2007-08) and $I_1$:17,550, $I_2$:18, 150, $I_3$: 18,750 (2008-09)
$N_1$:15, 500, $N_2$:16, 250, $N_3$:17,000 (2007-08) and $N_1$:17, 400, $N_2$:18, 150, $N_3$:18,900(2008-09)

**Table 3. Influence of irrigation schedules and nitrogen doses on 'N' uptake (kg/ha) of maize and soil available 'N' (kg/ha) under no till condition in rice fallows**

| Treatments | 'N' uptake (kg/ha) | | | | | | Soil available 'N' (kg/ha) after maize crop | |
|---|---|---|---|---|---|---|---|---|
| | 2007-08 | | | 2008-09 | | | 2007-08 | 2008-09 |
| | Kernel | Stover | Total | Kernel | Stover | Total | | |
| **Irrigation schedules (I)** | | | | | | | | |
| 0.6 IW/CPE | 29.7 | 17.5 | 47.2 | 37.8 | 21.5 | 59.3 | 216 | 220 |
| 0.8 IW/CPE | 36.8 | 21.6 | 58.4 | 42.7 | 24.8 | 67.5 | 218 | 221 |
| 1.0 IW/CPE | 46.4 | 26.3 | 72.7 | 47.8 | 27.4 | 75.2 | 219 | 223 |
| SEm± | 2.8 | 0.5 | 3.0 | 0.9 | 0.4 | 1.0 | - | - |
| CD at 5 % | 10.8 | 1.8 | 11.8 | 3.5 | 1.5 | 3.7 | - | - |
| **Nitrogen doses (N)** | | | | | | | | |
| 120 kg N/ha | 34.0 | 19.6 | 53.6 | 37.7 | 21.7 | 59.4 | 217 | 222 |
| 180 kg N/ha | 37.9 | 22.0 | 59.9 | 43.3 | 24.9 | 68.2 | 220 | 226 |
| 240 kg N/ha | 41.1 | 23.8 | 64.9 | 47.2 | 27.1 | 74.3 | 222 | 230 |
| SEm± | 1.3 | 0.5 | 1.2 | 1.3 | 0.4 | 1.1 | - | - |
| CD at 5 % | 4.0 | 1.6 | 3.7 | 4.0 | 1.3 | 3.5 | - | - |
| **Interaction** | | | | | | | | |
| SEm± | 2.3 | 0.9 | 2.1 | 2.2 | 0.7 | 1.9 | - | - |
| CD at 5 % | NS | NS | NS | NS | NS | NS | - | - |

Initial soil status (kg/ha): N: 215, $P_2O_5$: 24.6 and $K_2O$: 273

**REFERENCES**

Bhatt, S.P., Yakadri, M and Sivalakshmi, Y. 2010. Response of sweet corn hybrid to varying plant densities and nitrogen levels. Paper presented at the symposium on Resource conservation technologies in Agriculture in the context of climate change. Bapatla, Andhra Pradesh, 28-30 July 2010. pp: 29.

Elzubeir, A.O and Mohamed, A.M.E. 2011. Irrigation scheduling for maize (*Zea mays* L.) under desert area conditions –North of Sudan. Agriculture and Biology Journal of North America **2** (4):645-651.

FAO. 1995. Production Yearbook. Food and Agriculture Organization Vol. 49. United Nations, Rome, Italy.

Ko, J and Piccinni, G. 2009. Corn yield responses under crop evapotranspiration-based irrigation management. Agricultural Water Management **96:** 799-808.

Ramulu, V., Reddy, M.D and Rao, A.M. 2010. Response of *rabi* maize to irrigation schedules and fertigation levels. Agricultural Science Digest **30** (2):104-106.

Reddy, M.M., Padmaja, B and Raja Ram Reddy, D. 2010. Response of maize (*Zea mays L.*) to plant population and fertilizer levels in *rabi* under no til condition. The Andhra Agricultural Journal **57**(3):287-289.

Shinde, S.A., Shelke, D.K and Sawargaonkar, G.L. 2009. Effect of irrigation schedules and integrated nutrient management on yield and nutrient uptake by *rabi* maize (*Zea mays* L.). International Journal of Plant Sciences, Muzaffarnagar **4**(1):24-26.

Shivay, Y.S., Singh, R.P and Shiv Kumar, B.G. 2002. Effect of nitrogen on yield attributes, yield and quality of maize (*Zea mays*) in different cropping systems. Indian Journal of Agricultural Sciences **72**: 161-163.

Tank, D.A., Patel, S.K and Usadadia, V.P. 2006. Nitrogen Management in *rabi* maize (*Zea mays* L.). Crop Research, Hisar **31** (2) : 323-324.

# EVALUATION OF WATER SAVING RICE (*Oryza Sativa)* PRODUCTION SYSTEMS IN NSP LEFT CANAL OF NALGONDA DISTRICT

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## ABSTRACT

Different water saving techniques were studied in the farmers field pertaining to rice at Nidamanoor and Tripuraram mandals of Nalgonda district of Andhra Pradesh during Kharif 2008 and 2009. System of Rice Intensification(SRI) recorded highest grain yield during 2008 and 2009 (6461 and 7017 kg ha$^{-1}$) followed by rotational system of irrigation (6242 and 6429 kg ha$^{-1}$) when compared with farmers practice of growing rice with continuous flooding (5740 and 6167 kg ha$^{-1}$). SRI also resulted in 12.5 per cent and 13.7 per cent yield advantage with 36.9 per cent and 39.4 per cent irrigation water saving over farmers practice of flood irrigation during 2008 and 2009 respectively. Where as rotational system of irrigation registered 8.7 per cent and 4.2 per centyield advantage with 23.6 per cent and 20.0 per cent irrigation water saving than farmers practice of flood irrigation during the above years. High B:C ratio was registered with rotational system of irrigation (2.4 and 2.5) over SRI (2.2 and 2.4) and farmers practice of flood irrigation (2.2 and 2.4) in both the years under study.

Water saving irrigation technologies such as rotational system of irrigation, semi-dry rice and System of Rice Intensification (SRI) are receiving greater attention by the individuals and Governments in some parts of Asia who confront scarcity of water or high cost of water. The present study was conducted to identify the best economically viable water saving rice production system with higher grain yield and water use efficiency suitable to Nagarjuna Sagar Project left canal command of Nalgonda district of Andhra Pradesh.

## MATERIALS AND METHODS

Six demonstrations were conducted in the farmers field at Babusaipeta, Duggepally and Annaram villages of Tripuraram mandal and B.K.Padu, Kannekal and Mukundapuram villages of Nidamanoor mandal of Nalgonda district, Andhra Pradesh during *kharif* 2008 and 2009 with 3 water saving techniques in rice. The soils were sandy clay loam in texture with P$^H$ of 7-7.6, low to medium in nitrogen, medium to high in available P$_2$0$_5$ and high in available K$_2$0. The treatments included T$_1$- System of Rice Intensification, T$_2$- Rotational system of Irrigation and T$_3$- farmers practice of flood irrigation. BPT 5204 was the test variety in all the demonstrations and transplanting was done between 15$^{th}$ August to 31$^{st}$ August . The plot size for each

treatment was 4000 m$^2$. Total 12000 m$^2$ area was selected for each demonstration site.

In SRI, seed was sown on raised beds of puddled field (seed rate of 5 kg ha$^{-1}$). Pre-germinated seeds were broadcasted uniformly on nursery beds. After broadcasting the seed, 1:1 soil-FYM mixture was spread in a thin layer of one centimeter to cover the seeds. The beds were irrigated with a rose can daily in the morning and evening. Seedlings of 12 days old were lifted and transplanted in the main field in square pattern with spacing of 25 x 25 cm with single seedling per hill. In rotational system of irrigation and farmers practice of flooding, seed was sown @ 50 kg ha$^{-1}$. The seedlings were transplanted at 30 days age at a spacing of 20X15 cm. The main field was prepared by ploughing twice followed by thorough puddling. The farm yard manure @ 15 t ha$^{-1}$ was applied during first puddling in the main field. The fertilizers of N, P$_2$O$_5$ and K$_2$O at 180:60:40 NPK kg ha$^{-1}$ were applied. The entire phosphorous and half of the recommended potassium was applied as basal dose during transplanting and another half of recommended potassium was applied during panicle initiation stage. Nitrogen was applied in 3 equal splits at transplanting, active tillering and panicle initiation stage.

In SRI, field was irrigated just enough to saturate the soil with moisture. Subsequent

irrigations were given when fine cracks were seen in the field during vegetative phase. From flowering to 10-12 days before harvesting, a thin film of water was maintained continuously by frequent irrigations. During conoweeding, standing water was maintained to facilitate easy movement of conoweeder. In Rotational system of irrigation, irrigation was provided once in 2-3 days after disappearance of 5cm depth of water. Whereas in farmers practice of flood irrigation, 2 cm standing water was maintained up to vegetative stage, and 5cm standing water was maintained later till 10 days before physiological crop maturity. Irrigation water was measured by parshall flumes.

Pre emergence herbicide oxadiargyl @ 90 g ha^{-1} was applied with sand mixture immediately 3 days after transplanting in rotational system of irrigation and farmers practice of flood irrigation. Where as in SRI, cono weeding was done thrice at an interval of 15 days. In addition to this, one manual weeding was done at 30 days after transplanting in all the treatments. Plant protection was done as per the requirement.

Data on crop yield, rain fall and depth of water given through parshall flume during crop growth period were recorded. Water use efficiency and benefit cost ratio for all the treatments were calculated.

## RESULTS AND DISCUSSION

SRI registered higher grain yield during kharif 2008 and 2009 respectively compared to rotational system of irrigation and farmers practice of flood irrigation (Table 1). Grain yields under rotational system of irrigation were also higher than those from farmers practice of flood irrigation. The percentage of increase in grain yield in SRI and rotational system of irrigation were 12.5 per cent and 8.7 per cent during *kharif* 2008 and 13.7 per cent and 4.2 per cent during *kharif* 2009 over farmers practice of flood irrigation. The higher grain yield with SRI cultivation can be attributed to rotary weeding, keeping moisture condition of the field at saturation level, better aeration and optimum utilization of nutrients which helped the plant to put forth better root system and plant growth there by more number of productive tillers, more panicle length and filled grains over other systems.

Abu yamah (2002), Bruno Andrianaivo (2002) and Subbarao *et al* (2009) have also reported similar positive results with SRI cultivation over traditional farmers practice.

SRI utilized less quantity of 973 mm and 1017 mm water (through irrigation and rainfall) during 2008 and 2009 respectively over rotational system of irrigation (1017 and 1105 mm) and farmers practice of flood irrigation (1333 and 1383 mm). The percent of water saving in SRI and rotational system of irrigation were 36.9 and 23.6 during 2008 and 39.4 and 20 during 2009 over farmers practice of flood irrigation. Water saving of 40 per cent with moisture level at field saturation point was reported by Bhagat *et al* (1999) when compared to continuous shallow ponding with similar yields. Whereas Subbarao *et al* (2009) reported 47 per cent and 30 per cent water saving in SRI and rotational irrigation than farmers practice.

Higher water use efficiency was recorded with SRI cultivation (6.6 and 7.7 kg/ha mm) followed by rotational system of irrigation (6.1 and 5.8 kg/ha mm) compared to farmers practice of flood irrigation (4.3 and 4.4 kg/ ha mm). Similar results of higher water use efficiency and water saving were reported by Raju *et al* (1992) with saturation level of moisture and alternate wetting and drying. Subbarao *et al* (2009) also reported similar results .

Among three water saving techniques, rotational system of irrigation registered higher net returns (Rs.38693) than SRI (Rs. 38000) and farmers practice of flood irrigation (Rs.34450) during kharif 2008. Whereas in kharif 2009, the net returns were higher in SRI (Rs. 44333) than rotational system of irrigation (Rs. 41308) and farmers practice of flood irrigation (Rs. 39333). Higher B:C ratio was recorded with rotation system of irrigation (2.4 and 2.5) than SRI and farmers practice during kharif. It was due to higher cost of cultivation in SRI when compared to rotational system of irrigation.

The results, favour the adoption of System of Rice Intensification or rotational system of irrigation over farmers practice of flood irrigation in Nagarjuna Sagar left canal command of Nalgonda district of Andhra Pradesh.

**Table1. Grain yield, water use and water use efficiencies as influenced by different water saving techniques in rice**

| Water saving techniques | Grain yield (kg/ha) | | Water use (mm) | | Water use efficiency (kg/ha mm) | |
|---|---|---|---|---|---|---|
| | 2008 | 2009 | 2008 | 2009 | 2008 | 2009 |
| System of Rice Intensification | 6460 | 7016 | 973 | 991 | 6.6 | 7.0 |
| Rotational system of Irrigation | 6241 | 6429 | 1017 | 1105 | 6.1 | 5.8 |
| Farmers practice of flood irrigation | 5740 | 6166 | 1333 | 1383 | 4.3 | 4.4 |

**Table 2. Economics as influenced by different water saving techniques in rice**

| Water saving techniques | Cost of cultivation (Rs.) | | Gross returns (Rs.) | | Net returns (Rs.) | | B:C ratio | |
|---|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | 2008 | 2009 | 2008 | 2009 | 2008 | 2009 |
| System of Rice Intensification | 30358 | 29833 | 68358 | 74167 | 38000 | 44333 | 2.2 | 2.4 |
| Rotational system of Irrigation | 27473 | 27058 | 66167 | 68367 | 38693 | 41308 | 2.4 | 2.5 |
| Farmers practice of flood irrigation | 26717 | 26333 | 61167 | 65667 | 34450 | 39333 | 2.2 | 2.4 |

**REFERENCES**

Abu Yamah. 2002. The practice of the system of Rice Intensification in SIERRA Leone. World vision Sierra Leone, PMB 59, Fretown, Sierra Leone.

Bhagat, R.M., Bhuijan, S.I and Moody, K. 1999. Water tillage and weed management options for wet-seeded rice in the Phillippines. Soil and Tillage Research 52:51-58.

Bruno Andrianaivo. 2002. Evaluations of the System of Rice Intensification in Fianarantsoa Province of Madagascar FOFIFA, Fianarantsoa.

Raju, R.A., Reddy, M.N and Ananda Reddy, K. 1992. Phasic water management for rice (*Oryza Sativa*) in Godavari alluvials, India Journal of Agronomy. 37(1).

Subbarao, G., Kalpana, D., Srinivas, D., Mukunda Rao, B., Prasad, P.R.K and Satyanarayana, T.V. 2009. Grain yield and water use efficiencies of rice as influenced by transitions in rice cultivation in Krishna western delta command area of Andhra Pradesh. The Andhra Agricultural Journal 56(1):1- 3.

# NUTRIENT STATUS AND EXTENT OF THEIR DEFICIENCIES IN MAIZE CROP- A SURVEY IN THREE DISTRICTS OF ANDHRA PRADESH

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## ABSTRACT

A survey was carried out to assess the nutrient status of maize crop in major maize growing tract in three districts viz. Karimnagar, Nizamabad and Warangal of Andhra Pradesh and also to find out their deficiencies. Ear leaves opposite to cob at tasseling or silking stage were collected in 150 locations covering 50 locations in each district. Leaf samples were analysed for N, P, K, Zn, Cu, Fe and Mn following the standard procedures. The nutrient status in these samples was assessed following the critical levels suggested by different workers. N, P and K content of the leaf samples as a whole of three districts ranged from 2.01 to 2.97, 0.17 to 0.50 and 2.40 to 3.12 per cent with an overall mean of 2.47, 0.31 and 2.65 per cent, respectively. Leaf Zinc, Copper, Iron and Manganese contents in maize growing areas of three districts under study ranged from 10 to 91, 4 to 98, 14 to 250 and 15 to 205 mg kg$^{-1}$ with means of 40, 28, 102 and 130 mg kg$^{-1}$ respectively. As a whole in the three districts under study, the per cent deficiencies of N, P, K, Zn, Cu, Fe and Mn recorded were 73, 12, 0, 18, 1, 1 and 1, respectively.

Maize is an important crop grown in Andhra Pradesh in an area of 7.83 lakh hectares with the production of 27.61 lakh tonnes (DES, 2010). Thirty one percent of the total maize area and twenty nine percent of the total production in this state is located in three districts viz. Karimnagar, Nizamabad and Warangal.

Foliar analysis is usually considered to be an important method for monitoring the nutrient status of the plants and to identify the nutrient deficiencies. Sufficiency range approach is the most common method for interpretation of leaf tissue nutrient status of field crops. The interpretation is done based on comparing the level of nutrient(s) in the index tissue with critical or optimum range of the concerned nutrient. In case of maize, the indicated tissue to be sampled has been identified as ear leaf (leaf opposite to cob at tasseling or silking stage) of the plant (Escano et al., 1981 and Walworth et al., 1988)

In the conventional approach, the diagnosis of nutrient deficiencies was done on the basis of actual tissue concentrations comparing with Critical Nutrient Concentrations (CNC) or Sufficiency Range (SR) of the nutrients.

In case of maize, critical level(s) of nutrients to identify nutritional imbalances and deficiencies have been reported by Melsted et al. (1969), Neubert et al. (1969) and Jones et al. (1990). These critical levels have been developed outside the state of Andhra Pradesh. There are always some variations among the critical levels suggested by different workers for the same crop. Hence a survey was carried out in 2009 to assess the nutrient status of maize crop based on critical levels suggested by different workers

## MATERIAL AND METHODS

Index leaves (ear leaves opposite to cob at silking or tasseling stage) were collected at random from the 150 selected fields covering 50 locations in each district in 10 mandals covering 3-5 locations in each mandal for the analysis of nutrients. 15-20 index leaves at random were collected in each field and composite sample was prepared. Leaf samples collected were immediately washed first with tap water followed by 0.1 N HCl and then followed by repeated washings with running tap water. The samples were then rinsed in distilled water and finally with double distilled water. They were first dried under shade and then in hot air oven at 70$^0$C. Oven dried plant samples were powdered in a stainless steel grinder to a fineness of 40 meshes and stored in butter paper covers. Powdered plant samples were analyzed for N, P, K, Zn, Cu, Fe and Mn following standard procedures.

0.1g of sample was weighed, digested with 1 ml of concentrated sulphuric acid and the organic

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matter was oxidised using 30% hydrogen peroxide drop by drop. The digested material was distilled by microkjeldahl method with 10 ml of 40% sodium hydroxide. The ammonia thus released was collected in 4% boric acid mixed with bromocresol green and methyl red mixed indicator. This was titrated against 0.02N sulphuric acid and nitrogen content of samples were calculated (AOAC, 1980)

The powdered leaf sample of 1g was digested with 10 ml of diacid mixture of nitric acid and perchloric acid with a ratio of 5:2. The digested material was diluted making to 25 ml with double distilled water and filtered. This extract was used for the estimation of Zn, Cu, Fe and Mn. The extract was further diluted for analysis of P and K and accordingly calculated   (Wall *et al.*, 1980).

Phosphorus was estimated in the diacid extract by vanadomolybdate phosphoric yellow colour method as described by Jackson (1973) and potassium was estimated with flame photometer method (Muhr *et al.,* 1965) and expressed in per cent.

The micronutrient contents in diacid extract were measured with Atomic Absorption Spectrophotometer of model Varian 240 FS (AOAC, 1980) and expressed in mg kg$^{-1}$.

## RESULTS AND DISCUSSION

### Nitrogen (N)

N content of the leaf samples ranged from 2.01 to 2.97 per cent with an overall mean of 2.47 per cent. The leaf N content was below the critical level of 2.60 per cent developed by Neubert *et al.* (1969), in 110 samples (73%) out of the total 150 leaf samples collected from the major maize growing tracts of three districts in Telangana region of Andhra Pradesh. The N content of maize leaf samples of Nizamabad district ranged from 2.02 to 2.91 per cent with a mean N content of 2.49 per cent. Seventy four percent of  leaf samples (37) recorded N content below the critical level out of total 50 samples collected in the district, with samples of Velupur mandal containing highest mean N content (2.64%) and samples of  Balkonda mandal containing lowest mean N content (2.33%). The leaf samples collected from 9 mandals out of 10 mandals (90%) in the district were deficient in nitrogen. The N content of maize tissue samples of Karimnagar district ranged from

2.05 to 2.97 with mean N content of 2.50 per cent. Thirty five (70%) leaf samples recorded nitrogen content  below the critical level out of total 50 samples collected from the district. samples from Gollapally mandal had highest mean N content (2.68%) and Jagitial mandal had lowest nitrogen (2.25%). The leaf samples in 7 mandals out of 10 mandals had mean leaf N content below the critical level with the deficiency of seventy per cent. Nitrogen content of leaf samples  in Warangal district ranged from 2.01 to 2.70 with a mean N of 2.43 per cent where 38 leaf samples (76%) had N below the critical level out of 50 samples collected from the district. Highest N content (2.52%) was recorded in leaf samples of Geesukonda and Sangem mandals and lowest mean N (2.25%) was in leaf samples of Hasanparthy mandal. When mandal wise mean N contents were observed, all the mandals (100%) had mean leaf N content below the critical level. The reported values in this are within the acceptable ranges as reported in maize by Escano *et al.* (1981), Syed *et al.* (1992),  Sumner *et al.* (1978 and 1981) and Elwali and Gascho, (1988) and lesser than as reported by Walworth *et al.* (1988), Melsted  *et al.* (1969) and Sumner *et al.* (1979).

### Phosphorus (P)

Phosphorus content of leaf samples as a whole collected from three districts ranged 0.17 to 0.50 per cent with an overall mean of 0.31 percent. Eighteen samples out of total 150 samples collected were deficient (12 PSD) in phosphorus based on the critical level of 0.25 per cent developed by Melsted *et al.*(1969), Neubert *et al.* (1969) and Jones *et al.* (1990). The mean P content in leaf samples was more in Karimnagar district (0.34%) followed by Warangal (0.31%) and Nizamabad (0.29%) districts. The ranges were from 0.17 to 0.50, 0.21 to 0.41 and 0.18 to 0.49 per cent, respectively in Karimnagar, Warangal and Nizamabad districts. In Nizamabad district 7 leaf samples were having P below critical level out of 50 samples collected with the extent of 14 percent deficiency in the district. Samples of Maakluru mandal had highest mean P value of 0.37 percent and samples of Yellareddy mandal recorded lower P content of 0.22 per cent. In Karimnagar district, 10 percent of leaf samples had phosphorus below the critical level out of 50 samples collected in the district, with the higher P value (0.43%) in the

samples of Sarangapur mandal and the lowest mean P value (0.20%) in the samples of Metpally mandal. Ragunathpally mandal had highest mean P content (0.37%) and Vardhannapet mandal had lowest P content (0.27%) in Warangal district. Twelve percent of samples had the P content below critical level. When mandal wise mean P content in leaf samples were considered, in all the mandals in three districts under study were in sufficiency range except one mandal each in Nizamabad and Karimnagar disticts. The reported values are within the acceptable ranges as reported by Escano *et al.* (1981), Sumner *et al.* (1978, 1979 and 1981) and the mean values are lesser than as reported by Elwali and Gascho (1988), Walworth *et al.*(1988) and Melsted *et al.*(1969).

## Potassium (K)

Potassium content of leaf samples in maize growing areas of Telangana region ranged between 2.40 to 3.12 per cent with an overall mean of 2.65 per cent. All the 150 maize leaf samples collected from three districts were having mean leaf K content above the critical level of 1.9 per cent as suggested by Melsted *et al.* (1969). The mean leaf K content recorded was more in Warangal district (2.73%) followed by Karimnagar (2.54%) and Nizamabad districts (2.54%). The leaf K content in samples of Nizamabad, Karimnagar and Warangal districts ranged from 2.41 to 3.12, 2.40 to 3.01 and 2.41 to 3.05 per cent, respectively. In Nizamabad district, Maakluru mandal had highest mean K value of 2.68 per cent and Yellareddy mandal had lowest value of 2.45 per cent In Karimnagar district, Medipally mandal had highest mean K value of 2.85 percent and Dharmapuri mandal had lowest value of 2.49 per cent. In Warangal district, the highest mean K content was recorded (2.85%) in Geesukonda mandal and lowest was recorded (2.52%) in Hasanparthy mandal. No sample was found deficient in K content. The values reported in this study were within the acceptable ranges as reported earlier in maize by Escano *et al.*, (1981) and Sumner *et al.,* (1978,1979 and 1981).

## Zinc (Zn)

Leaf Zinc content in maize growing areas of three districts under study ranged from 10 to 91mg kg$^{-1}$ with a mean of 40 mg kg$^{-1}$. Out of 150 leaf samples collected, the leaf samples in 27 locations were below the critical level 20 mg kg$^{-1}$ as suggested

by Jones *et al.* (1990) and were deficient to an extent of 18 percent. The leaf Zn content ranged from 18 to 91, 10 to 73 and 10 to 77 mg kg$^{-1}$ in Nizamabad, Karimnagar and Warangal districts respectively. The mean leaf Zn content recorded was lowest (19 mg kg$^{-1}$) in Jakranpally mandal and was highest (74 mg kg$^{-1}$) in Edapally mandal with a mean of 41 mg kg$^{-1}$ in Nizamabad district. The lowest mean 13 mg kg$^{-1}$ Zn content was noticed in Hasanparthy mandal and higher content 72 mg kg$^{-1}$was recorded in Sangem mandal with a mean of 38 mg kg$^{-1}$in Warangal district. Similarly, the mean leaf Zn content recorded was lowest in Korutla mandal (22 mg kg$^{-1}$) and was highest in Medipally mandal (56 mg kg$^{-1}$) with a mean value of 40 mg kg$^{-1}$. The mean Zn contents were below the critical level only in 2 mandals out of total 30 mandals in three districts under study. The reported values are within the acceptable ranges as reported earlier by Escano *et al.* (1981) and mean values were slightly higher than as reported by Elwali and Gascho (1988) and Melsted *et al.* (1969).

## Copper (Cu)

Leaf copper content in maize growing areas of three districts under study ranged from 4 to 98 mg kg$^{-1}$ with a mean of 28 mg kg$^{-1}$. Out of leaf samples collected from 150 locations, the leaf samples in two locations were below the critical level of 6 mg kg$^{-1}$ as suggested by Jones (1990) and were deficient to an extent of 1 per cent. The leaf Cu content ranged from 4 to 30, 11 to 98 and 5 to 51 mg kg$^{-1}$ with mean values of 18, 41 and 25 in Nizamabad, Karimnagar and Warangal districts, respectively. The mean leaf Cu content recorded was lowest in Jakranpally and Navipeta mandals (12 mg kg$^{-1}$) and was highest in Kammarpally mandal (23 mg kg$^{-1}$) with mean of 18 mg kg$^{-1}$ in Nizamabad district. Similarly, the mean leaf Cu content recorded was lowest in Raikal mandal (27 mg kg$^{-1}$) and was highest in metpally mandal (63 mg kg$^{-1}$) with a mean value of 41 mg kg$^{-1}$.The lowest mean Cu content (9 mg kg$^{-1}$) was noticed in Parvathagiri mandal and higher content was recorded in Ragunathpally mandal (38 mg kg$^{-1}$) recorded with a mean of 25 mg kg$^{-1}$ in Warangal district. No mandal recorded the mean Cu contents below the critical level out of total 30 mandals in three districts under study. The mean values are higher than as reported earlier by Elwali and Gascho (1988) and Melsted *et al.*(1969) and the reported values are within the

acceptable ranges as reported earlier by Escano *et al.* (1981).

## Iron (Fe)

Leaf iron content in maize growing areas of three districts under study ranged from 14 to 250 mg $kg^{-1}$ with a mean of 102 mg $kg^{-1}$. Out of leaf samples collected from 150 locations, the leaf samples in only one location was below the critical level 21 mg $kg^{-1}$ as suggested by Jones (1990). In Nizamabad district the leaf Fe content ranged from 14 to 250 mg $kg^{-1}$ with a mean of 98 mg $kg^{-1}$, recording highest mean Fe content of 168 mg $kg^{-1}$ in Armoor mandal and lowest (66 mg $kg^{-1}$) in Edapally mandal . The leaf Fe content in Karimnagar district ranged from 30 to 172 mg $kg^{-1}$ with a mean of 95 mg $kg^{-1}$, having lowest mean Fe content of 56 mg $kg^{-1}$ in Korutla mandal and highest in Dharmapuri mandal (149 mg $kg^{-1}$). In Warangal district Fe content ranged from 39 to 200 mg $kg^{-1}$, with a mean Fe content of 113 mg $kg^{-1}$, having highest mean Fe content of 172 mg $kg^{-1}$ in Raghunathpally mandal and lowest (50 mg $kg^{-1}$)in Duggondi mandal. The reported values are within the acceptable ranges as reported earlier by Escano *et al.* (1981) and mean values are higher than as reported by Elwali and Gascho (1988), and Melsted *et al.* (1969). No mandal was noticed deficient in mean Fe content below the critical level out of total 30 mandals in three districts under study.

## Manganese (Mn)

Leaf Mn content in maize growing areas of three districts under study ranged from 15 to 205 mg $kg^{-1}$ with a mean of 130 mg $kg^{-1}$. Out of leaf samples collected from 150 locations, the leaf samples in one location was below the critical level of 20 mg $kg^{-1}$ as suggested by Jones (1990). The leaf Mn content ranged from 30 to 205 mg $kg^{-1}$ with a mean value of 135 mg $kg^{-1}$ in Nizamabad district, recording lowest mean Mn content in Yellareddy mandal (62 mg $kg^{-1}$) and highest in Balkonda mandal (161 mg $kg^{-1}$). In Karimnagar district, the Mn content ranged from 110 to 186 mg $kg^{-1}$ with a mean value of 149 mg $kg^{-1}$, recording highest mean value of 159 mg $kg^{-1}$ in Jagitial mandal and lowest in Sarangapur mandal (135 mg $kg^{-1}$). In Warangal district, the Mn content ranged from 15 to 189 mg $kg^{-1}$ with a mean of 106 mg $kg^{-1}$. The lowest mean Mn content (38 mg $kg^{-1}$) was noticed in Shayampeta mandal and higher content (149 mg

$kg^{-1}$) was recorded in Parvatagiri mandal. No mandal was deficient in mean Mn content out of total 30 mandals in three districts under study. The reported values are within the acceptable ranges as reported earlier by Escano *et al.* (1981) and are higher than values as reported by Elwali and Gascho (1988) and Melsted *et al.* (1969).

## REFERENCES:

AOAC, 1980. Association of Official Agricultural Chemistry. Official and Tentative Methods of Analysis. Washington DC.

DES, 2010. Directorate of Economics and Statistics, Statistical Abstracts, Government of Andhra Pradesh.

Elwali, A. M. O and Gascho, G. J. 1988. Supplemental fertilization of irrigated corn guided by foliar critical nutrient levels and recommendation integrated system norms. *Agronomy Journal* 80:243-249.

Escano, C. R., Jones, C. A and Uehara, 1981. Nutrient diagnosis in corn grown on hydric dystrandepts: Optimum tissue nutrient concentrations. *Soil Science Society of America Journal* 45: 1135-1139.

Jackson, M. L. 1973. *Soil chemical analysis,* prentice Hall of India Pvt. Ltd., New Delhi

Jones, J. B., Eck, H. V and Voss, R. 1990. Plant analysis as an aid in fertilizing corn and grain sorghum. Soil testing and plant analysis.3$^{rd}$ ed. SSSA Book Ser.3.SSSA, Madison, WI.

Melsted, S. W., Motto, H. L and Peck, T. R. 1969. Critical plant nutrition composition values useful in interpreting plant analysis data. *Agronomy Journal.*61:17-20.

Muhr, R., Gilbert, Dutta, N., pb and Sankara Subramoney, H., Dever, R. F., Laley, V. K and Donahue, R. L. 1965. Soil testing in India (United States Agency for International Development Mission to India, New Delhi).

Neubert, P. W., Wrazidlo, N. P., Vielmeyer I Hundt, F., Gullmick and Bergman, W. 1969. Tabellenzur Pflanzenanelze ersteorien-tierrende Ubersicht.Institut fur Pflanzenerah rung Jena, Berlin.

Sumner, M. E. 1978. Interpretation of nutrient ratios in plant tissues. Communications in *Soil Science and Plant Analysis*. 9: 335-345.

Sumner, M. E. 1979. Interpretation of foliar analyses for diagnostic purposes. *Agronomy* Journal. 71: 335-345.

Sumner, M. E. 1981. Diagnosing the sulphur requirements of corn and wheat using foliar analysis. *Soil Science Society of America Journal.*45: 87-90.

Syed dara, T., Fixen., P. E and Gelderman, R. H.1992. Sufficiency level and DRIS approaches for evaluating the nitrogen status of corn. *Agronomy Journal.*84:1006-1009.

Wall, L. L., Gehrke, C. W and Suzuku, J. 1980. An automated turbidimetric method for total sulphur in plant tissue and sulfate sulfur in soils. Communications in *Soil Science and Plant Analysis.* 11: 1087-1103.

Walworth, J. L.,Woodard, H. J and Sumner, M. E. 1988. Generation of corn tissue norms from a small, high-yield data base. *Communications in soil science plant analysis.*19(5)563-577.

Walworth, J. L.,Woodard, H. J and Sumner, M. E. 1988. Generation of corn tissue norms from a small, high-yield data base. *Communications in soil science plant analysis.*19(5)563-577.

# EFFECT OF INTERCROPPING ON GROWTH AND SEED COTTON YIELD OF Bt COTTON WITH DIFFERENT PLANTING PATTERNS

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## ABSTRACT

The present investigation was carried out during *kharif*2007and 2008at college farm, College of Agriculture, Rajendranagar, Hyderabad. The genotypes of cotton,Bt bunny and non Bt Bunny were tested for their relative performance with two planting patterns in a row orientation of a uniform distance of 90 cm and paired row planting with a spacing of 120/60 cm with intercrops. The intra row spacing was 45 cm in both the planting patterns of Bt and non Bt cotton. Two rows of intercrops *viz.,*greengram, blackgram and soybean were raised at 30 cm row spacing in uniformly rows of cotton. Three rows of each intercrop were accommodated between paired rows.Cotton was also grown without intercrops. The results showed that plant height, drymatter, leaf area, days to 50% flowering, number of monopodia, boll number, boll weight and seed cotton yield were not influenced by genotypes or the planting pattern.Intercropping reduced the crop growth, yield and yield attributes of cotton only during 2008. Among intercropping systems tested, reduction in yield of cotton was relatively more by intercropping soybean.

Cotton is one of the major fibre as well as cash crops of India.Eventhough several cotton cultivars with fair amount of tolerance to sucking pests have been developed, tangible resistance to most important pest, the bollworm has not been obtained through traditional plant breeding. Hence genetically modified (GE) cotton widely known as Bt cotton due to delta endotoxin gene from the ubiquitous soil fact crisis *Bacillus thuringenesis* developed to manage bollworm. The area under Bt cotton Hybrids leaped by 43 times in India and more than four times in Andhra Pradesh(control of Biotech crops, 2006)

For risk aversion in rainfed farming, intercropping in cotton is advocated instead of sole cropping. Traditional intercropping has been suggested in cotton (due to wide spacing and slow initial crop growth nature) to enhance total productivity, increase the monetary returns, diversify crop to produce food, fodder and improve intrinsic capacity of natural resources, greater land use efficiency and soil fertility enrichment and insurance against aberrant weather conditions.

## MATERIALS AND METHODS

The field experiment was carried out during kharif season 2007 and 2008 at College farm, College of Agriculture, Rajendranagar, Hyderabad. The soil was sandy loam in texture, neutral in reaction, low in organic carbon and available N (218.3 kg ha$^{-1}$), medium in available P (16.4 kg ha$^{-1}$) and high in K (283.7 kg ha$^{-1}$). The experiment was laid out in split plot design and replicated thrice with 16 treatments consisting of Main treatments as a) Genotypes Bt and Non Bt cotton b) Planting pattern uniform row (90 X 45 cm) and Paired row planting {(60-120 X 45 cm)}. Sub treatments with three rows of greengram, blackgram and soybean in uniform rows and two rows in paired row system.There was a rainfall of 539.9 mm distributed in 18 weeks during the crop growing period in 2007. A higher amount of rainfall of 797.4 mm was distributed in 19 weeks during the second year.Bt cotton was fertilized with 150: 75: 100 kg N, P$_2$O$_5$ and K$_2$O/ha in non Bt cotton was fertilized with 120:60:60 kg N, P$_2$O$_5$ and K$_2$O/ha in sole and intercropped systems. The intercrops were also fertilized in proportion to their sole population. Top dressing was done at 30,60 and 90 DAE in equal splits for cotton and entire dose of fertilizers to intercrops were applied as basal. All the agronomic practices were followed and crops were raised completely as rainfed. Plant protection schedule was followed for control of pests as per recommendations.

## RESULTS AND DISCUSSION

Both Bt and non Bt cotton did not exhibit significant variation in plant height at harvest during the two years (table1). Similarly, change in planting geometry of

the crop from uniform to paired row planting pattern had no differential influence. However, intercropping of greengram, black gram or soybean significantly reduced the plant height of cotton at harvest during the year 2008 as compared to sole cotton.

Bt and non Bt versions accumulated drymatter content on par with each other at harvest. The modified planting pattern from the conventional uniform to paired row planting also did not bring any change in the drymatter content of the crop at harvest of the crop during the two years of study. Similarly intercropping with greengram, blackgram or soybean did not deter the drymatter accumulation of cotton compared to sole cotton at harvest during 2007. While it reduced with intercropping than sole cotton crop during 2008.

The leaf area recorded by Bt or non Bt cotton did not vary significantly. The planting pattern also did not influence this parameter during the two years. The sole crop displayed significantly larger leaf area during the two yearsthanwhen intercropped with greengram, blackgram or soybean

The days to 50 per cent flowering and monopodials were not influenced by the choice of growing Bt or non Bt cotton either in uniform or paired row method and intercropping cotton with any of the three legumes also did not influence the above parameters during both the years of study.

Differential responses of cotton for vegetative growth characters to the intercropping competition during the two years may be perhaps the result of the interaction of the rainfall and its distribution pattern since there was precipitation of 539.9 mm distributed in 18 weeks during 2007 and these vegetative growth characters were relatively more affected in subsequent year which had a precipitation of 797.4 mm distributed in ninteen weeks. Doeche et al. (2004) and Raghurami Reddy (2006) also observed that the plant height, drymatter accumulation, leaf area, days to 50 % flowering and number of monopodials of cotton decreased significantly by intercropping of greengram,blackgram and soybean.

The two genotypes did not differ significantly in producing the number of bolls per plant, boll weight or seed cotton yield in 2007 and 2008 (table 2).

Planting cotton crop in uniform lines or in pairs also did not influence these parameters. The growth pattern, yield attributes, seed cotton yield of Bt cotton were on par with that of non Bt cotton. The intercropping of greengram, blackgram or soybean significantly reduced the number of bolls per plant and boll weight during both the years as compared to sole cotton crop. Seed cotton yield did not exhibit any significant variation with Bt or Non Bt genotypes or planting pattern. While, the seed cotton yield showed a significant variation (decrease) when intercropped with legumes.

Intercrops were more competitive during the years of low rainfall. Reduction in seed cotton yield due to intercropping of greengramor blackgramwas also reported by several research workers (Sanjay et al. 2003, Doeche et al. 2004, and Jayakumar et al. 2007)Among intercropping systems tested, reduction in yield of cotton was relatively more by intercropping soybean in the year of high rainfall than in the year of low rainfall. Less yield of 107 kg and 133 kg seed cotton per hectare during first and second year was noticed with intercropped soybean than sole cotton. It may be due to the fact that soybean crop competed with cotton crop relatively for a longer time of 91 days than the greengram and blackgram intercrops. The investigations of Ramanjaneyulu and Reddy (2002) and Doecheet al. (2004) also confirmed that the intercropped soybean competed to lower the yield of cotton.

## REFERENCES

Control of Biotech crops. 2006. Technical bulletin: Published by Biotech consortium India limited and Acharya N .G. Ranga Agricultural University

Deoche, S.A.,Wayazade, P. M.,Wankhade, S.T and Turkhede, A.B. 2004. Effect of intercropping in extra early hirsutum cotton genotype (AKH 081). Journal of Soils and Crops 14(2): 308-311.

Jayakumar,M., Ponnuswamy, K., Mohammed. Amanullah, M., Mohammed Yassin, M and Balasubramanian V. 2007. Effect of intercropping and sources of nitrogen on growth, yield and 'N' use efficiency in cotton. Research Journal of Agriculture and Biological Sciences 3(5): 398-402.

**Table 1. Vegetative growth characters of cotton as influenced by genotypes, planting pattern and cropping system**

| Treatment Genotypes | Year 2007 | | | | | Year 2008 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Plant height (cm) | Dry matter (g plant$^{-1}$) | Leaf area (cm$^2$) | Days to 50 percent flowering | No. of monopodia | Plant height (cm) | Dry matter (g plant$^{-1}$) | Leaf area (cm$^2$) | Days to 50 percent flowering | No. of monopodia |
| Bt Cotton | 100.8 | 96.0 | 2901 | 65.0 | 2.6 | 101.7 | 97.6 | 2971 | 65.4 | 3.2 |
| Non Bt Cotton | 101.5 | 95.6 | 2895 | 64.7 | 2.4 | 102.8 | 97.6 | 2959 | 64.8 | 3.2 |
| SEm ± | 0.4 | 0.3 | 3.2 | 0.4 | 0.1 | 2.0 | 0.4 | 6.2 | 0.4 | 0.1 |
| CD at 5 % | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| **Planting pattern** | | | | | | | | | | |
| Normal | 100.7 | 95.6 | 2951 | 65.1 | 2.6 | 103.8 | 97.5 | 3015 | 65.2 | 3.1 |
| Paired | 101.6 | 96.0 | 2844 | 64.5 | 2.5 | 100.7 | 97.7 | 2916 | 64.9 | 3.1 |
| SE ± | 0.4 | 0.3 | 3.2 | 0.4 | 0.1 | 2.0 | 0.4 | 6.2 | 0.4 | 0.1 |
| CD at 5 % | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| **Genotype X Planting Pattern** | | | | | | | | | | |
| SE ± | 0.6 | 0.5 | 4.6 | 0.5 | 0.2 | 2.8 | 0.6 | 8.7 | 0.6 | 0.2 |
| CD at 5 % | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| **Cropping system** | | | | | | | | | | |
| Sole crop of Cotton | 100.3 | 94.9 | 3561 | 64.8 | 2.6 | 108.8 | 100.3 | 3651 | 65.3 | 3.4 |
| Cotton + Greengram | 101.6 | 96.2 | 2610 | 65.2 | 2.5 | 100.2 | 96.5 | 2619 | 65.1 | 3.1 |
| Cotton + Blackgram | 101.7 | 96.0 | 2701 | 65.6 | 2.6 | 100.9 | 96.8 | 2798 | 64.4 | 3.1 |
| Cotton + Soybean | 100.9 | 96.1 | 2720 | 63.8 | 2.5 | 99.1 | 97.0 | 2792 | 64.7 | 3.1 |
| SE ± | 1.1 | 1.0 | 4.7 | 0.5 | 0.1 | 1.7 | 0.6 | 8.1 | 0.6 | 0.2 |
| CD at 5 % | NS | NS | 9.7 | 1.1 | NS | 3.4 | 1.3 | 16.7 | NS | NS |
| **Planting pattern X Cropping system** | | | | | | | | | | |
| SE ± | 1.5 | 1.5 | 6.6 | 0.8 | 0.1 | 2.4 | 0.9 | 11.5 | 0.8 | 0.3 |
| CD at 5 % | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| **Genotype X Cropping system** | | | | | | | | | | |
| SE ± | 1.5 | 1.5 | 6.6 | 0.8 | 0.1 | 2.4 | 0.9 | 11.5 | 0.8 | 0.3 |
| CD at 5 % | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| **Genotype X Planting pattern X Cropping system** | | | | | | | | | | |
| SE ± | 2.2 | 2.1 | 9.4 | 1.1 | 0.2 | 3.3 | 1.2 | 16.2 | 1.2 | 0.4 |
| CD at 5 % | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

**Table 2. Yield and yield attributes of cotton as influenced by genotypes, planting pattern and cropping system**

| Treatment Genotypes | Kharif 2007 | | | Kharif 2008 | | |
|---|---|---|---|---|---|---|
| | Bolls per plant | Boll weight (g plant⁻¹) | Seed cotton yield kg/ha | Bolls per plant | Boll weight (g plant⁻¹) | Seed cotton yield kg/ha |
| Bt Cotton | 40.2 | 3.4 | 1065 | 38.7 | 4.0 | 1614 |
| Non Bt Cotton | 38.9 | 3.2 | 1031 | 41.1 | 3.8 | 1604 |
| SE ± | 1.0 | 0.1 | 11.8 | 1.4 | 0.1 | 7.6 |
| CD at 5 % | NS | NS | NS | NS | NS | NS |
| **Planting pattern** | | | | | | |
| Normal | 39.4 | 3.3 | 1049 | 40.0 | 4.0 | 1616 |
| Paired | 39.7 | 3.3 | 1047 | 39.8 | 3.8 | 1601 |
| SE ± | 1.0 | 0.1 | 11.8 | 1.4 | 0.1 | 7.6 |
| CD at 5 % | NS | NS | NS | NS | NS | NS |
| **Genotype X Planting Pattern** | | | | | | |
| SE ± | 1.4 | 1.2 | 16.7 | 2.0 | 0.2 | 10.7 |
| CD at 5 % | NS | NS | NS | NS | NS | NS |
| **Cropping system** | | | | | | |
| Sole crop of Cotton | 44.8 | 3.6 | 1115 | 46.8 | 4.5 | 1705 |
| Cotton + Greengram | 37.4 | 3.3 | 1049 | 36.8 | 3.8 | 1575 |
| Cotton + Blackgram | 39.3 | 3.2 | 1019 | 39.3 | 3.9 | 1583 |
| Cotton + Soybean | 36.7 | 3.1 | 1008 | 36.8 | 3.6 | 1572 |
| SE ± | 2.5 | 0.1 | 23.8 | 2.9 | 0.2 | 9.3 |
| CD at 5 % | 5.2 | 0.3 | 49.1 | 5.9 | 0.4 | 19.2 |
| **Genotype X Cropping system** | | | | | | |
| SE ± | 3.6 | 0.2 | 33.6 | 4.1 | 0.3 | 13.1 |
| CD at 5 % | NS | NS | NS | NS | NS | NS |
| **Planting pattern X Cropping system** | | | | | | |
| SE ± | 3.6 | 0.2 | 33.6 | 4.1 | 0.3 | 13.1 |
| CD at 5 % | NS | NS | NS | NS | NS | NS |
| **Genotype X Planting pattern X Cropping system** | | | | | | |
| SE ± | 5.1 | 0.3 | 47.5 | 5.8 | 0.4 | 18.6 |
| CD at 5 % | NS | NS | NS | NS | NS | NS |

Raghurami Reddy, 2006. Planting techniques and intercropping studies in cotton Ph.D Thesis submitted to the Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad.

Ramanjaneyulu, A.V and Bucha Reddy, B. 2002. Influence of intercropping and fertility management in hybrid cotton on total productivity and economics. Journal of Research, ANGRAU 30(2): 109-111.

Sanjay, M.T., Nadagouda, V.B., Pujari, B.T., Narana Gouda, A and Somshekar. 2003. Intercropping in short duration compact cotton Anjali. Crop Research 26(2): 224-230.

# EFFECT OF ORGANIC MANURES AND BIOFERTILIZERS ON GROWTH, YIELD AND NUTRIENT UPTAKE IN GHERKIN (*Cucumis anguria* L.)

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## ABSTRACT

An experiment on Gherkin (*Cucumis anguria* L.) cv. Ajax Hybrid was carried out at Students Farm, College of Agriculture, Rajendranagar, Hyderabad during April-December 2007 and 2008 to study the effect of organic manures and biofertilizers on gherkin with reference to growth parameters, yield and nutrient uptake. Results of the pooled data revealed that, application of recommended dose of fertilizers (RDF) (150 N: 75 P: 150 K kg/ha) recorded highest vine length (167 cm), number of branches per vine (5.75), internodal length (16.44 cm), lowest node at which first female flower appeared (1.88) and highest fruit yield per vine (276 g) and was on a par with vermicompost 18t/ha + *Azotobacter* (2 kg/ha) + Phosphate solubilizing bacteria (2 kg/ha). Significantly highest nutrient uptake (N, P and K kg/ha) was recorded with recommended dose of fertilizers.

Gherkin (*Cucumis anguria* L.), commonly called as 'pickling cucumber', is an important cucurbitaceous crop. It is a monoecious, annual, trailing or climbing vine. Its unripe fruits are used for processing as pickles, eaten as a cooked vegetable and are used in curries (Purseglove, 1969). It is commonly grown in USA, Australia and Srilanka and was introduced in India during late eighties for export oriented production (Anon., 1975). In spite of its heavy demand from the buyers the average yield of gherkin in the country is low when compared to the yield obtained in USA and other countries. The situation thus demands evaluation of proper technology for improving the growth, yield and quality in gherkin.

Organic farming is not only resource conserving but also productive and plays a pivotal role in sustainable agriculture. So, their conservation and efficient usage in agriculture assume importance which facilitates supply of gherkin throughout the year meeting higher export demands. This necessitates the use of organic manures and biofertilizers for maintaining and sustaining a higher level of soil fertility and crop productivity accomplished with high quality fruits. Hence, it is imperative to evaluate organic manures and biofertilizers in gherkin.

## MATERIALS AND METHODS

An experiment was conducted for two years at Students Farm, College of Agriculture, Rajendranagar, Hyderabad to study the effect of organic manures and biofertilizers on growth, yield and nutrient uptake of gherkin (*Cucumis anguria* L.) cv Ajax. The soil of the experimental site was sandy loam with pH 7.6. The experiment was laid out in a randomized block design with three replications and eleven treatments as follows: Manurial doses were calculated based on recommended dose of nitrogen.

$T_1$ – Control, $T_2$ - Recommended dose of fertilizers (150 N: 75 P: 150 K kg ha$^{-1}$), $T_3$ - Neem cake @ 3 t ha$^{-1}$+ Biofertilizers (*Azotobacter* and PSB each @ 2kgha$^{-1}$), $T_4$- Neem cake @ 4.2 t ha$^{-1}$ + Biofertilizers, $T_5$ - Neem cake @ 5.4 t ha$^{-1}$ + Biofertilizers, $T_6$ - Vermicompost @ 10 t ha$^{-1}$ + Biofertilizers, $T_7$ - Vermicompost @ 14 t ha$^{-1}$ + Biofertilizers, $T_8$ - Vermicompost @ 18 t ha$^{-1}$ + Biofertilizers, $T_9$ - Castor cake @ 3 t ha$^{-1}$ + Biofertilizers, $T_{10}$ - Castor cake @ 4.2 t ha$^{-1}$ + Biofertilizers and $T_{11}$ - Castor cake @ 5.4 t ha$^{-1}$ + Biofertilizers.

Before leveling of the individual plots for sowing gherkin, farm yard manure (FYM) was applied @ 25 tonnes per hectare as basal dose and subsequently mixed well in the soil. In each treatment unit four furrows were opened with a spacing of 1.5 meter between rows and 0.75 meter between plants. Manuring and fertilization was done as per the treatments. Full dose of organic manures like FYM, Vermicompost, Castor cake and Neem cake were

applied as per the treatments one week before sowing of the crop as basal dose. At the time of sowing seed, 1/3 of nitrogen and full dose of phosphorus and full dose of potassium were applied in treatment ($T_2$) in the furrows and mixed well in the soil before sowing ($T_2$). The remaining 2/3 nitrogen was applied on 20th and 40th day after sowing. The nutrients were applied in the form of urea (46% N), single superphosphate (16% $P_2O_5$) and muriate of potash (60% $K_2O$). Regular weeding, irrigation and plant protection were followed. In each plot, five plants were selected at random and tagged for observations. Observations on growth parameters, yield and nutrient uptake viz., vine length (cm), number of branches per vine, internodal length (cm), node at which first female flower appeared, fruit yield per vine (g) and N, P and K uptake (kg/ha) were recorded.

## RESULTS AND DISCUSSION

The results of the mean data of the experiment on growth parameters and yield viz., vine length (cm), number of branches per vine, internodal length (cm), node at which first female flower appeared, fruit yield per vine (g) and nutrient uptake are presented in Table 1.

Application of recommended dose of fertilizers recorded highest vine length (167 cm) and highest number of branches per vine (5.75) but was on par with vermicompost 18 t ha⁻¹ which recorded 165 cm of vine length and 5.68 number of branches per vine. Significantly lowest vine length (126 cm) was recorded with control while lowest number of branches per vine was recorded with control and neem cake 3 t ha⁻¹ which recorded 4.28 and 4.37 number of branches respectively and were on par. The increased vine length might be due to continued vegetative growth enhanced by split application of nitrogen. The highest vine length in the best treatment might be due to ready availability of nutrients, their improved absorption and translocation by plants more quickly, which resulted in higher photosynthetic activity than other treatments. Increased rate of photosynthetic products entering into the system might have caused cell elongation and rapid cell division in the growing portion resulting in more number of branches per vine. Similar results were reported by Singh and Chhonkar (1986) in muskmelon.

The application of RDF recorded the longest internodal length (16.44) which was on par with vermicompost 18 t and 14 t ha⁻¹ (16.37 and 16.18 respectively). The shorter internodal length was observed with control (14.00) which was on par with neem cake 3 t ha⁻¹ (14.21). The increased vine length due to higher availability and uptake of nutrients might have resulted in increased internodal length of the vine.

The lowest node number at which first female flower appeared was recorded with RDF (1.88) which was significantly superior to all the other treatments but was on par with vermicompost 18 t ha⁻¹ (1.95). Significantly highest node at which first female flower appeared was recorded with control (2.68). In cucurbits, the lower node at which first female flower appear, the earlier is the crop. The increased vegetative growth due to the best treatment has inturn helped to produce more photosynthates and flowering stimulus, resulted in early induction of female flower at the lower nodes. The best performance of vermicompost was due to the presence of ample quantities of nutrients, vitamins and growth substances in vermicompost might have resulted in higher vine length and number of branches per vine resulting in higher yield in gherkin (Curry and Byrne, 1992).

The highest fruit yield per vine was recorded with RDF (276 g) which was on par with vermicompost 18 t ha⁻¹ (257 g). Significantly lowest total fruit yield per vine (120 g) was recorded with control. The vigorous vegetative growth which might have accelerated the photosynthetic rate and thereby increased the supply of carbohydrates. Better assimilation of these carbohydrates might have created favourable conditions for auxin synthesis inducing more female flowers resulting in more number of fruits per vine which inturn might have increased the yield. The present results were in conformity with the findings of Shivashankaramurthy *et al.* (2007).

Application of recommended dose of fertilizers recorded significantly highest uptake of nitrogen (126 kg/ha), phosphorus (55 kg/ha) and potassium (287 kg/ha) which was significantly superior to all other treatments. The lowest nitrogen and phosphorus uptake was recorded with the treatments, control and neem cake 3 t ha⁻¹ which

**Table 1. Effect of different organic manures and biofertilizers on vine length (cm), number of branches per vine, internodal length(cm), node at which first female flower appeared, fruit yield per vine(g) and nutrient uptake in gherkin**

| Treatments | Vine length (cm) | Number of branches per vine | Internodal length (cm) | Node at which first female flower appeared | Fruit yield Per vine (g) | Nutrient uptake (kg /ha) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Nitrogen | Phosphorus | Potassium |
| $T_1$ - control | 126 | 4.28 | 14.00 | 2.68 | 120 | 68 | 28 | 178 |
| $T_2$ - RDF (150 N: 75 P: 150 K kgha$^{-1}$) | 167 | 5.75 | 16.44 | 1.88 | 276 | 126 | 55 | 287 |
| $T_3$ - Neem cake @ 3 t ha-1 + Biofertilizers | 137 | 4.37 | 14.21 | 2.52 | 161 | 72 | 29 | 180 |
| $T_4$ - Neem cake @ 4.2 t ha-1 + Biofertilizers | 141 | 4.58 | 14.80 | 2.38 | 190 | 81 | 35 | 191 |
| $T_5$ - Neem cake @ 5.4 t ha-1 + Biofertilizers | 146 | 4.76 | 15.39 | 2.13 | 212 | 91 | 38 | 207 |
| $T_6$ - Vermicompost @ 10 t ha-1 + Biofertilizers | 155 | 5.18 | 15.96 | 2.08 | 240 | 113 | 44 | 216 |
| $T_7$ - Vermicompost @ 14 t ha-1 + Biofertilizers | 157 | 5.51 | 16.18 | 2.01 | 246 | 118 | 45 | 222 |
| $T_8$ - Vermicompost @ 18 t ha-1 + Biofertilizers | 165 | 5.68 | 16.37 | 1.95 | 257 | 120 | 46 | 254 |
| $T_9$ - Castor cake @ 3 t ha-1 + Biofertilizers | 139 | 4.43 | 14.65 | 2.40 | 176 | 82 | 33 | 186 |
| $T_{10}$ - Castor cake @ 4.2 t ha-1 + Biofertilizers | 146 | 4.77 | 15.39 | 2.25 | 214 | 88 | 37 | 204 |
| $T_{11}$ - Castor cake @ 5.4 t ha-1 + Biofertilizers | 150 | 5.17 | 15.83 | 2.13 | 228 | 98 | 41 | 209 |
| Mean | 148 | 4.95 | 15.38 | 2.22 | 211 | 96 | 39 | 212 |
| SEm± | 2.79 | 0.04 | 0.11 | 0.03 | 6.89 | 1.71 | 0.82 | 4.54 |
| CD at 5% | 8.23 | 0.11 | 0.32 | 0.09 | 20.32 | 5.04 | 2.43 | 13.4 |

\*    Biofertilizers (*Azotobacter* and PSB @ 2 kg per ha)

\*\*   FYM @ 25 t per ha was applied to all the treatments as basal dose

were at par with each other recording 68 and 72 kg/ha nitrogen uptake and 28 and 29 kg/ha phosphorus uptake respectively. While the lowest potassium uptake was recorded with control (178 kg/ha) which was on par with neem cake 3 t ha$^{-1}$, castor cake 3 t ha$^{-1}$ and neem cake 4.2 t ha$^{-1}$ recording 180, 186 and 191 values respectively.

Nutrient uptake is a positive function of dry matter yield. Owing to ready release of nutrients in available forms, N, P and K uptake was higher with RDF treatment compared to other treatments. In the present study, crop has best performed with RDF with respect to growth parameters, yield and nutrient uptake. Among the organic manures used, vermicompost was found to be promising which might be due to the fact that it reduces the leaching losses which resulted in increased availability of nitrogen for longer period. There was superior and desired reproductive growth which might have observed more due to the availability of nutrients by its application along with biofertilizers, thus ultimately higher yield (Jambhelkar, 1994).

The results indicated that comparable yields could be obtained when the plants were supplied with organic manures and biofertilizers. In other words, the entire nutrient requirement of the plants could be met exclusively through organics without impairing its productivity whenever organic manures are available in abundance at a cheaper cost or they could be integrated with inorganic sources whenever their availability in limited.

## REFERENCES

Anon, 1975. Gherkins (*Cucumis sativus* L.). *Farm Digest*. 1-3: 6-8.

Curry, J.P and Byrne, D. 1992. The role of earthworms in straw decomposition and nitrogen turnover in arable land in Ireland. Soil Biology and Biochemistry. 24(12): 1409-1412.

Jambhelkar, H. 1994. Bio-organic farming. Paper presented in the seminar on Development of Agriculture in Andhra Pradesh held on 4th and 5th September, 1'994 at Hyderabad., p.16.

Purseglove, J. W. 1969. Tropical Crops Dicotyledons-1. Longmans Green and Co. Ltd pp, 109-110.

Shivashankaramurthy, T. C., Nagegowda, V., Basavaiah and Farooqui, A. A. 2007. Influence of nitrogen, phosphorus and potassium on the yield and quality of gherkin. Indian Journal of Horticulture. 64(2) June : 228-230.

Singh, D. N and Chhonkar, V. S. 1986. Effect of nitrogen, phosphorus and potassium on growth and yield of muskmelon (*Cucumis melo* L.). Indian Journal of Horticulture. 43(3/4): 265-269.

# DRY MATTER PARTITIONING AND GRAIN YIELD POTENTIAL OF MAIZE (*Zea mays* L.) AS INFLUENCED BY DATES OF SOWING AND NITROGEN APPLICATION

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## ABSTRACT

An experiment was conducted at Agriculture Research Institute, Rajendranagar, Hyderabad during *Kharif* 2009 and 2010. with four dates of sowing (7 Jul, 21 Jul, 6 Aug and 22 Aug in 2009 and 18 Jun, 02 Jul, 17 Jul and 02 Aug in 2010) as main plots and five nitrogen levels (0, 100, 200, 300 and 400 kg N ha$^{-1}$) as sub-plots in split plot design replicated thrice. During both the years of study crop sown from 18 June to 21 June recorded significantly more dry matter. Sowing beyond 21 July in 2009 and 17 July in 2010 reduced the DM production by 11 per cent, over early sown crop. Application of 200 kg N ha$^{-1}$ was considered significant for increasing dry matter and grain yield even though increase was observed upto 400kg ha$^{-1}$. The mean dry matter partitioning towards leaf, stem and cob at physiological maturity was 16, 20 and 65 per cent respectively with 200 kg N ha$^{-1}$.

An experiment was conducted at Agriculture Research Institute, Rajendranagar, Hyderabad during *Kharif* 2009 and 2010 with four dates of sowing (7 Jul, 21 Jul, 6 Aug and 22 Aug in 2009 and 18 Jun, 02 Jul, 17 Jul and 02 Aug in 2010) as main plots and five nitrogen levels (0, 100, 200, 300 and 400 kg N ha$^{-1}$) as sub-plots in split plot design replicated thrice. During both the years of study crop sown from 18 June to 21 June recorded significantly more dry matter. Sowing beyond 21 July in 2009 and 17 July in 2010 reduced the DM production by 11 per cent, over early sown crop. Application of 200 kg N ha$^{-1}$ was considered significant for increasing dry matter and grain yield even though increase was observed upto 400kg ha$^{-1}$. The mean dry matter partitioning towards leaf, stem and cob at physiological maturity was 16, 20 and 65 per cent respectively with 200 kg N ha$^{-1}$.

The increasing demand for maize is rapidly transforming cropping systems in certain parts of Asia. Where the biophysical and socioeconomic conditions are favourable, significant shifts from rice monoculture to more Profitable rice-maize systems have either occurred or are emerging (IRRI and CIMMYT, 2006). In Andhra Pradesh, maize area increased from 4.4 lakh ha (2000) to 8.5 lakh ha with higher productivity of 4882 kg ha$^{-1}$ (CMIE, 2009). Introduction of high yielding single cross hybrids coupled with high input management and its spread to non traditional areas of rice-pulse system have

resulted in more production. Planting date is an important non monitory input that influences the crop performance to a great extent. Besides date of sowing, nitrogen management plays a key role in realizing higher yields. Nitrogen fertilizer is universally accepted as a key component to high yield, high seed quality and optimum economic return. Optimizing the input of N at the farm level would maximize biomass production and harvest index (Pandey *et al.* 2000).

Therefore, an experiment was carried out with an objective to study the effect of planting dates and N levels for enhancing partitioning of DM to maximize grain yield.

## MATERIALS AND METHODS

A field experiment was conducted during rainy season of 2009 and 2010 at Agricultural Research Institute, Rajendranagar, Hyderabad having 17$^0$19' N Latitude, 78$^0$23' E Longitude and 542.3 m above mean sea level. The soil of the experimental site was sandy loam in texture, neutral in reaction, low in available nitrogen, phosphorus and high in available potassium. The experiment was laid out in split plot design with four dates of sowing (7 Jul, 21 Jul, 6 Aug and 22 Aug in 2009 and 18 Jun, 02 Jul, 17 Jul and 02 Aug in 2010) as main plots and five nitrogen levels (N$_0$: 0 kg ha$^{-1}$ (control), N$_1$ : 100 kg ha$^{-1}$, N$_2$: 200 kg ha$^{-1}$, N$_3$ : 300 kg ha$^{-1}$and N$_4$: 400 kg ha$^{-1}$) as sub-plots, replicated thrice. Crop was

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fertilized with a uniform dose of 60 kg ha$^{-1}$ P$_2$O$_5$ as single super phosphate, potassium @ 60 kg ha$^{-1}$ as muriate of potash and ZnSO$_4$ @ 50 kg ha$^{-1}$. The entire P$_2$O$_5$, ZnSO$_4$ and half of K$_2$O were applied at sowing. Nitrogen was applied as per the treatments in the form of urea (46% N) in three equal splits (1/3 each at basal, at knee-high and tasseling). Similarly the remaining potassium was applied along with urea during second top dressing at tasseling. Other cultural operations and plant protection measures were followed as per the recommendations. During the crop period rainfall of 538.7 mm was received in 31 rainy days in 2009 and 943.8 mm in 56 rainy days in 2010, respectively as against the decennial average of 588.1 mm received in 37 rainy days, for the corresponding period indicating 2010 as wet year. Plant samples of maize were collected for dry matter estimation at six leaf, tasseling, silking and physiological maturity stages from different treatments. Data were collected on seed yield. Dry weight per plant was calculated as sum of the dry weights of the plant components. Cobs were threshed, grains were counted, weighed and the grain yield per plant was worked out.

**RESULTS AND DISCUSSIONS**

Dry matter production increased steadily after crop establishment until maturity in all the treatments. The crop accumulated more DM during 2009 as compared to 2010 wet season. In 2009, 21 July (D$_2$) sown crop and 7 July (D$_1$) sown crop produced onpar dry matter at six leaf, tasseling, silking and physiological maturity stages (Table 1 ). Lowest DM accumulation at all these stages was observed in 22 August (D$_4$) sown crop. In 2010, 18 June (D$_1$) sown crop showed maximum DM accumulation at six leaf (9.8 g plant$^{-1}$), tasseling (83.3 g plant$^{-1}$), silking (89.9 g plant$^{-1}$), and maturity stages (203.2 g plant$^{-1}$), and was on par with 2 July (D$_2$) sown crop and significantly superior to 17 July (D$_3$) and 2 August (D$_4$) sown crop. Sowing beyond 21 July and 17 July reduced the DM production in 2009 and 2010 by 11% and 11%, respectively over early sown crop. The observed difference in DM accumulation during development may result from differences in climate, differential absorption of PAR due to variation in plant population and LAI, or differences in the efficiency of converting absorbed photosynthetic

active radiation (APAR) into DM (Tollenaar and Aguilera, 1992).

Relatively higher DM accumulation was recorded with 400 kg N ha$^{-1}$ at six leaf, tasseling, silking, and physiological maturity stages (Table 1), but significant increase was observed only upto 200 kg N ha$^{-1}$ over 100 kg N ha$^{-1}$ and control (N$_0$). The increase in DM accumulation with higher level of nitrogen was due to better crop growth, which also gave maximum plant height, LAI and ultimately produced more biological yield. Enhanced DM production with adequate supply of nitrogen, as evidenced in this investigation corroborates the findings of Raja (2001) and Ramu (2005).

Observations were also made on dry matter partitioning. Dates of sowing and graded levels of N had significant effects on leaf weight per plant. In 2009, delay in sowing significantly reduced the leaf weight per plant from 34 to 25 g plant$^{-1}$, but 21 July (D$_2$) sown crop and 7 July (D$_1$) sown crop produced onpar leaf weight per plant. In 2010 also crop showed similar trend and 18 June (D$_1$) sown crop produced significantly higher leaf weight per plant (34 g plant$^{-1}$) followed by 2 July (D$_2$) sown crop (33 g plant$^{-1}$) while lowest leaf weight per plant was observed in 2 August sown crop.

Increase in the rate of N significantly increased leaf per weight plant from a minimum of 16.0 g at the lowest rate of N to a maximum of 39.0 g at higher rates (400 kg ha$^{-1}$) of N application. Increase in leaf weight per plant with increase in N rate application was due to the increase in leaf size and chlorophyll content, which resulted in higher leaf weight per plant. These results are in confirmation with those of Rajcan and Tollenaar (1999) that increase in N rates increased leaf longevity and photosynthesis in maize which results in higher dry matter production. Similar results were reported by Pandey *et al.* (2000) and Turgut (2000) that dry matter production of maize increased with increase in the rate of N application.

Dates of sowing and graded levels of nitrogen significantly affected stem weight per plant (Table 1). Higher stem weight of 41.0 g plant$^{-1}$ was recorded in the crop sown on 21 July and 18 June in 2009 and 2010. Lowest stem weight was recorded in 22 August

**Table 1. Dry matter (g plant$^{-1}$) partitioning at maturity stage of maize as influenced by dates of sowing and nitrogen levels**

| Date of sowing (D) | | Leaf | | | Stem | | | Cob | | | Total dry matter | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009 | 2010 | 2009 | 2010 | Mean | 2009 | 2010 | Mean | 2009 | 2010 | Mean | 2009 | 2010 | Mean |
| 7 Jul | 18 Jun | 34 | 34 | 34 | 41 | 41 | 41 | 128 | 128 | 128 | 203 | 203 | 203 |
| 21 Jul | 2 Jul | 37 | 33 | 35 | 43 | 40 | 42 | 129 | 124 | 126 | 209 | 197 | 203 |
| 6 Aug | 17 Jul | 30 | 31 | 30 | 37 | 38 | 37 | 120 | 120 | 120 | 186 | 188 | 187 |
| 22 Aug | 2 Aug | 25 | 26 | 26 | 31 | 32 | 31 | 111 | 109 | 110 | 167 | 167 | 167 |
| Mean | | 31 | 31 | 31 | 38 | 38 | 38 | 122 | 120 | 121 | 191 | 189 | 190 |
| S.Em± | | 2 | 1 | | 2 | 1 | | 2 | 3 | | 4 | 4 | |
| CD at 5% | | 4 | 2 | | 4 | 4 | | 5 | 7 | | 10 | 9 | |
| Nitrogen (N) (kg ha$^{-1}$) | | | | | | | | | | | | | |
| 0 | | 16 | 15 | 16 | 17 | 16 | 16 | 38 | 38 | 38 | 71 | 69 | 70 |
| 100 | | 25 | 26 | 26 | 34 | 31 | 33 | 106 | 106 | 106 | 165 | 163 | 164 |
| 200 | | 37 | 37 | 37 | 45 | 46 | 46 | 152 | 150 | 151 | 234 | 232 | 233 |
| 300 | | 39 | 37 | 38 | 47 | 48 | 47 | 154 | 152 | 153 | 239 | 237 | 238 |
| 400 | | 40 | 39 | 39 | 48 | 48 | 48 | 158 | 155 | 156 | 246 | 243 | 244 |
| Mean | | 31 | 31 | 31 | 38 | 38 | 38 | 122 | 120 | 121 | 191 | 189 | 190 |
| S.Em± | | 2 | 1 | | 2 | 1 | | 3 | 3 | | 6 | 5 | |
| CD at 5% | | 4 | 2 | | 4 | 3 | | 6 | 6 | | 13 | 11 | |
| Interaction (D X N) | | | | | | | | | | | | | |
| S. Em± | | 3 | 2 | | 4 | 3 | | 6 | 6 | | 13 | 11 | |
| CD at 5% | | NS | NS | | NS | NS | | NS | NS | | NS | NS | |

**Table 2. Partitioning of dry matter and grain yield potential in maize as affected by sowing dates and N application levels**

| Date of sowing (D) | | Number of grains cob$^{-1}$ | | | Grain yield g plant$^{-1}$ | | |
|---|---|---|---|---|---|---|---|
| 2009 | 2010 | 2009 | 2010 | Mean | 2009 | 2010 | Mean |
| 7 Jul | 18 Jun | 376 | 390 | 383 | 112 | 115 | 114 |
| 21 Jul | 2 Jul | 387 | 364 | 375 | 116 | 106 | 111 |
| 6 Aug | 17 Jul | 348 | 338 | 343 | 102 | 99 | 96 |
| 22 Aug | 2 Aug | 317 | 301 | 309 | 94 | 89 | 92 |
| Mean | | 357 | 348 | 353 | 106 | 102 | 103 |
| S.Em± | | 7 | 12 | | 3 | 4 | |
| CD at 5% | | 17 | 29 | | 8 | 10 | |
| Nitrogen (N) (kg ha$^{-1}$) | | | | | | | |
| 0 | | 113 | 112 | 112 | 28 | 26 | 27 |
| 100 | | 337 | 327 | 332 | 99 | 97 | 98 |
| 200 | | 434 | 422 | 428 | 136 | 131 | 134 |
| 300 | | 446 | 435 | 440 | 140 | 136 | 138 |
| 400 | | 453 | 446 | 450 | 143 | 140 | 142 |
| Mean | | 357 | 348 | 353 | 109 | 106 | 108 |
| S.Em± | | 11 | 13 | | 8 | 12 | |
| CD at 5% | | 22 | 27 | | 28 | 26 | |
| Interaction (D X N) | | | | | | | |
| S. Em± | | 21 | 26 | | 8 | 12 | |
| CD at 5% | | NS | NS | | NS | NS | |

and 2 August sown crops. Increase in N rates increased mean stem weight from 16 g per plant[-1] (with out N application) to 48 g plant[-1] in the crop that received the highest rate of N (400 kg ha^{-1}).

At physiological maturity cob weight per plant was found to vary significantly with sowing dates and graded levels of nitrogen. Delayed sowing beyond 21 July and 17 July reduced the mean cob weight plant[-1] to 167 g plant-1 from 203 g plant[-1]with early sown crop. Cob weight per plant increased with increase in nitrogen application. Weight per ear increased from a minimum of 38.0 g plant[-1] with out N application to 156.0 g plant[-1] at 400 kg N ha^{-1}.

Sowing beyond 21 July and 17 July reduced the grain number by 317 and 301 against 387 in 21 July sown crop and 390 in 18 June sown crop during both the years of study. Increase in grains cob[-1] was attributed to better LAI, which consequently increased the radiation use efficiency and resulted in the total DM production and its distribution to cobs as evidenced at maturity (Table 2). Superior cob size in early sown crop and more number of rows cob[-1] inturn produced more number of grains cob[-1]. In both the years, delay in sowing beyond 21 July and 17 July showed reduction of number of grains cob[-1] by 18% and 23%, respectively. Number of seeds ear[-1] showed positive relationship with N rates.. Increasing N rate increased number of grains cob-1 from a minimum of 112 (0 kg ha^{-1}) to a maximum of 450 (400 kg ha^{-1}) but significant increase was observed upto 200 kg ha^{-1}.

Dates of sowing and nitrogen levels were found to influence grain yield per plant during both the years of study (Table 2). Delay in sowing beyond 6 August in 2009 and 17 July in 2010 reduced the grain yield per plant by 19% and 23% respectively over 21 July in 2009and 18 June in 2010. The highest grain yield of 143g per plant in 2009 and 140 g per plant in 2010 was produced with 400 kg N ha^{-1} application, while the lowest yield of 28 and 26 g per plant was recorded with out N application during both the years of study. However significant increase was observed only upto 200 kg N ha^{-1} application.

Optimum time of sowing for higher DMP and grain yield would be from 18 June to 21 July with highest partitioning (64%) towards cob followed by stem (20%) and leaf (16%). Application of 200kg N ha^{-1} produced higher DM and grain yield with highest partitioning towards cob followed by stem and leaf as that of dates of sowing.

**REFERENCES**

CMIE. 2009. Data base Indian harvest. Centre for monitoring Indian Economy, Central Library Hyderabad. ANGRAU.

IRRI and CIMMYT. 2006. Rice-maize systems for improving the quality of life of Asia's poor.

Pandey, R.K., Maranville, J.W and M.M. Chetima. 2000. Deficit irrigation and nitrogen effects on maize in a Sahelian environment II. Shoot growth, nitrogen uptake and water extraction. Agricultural Water Management. **46**(1):15-27.

Raja, R. 2001. Effect of time of sowing and nutrient levels on dryland sorghum varieties and evaluation of DSSAT v3.5 CERES-Sorghum model to optimize farm management strategies. Ph.D. Thesis submitted to Tamil Nadu Agricultural University, Coimbatore.

Rajcan, I and Tollenaar, M. 1999. Source:sink ratio and leaf senescence in maize: I. Dry matter accumulation and partitioning during grain filling. Field Crops Research. **60**(3):245-253.

Ramu, R.Y. 2005. Agrotechniques for enhancing productivity and quality of hybrid maize (*Zea mays* L.) Ph.D Thesis submitted to ANGRAU.

Tollenaar, M and Aguilera, A. 1992. Radiation use efficiency of anold and a new maize hybrid. *Agronomy Journal.* 84: 536–541.

Turgut, I. 2000. Effects of plant populations and nitrogen doses on fresh ear yield and yield components of sweet corn grown under Bursa conditions. Turkish Journal of Agriculture and Forest. **24**(3):341-347.

# IMPACT OF FARMER FIELD SCHOOLS IN KVK ADOPTED VILLAGES ON LEVEL OF KNOWLEDGE AND EXTENT OF ADOPTION OF IMPROVED PRACTICES OF PADDY(*Oryza sativa* L.)

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## ABSTRACT

Farmer Field Schools (FFS) is the methodology in extension to work with people by way of creating a learning environment in which farmers can master and apply specific management skills. Krishi Vigyan Kendra (KVK), Jammikunta has conducted demonstrations in Rice by adopting the FFS method under Sree Ram Sagar Project (SRSP) command area in Karimnagar District in Collaboration with I&CAD department under Productivity enhancement Scheme. These demonstrations of KVK have created awareness among the farming community on Integrated Crop Management aspects in Rice with a special focus on water management.  As the programme has completed four years of its implementation, an attempt was made to study the level of knowledge and extent of adoption of improved paddy cultivation practices by the farmers in karimnagar district of Andhra Pradesh using ex-post facto research design sample size consists of 80 FFS participant and non participant farmers selected for the study. The profile analysis of FFS farmers indicated that majority of them were middle aged, with medium farming experience, medium farm size, high extension contact,  innovativeness, medium level of  mass media exposure, scientific orientation, risk orientation   and medium level of training received.  Fifty Seven per cent of the FFS farmers possessed high level of Knowledge  where as only 42 per cent of the Non FFS farmers has high level of knowledge. The level of adoption was high (47%) compared to only 34 per cent among the Non FFS Farmers.   Thus, the present extension delivery system can be supported through taking demonstrations by using FFS methodology as a successful extension  approach.

Farmer Field School (FFS) is not about a technology, but it is about people's development conducted for the purpose of creating a learning environment in which farmers can master and apply specific management skills. The emphasis is on empowering farmers to implement their own decisions in their own fields. FAO has proposed the following broad contents for farmer field school curriculum on integrated Soil and nutrient management and conservation .

1.  Diagnosis of the farming environment and observation of field problems

2.  Diagnosis of problems, causes and possible solutions

3.  Principles and skills of integrated soil and nutrient management

4.  Planning, testing, monitoring and evaluation of solutions

5.  School evaluation

**Objectives of Farmer Field Schools**

● To empower farmers with knowledge and skills

● To sharpen the farmers ability to make critical and informed decisions.

● To sensitise farmers in new ways of thinking and problem solving.

● To help farmers learn to organize themselves and their communities.

**METHODOLOGY**

Krishi Vigyan Kendra, Jammikunta has adopted Farmer field school methodology for demonstration of improved package of practices of Rice cultivation under Sree Ram Sagar Project (SRSP) area in Collaboration with I&CAD department under Productivity enhancement of Rice from the year 2006-07 (Rabi) onwards to educate the farmers. KVK has created awareness on Diagnosis of problems, causes and possible solutions on pest and diseases and help farmers learn to organize themselves and their communities to solve their problems

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**Table 1. Details of year wise FFS Demonstrations Conducted by KVK Karimnagar**

| S.No. | Year and Season | No. of FFS | No. of Villages | No. of Farmers |
|---|---|---|---|---|
| 1. | 2007-08  - Rabi | 50 | 50 | 50 |
| 2. | 2008-09 – Kharif | 50 | 50 | 50 |
| 3. | 2008-09 - Rabi | 50 | 50 | 50 |
| 4. | 2009-10 – Kharif | 50 | 50 | 50 |
| 5. | 2009-10 – Rabi | 50 | 50 | 50 |
| 6. | 2010-11 – Kharif | 65 | 65 | 65 |
| 7. | 2010-11 – Rabi | 100 | 100 | 100 |
| | **TOTAL** | **415** | **415** | **415** |

An ex-post facto research design was adopted for the study as all the variables have already occurred.  The KVK has conducted a total of 415 demonstrations covering 415 villages in Karimnagar district and hence two mandals were selected purposively where KVK, Jammikunta conducted FFS for Demonstration of Rice improved cultivation methods.  From each mandal two villages were selected at random and from each village ten (10) FFS participant and non participant farmers were selected, thus a total of 80 farmers were selected for the study.

Selected profile characteristics – Age, Education, farming experience, farm size, and training received, mass media exposure and extension contact were measured using schedules developed for study. While innovativeness and scientific orientation and Risk orientation were measured by using scale.  The Extent of Knowledge and level of adoption were measured by the schedule developed for the study.

**RESULTS AND DISCUSSION**

**Table 2. Distribution of Respondents based on Profile Characteristics**

| S. No. | Profile characteristics | | Participant (40) | Non- Participant (40) |
|---|---|---|---|---|
| 1. | Age: | | | |
| | Young : (25-36) | | 12 (30) | 8 (20) |
| | Middle : (37-46) | | 21 (53) | 14 (35) |
| | Old : (47-60) | | 7 (17) | 18 (45) |
| | | Mean | 41.90 | 45.12 |
| | | S.D | 10.50 | 9.95 |
| 2. | Farming experience: | | | |
| | Low : (6-11) | | 11(27) | 6(15) |
| | Medium : (12-18) | | 17(43) | 15(38) |
| | High : (19-24) | | 12(30) | 19(47) |
| | | Mean | 15.27 | 17.6 |
| | | S.D | 5.10 | 6.06 |

| S. No. | Profile characteristics | | | Participant (40) | Non- Participant (40) |
|---|---|---|---|---|---|
| 3. | Farm size: | | | | |
| | Marginal : | (up to 2.5 acres) | | 9(23) | 13(33) |
| | Small : | (2.6to 5acres) | | 11(27) | 19(48) |
| | Medium : | (5.1 to10 acres) | | 14(35) | 6(14) |
| | Large : | (>10 acres) | | 6(15) | 2(5) |
| | | | Mean | 5.67 | 4.12 |
| | | | S.D | 3.51 | 2.93 |
| 4. | Mass media exposure: | | | | |
| | Low : | (7-13) | | 6(15) | 11(28) |
| | Medium : | (14-21) | | 24(60) | 20(50) |
| | High : | (20-28) | | 10(25) | 9(22) |
| | | | Mean | 18.70 | 18.17 |
| | | | S.D | 5.33 | 5.65 |
| 5. | Extension contact: | | | | |
| | Low : | (0-10) | | 6(15) | 9(23) |
| | Medium : | (11-22) | | 13(33) | 24(60) |
| | High : | (23-34) | | 21(52) | 7(17) |
| | | | Mean | 20.38 | 18.07 |
| | | | S.D | 7.45 | 6.09 |
| 6. | Innovativeness: | | | | |
| | Low : | (0-4) | | 6(15) | 7(17) |
| | Medium : | (5-8) | | 14(35) | 22(55) |
| | High : | (9-12) | | 20(50) | 11(28) |
| | | | Mean | 8.10 | 6.50 |
| | | | S.D | 3.00 | 2.90 |
| 7. | Scientific orientation: | | | | |
| | Low : | (0-8) | | 6(15) | 10(25) |
| | Medium : | (9-16) | | 18(45) | 16(40) |
| | High : | (17-24 ) | | 16(40) | 14(35) |
| | | | Mean | 13.87 | 15.77 |
| | | | S.D | 4.79 | 8.13 |
| 8. | Risk orientation | | | | |
| | Low : | (0-7) | | 8(20) | 7(18) |
| | Medium : | (8-14) | | 13(33) | 24(60) |
| | High : | (15-20) | | 19(47) | 9(22) |
| | | | Mean | 12.82 | 11.47 |
| | | | S.D | 5.14 | 5.07 |

| S. No. | Profile characteristics | | Participant (40) | Non- Participant (40) |
|---|---|---|---|---|
| 9. | Trainings received: | | | |
| | One training received | | 12(30) | 22(55) |
| | Two  training received | | 20(50) | 14(35) |
| | Three  training received | | 8(20) | 4(10) |
| | | Mean | 1.87 | 1.55 |
| | | S.D | 0.68 | 0.67 |
| 10. | Knowledge: | | | |
| | Low        :    (0-9) | | 5(13) | 8(20) |
| | Medium  :    (10-18) | | 12(30) | 15(38) |
| | Large      :    (19-27) | | 23(57) | 17(42) |
| | | Mean | 18.35 | 15.44 |
| | | S.D | 6.85 | 6.84 |
| 11. | Adoption (0-27): | | | |
| | Low        :    (0-9) | | 10(25) | 9(23) |
| | Medium  :    (10-18) | | 11(28) | 17(43) |
| | Large      :    (19-27) | | 19(47) | 14(34) |
| | | Mean | 16.10 | 15.30 |
| | | S.D | 7.60 | 6.78 |

It could be observed from the Table - 2 that majority (53.00%) of the FFS participant farmers belonged to middle age while majority (45.00%) of the FFS non participant farmers belonged to old age.

The probable reason might be that KVK tried to motivate the middle and young aged farmers involved in farming activities as they are more energetic and enthusiastic towards adoption of innovations and able to adopt the FFS cultivation practices.

The results in Table 2 indicated that, majority of the FFS respondents had medium farming experience (43.00%) while majority of the non FFS respondents had high level of farming experience (47.00%) .Farming experience correlated with the age of the farmers as old farmers had more years of farming experience than the young farmers.

Majority (35.00%) of the FFS respondents were having medium farm holding. In case of the non FFS respondents, majority (48.00%) of them were small farmers.

Majority (52.00%)  FFS farmer's had high extension contact .The probable reason for the above trend might be due to the fact that majority of respondents were educated and frequently contacted different extension functionaries working in public, private and voluntary organizations to share information and to get the advice on technical matters. Majority of non FFS farmers had (60.00%) medium extension contact.

Majority (60.00%) of FFS respondents as well as non FFS respondents (50.00%) had medium mass media exposure.

Majority (50.00%) of the FFS respondents had received medium training. The reason could be their high extension contact with extension functionaries and institutions like KVK with active participation to learn new technologies. Majority (55.00%) of the non FFS respondents had received low level of training. This finding was in line with that of Obaiah (2004).

More exposure to mass media, more number of trainings received and the information sources utilized coupled with educational back ground helped majority of FFS respondents (45.00% medium and 40.00% high) to have good scientific orientation. The non FFS respondents had medium scientific orientation (40.00%) followed by high (35.00%).

50.0 per cent of FFS respondents had high innovativeness. As innovativeness involves risk, most of the farmers afforded to take risk. Generally of farmers adopt technology only after success is established by the other farmers in the village. Hence Extension agencies of KVK worked in harmony with farmers while conducting trainings and during extension contacts they easily convinced the need of innovation. Majority of the non FFS farmers (55.00%) per cent of respondents had medium innovativeness.

Majority (47.00%) of FFS respondents as high risk orintation well as non FFS respondents (60.00%) had medium risk orientation.

With reference to level of knowledge, majority of the FFS respondents (57.00%) were in the high level group, while only 42.0 per cent of non FFS respondents had high level of knowledge. This finding was in line with that of Prasad (2002).

47.0 per cent of FFS farmers were grouped under high level of adoption category. While only 34.0 per cent of Non FFS farmers came under the group.

**Table 3. Item wise analysis of knowledge and adoption of participants and non participants**

| S.No. | Item | Knowledge | | Adoption | |
|---|---|---|---|---|---|
| | | Participant (40) | Non Participant (40) | Participant (40) | Non Participant (40) |
| 1. | Soil Samples collected up to 15-20cm depth in V shape for soil testing. | 38% | 23% | 34% | 19% |
| 2. | Soil test based fertilizers application is economical | 35% | 20% | 31% | 18% |
| 3. | Growing of green manure crop preceding to Rice and incorporate into the soil improves the soil fertility | 37% | 30% | 21% | 11% |
| 4. | Seed Treatment with Pseudomonas bio fungicide reduces the disease incidence in the initial stages of plant growth | 30% | 22% | 19% | 10% |
| 5. | Selection of suitable variety according to the season for obtaining higher yields. | 22% | 18% | 17% | 12% |
| 6. | Spraying of herbicide Cyhalofop butyl 10% solution @ 2 ml /lt of water reduces the weeds of Echinochloa in Nursery | 25% | 19% | 21% | 13% |
| 7. | Application of 1kg Carbofuron granules in paddy nursery before one week of transplantation reduces stem borer and gall midge incidence in early stages of plant growth | 37% | 23% | 34% | 18% |
| 8. | Clipping of leaves before transplantation destroys the eggs of stem borer incidence | 40% | 32% | 40% | 30% |
| 9. | Transplantation of lesser seedlings(2-3) per hill and shallow transplantation facilitates more tillers leads to higher yields | 34% | 30% | 30% | 28% |

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| 10. | Application of Complex Fertilizers at basal and straight fertilizers in split up with recommended doses reduces the pest and disease incidence | 36% | 31% | 32% | 25% |
| 11. | Creation of alley ways help to control BPH | 40% | 32% | 37% | 22% |
| 12. | Weeds can be effectively controlled by using recommended herbicides at 3-5 days after transplanting by keeping a thin film of water in the field | 36% | 32% | 34% | 28% |
| 13. | Mid season drainage is important for obtaining higher yield | 34% | 28% | 26% | 15% |
| 14. | Providing irrigation at critical stages of plant growth i) Panicle initiationii) Dough stage | 38% | 30% | 36% | 25% |
| 15. | Application of biological pesticides is economical and effective in controlling pests | 36% | 20% | 25% | 13% |
| 16. | Use of Bio fertilizers like BGA, Azolla and PSB reduces the usage of N and P fertilizers up to 20% | 34% | 18% | 25% | 9% |
| 17. | Timely management of Zinc deficiency with foliar spray increases the yields | 33% | 25% | 31% | 20% |
| 18. | Application of pesticides based on ETL levels is more economical | 34% | 28% | 24% | 16% |
| 19. | Crop rotation reduces incidence of pests and diseases. | 40% | 32% | 30% | 21% |
| 20. | Last dose of fertilizers applied before panicle initiation reduces pest and diseases | 33% | 25% | 30% | 21% |
| 21. | Application of chemical pesticides as and when damage is observed is more economical and effective | 32% | 25% | 26% | 18% |
| 22. | Removal and destruction of insect disease effected plants by hand picking is more economical and effective | 32% | 22% | 28% | 18% |
| 23. | Installation of pheromone traps is good for monitoring of pests | 40% | 35% | 34% | 28% |
| 24. | Application of urea with neem cake or neem oil reduces the nitrogen loss | 38% | 32% | 29% | 22% |
| 25. | Monocropping of paddy favours pests and disease build up | 35% | 32% | 30% | 28% |
| 26. | Harvesting of paddy need to be done close to the ground level to prevent pest incidence. | 39% | 35% | 37% | 30% |
| 27. | Trimming and plastering of field bunds reduces weeds, insect pests and disease incidence | 38% | 31% | 34% | 26% |

The success of the important intervention of the government lies upon the development of mindset of the farmers as well as the extension staff by recognizing each other as a part of the extension system through regular process of sharing information and knowledge. The success of demonstrations of improved paddy package of practices through FFS were found to be more suitable in increasing the knowledge and adoption level of the farmers.

The Department of Agriculture should involve Farmer clubs, Rythu mithra groups and Adarsha Rythus in awareness building of farmers on FFS in the villages. Field support should be extended to farmers throughout the crop season by field extension workers that can build more confidence among farmers and result in better adoption of technologies and thereby increasing the production and productivity levels in various crops.

## REFERENCES

Obaiah, M. 2004. A study on capacity building of rice growing farmers of Farmers Field Schools (FFS) in Krishna - Godavari zone of Andhra Pradesh. Ph.D. Thesis submitted to Acharya N G Ranga Agricultural University, Hyderabad.

Prasad, C. 2002. A study on the impact of On-Farm Extension Demonstrations (OFEDs) in Rice in Nellore district of Andhra Pradesh. M.Sc. (Ag.) Thesis submitted to Acharya N. G. Ranga Agricultural University, Hyderabad.

# JOB RELATED TENSIONS AMONG SOFTWARE AND NON-SOFTWARE PROFESSIONALS

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## ABSTRACT

Software profession offers an elevated standard of life, but takes tolls on the mental health and relationship aspects of the professionals. The study was designed to find out the difference in job related tensions faced by software and non-software professional with respect to their experience and area of birth. Three hundred subjects with equal distribution from software and non-software profession formed the sample. Job-related tension index (JRTI) was designed to measure employee perception of job-related tensions. Factorial design based upon three different independent variables viz., type of occupation, work experience and area of birth was followed. 2×2×2 analysis of variance (ANOVA) was used for the three independent variables, in case of significant main effects as well as interaction; the ANOVA was supplemented by t-test. According to the results of the study, area of birth had a significant independent effect upon the job related tension of the subjects. Software professionals with less than one year experience belonging to urban area experienced marginally more job related tensions than their non-software professional counterparts and irrespective of the type of occupation, freshers belonging to urban area experienced more job related tensions than experienced urban and rural professionals.

Job related tension is the response people may have when presented with job demands and pressures that are not matched to their knowledge and abilities and which challenge their ability to cope. Job related tensions can precipitate into occupational stressors. And these sources of stressor are elements that causes stress reaction. Job related tensions can be due to organizational aspects, long work hours, lack of organizational support and organizational change (Davey, et al., 2001), lack of support from supervisors and colleagues, and conflict with demands and pressures (Leka. et al., 2004).

Job related tension is a common phenomenon in software profession where time pressed schedules, changing demands of the customer and retooling of the employers occur frequently. The software professionals work under pressure to complete time-bound projects. The job related tensions faced by non-software professionals are bit different from software professionals. Lack of adequate facilities, role over load are some of the common problems faced by non-software professionals Rashidi and Jalbani (2009) studied job stress among software professionals in Pakistan. According to their findings software professional in Pakistan were experiencing a moderate level of stress.

The age group of 21 to 28 years experienced highest stress as compared to their senior colleagues. The prominent segment which reported highest stress was unmarried males in the age group of 25 to 28 years. According to a study conducted by Bhattacharya and Basu (2007), IT profession in Kolkata was not unusually stressful for its incumbents and follows the usual stress model applicable in all other professions. However the findings of the previous research were inconsistent.

The young intelligent population of India is opting for software profession. These jobs are different from traditional secured jobs. There is no research evidence on job related tensions faced by this population. Hence the present investigation was undertaken to study the job related tensions among software and non-software professionals. The objectives of the study are to find out the difference in job related tensions faced by software and non-software professionals with respect to their experience (freshers and experienced), with respect to the area of their birth (rural and urban).

## MATERIALS AND METHODS

The randomly selected sample consisted of 300 subjects: 150 software professional working in

IT companies and 150 non-software professionals working in banks, telecom services and government offices. The 150 sample in each category consisted of 75 freshers with less than one year work experience and 75 with a minimum of five years of work experience. Job-related tension index (JRTI) was designed to measure employee perceptions of job-related tensions. The scale comprised of 15 items asking about the frequency of job-related tension events and the extent of role overload. Responses were obtained on a summated rating scale format ranging from "never" to "always." Higher score indicated higher perceived job-related tensions.

**Hypotheses:** The hypotheses framed to pursue the objectives were

1. There is no difference in the job related tension faced by software and non-software professionals with respect to their work experience.

2. There is no difference in the job related tension faced by software and non-software professionals with respect to the area to which they belong (urban/rural).

**Design and Procedure:** For the purpose of the present investigation, factorial design based upon three different independent variables viz., i) the type of occupation, ii) work experience iii) area to which they belong by birth was followed. The first independent variable viz., type of occupation (A) varied in two ways –non-software(A1) and software(A2); the second independent variable work experience (B) varied in two ways freshers (B1) and experienced (B2); the third independent variable area (C) varied in two ways – Urban(C1) and Rural(C2).

In order to analyze the data, a (2×2×2) analysis of variance (ANOVA) was used for the three independent variables in case of significant main effects as well as interaction; the ANOVA was supplemented by t-test.

**RESULTS AND DISCUSSION**

The results indicate that in case of area, F-ratio 84.57 (Table 1) was significant at. 0.01 level. Area had a significant independent effect upon the job related tension scores of the subjects. In order to interpret this, t-test was applied. The results for the same have been given in Table 2.

**Table 1. Summary of (2×2×2) ANOVA for job related tension (Occupation× Experience × Area)**

| Source of Variation | F-ratios |
|---|---|
| A | 2.27 |
| B | 0.43 |
| C | 84.57* |
| A×B | 0.35 |
| A×C | 0.02 |
| B×C | 0.98 |
| A×B×C | 45.62* |

*Significant at .01 level

**Table 2. Mean and t-ratio of job related tension Scores on Area**

| S.No. | Group | Mean | t-ratio |
|---|---|---|---|
| 1. | C1 | 14.07 | 11.51** |
| 2. | C2 | 7.16 | |

*Significant at .01 level

**Table 3. t-ratios for difference of mean job related tension scores of different combination groups for occupation × experience × area**

|  | Groups | Means | | t-ratios |
|---|---|---|---|---|
| A1 | B1C1 vs. B1C2 | 14.50 | 6.57 | 6.49** |
|  | B2C1 vs. B2C2 | 12.81 | 6.74 | 4.98** |
| A2 | B1C1 vs. B1C2 | 14.64 | 7.52 | 5.83** |
|  | B2C1 vs. B2C2 | 14.32 | 7.78 | 5.36** |

*Significant at .01 level

The t-ratios for difference between job related tension scores were significant (Table 3). All combinations of occupation, experience and area differed significantly on job related tension scores

**Table 4. Group-wise arrangement of mean job related tension scores in descending order for occupation x experience x area**

|  | Groups | Means |
|---|---|---|
| A2 | B1 C1 | 14.64 |
| A1 | B1 C1 | 14.50 |
| A2 | B2 C1 | 14.32 |
| A1 | B2 C1 | 12.81 |
| A2 | B2 C2 | 7.78 |
| A2 | B1 C2 | 7.52 |
| A1 | B2 C2 | 6.74 |
| A1 | B1 C2 | 6.57 |

from one another. The mean scores on job related tension have been arranged in descending order in Table 4.

It is seen that software professionals without experience (freshers) and belonging to urban had the highest job related tension scores. Non-software professionals without experience (freshers) belonging to rural area had the lowest job related tension scores. These results indicated difference in the job related tension of software and non-software professionals existed with respect to the experience and area. Hence, both the null hypotheses stand rejected.

The present study revealed that software professionals faced more job related tensions than non-software professionals. This may be due to the nature of software profession. Most software companies try to extract maximum work out of the candidate. Even though the official working hours are

8-9 hours per day it is usually much more because of unrealistic deadlines set by managers. Additionally many individuals work on weekends to meet deadlines and make their managers happy for a better raise

and job security. On the other hand non-software jobs are with fixed hours of work with pre defined role responsibilities and without unrealistic deadlines.

Lim and Teo (1999) identified factors that generate stress at workplace among IT professionals. He conducted a study among 308 information technology professionals in Singapore and grouped the factors that generate stress at workplace into four broad categories as (i) lack of career advancement related to the problem of high rate of employee turnover (ii) work overload resulting in spillover of workload at home and guilt and dissatisfaction for being less attentive to family (iii) risk taking and decision making consisting of fear of making mistakes and (iv) employee morale and organizational culture related to lack of participation in decisions affecting their work, undue blame for machine failure and difficulty in team work considering the fluid and non-involved nature of work.

Another finding in the present study was that software professionals with less than one year of experience experienced marginally (statistically insignificant) more work related tensions than experienced urban and rural counterparts. This observation though not significant is in the line of the finding of the study by Roshidi and Jalbani (2009), which revealed that the young software professionals in the age group of 21 and 28 years experienced highest stress as compared to their senior colleagues.

The results indicated that professionals from urban background experienced more job related tensions than professionals with rural background. Work and workplace emphasizes many issues related to organizational psychology. Perceived satisfaction on the job is reflected by the needs of sense of fulfillment and expectation for the job to be interesting, challenging and personally satisfying (Smither, 1994).Job satisfaction is also an achievement indicator in career developmental tasks and is associated with the psychological (Limbeat, 2004) and individual well-being (Nassab, 2008). The results of the study that the professionals with urban background experiencing more job related tensions may be attributed to their perceived satisfaction on the job. Professionals with urban and rural background may differ in their expectations from the job and attitude towards work.

From the results of the study it can be summarized that (i) area of birth had a significant independent effect upon the job related tension of the subjects (ii) software professionals with less than one year experience belonging to urban area experienced marginally more job related tensions than their non-software professional counterparts (iii) Irrespective of the type of occupation, freshers belonging to urban area experienced more job related tensions than experienced  urban and rural professionals.

**REFERENCES**

Davey, J., Obst, P and Sheehan, M. 2001. Demographic and workplace characteristics which add to the prediction of stress and job satisfaction within the police workplace. Journal of Police and Criminal Psychology. 16 (1): 29-39.

Leka, S., Griffiths, A and Cox, T. 2004. Work organization and stress, Systematic Problem Approaches For Employers, Managers and Trade Union Representatives. retrieved on 5th June 2011from http://www.who.int/ occupational health Publication/pwh 3rev.pdf.

Limbert, C. 2004. Psychological well – Being and Job satisfaction amongst Military Personnel on Unaccompanied Tours: The Impact of Perceived Social Support and Coping Strategies. retrieved on 5th June 2011 from http://www.who.int/occupational health Publication/pwh 3rev.pdf.

Lim, K. G. V and Teo, T. S. 1999. Occupational stress and IT personnel in Singapore: Factorial dimensions and differential effects. International Journal of Information Management. 19: 227-291.

Nassab, R. 2008. Factors Influencing Job Satisfaction amongst Plastic Surgical Trainees:  Experience from Regional Unit in the United Kingdom. European Journal of Plastic Surgery. 31(2): 55-58.

Smither, R.D. 1994. The Psychology of Work and Human Performance. 2nd Ed. Harper Collins College Publishers. New York. pp – 286.

Sunetra Bhattacharya and Jayanti Basu. 2007. Distress, Wellness and Organizational Role Stress among IT Professionals: Role of Life Events and Coping Resources. Journal of the Indian Academy of Applied Psychology. 33 (92): 196-178.

Zaki Rashidi and Amanat Ali Jalbani. 2009. Job Stress among Software Professionals in Pakistan: A Factor Analytical Study. Journal of Independent Studies And Research (MSSE). 7(1): 1-12.

# INFLUENCE OF BIOFERTILIZERS ON YIELD AND NUTRIENT CONTENT OF SPINACH BEET (*Beta vulgaris*)

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Since the inception of green revolution technologies in India, the modern agriculture is getting more and more dependent upon the chemical fertilizers. Adverse effects on crops are being noticed due to the excessive and imbalanced use of these synthetic inputs. Hence the present research work was carried out to find out the effect of integrated use of biofertilizers, vermicompost and chemical fertilizers (N, P, and K) on yield and nutrient content of spinach beet.

The experiment was conducted in poly bags at College of Agriculture, Rajendranagar, Hyderabad during *rabi* season (2010-11). Experiment was laid out in completely randomized design with 3 replications and 12 treatments. Variety named 'All green' was used in the study. Each poly bag was filled with 8 kg red soil. The recommended fertilizer dose was used for the experiment @ 0.43: 1.25: 0.66 g NPK poly bag$^{-1}$, vermicompost (24g poly bag$^{-1}$) and biofertilizers (nitrogen biofertilizer (NBF) - *Azotobacter* and phosphate solubilizing biofertilizer (PSBF) - *Bacillus*). *Azotobacter* and *Bacillus* cultures were collected from bacterial inoculants laboratory, ARI, Rajendranagar and mixed with farm yard manure (1:10 g poly bag$^{-1}$) and vermicompost (VC) (1:24 g poly bag$^{-1}$).

The treatments consisted of $T_1$ - 100% RDF, $T_2$ - NBF, $T_3$ - PSBF, $T_4$ - NBF + PSBF, $T_5$ - 50% RDF + NBF, $T_6$ - 50% RDF + PSBF, $T_7$ - 50% RDF + NBF + PSBF, $T_8$ – VC, $T_9$ - VC + NBF, $T_{10}$ - VC + PSBF, $T_{11}$ - VC +NBF + PSBF, $T_{12}$ - VC + 50% RDF. The plants were harvested after 30 days (1st picking), 45 days (2nd picking) and 60 days (3rd picking) after sowing. Mean of Yield, vitamin C and mineral contents were given in table since there is no difference among 30, 45 and 60 DAS.

Vitamin C was determined in fresh samples (Ranganna, 1997), calcium and iron contents were determined using Atomic absorption spectro-photometer (AAS) (Singh *et al.,* 1999). The soil collected for experiment was analyzed for microbial population by the standard serial dilution plate count method (Vlassak *et al.,* 1992) before and at the end of the experiment.

Application of 50% RDF + NBF + PSBF recorded higher yield at 30, 45 and 60 DAS over all other treatments. The yield was low at 45 and 60 days after sowing compared to 30 days after sowing. The decrease in yield was significant between 1st and 2nd picking compared to the 3rd picking. The better efficiency of biofertilizers in combination with chemical fertilizers in increasing yield might due to the availability of nutrients at an optimum level due to the microbial activity. Similar findings were also reported by Young *et al.* (2003), 25 per cent increase in lettuce yield with 50 per cent chemical fertilizers with biofertilizers (mixture of *Bacillus* sp. *B. subtilis*, *B. erythropolis*, *B. pumilus* and *Pseudomonas rubiacearum*).

Vitamin C content showed an increase with 50% RDF + NBF + PSBF ($T_7$) followed by 50% RDF + PSBF (table-1). No significant difference was noted among the three pickings at 30, 45 and 60 days after sowing. Also resulted in vitamin C content in spinach cv. balady by use of 50:50 nitrogen mixtures (chemical fertilizer + biofertilizer) by (Al-Moshileh, 2004).

Calcium content was found to be significantly higher with the application of 50% RDF + NBF + PSBF ($T_7$) followed by vermicompost with biofertilizers alone or combined and with 50% RDF ($T_9$, $T_{10}$, $T_{11}$ or $T_{12}$). EL-Assiouty and ABO-Sedera, (2005) reported that highest values (1.46%, 1.42% and 1.39%) of calcium content with 300 g fed$^{-1}$ phosphorein plus 40 kg N fed$^{-1}$ + 15.0 or 7.5 kg $P_2O_5$ fed$^{-1}$ or 300 g fed$^{-1}$ *Azotobacter* inoculum plus 20 kg N + 22.5 kg $P_2O_5$ fed$^{-1}$ respectively in spinach.

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**Table. Influence of biofertilizers, vermicompost and chemical fertilizers on spinach beet yield (g poly bag$^{-1}$), vitamin C (mg 100 g$^{-1}$ fresh weight),**

| Treatments | Yield at 30 DAS | Yield at 45 DAS | Yield at 60 DAS | Sum | Vitamin C | Calcium | Iron | Bacteria ×10$^8$ | Azoto bacter ×10$^4$ | Bacillus ×10$^6$ | Actino mycetes ×10$^4$ | Fungi ×10$^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T$_1$ - Control (100% RDF) | 99 | 84 | 76 | 259 | 23.65 | 126.3 | 1.85 | 15 | 25 | 15 | 12 | 16 |
| T$_2$ - NBF | 75 | 60 | 58 | 193 | 21.31 | 128.7 | 2.15 | 35 | 80 | 75 | 75 | 70 |
| T$_3$ - PSBF | 79 | 58 | 47 | 184 | 19.13 | 128.6 | 1.94 | 40 | 60 | 80 | 55 | 90 |
| T$_4$ - NBF+PSBF | 81 | 65 | 61 | 207 | 22.40 | 128.5 | 2.35 | 80 | 120 | 88 | 50 | 95 |
| T$_5$ - 50% RDF + NBF | 98 | 76 | 71 | 244 | 22.09 | 131.5 | 2.75 | 44 | 85 | 78 | 80 | 98 |
| T$_6$ - 50% RDF + PSBF | 96 | 72 | 70 | 238 | 25.05 | 132.6 | 2.54 | 52 | 72 | 85 | 60 | 90 |
| T$_7$ - 50% RDF + NBF + PSBF | 113 | 88 | 79 | 279 | 28.16 | 135.7 | 3.53 | 85 | 132 | 90 | 93 | 80 |
| T$_8$ - VC | 65 | 49 | 48 | 163 | 21.15 | 125.3 | 1.74 | 70 | 105 | 65 | 67 | 60 |
| T$_9$ - VC + NBF | 66 | 42 | 48 | 156 | 18.98 | 133.5 | 2.64 | 30 | 65 | 70 | 35 | 80 |
| T$_{10}$ -VC + PSBF | 63 | 36 | 50 | 149 | 20.22 | 130.5 | 2.44 | 33 | 60 | 75 | 58 | 70 |
| T$_{11}$ - VC +NBF + PSBF | 71 | 52 | 46 | 168 | 21.16 | 133.5 | 2.95 | 60 | 70 | 80 | 96 | 95 |
| T$_{12}$ - VC +50% RDF | 88 | 77 | 74 | 238 | 23.18 | 132.5 | 3.24 | 45 | 62 | 68 | 62 | 98 |
| Mean | 83 | 63 | 61 | 207 | 22.21 | 130.6 | 2.51 | 46.07 | 73.38 | 67.76 | 57.84 | 73.53 |
| Initial soil microbial population | - | - | - | - | - | - | - | 10 | 18 | 12 | 9 | 14 |
| S Em± | | | 1.09 | - | 0.63 | 0.08 | 0.00 | 1.14 | 1.12 | 1.13 | 1.13 | 1.12 |
| CD at 5% | | | 3.29 | - | 1.90 | 0.25 | 0.02 | 3.43 | 3.36 | 3.39 | 3.39 | 3.36 |

Calcium, Iron (mg 100g$^{-1}$) and soil microbial population (CFU g$^{-1}$ soil).

Iron content was found to be significantly higher with the application of 50% RDF + NBF + PSBF ($T_7$) followed by VC + 50% RDF ($T_{12}$) and with two biofertilizers i.e. NBF and PSBF ($T_4$). Iron content was significantly reduced from the 1st to 3rd picking i.e. on 60 days after sowing. Al-Moshileh (2004) reported that the Fe concentration was found to be higher in spinach cv. balady with 50:50 N-mixture (chemical fertilizer + biofertilizer) applications.

Soil microbial population increased irrespective of the fertilizer applied. Initial bacterial count was $10 \times 10^8$ CFU $g^{-1}$ soil. At the harvest of the crop increase in population varied from 15-85 CFU $g^{-1}$. Maximum *Azotobacter* count was recorded with 50% RDF+NBF+PSBF ($T_7$). *Bacillus* population was higher with addition of 50% RDF+NBF+PSBF ($T_7$) and was on par with NBF+PSBF ($T_4$). Actinomycetes was maximum with VC+NBF+PSBF ($T_{11}$) and was on par with 50% RDF+NBF+PSBF ($T_7$). Fungal population was maximum in 50% RDF+NBF+PSBF ($T_7$) and in VC+50% RDF ($T_{12}$). As compared microbial population was lowest in 100% RDF ($T_1$). Similar build up in microbial population was recorded with application of organic manures (Nedunchezhiyan *et al.*, 2010)) *Azotobactor*, phosphorein (EL-Assiouty and ABO-Sedera, 2005) and PSB (Sundara *et al.*, 2002). High microbial populations in soil correlated with improved soil fertility status/mineral nutrient content, physical and chemical properties (Revathi, 2010).

Application of 50% RDF + NBF + PSBF was found to be more effective on yield, vitamin C, mineral nutrients and soil microbial population over the other treatments. The yield obtained and other parameters analysed in the present study were always more in 50% RDF with biofertilizers compared to 100% RDF indicating the possibility of cost reduction on chemical fertilizers. Biofertilizers treatment always helped in increasing the calcium and iron content in spinach beet. Application of biofertilizers in combination with chemical fertilizers are more effective compared to the recommended chemical fertilizers alone.

## REFERENCES

Al-Moshile, A.M. 2004. Effects of chemical and bio-fertilization on the growth and the chemical constituents of spinach plants. Bulletin of Faculty of Agriculture, Cairo University. 55: 443-458.

EL-Assiouty, F.M.M and ABO-Sedera, S.A. 2005. Effect of bio and chemical fertilizers on seed production and quality of spinach (*Spinacia oleracea* L.). *International Journal of Agriculture and Biology*. 7 (6): 947–952.

Nedunchezhiyan, M., Byju, G and S.N. Dash, N.S. 2010. Effects of organic production of orange fleshed sweet potato (*Ipomoea batatas* L.) on root yield, quality and soil biological health. *International Research Journal of Plant Science*. 1 (6): 136-143.

Ranganna, S. 1997. Manual of analysis of fruit and vegetable products. 9th Edition, Tata Mc Graw Hill, New Delhi.

Revahi, K. 2010. MSc thesis submitted to the Acharya N.G. Ranga Agiculture University, Rajendranagar, Hyderabad-30.

Singh, D., chonkan, P.K and Pandey, R. N. 1999. Soil, plant and water Analysis Manual. Indian Agricultural Research Institute, New Delhi.

Sundara, B., Natarajan, V and Hari, K. 2002. Influence of phosphorus solubilizing bacteria on the change in soil available phosphorus and sugarcane and sugar yields. *Field Crop Research*. 77: 43-49.

Vlassak, K.L., Van Holm and Duchateau, L. 1992. Isolation and characterization of fluorescent *Pseudomonas* associated with the roots of rice and banana grown in Srilanka. *Plant and soil*. 145: 51-63.

Young, C.C., Lai, W.A., Shen, F.T., Hung, M.H., Hung, W.S and Arun, A.B. 2003. Exploring the microbial potentially to augment soil fertility in Taiwan. In Proceedings of the 6th ESAFS International Conference: Soil Management Technology on Low Productivity and Degraded Soils, Taipei, Taiwan. pp. 25-27.

# EFFECT OF SYSTEM OF RICE CULTIVATION, CULTIVARS AND NUTRIENT MANAGEMENT OPTIONS ON DRY MATTER PRODUCTION AND NUTRIENT UPTAKE AT DIFFERENT GROWTH STAGES OF RICE (*Oryza sativa* L.)

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The System of Rice Intensification (SRI) was introduced in India during the year 2000 as a viable alternative of rice cultivation that enhances the productivity while minimizing the inputs. Contrary to this, SRI was also stated as labour intensive, difficult to practice and on par to that of conventional method without any yield advantage (Dobermann, 2003., Islam *et al.*, 2005 and Stoop *et al.*, 2002). The use of manures such as FYM is the nutrient management strategy in SRI. However, under modified conditions, the quantities of the organics/ chemical fertilizers when used alone or in integrated manner have to be determined for achieving potential of the rice crop under SRI vis a vis NTP (Normal transplanting method). Hence the present investigation was undertaken to study the performance of rice entries (one hybrid and one high yielding variety) in relation to methods of planting (SRI and NTP) and nutrient management options determined through dry matter production and nutrient uptake at different growth stages.

The experiment was conducted at the Directorate of Rice Research Farm, Rajendranagar, Hyderabad during the *kharif* 2006. The soil of the experimental site was clayey vertisol in texture with a medium content of organic carbon and nitrogen, high in available phosphorous and potassium and slightly alkaline in reaction (pH 8.2).The experiment was laid out in a split-split plot design replicated thrice with two methods of cultivation (SRI and NTP), two cultivars (PSD-1 and BPT-5204 ) and six nutrient management options (5t FYM ha$^{-1}$ , 10 t FYM ha$^{-1}$, 50 % RDF, 100 % RDF (100: 60:40 N, P$_2$O$_5$, K$_2$O kg ha$^{-1}$), 5 t FYM ha$^{-1}$ + 50 % RDF and 10 t FYM ha$^{-1}$ +50 % RDF).

Seedlings under SRI and NTP were transplanted by adopting a spacing of 25 cm x 25 cm and 20 cm x 10 cm respectively. FYM was applied as per the treatments after field layout and incorporated. Urea, single super phosphate and muriate of potash were used as chemical fertilizers. Entire dose of phosphorous and potassium and one third of nitrogen was applied basally. The remaining nitrogen was top dressed equally at active tillering and panicle initiation stages as per the treatments. Observations on dry matter production at maximum tillering stage, flowering stage and at crop harvest were taken. The plant samples collected for dry matter production were ground and analyzed for N, P and K content adopting standard procedure (N: Microkjeldhal method; P: Molybdophosphoric yellow colour method and K: Flame photometer method). The contents were multiplied with dry matter and uptake was obtained. The data were subjected to statistical analysis as described by Gomez and Gomez (1984).

Normal transplanting resulted in higher dry matter production over SRI at maximum tillering stage (Table 1). As the growth progressed, the differences between normal transplanting and SRI in terms of dry matter accumulation were narrowed down resulting in comparable dry matter production at flowering and crop harvest. Similar results were observed by Wang Shao-hua *et al.* (2002). The nutrient uptake (N, P and K) did not vary between methods at crop harvest following the same trend as that of dry matter accumulation (Table 2, 3). Like wise Krupakar Reddy (2004) and Surekha *et al.* (2007) reported similar results in terms of nutrient uptake. The two cultivars *viz.,* PSD-1 and BPT-5204 had a profound influence wherein greater dry matter production as well as nutrient uptake at flowering and at crop harvest was expressed by the hybrid PSD-1 when compared to BPT-5204. This shows that PSD-1 hybrid is more efficient in acquiring/extracting

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**Table 1. Dry matter production (kg ha$^{-1}$) of rice at different growth stages as influenced by treatments**

| Treatments | Tillering | Flowering | Harvest |
|---|---|---|---|
| **Main plots** | | | |
| SRI | 2087 | 4582 | 10235 |
| NTP | 3039 | 4997 | 10477 |
| SEm ± | 141 | 146 | 67 |
| CD at 5% | 861 | NS | NS |
| **Sub plots** | | | |
| PSD-1 | 2657 | 5009 | 10873 |
| BPT-5204 | 2469 | 4569 | 9839 |
| SEm ± | 68 | 25 | 28 |
| CD at 5% | NS | 100 | 108 |
| **Sub sub plots** | | | |
| 5 t FYM ha$^{-1}$ | 2053 | 4125 | 8924 |
| 10 t FYM ha$^{-1}$ | 2497 | 4789 | 10333 |
| 50 % RDF | 2059 | 3999 | 8672 |
| 100 % RDF | 2743 | 5141 | 11064 |
| 5 t FYM ha$^{-1}$ + 50 % RDF | 2812 | 5044 | 10864 |
| 10 t FYM ha$^{-1}$ + 50 % RDF | 3213 | 5638 | 12277 |
| SEm ± | 105 | 35 | 105 |
| CD at 5% | 300 | 100 | 300 |
| **Main x sub** | NS | NS | S |
| **Sub x subsub** | NS | S | S |
| **Main x subsub** | NS | S | S |
| **Main x sub x subsub** | NS | S | S |

Note : SRI- System of Rice Intensification
NTP – Normal transplanting method
100 % RDF- 100: 60:40 N, P$_2$O$_5$, K$_2$O kg ha$^{-1}$

**Table 2. N uptake (kg ha$^{-1}$) of rice at different growth stages as influenced by treatments**

| Treatments | Tillering | Flowering | At harvest | | |
|---|---|---|---|---|---|
| | | | Grain | Straw | Total |
| Main plots | | | | | |
| SRI | 40.9 | 66.4 | 66.2 | 33.1 | 96.5 |
| NTP | 57.5 | 70.9 | 61.9 | 36.4 | 98.3 |
| SEm ± | 2.4 | 1.8 | 2.4 | 3.3 | 2.8 |
| CD at 5% | 14.8 | NS | NS | NS | NS |
| **Sub plots** | | | | | |
| PSD-1 | 51.3 | 71.9 | 66.5 | 37.4 | 103.9 |
| BPT-5204 | 47.1 | 65.4 | 61.5 | 32.2 | 91.0 |
| SEm ± | 1.4 | 0.5 | 1.0 | 0.9 | 2.4 |

| Treatments | Tillering | Flowering | At harvest | | |
|---|---|---|---|---|---|
| | | | Grain | Straw | Total |
| CD at 5% | NS | 2.0 | 3.9 | 3.4 | 9.4 |
| **Sub sub plots** | | | | | |
| 5 t FYM ha$^{-1}$ | 36.4 | 58.2 | 51.6 | 29.0 | 80.7 |
| 10 t FYM ha$^{-1}$ | 47.5 | 68.4 | 64.6 | 33.8 | 98.4 |
| 50 % RDF | 36.3 | 56.5 | 51.3 | 29.5 | 80.8 |
| 100 % RDF | 55.3 | 73.5 | 68.5 | 37.1 | 105.6 |
| 5 t FYM ha$^{-1}$ + 50 % RDF | 54.8 | 73.1 | 69.2 | 36.8 | 97.7 |
| 10 t FYM ha$^{-1}$ + 50 % RDF | 65.0 | 82.3 | 78.9 | 42.5 | 121.4 |
| SEm ± | 2.0 | 1.1 | 1.3 | 1.1 | 3.9 |
| CD at 5% | 5.8 | 3.1 | 3.7 | 3.1 | 11.1 |
| **Main x sub** | NS | NS | S | NS | NS |
| **Sub x subsub** | NS | NS | NS | NS | NS |
| **Main x subsub** | NS | S | NS | NS | NS |
| **Main x sub x subsub** | NS | S | NS | NS | NS |

**Table 3. P and K uptake (kg ha$^{-1}$) of rice at different growth stages as influenced by treatments**

| Treatments | P uptake | | K uptake | |
|---|---|---|---|---|
| | Flowering | Harvest | Flowering | Harvest |
| **Main plots** | | | | |
| SRI | 16.3 | 24.4 | 64.2 | 87.9 |
| NTP | 17.2 | 24.2 | 69.1 | 93.4 |
| SEm ± | 0.1 | 3.6 | 2.0 | 3.0 |
| CD at 5% | 0.7 | NS | NS | NS |
| **Sub plots** | | | | |
| PSD-1 | 17.6 | 25.9 | 69.7 | 96.1 |
| BPT-5204 | 16.0 | 22.8 | 63.6 | 85.2 |
| SEm ± | 0.4 | 0.6 | 0.2 | 1.1 |
| CD at 5% | 1.6 | 2.3 | 0.9 | 4.5 |
| **Sub sub plots** | | | | |
| 5 t FYM ha$^{-1}$ | 13.5 | 18.9 | 56.4 | 75.5 |
| 10 t FYM ha$^{-1}$ | 16.6 | 23.9 | 66.6 | 89.3 |
| 50 % RDF | 13.2 | 18.3 | 54.8 | 76.7 |
| 100 % RDF | 17.8 | 26.4 | 71.4 | 96.4 |
| 5 t FYM ha$^{-1}$ + 50 % RDF | 18.3 | 26.8 | 71.0 | 95.5 |
| 10 t FYM ha$^{-1}$ + 50 % RDF | 21.3 | 31.8 | 79.8 | 110.6 |
| SEm ± | 0.6 | 1.2 | 0.7 | 1.6 |
| CD at 5% | 1.8 | 3.5 | 2.0 | 4.6 |
| **Main x sub** | NS | S | NS | NS |
| **Sub x subsub** | NS | NS | S | NS |
| **Main x subsub** | NS | NS | S | NS |
| **Main x sub x subsub** | NS | NS | S | S |

nutrients from soil. Significant differences were observed among different nutrient management options. Dry matter production and uptake of N, P and K at all stages of crop growth was higher with the application of 10 t FYM ha$^{-1}$ + 50 % RDF. This was followed by 5 t FYM ha$^{-1}$ + 50 % RDF, 100 % RDF alone and 10 t FYM ha$^{-1}$ alone. Increased N, P and K uptake with conjunctive use of organic source (FYM) with fertilizers might be due to consistent supply of nutrients to the crop and decreased loss of nutrients during decomposition of organic manures. Bharathy (2005) reported similar results.

The two factor interaction between methods of cultivation and cultivars had a significant influence on dry matter accumulation, total P uptake at harvest as well as N uptake by the grain wherein the hybrid PSD-1 performed better compared to BPT-5204. The two factor interaction between methods of cultivation and nutrient management options indicated that there was a marked difference between methods of cultivation only with integrated treatments (FYM @ 5 t ha$^{-1}$ / 10 t ha$^{-1}$ + 50 % RDF) wherein SRI recorded better dry matter production over conventional method indicating the need for integrated use of nutrients for exploiting the yield potential under SRI. The importance of FYM application under SRI was emphasized by Bharathy (2005). The two factor interaction between cultivars and nutrient management options revealed that nutrient management options exhibited similar response as noticed under mean effects. The hybrid PSD-1 performed better than BPT-5204 in terms of dry matter production at flowering and harvest. This shows the superiority of hybrid over high yielding variety over a wide range of levels and sources of nutrients.

Three factor interactions among methods of cultivation, cultivars and nutrient management options affected the dry matter production and N, K uptake from flowering to crop harvest. Overall, highest dry matter and nutrient uptake was recorded by the hybrid PSD-1 with integrated treatment (10 t FYM ha$^{-1}$ + 50 RDF) under normal transplanting method followed by the same combination of cultivar and nutrient management options under SRI.

## REFERENCES

Bharathy, V. E. 2005. Effect of FYM and rotary weeding on crop yield in the System of Rice Intensification (SRI). M.Sc. (Ag.) Thesis submitted to Acharya N. G. Ranga Agricultural University, Hyderabad, India.

Dobermann, A. 2003. A critical assessment of the System of Rice Intensification (SRI). *Agricultural Systems* 79: 261-281.

Gomez, K. A and Gomez, A. A. 1984. Statistical procedure for Agriculture Research. 2$^{nd}$ Ed. John Willey and Sons, New York. pp. 680.

Islam, M.S, Ahmed, G.J.U and Julfiquar, A.W. 2005. Effect of System of Rice Intensification on hybrid rice performance and yield. *International Rice Research Newsletter*. 30 (2): 43-45.

Krupakar Reddy, G. 2004. Varietal performance and spatial requirement of rice under System of Rice Intensification during *kharif* season. M.Sc.(Ag.) Thesis submitted to Acharya N. G. Ranga Agricultural University, Hyderabad, India.

Stoop, W.A., Uphoff, N and Kassam, A. 2002. A review of agricultural research issues raised by the System of Rice Intensification (SRI) from Madagascar: Opportunities for improving farming systems for resource poor farmers. *Agricultural Systems*. 71: 249-274.

Surekha, K., Mahender Kumar, R., Padmavathi, Ch., Latha, P.C., Subba Rao, L.V., Ravindra Babu, V., Prasad, J.S., Srinivas Prasad, M., Muthuraman, P., Rupela, O.P., Vinod Goud, V., Rao, K.V and Viraktamath, B.C. 2007. In: *SRI India 2007 Second National Symposium on System of Rice Intensification (SRI) in India* – Progress and Prospects, Papers and Extended Summaries. Agartala, Tripura - India. 3-5 October 2007. pp. 85-86.

Wang Shao-hua, Cao Weixing, Jiang Dong, Dai Tingbo and Zhu Yan. 2002. Physiological characteristics and high yielding techniques with SRI rice. In: *Assessments of the System of Rice Intensification (SRI)*: Proceedings of an International Conference. Sanya -China. 1 – 4 April 2002. pp.116-124.

# AN EMPIRICAL STUDY ON VARIOUS CAUSES OF CROP HOLIDAY DECLARATION BY RICE FARMERS OF ANDHRA PRADESH: A CASE STUDY IN EAST GODAVARI DISTRICT OF A.P.

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In an innovative way a unique protest surfaced in the coastal area of Andhra Pradesh by the rice growers in the name of crop holiday which resembles the strike by industrial workers. Farmers of the region described this step as most painful but inevitable. Farmers felt that paddy cultivation will land them in more pathetic situation because of negative returns and instead they can maintain no profit no loss situation by keeping their fields fallow. Further, they felt that rice cultivation will help only the millers, middlemen and other people who are indirectly depending on agriculture like the input suppliers.

Crop holiday was first announced by the farmers association of Achanta, a village in West Godavari district of Andhra Pradesh. Interestingly this is the same village where green revolution trials were initially made during 1960's. After that the decision has spread to surrounding villages, mandals and even to other regions of the state like Khammam and Warangal in Telangana region and Kurnool in Rayalaseema region where farmers are very unhappy over rice cultivation.

Presently the campaign has spread to more than 1,20,000 ha and would affect about 1.5 million tonnes of rice in the current year according to Consortium of Indian Farmers Association (CIFA). This quantity is 5 lakh tonnes more than the total government's rice export quota from India whereas the demand for rice in India is projected at 128 million tonnes for the year 2012 and for this it requires a production level of 3,000 kg/ha, significantly greater than the present average yield of 1,930 kg/ha. In this situation even decrease in the total area under rice cultivation would definitely jeopardize the food security of the country severely.

The main reason which triggered the problem was that the farmers were unable to sell their produce as they were denied remunerative price in proportion to the increased cost of cultivation. This increase become very prominent especially after the implementation of NREGS in the area in spite of the mandatory Minimum Support Price (MSP) offered by the government as MSP was calculated at 2007-08 prices and since then there were radical changes in pattern of labour availability and the labour wages with implementation of NREGS which is constantly increasing the coverage of more people and more area and steep rise in prices of various agricultural inputs. In addition to this, about 30 per cent of total produce of last year is still with farmers as a result of this grain quality decreased gradually. Procurement by the government was also decreased because of lack of sufficient storage capacity and poor quality grain brought by the farmer which failed to meet the prescribed quality parameters. This situation was exploited by middlemen and millers. The rice was procured at Rs 650 to 700 / quintal against the mandatory MSP of Rs. 1080 / quintal by showing poor grain quality as an excuse.

The present study was taken up with the main objective of identifying and analyzing the various causes for declaration of crop holiday by paddy farmers, particularly the farmers of coastal region and to suggest the various possible remedies/measures.

Thirty farmers were selected from East Godavari district of Andhra Pradesh who declared crop holiday during Kharif, 2011. From the pre sample survey visits, preliminary data were gathered from the farmers, marketing agencies and the officials of the state engaged in paddy procurement. Various reasons for the crop holiday and appropriate solutions felt by the stake holders of farming, marketing and procurement department were pooled and tabulated. Using a schedule developed for the study, farmers' responses were recorded for each parameter identified. The data were analyzed using Kendall's

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coefficient of concordance (W) test. After processing the data, relevant conclusions were drawn and accordingly various suggestions were made for betterment of the existing situation.

Various causes identified in the preliminary survey were categorized and presented under 8 selected parameters based on their identical nature. The sample farmers were requested to rank each parameter based on the intensity and magnitude.

Kendall's coefficient of concordance (W) test was applied to analyze the collected data. Frequency of ranks assigned to various causes by the sample farmers are presented in table 1. Sum of the ranks assigned to each parameter by the sample farmers are presented in table 2. The test was used to identify the agreement among respondents on the mentioned parameters.

**Table 1. Frequency of the ranks assigned to the various causes by the sample farmers**

| Rank \ Parameter | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1 | 5 | 9 | 1 | 10 | 5 | 0 | 0 | 0 |
| 2 | 3 | 9 | 4 | 4 | 5 | 2 | 1 | 2 |
| 3 | 3 | 1 | 5 | 5 | 4 | 5 | 5 | 2 |
| 4 | 1 | 2 | 1 | 4 | 5 | 5 | 3 | 9 |
| 5 | 2 | 1 | 5 | 1 | 5 | 10 | 3 | 3 |
| 6 | 5 | 2 | 9 | 1 | 3 | 6 | 3 | 1 |
| 7 | 6 | 4 | 3 | 3 | 2 | 1 | 3 | 8 |
| 8 | 5 | 2 | 2 | 2 | 1 | 1 | 12 | 5 |

**Table 2. Sum of the ranks assigned by the sample farmers to each parameter**

| Parameter | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Sum of the rank's($\Sigma Ri$) | 146 ($=c_1$) | 99 ($=c_2$) | 144 ($=c_3$) | 97 ($=c_4$) | 112 ($=c_5$) | 140 ($=c_6$) | 179 ($=c_7$) | 163 ($=c_8$) |

Ranks were given in ascending order, lower is the value higher is the intensity and magnitude of impact. It was shown on graph by subtracting each value from total.

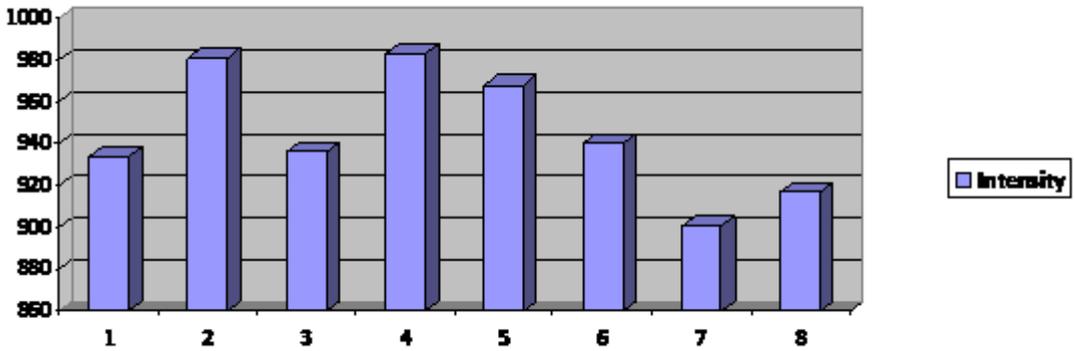$$= c_1 + c_2 + c_3 + c_4 + c_5 + c_6 + c_7 + c_8 = C = 1080$$

On substracting the sum of each rank from the total

$$= C-c_1, C-c_2, C-c_3, C-c_4, C-c_5, C-c_6, C-c_7, C-c_8$$

$$= 934, 981, 936, 983, 968, 940, 901, 917.$$

Obtained values were presented in bar chart.

**Figure-1. Magnitude of impact of each parameter on crop holiday declaration decision**



On substituting the values obtained from tabular analysis in the formula of Kendal's coefficient of concordance test, "W" value was obtained.

$$W = \frac{12 \, \Sigma (Ri - \bar{R})^2}{K^2(N^3 - N)}$$

Where        $\Sigma Ri = 1080$,

$\varnothing = 135$

$\Sigma (Ri - \varnothing)^2 = 6216$

$K = 30$ and

$N = 8$

$$W = \frac{12 \times 6216}{30^2(8^3 - 8)} = 0.16444444$$

Using the W value, $\varnothing^2$ value was calculated to test the significance of the test.

$\varnothing^2 = K(N-1) \, W$ at $(N-1)$ df

$= 30(8-1) \times 0.16444444 = 34.533$

and $\varnothing^2$ table value at á $= 0.05$ with 7 df $= 14.07$

Since the calculated value of $\varnothing^2$ was greater than the table value of 14.07 at 7 df (degrees of freedom) with á $= 0.05$ level, the rankings were significant. The parameters are arranged in descending order of intensity and magnitude.

1. Very less margin between the MSP and actual cost of production.

2. Labour scarcity due to implementation of NREGS in the area.

3. Lack of sufficient storage facility with the farmers.

4. Exploitation by millers and middlemen.

5. Lack of availability of appropriate and sufficient inputs at reasonable prices.

6. Untimely heavy rains, floods and under irrigation.

7. Lack of sufficient and timely credit support from financial institutions.

8. Higher returns from other enterprises like Aquaculture / Coconut farming / Oil palm cultivation in the area.

Very low MSP against the actual cost of cultivation was the most important parameter followed by labor shortage and lack of sufficient storage facility and at the same time, the cause like higher returns from other enterprises in the area viz., Aquaculture, Coconut farming and Oil palm cultivation was given least rank.

From the statistical analysis of the data and personal opinions of the farmers expressed at the time of discussion, various solutions were identified and summarized below.

1. Payment of 50 per cent over the actual cost of cultivation during procurement for continuation of the farming of high cost of cultivation is needed. This is also one of the recommendations of M.S.Swaminathan's committee.

2. Farm operations like transplanting, threshing and harvesting are to be included in NREGS

to mitigate labor shortage and to have a control over cost of cultivation.

3.  Creating sufficient storage space in public and private sectors and construction of village level godowns which are to be owned and operated by gram panchayat and cooperative societies.

4.  Need to develop effective procurement system. In the present situation only small portion of the total production is procured by the government. FCI should be made responsible to procure the entire produce from the farmers (no middlemen / agency be included). Government can also use the women self help groups, farmers cooperatives and other community based organizations for procurement of the paddy in addition to FCI. In states like Punjab and Chhattisgarh, state governments have established efficient systems of procurement and distribution, A.P. government should also move into the system of procuring and going for custom milling rather than procuring through millers.

5.  Decreasing the levy and lifting ban on foreign export of rice for increased demand in the open market. However, in September 2011, the government of India lifted the ban on rice export without any quantitative restriction.

6.  Increasing subsidies for seeds and fertilizers and mechanization process to minimize the labour shortage problem.

7.  Subsidizing Farm labour, if a farm labour is to be paid an amount of Rs. 200, government should pay 50% i.e Rs.100 and rest of the amount be borne by farmers.

8.  Preparation of efficient water distribution plan to improve irrigation water use efficiency.

9.  Providing sufficient and timely credit by the financial institutions.

10. To encourage crop rotation and mixed farming to safeguard the farmer's economic interest.

11. Insurance must cover the costs of storage and economic loss due to deterioration of quality during storage if any, apart from the present system of coverage only till harvest.

## REFERENCES

Ravichandra Prasad C 2002. A study on the impact of on farm extension demonstrations in rice in Nellore district of Andhra Pradesh. M.Sc (Ag) Thesis, Acharya N G Ranga Agricultural University, Hyderabad.

Ahire L M, Sandhya Shenoy and Venugopal Reddy Ch 2007. A study on adoption level of paddy grower of Krishna district of Andhra Pradesh. *Journal of Research ANGRAU* 35(1):73-76.

Agarwal, B.L. 2010. Kendall's rank correlation test. *Programmed statistics*. 2nd Edition Pp:312-317.

http://www.indianfarmers.org/cifa_pages/cropholiday_lettertopm.pdf

http://agrariancrisis.in/2011/09/05/presentation-to-mohan-kandas-committee-on-crop-holiday-in-ap/

# VARIABILITY, ASSOCIATION AND EFFECT OF YIELD RELATED TRAITS IN SUNFLOWER (*Helianthus annuus* L.)

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In the present study, forty five entries of sunflower comprising 43 single cross hybrids and two checks NDSH-1 and DRSH-1 were evaluated during *kharif* 2009 at Regional Agricultural Research Station, Nandyal. All the genotypes were sown in a randomized complete block design with three replications, wherein each replication was represented by three rows of 3 m length for each entry. A spacing of 60 cm between rows and 30 cm within a row was provided. Two to three seeds of each entry were dibbled/hill in furrows at a depth of 2-3 cm. After 15 days, only one healthy seedling per hill was retained by removing remaining seedlings. All other recommended agronomic practices were followed to raise successful experimental crop. Observations were recorded on central row of eight plants for days to 50 per cent flowering, plant height, head diameter,100 seed weight and seed yield per plant and the data was subjected to genetic analysis.

The Analysis of variance revealed (Table1) significant differences among the genotypes for all the five characters studied indicating worth of genetic material under study. The range of variation (Table 2) was found to be maximum for plant height (83.8 – 173.5) followed by seed yield per plant (19.9-51.7) which infers better scope for selection of these traits. Marginally higher magnitude of phenotypic coefficient of variation was noticed than genotypic coefficient of variation which infers low to high role of environment. In the present investigation moderate to low PCV and GCV values were noted. High PCV and GCV were noted for seed yield (26.89 % and 16.17 %) and plant height (17.95 and 15.72). Higher amount of variability was noticed for seed yield per plant supporting the presence of substantial magnitude of genetic

variability in the experimental material of sunflower and better scope for improvement of this trait (Safavi *et al.*, 2011). Moderate level of PCV and GCV was observed for plant height, 100 seed weight and head diameter. Days to 50 per cent flowering has lower PCV and GCV (7.066 and 5.982) values and hence less scope exists for improvement of this trait (Janamma *et al.*, 2008).

Highest heritability was noticed for plant height (76.70) and days to 50 % flowering (72.90), while rest of the traits had low heritability. Johnson *et al.*, (1955) suggested that heritability considered together with genetic advance is more reliable in predicting the effect of selection than heritability alone. High heritability coupled with high GAM was observed for plant height inferring this trait is governed by additive gene action and simple selection is effective and this finding was in agreement with the studies of Sujatha *et al.*, (2002). High heritability coupled with low GAM was noted for days to 50 per cent flowering suggesting selection is ineffective due to high influence of environment. Low heritability and high GAM was observed for seed yield indicates yield is governed by additive gene effects and is highly influenced by favorable environment. However, Sutar *et al.*, (2010) reported high heritability and high genetic advance as per cent of mean for seed yield. Low heritability coupled with low GAM was found in traits head diameter and 100 seed weight.

Existence of wider range, high PCV and GCV, low heritability and high GAM were noticed for seed yield per plant implies the existence of better scope for variability, high influence of favourable environment, additive gene action and effectiveness of selection procedure.

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**Table 1. Analysis of variance for yield and component characters**

| Character | Mean sum of squares | | |
|---|---|---|---|
| | Replications (1 df) | Genotypes (44 df) | Error 44 df |
| Days to 50 % flowering | 13.61 | 23.19** | 3.64 |
| Plant height (cm) | 120.18 | 936.4** | 123.6 |
| Head diameter (cm) | 0.174 | 4.543** | 1.951 |
| 100 Seed weight (g) | 2.153 | 0.959** | 0.547 |
| Seed yield per plant (g) | 33.8 | 115.4** | 54.12 |
| Seed yield per plant (g) | 33.8 | 115.4** | 54.12 |

**Table 2. Genetic variability for different parameters in sunflower**

| Character | Mean | Range | | PCV (% | GCV (%) | Herita bility (%) | GAM |
|---|---|---|---|---|---|---|---|
| | | Min. | Max. | | | | |
| **Days to 50 % flowering** | 59.00 | 44.50 | 59.00 | 7.066 | 5.982 | 72.90 | 10.523 |
| **Plant height (cm)** | 173.75 | 83.80 | 173.50 | 17.948 | 15.717 | 76.70 | 28.352 |
| **Head diameter (cm)** | 15.57 | 9.80 | 16.40 | 13.257 | 8.375 | 39.90 | 10.899 |
| **100 Seed weight (g)** | 7.14 | 4.80 | 7.70 | 14.914 | 7.805 | 27.40 | 8.414 |
| **Seed yield per plant (g)** | 44.63 | 19.90 | 51.70 | 26.886 | 16.167 | 36.20 | 20.026 |

PCV: Phenotypic co-efficient of variation,    GCV : Genotypic co-efficient of variation

GAM : Genetic advance as per cent of mean

**Table 3. Correlation coefficients for seed yield and its related traits**

| | Days to 50 % flowering | Plant height (cm) | Head diameter (cm) | 100 seed weight (g) | Seed yield/ plant (g) |
|---|---|---|---|---|---|
| **Days to 50 % flowering** | 1.000 | | | | |
| **Plant height (cm)** | 0.7821** | 1.000 | | | |
| **Head diameter cm)** | 0.9024** | 0.8679** | 1.000 | | |
| **100 seed weight (g)** | 0.6491** | 0.6689** | 0.3802** | 1.000 | |
| **Seed yield/plant (g)** | 0.7312** | 1.0036** | 0.9448** | 0.4385** | 1.000 |

**Table 4. Direct and indirect effects for seed yield and its related traits**

|  | Days to 50 % flowering | Plant height (cm) | Head diameter (cm) | 100 seed weight (g) | Seed yield/ plant ($r_g$) |
|---|---|---|---|---|---|
| **Days to 50 % flowering** | **-0.2781** | -0.2175 | -0.251 | -0.1805 | **0.7312**[**] |
| **Plant height (cm)** | 0.8215 | **1.0505** | 0.9117 | 0.7027 | **1.0036**[**] |
| **Head diameter (cm)** | 0.3332 | 0.3205 | **0.3692** | 0.1404 | **0.9448**[**] |
| **100 seed weight (g)** | -0.1454 | -0.1499 | -0.0852 | **-0.224** | **0.4385**[**] |

Considering association analysis between a pair of characters at genetic level (Table 3), plant height recorded maximum correlation with seed yield followed by head diameter. In turn these traits were also strongly intercorrelated (0.8679). Similar finding was reported by Lawrence and Shaik Mohammad., (1993). Among yield component characters, days to 50 % flowering and head diameter has strong association (0.9024) followed by plant height and head diameter (0.8679). Since all associations are in desirable direction, these aid in easy selection with desirable characters.

The path analysis (Table 4) showed that plant height has higher magnitude of direct effect on seed yield (1.0505). Thus, the character plant height which showed high positive correlation and high direct effect with seed yield had a high influence on seed yield. The direct effect of head diameter on seed yield/ plant was found to be low in magnitude (0.3692) and its indirect effect through plant height (0.9117) proved to be chief cause of high positive genotypic correlation with seed yield (0.9448). Hundred seed weight and days to 50 per cent flowering had significant positive correlation with seed yield (0.7312 and 0.4385) but the path coefficient analysis revealed a negative direct contribution (-0.2781 and -0.2224). On contrary, Yasin and Singh (2010) reported positive direct effect of head diameter and 100 seed weight with seed yield. The significant positive association with seed yield was owing to its indirect contribution mainly through plant height (0.8215, 0.7027) and head diameter (0.3332 and 0.1404).

## REFERENCES

Janamma, P., Farzana Jabeen and Ranganatha, A. R. G. 2008. Genetic variability in sunflower (*Helianthus annuus* L.) genotypes. Journal of Oilseeds Research. **25** (1) : 73-74.

Johnson, H. W., Robinson, H. F and Comstock, R. E. 1955. Estimates of genetic and environmental variability in soybeans. Agronomy Journal. **47**: 314-318.

Lawrence, M and Shaik Mohammad. 1993. Character association and path analysis of certain quantitative characters in sunflower (*Helianthus annuus* L.). Journal of Oilseeds Research **10** (1): 124-126.

Safavi, S. M., Safavi, A. S and Safavi, S. A. 2011. Heritability and genetic gain of some morphological traits in sunflower (*Helianthus annuus L.*). American Journal of Plant Sciences. **19** : 27-31.

Sujatha, H. L., Chikkadevaiah and Nandini. 2002. Genetic variability study in sunflower Inbreds. Helia. **25** (37) : 93-100.

Sutar, D. S., Ghodke, M. K and Pole, S. P. 2010. Genetic variability and genetic advance in sunflower *(Helianthus annuus L.).* Journal of Oilseeds Research. **27** (1): 55-56.

Yasin, A. B and Singh, S. 2010. Correlation and path coefficient analyses in sunflower. Journal of Plant Breeding and Crop Science. **2** (5) : 129-133 .

# GENE ACTION AND COMBINING ABILITY FOR QUANTITATIVE TRAITS IN RICE
## (*Oryza sativa .L*)

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Genetic components of variation were estimated for yield, its components and quality traits through Griffing's approach of 8 x 8 diallel set. The yield components *viz.,* plant height, panicle length and 1000-grain weight were under the influence of additive gene action, while the remaining traits *viz.,* days to 50% flowering, panicle weight, productive tillers plant[-1], grain yield and kernel quality traits were governed by non additive (dominance and epistatis) gene actions. The parents *viz.,* JGL 3855, JGL1881 for plant height and days to 50% flowering, WGL 32100 and NLR 34452 for effective tillers, White ponny for panicle length, JGL 3844 and 7046 for panicle weight, MTU 4870 for 1000 grain weight, White ponny and JGL 7046 for grain yield, JGL 1881 and JGL 7046 for kernel length and L/B ratio and NLR 34452 and WGL 32100 for kernel breadth were identified as good general combiners. The promising crosses with parents of high x high gca effects *viz.,* JGL 1881 x White ponny and JGL 7046 x White ponny for 1000 grain weight, JGL 3844 x MTU 4870 for panicle weight and WGL 32100 x JGL 7046 for effective tillers are recommended for yield improvement through progeny selection. In case of other promising crosses which were in the category of high x low combination of general combiners, mass selection with recurrent random mating in early segregating generations could be a perspective breeding technique.

Rice is the preferred staple food for more than one-half of the world's population. Hence concerted efforts are always required for breaking yield barriers in this crop so as to feed the rapidly growing population. In Northern Telangana Zone of Andhra Pradesh state, incidence of gall midge at initial stages of the crop and blast at flowering stage is one of the main reasons of yield losses.

As such, in this zone the main focus will be towards development of high yielding cultivars with resistance to gall midge and blast in addition to good kernel characteristics with quality Success of any plant breeding programme depends on the choice of right type of genotypes as parents in the hybridization programme. The combining ability studies of the parents and their crosses provide information for the selection of high order parents for effective breeding besides, depicting complete picture on two genetic components of variance *viz.,* additive and dominance variance, which ultimately facilitates adoption of a correct breeding strategy to bring out genetical improvement in the target traits. Among the different methods available to assess the nature and magnitude of gene action for each character, the diallel cross techniques (Griffing, 1956) is a systematic and effective method. With this view, the present study was envisaged after careful selection of the parents from the gene bank available at Regional Agricultural Research Station, Jagtial.

The material consisted of eight divergent parents whose specific features are described below.

*Warangal Sannalu (WGL 32100):* A across derivative of Divya/ BPT-5204 with medium duration (135 days) and medium slender grains. It is resistant to gall midge.

*JGL 3855 (Pre-release):* Derived from cross, BPT-5204/ARC 5984//Kavya is a gall midge resistant culture with dark green foliage, more responsive to fertilizer with cold tolerance (at vegetative stage). Possessing excellent (superfine) grain characteristics, attains maturity in 135 days.

**Jagtial Samba (JGL 3844):** A cross derivative of BPT 5204/ ARC 5984// Kavya, with 120 duration and resistance to gall midge. It has medium slender grains

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with excellent panicle exertion (2-4 cm above flag leaf ) and high yield potential.

**JGL 7046 (Pre-release):** Selected from a cross, JGL 384/ Vajram is a very high yielding medium duration variety with medium bold grains.

**JGL 1881 (Pre-release):** Derived from BPT-5204/ Kavya cross, has long slender grains and multiple biotype resistance for gall midge.

**Deepti (MTU 4870):** Derived from the cross, Sowbhagya/ ARC 6650. It is a long duration (145 days) variety with resistance to BPH and medium slender type grains.

**NLR 34452 :** Selected from cross, IR 72/ BPT 5204. It is a short duration variety with medium slender grains possesses resistance to blast.

**White ponny:** Possessing medium slender grains with excellent cooking quality.

All possible 28 crosses (excluding reciprocals) were made during wet *(kharif)* season *2004* and the resultant $F_1$s along with their parents were grown during post rainy (*rabi*) season, 2004-05 in a randomized complete block design with three replications at Regional Agricultural Research Station, Jagtial located in Karimnagar district of Andhra Pradesh. Each parent and F1 was represented by 2 rows in each replication with a spacing of 20 x 20 cm and the crop management practices were followed as recommended by ANGRAU. Observations were recorded on ten randomly selected competitive plants in each replication for seven yield characters *viz.,* days to 50% flowering, plant height, ear bearing tillers plant[-1], panicle length, panicle weight, 1000- grain weight and grain yield plant[-1] and there quality characters *viz.,* kernel length, kernel breadth and length / breadth ratio. A statistical procedure as developed by Griffing (1956) was followed for genetic component analysis.

Analysis of variance for combining ability revealed significant differences between the genotypes evaluated. Mean squares due to GCA and SCA were highly significant, which indicated presence of sufficient variability in the experimental material (Table 1). Variance due to GCA in comparison to that of SCA was high for plant height, panicle length and 1000-grain weight indicating the preponderance of additive gene action for these traits, while *vice versa* with respect to other traits confirmed greater role of non-additive (dominance and epistatis) gene actions. Similar results were observed earlier by Shanti *et al* (2003) for plant height and 1000-grain weight; Sharma and Mani (2008) for days to 50% flowering and panicle length, Salgotra *et al* (2009) for productive tillers and grain yield plant[-1] and Saravanan *et al* (2006) for kernel length and length/ breadth ratio.

The GCA is generally attributed to additive effects of genes and fixable (Spraque and Tautum, 1942). Hence selection of parents based on GCA effects is of great importance in plant breeding. Character wise estimation of mean and GCA effects for yield and quality characters of parents are presented in Table 2. All the parents with significant negative GCA effects for days to 50% flowering, plant height and kernel breadth and with significant positive GCA effects for remaining characters are considered as good general combiners. Accordingly, parents *viz.,* JGL 3855, JGL 1881 for plant height and days to 50% flowering, WGL 32100 and NLR 34452 for effective tillers, White ponny for panicle length, JGL 3844 and JGL 7046 for panicle weight, MTU 4870 for 1000 grain weight, White ponny and JGL 7046 for grain yield, JGL 1881 and JGL 7046 for kernel length and L/B ratio and NLR 34452 and WGL 32100 for kernel breadth were identified as good general combiners. There was good correlation between *per se* performance of the parents and their GCA effects.

Specific combining ability (SCA) effects and mean values of different cross combinations are presented in Table 3. The cross combinations showing desirable SCA effects for days to 50% flowering (earliness) were JGL 3855 x JGL 1881 and JGL 7046 x JGL 1881. For plant height negative estimates of SCA are desirable and the promising crosses were WGL 32100 x JGL 3855 and JGL 3855 x JGL x JGL 1881. High negative SCA effects associated with these crosses are mostly attributed to high proportion of negative genes in fixable (additive) state, as their parents mostly had negative x negative or negative x low positive GCA effects. As such, they would be useful to isolate homozygous lines with earliness / dwarfness.

Among the yield contributing characters, effective tillers plant[-1] is very important. Hence, breeders always aim for higher productive tillers especially when dwarf genotypes are cultivated under good management practices. Out of 28 crosses, 4 crosses (WGL 32100 x JGL 7046, WGL 32100 x JGL 3844, JGL 3844 x MTU 4870 and JGL 7046 x JGL 1881) were identified as superior ones based on high SCA effects and *per se* performance. These cross combinations except WGL 32100 x JGL 7046 involved parents with GCA effects of high x low and low x high indicating mostly additive x dominant type of gene interaction. The superiority of other cross (WGL 32100 x JGL 7046), which resulted due to high x high GCA combination can be better exploited for developing pure lines with profuse tillering. As the phenotypic expression was attributed to additive x additive type gene action.

The other components, which influence final yield are panicle length and panicle weight. The crosses *viz.,* JGL 1881 x NLR 34452 and WGL 32100 x JGL 3844 for panicle length and JGL 3855 x White ponny, JGL 3844 x MTU 4870 and JGL 3855 x MTU 4870 for panicle weight and possessing at least one parent with high GCA were identified as good specific combiners. The resultant high SCA and *per se* was mostly due to presence of additive x dominance type of interaction. One cross combination (JGL 1881 x NLR 34452) with low x low gca category and possessing high SCA for panicle length has suggested that epistatic gene action may be due to genetic diversity in the form of heterozygous loci (Pradhan and Singh, 2008).

Inheritance of 1000 grain weight was largely under the influence of additive genetic effects and the superior crosses identified for progeny selection were JGL 3844 x White ponny ( low x high), JGL 1881 x White ponny ( high x high) and JGL 7046 x White ponny ( high x high).

Grain yield is the ultimate result, which is dependent on its component characters. Grafius (1959) suggested that there would be no separate gene system for yield *per se* and yield is the end product of multiplicative interaction between yield and its components. Interestingly, the parents *viz.,* White ponny and JGL 7046 with high gca effects for yield also exhibited high gca and *per se* for other five yield

components. Similarly, few crosses with high sca and *per se* performance (JGL 7046 x JGL 1881, JGL 3855 x JGL 7046, JGL 3844 x MTU 4870 and WGL 32100 x JGL 3844) for grain yield also possessed high sca effects at least for two or three component traits. The superior cross combinations for yield were obtained due to crossing with at least one parent having high gca and high mean value. Good performance of such crosses with high x low or low x high gca parents is attributed to additive x dominance type of interaction. Such crosses could produce good segregants only if the additive genetic effect in the other act in the same direction to maximize the desirable plant attributes (Singh and Choudary 1995).

With respect to the quality trait, kernel length four crosses *viz.,* JGL 3855 x NLR 34452, WGL 32100 x NLR 34452, NLR 34452 x White ponny and JGL 3844 x NLR 34452 registered high sca effect as well as *per se* performance. In all these crosses, NLR 34452 was one of the parent. These crosses involved the parents with low x low gca effects and the superior performance was due to non additive (dominance and epistatis) genetic effects. Only one cross combination was identified for its superiority for kernel breadth and L/B ratio which was under non additive gene action was MTU 4870 x NLR 34452.

A perusal of above results indicated that the superior crosses with parents of high x high gca effects *viz.,* JGL 1881 x White ponny and JGL 7046 x White ponny for 1000 grain weight, JGL 3844 x MTU 4870 for panicle weight and WGL 32100 x JGL 7046 for effective tillers are recommended for yield improvement through progeny selection, as they were chiefly under the governance of additive and additive x additive type of genetic effects, which are fixable in nature (Singh *et al.*, 1971). In case of other promising crosses which were in the category of high x low combination of general combiners, the expression of high positive sca effects may be due to the dominant x recessive reaction, expected to produce desirable segregants in subsequent generations ( Langham, 1961). For quality traits, the good crosses involved average or poor general combiners as their parents, indicating that sca effect of crosses does not depend upon gca effects of their parental lines. It may be due to differential expression of component traits in specific back ground or may

**Table 1. Analysis of variance for combining ability in 8 x 8 diallel set**

| Source | D.f | Mean sum of squares | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | Days to 50% flowering | Plant height | Panicle length | Panicle weight | Productive tillers plant$^{-1}$ | 1000 grain weight | Grain yield plant$^{-1}$ | Kernel length | Kernel breadth | Kernel L/B ratio |
| Replications | 2 | 0.11 | 6.33 | 0.64 | 0.03 | 0.68 | 0.03 | 8.39 | 2.17 | 0.19 | 0.002 |
| Genotypes | 35 | 231.66** | 803.24** | 6.52** | 1.67** | 8.71** | 12.23** | 109.81** | 0.10** | 0.02** | 0.103** |
| Parents | 7 | 103.32** | 791.21** | 8.32** | 0.77** | 1.69 | 21.35** | 86.96** | 0.18** | 0.04** | 0.184** |
| Hybrids | 27 | 273.33** | 836.01** | 6.29** | 1.93** | 10.67** | 9.71** | 115.60** | 0.08** | 0.02** | 0.086** |
| Parents vs Hybrids | 1 | 5.00** | 2.88 | 0.108 | 1.03** | 4.77* | 16.46** | 113.57** | 0.02 | 0.0001 | 0.023 |
| GCA | | 141.49** | 1170.31** | 7.98** | 1.18** | 3.33** | 16.34** | 35.96** | 0.07** | 0.026** | 0.088** |
| SCA | | 61.15** | 42.10** | 0.71** | 0.40** | 2.79** | 1.01** | 36.76** | 0.02** | 0.002** | 0.021** |
| GCA variance | | 14.12 | 116.83 | 0.77 | 0.11 | 0.30 | 1.63 | 3.46 | 0.006 | 0.003 | 0.008 |
| SCA variance | | 60.92 | 40.10 | 0.49 | 0.37 | 2.51 | 0.99 | 35.42 | 0.016 | 0.004 | 0.013 |
| gca/ sca | | 0.23 | 2.91 | 1.57 | 0.29 | 0.11 | 1.64 | 0.09 | 0.375 | 0.75 | 0.615 |
| Error | 70 | 0.69 | 6.01 | 0.68 | 0.09 | 0.84 | 0.05 | 4.00 | 0.02 | 0.002 | 0.024 |

** significant at 1% level, * significant at 5% level

**Table 2. Mean and GCA effects of parents in 8 x 8 diallel set.**

| Trait | Days to 50% flowering | | Plant height | | Panicle length | | Panicle weight | | Productive tillers plant⁻¹ | | 1000 grain weight | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | μ | gca | μ | gca | μ | gca | μ | gca | μ | gca | μ | gca |
| WGL-32100 | 109.66 | 5.242** | 83.66 | -6.083** | 21.86 | -0.598** | 3.49 | -0.514** | 10.73 | 0.637** | 12.33 | -1.543** |
| JGL-3855 | 109.66 | -6.725** | 86.33 | -10.250** | 23.60 | -0.718** | 4.040 | -0.178** | 9.73 | -0.990** | 12.33 | -1.276** |
| JGL-3844 | 104.66 | -0.15 | 96.33 | 0.450 | 24.80 | 0.688** | 4.21 | 0.378** | 10.40 | -0.333** | 13.63 | -0.539** |
| JGL-7046 | 114.66 | 1.008** | 97.00 | 0.817 | 24.80 | 0.675** | 4.93 | 0.789** | 11.33 | 0.377* | 15.36 | 0.207** |
| JGL-1881 | 117.00 | -2.658** | 93.66 | -7.683** | 24.93 | -0.672** | 4.67 | 0.080 | 10.66 | 0.123 | 16.93 | 1.054** |
| MTU-4870 | 119.33 | 4.108** | 96.33 | 2.150** | 22.86 | 0.355* | 3.61 | 0.239** | 11.20 | -0.600** | 19.93 | 2.404** |
| NLR-34452 | 104.66 | 0.308* | 81.00 | -3.850** | 24.00 | -1.125** | 3.91 | -0.465** | 11.80 | 0.463** | 13.53 | -0.439** |
| White ponny | 104.66 | -1.12** | 133.00 | 24.450** | 21.33 | 1.395** | 3.74 | 0.172** | 9.66 | 0.323** | 12.86 | 0.131** |

Cont….2nd table

| Trait | Grain yield plant[-1] | | Kernel length | | Kernel breadth | | Kernel L/B ratio | |
|---|---|---|---|---|---|---|---|---|
| | μ | gca | μ | gca | μ | gca | μ | gca |
| WGL-32100 | 16.00 | -2.023** | 4.23 | -0.100** | 1.12 | -0.036** | 3.33 | 0.003 |
| JGL-3855 | 27.06 | -1.050** | 4.24 | -0.064* | 1.24 | -0.034** | 3.42 | 0.034 |
| JGL-3844 | 24.93 | 1.010** | 4.25 | -0.076** | 1.30 | 0.012 | 3.27 | -0.088 |
| JGL-7046 | 26.00 | 1.643** | 4.37 | 0.048 | 1.31 | -0.011 | 3.32 | 0.058* |
| JGL-1881 | 16.40 | -1.697** | 4.59 | 0.136** | 1.30 | -0.003 | 3.53 | 0.109** |
| MTU-4870 | 17.73 | 0.030 | 4.39 | 0.091** | 1.58 | 0.119** | 2.79 | -0.188** |
| NLR-34452 | 13.46 | -1.323** | 3.74 | -0.056* | 1.26 | -0.040** | 2.90 | 0.050 |
| White ponny | 24.53 | 3.410** | 4.30 | 0.021 | 1.27 | -0.006 | 3.37 | 0.023 |

** significant at 1% level, * significant at 5% level

**Table 3. Mean (μ), specific combining ability (sca) effects in 8 x 8 diallel set**

| S.No. | Cross combination | Days to 50 % flowering | | Plant height | | Panicle length | | Panicle weight | |
|---|---|---|---|---|---|---|---|---|---|
| | | μ | sca | μ | sca | μ | sca | μ | sca |
| 1 | WGL 32100xJGL 3855 | 108.00 | -0.656 | 67.00 | -12.278** | 21.00 | -1.341** | 2.62 | -0.944** |
| 2 | WGL 32100xJGL 3844 | 119.00 | 3.778** | 97.00 | 7.022** | 25.00 | -1.253** | 4.63 | 0.510** |
| 3 | WGL 32100xJGL7046 | 117.67 | 1.278** | 94.33 | 3.989** | 24.13 | 0.399 | 3.98 | -0.057 |
| 4 | WGL 32100xJGL 1881 | 134.67 | 21.944** | 75.33 | -6.511** | 21.67 | -0.721 | 3.90 | 0.071 |
| 5 | WGL 32100xMTU 4870 | 118.67 | -0.822 | 93.00 | 1.322 | 23.80 | 0.386 | 4.00 | 0.019 |
| 6 | WGL 32100xNLR 34452 | 112.67 | -3.022** | 87.67 | 1.989 | 22.40 | 0.466 | 2.84 | -0.444** |
| 7 | WGL 32100xWhite ponny | 113.67 | -0.589 | 118.00 | 4.022** | 25.20 | 0.746 | 4.24 | 0.326* |
| 8 | JGL 3855xJGL 3844 | 102.33 | -0.922* | 81.00 | -4.811 | 23.27 | -0.361 | 4.24 | -0.219 |
| 9 | JGL 3855xJGL 7046 | 97.00 | -7.422** | 83.00 | -3.178* | 23.47 | -0.147 | 4.73 | 0.360* |
| 10 | JGL 3855xJGL 1881 | 88.00 | -12.756** | 69.33 | -8.344** | 20.33 | -1.934** | 2.70 | -1.456** |
| 11 | JGL 3855xJGL 4870 | 101.67 | -5.856** | 86.33 | -1.178 | 23.53 | 0.239 | 5.19 | 0.866** |
| 12 | JGL 3855xNLR 34452 | 103.67 | -0.056 | 85.00 | 3.489** | 22.27 | 0.453 | 3.70 | 0.080 |
| 13 | JGL 3855xWhite ponny | 104.00 | 1.711** | 113.67 | 3.856** | 24.67 | 0.333 | 5.29 | 1.040** |
| 14 | JGL 3844xJGL 7046 | 116.67 | 5.678** | 98.67 | 1.789 | 25.20 | 0.179 | 5.04 | 0.111 |
| 15 | JGL 3844xJGL 1881 | 100.33 | -6.989** | 84.33 | -4.044** | 23.67 | -0.007 | 4.69 | -0.024 |
| 16 | JGL 3844xMTU 4870 | 116.33 | 2.244** | 95.00 | -3.211* | 24.13 | -0.567 | 5.87 | 0.997** |
| 17 | JGL 3844xNLR 34452 | 112.00 | 1.711** | 91.67 | -0.544** | 23.07 | -0.154 | 4.03 | -0.143 |
| 18 | JGL 3844xWhite ponny | 113.67 | 4.811** | 124.67 | 4.156** | 25.87 | 0.126 | 5.18 | 0.371* |
| 19 | JGL 7046xJGL 1881 | 98.33 | -10.156** | 79.67 | -9.078** | 23.00 | -0.661 | 5.17 | 0.542** |
| 20 | JGL 7046xMTU 4870 | 114.00 | -1.256** | 97.33 | -1.244 | 25.07 | 0.379 | 4.23 | -0.558** |
| 21 | JGL 7046xNLR 34452 | 115.33 | 3.878** | 94.33 | 1.756 | 23.40 | 0.193 | 3.77 | -0.317 |
| 22 | JGL 7046xWhite ponny | 113.00 | 2.978** | 127.33 | 6.456** | 25.53 | -0.194 | 4.45 | -0.267 |
| 23 | JGL 1881xMTU 4870 | 106.67 | -4.922** | 93.33 | 3.256* | 24.33 | 0.993* | 4.97 | 0.394* |
| 24 | JGL 1881xNLR 34452 | 105.00 | -2.789** | 86.67 | 2.589* | 23.47 | 1.606** | 3.58 | -0.298* |
| 25 | JGL 1881xWhite ponny | 97.67 | -8.689** | 107.67 | -4.711** | 24.00 | -0.309 | 4.78 | 0.264 |
| 26 | MTU 4870xNLR 34452 | 122.00 | 7.444 | 95.67 | 1.756 | 21.53 | -1.354** | 4.30 | 0.262 |
| 27 | MTU 4870xWhite ponny | 114.33 | 1.211** | 128.67 | 6.456** | 26.07 | 0.659 | 4.95 | 0.276 |
| 28 | NLR 34452xWhite ponny | 114.33 | 5.011** | 119.00 | 2.789* | 22.87 | -1.061* | 3.67 | -0.300 |

| S.No. | Cross combination | Productive tillers plant⁻¹ | | 1000 grain weight | | Grain yield plant⁻¹ | | Kernel length | | Kernel breadth | | Kernel L/B Raio | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | μ | sca | μ | sca | μ | sca | μ | sca | μ | sca | μ | sca |
| 1 | WGL 32100xJGL 3855 | 10.67 | -0.065 | 11.40 | -1.129** | 9.93 | -9.679** | 3.83 | -0.254** | 1.22 | -0.030 | 3.14 | -0.127 |
| 2 | WGL 32100xJGL 3844 | 13.47 | 2.078** | 13.13 | -0.132 | 28.60 | 6.928** | 3.85 | -0.215** | 1.27 | -0.026 | 3.03 | -0.112 |
| 3 | WGL 32100xJGL7046 | 14.67 | 2.568** | 13.57 | -0.446** | 21.20 | -1.105 | 4.26 | 0.067 | 1.27 | -0.003 | 3.35 | 0.069 |
| 4 | WGL 32100xJGL 1881 | 13.20 | 1.355** | 15.23 | 0.374** | 21.93 | 2.968* | 4.26 | -0.020 | 1.27 | -0.011 | 3.35 | 0.015 |
| 5 | WGL 32100xMTU 4870 | 8.13 | -2.989** | 16.23 | 0.024 | 16.13 | -4.559** | 4.25 | 0.018 | 1.37 | -0.030 | 3.09 | 0.052 |
| 6 | WGL 32100xNLR 34452 | 11.13 | -1.052** | 14.27 | 0.901** | 20.80 | 1.461 | 4.26 | 0.175* | 1.26 | 0.019 | 3.38 | 0.100 |
| 7 | WGL 32100xWhite ponny | 13.40 | -1.356** | 14.20 | 0.264* | 33.33 | 9.261** | 4.02 | -0.149* | 1.32 | 0.042 | 3.05 | -0.206** |
| 8 | JGL 3855xJGL 3844 | 6.27 | -3.498** | 13.63 | 0.101 | 13.07 | -9.579** | 3.79 | -0.318** | 1.26 | -0.038 | 2.99 | -0.180* |
| 9 | JGL 3855xJGL 7046 | 11.60 | 1.128* | 14.47 | 0.188 | 31.27 | 7.988** | 4.30 | 0.071 | 1.29 | 0.011 | 3.34 | 0.024 |
| 10 | JGL 3855xJGL 1881 | 8.93 | -1.285** | 14.33 | -0.792** | 9.47 | -10.472** | 4.28 | -0.040 | 1.27 | -0.009 | 3.36 | -0.007 |
| 11 | JGL 3855xJGL 4870 | 10.60 | 1.105* | 17.17 | 0.691** | 26.87 | 5.201** | 4.28 | 0.005 | 1.47 | 0.065** | 2.94 | -0.130 |
| 12 | JGL 3855xNLR 34452 | 11.40 | 0.841 | 13.90 | 0.268* | 23.73 | 3.421** | 4.31 | 0.182** | 1.25 | 0.001 | 3.45 | 0.142 |
| 13 | JGL 3855xWhite ponny | 10.93 | 0.515 | 15.80 | 1.598** | 25.20 | 0.155 | 4.30 | 0.095 | 1.30 | 0.023 | 3.30 | 0.013 |
| 14 | JGL 3844xJGL 7046 | 11.00 | -0.129 | 14.10 | -0.916** | 22.07 | -3.272** | 4.14 | -0.077 | 1.30 | -0.021 | 3.18 | -0.011 |
| 15 | JGL 3844xJGL 1881 | 10.33 | -0.542 | 15.43 | -0.429** | 16.73 | -5.265** | 4.32 | 0.013 | 1.31 | -0.018 | 3.29 | 0.045 |
| 16 | JGL 3844xMTU 4870 | 12.20 | 2.048** | 18.47 | 1.254** | 31.40 | 7.675** | 4.35 | 0.087 | 1.58 | 0.129** | 2.77 | -0.184* |
| 17 | JGL 3844xNLR 34452 | 12.30 | 1.085* | 14.03 | -0.336** | 26.60 | 4.228** | 4.24 | 0.131* | 1.30 | 0.012 | 3.26 | 0.068 |
| 18 | JGL 3844xWhite ponny | 10.07 | -1.009* | 16.67 | 1.728** | 25.93 | -1.172 | 4.25 | 0.057 | 1.37 | 0.048 | 3.09 | -0.072 |
| 19 | JGL 7046xJGL 1881 | 13.27 | 1.681** | 16.90 | 0.291** | 30.67 | 8.035** | 4.40 | -0.028 | 1.30 | -0.006 | 3.38 | -0.011 |
| 20 | JGL 7046xMTU 4870 | 8.40 | -2.462** | 18.23 | 0.274* | 18.67 | -5.692** | 4.32 | -0.067 | 1.38 | -0.045 | 3.12 | 0.029 |
| 21 | JGL 7046xNLR 34452 | 9.67 | -2.259** | 15.27 | 0.151 | 19.27 | -3.739** | 4.28 | 0.043 | 1.29 | 0.017 | 3.33 | 0.001 |
| 22 | JGL 7046xWhite ponny | 12.27 | 0.481 | 16.93 | 1.248** | 25.47 | -2.272* | 4.23 | -0.080 | 1.31 | 0.010 | 3.22 | -0.081 |
| 23 | JGL 1881xMTU 4870 | 9.13 | -1.475* | 18.63 | -0.172 | 22.40 | 1.381 | 4.46 | -0.011 | 1.47 | 0.038 | 3.04 | -0.108 |
| 24 | JGL 1881xNLR 34452 | 12.57 | 0.895 | 16.27 | 0.304** | 23.33 | 3.668** | 4.32 | -0.008 | 1.28 | 0.003 | 3.38 | -0.009 |
| 25 | JGL 1881xWhite ponny | 12.23 | 0.701 | 18.00 | 1.468** | 29.87 | 5.468** | 4.34 | -0.061 | 1.33 | 0.023 | 3.26 | -0.095 |
| 26 | MTU 4870xNLR 34452 | 10.93 | -0.015 | 17.20 | -0.112 | 27.20 | 5.808** | 4.37 | 0.094 | 1.28 | -0.116** | 3.41 | 0.321** |
| 27 | MTU 4870xWhite ponny | 11.97 | 1.158* | 16.37 | -1.516** | 26.33 | 0.208 | 4.29 | -0.066 | 1.34 | -0.093** | 3.20 | 0.142 |
| 28 | NLR 34452xWhite ponny | 12.80 | 0.928 | 15.73 | 0.694** | 23.07 | -1.705 | 4.38 | 0.170* | 1.29 | 0.016 | 3.39 | 0.090 |

be due to complementary type of gene action, which can result in strong transgressive segregants for the desired traits due to segregation of genes with strong potentials and their specific buffers (Langham, 1961).

Parents *viz.,* JGL 7046 and JGL 3844 for yield, JGL 1881 and NLR 34452 for quality and White ponny for both were identified as good general combiners.

## REFERENCES

Griffing, 1956. The concept of general and specific combining ability in relation to diallel crossing system Australian Journal of Biological Science : 463-493.

Grafius, J. E. 1959. Heterosis in barly. Agronomy Journal 51: 551-554.

Lang ham, D. G. 1961. The high – low method of improvement, crop Sci. 376 -378.

Pradhan, S. K and Singh, S. 2008. Combining ability and gene action analysis for morphological and quality traits in basmati rice. Oryza 45 (3): 193-197.

Spraque, G. F and Tatum, L.A. 1942. General vs specific combining ability in single crosses of corn Journal of American Society of Agronomy 3 : 923-932.

Singh, T.H., Gupta, S.P and phul, P.S 1971. Line x Tester analysis of combining ability in cotton. International Journal of Genetics & Plant Breeding 31: 316-321.

Singh, S and Choudary, B.S.1995. Combining ability for some metric traits in rice. Madras Agricultural Journal 82: 165-169.

Shanthi, P., Shanmuga Sundaram, P and Nagarajan, P .2003. Combining ability in rice, Oryza 40 (&2): 11-13.

Salgotra, R.K., Gupta, B. B and Praveen singh, 2009. Combining ability studies for yield and yield components in Basmati rice. Oryza 46 (1): 12-16.

# ATTITUDE TOWARDS PURSUING SELF EMPLOYMENT IN AGRICULTURE

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In the recent trends of globalization and privatization there is growing suspicion that the concept of full time government employment may remain a dream. Agricultural graduates are not exception to this situation. The relative proportion of agricultural graduates finding employment in the pubic sector in India is also shrinking gradually (Parimaladevi *et al.*, 2006). More jobs should, therefore, be created in the private sector (George and Bhaskaran, 2004), besides increasing avenues for self employment. Now-a-days with growing population, food demand, technological advances in agriculture there is a wider scope for specialized self employment in agriculture. Further, with the professional skills and abilities posses by the agricultural graduates he/she can excel and succeed with ease when compared to other graduates.

It is universally accepted fact that the attitude of an individual plays an important role in determining the behaviour with respect to a particular object. Many factors can be attributed for this situation and one among them is the attitude towards pursuing self employment. Thus, attitude in the study was operationally defined as the degree of positive or negative feelings of agricultural graduating students towards pursuing self employment in agriculture. The study was undertaken during 2008 to find out the attitude of the agricultural graduates towards pursuing self employment in agriculture and its relationship between selected profile characteristics the agricultural graduates.

Ex-post facto research design was adopted for the study. An attitude scale was prepared using Likert Summated Rating method. Independent variables *viz.,*rural urban back ground, type of family, parents income, occupation of the parent, Overall Grade Point Average during B.Sc (Agril.) course, mass media exposure and achievement motivation were selected for the study. Under-graduate students of College of Agriculture, Rajendranagar, Acharya NG Ranga Agricultural University, Hyderabad who were about to complete the B.Sc (Agriculture) course during the academic year of 2007-08 were selected randomly. Total number of respondents selected for the study was 100. Structured questionnaire was used to collect the data. Statistical methods like average, correlation and multiple leaner regression used to draw the conclusions.

The selected personal and socio-psychological characteristics of the agricultural graduates were studied to find the relationship with the attitude towards self employment.

Almost equal number of students hailed from urban (52%) and rural (48%) areas (Table 1). Majority of the students belonged to nuclear families. Majority of the parents had income between Rs.5001 – Rs.10000 per month (52%) and employed in the government services (40%). With regard to Overall Grade Point Average (OGPA) during B.Sc (Agril.) course, majority (40%) of the students had OGPA between 7.1-7.5.

Majority of the students had medium mass media exposure (72%) and medium achievement motivation (64%). In this era of Information technology with students of medium mass media exposure there is every need to make the agricultural graduates well aware of the opportunities and avenues of right self employment.

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Table 1. Distribution of respondents according to their selected profile characteristics (n = 100)

| S.No. | Selected Profile Character | Respondents category | Frequency |
|---|---|---|---|
| 1. | Rural urban background | Rural | 48 |
| | | Urban | 52 |
| 2. | Type of family | Joint | 40 |
| | | Nuclear | 60 |
| 3. | Parents income (Rs./month) | Above 10000 | 44 |
| | | 5001-10000 | 52 |
| | | Less then 5000 | 4 |
| 4. | Occupation of the parent | Government service | 40 |
| | | Non-Govt. /Quasi/Private | 12 |
| | | Business | 28 |
| | | Farming | 20 |
| 5. | Overall Grade Point Average (OGPA) of student | 6.0-6.5 | 0 |
| | | 6.6-7.0 | 12 |
| | | 7.1-7.5 | 40 |
| | | 7.6-8.0 | 24 |
| | | 8.1-8.5 | 24 |
| | | 8.6-9.0 | 0 |
| | | 9.1 and above | 0 |

Table 2. Distribution of respondents according to their mass media exposure and achievement motivation (n=100)

| S.No. | Selected profile character | Respondents categories | Frequency | Mean | SD |
|---|---|---|---|---|---|
| 1. | Mass media exposure | Low | 16 | 12.56 | 2.62 |
| | | Medium | 72 | | |
| | | High | 12 | | |
| 2. | Achievement motivation | Low | 24 | 19.56 | 2.88 |
| | | Medium | 64 | | |
| | | High | 12 | | |

Table 3. Distribution of respondent graduates according to their attitude towards pursuing self employment in agriculture (n=100)

| S.No. | Respondents categories | Frequency |
|---|---|---|
| 1 | Less favourable | 11 |
| 2 | Favourable | 53 |
| 3 | Highly favourable | 36 |

**Table 4. Correlation coefficient of selected independent variables and attitude of graduating students**

| Variable Number | Variable | Coefficient of variation 'r' |
|---|---|---|
| $X_1$ | Rural urban background | -0.059 |
| $X_2$ | Type of family | 0.317 ** |
| $X_3$ | Parent income | -0.189 |
| $X_4$ | Occupation of the parents | 0.241 * |
| $X_5$ | Overall Grade Point Average | -0.009 |
| $X_6$ | Mass Media Exposure | 0.205 * |
| $X_7$ | Achievement motivation | 0.534 ** |

Majority of the students were found to have favourable attitude towards pursuing self employment in agriculture. It is a welcome sign to deal with the problem of unemployment by engaging the technically qualified agricultural graduates in their well qualified profession of farming. As majority of the agricultural graduating students are with favourable attitude there is every scope to motivate them easily to become a successful agriprenuer. This trend in long run will motivate many agri-graduates to utilize their skills and knowledge as a job provided rather than job seeker. More such agri-entrepreneurs will explore the many untapped potential of agricultural sector. These results were in accordance with the findings of Jagadeswary *et al,* (2005).

To find out the relationship between the selected profile characteristics and the attitude of agricultural graduates correlation analysis was carried out. Type of family ($X_2$) and achievement motivation ($X_7$) were positively and significantly correlated (P>0.01) with attitude of the students towards pursuing self employment in agriculture (Table 4). The variables rural urban background ($X_1$), parent income ($X_3$) and Overall Grade Point Average were negative and non-significant by correlated with the attitude towards self employment.

Further, Multiple Linear Regression analysis was carried out to ascertain the influence of the selected variables on dependent variable. Table 5 indicate that four variables *viz.,* rural urban background ($X_1$), type of family ($X_2$), occupation of the parents ($X_3$) and achievement motivation ($X_7$) were found to be positively significant and parent income ($X_3$) was negatively significant in explaining the variation in attitude of the students. It revealed that all the selected 7 variables put together explained about 68.23 per cent variation in attitude (Table 5).

To strengthen the extension services and provide employment avenues to young and talented agricultural graduates Government of India has started many supportive programmes. Analysis of the attitude shows that many of the agricultural graduates were with favourable attitude towards pursing self employment. Further, this trend is encouraging and need to utilize for addressing unemployment among agricultural graduates and strengthen the agricultural sector in the country. Still other factors which influence promoting self employment promotion in agriculture by qualified agricultural graduates needs to be analysed further.

Table 5. Multiple regression analysis of selected independent variables and attitude of graduating students

| Variable number | Variable | Unstandarised coefficients | | t |
| --- | --- | --- | --- | --- |
| | | b | Std. Error | |
| $X_1$ | Rural urban background | 2.579* | 1.342 | 1.992 |
| $X_2$ | Type of family | 5.458** | 1.174 | 4.650 |
| $X_3$ | Parent income | -1.965** | 0.564 | -3.484 |
| $X_4$ | Occupation of the parents | 1.104** | 0.230 | 4.799 |
| $X_5$ | Overall Grade Point Average | 0.129 | 0.684 | 0.189 |
| $X_6$ | Mass Media Exposure | 0.070 | 0.245 | 0.286 |
| $X_7$ | Achievement motivation | 1.906** | 0.213 | 8.958 |

** significant at 1%    $R^2$= 0.6823    F=21.52 *   significant at 5%

## REFERENCES

George, A and Bhaskaran, S. 2004. Agriclinics: An innovative extension approach. Abstaract. 73, National seminar on Alternative Extension Approaches in Technology Transfer. 21-22 Febraury 2004, Mitraniketan Krishi Vignyan Kendra, Vellanad, Trivendrum.

Jagadeswary, V., Sudhakar Rao, B and Subhash, C. B. 2005. Opinion of veterinary students towards establishment of private veterinary clinics. Manage Extension Research Review. 4(2): July-December, 2005

Parimaladevi, S., Sakeer Husain, A and Bhaskaran. S. 2006. Determinants of the effectiveness of 'Agriclinics and agribusiness centres scheme' in Kerala. Journal of Tropical Agriculture. 44(1-2):91-93.

# GENETICS OF POWDERY MILDEW RESISTANCE IN SESAMUM
## (*Sesamum Indicum* L.)

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Sesame (*Sesamum indicum* L.) is an important ancient oilseed crop. It is rich in oil (53.53%) and protein (26.25%). Sesame oil is characterized for its stability and quality. However, it has not contributed much to the current oilseed scenario. The average productivity of sesame is low as compared to other oilseeds due to lack of high yielding cultivars resistant to major insect pests and diseases. Sesame is susceptible to several pests and diseases of which, powdery mildew caused by *Oidium acanthospermi* (Childarwar), showed considerable economic damage throughout the sesame growing areas in post rainy/severe winter season. Shambarkar *et al*. (1997 ) reported that powdery mildew alone could cause yield loss up to 45%. Therefore, in addition to breeding for yield contributing characters, more attention should be given  to resistance breeding to identify resistant/ tolerant varieties or hybrids with higher yield. An attempt was made to study the mode of powdery mildew inheritance in sesame (*Sesamum indicum* L.) to assist sesame breeders in future breeding programmes aimed at resistance breeding.

In the present investigation Swetha til, a high yielding variety but susceptible to powdery mildew and  BB3-8 of *Sesamum mulayanum* line  resistant to powdery mildew from RARS**,** Jagtial were chosen as parents for hybridization. F1 was developed by crossing the resistant parent *Sesamum mulayanum* and the susceptible parent Swetha til.  $F_1$ was selfed to develop $F_2$.

Parents, F1, $F_2$ populations were screened under field conditions for powdery mildew resistance/ susceptibility on artificial inoculation with conidiospores of the causal organism for 10 days. Plants in all the generations were scored for disease reaction as either resistant or susceptible by the presence or absence of mycelial growth.

Chi-square test (Karl Pearson, 1914) was applied for testing the deviation of the observed segregation from theoretical segregation.

In the present study $F_1$ of swetha til and *Sesamum mulayanum*  cross showed the susceptible reaction indicating the dominance of susceptible allele over the resistant allele. The 104 $F_2$ population segregated in a ratio of 9:7 (61 susceptible: 43 resistant) for powdery mildew disease confirming that the resistance to disease was governed by two pairs  of recessive genes contributed by resistant parent

Inheritance of resistance to powdery mildew has been studied in crops sensitive to the disease including sesamum. Ramanarao et al. (2009) reported that resistance to powdery mildew was under the control of two pairs of recessive genes showing complementary gene action in sesamum. However, Krishnaswami *et al.* (1983) and Raja Ravindran and Rathinam (1996) have reported that powdery mildew tolerance in sesame  was controlled by two pairs of dominant genes showing complementary gene action. Reddy and Haripriya (1990) from their study involving RT 54, a moderately resistant parent have noticed the tolerance to be under dominant gene control. The finding in the present study which is contradictory to the earlier repots by Krishnaswami *et al.* (1983), Reddy and Haripriya (1990)  and Raja Ravindran and Amritha Devarathinam (1996) might be because of resistant sources included are different.

Timmerman *et al*. (1994), Vaid and Tyagi (1997), Janila and Sharma (2004) reported single recessive gene '*er1*', conferring resistance to powdery mildew in peas. Same has been the case as well in barley, where resistance has been reported to be governed by recessive gene in all the tested isolates (Buschges *et al.* 1997).

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**Table 1. Mode of inheritance of powdery mildew resistance in the F$_2$ progeny of cross between Swetha til x BB3-8 accession of *S.mulayanum.***

| Generation | No of Plants | Observed frequencies | | Expected frequencies | | Ratio R:S | Chi square |
|---|---|---|---|---|---|---|---|
| | | **S** | **R** | **S** | **R** | | |
| Swetha | 10 | | 10 | | | | |
| *S.mulayanum* | 5 | 5 | | | | | |
| F$_1$ | 5 | | 5 | | | | |
| F$_2$ | 104 | 61 | 43 | 58.5. | 45.5 | 9:7 | 0.1* |

S- Susceptible ; R-Resistant

* significant at 5% level of significance

**REFERENCES**

Buschges, R., Hollricher, K., Panstruga, R., Simons, G., Wolter, M., Frijters, A., van Daelen, R., van der Lee, T., Diergaarde, P., Groenendijk, J., Topsch, S., Vos, P. Salamini, F and Schulze-Lefert, P. 1997. The barley Mlo gene: A novel control element of plant pathogen resistance.**88**:695-705.

Janila, P and Sharma, B. 2004. RAPD and SCAR markers for Powdery mildew resistance gene in pea. Plant Breeding **123**:271-274.

Karl Pearson.1914. *Tables for Statisticians and Biometricians*. University Press., London. 80-85.

Krishnaswami, S., Venkata rao, A and Appaduari, R. 1983. National seminar on breeding crop Plants for resistance to pests and diseases. May 25-27, Coimbatore.

Raja Ravindran, G and Rathinam, A.A. 1996. Inheritance of resistance to Powdery mildew in sesame. Sesame and safflower newsletter.**11**:82-84.

Ramana Rao P.V., Raja reddy, K., Eswar reddy, N.P., Anuradha, G and Siddiq, E.A. 2009. Molecular mapping and tagging of powdery mildew tolerance and other traits of agronomic importance in sesamum. *Ph.D thesis.* Acharya N G Ranga Agricultural University (ANGRAU), Hyderabad.

Reddy, C.D and Haripriya, S.1990. Heterosis for tolerance of Powdery mildew in sesame. Indian journal of mycology and plant pathology. **20**(2):160-161.

Shambarkar, D.A., Shinde, Y.M and Baviskar, 1997. Genetic resource evaluation against major diseases of sesame. Sesame and Safflower News letter **12** : 6-10.

Timmerman, G.M., Frew, T.J., Miller, A.L and Golden, D.S. 1994. Linkage analysis of *er 1* a recessive *Pisum sativum* genes for resistance to Powdery mildew fungus (*Erysiphe pisi* D.c.,). Theory of Applied Genetics. **88**(8): 1050-1055.

Vaid, A and Tyagi, P.D. 1997. Genetics of Powdery mildew resistance in pea. Euphytica. **96**: 203-206.

# RESOURCE USE EFFICIENCY OF ALMOND PRODUCTION IN AFGHANISTAN – A CASE STUDY IN KUNDUZ PROVINCE

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A study was made to identify the resource use efficiency in almond cultivation; Stratified proportionate random sampling method was followed. The investigation was carried out in kunduz province which is purposively selected for the present study as a considerable area is found under almond cultivation in Afghanistan.

By choosing Two districts (Chahardara, Qalazal) and centre of kunduz were selected and three villages namely from each districts MaMakhail, Hazrat ha, Ainul majar, Kakar, Ortaboz, Aqtapa, Gultapa larkhaby, Chemtapa were purposely selected as they ranked good under almond cultivation. Based on operational holding as per criterion adopted by villagers by adopting proportionate random sampling 21 farmers were selected from small, 24 medium and 15 large category, making a total sample of 60 farmers.

The required primary data were collected through personal interview of selected farmers and marketing agencies with the help of pretested schedules designed for the purpose. The data for the present study pertained to agricultural year 2009-2010. The data collected and analysed, by working out simple averages, percentages of various costs and fitted with Cobb-Douglas Production function. Cobb - Douglas production function has been chosen to analysis the resource use efficiency for its flexibility and suitability.

The Cobb-Douglas function was fitted with six independent variables namely land ($X_1$), labour ($X_2$), plant material ($X_3$), FYM ($X_4$), fertilizer (x5) and plant protection(x6).

The model for the study was.

$Y= ax_1^{b1}x_2^{b2}x_3^{b3}x_4^{b4}x_5^{b5}\,u$

U= Error

For convenience in estimating the parameters in the function following log linear form is adopted.

$\text{Log } Y = \text{Log } A + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 +$

$$b_6 \log x_{6+} U$$

Where:

(A=Intercept,$b_1$ to $b_6$ = elasticity co-efficient)

The values included in the study were in terms of Afghani currency of Afghanistan. Where the conversion is (1000 INR=1040 Afg). The explanatory variables included in the study explained 98.8 percent variations in the gross returns in almond orchards (Table 1). The production elasticities for all the variables namely land, labour, plant material expenditure, manures, fertilizers and plant protection expenditure were found to be positively significant. According to the results one percent increase in land and labour would increase gross returns by 0.388 and 0.289 percent. It is obvious from the table that the sum of elasticities (ebi) was 1.030, indicating the increasing rate of returns. One percent increase in the level of all the included variables would bring about 1.030 per cent increase in the gross returns, indicating that there is possibility of increasing in returns by increasing the inputs. The above results imply that one unit increase in land, labour, plant protection cost, fertilizer cost would result in 0.38, 0.28, 0.15 and 0.15 units of increase in yields. Naidu *et al.* (1986) studied the resource productivity of banana and found that the coefficients of all variables, except human labour were significant reflecting their contribution to profitability.

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**Table 1. Production elasticities of almond orchard**

| Sl.No | Particulars | Almond orchard |
|-------|-------------|----------------|
| 1. | Number of farms | 60 |
| 2. | Constant A (intercept) | 7.54 |
| 3. | **Production Elasticities**<br>$X_1$ land in hectare | 0.3380** <br> (0.0692) |
| | $X_2$ labour in Afg. | 0.2896** <br> (0.0771) |
| | $X_3$ plant material in Afg. | 0.0833* <br> (0.0354) |
| | $X_4$ manures in Afg. | 0.014388** <br> (0.0046) |
| | $X_5$ fertilizers in Afg. | 0.1504** <br> (0.044) |
| | $X_6$ plant protection in Afg. | 0.15480** <br> (0.0577) |
| 4. | $R^2$ | 0.98.84 |
| 5. | Returns to scale ($\Sigma$bi) | 1.02 |

**Note: Figures in parentheses indicate standard errors**

An attempt was made to determine the efficiency of resource use, which requires the estimation of marginal value products (MVP) of the resources. The MVP of plant material, plant protection, fertilizers and manures were estimated to be 150.41, 20.29, 19.36 and 7.14. The difference between MVP and OC was significantly positive. Whereas the ratio of MVP to OC for plant materials (150.41), manures (7.14), fertilizers (19.36), and plant protection chemicals (20.29) were found to be more than one indicating that the utilization of these inputs could be increased sufficiently to reach the optimum level (Table 2). These ratios are higher indicating that the increase of these resources will lead to greater increase by 197.2 Kg per hectare in the output of almond orchards.

Cobb Douglas production function analysis revealed that the variables plant materials, FYM, fertilizers and plant protection were found to be positively significant. The sum of production elasticities indicated increasing returns to scale. The co-efficient of multiple determinations are significant explaining 98.8 percent in the gross returns by all input categories. MVP/OC ratio revealed that all variables had high degree of resource use efficiency, but can be improved further. If the government provides loans and input subsidy to almond growers, as the use of fertilizer is less than-recommended dose, there is a possibility of increase in yields. Agriculture and allied departments should provide good quality pesticides and fungicides hence the attack of pests and diseases are a major problem of growers. And provision of better storage, packing and packaging facilities.

**Table  2.  Marginal value products, opportunity costs and ratios of MVP to opportunity costs**

| S.No | Particulars | Almond orchard |
|:---:|---|---|
| 1 | Marginal value products<br>$X_1$   -  plant materials in Afg.<br>$X_2$   -  FYM in Afg.<br>$X_3$   -  fertilizer in Afg.<br>$X_4$    -  Plant protection chemicals  in Afg. | 150.41[*]<br>7.1463[**]<br>19.362[**]<br>20.2932[**] |
| 2 | Opportunity costs<br>$X_1$  -  plant materials<br>$X_1$  -  FYM<br>$X_2$  -  Fertilizers<br>$X_4$   -  Plant protection chemicals | <br>1<br>1<br>1<br>1 |
| 3 | $X_1$   -   plant materials<br>$X_2$   -  FYM<br>$X_3$   -  Fertilizers<br>$X_4$    -  Plant protection chemicals | 150.41[*]<br>7.1463[**]<br>19.362[**]<br>20.2932[**] |

**REFERENCES**

Naidu, M. R., Chenerayudu, K,C and Apparao, T. 1986. Resource Productivity on banana zonal farms of East Godavari district of Andhra Pradesh. Andhra  Agricutlural Journal. 33(3):267-270

# IDENTIFICATION OF GENOTYPE SPECIFIC SSR MARKERS FOR SHORT GRAIN AROMATIC RICE (*Oryza sativa* L.)

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Rice is the most important cultivable crop and source for food for more than half of the world population and occupies almost 1/5th of the total land under cereals(Chakravarthi *et al.,* 2006). Genetic diversity is one of the most important factor for the improvement of crop plants as improvement is done by selection(Ravi *et al.*, 2003). It plays a crucial role in progress and success of modern agriculture. Characterization and quantification of genetic diversity has long been a major goal in evolutionary biology. Although a large amount of genetic diversity exists in nature for rice, It is estimated that very small proportion of it is being utilized for development of superior varieties.

Among various quality traits, aroma is one of the important trait determining the consumer preference and market value. Aromatic rice is grouped in to long grained (*Basmati* type) and short grained (local landrace type). These are best in quality and fetch much higher price than high quality non-aromatic rice in international market. Aromatic rice has become an important commercial commodity. It is more preferred by the consumers all over the world because of its scent and palatability. So far work has been done by using Basmati genotypes and SSR markers Nagaraju *et al.*,2002).The improvement of indigenous short grained aromatic rice has been paid little attention inspite of their outstanding quality like aroma and taste. Therefore, it is highly necessary not only to conserve the landrace genotypes but also to investigate the gene-pool of aromatic rice for breeding purposes of high yielding varieties in the country (Rabbani *et al.*, 2008). Hence investigation of this prized gene pool at molecular level would be rewarding for their conservation and further improvement research in future. Microsatellites or Simple Sequence Repeat (SSR) are amongst the most widely used DNA marker types(McCouch *et al.*, 2002). for many purposes such as diversity, genome mapping and varietal identification (Pervaiz *et al.,* 2009, Singh *et al*.,2004).

The present study was undertaken with the objective to identify some genotype specific markers which can generate a distinguished banding pattern among the genotypes of short grain aromatic rice.

**Genomic DNA Isolation:** The present study included 96 genotypes of short grain aromatic rice which have been collected from different parts of India by Dierectorate of Rice Research (DRR), Rajendranagar, Hyderabad. Genomic DNA from the leaf samples of 20-25 days old seedlings were isolated using the procedure of Zheng *et al.,* 1991 with little modifications.

**Polymerase Chain Reaction (PCR):** The PCR mixture were carried out in a reaction volume of 15 ìl which contained 50 ng template DNA, 1.0 ìl PCR buffer (10 x), 0.5 ìl dNTP's (2.5 mM), 0.5 ìl each primers (5 mM), 0.1 ìl *Taq* DNA Polymerase (3 U / ml). Template DNA was initially denatured at 94°C for 5 min followed by 35 cycles of PCR amplification with the following parameters: 30 sec denaturation at 94°C, 30 sec annealing at 55°C and 1–2 min of primer extension at 72°C. A final extension was done at 72°C for 7 min. PCR amplified products were electrophoretically resolved in 3% Meta-Phor®Agarose gels (Lonza, USA) in 0.5× TBE buffer at 100 V for 3.5 h in Hoeffer Super Submarine Electrophoresis unit (GE Biosciences, USA). The gels were stained in ethidium bromide (10 mg/ml) and placed over a UVTrans illuminator and documented in an Alpha Imager gel documentation system (Alpha Innotech, USA).

**Data Analysis:** Amplified products from the SSR markers analysis were scored qualitatively for the presence or absence of the corresponding band among the genotypes. Only the clear and unambiguous amplified bands were scored. The

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presence or absence of each band in all the genotypes was scored manually by binary data matrix with '1' indicating the presence of the band and '0' indicating the absence of the band.

To measure the informativeness of the markers, the polymorphism information content (PIC) for each SSR marker was calculated according to the formula (Weir, 1996).

PIC=1-($\Sigma$P$i^2$)

Where; '$i$' is the total number of alleles detected for SSR marker and 'P$i$ is the frequency of the $i^{th}$ plus allele in the set of 96 genotypes investigated. PIC value estimates the discriminatory power of the SSR marker.

In the present study, a total of 27 polymorphic SSR markers which were dispersed throughout 12 chromosomes were used to check the banding pattern of 96 short grain aromatic rice genotypes collected from different parts of the country. The set of SSR markers used were highly informative. The PIC values of the markers ranged from 0.066 (RM505) detected on chromosome 7 to 0.721 (RM276) detected on chromosome 6, with an average of 0.54 per locus (Table 1). This corresponded well with the average PIC value of 0.54 obtained by Joshi and Behera (2006) who studied indigenous non-Basmati aromatic rice genotypes. Markers with PIC values of 0.5 or higher are highly informative for genetic studies and are extremely useful in distinguishing the polymorphism rate of a specific locus (Akkaya and Buyukunal Bal, 2004).

**Table 1. Allelic variation and PIC values for SSR loci identified in 96  genotypes**

| S. No. | Chr. No. | Primer Name | No. of Alleles | PIC Values | Repeat Motif |
|--------|----------|-------------|----------------|------------|--------------|
| 1. | 1 | RM577 | 2 | 0.171 | (TA)9(CA)8 |
| 2. | 1 | RM10843 | 3 | 0.512 | (TC)10 |
| 3. | 2 | RM6318 | 3 | 0.662 | (CTT)12 |
| 4. | 2 | RM14140 | 3 | 0.514 | (TTA)55 |
| 5. | 3 | RM85 | 4 | 0.688 | (TGG)5(TCT)12 |
| 6. | 3 | RM6759 | 3 | 0.617 | (TAT)53 |
| 7. | 4 | HRM16592 | 2 | 0.300 | (ATAC)29 |
| 8. | 4 | HRM16913 | 4 | 0.711 | (TAT)51 (TAT)51 |
| 9. | 5 | RM122 | 3 | 0.533 | (GA)7A(GA)2A(GA)11 |
| 10. | 5 | RM267 | 2 | 0.500 | (GA)21 |
| 11. | 6 | RM276 | 5 | 0.721 | (AG)8A3(GA)33 |
| 12. | 6 | HRM20060 | 3 | 0.585 | (TTA)39 |
| 13. | 7 | RM11 | 3 | 0.634 | (GA)17 |
| 14. | 7 | RM229 | 2 | 0.478 | (TC)11(CT)5C3(CT)5 |
| 15. | 7 | RM505 | 2 | 0.066 | (CT)12 |
| 16. | 7 | RM21260 | 4 | 0.686 | (AG)18 |
| 17. | 8 | RM23595 | 3 | 0.652 | (GCAG)6 |
| 18. | 8 | RM22866 | 3 | 0.367 | (TA)19 |
| 19. | 8 | RM89 | 4 | 0.517 | - |
| 20. | 9 | RM7424 | 3 | 0.547 | (GGAT)6 |
| 21. | 9 | RM23899 | 2 | 0.382 | (AT)32 |
| 22. | 9 | RM24383 | 3 | 0.636 | (CTC)8 |

| 1 | 2 | 3 | 4 | 5 | 6 |
|-----|-----|----------|-----|-------|---------|
| 23. | 10 | HRM25754 | 3 | 0.634 | (AT)47 |
| 24. | 11 | RM26329 | 3 | 0.614 | (AT)54 |
| 25. | 11 | RM27311 | 3 | 0.653 | (AT)72 |
| 26. | 12 | RM27406 | 4 | 0.717 | - |
| 27. | 12 | HRM27840 | 3 | 0.603 | (TAT)37 |

The banding patterns which were distinct, unique and less frequency at a particular base pair by a particular marker is taken as specific band (Fig 1,2,3and4). Out of 27 polymorphic markers, 4 SSR markers were identified as genotype specific markers, namely RM577 on chromosome 1, RM505 on chromosome 7, RM89 and RM22866 on chromosome 8. Fig 1. Distinguished banding pattern for genotypes RAU3054
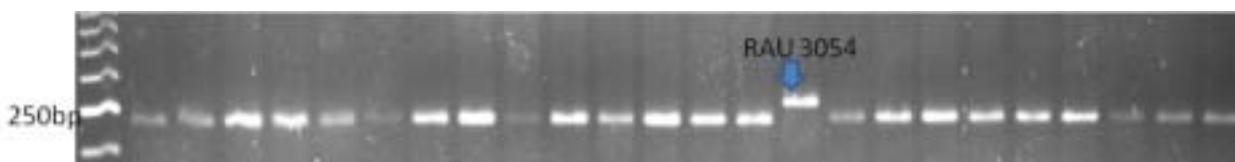


on chromosome1 , from the rest of the Aromatic Short Grain (ASG) rice varieties generated by RM505 on 3% Ethidium Bromide stained gel. DNA ladder size =50bp.



Fig 2. Distinguished banding pattern for genotypes Ratnasundari and Atmashital from the rest of the Aromatic Short Grain (ASG) rice varieties generated by RM505 on 3% Ethidium Bromide stained gel. DNA ladder size =50bp.



Fig3: Distinguished banding pattern for genotypes Bhulapuri, Lalkanhu and Kota Basmati from the rest of the Aromatic Short Grain (ASG) rice varieties generated by RM89 on 3% Ethidium Bromide stained gel. DNA ladder size =50bp.
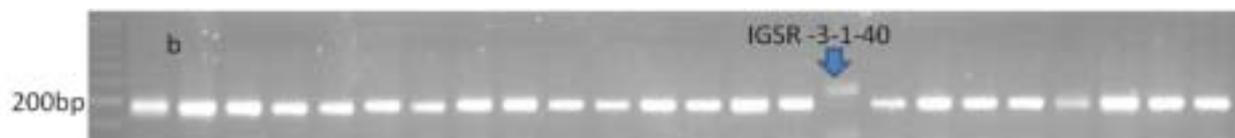


Fig4: Distinguished banding pattern for genotypes IGSR-3-1-40 from the rest of the Aromatic Short Grain (ASG) rice varieties generated by RM22866 on 3% Ethidium Bromide stained gel. DNA ladder size =50bp.

RM577 with repeat motif (TA)9(CA)8, detected 5 specific bands at 250bp for the genotypes Gatia, IGSR -3-1-40, RC 781 Chinor , RK 395 Kubrimoher and Kapoor Chini. RM505 with repeat motif (CT)12 detected 3 distinguished banding pattern at 260bp for the genotypes RAU 3054, Ratnasundari and Atmashital. While RM22866 (TA)19, detected 3 specific bands at 210bp and those genotypes includes IGSR -3-1-40, RK 395 Kubrimoher and PDKV Shriran. RM89 detected 5 specific bands at 150bp for the genotypes Magura, Bhulasapuri, Lalkanhu, Kota Basmati and Lectimachi. Out of different genotypes mentioned above, 2 genotypes namely IGSR-3-1-40 and RK395 Kubrimoher were detected by 2 markers, RM577 and RM22866 at 250bp and 210bp respectively (Table 2).

**Table 2. Genotypes specific markers**

| S.No. | Chr. No. | Markers | Genotypes |
|-------|----------|---------|-----------|
| 1. | 1 | RM577 | Gatia, IGSR -3-1-40, RC 781 Chinor, RK 395 Kubrimoher and Kapoor Chini |
| 2. | 7 | RM 505 | RAU 3054, Ratnasundari and Atmashital |
| 3. | 8 | RM89 | Magura, Bhulasapuri, Lalkanhu, Kota Basmati and Lectimachi |
| 4. | 8 | RM22866 | IGSR -3-1-40, RK 395 Kubrimoher and PDKV Shriran |

Jain *et al.* (2004) have also observed similar finding and reported that RM 252 could distinguished commercially important traditional Basmati rice varieties such as *Taraori Basmati* and *Basmati* 370 from cross bred varieties, such as *Pusa Basmati* 1 and *Haryana Basmati* 1. Acccording to Sivaranjani *et al.*(2010) RM 577 on chromosome 1 was found to be a distinguished marker for the genotypes Basmati 334, Kanakjeer B and RAU 3014 while RM 3 and RM 38 on chromosome 6 and 8 respectively were found to be the distinguished markers for the genotype Lectimachi from the rest of the genotypes.

The multiallelic nature of SSR markers has the unambiguous advantage of discriminating the accessions more precisely. The specific SSR markers identified in the present study would be used for varietal identification.

**REFERENCES:**

Akkaya ,M .S and Buyukunal Bal ,E .B.2004. Assessment of genetic variation of bread wheat varieties using microsatellite markers. *Euphytica* 135:179-185.

Chakravarthi, B. K and Naravaneni. R. 2006. SSR marker based DNA fingerprinting and diversity study in (Oryza sativa. L).*African Journal of Biotechnology* vol 5(9):686-688.

Jain, S., Jain, R.K and McCouch, S.R. 2004. Genetic analysis of Indian aromatic and quality rice (*Oryza sativa* L.) germplasm using panels of fluorescently-labeled microsatellite markers.*Theoretical and Applied Genetics*. 109: 965-977.

Joshi, R.K and Behera, L. 2006. Identification and differentiaton of indigenous non Basmati rice genotypes of India using microdatellite markers. *African Journal of Biotechnology*. 4: 348-354.

McCouch, SR., Teytelman,L., Xu,Y., Lobos.K.B., Clare, K., Walton, M., Fu ,B., Maghirang.R., Li. Z., Xing .Y., Zhang.Q., Kono. I., Yano ,M., Fjellstrom, R., DeClerck. G., Schneider.D., Cartinhour.S. and Ware.D.,Stein,L.2002. Development and mapping of 2240 new SSR markers for rice (Oryza sativa L.). *DNA Research* 9(6) : 199-207.

Nagaraju, J., Kathirvel, M., Ramesh Kumar, R and Siddiq E .A., Hasnain S. E.2002. Genetic analysis of traditional and evolved Basmati and non- Basmati rice varieties by using fluorescence-based ISSR-PCR and SSR markers. *Proc Natl Acad Sci USA 99*:5836–5841.

Pervaiz, Z.H., Rabbani, M.A., Pearce, S.R and Malik, S.A. 2009. Determination of genetic varialibilty of Asian rice (*O. sativa* L.) varieties using microsatellite markers. *African Journal of Biotechnology*. 8(21): 5641-5651.

Rabbani, M.A., Pervaiz ,Z. H and Masood, M .S .2008. Genetic diversity analysis of traditional and improved cultivars of Pakistan rice (*Oryza sativa* L.) RAPD markers. *Electronic Journal of Biotechnology* 11(3) : 1-10.

Ravi, M.,Geethanjali.S., Sameeyafarheen. F and Maheswaran. M. 2003. Molecular marker based genetic diversity analysis in Rice (Oryza sativa L.) using RAPD and SSR markers. *Euphytica* 133 : 243-252.

Sivaranjani, A.K.P., Pandey, M.K.,Sudharshan, I., Ram Kumar, G., Madhav, M.S., Sundaram, R.M., Varaprasad, G.S and Shobha Rani, N. 2010. Assessment of genetic diversity among basmati and non-basmati aromatic rices of India using SSR markers. *Current Science.* 99(2): 221-226.

Singh, R .K., Sharma, R.K., Singh, A.K., Singh, V.P., Singh, N. K., Tiwari, S .P and Mohapatra .T. 2004. Suitability of mapped sequence tagged microsatellite site markers for establishing distinctness, uniformity and stability in aromatic rice. *Euphytica* 135 : 135-143.

Weir, B.S. 1996. *Genetic data analysis* II, 2nd ed. Sunderland, Massachussets, Sinauer Associates. 377.

Zheng, K.L., Shen, B and Qian, H.R. 1991. DNA polymorphism generated by arbitrary primed PCR in rice. *Rice Genetics Newsletter.* 8 : 134-136.

# HETEROSIS FOR GRAIN YIELD AND ITS COMPONENT TRAITS IN MAIZE(*Zea mays*L.)

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Maize (*Zea mays* L.) is a highly cross pollinated crop and scope for the exploitation of hybrid vigour will depend on the direction and magnitude of heterosis, biological feasibility and the type of gene action involved. The information of heterosis will have a direct bearing on the breeding methodology to be adopted for standard heterosis. Therefore, the present investigation was carried out to know the direction and magnitude of different kinds of heterosis in maize.

The material comprised of ten diverse genotypes and their forty five crosses obtained from 10 x 10 half diallel set of crosses. Crosses along with parents and their standard checks were grown in a Randomized Block Design with three replications during *rabi*, 2008-09. Each entry was grown in 5m row accommodating 20 plants with intra and inter row spacing of 20cm and 75cm, respectively. Quantitative observations were recorded on five randomly selected competitive plants for eleven characters in each entry. Heterosis (expressed as percentage) was estimated for all the characters over better parent (BP) as per standard procedure.

Considerable amount of heterosis was observed for the eleven characters under study. However, the magnitude varied with characters. Heterosis over the better parent for plant height ranged from 65.85-8.24  per cent. Highest heterobeltiosis for this trait was exhibited by the hybrid SK-1 X SK-3. Forty five hybrids showed significant positive heterosis over better for number of kernel rows per ear. Significant positive heterosis over better parent for number of kernels per row was observed in twenty five hybrids. The hybrid SK-1 X BML-7 recorded highest heterosis of 34.50 per cent. High heterosis for number of grains per row was earlier reported by Malik *et al.* (2004) and Chattopadhyay

and Dhiman (2005), Kumari *et al.* (2006), Lata *et al.* (2008) and Alam *et al.*(2008). Positive significant heterosis over better parent for girth ranged from 41.71 – 6.93 per cent, maximum being with the cross SRRL-79 X SK-1. Nineteen hybrids showed significant negative heterosis over the better parent for days to 50 per cent silking.

The maximum negative heterosis of 85 per cent was observed in hybrid SK-2 XSK-3. Significant heterosis over better parent for 100 grain weight was observed in thirty four hybrids, the maximum heterosis being 42.35 per cent in the cross CM-211 X SRRL-79.

The grain yield per plant exhibited greater magnitude of heterosis over better parent. Among the hybrids, SRRL-79 X SK-3 showed highest positive and significant heterosis over better parent (128.50). Similar observations have been reported by Nagda *et al.* (1995), Joshi  *et al.* (1998), Appunu (2002) and Amanullah  *et al.*(2011).

The grain yield is a polygenically controlled character and depends on large number of other related characters. In the present study, significant positive heterosis in grain yield was found to be associated with the heterosis in number of kernels per row, 100 grain weight and number of kernel rows per ear. Similar observations were made by Vasal *et al.*(1993), Dan Makumbi *et al.*(2011) and Premalatha *et al*. (2011).

To summarise, the cross  SRRL-79 X SK-3 with 128.50  per cent of heterosis over better parent showed  significant heterotic responses to  traits like days to 50 per cent silking, days to 50 per cent maturity, ear height, ear length, ear girth, number of kernels per row and  100 grain weight. CM-211 X ACROSS with  99.69 yield heterobeltiosis had

**Table 1. Estimates of percent heterosis (h₁), heterobeltiosis (h₂) and standard heterosis (h₃) for days to fifty percent tasselling, plant height and ear length in maize**

| Crosses | Days to fifty percent tasselling | | | Plant height | | | Ear length | | |
|---|---|---|---|---|---|---|---|---|---|
| | h1 | h2 | h3 | h1 | h2 | h3 | h1 | h2 | h3 |
| CM-211 X SRRL-79 | -1.32 | -0.88 | -4.27 ** | 50.10** | 53.51** | -1.61 | 49.49 ** | 48.82 ** | 2.57 |
| CM-211 XSRRL-65 | -0.43 | 0.44 | -2.14 | 37.19** | 56.11** | 0.06 | 9.09 | -7.28 | -8.69 |
| CM-211 X SK-1 | 4.68 ** | 6.33 ** | 0.43 | 52.69** | 54.43** | -1.03 | 63.47 ** | 54.02 ** | 6.16 |
| CM-211 X BML-7 | 5.54 ** | 6.73 ** | 1.71 | 43.46** | 59.16** | 2.01 | 42.71 ** | 32.33 ** | 6.74 |
| CM-211 X DMR-103 | 0.44 | 1.34 | -2.99 ** | 17.24** | 37.58** | -11.82** | 5.26 | -7.79 | -15.50 ** |
| CM-211 X SK-2 | 4.25 ** | 6.39 ** | -0.43 | 22.48** | 48.03** | -5.13 | 25.26 ** | 6.69 | 4.53 |
| CM-211 X ACROSS | 1.10 | 1.78 | -2.14 | 23.39* | 42.18** | -8.88** | 26.35 ** | 7.52 | 5.58 |
| CM-211 XSK-3 | 1.96 | 2.63 * | 0.00 | 9.27* | 24.19** | -20.40** | 16.20 * | 10.35 | -15.43 * |
| CM-211 X MH-12 | -2.08 * | 3.07 ** | 0.43 | 6.55 | 15.43** | -26.02** | 6.69 | -1.94 | -19.38 ** |
| SRRL-79 X SRRL-65 | -3.06 ** | -1.77 | -5.13 ** | 36.11** | 51.12** | 1.25 | 15.09 * | -2.54 | -4.02 |
| SRRL-79 X SK-1 | -0.67 | 0.45 | -5.13 ** | 56.27** | 57.99** | 3.57 | 69.91 ** | 60.76 ** | 9.82 |
| SRRL-79 X BML-7 | 0.22 | 0.90 | -3.85 ** | 44.96** | 56.99** | 5.18 | 28.96 ** | 19.08 * | -3.95 |
| SRRL-79 X DMR-103 | -0.89 | -0.45 | -4.70 ** | 26.27** | 44.48** | -3.20 | 34.78 ** | 17.63 ** | 7.79 |
| SRRL-79 X SK-2 | 4.72 ** | 6.39 ** | -0.43 | 28.11** | 50.89** | 1.10 | 23.28 ** | 4.62 | 2.50 |
| SRRL-79 X ACROSS | 0.22 | 0.44 | -3.42 ** | 31.75** | 48.08** | -0.79 | 23.47 ** | 4.68 | 2.79 |
| SRRL-79 X SK-3 | 1.53 | 2.65 * | -0.85 | 28.15** | 42.11** | -4.79 | 31.08 ** | 23.96 ** | -5.00 |
| SRRL-79 X MH-12 | -5.44 ** | 0.00 | -3.42 ** | 41.38** | 49.57** | 0.21 | 35.37 ** | 23.92 ** | 1.88 |
| SRRL-65 X SK-1 | 1.10 | 3.62 ** | -2.14 | 32.34** | 48.71** | -2.51 | 14.77 * | -7.10 | -8.51 |
| SRRL-65 X BML-7 | 0.66 | 2.69 * | -2.14 | 31.06** | 34.12** | 4.77 | 15.41 ** | 4.97 | 3.37 |
| SRRL-65 X DMR 103 | -1.75 | 0.00 | -4.27 ** | 18.55** | 21.84** | -0.37 | 5.09 | 1.43 | -0.11 |
| SRRL-65 X SK-2 | 2.00 | 5.02 ** | -1.71 | 18.43** | 24.99** | 2.20 | 4.50 | 4.23 | 2.64 |

**Contd…1st page**

| Cross | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SRRL -65 X ACROSS | 2.41 * | 4.00 ** | 0.00 | 16.62** | 17.93** | -3.57 | -10.39 | -10.52 | -11.88 * |
| SRRL -65 X SK -3 | -2.38 * | -2.16 | -3.42 ** | 19.11** | 19.24** | -2.71 | 2.30 | -9.05 | -10.43 |
| SRRL -65 X MH 12 | -3.72 ** | 0.43 | -0.43 | 39.41** | 45.94** | 9.11** | 15.29** | 5.77 | 4.17 |
| SK -1 X BML -7 | 4.50 ** | 4.98 ** | -0.85 | 51.34** | 65.85** | 8.72** | 56.11 ** | 37.05 ** | 10.54 |
| SK -1 X DMR -103 | 0.22 | 0.90 | -4.70 ** | 28.03** | 48.31** | -2.78 | 42.37 ** | 18.54 ** | 8.62 |
| SK -1 X SK -2 | 1.82 | 2.28 | -4.27 ** | 29.63** | 54.63** | 1.36 | 36.28 ** | 10.54 | 8.29 |
| SK -1 X ACROSS | 0.90 | 1.81 | -3.85 ** | 38.47** | 57.54** | 3.27 | 18.75 ** | -3.76 | -5.51 |
| SK -1 X SK -3 | 0.44 | 2.71 * | -2.99 ** | 42.16** | 59.55** | 4.59 | 57.57 ** | 41.45 ** | 8.40 |
| SK -1 X MH -12 | -1.48 | 5.43 ** | -0.43 | 46.68** | 56.98** | 2.91 | 33.82 ** | 16.52 * | -4.20 |
| BML -7 X DMR -103 | 2.91 ** | 3.14 ** | -1.71 | 29.70** | 36.51** | 6.64* | 29.96 ** | 22.17 ** | 11.95 * |
| BML -7 X SK -2 | 6.79 ** | 7.76 ** | 0.85 | 33.92** | 44.81** | 13.13** | 9.65 | -0.04 | -2.06 |
| BML -7 X ACROSS | 4.91 ** | 5.38 ** | 0.43 | 38.35** | 43.21** | 11.88** | 11.30 | 1.36 | -0.47 |
| BML -7 X SK -3 | 4.41 ** | 6.28 ** | 1.28 | 31.43** | 34.35** | 4.96 | 27.29 ** | 24.11 ** | 0.11 |
| BML -7 X MH-12 | -4.84 ** | 1.35 | -3.42 ** | 54.46** | 57.93** | 18.07** | 35.47 ** | 34.19 ** | 10.32 |
| DMR -103 X SK -2 | 2.03 | 3.20 ** | -3.42 ** | 7.95* | 10.77** | -4.38 | 2.77 | -0.55 | -2.57 |
| DMR -103 X ACROSS | 0.22 | 0.45 | -3.85 ** | 16.06** | 17.94** | -1.39 | 16.12 ** | 12.25 * | 10.21 |
| DMR -103 X SK -3 | -1.54 | 0.00 | -4.27 ** | 5.19 | 8.24* | -11.68** | 16.75 ** | 7.19 | -1.77 |
| DMR -103 X MH -12 | -5.88 ** | 0.00 | -4.27 ** | 20.37** | 29.68** | -3.05 | 28.08 ** | 21.50 ** | 11.34 |
| SK -2 X ACROSS | 5.41 ** | 6.85 ** | 0.00 | 8.68** | 13.37** | -5.21 | -9.60 | -9.70 | -11.34 |
| SK -2 X SK -3 | 5.33 ** | 8.22 ** | 1.28 | 9.95* | 16.18** | -5.21 | 20.76 ** | 7.62 | 5.43 |
| SK -2 X MH -12 | -1.49 | 5.94 ** | -0.85 | 19.88** | 32.76** | -0.74 | 6.21 | -2.33 | -4.31 |
| ACROSS X SK -3 | 2.19 * | 3.56 ** | -0.43 | 11.12** | 12.50** | -8.22* | 4.33 | -7.12 | -8.80 |
| ACROSS X MH -12 | -3.14 ** | 2.67 * | -1.28 | 13.05** | 19.74** | -10.48** | 16.88 ** | 7.38 | 5.43 |
| SK -3 X MH -12 | -3.93 ** | 0.43 | -0.85 | 18.34** | 23.74** | -7.48* | 39.26 ** | 34.54 ** | 10.61 |
| **Range** | **-5.88 to 6.79** | **-2.16 to 8.22** | **-5.13 to 1.71** | **5.19 to 56.27** | **8.24 to 65.85** | **-26.02 to18.07** | **-10.39 to 69.91** | **-10.52 to 60.76** | **19.38 to11.95** |

**Table 2. Estimates of percent heterosis (h₁), heterobeltiosis (h₂) and standard heterosis (h₃) for Ear girth(cm), number of kernels per plant and 100 grain weight (g) in maize.**

| Crosses | Ear girth | | | Number of kernels per plant | | | 100 grain weight | | |
|---|---|---|---|---|---|---|---|---|---|
| | h1 | h2 | h3 | h1 | h2 | h3 | h1 | h2 | h3 |
| CM -211 X SRRL -79 | 24.74** | 22.81** | 6.28 | 0.44 | -11.02* | 2.73 | 48.51** | 42.35** | 9.03* |
| CM -211 XSRRL -65 | 19.27** | 19.18** | 3.30 | 11.30* | 0.79 | 16.36** | 22.61** | 8.00 | -0.40 |
| CM -211 X SK -1 | 28.52** | 21.94** | 5.53 | 19.42** | -3.15 | 11.82* | 20.18** | 2.35 | 2.24 |
| CM -211 X BML -7 | 24.44** | 24.05** | 8.02 | 16.71** | -2.36 | 12.73 | 26.96** | 8.15 | 7.96 |
| CM -211 X DMR-103 | -0.38 | -6.93 | -7.26 | -6.61 | -11.02* | 2.73 | 8.09 | -7.46 | -8.74 |
| CM -211 X SK -2 | 20.26** | 12.28** | 12.03** | -2.02 | -4.72 | 10.00 | 24.72** | 5.18 | 7.60 |
| CM -211 X ACROSS | 21.99** | 16.09** | 11.23** | -13.62** | -14.62** | 0.91 | 40.28** | 22.41** | 15.38** |
| CM -211 XSK -3 | 12.00** | 8.44 | 0.22 | 2.1 | -4.33 | 10.45 | 30.77** | 27.04** | -5.37 |
| CM -211 X MH -12 | 6.8 | 4.33 | -9.71* | -4.46 | -15.75** | -2.73 | 26.49** | 11.45* | 2.71 |
| SRRL -79 X SRRL -65 | 38.86** | 36.61** | 18.40** | 11.44* | 8.74 | 1.82 | 20.12** | 9.94* | 1.39 |
| SRRL -79 X SK -1 | 47.14** | 41.71** | 18.85** | 28.81** | 16.33** | 3.64 | 23.76** | 9.33* | 9.21* |
| SRRL -79 X BML -7 | 27.27** | 24.92** | 8.78 | 30.79** | 22.45** | 9.09 | 19.45** | 5.55 | 5.37 |
| SRRL-79 X DMR-103 | 14.47** | 5.41 | 5.04 | 12.68** | 4.35 | 9.09 | 20.71** | 7.23 | 5.75 |
| SRRL -79 X SK -2 | 17.25** | 7.91 | 7.66 | 6.42 | -3.33 | 5.45 | 24.59** | 8.94* | 11.45* |
| SRRL -79 X ACROSS | 18.11** | 10.74* | 6.11 | -2.63 | -14.62** | 0.91 | 23.76** | 12.17* | 5.72 |
| SRRL -79 X SK -3 | 16.63** | 11.23* | 2.81 | 7.18 | 0.9 | 1.82 | 41.49** | 39.55** | 6.89 |
| SRRL -79 X MH -12 | 24.37** | 23.38** | 3.48 | 10.77* | 10.2 | -1.82 | 37.15** | 25.57** | 15.72** |
| SRRL -65 X SK -1 | 33.41** | 26.48** | 9.63* | 32.97** | 17.48** | 10.00 | 14.47** | 10.07* | 9.95* |
| SRRL -65 X BML -7 | 33.57** | 33.27** | 16.04** | 25.20** | 14.56* | 7.27 | 8.71* | 4.57 | 4.38 |
| SRRL -65 X DMR 103 | 10.26* | 3.09 | 2.72 | 11.01* | 5.22 | 10.00 | 8.67* | 5.15 | 3.69 |
| SRRL -65 X SK -2 | 18.83** | 11.03* | 10.78* | 4.04 | -3.33 | 5.45 | 1.97 | -3.06 | -0.83 |
| SRRL -65 X ACROSS | 18.88** | 13.21** | 8.47 | 0.43 | -10.00* | 6.36 | 12.11** | 10.90* | 4.53 |

Contd…2nd table

| Cross | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SRRL-65 X SK-3 | 8.19 | 4.82 | -3.12 | 9.35 | 5.41 | 6.36 | 27.72** | 15.44** | 6.46 |
| SRRL-65 X MH 12 | 23.78** | 20.82** | 4.72 | 10 | 6.8 | 0.00 | 26.59** | 26.55** | 16.70** |
| SK-1 X BML-7 | 32.70** | 25.54** | 9.31* | 51.36** | 31.07** | 26.37** | 7.80* | 7.77 | 7.65 |
| SK-1 X DMR-103 | 22.19** | 8.72 | 8.33 | 28.33** | 4.51 | 17.30* | -25.31** | -25.78** | -25.87** |
| SK-1 X SK-2 | 30.84** | 16.35** | 16.09* | 33.70** | 6.15 | 27.43** | 12.63** | 11.30** | 13.86** |
| SK-1 X ACROSS | 20.94** | 9.49 | 4.90 | 48.86** | 26.62** | 27.43** | 9.01* | 5.93 | 5.81 |
| SK-1 X SK-3 | 26.54** | 16.44** | 7.62 | 69.67*** | 51.29** | 36.29** | 14.03** | -0.47 | -0.58 |
| SK-1 X MH-12 | 17.11** | 13.66* | -6.19 | 75.17** | 61.14** | 13.71 | -3.61 | -7.34 | -7.44 |
| BML-7 X DMR-103 | 14.18** | 6.98 | 6.60 | 17.29* | 9.02 | 22.36** | 6.71 | 6.07 | 5.88 |
| BML-7 X SK-2 | 5.6 | -1.12 | -1.34 | 11.7 | 0.7 | 20.89* | 12.38** | 11.01* | 13.57** |
| BML-7 X ACROSS | 21.73** | 16.19** | 11.32* | 17.34* | 14.88 | 15.61 | -1.12 | -3.87 | -4.05 |
| BML-7 X SK-3 | 15.59** | 12.25* | 3.74 | 25.34** | 21.23* | 16.88* | 6.07 | -7.39 | -7.56 |
| BML-7 X MH-12 | 28.01** | 24.67** | 8.56 | 47.17** | 18.82* | 14.56 | 11.40** | 7.12 | 6.93 |
| DMR-103 X SK-2 | 4.09 | 4.02 | 3.79 | -6.09 | -9.14 | 9.07 | 2.26 | 0.42 | 2.73 |
| DMR-103 X ACROSS | 11.99** | 9.84** | 9.45* | 21.11** | 14.85* | 28.90** | -1.22 | -3.4 | -4.74 |
| DMR-103 X SK-3 | 8.31* | 4.38 | 4.01 | 21.17** | 9.21 | 22.57** | 11.35* | -2.27 | -3.62 |
| DMR-103 X MH-12 | 11.55** | 1.97 | 1.60 | 41.47** | 8.08 | 21.31* | 8.29* | 4.74 | 3.29 |
| SK-2 X ACROSS | 8.36* | 6.21 | 5.97 | -4.78 | -12.48 | 5.06 | 7.23 | 3.02 | 5.39 |
| SK-2 X SK-3 | 12.31** | 8.17 | 7.93 | 16.27* | 1.76 | 22.15** | 14.15** | -1.37 | 0.91 |
| SK-2 X MH-12 | 9.46* | 0.00 | -0.22 | 17.90* | -11.95 | 5.70 | -0.25 | -5.2 | -3.02 |
| ACROSS X SK-3 | 5.45 | 3.58 | -0.76 | 9.07 | 3.35 | 4.01 | 14.73** | 2.7 | -3.20 |
| ACROSS X MH-12 | 14.84** | 6.88 | 2.41 | 55.96** | 23.90** | 24.68** | 20.68** | 19.33** | 12.47** |
| SK-3 X MH-12 | 12.63** | 6.61 | -1.47 | 57.93** | 30.91** | 17.93** | 20.59** | 9.04 | 0.48 |
| Range | -0.38 to 47.14 | -6.93 to 41.71 | -7.26 to 18.85 | -8.16 to 75.17 | -27.76 to 61.14 | -25.32 to 36.29 | -25.31 to48.51 | -25.78 to 42.35 | -25.87 to 16.70 |

**Table 3. Estimates of percent heterosis (h₁), heterobeltiosis (h₂) and standard heterosis (h₃) against BH 1576 for grain yield per plant (g) in maize**

| Crosses | Grain yield per plant | | |
|---|---|---|---|
| | h1 | h2 | h3 |
| CM -211 X SRRL -79 | 119.50 ** | 91.58 ** | 7.59 |
| CM -211 XSRRL -65 | 33.78 ** | 20.73 ** | -15.76 ** |
| CM -211 X SK -1 | 57.04 ** | 45.16 ** | -3.94 |
| CM -211 X BML -7 | 66.78 ** | 65.16 ** | -5.41 |
| CM -211 X DMR -103 | 20.89 ** | 5.39 | -20.40 ** |
| CM -211 X SK -2 | 35.86 ** | 8.76 | 1.62 |
| CM -211 X ACROSS | 111.01 ** | 99.69 ** | 25.63 ** |
| CM -211 XSK -3 | 29.26 ** | 20.10 * | -32.55 ** |
| CM -211 X MH -12 | 38.27 ** | 10.30 | -38.06 ** |
| SRRL -79 X SRRL -65 | 100.12 ** | 60.10 ** | 11.71 * |
| SRRL -79 X SK -1 | 135.01 ** | 91.85 ** | 26.96 ** |
| SRRL -79 X BML -7 | 95.71 ** | 69.39 ** | -2.99 |
| SRRL -79 X DMR -103 | 63.09 ** | 26.75 ** | -4.27 |
| SRRL -79 X SK -2 | 40.23 ** | 1.53 | -5.13 |
| SRRL -79 X ACROSS | 68.64 ** | 40.44 ** | -11.65 * |
| SRRL -79 X SK -3 | 144.55 ** | 128.50 ** | 10.13 * |
| SRRL -79 X MH -12 | 113.79 ** | 92.26 ** | -19.50 ** |
| SRRL -65 X SK -1 | 34.69 ** | 31.21 ** | -8.44 |
| SRRL -65 X BML -7 | 85.71 ** | 69.07 ** | 17.67 ** |
| SRRL -65 X DMR 103 | 21.03 ** | 16.42 * | -12.07 * |
| SRRL -65 X SK -2 | 28.67 ** | 12.38 * | 5.00 |
| SRRL -65 X ACROSS | 48.02 ** | 40.74 ** | -1.79 |
| SRRL -65 X SK -3 | 65.48 ** | 39.89 ** | -2.39 |

Contd…3rd Table

*HETEROSIS FOR GRAIN YIELD*

| Cross | | | |
|---|---|---|---|
| SRRL -65 X MH 12 | 104.09 ** | 50.95 ** | 5.32 |
| SK -1 X BML -7 | 75.43 ** | 63.63 ** | 8.28 |
| SK -1 X DMR -103 | 15.83 ** | 8.66 | -17.93 ** |
| SK -1 X SK -2 | 49.58 ** | 27.76 ** | 19.38 ** |
| SK -1 X ACROSS | 52.68 ** | 48.92 ** | -1.46 |
| SK -1 X SK -3 | 128.37 ** | 97.35 ** | 30.60 ** |
| SK -1 X MH -12 | 36.61 ** | 2.82 | -31.96 ** |
| BML -7 X DMR -103 | 41.78 ** | 24.64 ** | -5.86 |
| BML -7 X SK -2 | 42.67 ** | 15.06 ** | 7.51 |
| BML -7 X ACROSS | 34.79 ** | 28.75 ** | -19.00 ** |
| BML -7 X SK -3 | 66.84 ** | 53.63 ** | -12.02 * |
| BML -7 X MH-12 | 104.13 ** | 61.65 ** | -7.42 |
| DMR -103 X SK -2 | 15.81 ** | 4.72 | -2.16 |
| DMR -103 X ACROSS | 49.27 ** | 36.80 ** | 3.32 |
| DMR -103 X SK -3 | 59.36 ** | 30.53 ** | -1.42 |
| DMR -103 X MH -12 | 84.16 ** | 32.85 ** | 0.34 |
| SK -2 X ACROSS | 3.22 | -13.64 * | -19.31 ** |
| SK -2 X SK -3 | 64.46 ** | 24.64 ** | 16.46 ** |
| SK -2 X MH -12 | 30.68 ** | -11.27 * | -17.10 ** |
| ACROSS X SK -3 | 53.96 ** | 35.95 ** | -14.47 ** |
| ACROSS X MH -12 | 84.39 ** | 41.20 ** | -11.17 * |
| SK -3 X MH -12 | 119.52 ** | 85.91 ** | -10.40 * |
| **Range** | **3.22 to 144.55** | **-13.64 to 128.50** | **-38.06 to 30.60** |

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significant heterobeltiotic response to days to 50 per cent tasselling, days to 50% maturity, plant height, ear height, ear girth, number of kernels per row; SK-1 X SK-3 with heterobeltiosis of 97.35 per cent registered significant heterosis to days to 50 per cent tasseling, days to 50 per cent silking, days to 50 per cent maturity, plant height, ear height, ear length, ear girth, number of kernels per row; SRRL-79 X SK-1 (91.85% yield heterobeltiosis) showed significant heterosis to plant height, ear height, ear length, ear girth, number of kernel rows per ear, number of kernels per row, 100 grain weight; while the cross CM-211 X SRRL-79 showed heterobeltiosis of 91.58 % and significant response for plant height, ear height, ear length, ear girth, 100 grain weight.

The present investigation clearly showed large magnitude of heterosis for grain yield and yield contributing characters in the five hybrids *viz.,* SRRL-79 X SK-3, CM-211 X ACROSS, SK-1 X SK-3, SRRL-79 X SK-1 and CM-211 X SRRL-79. They appeared to be the most promising hybrids in exploitation of heterosis in maize.

## REFERENCES

Appunu, C. 2002. Heterosis and combining ability studies for Physiological parameters and grain yield in maize *(Zea mays L.).* M. Sc. Thesis, Acharya N. G. Ranga Agricultural University, Rajendranagar, Hyderabad.

Alam, A.K.M.M., S. Ahmed, M. Begum and M.K. Sultan. 2008. Heterosis and combining ability for yield and its contributing characters in maize. Bangladesh Journal of Agricultural Research 33(3) 375-379.

Amanullah, Shah Jehan, Muhammad Mansoor and Muhammad Anwar Khan. 2011. Heterosis studies in diallel crosses of maize. Sarhad Journal of Agriculture. 27(.2): 207-211

Chattopahdyay, K and Dhiman, K. R. 2005. Heterosis for ear parameters, crop duration and prolificacy in varietal crosses of maize *(Zea mays L.).* Indian Journal of Genetics 66(1) : 45-46.

Dan Makumbi, Javier, F. Betrán, Marianne, Bänziger and Jean, Marcel Ribaut. 2011. Combining ability, heterosis and genetic diversity in tropical maize (Zea mays L.) under stress and non-stress conditions. Euphytica 180(2): 143-162

Joshi, V. N., Pandiya, N. K and Dubey, R. B. 1998. Heterosis and combining ability for quality and yield in early maturing single cross hybrids of maize *(Zea mays L.).* Indian Journal of Genetics and Plant Breeding 58: 5 19-524.

Malik, H. N., Malik, S. I., Chughtai, S. R and Javed, H. I. 2004. Estimates of heterosis among temperate, subtropical and tropical maize germplasm. Asian Journal of Plant Sciences 3(1): 6-10.

Nagda, A. K., Dubey, R. B and Pandiya, N. K. 1995. Heterosis and combining ability for grain ability and its components in maize *(Zea mays L.).* Crop Research 10: 297-301.

Premalatha, M, Kalamani, A and Nirmalakumari, A.. 2011. Heterosis and Combining Ability for Grain Yield and Quality in Maize (Zea Mays L.). Advances in Environmental Biology. 5(6): 1264-1266

Vasal, S. K., Srinivasan,G and Pandey, S. I. 1993. Heterosis and combining ability of CIMMYT's quality protein maize germplasm. Low land Tropical Crop Science 33: 46-5 1.

Kumari, Jyoti., Gadag, R.N and Jha, G.K. 2006. Heterosis in maize hybrids. Indian Journal of Agricultural Sciences. 76: 383-385.

Lata, S., sharma, J ,K., Katna, G and Guleria, S. K. 2008. Heterosis and combining ability for polygenic traits in medium maturity hybrids of maize Crop Improvement 35(2):135-138.

# GENETIC TRANSFORMATION STUDIES IN SUNFLOWER (*Helianthus annuus* L.)

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Sunflower (*Helianthus annuus* L.) is one of the most important oil seed crops in the world. In the past few years several attempts were made to obtain sunflower genetic transformation using different tissues such as meristem, shoot axes, hypocotyls, cotyledons of young seedlings and immature embryos (Laparra *et al.,* 1995). Transgenic plants were obtained in some instances, but the efficiency and reproducibility of the transformation process were low. The common problem was the difficulty to establish an efficient regeneration system coupled with transformation. Particle bombardment could be an effective alternative to obtain sunflower transformation also in combination with *A.tumefaciens* co-culture (Bidney *et al.,* 1992; Laparra *et al.,* 1995). Sunflower cotyledons appear to be one of the most effective explants for plant regeneration (Knittel *et al.*, 1991; Fiore *et al*; 1997).

Experiments were carried out with five sunflower genotypes *viz.,* APSH-11, NDSH-1, DRSF-108, BRISF-73 and EC-68415 in the Tissue culture research laboratory of Dept. of Genetics and Plant Breeding during 2005-06. Seeds were sterilized with 0.1% $HgCl_2$ for 5 minutes, subsequently, the seeds were rinsed with sterile distilled water for 5 min. This was repeated thrice to remove any traces of mercuric chloride on seeds. The seeds were maintained on an half M.S. medium for germination. Hypocotyl, cotyledon, primary leaves were excised and cultured on to M.S. medium containing different concentrations of NAA, BA to obtain the callus and multiple shoots.

The pCAM 1391Z with 35 S plasmid, cloned in *E.coli* was used for transformation. The most convenient method for preparing plasmid DNA was the alkali lysis method. In this procedure, cells were lysed by SDS at high pH and then neutralized. Samples of more than 10 ml were best to deproteinize the plasmid with phenol/chloroform prior to ethanol precipitation.

For particle bombardment the hypocotyl, cotyledon, primary leaves were placed in petri dishes. The particle inflow gun (model *Gene pro 2000 He* ) has a chamber of vacuum which enables the particles to get propelled by a controlled burst of pressurized gas, which transports them towards the biological target material, the micro projectiles penetrate thier surface and become incorporated into the interior of the cells, thus indicating biological transformation. The pressure used for bombardment was adjusted to 15 kg/$cm^2$ and tungsten particles size was 325ì. The distance was adjusted to 15 cm by placing the sliding tray in the appropriate slot of the target shelf. The vacuum chamber was having a pressure of 550 mm of Hg. For each shot 25-50 explants were used and each treatment was repeated thrice. 30 mg of tungsten particles were taken into a 1.5 ml micro centrifuge comtube & 10x fold/times volume of absolute ethanol i.e. 300 ìl distilled water, 10 ìl of plasmid, 50 ìl of 2.5 M $CaCl_2$ & 20 ìl of 0.1m spermidine were added under continous vortexing to 50 ìl of tungsten suspension. The solution was then centrifuged and the supernatant was removed. A volume of 150ìl of absolute ethanol was first added and vortexed for 1-2 minutes. The pellet was re suspended in 30 ml ethanol. The mixture (25-30 ìl) is sufficient for at least 5-6 bombardments.

Transient expression of the â –glucuronidase coding gene was examined for 48 hours after transformation. Explants were incubated in X-gluc solution at 37 °C overnight and â - glucuronidase activity was determined microscopically

$$\text{Transient } GUS \text{ Expression (\%)} = \frac{\text{No. of calli /explants showing blue color}}{\text{Total no. of calli/explants bombarded}} \times 100$$

The result thus obtained was subjected to statistical analysis using complete randomized block design.

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Table 1. Transient expression of *GUS* gene (%) in different seedling explants

| Genotype / Explant | APSH-11 | NDSH-1 | DRSF-108 | BRISF-73 | EC-68415 | Mean |
|---|---|---|---|---|---|---|
| Hypocotyl | 71.42 | 100.00 | 100.00 | 100.00 | 75.38 | 89.36 |
| Cotyledonary leaf | 74.28 | 81.81 | 87.67 | 89.09 | 66.03 | 79.77 |
| Primary leaf | 69.23 | 75.38 | 63.15 | 73.68 | 52.63 | 66.82 |
| Mean | 71.64 | 85.73 | 83.60 | 87.59 | 64.68 | 78.64 |

|  | S. E m± | CD at 5% |
|---|---|---|
| Genotype (G) | 0.60 | 1.23 |
| Explant (E) | 0.46 | 0.95 |
| Interaction (GxE) | 1.04 | 2.13 |

Table 2. Transient expression of *GUS* gene of the callus derived from three different explants

| Genotype / Explant | APSH-11 | NDSH-1 | DRSF-108 | BRISF-73 | EC-68415 | Mean |
|---|---|---|---|---|---|---|
| Hypocotyl | 82.35 | 100.00 | 100.00 | 85.70 | 83.72 | 90.35 |
| Cotyledonary leaf | 80.00 | 83.33 | 87.50 | 84.61 | 75.47 | 82.18 |
| Primary leaf | 72.50 | 68.75 | 76.19 | 81.81 | 71.42 | 74.13 |
| Mean | 78.28 | 84.02 | 87.89 | 84.04 | 76.87 | 82.22 |

|  | S. E m± | CD at 5% |
|---|---|---|
| Genotype (G) | 0.48 | 0.98 |
| Explant (E) | 0.37 | 0.75 |
| Interaction (GxE) | 0.83 | 1.69 |

Mean transient *GUS* expression percentage in explants *viz.,* hypocotyl, cotyledonary and primary leaf of APSH-11, NDSH-1, DRSF-108, BRISF-73 and EC-68415 genotypes ranged from 52.63 per cent to 100 per cent with an overall mean value of 78.64 per cent (Table 1). Among the genotypes BRISF-73 has shown highest mean of transient *GUS* expression of 87.59% and lowest mean in EC-68415 (64.68%). Among the explants, hypocotyl has shown highest mean of transient *GUS* expression (89.36%) and lowest mean was in primary leaf (66.82%).

Among the genotypes studied, BRISF-73 was found to be more responsive to transformation in the direct explants followed by NDSH-1, DRSF-108, APSH-11 and EC-68415. The mean transient *GUS* expression percentage in the calli derived from explants ranged from 68.75 per cent to 100 per cent. Overall mean value observed was 82.22 per cent. Among the genotypes, highest mean of transient expression of *GUS* gene was observed in callus derived from DRSF-108 (87.89%), while lowest mean was recorded in EC-68415 (76.87%). The differential response of the genotypes could be due to the genetic make up of the genotype, since both the genotypes, DRSF-108, BRISF-73 were found to be more responsive to transformation compared to their parental lines

Among the different calli, hypocotyl calli recorded highest mean (90.35%) while lowest mean was in primary leaf (74.13%), Overall mean revealed that *GUS* expression was higher in the calli (82.22%)

as compared to the explant (78.64%) in all the genotypes (Table 2). The differences in the expression levels of the explants may be attributed to the differences in their physical and biochemical characteristics that may affect the expression of the *GUS* gene or the activity of the *GUS* enzymes. The success of transformation ultimately depends on the availability of an efficient transformation system.

## REFERENCES

Bidney, D.L., Scelonge, C. J and Malone-Schoneberg, J.B. (1992). Transformed progeny can be recovered from chimeric plants regenerated from *Agrobacterium tumefaciens* treated embryonic axes of sunflower. Proc.13th Int. Sunflower Conf. Vol.II.

Fiore, M. C., Trabace, T and Sunseri, F. ( 1997). High frequency of plant regeneration in sunflower from cotyledons via somatic embryogenesis. Plant cell reporter 16 : 295-298.

Knittel, N., Escandon, A. S and Hahne, G. (1991). Plant regeneration at high frequency from mature sunflower cotyledons. Plant Science, 73: 219-226.

Laparra, H., Burrus, M., Hunold, R., Damm, B., Bravo Angel, A. M., Brunner, R., Huhne, G., Cassells, A. C and Jones, P. W. (1995). Expression of foreign genes in sunflower (*Helianthus annuus* L). evaluation of three transfer methods. Euphytica 85: 63-74.

# EFFECTIVENESS OF ANIMATED MODULES OF NUTRITION MESSAGES ON HIGH SCHOOL CHILDREN

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Animated modules on nutrition focus on the basic concepts in human nutrition. Through these modules, school children can learn the role and function of the macro and micronutrients essential for human health, and how the growth processes are affected by nutritional deficiencies. They also make children to learn nutritional requirements for healthy body.

Several studies have reported that multimedia interventions and animated modules are successful in improving knowledge and changing the attitude of the school children. The present study was formulated to know how developed animated modules on nutrition messages with different formats such as with text, with dialogue, and with jingle were effective.

In the present study nutrition messages for high school children were identified and selected from nutrition experts. Based on the content of nutrition messages three animated modules ( AM 1 Food groups and functions,  AM 2 Be well red –Aware of anemia and  AM 3   Bye bye to junk foods) were developed with different formats for high school children. 120 high school children from government and private schools in Hyderabad were selected as sample through sequential sampling technique and exploratory research design was adopted for the study. A three point rating score card with six major indicators and three sub indicators was developed to measure the effectiveness of animated modules and index value of three modules was calculated based on indicator score.

In case of AM 1, presentation contributed to the maximum (18.3%), followed by animation (18.1%) and audio and video (17.3%) indicators. The lowest contribution was from design (14.8%). The contribution of colour (16.4%) and illustration (15.0%)

was also at optimum level. The load of information was more in this module as there were 22 messages. Sequence, use simple words for easy understanding, compatible images and voice over might have been given top priority in production of the module.

Natessan and Girija (2001) in their study also prepared multimedia animated modules for selected 24 topics of VIII standard General Science text book. The research findings of their study indicated that experimental group student's achievements were higher than the control group. The multimedia based modular approach was rated high on presentation.

In AM 2 colour attained high score (17.6%) followed by illustration (17.3%), audio and video (17.1%) and design (16.4%). The slogan of the module being 'be well red' and the content on blood and hemoglobin, more of red colour was used. The colourful images of fruits and vegetable might have also impressed the school children.

Emma *et al.* (2000) developed a computer aided learning module for educating patients about diabetes. They found that interactive module was very effective, colourful and useful in teaching practical skills and promoting consolidated theoretical understanding.

In AM 3 colour (18.7%), illustration (18.6%) and design (18.3) ranged almost equally in contributing to the effectiveness of the module. There were only five messages and the nature of these messages was motivation for avoidance of eating junk foods. Efforts were made to present them in a pleasant manner. Pleasant colours, cartoon images and subtle jingle were the highlights of this module. Moreover the period of presentation was also less compared to other two modules. These might be the reasons for low scoring on presentation.

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In spite of higher contribution from illustration, colour and design in case of AM 3, it attained lowest index value because of lower contribution from presentation, animation and audio& video.

Murray (1994) claimed that animation, especially cartoon techniques, can be very motivating, have charisma and glamour. They were more economical for the computer's memory and were therefore displayed more rapidly, a fact that contributed to the general excitement. Furthermore, animated and interactive images, in comparison to static ones, can radically increase the viewer's sense of reality and hence increase motivation. It seems that moving pictures have some kind of inherent characteristics like playful motion and interactivity that attract the attention of the eye, characteristics that are missing from static pictures.

The findings of the study indicate that animated module 1 was effective in terms of indicators presentation and animation. These module attained high index value based on the indicator scores where as animated module 2 and module 3 were effective in colour and illustration. The three animated modules were effective and found to be significantly different in terms of effectiveness.

**Table 1. Effectiveness of three animated modules**

| S.No | Major Indicators | Indicators contribution percentage for three modules | | |
|------|------------------|------|------|------|
|      |                  | **AM 1** | **AM 2** | **AM 3** |
| 1. | Design | 14.8 | 16.4 | 18.3 |
| 2. | Illustration | 15.0 | 17.3 | 18.6 |
| 3 | Colour | 16.4 | 17.6 | 18.7 |
| 4 | Audio and Video | 17.3 | 17.1 | 17.0 |
| 5 | Animation | 18.1 | 15.9 | 14.1 |
| 6 | Presentation | 18.3 | 15.7 | 13.3 |
|   | Total | 100 | 100 | 100 |

**Table 2. Effectiveness of Animated Modules based on Index Value**

| S.No | Indicator | AM 1 | AM 2 | AM 3 |
|------|-----------|------|------|------|
| 1. | Design | 7.06 | 6.3 | 6.22 |
| 2. | Illustration | 7.18 | 6.62 | 6.32 |
| 3 | Colour | 7.82 | 6.72 | 6.37 |
| 4 | Audio and Video | 8.28 | 6.54 | 5.78 |
| 5 | Animation | 8.65 | 6.13 | 4.85 |
| 6 | Presentation | 8.74 | 6.05 | 4.51 |
|   | Total | 47.73 | 38.36 | 34.05 |
|   | Rank | I | II | III |

**REFERENCES**

Emma, J. B., Abdul, R., Sheila, T. and Steve, C. 2000. Computer- aided learning for the education of patients and family practice professionals in the personal care of diabetes. *Journal of Nutrition Education.* 32 (4): 204-213.

Murray, H. J., (1994), Restructuring Space, Time, Story, and Text in Advanced Multimedia Learning Environments. In Barret, E., Sociomedia: Multimedia, Hypermedia and the Social construction of Knowledge. Cambridge: MIT Press.

Natessan, N. and Girija, R.S. 2001. Methods of communication for general science education. *Journal of Communication Studies.* 19 100-107.

# PESTICIDE RESIDUE CONTENT OF SELECTED WHOLE AND PROCESSED FOOD GRAINS OF SCARCE RAINFALL ZONE OF ANDHRA PRADESH

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The ever-increasing trend of population growth and the higher rate of food consumption have forced the producers to intensify their efforts to increase food production. The farmers as one of the main components of this chain are also using escalating amounts of pesticides to protect their crops (Ckamaca, 2002; Struger, 2002). Pesticide residues adversely affect human health and the natural environment. For issues affecting human health, several pesticides were detected to exceed Maximum Residue Limit (MRL) in different crops. Concern about the effect of pesticides on human health has lead to the estimation of pesticides in food crops and foods. Data on these aspects is scarce in India mainly in Andhra Pradesh. Therefore, this study was taken up to estimate the level of pesticide residues present in food crops commonly grown in the scarce rainfall zone of Kurnool and Anantapur in Andhra Pradesh.

In the present study residue level of certain organochlorines (OCs), organophosphates (OPs) and carbamates (Carbofuran) such as monocrotophos, quinalphos, endosulfan, chlorpyrifos, acephate and carbofuran were determined in maize, bengal gram, groundnut and jowar and the effect of processing of grain on the residue level was determined. Samples were procured from RARS Nandyal, scarce rainfall zone of Andhra Pradesh. The samples used for pesticide analysis had been stored for 6 months after harvesting by the farmers. The whole samples were processed - maize as flour, bengal gram dehulled, groundnut roasted and jowar dehulled. After processing the samples were poured into polythene zip lock covers and stored in a refrigerator at $14^0$C. The samples were first extracted by solvent extraction method and residues were estimated by using multi residue analytical technique employing gas chromatography (GC), with electron capture detector (ECD) equipped with capillary column (Sharma, 2007).

The results of pesticide residue content showed that, the residues in whole and processed grains were Below Detectable Level (BDL). These results agreed with Holland *et al.* (1994) who reported that residues of foods are influenced by the storage, handling and processing that occurs between harvesting of raw agricultural commodities and consumption of prepared foodstuffs and just by the insecticides sprayed. Thus, in this study also storage of the grains for six months by the farmer had degraded the pesticides to BDL, making them safe for consumption.

Thus, this study indicated that residues of none of the pesticides were detected. Handling, processing and storage perhaps had an effect on further reduction of pesticide residues. Therefore the grains grown in scarce rainfall zone of Andhra Pradesh are safe to consume, they may not pose any hazards to human health at the present levels of pesticides application and storage.

**Table 1. Maximum Residue Limit (MRL) and Pesticide Residue obtained for samples studied**

| S. No. | Name of Pesticide | MRL Value (mg/kg) | Residue obtained |
|--------|-------------------|-------------------|------------------|
| 1. | Monocrotophos | 0.025 | BDL |
| 2. | Quinalphos | 0.01 | BDL |
| 3. | Endosulfan | - | BDL |
| 4. | Chlorpyrifos | 0.05 | BDL |
| 5. | Acephate | 0.02 | BDL |
| 6. | Carbofuran | 0.10 | BDL |

Source: Indian Ministry of Health and Family Welfare, (2004); Jiwan Prava Lama, (2008).

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**REFERENCES**

Ckamaca, H. 2002. Alga growth inhibition by water pollution. Environmental Pollution. 117 (3): 411-419.

Holland, P.T., Hamilton, D., Ohlin, B and Skidmore, M.W. 1994. Effects of storage and processing on pesticide residues in plant products. *Pure and Applied Chemistry*. 66 (2): 335-356.

Indian Ministry of Health and Family Welfare. 2004. The Prevention of Food Adulteration Act & Rules; Part XIV - Insecticides and Pesticides – 65 Restriction on the use of insecticides plus amendments.

Jiwan Prava Lama. 2008. Standard setting on pesticide residues to ensure food safety**.** The Journal of Agriculture and Environment. Vol. 9.

Sharma, K. K. 2007. Pesticide Residue Analysis Manual. ICAR, Directorate of information and publications of Agriculture, New Delhi.

Struger, J. 2002. Pesticide concentration in the Don and number river watersheds 1998-2000. Environment Canada. 1-3.

*Abstracts of Thesis Accepted for the Award of Post-Graduate and Doctorate Degrees in the Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad - 500 030*

# Interaction of acid exudates in chickpea with biological activity of cry toxins from *Bacillus thuringiensis* Berliner against *Helicoverpa armigera*(Hubner)

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Major Advisor:  Dr. P. Arjuna Rao

**Department of Entomology**

The present research was taken up to study the "Interaction of acid exudates in chickpea with biological activity of cry toxins from *Bacillus thuringiensis* Berliner against *Helicoverpa armigera* (Hubner)." These studies were carried out at the International Crops Research Institute for Semi-Arid  Tropics (ICRSAT), Patancheru, Andhra Pradesh, India during 2005-08. The effect of acid exudates on the biological activity of Cry toxins from *B. thuringiensis* was studied both under laboratory and field conditions.

The *H. armigera* egg and larval nubmers before and after sprays of *B. thuringiensis (Bt)* fromulation Biolep were low on the chickpea genotypes ICC 506 and ICCV 10 across *Bt* concentrations as compared to those on L 550 and C 235 during vegetative and flowering stages. Leaf feeding and were lowest on ICC 506, followed by ICCV 10 across *Bt* concentrations as compared to the on L 550 and C 235. During the 2005-06 post-rainy season and first planting during the 2006-07 post-rainy season, highest grain yield was recorded in case of ICCV 10. In the second planting the genotypes ICCV 10 and ICC 506 recorded the highest total grain yield. There were no significant differences between the genotypes and *Bt* concentrations for grain yield.

Significantly lower leaf damage was recorded on ICC 506 across *Bt* concentrations in detached leaf assay under laboratory conditions.

At the vegetative and flowering  stages, ICC 506 had the highest amounts of oxalic acid on dry weight and leaf area bais. At the podding stage, ICCV 10 had the highest amount of  malic acid at the vegetative, flowering, and podding stages. On leaf area basis, ICCV 10 had the highest amount of malic acid at the vegetative stage, whereas C 235 had the highest amount of malic acid at the flowering and podding stages.  Fumaric and citric acids were recorded at the podding stage only. The genotype  C 235 had the highest amount of fumaric and citric acids. There was no citric acid in ICC 506.

The survival and developmcnt of H. *armigera* larvae reared on artificial diet with leaf/pod powder of different chickpea genotypes and *Bt* were significantly lower as compared to that on the standard artificial diet, and the diets without *Bt*. Larval survival, larval and pupal weight and pupation and adult emergence were lower on the resistant genotypes than on the susceptible ones, and the standard artificial diet. Oxalic and malic acids in the artificial diet increased the biological activity of *Bt* toxins on the *Harmigera,* and resulted in reduced larval weight, prolonged development, and reduced longevity and fecundity.

The amounts protein in the BBMV preparations ranged from 0.131 to 0.326 mg ga$^{-1}$. The amount of protein estimated from the BBMV of larvae fed on diets with *Bt* was higher as compared to the amounts in the BBMV of the larvae fed on diet without *Bt*, indicating the binding of the *Bt* protein to the BBMV which resulted in increased protein content in the BBMV.

The insecticidal activity of *Bt* endotoxins depends on the amounts of food ingested by the target insects. The organic acids (oxalic and malic acids) also act as antifeedents and therefore may reduce the effect of *Bt* as less amounts of food  will be consumed by the larvae. However,  the amounts of oxalic and malic acids impregnated in to the diet did not effect the conversion of protoxin to toxin and binding to the BBMV, and thus the effectiveness of *Bt*  toxins.

## Prevelence of obesity among school children (9-12 years) and development of education material

Student: Mitu Singh                               Major Advisor:  Dr.S. Sumathi

**Department of Nutrition & Dietetics**

The study was carried out in the randomly selected schools, out of which two were private schools and the other two were government schools. 50 school children of the age group of 9-12 years (50x4=200) were randomly selected from these four schools. Height, weight, waist circumference and skinfold thickness for every child were taken. BMI for each child was calculated and children were categorized as obese, overweight and non-obese as per IAP guidelines. Information on general dietary habits and physical activity patterns, which relate the school children with obesity, was collected by a questionnaire. As the study was aimed to impart education about childhood obesity, its causes, consequences, prevention and management, education materials in an easy and understandable language were developed.

The prevalence of obesity and overweight in the study sample was reported as 7 per cent and 21.5 per cent respectively. Obesity and overweight were prevalent more in private school children (11% and 32%) as compared to government school children (3% and 11%). Boys (8.7%) were reported to be more obese than girls (5.2%).

When the general dietary habits of the obese and non-obese children were compared, it was observed that obese children were more inclined to faulty eating habits like more consumption of junk foods, soft drinks, bakery products, butter/ghee/cream etc and frequent eating outside the home. The consumption of fruits and vegetables was found to be more by non-obese children when compared to the obese children. Obese children were found less active when compared to non-obese children. They sleep more; spend more time in front of T.V./computers/Videogames and do not indulge themselves in any extra curricular activities or any exercise routines and prefer car/bikes/buses to walking as compared to the non-obese children.

Obese children and their parents were given education about childhood obesity, its causes, consequences, prevention and management. A significant change in knowledge levels (94.1%) and attitude levels (93.9%) was reported in obese children after the education program. In parents, a change of 68.7 per cent in knowledge levels and 71.5 per cent in attitude levels was observed. Hence, schools can be considered as the key locations and family based intervention programes are the best approaches for health promotion and prevention of childhood obesity. **M.Sc.(HS), 2008.**

## Development of low calorie grape fruit productions for diabetics

Student: Nida Fatima Hazari                         Major Advisor:  Dr. M. Usha Rani

**Department of  Foods and Nutrition**

Diabetes mellitus is a common disease caused by the absolute or relative absence of insulin and it remains an active disease and danger to human health. The prevalence of Diabetes is increasing constantly and the World Health Organization has estimated that Diabetes will affect 221 million people world wide by the year 2010. Habitual diet is the major modifiable risk factor and the identification of simple, cost effective strategies for prevention  and management as a matter of urgency.

Obesity is also an independent risk factor for various chronic diseases and moderate weight loss improves glycemic control, reduce the risk of cardiovascular disease and can prevent the development of type II  Diabetes Hence Grapefruit, a citrus fruit with low Glycemic index suitable for Diabetics was selected for the present study. Low calorie products like Grapefruit juice, chiller, spread and ketchup incorporating artificial sweetner in place of sugar were developed.

The low calorie products developed were subjected to organolleptic evaluation for better assessment The four acceptable products were selected

and analyzed for proximate composition. Acceptability study was carried out on six non-insulin dependent diabetic patients and it was found that the ready to serve beverages like Grapefruit juice and Grapefruit chiller were more acceptable and preferred than the preserved products like Grapefruit spread and Grapefruit ketchup.

Thus. the inclusion of grapefruit and its products maybe recommended, especially to the pre-diabetic and diabetic patients to delay the long term complications and add variety to the diabetic diet and achieve a tight good glycemic control. **M.Sc.(HS), 2008.**

## Development of probiotic enriched food mixes

Student: Lavanya Nallamothu                     Major Advisor:  Dr. K. Uma Maheswari

**Department of   Food Science and Technology**

The developed indigenous food mixes were assessed for nutrient composition, physico chemical characteristics (moisture, protein, fat, ash, crude fibre, pH, acidity, phytic acid, polyphenols, *in vitro* protein digestibility [IVPD] and *in vitro* starch digestibility[IVSD]) and microbiological analysis (Standard plate count [SPC], coliform, yeast, mould and lactobacilli counts). Storage studies of the mixes was done for a period of two months. Two products viz. roti (10%, 20% and 30%) and weaning mix were prepared (5%, 10% and 15%) by incorporating PEFM at different levels and subjected to sensory evaluation.

The moisture, phytic acid, polyphenol content and pH in PEFM was significantly lower on initial day compared to Raw mix and Autoclaved mix. The protein and fat content was non significantly lower in PEFM than in Raw mix and Autoclaved **mix on initial** day. Acidity, IVPD and IVSD, in PEFM was significantly higher on initial day than Raw mix and Autoclaved mix. However, the ash and crude fiber content was non significantly higher in PEFM compared to Raw mix and Autoclaved mix.

The standard plate count (SPC),  yeast and mould count was higher, where as coliform count was lower in PEFM compared to Raw mix and Autoclaved mix. The lactobacilli count was $6.7 \times 10^7$ in PEFM.

After 60 days of storage the acidity increased significantly in PEFM compared to raw mix and autoclaved mix. The moisture, protein, fat, ash, crude fiber, IVPD and IVSD in PEFM also increased during storage of 60 days, but the increase was not statistically significant. It was observed that pH and polyphenol content reduced significantly in PEFM compared to raw mix and autoclaved mix, but there was non significant decrease in phytic acid. The SPC, coliform count, yeast and mould count increased where as the lactobacilli counts decreased in PEFM after 60 days of storage.

The developed PEFM was incorporated at different levels and two products *viz* roti (10%, 20% and 30%) and weaning mix (5%, 10% and 15%) were prepared. Sensory evaluation scores indicated that overall acceptability of roti at 20% level and weaning mix at 10% level was acceptable.

It can be concluded that the PEFM prepared with bajra flour, defatted soyaflour and SMP in the ratio 2:1:1 has resulted in enhanced physico chemical characteristics such as moisture, fat, crude fiber, IVPD, IVSD and lactobacilli counts. The developed PEFM can be incorporated to prepare acceptable food products such as roti at 20 per cent level and weaning mix at 10 per cent level. **M.Sc.(HS),  2008.**

## Effect of Parenting Styles on identity styles of Adolescents

Student: Priyanka                     Major Advisor:  Dr. (Mrs.) M. Sarada Devi

**Department of Children Guidance and Family Counselling**

Adolescence is a very crucial process in the span of human life where identity plays a major role. The process of developing an identity begins with the

infant's discovery of self, continues throughout childhood and becomes the focus of adolescence. The present study  was undertaken to identify the parenting styles as

perceived by adolescents on their parents parenting style and identity style of adolescents.

Then major findings of the study are as follows. Majority of adolescents were in the age group of 18-22 years and pursuing graduation. Majority of fathers (65%) were found to be graduate while majority of mothers (58%) had education up to intermediate. In total 60 per cent of fathers were working in government and private sectors, 21 per cent were involved in business and few were professionals from various fields. Only 17 per cent of mothers were found to be working in various private and government organizations and majority were house wives.

Parenting styles were found to be significantly related to identity styles of adolescents. Democratic parenting style had favorable identity styles among adolescents as information identity style comparing to authoritarian and permissive parenting style.

Majority of adolescents under authoritarian parenting had normative identity style. Adolescents and their fathers higher education was found to be related to favorable identity styles. Higher income of mother was related to less favorable identity styles under authoritarian parenting style.

Permissive parenting style had more favorable identity style among adolescents as information identity style comparing to authoritarian parenting style but also resulted in higher risk of diffuse / avoidant identity style compared to democratic and authoritarian parenting styles

Among adolescents, boys had more favorable identity style (as inform ion identity style) comparing to girls. Majority of girls had lack of exploration and hence reported normative identity style comparing to boys.

Thus democratic parenting style charactgerized by warmth and responsiveness was favourable for better exploration and reasonable demandingness resulted in commitment which favored higher identity styles followed by authoritarian parenting style. Variations under permissive parenting as higher information identity style than authoritarian parenting style and higher diffuse / avoidant identity style than democratic and authoritarian parenting style was found. **M.Sc.(HS), 2008.**

# Effect of oat based breakfast products on glycaemic response in niddm subjects

Student: Afshan Ambreen                                    Major Advisor:  Dr. M. Usha Rani

**Department of Food and Nutrition**

The present study the glycaemic response to eight breakfast items namely roti, oat roti, uttapam, oat uttapam, missi roti, oat missi roti, upma, oat upma was studied in six non-insulin dependent diabetic subjects. The products made with oat were subjected to organoleptic evaluation along with the control product for better ease of assessment. The control and oat breakfast items were selected and analyzed for proximate composition. It was observed that oat incorporated breakfast items were rich in soluble fibre and protein when compared to their control counterparts.

All the breakfast items tested had almost similar nutrient contents. An oral glucose tolerance test was conducted for all the subjects using 75 g glucose load. Each of the test breakfast items were then given separately after an overnight fast to subjects. The fasting and post prandial blood samples collected at half hourly intervals upto 2 hours were analysed for plasma glucose by the glucose-oxidase peroxidase method. The glycaemic response to the breakfast items as compared to that of glucose in the diabetic subjects was determined by comparing the areas under the 2-hour glucose response curve.

Results obtained indicate that the consumption of oat based breakfast products elicit lower plasma glucose levels in diabetic subjects compared to control products. Amongst all breakfast products control roti (0.8) elicited highest glycaemic response followed by control uttapam (0.76), control missi roti (0.745), control upma (0.71), oat roti (0.71), oat missi roti (0.7), oat uttapam (0.69), and oat upma (0.67). The similar trend was observed in peak rise over fasting levels and area under the curve. Therefore incorporating oat in breakfast products is efficient in reducing post prandial glucose rise. Thus oat incorporated breakfast products should be encouraged in the dietary management of diabetes **M.Sc.(HS), 2008**

# Effect of teachers absenteeism on children academic

Student: A. Prashanthi                                Major Advisor:  Dr. (Mrs.) S. Ratna Kumari

## Department of  Human Development & Family Studies

Exploratory study was used to know the teachers absenteeism on children's academic performance. Warangal district of Andhra Pradesh was purposively selected for conducting the study. Co-educational government upper primary schools in Hanamkonda (rural area) and Warangal town (urban area) were selected. Thirty (30) schools (15-urban, 15-rural) were selected for the study. All teachers including vidyavolenteers, who were teaching 4th and 5th classes, were studied. Three students each of all the sample teachers were selected.

Results revealed that teachers attendance status on the investigation was nearly three thirds (72%) of the teachers were present in the school. Majority (82%) of the teachers expressed that they had participated in trainings, meetings etc during working days by being on leave.

Major findings of the study were teacher's absenteeism had not shown any significant relationship with children's academic performance both in urban and rural schools. It was also clear that teachers' absenteeism had not shown any significant relationship with academic performance of children belonging to rural area studying in 4th and 5th classes of.

The findings of the present study could be useful to the higher authorities of education to know about what were the difference between the academic performance of children studying in urban and rural government schools. (Children belonging to urban government schools had higher mean scores than children from rural government schools). **M.Sc. (HS), 2008.**

# Designing Functional Residential Interiors for wheelchair users

Student: Manisha Mohanta                          Major Advisor:  Dr. (Mrs.) Mahalakshmi V. Reddy

## Department of  Home Science

Findings of the study indicated that, there were an equal number of male and female respondents in this study. Respondents who were affected with polio and victims of accidents were four each and another two were sufferers of cerebral palsy or paralysis. All of them had problem with lower limbs and six among them also had problems with upper limbs and deformed facial bones. Polio and cerebral palsy affected members had prolonged disability period while the rest were for less than 10 years.  Among the 10 respondents, seven were young adults in the age group of 20-30 and four were married. All of them had the support of either parental or conjugal family except one who opted to live independently. All the respondents had formal education except one. Five among them have completed either graduation or post graduation, while two more are pursuing post-graduation. Two of the respondents were engaged in managing their own family enterprise while one respondent was employed outside the home. Except one respondent, all of them belong to middle or upper-middle income group. Regarding management of their

daily chores, seven of them needed assistance in toilet activities and clothing management, while four persons looked-for assistance in activities like bathing and grooming, cooking and home management.

Equal number of respondents lived in Independent houses and apartments. All the participants reported their partial satisfaction with adaptations introduced in the home. Everyone had problem in accessing toilets bath area, personal room, kitchen and approach area outside the house

It was observed that the selected residential buildings did not possess many design features as per standards and guidelines meant for wheelchair users. So, design guidelines and standards suggested by various authors and authorities were considered, for evolving design solutions to overcome the problems expressed by the respondents. Design solutions suggested in this study are presented in the form of computer graphical drawings in AutoCAD 2007. Necessary plan and perspectives for each functional

area of the house were evolved independently by incorporating the design solutions and these were unified to create a model residential house plan.

From the present study it can be concluded that residential buildings should ensure accessibility features to meet the needs of end-users. The design solutions proposed in this research can be incorporated in any residential building to improve functionality. There are several ways of humanizing the residential buildings like -altering an existing house with suitable modification, building an additional portion or buying a new home to provide a satisfactory and self-dependent life. **M.Sc.(HS), 2008**

## Strategies for judicious residential interior space management

Student: M. Nirvikalpa                                  Major Advisor:  Dr. (Mrs.) Vijaya Nambiar

### Department of  Home Science

The model of two bed room apartment was developed in Auto CAD . Floor plans, perspectives and rendered views of each room with space saving techniques (furniture arrangement, furniture design, accessories, colour schemes and lighting features) were developed.

As summary, space was limited for bedrooms, kitchens and bathrooms. Living / dining spaces were observed to be large in size when compared to other rooms. Built-in furniture and movable furniture are the types of space savers found in households that allow the homemaker to treat space as required. Majority of households had light coloured walls with emulsion paint and rough finish, enabling easy maintenance. CFL with white tinge were common lighting systems found in all rooms of households as they are economical and also give cool effect to space leading to space illusion. Marble white flooring is other common type of flooring observed at majority of households, though difficult to maintain, led to illusion of space.

To conclude, the space saving strategies were adopted by homemakers as there is availability of wide range of products that save space. Also because of economic reasons, homemakers are compromised to get satisfied with the available space which provokes then to find ways to save space. Varied way *s* of obtaining information on space saving techniques have helped the homemakers, space planners , furniture designers and architects to look into space as an important factor and treat them accordingly depending up on the requirements of occupants. **M.Sc.(HS), 2008.**

## Selection Criteria In Rice Under Sri Management System

Student: Ch. Madhu Sudhan Rao                         Major Advisor:  Dr. M. Hemanth Kumar

### Department of Genetics and Plant Breeding

The present investigation was under taken in Rice (*oryza.o sativa* L.) to evaluate the promising rice varieties for SRI cultivation, assess, variability and estimate heritability and genetic advance as per cent of mean, character association and path coefficient analysis for ten genotypes under SRI and conventional managements. The experiment was laid out at S. V. Agricultural College, Tirupati during *Rabi,* 2006

Analysis of variance revealed that significant differences among the genotypes for the characters studied indicating the existence of genetic variability among the genotypes. Based on the mean performance Sravani, Swathi and Swarnamukhi were considered to be best suited for cultivation under SRI management.

High variability was observed for grain yield per plant followed by root mass and total dry matter production. Whereas moderate variability existed for plant height, total tillers per plant, number of effective tillers, number of grains per panicle, root to shoot ratio, test weight and leaf area index at 90 DAS. High heritability coupled with high genetic advance as per cent of mean was observed for grain yield per plant, leaf area index at 90 DAS, total dry matter production, test weight, total tillers per plant, number of effective tillers per plant, root

mass and root to shoot ratio indicating that they were under the influence of additive gene action, which can be improved through simple selection procedures.

Grain yield per plant exhibited positive significant correlation with plant height, panicle length, total dry matter production, root mass and harvest index under SRI management and with total dry matter production alone under conventional management. Direct selection for total dry matter production and root mass and indirect selection through root to shoot ratio and harvest index in SRI management and direct selection for days to maturity, harvest index and leaf area index at 90 DAS in conventional management would be effective for improving grain yield. **M.Sc.(Ag), 2008**

# A Study On The Market Potential For Saaf In Nizamabad Territory Of Andhra Pradesh.

Student: K. Mahendra                                    Major Advisor: Dr.P.Radhika

## Department of Agribusiness Management

The study was carried out in Nizamabad district. In the district four mandals were selected and in each mandal four villages were selected and from each village 10 farmers were identified for the study randomly. The data was also collected from dealers and for the purpose 20 dealers from four mandals were selected randomly, thus making a total sample of 120 farmers and 20 dealers. The Primary data was collected from farmers and dealers using questionnaires through survey method. The secondary data was gathered from the past records maintained by pesticides dealers, Company distributors, journals, and various sites in the internet.

The project study revealed that Primary educational level of the farmers in the study area was 38.33 percent. With regards to land holding majority of the farmers were holding semi-medium (33 percent) and medium (29 percent) size land ranging between 2-4 acres and 4-10 acres.

Majority (32 percent) of the farmers are allocating Rs 500-1000 for pest and diseases control. Whereas 28 percent of farmers are spending an amount of Rs.1500-2000, and 23 percent of farmers are spending an amount of Rs.2000 and more. Most of the farmers (70 percent) are considering the factors of excellent control, quality of the produce, availability of the credit and dealers recommendations at the time of buying fungicides. Most of the farmers (95 percent) are using more fungicides during *kharif* season.

Majority of the farmers (66 percent) were going for two sprayings in one season. When their satisfaction levels were assessed, most of the farmers said they are satisfied. About 65 percent of farmers gave low rating to the factors price and promotional activities for Saaf fungicide. Seventy percent of farmers gave high rating to the factors performance, farmers' acceptability and timely availability for Saaf fungicide.

The project study revealed that educating the farmers regarding the fungicides availability, usage and benefits through aggressive promotional strategies like field demonstrations, visits and other promotional campaigns will be very beneficial to the company. Appointing of more field assistants to train and interact with farmers and to provide prescriptions, better schemes and incentives to the dealers to promote the product are certain other measures which can be taken up. The prices of the products can be made competitive with other company products. Fungicide market is still a nascent market and has huge potential for development.

Fungicides molecule to be launched can be systemic in nature, effective on wide range of diseases with non-phytotoxicity, no residual effect and that shows quick results with longer duration of effectiveness and product positioning must be done with better promotional strategies.

The dealers expect an increase of five to six percent in the sales of Saaf in the next season. Hence the company should concentrate on increasing the market share with help of appropriate promotional activities. MSc.(**MABM), 2008.**

# A Study on assessing the acceptability of single cross maize in Guntur and Mahaboobnagar Districts of Andhra Pradesh.

Student: CH. Venkatesh                                    Major Advisor:  Dr. Seema

**Department of Agribusiness Management**

The study was conducted in two districts viz., Guntur and Mahaboobnagar of Andhra Pradesh.

The average land holding of the sampled farmers in Guntur is 10.76 acres where as it is in Mahaboobnagar with 9.88 acre. The area under maize is 996.2 acres in Guntur and 301.5 acres in Mahaboobnagar. With regards to cost of cultivation per acre, among the different maize brands, it is higher for 30V92 (Rs. 14367) in Guntur and Sampann (Rs. 7996) in Mahaboobnagar. The results revealed that labour cost shared the major slice of expenditure for both the districts. Yields per acre were highest for 30V92 (38.84q) in Guntur and K50 (16.35q) brand in Mahaboobnagar. Gross returns per acre were highest for 30V92 (Rs. 25219) in Guntur and K50 (Rs. 10356) brand in Mahaboobnagar. With regards to the satisfaction levels of the farmers, in Guntur district, majority of the farmers were not satisfied with regards to price, total yield increase of all brands where as the farmers were highly satisfied with regards to the germination percentage and convenience in harvesting of all brands.

The project study suggests that NSL should increase the awareness levels of the product. Conduct of demos, arranging of visits for farmers brings difference from other competitors' products. The company may take up intensive advertisements and sales promotion activities. **M.Sc.(MABM), 2008.**

# Evaluation of Retailer Network and Benchmarking for Preferred Dealer inTadepalligudem region of Andhra Pradesh state

Student: Suresh Vemula                                    Major Advisor:  Mrs. P. Radhika

**Department of Agribusiness Management**

The present study is focused on Evaluating the Financial & Distribution strengths of dealers & retailers, evaluating the retailers reach to the farmers, understanding his level of interest in PGPs & Biozyme in particular, understanding his dealings with Biostadt, understanding his allied business activities and evaluating the market potential for PGRs and analysis of the competitors in the territory of Tadepalligudem, Andhra Pradesh state. Convenience sampling method was followed for selecting the respondents.

The data collected was analyzed by using the statistical tools such as totals, averages, weighted averages, frequency distribution methods

The competitor's analysis is made based on the competitor products & their prices collected from the markets surveyed.

Out of the total dealers surveyed 72 per cent of them are providing good services to the farmers & 69 per cent possess good distribution strength & 65 per cent of them have good financial strengths. On the whole 35 per cent dealers possess good strength in all the three aspects i.e financial, distribution & services to the farmers.

56 per cent of the dealers are recommending the PGPs due to attractive field work, which make aware of the products to the farmers and 25.4 per cent of the dealers are recommending PGPs based on perceived quality. Based on all these factors which also creates trust among the farmers.

The quality is perceived to be very good by majority of the dealers, The price is perceived to be average, (i.e highly priced) , the packaging is perceived to be very good and field work is perceived to be poor & promotional material is perceived to be poor by majority of the dealers. So field work has to be stregthen for improved sales and introducing the customised packages for all the products will also helpful for improved sales. **M.Sc.(MABM), 2005.**

# Assessing the market potential for selected cotton hybrids of Sri Rama Agri Genetic private limited in Guntur District of Andhra Pradesh.

Student: A. Ratnakara Rao                                      Major Advisor: Dr. A. Janaiah

**Department of Agribusiness Management**

The study was conducted in the district of Guntur in the mandals, Piduguralla and Macharla. A sample of 90 farmers and 30 dealers was drawn randomly to facilitate the study. Data was collected both from the primary and secondary sources. For collecting the primary data a pretested questionnaire was administered to the sample farmers and the dealers. Secondary data was collected from the department of agriculture, directorate of economics, agricultural journals and internet sources. Data collected was analyzed using suitable statistical techniques like frequency distribution, percentages and averages.

Majrfty of the farmers (36) in the sample selected of size (90) are in the age group of less than 30. As majority of the farmers are young they are willing to try out new products in the market. In the sample size of 90 as many as 76 farmers have at five schooling years in their education life. So they have fairly good adoption levels about the new products in the market, In the sample of 90 farmers 44 (48.68%) farmers are have less than 5 acres of land. So the farmers are going for cultivation of different hybrids in the small amount of land they have for fear of losing the crop if they cultivate a single hybrid in their entire land. In the sample area of a total of 604 acres only 245 acres area is under irrigated area. The success of the hybrid *Saraswathi* can be attributed to this factor as it performs well in dry areas too. Nuziveedu seeds occupy the first position in the area under cultivation of different company's hybrids.Farmers give maximum preference to the quality resistance to pests and diseases while choosing a cotton hybrid to cultivate in their farm. The awareness levels of the farmers about the Sree Rama seeds hybrids are very high. The satisfaction levels of the farmers who have cultivated the hybrids of the Sree Rama seeds are very high and no level of dissatisfaction was found among the farmers. The study of the comparative economics of different Cotton Hybrids in the market revealed that there is very little difference in the cost of cultivation of different hybrids and the market price is also same for the different hybrids. The study revealed that the dealers are fairly well educated. In a sample of 30, 16 numbers of dealers (53.33%) are having schooling years of 10 and above. This suggests that as the dealers have good educational background they will have fairly good idea about the good quality products, and will be aware of the promotional activities of the companies. The total hybrid cotton seed requirement of the selected sample area (Piduguralla, Macharla, Gurajala) is 80,000 packets of 450 grams each. The divided area 50,000, 10,000 and 20000 packets each respectively. The market share of the company Sree Rama Seeds in the total sales of the cotton hybrids during the last year was 13.75%. Nuziveedu Seeds is the Market leader with a share of nearly 70 per cent. Good adoptability to the local areas and big boll size are the primary reasons behind the success of the Company's hybrids along with the good yields they give. The company's market share during the last year was 13.75 per cent and this year they are expecting to touch a percentage market share of 18.12 per cent with the improvement in the sales of the Cotton hybrids **M.Sc.(MABM),  2008.**.

# A Study on the viability of Anakapalle, Munagapaka, Chodavaram sugarcane farmers to establish jaggery units in Visakhapatnam District of Andhra Pradesh

Student: Suresh Konkena                                      Major Advisor: Dr.P. Radhika

**Department of Agribusiness Management**

The study is mainly based on primary data and secondary data. Interview method was used in collecting data through the pre-tested, suitably structured schedules regarding cane cultivation and marketing of cane as well as production and marketing of jaggery.

Among 120 farmers 49 members (41 percent) of the sample farmers were between 31 to 40 years of age, followed by 33 members (27 percent) between 41 to 50 years of age. It shows that the ages between 31 to 50 are involving more in sugarcane cultivation than others.

Among the 120 sample farmers, only 12 (10 percent) of them had secondary education, 80 per cent of cultivation of farmers with secondary education is of jaggery varieties of sugarcane for jaggery. Only 45 of them (37 percent) were illiterates, 70 percent of the cultivation of illiterates is sugar varieties for jaggery.

Of the average land holdings 1.21 ha, sugarcane cultivated area in the year 2006-07 was 0.98 which is 81 percent of the total land holdings and in the subsequent year (2007-08) the area under sugarcane cultivation was 0.77 ha which is amounting 64.15 percent of the total area.

There is a decrease in average sugarcane production by farmers. An average production of 93.07 tonnes in 2006-07 to 83.57 tonnes in 2007-08 is noted. At the same time sugarcane supply to sugar industry has enormously decreases from 58.38 percent (54.33 tones) in 2006-07 to 21.19 percent (17.71 tonnes) in 2007-08 and sugar cane supply to jaggery production has increased from 41.62 percent to 78.81 percent in 2007-08.Which seems that farmers are prefer to supply the sugarcane to jaggery making rather than sugar industry.

Percentage of cane supplied to the jaggery making unit has increased from 41.62 percent to 78.81 percent. This information shows that farmers are shifting from suppying sugarcane to sugar industry (Sugar factory) to jaggery making units though production was lesser than previous year.

Out of 120 farmers 30 members says that they supply cane only to the jaggery making in 2006-07. Where as in the subsequent year 2007-08, 72 members supplied cane to jaggery making. It shows in spite of overall reduction in sugarcane production, cane utilization for jaggery making is increasing both in terms of percent of cane and numbers of farmers.

Statutory minimum price, seasonal glut and fluctuations in jaggery price were the main reasons for adopting sugarcane supply to sugar industry according to sample farmers. However profitability of jaggery production, comparatively less harvest charges than sugarcane supply to sugar industry, easy availability of credits from local merchants encouraged sample farmers to adopt jaggery production especially by those farmers who are willing to spare more family labour.

Labour shortage, high harvest charges during peak labour requirement and low Statutory Minimum Price (SMP) were the major problems encountered by the sample farmers who produced sugarcane for sugar industry. Non availability of credit to establish jaggery units, fluctuations in jaggery prices were the major problems faced by the jaggery producers.

At present market price for jaggery being satisfactory for the farmers (Rs. 15.43 per kg) majority of the farmers are of the opinion that manufacturing jaggery is more beneficial than selling to sugar industry. There are also of the opinion that if there is a fall in market price of jaggery, cultivation of sugarcane would not be remunerative and it would be better to shift to other crops. **M.Sc.(MABM), 2008.**

# Management of food distribution system in Andhra Pradesh: a case study of Nalgonda District.

Student: K.S.D. Vara Prasad                          Major Advisor: Dr. A. Janaiah

**Department of Agribusiness Management**

The study has been conducted to understand the growth of food distribution in the state of Andhra Pradesh and in Nalgonda district. Various channels of food distribution have been studied to understand the efficiency of the system. In order to know the perception of consumers and retailers on the Public Distribution System and its functioning, they were interacted directly with the help of questionnaires.

The distribution of food grains happens in a three tiered system at the national, state district and retailers' levels. Before distribution procurement is done by the FCI and the whole volume procured will be called

as central pool which is distributed by the Central Government. The transportation during procurement is borne by the central government and during distribution it is to be borne by the State Governments.

The consumers are happy with the quality of food grains and the prices at which they are supplied in the PDS. They are not happy with the allocation of grains on their cards, the reason for which most of the families are having a size of four to six persons. Moreover the targeting has excluded many needy from the system. They feel that the income ceiling for BPL should be raised so that the needy may get the benefits of the PDS.

Most of the retailers are either very old or recent. Recently issue of dealerships has been increased due to the increase in the number of beneficiaries. Daily commodities like rice, wheat, sugar, kerosene, palmolein oil and red grain are supplied through the FPS. In addition to this they are allowed to supply Gruha Mithra products at a price lower than open market. Due to the increased number of dealerships and decreased amounts of food grains through the system the viability of FPS has come under question.

The malpractices that are being performed by the FPS dealers should be tackled with the help of public institutions and transparency in the system. The mismanagements in the transport could be avoided with the help of GPS.

The dealers express their distress towards the PDS as they are not given proper compensation to the supply of food grains. They say that they are not given any concessions though it is a subsidy based system.

Because all the problems like building up of stock with the FCI, carrying costs, deterioration of stocks in the godowns etc. are the results of the TPDS, which caused a threat to the basic objective of food security to the nation, many scholars have suggested a shift to the universal PDS in which there are no differences in the allocations.

In the era economic reforms, the maintenance of social programmes as food subsidy are under threat. These reforms call for reduction in Government expenditures. Under this situation, for a country like India which has more than 50 percent of the population is malnourished, it is very difficult to maintain these welfare programmes. But these are important for the very basic concept of the country, 'Food Security'. **M.Sc.(MABM),**

# A Study to understand the marketing pattern of milk in Bangalore city of Karnataka

Student: B.N. Mahendra                                                                 Major Advisor: Dr. A. Janaiah

**Department of Agribusiness Management**

The important findings of the study are summarized and suitable conclusions are drawn and presented below.

- The general characteristics of the 80 households revealed that majority (36.25) percent of households belonged to income groups $IG_3$.

- In about 51.25 per cent of the households, housewives made the buying decisions of milk.

- The average monthly family income of IG1, IG2 and IG3 were Rs. 2,600, Rs. 9,200 and Rs. 20,000, respectively, and there was positive relationship between income of the households and their family size.

- The Average age of the decision makers varied from 35 years to 58 years and the average family size from 2 to 5 members per family across the income groups. A majority of the households were nuclear families.

- Purchase behaviour of liquid milk by the households showed that all the households consumed liquid milk as it is required for preparing tea, coffee, curds etc.

- About 38.75 per cent of households from all income groups preferred dairy vendors or milk boys only because of the convenience of home delivery.

- Nandini was the most popular brand due to the co-operative nature of the firm, good quality and reputation as the oldest brand in the market. The other brands of milk used by households were Heritage, Arokya, Tirumala and Dodla.

- All the liquid milk consumers, about 100 per cent of milk buyers purchased milk on daily basis.

- Most of the bulk consumers, except few sweet marts purchased and consumed milk on daily basis.

- For liquid milk, majority of bulk consumers in case of hostels preferred dealers only, as they offered home deliver.

- About 98.82 per cent of bulk consumers (sum of the percentages of branded milk) preferred packed milk over loose milk (1.18) per cent because of the regular supply and easy availability. In the packed milk category, 'Nandini' brand alone contributed about 53.12 per cent to the total milk purchased.

- High-income groups spent more on milk than lower income groups.

- Besides consuming liquid milk as such, most of the households utilized it for other purposes such as making tea / coffee 65 per cent, and direct consumption by 19 per cent of households.

- The quantity of milk purchased and the expenditure incurred was highest in the case of hostels because of high demand for milk for preparing tea, coffee, for direct consumption and for various dish items.

- The results of the conjoint analysis for liquid milk revealed that the households attached highest importance (52.63 per cent relative importance) to brand. Among the brands, Nandini was most preferred. **M.Sc.(MABM), 2008.**.

## A Study to assess the market potential for exchange of meal/gift vouchers of sodexho pass and ticket restaurants for jersey milk and milk products.

Student: Anvesh Kumar Challa          Major Advisor: Dr. Seema

**Department of Agribusiness Management**

1. The study revealed that nearly 88.33 per cent of the consumers are Sodexho pass holders and 11.66 per cent of them are possessing ticket restaurant vouchers.

2. As per the findings of study, majority of consumers having Rs.1200-1500 value vouchers.

3. Among the collected sample, majority of the consumers spending about 25-75 per cent of their value vouchers in their favourite locations.

4. The study indicates that transaction charge on voucher exchange is nil at majority of exchange locations.

5. About 67 consumers out of 120 said that introduction of this scheme is beneficial to household purpose and can also be used for essential goods, 37 consumers expressed that it is good, but 16 consumers said that it is not practicable since it involves risk of exchange and it may not be accepted by consumers for this scheme as accepted for refreshment goods.

6. About acceptance of exchange scheme by consumers with milk and milk products is favoured by eighty two consumers and not accepted by thirty eight consumers.

7. Acceptance of discount by majority of consumers is nil for voucher exchange with milk and milk products.

8. Heritage brand have huge demand in the market followed by Jersey, Tirumala in case of milk and among milk products Amul have better edge than others.

9. The anlaysis of the response of the consumers to accept voucher exchange with Jersey milk and milk products is accepted by 59 percent of consumers.

10. The study shows reasons for non-acceptance of voucher exchange for Jersey products by consumers as non availability at their locations.

11. Majority of restaurants/supermarkets are accepting meal/gift voucher of sodexho and ticket restaurants for exchange

12. Restaurants/Supermarkets having their volume of business through vouchers is below 5 per cent.

13. Majority of restaurants/supermarkets will ask for discount on the vouchers as they do not realize instant cash.

14. Majority of restaurants/supermarkets responded that they will encash the vouchers at Sodexho/ticket restaurants offices as they would realize full voucher value with any transaction charges. Other restaurants/supermarkets responded that they will encash the vouchers at cash exchanges as they would realize the cash instantly by accepting with some transaction charge.

15. About acceptance of exchange scheme by restaurants/supermarkets with milk and milk products is favoured by 64 per cent of restaurants/supermarkets and not accepted by 36 per cent of restaurants/supermarkets.

16. The anlaysis of the response of the restaurant/supermarkets to accept voucher exchange with Jersey milk and milk products is accepted by 57 percent of the consumers to accept voucher exchange with Jersey milk and milk products is accepted by 59 percent of consumers. **M.Sc.(MABM), 2008.**

# Relationship farming-benefit to the farmer- A case study of shantipuram mandal, Chittoor District, Andhra Pradesh

Student: Swaroop. A                                         Major Advisor: Dr. Seema

### Department of Agribusiness Management

The present study has been undertaken to find out the awareness levels, participation levels, benefits, response on pricing mechanism and services, willingness to continue and problems faced by the farmers in Relationship farming.

Most of the HFIL farmer belongs to 36-45 years category followed by 25-35 year 46-50 years and least belong to >50 years. Where as in NON-HFIL farmers most belong to >50 years followed by 46-50 years, 36-45 years and least belong to 25-35 years.

With regards to family size, majority of the HFIL farmers belong to family size of 3-5 members, followed by 6-8 members and >8 members. Where as most of the NON-HFIL farmers belong to family size of 3-5 members, followed by >8 members and 6-8 members.

By analyzing the land holdings of the farmer, majority of HFIL farmers belongs to large and medium farmers where as in the case of NON-HFIL farmers most of the farmers are small farmers.

It could be noted that majority of the HFIL farmers were primary educated followed by high school, illiterates and college. Same trend was observed in the case of NON-HFIL farmers also.

Both HFIL and NON-HFIL farmers were also doing secondary occupation like stationary shops, fruits and vegetable business and other jobs like teachers etc.

Majority of the HFIL farmers have farming experience of 10-15 years and 15-20 years, followed by 5-10 years and >20 years where as most of NON-HFIL farmers have farming experience of 15-20 years, followed by >20 years, 5-10 years and 10-15 years.

Before Relationship farming most of the HFIL farmers were marketing their produce through mandis and then followed by On land buyers same trend was followed in NON-HFIL farmers also.

All HFIL farmers were aware of Relationship farming but, some of NON-HFIL farmers were not aware of Relationship farming.

Company representatives were the main source of awareness about Relationship farming followed by friends and relatives of farmers.

Many HFIL farmers were having >12 months experience in Relationship farming followed by 9-12 months and 6-9 months.

The cost benefit ratio of crop production in Relationship farming was more than the traditional farming because scientific practices were followed in Relationship farming which was guided by the production staff of the company.

Three types of farmer price fixing mechanism were followed in Relationship farming namely: Local market benchmarking, MIS benchmarking and Retail price benchmarking.

HFIL farmers were not satisfied with the price paid by company because they were expecting more price than local market has they were giving graded produce to company.

Most of the HFIL farmers were satisfied by the services provided through Relationship farming but some farmers are not satisfied because they were expecting services like loan availability, fertilizers availability etc by company.

All the selected farmers of HFIL said that they are willing to continue Relationship farming because of assured payments in time, higher returns, input availability etc. Farmers were much pleased by the advices given by company field assistants.

Advantages to the farmers by participating in Relationship farming like input (seed) availability and the production services offered by the sponsor. This is usually done on credit basic from the sponsor. Relationship farming can open up new markets which would otherwise be unavailable to farmer's especially small farmers who produce in small quantities.

Among the reasons to participate, no marketing risk ranked first followed by higher yields, better returns,

availability of seeds, availability of extension service and no commission.

HFIL farmers perceived assured payment in time, higher returns followed by input availability (seed) were the major monetary benefits by Relationship farming.

Non-monetary benefits of Relationship farming include supply of quality seeds, access to new technology, technical service and crop diversification.

Among the reasons for willingness to continue Relationship farming higher returns stands first followed by reduction in marketing risk, assured payment, low commission, correct weighment and trustworthy.

Problems faced by farmers in Relationship farming were grading problems in produce, no cash payment, less price for 'B' grade produce, acceptance of produce as on daily demand, labour problem, and non availability of other inputs except seeds. **M.Sc.(MABM), 2008.**

# Micro level management of kisan credit cards and their impact on farmers income in Krishna District of Andhra Pradesh

Student: M. Venkataram

Major Advisor:  Dr.  Aldas Janaiah

**Department of  Agribusiness Management**

The Kisan Credit Card (KCC) scheme introduced in 1998-99 was a step towards facilitating the access to Short Term (ST) credit for the borrowers from the financial institutions. It aims at providing adequate and timely support from the banking system to the farmers for their short-term credit needs for cultivation of crops. This mainly helps farmer for purchase of inputs etc., during the cropping season. Credit card scheme proposed to introduce flexibility to the system and improve cost efficiency. The analysis of the study 120 respondents and bankers are taken with the cooperation of State Bank of India. The entire study summarized and presented in the following points. Since the year of its introduction i.e., from 1998-99 to 31 March 2002, 2.38 crore Kisan Credit Cards issued and in 2006-07, 85.11 lakh cards were issued and Rs.46.72 lakh credit extended to farmers. In India total Kisan Credit Cards issued 675.45 lakh with sanctioned amount of Rs.234,44,946 lakh up to June 30, 2007.Andhra Pradesh occupies second place issuing cards 109,62,320 in India with amount sanctioned Rs.25,12,136 lakh.

- Kisan credit card has been appreciated and accepted both by the bankers as well as farmers. Despite all this, Kisan card scheme is not free of problems. The discussion held in the field with farmers and bankers, thus giving a feeling to the farmers that there is an underlying guarantee of getting loan from the bank as long as the earlier loan is repaid.

- Most of the farmers are not aware about the kisan credit card scheme. V' Farmers can avail timely credit through kisan credit card.

- Farmers having good track record in other banks are also eligible to obtain Kisan Credit Card.

- Assured availability for three years and avoidance of uncertainty involved in accessing credit on a year to year basis.

- The farmer have kisan credit card has less cost of cultivation than non-kisan credit card holder due to timely availability of the credit.

- The kisan credit card has impact on farmer's income that farmer having kisan credit card getting more net profit than Non-Kisan credit card farmer the difference is Rs.2416.

- Non- kisan credit card holder paying more interest to money lender.

- Actually Kisan credit cards are not issuing but the farmers having patta passbook which consists of clear detail about the land holding size, owner name, land belongs to which area basing on this pass book the loans are given to farmers.

- Crops grown in this area are paddy, sugar cane, green gram, elephant yam and turmeric.

- Availability of timely credit to kcc holders are able to buy products at cheaper prices because they are not availing credit in shops compared to non kcc holders.

- Non-kcc holders are in the clutches of money lenders when compared with kcc holders and the share is 20 per cent , 13 per cent respectively.

- The credit taken by kcc holders and non-kcc holders from financial institutions, others are 66 per cent, 11 per cent and 47 per cent, 15 per cent respectively so major portion of credit taken by kcc holders from financial institutions only.

- The amount utilized for crop production by kcc holders (76%) and non-kcc holder (43%) so major portion of money utilized for crop production by the kcc holders.

- Some of the farmers are taking money at a time; they are not using the money throughout the year.

- There are no institutional and management constraints except slightly delay in issuing the loans.
**AGBM, 2008**

# A study of current market potential and scope for advanta maize hybrids in Nizamabad District

Student: K. Jayasyam                                             Major Advisor:  Dr. Seema

**Department of  Agribusiness Management**

The present study is conducted in Nizamabad district. The analytical tools employed in the study are percentages, averages etc

1. .Among the selected farmers, about 55percent are in the range of 30-50 years of the age category followed by 27percent of farmers in >50 years age group and 18percent are having <30 of years age .

2. Among the selected farmers, about 5lpercent are in the category of the primary education, followed by 27percent of farmers who are illiterates, 15percent and 7percent of farmers who are secondary and higher educated respectively.

3. Mainly hybrid Maize varieties are preferred by farmers than traditional open pollinated varieties.

4. Among the selected farmers, 45percent are semi medium (2.5-5 acres), 34percent is mall farmers, 15percent are medium farmers and 6 percent are large farmers with respect to their land holdings.

5. Most preferred brands at farmer level are Pioneer, Syngenta, Monsanto, Kaveri etc.

6. Main factors that influence the farmers to a large extent in preferring particular brand of products are high yield, pest resistance, quality, timely availability, brand name, neighbours influence and where as price and dealers choice influence the farmers only to a moderate extent.

7. About 55percent of the dealers are having more than 10 years of experience in the seed business followed by 25 percent with 5-10 years, 10percent with 1-5 years and 10percent with <1 years of experience in seed business.

8. Most preferred brands at dealers level are Pioneer, Syngenta, Monsanto, Kaveri etc.

9. Most important factors that influence the dealers in preferring the brands are margins, timely supply, stock returns, and promotional activities of the established brands.

10. Expected sales of the dealers in the coming *kharif* 2008 season is 116.8 tons from all brands of the Maize hybrids which includes 6.8 tons from Advanta Maize.

11. The dealers felt that Advanta maize hybrids are giving good yields and margins but it has poor promotional activities and brand name.

12. From the sales data of the subsidy maize the total sales of the maize in the kharif season 2007 from government counters is 816.8 tons and Advanta share is only 1.1percent with 9 tons. **M.Sc.(MABM), 2008**

# A study on procurement management of foodgrains by food corporation of India in Andhra Pradesh

Student: D. Ramesh                                                    Major Advisor:  Dr. Seema

## Department of  Agriculture

Rice area, production and procurement in the state has shown greater fluctuations where as productivity has been increased over period of time.

Regional wise rice production in the state was highest in the Coastal andhra followed by Telangana and Rayalaseema.

Contribution to the levy procurement is also more from the Coastal andhra about 50-65 per cent followed by Telangana region 30-45 per cent and Rayalaseema region 0.5-1.5 per cent.

Productivity in the state has been increased from two and half tonnes/ha in 1992 to three and half tonne present.

Direct procurement (MSP operations) by FCI is marginal or negligible. Levy procurement of FCI constitutes 90-95 per cent of procurement.

Among the districts East Godavari, West Godavari, Krishna, Karimnagar, Nalgonda are the five major districts which have been contributing more than 50% to levy procurement by FCI.

Anantapur, Adilabad, Chittor, Cuddapah, Vizag are the five least contributing districts in production and procurement.

The years 2001 and 2002 witnessed high level of paddy procurement and reached its peak procurement level of 68.9 L.MT in 2000-01, which resulted into build up of heavy stocks in godowns. The following year 2002-03 was a bad agricultural year which experienced worst production because of failure of monsoons; severe drought prevailed in the season. Hence the year 2003-04 witnessed a general easing in the foodgrains stocks and relatively lower procurement of rice in 2002-03 and high off take of foodgrains for drought relief operations under the welfare schemes.

Rice production seasonal wise was highest in the kharif season than rabi.

MSP of paddy in levy rice constitutes about 90-92 per cent of Cost of one quintal of paddy, remaining will be added by market fee, mandi labour charges, Driage etc.

Cost of one quintal of rice constitute about 90-91 per cent  of total cost of levy rice.

MSP of paddy in custom milled rice constitutes about  87 per cent of one quintal of paddy and cost of one quintal of rice constitutes about 95 per cent of total cost of CMR.

Procurement cost of one quintal of rice constitutes 80 per cent of economic cost of grain, remaining 20 per cent of economic cost of grain will be contributed by transport, storage, handling, labour charges and interest charges.

Farmers still expecting better price for their produce. They want to increase MSP still further. Self help groups role in procurement should be increased, they should encourage for more participation. **M.Sc.(MABM), 2008**

# Management of supply chain in contract vs individual farming in broiler production : A case study in Ranga Reddy District in Andhra Pradesh

Student: K. Ugender

Major Advisor: Dr. Seema

**Department of Agribusiness Management**

The major findings of the study are

Availability of infrastructure facilities in case of both individual far r and contract farmers was almost the same whereas in terms of credit facility, there was better access for individual farmers to credit facilities through Co-Operative Credit Society or the Regional Rural Bank.

It has been observed that the non contract farmers had more experience than the contract farmers. Further the individual farmers were slightly more educated, and little younger than the contract farmers. The sample of non contract farmers also contains a substantially higher proportion of farmers who are specialized in poultry farming.

Non-contract farmers have longer production cycles and lower flock sizes and they spend less on feed, vaccination, and labor. The involvement of family labor is more than contract farmers.

It can be seen that the cost structure is comparable across the two Production systems. Feed, medicine and veterinary services accounts for about 75% of total variable cost. The expenditure on chicks is about 15.30% of cost while other variable costs such as labor and electricity constitute only 7.5% of total costs.

Costs in contract production could be lower than in non-contract production in two distinct ways. It is because of technology and management practices brought by the company of which contract production is found to be more efficient than individual production.

The company can offer some inputs such as insurance and credit at lower cost to the contract farmer. Then contract production could be cheaper than individual production, even if production efficiency is not changed.

Survey of the total feed purchased by the firms, 20 percent of non-contract farmers purchased from market, 10 percent purchased feed from the field whereas 70 percent purchased from companies. It shows that majority of individual farmers depend on the companies for feed. All the contract farmers are supplied poultry feed by the companies.

In the case of already established firms, diseases cause a major problem and primarily a discouraging factor. Hence they pose a major threat for the survival of newly established firms. Birds die not only due to diseases but also due to nutritional disorders and unfavorable weather conditions. **M.Sc.(MAMB), 2008.**

# A study on current market potential and scope for advanta cotton in Guntur District

Student: G. Sudhakar Naidu

Major Advisor: Dr. Seema

**Department of Agriculture**

Major findings of the study:

● Among the sample farmers 59 farmers are in the age group of 46 and above, it constitutes percentage of 39.33.56 farmers are in the age group of 30 - 45 years and the remaining 35 farmers have less than 30 years of age.

● Out of the sample of 150 farmer's majority (58) of the farmers have 5 to 10 schooling years in their educational life constituting 38.66%. Very few farmers (19) have collegiate education.

● Majority (94) of the sample farmers have less than 4 acres of cultivation land which constitutes a percentage of 62.66.

● Out of the total area of 820 acres which is under cultivation by the sample farmers 540 acres is under irrigated area and the remaining 280 acres is under rain fed cultivation constituting a percentage of 64.8 and 34.2 respectively.

● In the sample area the hybrids Mallika and Bunny are cultivated in 46% of the total area. Bhaskar is cultivated in 25% of the total area. Dhoom which is a hybrid of Advanta is cultivated in 82 acres constituting a percentage of 10 in the total area.

● Among the different factors considered by the farmers in purchasing cotton hybrids pest resistance is given paramount importance followed by high yields timely availability and the brand name.

- Among the total respondents of 150, 92 were aware of the Advanta cotton hybrids which constitute 62 per cent of the total respondents.

- The farmers are fairly satisfied with the cultivation of Advanta hybrids, some level of dissatisfaction was found about the picking quality of these hybrids.

- The sample farmers prefer to buy Mallika as the first preference hybrid followed by Bhakar and Dhoom occupies 4th place in order of preference given by the farmers.

- Among different Advanta cotton hybrids Dhoom is cultivated by maximum number of farmers using Advanta seeds. Balaji and varun444 are cultivated by small number of farmers.

- Farmers are very much influenced by the field visit programmes conducted by Advanta India limited.

- Among the sample of 30 dealers 16 of them have more than 10 years of schooling years in their educational life.

- The sample dealers have an average experience of 14 years in seeds and pesticides business.

- Among the selected mandals for the study the Mandal Sattenapalli requires maximum quantity of hybrid seed followed by the Mandal Macherla. The difference in the quantity required can be attributed to the number of acres in the cultivation in respected mandals.

- Among different cotton hybrids Bhaskar was cultivated in 30 per cent of the total area under cotton cultivation in the last year. Mallika is also cultivated in 30 per cent of the total area; the hybrids of many companies are cultivated in the remaining 40 per cent area.

- Out of the total requirement of 501800 packets Advanta hybrids sales were 6000 packets which are nearly 12 per cent of the total area.

- Factors like big boll size and suitability to the study area are responsible for sale of Advanta cotton hybrids. **M.Sc.(MAMB), 2008.**

## A study to assess the awareness levels and perception of investors and prospective investors in commodity market in Visakhapatman District of Andhra Pradesh

Student: K. V. Kanakarao                    Major Advisor: Dr. Seema

**Department of Agriculture**

Indian commodity market which expanded by 50 times in a span of 5 years from Rs-66530 Crore in 2002 to Rs. 3375336 Crore in 2007 is now expected to grow at a steady speed of about 30 percent by 2010 and touch a volume of Rs. 7415613 Crore since people participation in such trade would continue (ASSOCHAM).

Growth in commodities derivatives trading which was at massive level in the last five years would grow to reach the projected level in the next two years. The turn over as proportion to GDP of commodity trade increased from 4.7 percent in 2004 to 20 percent in 2007 and is expected to grow up many folds since commodity markets would remain friendly to its subscribers.

The growing market indicates that the investments in commodity market are increasing but the awareness levels are not upto mark compared to investments. The investments are growing due to the flourishing market situation from the last five years, but at the same time the awareness levels should be increased, but it is not happening. The present study

was conducted to know the awareness level of the investors and prospective investors in the market. A total sample size is 100, in which 40 investors, 50 prospective investors and corporate investors have been interviewed. The pre tested questionnaire was used to collect data through survey method. Analytical tools employed in the study were percentages, averages etc. The salient findings are presented below.

The awareness level about the commodity market is high. 70 percent of the investors are aware of the commodity market and 30 percent of the investors are not aware of the commodity market.

The project study suggests that the awareness levels of the investors and prospective investors can be increased by providing them the booklets containing information regarding commodity market, through counselling sessions and interacting with their family members. Most of the investors are interested to take moderate risk for their investment, so the investors should be provided with the products which are less risky in nature. **M.Sc.(MAMB), 2008.**

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Books

AOAC. 1990. Official methods of analysis. Association of official analytical chemists. 15$^{th}$ 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

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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.

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