

IV. RESEARCH

Research is by far the largest component of the University's functions both in terms of manpower engaged and funds utilized through several projects including those sponsored by ICAR and other agencies.

The University continued its research efforts in agriculture, home science and allied fields with renewed vigour and commitment for improving the production and economic status of the farmers of the state.

The research activities of the University are being carried out in 48 Research Stations including nine Regional Agricultural Research Stations spread over the entire state of Andhra Pradesh in respect of Agriculture and Home Science.

The organizational structure of research in the University is depicted in flow chart III. The agro-climatic zone-wise list of research stations of the University and their functions and the list of ICAR Coordinated research projects and other schemes are given in Annexures VII and VIII.

The research activities of the University mainly focus on crop improvement, crop production and crop protection aspects for adoption by the farming community for overall increase in agricultural production besides solving location specific problems. Research was also carried out in basic sciences, which is supportive to applied research. On-farm research was also conducted for evaluation and

refinement of newly developed technology under farmers' field conditions.

SEASONAL CONDITIONS AND CROP PERFORMANCE

Seasonal conditions prevailed in the state during the year 2008-09 on the whole were not satisfactory. The state received an average total rainfall of 815 mm as against normal rainfall of 898 mm, the deficit being 9 per cent. During south west monsoon the state received an average rainfall of 666 mm as against the normal rainfall of 624 mm, the surplus being 7 per cent. During North East monsoon period an average rainfall of 149 mm was received as against the normal rainfall of 274 mm, the deficit being 45 per cent. The South West monsoon entered in the state on 2nd June 2008, covering some parts of Rayalaseema and Coastal Andhra. It advanced into Rayalaseema and Coastal Andhra and some parts of Telangana and covered the entire state on 10th June 2008.

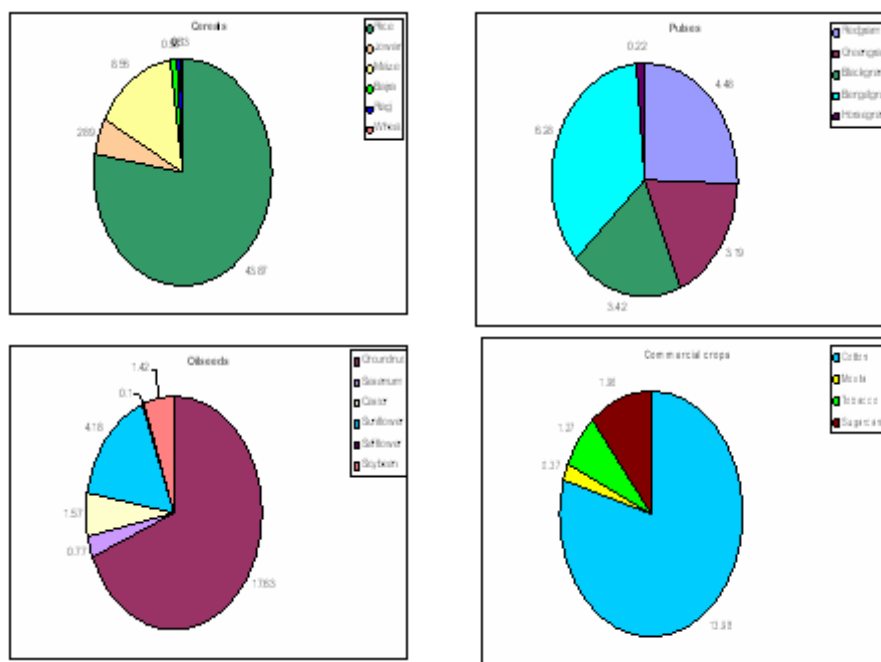
The gross cropped area during 2008-09 was 130.68 lakh hectares as against 148.61 lakh hectares in 2007-08.

The productivity of rice, maize, bajra, *ragi*, redgram, greengram, bengalgram, horsegram, groundnut, castor, sunflower, soybean, cotton, mesta and tobacco decreased, while the productivity of jowar, blackgram, sesamum and safflower increased compared to previous year. The area, production and productivity of important crops in Andhra Pradesh for the year 2008-09 are given in Table 12.

Table 12. Crop Statistics of Andhra Pradesh during 2008-09

Crop	Area (lakh hectares)	Production (lakh tones)	Productivity (kg/ha)
Rice	43.87	142.10	3239
Jowar	2.89	4.37	1512
Maize	8.56	42.20	4930
Bajra	0.58	0.58	1000
Ragi	0.50	0.52	1040
Wheat	0.13	0.10	757
Redgram	4.48	2.01	454
Greengram	3.19	1.49	469
Blackgram	3.42	2.11	617
Bengalgram	6.28	8.84	1407
Horsegram	0.22	0.09	409
Groundnut	17.63	9.57	543
Sesamum	0.77	0.18	234
Castor	1.57	0.80	511
Sunflower	4.18	3.32	794
Safflower	0.10	0.05	513
Soybean	1.42	1.94	1365
Cotton	13.98	34.62	421
Mesta	0.37	2.94	1431
Tobacco	1.27	1.80	1419
Sugarcane	1.96	153.22 (cane)	78176 (cane)

Fig.5: Area of major crops in Andhra Pradesh (lakh hectares)



FLOW CHART III

ORGANISATIONAL STRUCTURE OF RESEARCH IN ANGRAU

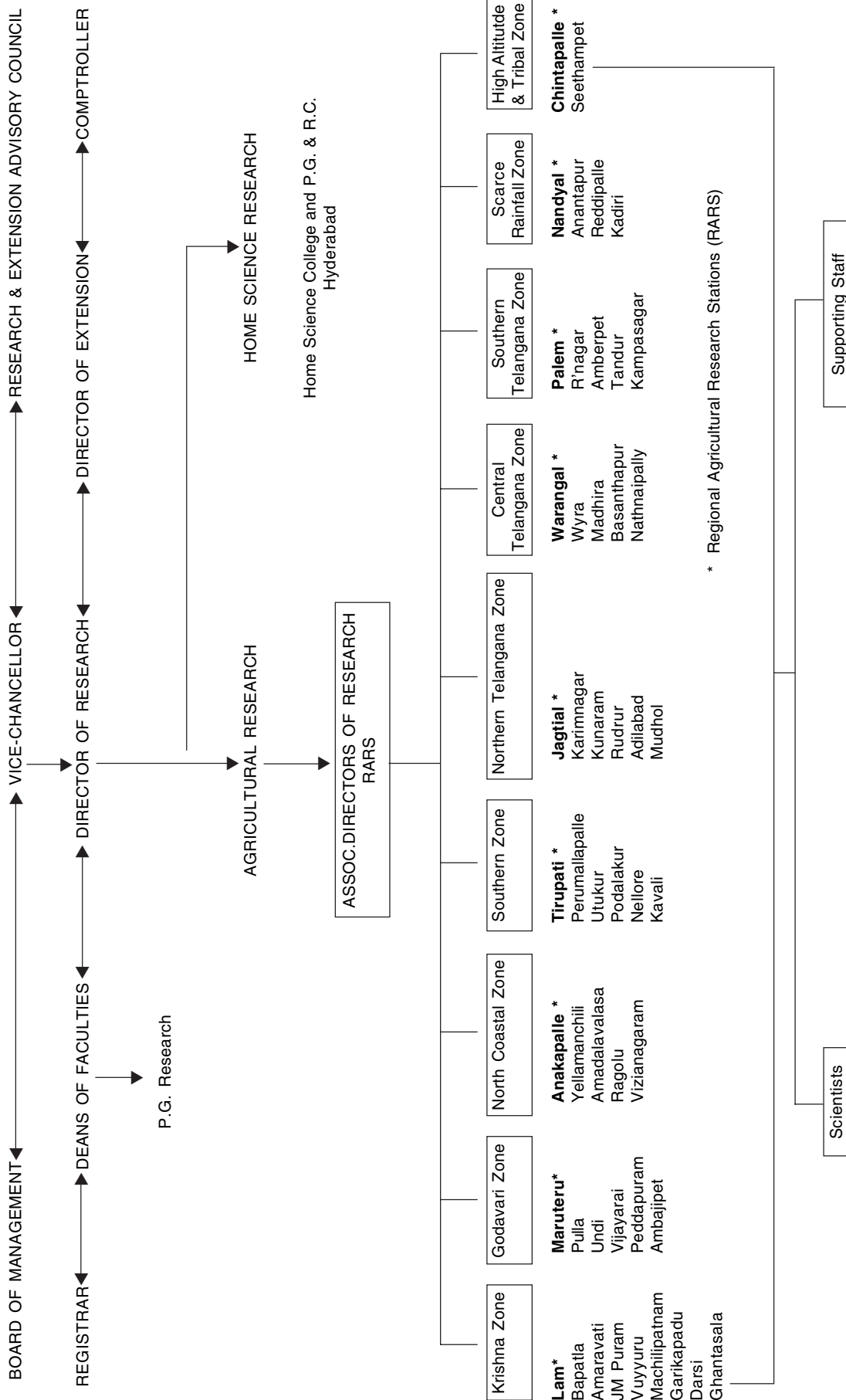
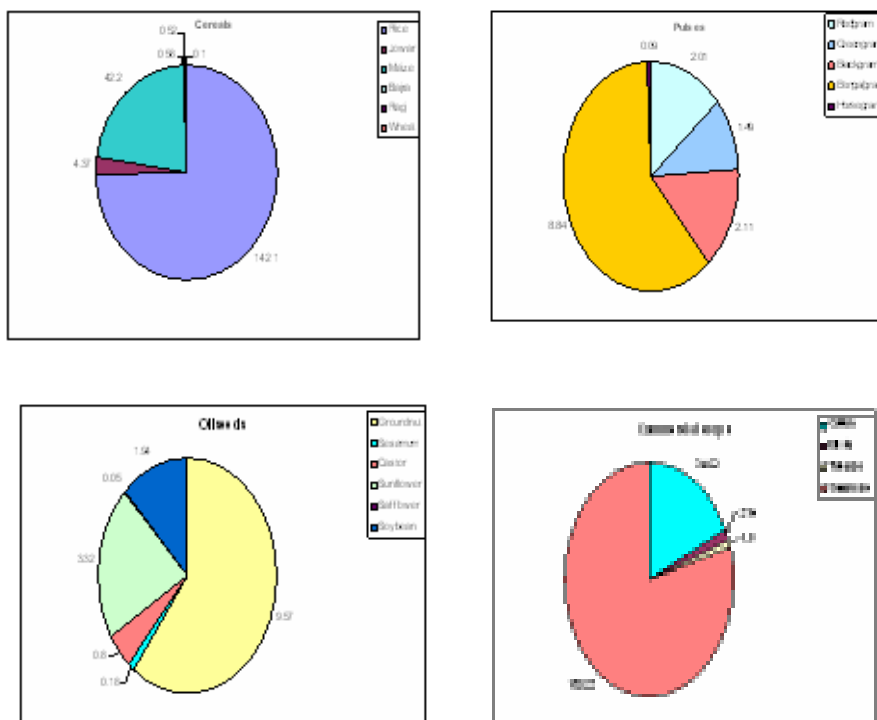


Fig. 6: Production of major crops in Andhra Pradesh (lakh tones)



A. AGRICULTURE

New crop varieties, farm implements released during 2008-09

ANGRAU is constantly engaged in the service of farmers through development of profitable farm technologies and new crop varieties. The university has recently released 24 new crop varieties which included 7 rice varieties, 3 maize hybrids, 4 groundnut varieties, 2 redgram varieties, 2 black gram varieties and one variety each in sorghum, finger millet, greengram, soybean, cotton and sesame. Some of these varieties / hybrids are given below.

1. New Varieties

1. Rice (Nellore Mahsuri)

Pedigree : IR 72 / BPT 5204

Duration : 125 days



Season: Early *kharif*, *kharif* and *rabi*

Grain Yield: 65 q/ha

Special Features:

- Non-lodging
- Fertilizer responsive (160-200 kg N/ha)
- Photo-insensitive variety

2. Rice (Taramati)



Pedigree : Samba Mahsuri / Tella hamsa

Duration: 130 to 135 days

Season: *Kharif* and *rabi*

Grain Yield: 57-70 q/ha

Special Features:

- Tolerant to gallmidge and moderately resistant to sheath rot
- Non-lodging
- Non-shattering
- Good milling (71%) and cooking qualities (24 to 27 amylose) Tolerant to cold

3. Rice (Ramappa)



Pedigree : Kavya / AC 20

Duration : 125-130 days

Season: *Kharif* and *rabi*

Grain Yield: 60 q/ha

Special Features:

- Resistant to gallmidge biotypes (1, 3, 4, 5 and 6)
- Non-lodging
- Non-shattering
- Medium grain type
- Suitable for early and late sown conditions

4. Rice (Amara)



Pedigree : PLA 1100 / MTU 1010

Duration : 145-150 days

Season: *Kharif*

Grain Yield: 65 q/ha

Special Features:

- Non-lodging
- Resistant to BPH
- Tolerant to Bacterial leaf blight and leaf blast
- Flood tolerant
- Low grain shattering (< 3%)
- Good cooking quality and consumer acceptability

5. Maize (BH 1620)



Pedigree : BML 2 / BML 7

Duration : 112-120 days

Season: *Kharif*

Grain Yield: 66 q/ha

Special Features:

- Tolerant to *maydis* leaf blight
- Tolerant to *turcicum* leaf blight and brown stripe
- Tolerant to downy mildew disease
- Non-lodging
- Can be recommended as baby corn hybrid

6. Finger Millet (Srichaitanya)



Pedigree : GPU 26 / L 5

Duration : 110-115 days

Season: *Kharif* and *rabi*

Grain Yield: 30 q/ha

Special Features:

- Suitable for both rainfed and irrigated conditions
- Moderately resistant to blast and lodging

7. Sorghum (Kinnera MJ 278)



Pedigree: Moti / D 71258

Duration : 102-108 days

Season : *Kharif*

Yield: 30-40 q/ha (grain)
100-120 (fodder)

Special features:

- Moderately tolerant to stem borer

8. Greengram (Madhira Pesara-347)



Pedigree : K 851 / PDM 54

Duration : 60-65 days

Season: *Kharif* and *rabi*

Grain Yield: 12-14 q/ha

Special Features:

- Early maturing
- Tolerance to YMV, *Cercospora* leaf spot
- Tolerance to thrips, stemfly and moisture stress
- Top bearing with synchronous maturity

9. Blackgram (Madihra Minumu MBG 207)



Pedigree : LBG 167 / LBG 637

Duration : 75-80 days

Season: *Rabi*

Grain Yield: 13-15 q/ha

Special Features:

- Tolerant to YMV

10. Blackgram (Lam Minumu-752)



Pedigree : LBG 402 / LBG 20

Duration : 75-80 days

Season: *Kharif, rabi* and summer

Grain Yield: 18 q/ha

Special Features:

- Resistant to YMV
- Escapes terminal moisture stress
- Photo insensitive

11. Redgram (Surya MRG 1004)



Pedigree : Local selection

Duration : 165-180 days

Season: *Kharif* and *rabi*

Grain yield : 20-22 q/ha

Special Features:

- Tolerant to *Macrophomina* stem canker

12. Groundnut (Greeshma)



Pedigree : TIR 46 / JUG 37

Duration : 95-100 days

Season: Early *kharif* and *rabi*

Grain Yield: 20-27 q/ha in *kharif* and 40-47 q/ha in *rabi*

Special Features:

- Tolerant to drought
- Tolerant to late leaf spot
- Less susceptible to rust PBND/PSND
- Oil content 48-50%

13. Sesame (Sarada)



Pedigraee : YLM 17 / PS 201

Duration : 80-85 days

Season: *Kharif* and *rabi*

Grain Yield: 10-15 q/ha

Special Features:

- Resistant to *Macrophomina* stem rot / root rot
- Resistant to *Cercospora*, *alternaria* leaf spot
- Resistant to Phyllody

2. Farm Implements

1. Self propelled 4 row cono weeder



Coverage: 0.15 ha/h

Weeding efficiency: 65-70%

Fuel consumption: 0.70 l/h

Special Features:

- Suitable for weeding operation in four rows
- Works well in light soil

2. Paddy row seeder for SRI cultivation



Coverage: 1.5 ha/day

Special Features:

- Saves sinkage raising nursery and cost of operation
- Places the pre-germinated seed directly on the main field

3. 10-row paddy seeder



Special Features:

- The implement can float on puddled soils and can move at forward speed of 2 km/h
- Field capacity is 0.038 ha/h

1. Cereals and Millets

1.1 Rice

Crop Improvement

Research on rice was carried out at Bapatla, Pulla, Machilipatnam, Ragolu, Nellore, Jagtial, Rudrur, Warangal, Rajendranagar and Chintapalli research stations covering almost all Agro-Climatic Zones of the state with lead center at Maruteru.

Genetic Resources

Eight hundred germplasm cultures at Maruteru, 500 cultures at Warangal, 226 cultures at Nellore, 300 cultures at Jagtial, were maintained for further evaluation and utilization in the breeding programmes.

The characteristics of various rice cultures under minikit testing at different places are given here under.

Particulars of rice cultures under minikit testing

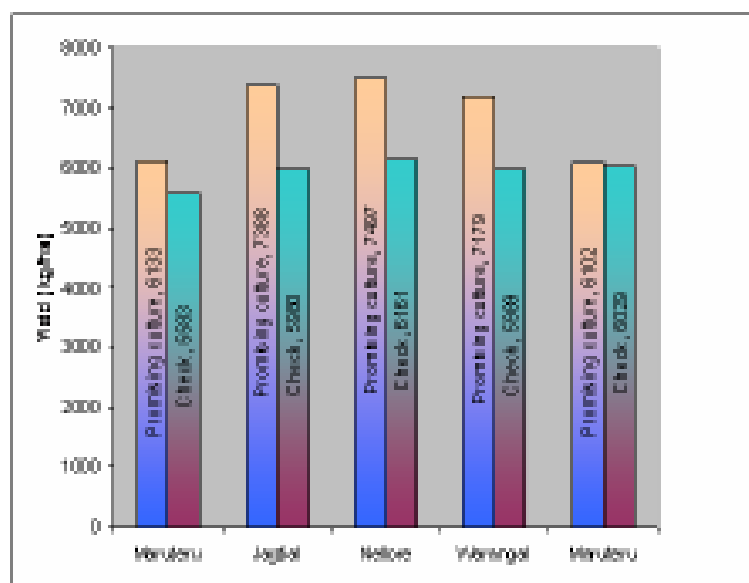
Culture	Developed at	Year of Miniki Testing	Important Features
1	2	3	4
<i>Kharif</i>			
JGL 11470	Jagtial	3	Resistant to multiple gallmidge, tolerant to sheath blight, fine grain
JGL 11727	Jagtial	2	Gallmidge resistance, BPH tolerant, long slender grain
JGL 13595	Jagtial	2	Resistance to multiple gallmidge, fine grain
NLR 3041	Nellore	1	Blast resistance
NLR 40024	Nellore	1	Medium slender grain, resistant to blast
NLR 3042	Nellore	1	Coarse grain suitable for <i>rabi</i> season resistant to blast

Culture	Developed at	Year of Miniki Testing	Important Features
WGL 44	Warangal	3	Gallmidge resistant, BPH tolerant, fine grain
WGL 283	Warangal	2	Long slender grain with cold tolerance, BPH resistance
WGL 347	Warangal	1	Fine grain, gallmidge resistant
RNR 2465	Rajendranagar	1	Medium duration, medium slender grain with aroma
RNR C-28	Rajendranagar	3	Cold tolerant, short duration culture with long slender grains

Performance of early duration rice cultures in Multi Location Trials at different locations

Station	Promising Culture	Yield (kg/ha)	Check	Yield (kg/ha)
<i>Kharif</i>				
Maruteru	MTU II 178-34-1-2-1	6133	MTU 1081	5583
Jagtial	MTU II 178-34-1-2	7388	MTU 1010	5980
Nellore	E 342	7497	Keshava	6161
Warangal	WGL 342	7179	Keshava	5989
<i>Rabi</i>				
Maruteru	MTU 1499-2-1-1	6102	MTU 1010	6029

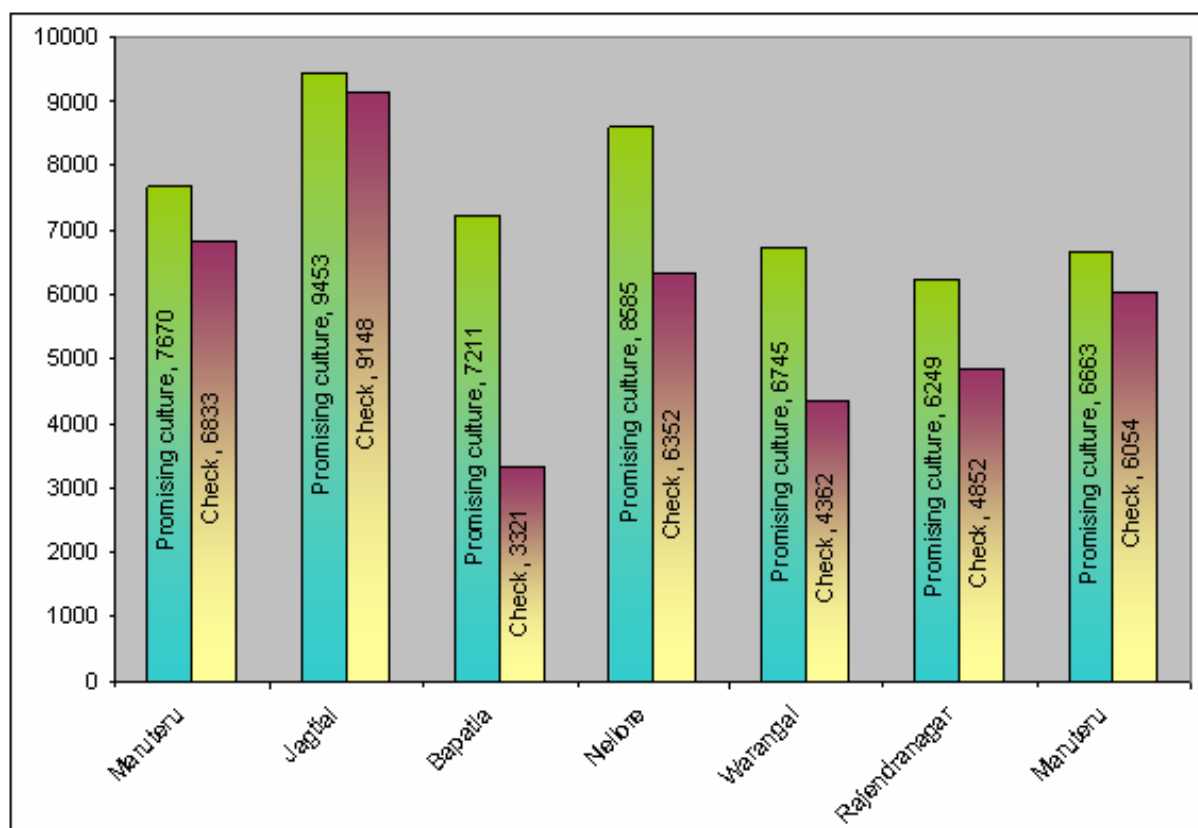
Fig. 7 : Performance of early duration rice cultures in MLTs at different locations



Performance of medium duration rice cultures in Multilocation trials at different locations

Station	Promising Culture	Yield (kg/ha)	Check	Yield (kg/ha)
<i>Kharif</i>				
Maruteru	MTU II 192-95-1-1	7670	MTU 1001	6833
Jagtial	WGL 328	9453	MTU 1001	9148
Bapatla	BPT 355	7211	BPT 5204	3321
Nellore	M 367	8585	WGL 14	6352
Warangal	M 350	6745	WGL 14	4362
Rajendranagar	M 359	6249	Early Samba	4852
<i>Rabi</i>				
Maruteru	MTU 1769-16-1-4-1	6663	MTU 1001	6054

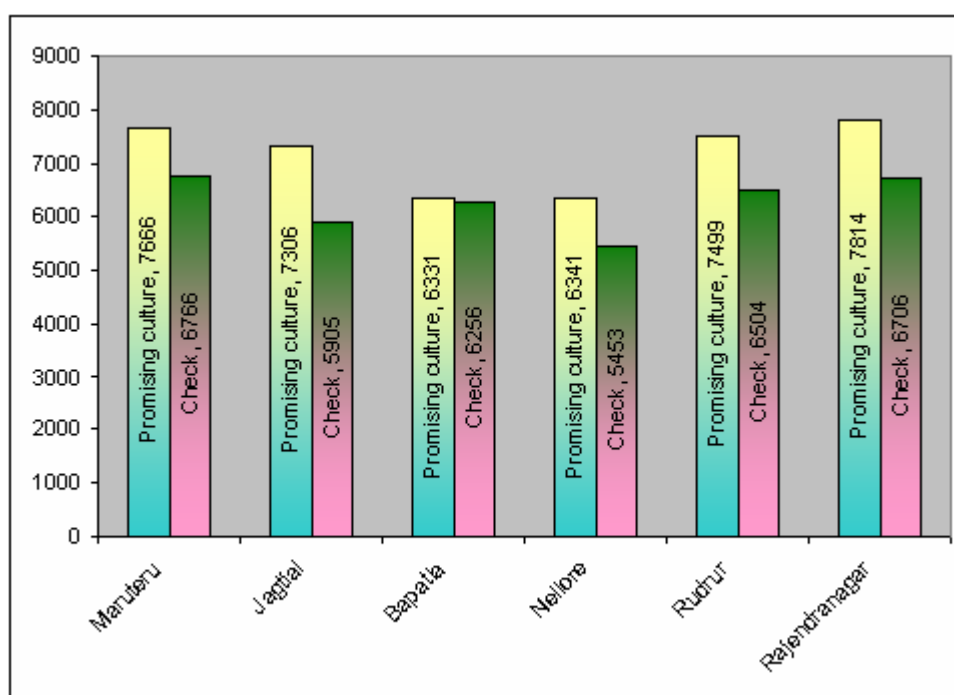
Fig. 8: Performance of medium duration rice cultures in MLTs at different locations



Performance of long duration rice cultures in Multilocation trials at different locations

Station	Promising Culture	Yield (kg/ha)	Check	Yield (kg/ha)
Maruteru	MTU II 225-9-1-1	7666	Indra	6766
Jagtial	RDR 1006	7306	BPT 5204	5905
Bapatla	BPT 372	6331	BPT 2270	6256
Nellore	L 378	6341	NLR 33892	5453
Rudrur	L 375	7499	BPT 5204	6504
Rajendranagar	RNR 2454	7814	BPT 5204	6706

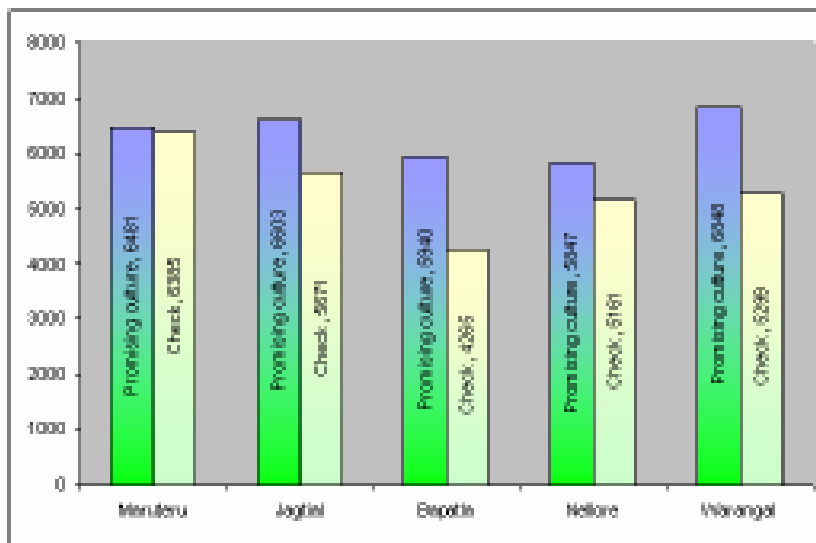
Fig. 9: Performance of long duration rice cultures in MLTs at different locations



Performance of mid early duration rice cultures in AVTs I & II at different locations

Station	Promising Culture	Yield (kg/ha)	Check	Yield (kg/ha)
Maruteru	MTU 1802-14-2-1-1	6481	MTU 1010	6385
Jagtial	JGL 11160	6603	MTU 1010	5671
Bapatla	NK 5017	5940	BPT 5204	4265
Nellore	NLR 40058	5847	NLR 34449	5161
Warangal	WGL 328	6848	Keshava	5299

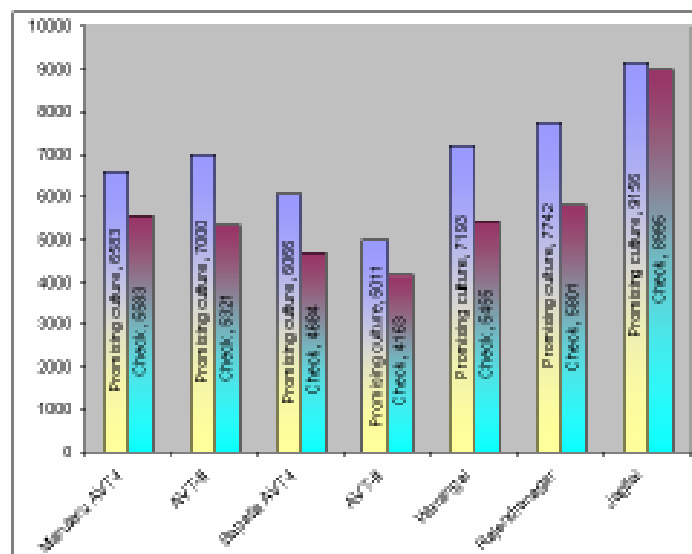
Fig.10: Performance of mid early duration rice cultures in AVTs I & II at different locations



Performance of medium duration rice cultures in AVT I & II at different locations

Station	Promising Culture	Yield (kg/ha)	Check	Yield (kg/ha)
MaruteruAVT-I	OR 2329-44	6583	MTU 1001	5583
AVT-II	MTU 1743-60-2-2-1	7000	MTU 3626	5321
Bapatla AVT-I	CRHR 28	6066	BPT 5204	4684
AVT-II	CN 1383-5-11	5011	BPT 5204	4163
Warangal	WGL 346	7193	WGL 32100	5455
Rajendranagar	RNR 2458	7742	Early Samba	5801
Jagtial	JGL 11728	9156	Vijetha	8995

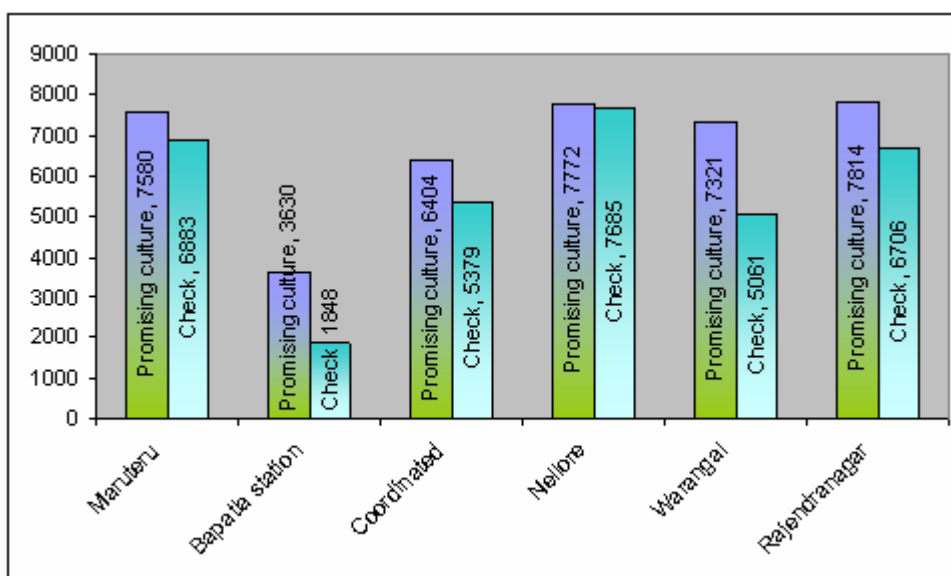
Fig.11: Performance of medium duration rice cultures in AVT I & II at different locations



Performance of long duration rice cultures in AVTs I&II at different locations

Station	Promising Culture	Yield (kg/ha)	Check	Yield (kg/ha)
Maruteru	MTU 1691-10-2-1-3	7580	MTU 1061	6883
Bapatla	BPT 2320	3630	BPT 5204	1848
Coordinated	RGL 20545	6404	BPT 2270	5379
Nellore	NLR 20127	7772	NLR 33892	7685
Warangal	WGL 350	7321	BPT 5204	5061
Rajendranagar	RNR 2454	7814	BPT 5204	6706

Fig.12: Performance of long duration rice cultures in AVTs I&II at different locations



Fifteen QTLs were identified for seven traits by CIM method governing drought and its components under upland and control conditions at Maruteru.

In development of rice varieties for blast resistance through MAB (Marker assisted back crossing) at Maruteru, RM-260 and RM-547 on chromosome 8 were co-localized with candidate gene oxalate oxidase and RM-412 and RM-2420 present on the chromosome 12 and 7 co-localized with HSP-90 and rice peroxidase respectively (120 primers was studied in the laboratory for BPH resistance), out of which 40

were found to be polymorphic for five rice genotypes (swarna, prabhat, sambamashuri, BM-71 and PTB-33).

In early duration group WGL-328 (6.85 t/ha) and WGL-326 (6.08 t/ha) recorded higher grain yield over the check, Keshava (6.06 t/ha). In medium duration group, WGL-346 (7.19 t/ha), WGL-347 (6.23 t/ha) and WGL-345 (5.84 t/ha) recorded significant superior yield over the check, Kavya (4.46 t/ha). In long duration group WGL-350 (7.32 t/ha) recorded significant superior yield over check, BPT-5204 (5.06 t/ha) at Warangal.

In export oriented non-basmathi trial, WGL-404 (6.57 t/ha) and WGL-401 (6.46 t/ha) recorded significant superior yield over the check Erramallelu (3.29 t/ha) at Warangal.

In multilocation trials RDR-1006 (7.3 t/ha) (Late), WGL-328 (9.5 t/ha) (Medium) and MTU II 178-34-1-2 (7.4 t/ha) (Early) recorded significantly higher grain yield compared to the other entries tested at Jagtial. In advanced varietal trials, JGL-11728 (9.2 t/ha) and JGL-11160 (6.6 t/ha) recorded highest grain yield, compared to the check Vijetha (8995 kg/ha).

In the MLT-Medium duration trial conducted at Bapatla, the entry 367 recorded highest yield of 7346 kg/ha followed by 335 (7211 kg/ha) and 354 (7040 kg/ha), compared to the check BPT-5204 (3321 kg/ha).

In Advanced Varietal Trial-I irrigated medium early (AVT 1-IME), NK 5017 (5.94 t/ha) and NK 5048 (5.91 t/ha) were significantly superior to the national check IR 64 (3.46 t/ha), regional check MTU-1010 (3.94 t/ha) and local check BPT-5204 (4.27 t/ha) at Bapatla.

In coastal saline tolerant varietal trial conducted at Machilipatnam. NDR- 9830119 recorded highest grain yield of 7334 kg/ha followed by CN-1347 (7217 kg/ha) and CN-1266-9-6 (6467 kg/ha). In Multilocation trial (Early) NLR-40013 recorded highest grain yield of 6878 kg/ha followed by MTU-1010 (5250 kg/ha) and entry MTU II 178-34-1-2-1 (4998 kg/ha).

In Multilocation trial (Medium) the entry WGL-285 recorded the highest grain yield of 6255 kg/ha followed by the entry NLR-3046 (5655 kg/ha) and entry MTU II 218-27-1 (5635 kg/ha). In Multilocation trial (Late) the entry NLR-20106 recorded highest grain yield of 6750 kg/ha followed by the entry MTU-1061 (6231 kg/ha) and entry MTU II 197-2-1-1 (6039 kg/ha) at Machilipatnam.

In MLT (Late) five entries recorded significantly superior yield than the check BPT-5204 with entries L-375 and L-382 recorded highest yield of 74995 kg/ha each and two entries were on par with each other at Rudrur.

Rice cultures developed at Nellore NLR-20017 (Long), NLR-34242 (Short), NLR-33636 medium duration and NLR-33671 are ready for release.

Among the 11 test entries tested in AVT (Medium) four cultures viz., NLR-3058, NLR-3059, NLR-3064 and NLR-3061 recorded significantly higher grain yield over the best check NLR-33654 (6841 kg/ha) at Nellore.



RNR 2465 medium duration aromatic culture developed at Rajendranagar

In advanced yield trial (late), RGL-21349 (6571 kg/ha) and RGL-20547 (6240 kg/ha) were found to be significantly superior. In multilocation yield trial (late) L-369 (6250 kg/ha), L-370 (5833 kg/ha) and L-381 (5400 kg/ha) were found to be significantly superior to local check RGL-2332 (5105 kg/ha) at Ragolu.

In the trial on development of short duration fine grain rice varieties for tankfed areas, RGL-1880 (4833 kg/ha), IR-64 (4778 kg/ha), Anjali (4778 kg/ha), RGL-3996 (4750 kg/ha) and WGL-14377 (4469 kg/ha) were found to be significantly superior, compared to other entries at Ragolu.

Crop Production

Evaluation of different planting methods in rice at Kampasagar revealed that sowing of dry seed behind the small plough has given highest yield (6475 kg/ha) followed by sowing of dry paddy by using zero till drill machine (6416 kg/ha).



Semi dry paddy field sown behind the small plough at Kampasagar



Performance of JGL 11727 Under Aerobic Situation at Kampasagar

Tillering, yield components, panicle exertion and the yields of paddy (5250 kg/ha) were much higher with the application of inorganic fertilizers when compared to the yields (3815 kg/ha) obtained with organic manures at Kampasagar. Among the organic manures, application of poultry manure was superior (4200 kg/ha) over the source of manures. In SRI method of cultivation, running of cono weeder 3 times at 15 days interval has given highest yield of 7000 kg/ha.

Application of glyphosate @ 0.75 kg a.i./ha 15 days before crop establishment without standard method of farmer's field preparation coupled with Bensulfuronmethyl + Pretilachlor (6.6 GR) @ 0.06 kg a.i./ha at 8-15 DAT (Post emergence) resulted in better control of weeds and recorded higher grain yield (6097 kg/ha) at Maruteru.

Higher grain yield of rice was recorded with recommended water management (62.08 kg/ha) followed by submergence at 2 cm depth and continuous saturation. The highest mean grain yield of 5112 kg/ha was recorded in 100% NPK + FYM @ 5 t/ha (T14) and was significantly superior to other treatments. Highest uptake of N, P and K by grain and straw was recorded with 100% NPK + FYM @ 5 t/ha treatment at Matuteru.

Nitrogen management in rice-rice cropping system on red sandy loam soils of NSP left command area at Garikapadu revealed that application of 275-80-60 NPK kg/ha (Farmers Practice) resulted in highest grain yield of (6655 kg/ha).



Response of rice to nitrogen application in rice – rice cropping system on red sandy loam soils of NSP left canal command area

The mean grain yield data of four seasons revealed that highest grain yield of 6908 kg/ha was recorded with application of 275-80-60 NPK kg/ha followed by 200-60-40 NPK kg/ha. Based on the results, N recommendation is revised to 240 kg N/ha in rice-rice system under red sandy loamy soils of NSP left command area.



Paddy sowing with drum seeder on puddled soil at Garikapadu

Effect of different levels of phosphorous with and without FYM on growth and yield of rice under sandy and heavy soils indicated that application of 30 kg P_2O_5 /ha + 2.5 t FYM/ha in both the soils resulted higher grain yield which was comparable with 60 kg P_2O_5 /ha + 2.5t FYM/ha. There by saving of 30 kg P_2O_5 /ha can be possible by blending with FYM @ 2.5 t/ha and 30 kg P_2O_5 /ha at Bapatla.

The results of second year study conducted at Chintapalle indicated that among the six different plant extracts used on control of weeds, higher weed control efficiency (35%) was recorded in datura leaf extracts applied plot followed by lantana leaf extract (31%) over control. Higher grain yield of 56.0 q/ha was recorded in jack leaf extract applied plot and datura leaf extract field (50.8 q/ha) which was 14.2% and 5.5% increase over control.

Paddy cum fish culture was promising over poultry-cum-fish culture in getting higher profits since the initial investment was more in poultry-cum-fish culture. Under agro-forestry study at Chintapalle intercropping of Silver oak + Rajmash, Silver oak + Pineapple, Silver oak + Niger and Teak + *ragi*/niger was found to be more remunerative



Paddy cum fish culture at Chintapalle

Among the seven pre-release rice cultures tested under organic farming, NLR 20084 gave the highest grain yield (5976 kg/ha). In the experiment on weed management in rice, transplanting with continuous submergence recorded the highest grain yield (6670 kg/ha) followed by alternate wetting and drying conditions (6069 kg/ha) over the broadcasting method (5162 kg/ha) and sowing with 8 row drum seeder (5283 kg/ha) at Nellore.

Rice varieties Vijetha and Sambamashuri at a seed rate of 40 kg/ha recorded the maximum yield of 4936 kg/ha and 4783 kg/ha at Ragolu.

Results of weed management trial in direct sown, wet seeded rice showed that preemergence application of Oxadiargyl @ 35 g/acre at 5 days after sowing recorded the highest grain yield of 3333 kg/ha at Ragolu.

Maximum grain yield of 5185 kg/ha was recorded with 50% recommended dose of

fertilizers (RDF) + 50% N through FYM which was significantly higher compared to control at Rajendranagar.

Studies conducted on the response of rice genotypes in rice-wheat system, grain yield with MTU 1001 (6644 kg/ha) was significantly higher compared to MTU 1010, Tellahamsa, Rajavadlu, PHB 71 and PSB 3 at Rajendranagar.

In the trial on aerobic rice the varieties WGL-14377 (5667 kg/ha), RGL-2332 (5180 kg/ha), Sonamashuri (5165 kg/ha) and IR-64 (5013 kg/ha) recorded maximum grain yields at Ragolu.

In the experiment on response of rice varieties to nitrogen levels under transplanted conditions conducted at Warangal, MTU-1001 registered significantly higher gain yield (6782 kg/ha) over the WGL-14. Significantly higher yields were recorded with 24 kg N/ha (5664 kg/ha) over 180 kg N/ha (5383 kg/ha) which was at par with 120 kg N/ha (5144 kg/ha).

Crop Protection

Insect Pest Management

In paddy severe incidence of brown plant hopper (*Nilaparvata lugens*) was observed under NSP left canal command area in different mandals of Nalgonda district. Milbemectin 1 EC @ 1 ml/lit + Propiconazole 25 EC @ 1 ml/lit was most compatible for controlling panicle mite (*Steneotarsonemus spinkii*) recording highest (79.42 per cent) healthy grains per panicle and lowest (8.03 per cent) discolored grains per panicle at ARS, Kampasagar.

Out of 51 entries of rice screened against gallmidge and plant hoppers only five entries viz., WGL-467, WGL-470, WGL-472, WGL-473 and WGL-474 recorded less than 5% silver shoots on tiller basis at 50 DAT. Checks TN1, Kavya recorded 13.64 to 49.02% silver shoots at Warangal.

In gallmidge screening special trial, sixteen entries viz., ARC-6616, ARC-13516, ARC-15067, DNJ-9, INRC-8843, INRC-8897, INRC-15899, INRC-17459, INRC-17470, INRC-17494, INRC-6260, INRC-17667, Dukong, Jhitpiti, Madhuri 9 and INDCR-1351 have shown 100 per cent resistance by recording nil gallmidge attack at Jagtial.

Evaluation of recommended and new insecticides against BPH / WBPH in paddy revealed that buprofezin, acephate, ethofenprox and fenobucarb were found to be promising in controlling rice plant hoppers and giving higher yields compared to other treatments and untreated control at Jagtial.

Out of 31 rice cultures tested for multiple resistance (MRST) under natural field conditions, two cultures viz., RP 4643-1020 and RP 4616-8-1-333 have shown multiple resistance to whorl maggot and thrips at Rajendranagar.

Among the different organic protection treatments evaluated, application of pongamia oil alone @ 10ml/l of water resulted in lowest whorl maggot incidence (9.84%), significantly superior over Neem oil alone @ 10 ml/l and Neem oil @ 10 ml + Pongamia oil 10 ml/l of water. Pongamia oil alone @ 10 ml/l of water also recorded significantly higher yield (7273.37 kg/ha) over all other treatments at Rajendranagar.

In the insecticidal evaluation trial Flubendamide 36 per cent + Fipronil 30 per cent 66 WG @ 33 a.i/ha sprayed twice at 10 DAT & 23 DAT was found to be promising with low dead hearts and white ears and low silver shoots below ETL with maximum grain yield of 6 t/ha at Ragolu.

Disease Management

Leaf and neck blast incidence was low in tricyclazole (33.0% and 4.89%) and RIL 013/F1 35SC @ 2.0 ml (39.7% and 9.96%) treated plots. Highest yield was recorded in case of RIL 013/F1 53SC @ 2.0 ml (6384 kg/ha) followed by

tricyclazole (6243 kg/ha). Spraying of sivic 0.6g + Fipronil 2.0 ml/L recorded low incidence of blast and white ears (10.7% and 2.95% respectively) and recorded highest grain yield of 5027 kg/ha among the combinations tested at Maruteru.

Mean of four years data indicated that among the different chemicals tried against stem rot of rice, Hexaconazole @ 2 ml/lt recorded higher grain yield of 7608 kg/ha and the lowest incidence (9.8% tillers affected / m²) of stem rot followed by Propiconazole @ 1 ml/lt.

1.2 Maize

Crop Improvement

BH-40625 is a medium to late maturity single cross hybrid and released for Andhra Pradesh as DHM 117. It is highly suitable for *khariif* with protected irrigation and for *rabi* under zero tillage. It recorded the highest grain yield (>8.0 t/ha) under good crop management at Rajendranagar.



BH-40625 single cross maize hybrid released from Rajendranagar

Among 18 hybrids evaluated, during *rabi* KNMH-40904 (8067 kg/ha) was found to be high yielding at Karimnagar.

Crop Production

The mean of three years data revealed that highest maize grain yield of 4363 kg/ha was recorded with plots received 150% RDF with 50%

N through *insitu* green manuring (Daincha) to the preceding *khariif* rice crop at Garikapadu.

Significantly higher maize equivalent yield (MEY) was recorded with November 15th sowing (4739 kg/ha) over all other dates of sowing. Sowing beyond November 15th was not favorable for sunflower and sowing of maize can be extended up to November 30th for getting higher yields in zero tillage at Warangal.

In the experiment on weed management in zero tillage maize conducted at Warangal the grain yield of maize was significantly higher in the treatments where Atrazine @ 3 g/lit was applied immediately after sowing in combination with Glyphosate @ 4 ml/lit (6253 kg/ha) or with Paraquat @ 3ml/lit (5822 kg/ha) compared to sole application of Glyphosate @ 8ml (5346 kg/ha) / Paraquat @ 6ml(5075 kg/ha) / Atrazine @ 5 g/lit (3318 kg/ha) and unweeded plot (2262 kg/ha).

In genotype Vs nutrient trial, among the full season maturity hybrids, the hybrid MCH-132 (9741 kg/ha) recorded superior grain yields. Among the extra early hybrids MCH-35 (6878 kg/ha) recorded the highest grain yield. Full season hybrids recorded higher grain yields with a fertilizer dose of 150:65:65 N:P₂O₅:K₂O kg/ha i.e. N₂ treatment whereas extra early hybrids performed better with the fertility dose of 100:50:50 N:P₂O₅:K₂O kg/ha at Rajendranagar.



Maize INM trial at Rajendranagar

In the third year of INM trial both QPM (grain yield) and sweet corn (cob yield) recorded higher yields with 50% organic + 50% inorganic + BF as seed inoculant treatment at Rajendranagar.

The crops maize and safflower sown for comparison between zero and minimum tillage method under rice fallow situation showed that, the highest maize equivalent yield of 4583 kg/ha and net returns of Rs.21,023/- recorded by the maize crop under zero tillage method of sowing at Madhira.

Sowing of maize under zero tillage condition during first week of December recorded significantly higher grain yield (8448 kg/ha), than sowing of maize during last week of December (6724 kg/ha). Sowing of zero tillage maize at 45 x 25 cm spacing recorded significantly higher grain yield and stover yield (7802 and 11466 kg/ha, respectively) than that of 60 x 25 cm (7370 and 10815 kg/ha) due to more number of plants per unit area at Jagtial.

The pooled data of 2007-08 and 2008-09 revealed that application of nitrogen @ 200 kg N/ha recorded the highest seed yield of 9572 kg/ha and was significantly superior to rest of the treatments tested at Tirupati.

Crop Protection

Insect Pest Management

Percent infestation of maize by *Chilo partellus* was found to be the highest in sole maize compared to maize intercropped with cowpea and maize protected with 0.1% endosulfan. Correlation was observed between the infestation dose and damage symptoms caused by *Chilo partellus* and also yield at Rajendranagar.

1.3 Sorghum

Crop Improvement

Among 18 sweet sorghum varieties and hybrids tested, the genotype SPSSH-30

recorded significantly highest cane yield followed by SPSSH 29, 26. Highest grain yield was recorded in SPSSH 26 & 30. Highest brix % was recorded in SPSSV-34, SPSSH-27 & 37 at Perumallapalle.

In advanced varietal trial at Madhira MJ-296 (5716 kg/ha), MJ-301 (5419 kg/ha) and MJ-300 (4675 kg/ha) recorded significantly high yield compared to check MJ-278 (4091 kg/ha). With regard to dry fodder MJ-296 (13665 kg/ha), 297 (13274 kg/ha) and 302 (10872 kg/ha) recorded significantly high yield compared to check MJ-278 (7328 kg/ha).

In AVHT grain sorghum trial SPH-1611 (4805 kg/ha) and in AVT dual purpose trial SPV-1782 (2697 kg/ha) were identified as potential for grain yields and with dual purpose importance at Palem.

NJ-2597 recorded highest grain yield (3375 kg/ha) closely followed by NTJ-4 check (3094 kg/ha) and both were on par with each other. NJ-2446 yellow grain types recorded highest grain yield of 3331 kg/ha, fodder yield of 6.76 t/ha and was significantly superior to all other entries including the best yellow check, N-14 (22.26 q/ha) at Nandyal.

Crop Production

In the trial on response of *rabi* sorghum genotypes to fertility levels at different moisture conservation practices conducted at Tandur, sorghum grain yield for compartmental bunding (3276 kg/ha) was significantly superior to flat bed (2682 kg/ha) method.

The trial on effect of plant growth regulator cycocel on growth and yield of *rabi* sorghum indicated that (foliar spray at 40 DAS and at boot leaf stage @ 500 PPM) recorded the highest grain yield of 3747 kg/ha at Tandur.

Among the sweet sorghum genotypes tested, CSH-22 SS was found significantly

superior over SSV-84 in all yield parameters viz., total plant (30.8 t/ha), juice yield (6540 l/ha) and grain yield (35.5 kg/ha) except in brix value which was recorded by the variety SSV 84 (13.8%). The interaction effect of total plant weight and juice yield was found significant. The highest total plant weight of 35.1 t/ha was recorded by CSV- 22SS at 60 x 10 cm spacing. While the highest juice yield of 9972 l/ha was recorded by CSH-22SS at 60 x 10 cm spacing at Madhira.



PSV-1 (SPV 462) high yielding sorghum variety at Palem

Among the fertilizers used there was linear response to applied fertilizer from native to 150% level (3106 kg/ha). Among the varieties, CSV-15 (2204 kg/ha) gave significantly higher grain and fodder yield. The variety CSV-15 (3221 kg/ha) and SPV-1781 (3144 kg/ha) with 150% RDF was found to be superior to other treatments at Palem. The sorghum variety SPV 462 has recorded higher grain yield with placement method when compared to broadcasting. Application of 120 kg N/ha with 3 splits through placement in bands registered higher grain yield (3254 kg/ha) when compared with broadcasting method (2720 kg/ha).

Crop Protection

Insect Pest Management

Seed treatment with Thiamethoxam @ 3 g/kg seed +Foliar spray of endosulfan @ 2ml/l

at 45 DAS recorded significantly less number of shoot fly eggs / 25 seedlings (17.66), stem borer dead heart (9.25%), stem borer peduncle damage (20.77%) and significantly high yield (15.62 kg/plot) when compared to other treatments at Palem.

Disease Management

In the trial on evaluation of advanced varieties / hybrids for resistance to grain mold, SPV-1786, SPH-1604 and CSH-16 showed resistance against grain mould (3.8 – 4.1) at Palem.

1.4 Finger Millet (*Ragi*)

Crop Improvement

In the multi location trial of *ragi* conducted at Peddapuram, VR-900 recorded significantly superior grain yield of 3059 kg/ha followed by VR-917 (2400 kg/ha) against the check Ratnagiri (1973 kg/ha).

In the experiment on evaluation of white *ragi* varieties for coastal Andhra Pradesh, VRW-972 recorded significantly superior yield (2546 kg/ha), followed by PPR 2700 (2306 kg/ha) at Peddapuram.

In advanced varietal trial I & II (early and medium duration group) the entry VL-333 recorded maximum ear length (8.6 cm) and highest yield 4350 kg/ha. In multilocation trial the finger millet entry CTPL-10 recorded maximum grain yield (3547 kg/ha) at Chintapalle.

In finger millet advanced varietal trial (early and medium duration group) OEB-219 (4330 kg/ha), TNAU-1022 (3941 kg/ha), KMR-204 (3910 kg/ha) and PRM-9809 (3810 kg/ha) recorded significantly higher grain yield against the checks HR-374 (2849 kg/ha) and VR-708 (2676 kg/ha). OEB-219 (16667 kg/ha) recorded significantly higher straw yield against the check VL-149 (10802 kg/ha), VR-708 (6173 kg/ha) but were on par with RAU-8 (15741 kg/ha) and GPU-45 (15741 kg/ha) at Nandyal.

In advanced yield trial the entry VR 958 recorded the maximum grain yield of 3286 kg/ha, followed by VR 929 (3201 kg/ha) and statistically significant to VR 847 (2831 kg/ha). In multilocation trial *ragi* cultures CPTL 10 (3334 kg/ha) and VR 929 (3171 kg/ha) recorded significantly higher grain yield than control Bharathi (2905 kg/ha) at Vizianagaram.

1.5 Foxtail Millet (*Korra*)

Crop Improvement

In advanced varietal trial SiA 3088 (4958 kg/ha) and SiA 2750 (4943 kg/ha) recorded significantly higher grain yield against the checks Krishnadevaraya (3916 kg/ha) and Narasimharaya (3733 kg/ha) at Nandyal.

In foxtail millet advanced varietal trial (FAVT) the culture FAVT 13 recorded maximum grain yield of 1730 kg/ha followed by FAVT 6 (1684 kg/ha) and significantly superior to check (1248 kg/ha) at Vizianagaram.

Crop Production

Among the different cropping sequences studied at Nandyal, foxtail millet in *khariif* followed by *bhendi* in *rabi* produced highest net monetary returns (Rs.49220/- ha) followed by foxtail millet – jowar (Rs.39097/ha) and foxtail millet – sunflower (Rs.33672/ha).

Application of recommended dose of potassium fertilizer recorded lower grain yield of 1759 kg/ha while addition of 20 kg K/ha to RDF recorded grain yield of 2064 kg/ha. The magnitude of increase was 17.3% over no application of K. Similarly, higher net return was recorded with higher doses of K application compared to lower doses and no application of K at Nandyal.

1.6 Wheat

Crop Production

Raj 1555 (V2) recorded significantly higher grain yield (25.7 q/ha) over Balram 011

(V1) and was on par with AKDW 2997-16. Among N levels, 90 kg N/ha recorded significantly higher grain yield (25.4 q/ha) over 120 kg N/ha but was on par with 150 kg N/ha (23.4 q/ha) at Adilabad.

Among different wheat varieties tested at Basanthapur the entry PDW-533 recorded 800 gm/sq.m compared to other varieties.



Performance of Wheat variety (PDW-533) at Basanthapur

2. Pulses

2.1 Redgram

Crop Improvement

Three redgram entries viz., WRG-79 (1931 kg/ha), WRG-136 (1874 kg/ha) and TRG-33 (1823 kg/ha) recorded higher seed yield in MLT at Utukur.

In advanced yield evaluation trial, the entries 11916 (610 kg/ha) and 11969 (613 kg/ha) were found to be promising compared to checks Asha and LRG-41 (173 kg/ha) at Tandur.

WRG-65 medium duration variety which completed 3rd year minikit testing and recorded highest yield in MLT, WRG-53 was released as Warangal Kandi. WRGE-18 an early duration redgram culture had 100% wilt resistance and completed 3rd minikit testing at Warangal.

WRG-79 performed well in the coordinated trial and promoted to AVT-1 trials in South Zone at Warangal.



WRG 53 medium duration Helicoverpa tolerant high yielding pigeonpea

PRG-171 showed highest per se performance for seed yield (1694 kg/ha) followed by PRG-176 (1672 kg/ha) and PRG-175 (1528 kg/ha) and PRG-168 (1412 kg/ha) compared to the check PRG-158 (1344 kg/ha) at Palem.



PRG 158 high yielding redgram variety at Palem

In Multi location trial conducted at Palem, PRG-07 recorded highest per se performance for seed yield with 1546 kg/ha followed by PRG-02 (1505 kg/ha) compared to the check PRG-158 (1379 kg/ha). Highest yield of 1940 kg/ha was recorded by entry WRG-132 closely followed by TRG-22 (1840 kg/ha) and TRG-21 (1820 kg/ha) at Podalakur.

In advanced varietal trial for wilt resistance, the entry TRG-38 gave higher seed yield of 1494 kg/ha followed by TRG-32 (1484 kg/ha). TRG-38 was identified for SMD and wilt resistance through molecular marker analysis at Tirupati.

In multilocation trial, RG 5 (TRG-21) ranked first with highest seed yield of 2416 kg/ha and RG 7 (TRG-22) with 2111 kg/ha over check RG 9 (LRG-41) (1286 kg) and local check yielded 1515 kg/ha in 160 days at Tirupati.

Crop Production

Application of Pendimethalin @ 0.75 kg a.i./ha as pre-emergence spray or Imazethapyr @ 0.075 kg a.i./ha as early post emergence spray (15-20 DAS) significantly controlled the dicots and monocots at 30 days after sowing and was comparable with one hand weeding. Further, one more application of paraquat @ 0.48 kg a.i./ha at 6 or 8 weeks after sowing along with hand weeding or pre-emergence or early post emergence application of weedicides was found to be effective in controlling the weeds upto 70 days after sowing at Warangal.

Among the 17 pigeonpea genotypes tested for moisture stress through root associated traits at Warangal, TTB-7, BRG-2, JSA-59, WRG-79 maintained good growth under moisture stress compared to other genotypes. Higher root to shoot ratio which is a favourable trait for drought tolerance was maintained in TTB-7 (0.80), WRG-79 (0.58), BRG-2 (0.54) and JSA-59 (0.48) during moisture stress.

In the experiment on organic farming in redgram (ICP-8803), application of 100% nutrients (NPK) through inorganic source and inorganic pesticides for control of pests and diseases gave highest grain yield of 1084 kg/ha and net return of Rs.20,000/ha. Where as highest B:C ratio of 2.1 recorded with 100% inorganic source of NPK in combination with organic source of pesticides at Madhira.

In rainfed vertisols, sowing redgram in first week of June along with application of RDF (20-50 kg N-P/ha) gave significantly highest yield (1949 kg/ha) at Lam.

Crop Protection

Insect Pest Management

In summer greengram trial conducted at Warangal application of Fipronil granules @ 8kg/acre followed by spraying with NSKE @ 5% and seed treatment with monocrotophos @ 5 ml/kg followed by spraying of NSKE @ 5% recorded lower thrips population after sprays and also gave significant superior yield than other treatments.

The pod damage due to Maruca ranged between 4.13% to 9.42% lowest pod damage recorded in Entomopathogen nematode treatment (4.13 %) at Lam.

Disease Management

Survey of redgram diseases during *rabi* revealed high wilt incidence in Tandur and Basheerabad mandals of Ranga Reddy district.

Survey on redgram crop revealed that, the overall pigeonpea wilt incidence in the Warangal district is reduced slightly when compared to previous year. The reason could be the crop shift from pigeonpea to castor / cotton and crop rotation and / or intercropping with maize. 18 entries recorded per cent wilt disease incidence below < 10%. The % PDI wilt was zero in WRG-146.

2.2 Blackgram

Crop Improvement

In MLT evaluated at Utukur, LBG-728 and 741 have out yielded both the check varieties and recorded the yield of 17.72 and 17.56 q/ha respectively.

Entries KU-8-558, 551 and 553 recorded significantly high yield (1114, 1089 & 1080

compared to check MBG-207 (799 kg/ha) in advanced varietal trial at Madhira. In MLT, entry LBG-748 (880 kg/ha) recorded significantly high yield over the local check LBG-20 (626 kg/ha).

In AYT the genotypes LBG-750 (1117 kg/ha) followed by LBG-768 (944 kg/ha) and LBG-764 (914 kg/ha) performed better compared to the best check LBG-709 (1001 kg/ha) while in MLT the genotypes LBG-756 (1020 kg/ha) and LBG-729 (875 kg/ha) performed better than best yielding check LBG-709 (670 kg/ha) at Lam.

Crop Production

In *kharif* blackgram, post emergence application of Imizathapyr @ 250 ml/ha at 20 DAS gave highest grain yield (1750 kg/ha) which was significantly superior over all weed management treatments except twice hand weeding at 20 and 40 DAS and post emergence application of Chlorimuronethyl @ 4 g/ha at 20 DAS at Lam.

Seed priming of blackgram cv LBG-752 with 100 ppm salicylic acid and 2% urea spray at 20 and 30 DAS and irrigation at 30 DAS resulted in highest grain yield (1459 kg/ha) in rice fallow by mitigating the incidence of YMV at Lam.

Post emergence application of bispyribac sodium @ 20 g/ha at 15 days after sowing was effective in reducing weed growth with 72% WCE and recorded higher crop dry weight and was on par with all other herbicide treatments except propaquizafop which caused severe injury (90%) to crop at Lam.

Among different blackgram varieties LBG-623 (620 kg/ha) gave significantly higher yield followed by T-9 (484 kg/ha) and LBG-752 (420 kg/ha) at Anakapalle.

Crop Protection

Insect Pest Management

Renaxypyr @ 150 ml/ha recorded lower web formation (14.99%), lower pod damage

(13.76%) and highest grain yield (953.33 kg/ha) at Ghantasala.

2.3 Greengram

Crop Improvement

Greengram entry MGG-351 with excellent yield performance suitable for round the year cultivations had completed 3 years of minikit testing at Madhira.

In multilocation trial of greengram conducted at Palem GG-8 recorded highest per se performance for seed yield with 789 kg/ha and GG-6 (767 kg/ha) followed by GG-3 with 728 kg/ha.

In AYT the entry LGG-502 (955 kg/ha) and LGG-477 (746 kg/ha) performed better while in MLT the entry LGG-527 (1122 kg/ha) was found better during *kharif* season at Lam.

Crop Production

Among various P-management options, greengram supplied with 100% P when preceding safflower received PSB + 5t FYM/ha, has produced significantly highest seed yield (700 kg/ha) at Tandur.

Greengram entry, LGG-505 gave significantly higher yield (684 kg/ha) than the best check LGG 460 (509 kg/ha) at Garikapadu.

The highest mean grain yield of 1412 kg/ha was recorded under conventional tillage which was on par with minimum tillage method and significantly superior over relay cropping method of cultivation. Among the genotypes tested across the methods of cultivation, the highest mean grain yield of 1414 kg/ha was recorded by LGG-450. The interaction effect of genotypes and methods of cultivation resulted

that the variety LGG-410 recorded highest grain yield of 1587 kg/ha under conventional tillage at Madhira.



Green gram after Zero tillage Maize at Utukur

In rice fallows, among different greengram varieties tested at Anakapalle. LGG-460 recorded significantly higher yield (781 kg/ha) followed by LGG-410 (633 kg/ha) and LGG-407 (603 kg/ha).

Crop Protection

Insect Pest Management

Among all foliar treatments tested fipronil @ 1ml was found effective with higher yields in all the main plots. In case of thrips spinosad was found effective with lower thrips population. In case of Maruca, the pod damage was less in fipronil treatment followed by Spinosad at Lam.

Disease Management

Out of 15 greengram varieties tested 12 were resistant to YMV at Lam. Only one entry M-141 was found resistant to powdery mildew. The greengram entries P101, P105, P106, P109, P110, P113, P115, P120, P125 were found resistant to YMV under field screening for three seasons.



YMV resistant Greengram entry P 113



YMV resistant Greengram entry P 115

Compatibility study of insecticide (*Thiodicarb*) with fungicides was conducted invitro by poisoned food technique at Lam. Mancozeb, copper Oxochloride, Dinocap, Tridemorph were compatible with Thiodicarb (insecticide).

Plant Physiology

Spraying of urea @ 2%, potassium nitrate @ 2%, Salicylic acid @ 100 ppm and brassinolide @ 0.1 ppm increased yield of greengram effected by water logged conditions at Lam. Among the eight foliar sprays concentrations of ethrel, ethrel @ 75 ppm and @ 100 ppm produced significantly higher dry matter per plant (9.7 g and 9.4 g) over control (7.8 g). Ethrel @ 75 ppm and @ 100 ppm produced significantly higher yield (25.23 q/ha and 25.09 q/ha) over control (22.75 q/ha) at Lam.

2.4 Bengalgram

Crop Improvement

In AVT-1 (Desi) except NBeG 55 all the entries recorded significantly superior yield than the check JG-11 (994 kg/ha). In AVT-1 Kabuli, only two entries NBeG 119 (1173 kg/ha) and NBeG 72 (1137 kg/ha) were found to be on par with the check Vihar (1128 kg/ha) but significantly superior to KAK-2 (766 kg/ha) at Nandyal.

In MLT among the entries tested, NBeG 1 (1561 kg/ha) recorded significant superior yield and 100 seed weight (29.5 g) than the best check JG-11 (1306 kg/ha). NBeG 28 (1439 kg/ha) and NBeG 13 (1410 kg/ha) recorded significant superior yield than Annigeri with bigger seed size, which is significantly superior to JG-11 (24.3 g) at Nandyal.

Crop Production

In oil seed-chickpea cropping system, application of FYM 5 t/ha to *kharif* and *rabi* crops and 60 + 20 kg P₂O₅+S/ha to chickpea gave higher chickpea grain yield (1974 kg/ha) at Lam.

In the trial on influence of seed rates on chickpea varieties Annegeri and JG-11 produced comparable number of pods/plant (47.3 and 39.0 respectively) with higher seed yields (1927 and 1831 respectively) compared to KAK-2 (1044 kg/ha). Annegeri and JG-11 produced comparable yields at different seed rates ranging from 25 to 45 kg/acre at Nandyal.

Plant Physiology

In the trial physiological parameters in relation to drought tolerance in chickpea, highest relative water content of 69% and lowest of 54.2% was recorded in ICCV-37 and vijay respectively. Highest seed yield was recorded in Vijay (959 kg/ha) followed by LBeG-7 (943 kg/ha) at Nandyal.

2.5 Horsegram

Crop Improvement

In horsegram, 90 germplasm lines were evaluated. The germplasm lines viz., PHG-45 (436 g/plot), PHG-47 (451 g/plot), PHG-59 (439 g/plot) and PHG-82 (424 g/plot) recorded highest number of pods per plant and seed yield per plot, respectively at Palem.

In horsegram advanced varietal trial conducted at Palem. HG-13 showed highest per se performance for seed yield (1192 kg/ha) followed by HG-10 (1182 kg/ha) and HG-9 (1175 kg/ha) compared to the check Palem-1 (1097 kg/ha).

Among the eight lines evaluated in AVT II, HG-13 gave highest seed yield of 1067 kg/ha followed by HG 8 (1054 kg) at Tirupati.

2.6 Soybean

Crop Improvement

In advanced varietal trial-II, ADB-11 (3333 kg/ha), ADB-23 (3323 kg/ha), ADB-22 (3315 kg/ha) and ADB-12 (3182 kg/ha) exhibited superior performance over the check varieties JS-335, PS-1029 and JS 93-05 at Adilabad.

Crop Production

In the experiment on production potential of cotton through organics cotton boll no. (37.6), boll weight (3.4 g) and yield / plant (58.7 g) were more in organic cotton while in inorganic cotton boll number (27.1), boll weight (3.2 g), yield / plant (50.5 g) and seed cotton yield (1405 kg/ha) was recorded at Adilabad.

Among the different management practices in soybean based cropping systems 50% organic + 50% inorganic management (2271 kg/ha) recorded significantly higher soybean seed yield and was on par with that of 100% organic management (2250 kg/ha) and superior to 100% inorganic management. Seed

equivalent yield of the soybean – chickpea system (1928 kg/ha) was significantly higher than that recorded by soybean – mustard system (1348 kg/ha) at Lam.

2.8 Cowpea

Crop Improvement

In advanced varietal trial, the entry TPTC-14 recorded highest yield of 985 kg/ha followed by TPTC-7 (970 kg) over check co-702 (710 kg) in light shallow soils at Tirupati.

3. Oilseeds

3.1 Castor

Crop Improvement

A wilt resistant, short duration promising new hybrid PCH-111 developed at Palem suitable for *kharif* and *rabi* under rainfed and irrigated conditions with yield superiority of 22 per cent over GCH 4 in second year of minikit testing. Two promising new hybrids PCH-234 and PCH-244 were nominated for AICRP trials for testing at national level.



Pre release castor variety PCH 111 developed at Palem

Crop Production

The total productivity of the castor + redgram intercropping system as measured in terms of castor seed equivalent yield revealed that castor + redgram 1:1 (805 kg/ha), 6:1

(734 kg/ha) and sole castor (808 kg/ha) were found to be significantly higher and superior to rest of the treatments at Palem.

Intercropping of DCH-177 + PRG-158 gave 13.4% yield advantage with a B:C ratio of 3.2 over GCH-4 + local kandi (1296 kg/ha and 2.8). Intercropping (DCH-177+PRG-158) gave an yield advantage of 50% over sole castor (GCH-4) at Palem.

Crop Protection

Insect Pest Management

In AVT, SKI-215 was highly susceptible to hoppers with hopper burn scale of 3.0. The entries DSP-222 and DCS-105 showed relatively high infestation of thrips (10.3-11.6 thrips/spike) at Palem.

The treatment involving mechanical control and monocrotophos spray was effective in reducing the defoliator population followed by mechanical control of defoliators more particularly *Spodoptera* and Bihar Hairy Caterpillar. Accordingly highest seed yield of 1472 and 1352 kg/ha was recorded in the two treatments respectively at Palem.

Disease Management

Among 42 entries of advanced breeding lines screened in wilt sick plot CK08 and AHT-155 entries were found resistant to wilt (<20% wilt) up to 150 days after sowing (DAS) at Palem.

Among the varieties and hybrids of castor DCS-9, DPC-9, Haritha, DCH-177, PCH-111 showed resistant reaction to Palem, Hyderabad and S.K.nagar isolates of *Fusarium oxysporum* f.sp. *ricini*, where as PCH-80, GCH-7, M-574, PCS-137, GCH-4 and Kranti showed moderately resistant reaction at Palem.

3.2 Groundnut

Crop Improvement

Among the fifteen groundnut cultivars evaluated at Utukur. TIR-9 (3.47 t/ha), K-1501

(3.35), TCGS-750 (3.24 t/ha), K-1504 (T) (3.10 t/ha) and K-1504 (s) (3.04 t/ha) recorded significantly higher pod yield over best check Vemana (2.38 t/ha).

Groundnut variety Kadiri Harithandhra (K-1319) identified for release at National level for *rabi* season. Pod yield ranging from 35-40 q/ha and matures in 120 days. The oil content is as high as 48% and was showing field tolerance to foliar diseases and thrips at kadiri.

The first confectionary bold groundnut varieties Kadiri-7 and Kadiri-8 are tolerance to foliar diseases and sucking pest. Drought tolerant groundnut variety K 1375 having high shelling % of 80 and highest oil content 53%.

In a multi location trial conducted at Yellamanchili the culture MLTG-9 recorded highest pod yield (2240 kg/ha) followed by MLTG-8 (2100 kg/ha) and MLTG-11 (2100 kg/ha) compared to the check JL-24 (1260 kg/ha).

In multi location trial, MLTG-07-11 (1688 kg/ha) was found significantly superior over the local check JCG-88 at Jagtial. In advanced varietal trial (SB) AIS 2007-7 (4325 kg/ha) was superior to local check Kadiri-6 (4015 kg/ha).

In advanced varietal trial-set II at Tirupati, TCGS-1042 and TCGS-1045 were the top yielder in early group (100 days) with pod yield of 1347 kg/ha and 1454 kg/ha and kernel yield of 835 kg/ha and 771 kg/ha respectively while early check Narayani recorded the pod yield of 889 kg/ha and kernel yield of 604 kg/ha. In late group (105-110 days), TCGS-1051 and TCGS-1065 recorded pod yield of 1462 and 1406 kg/ha respectively which was 7% and 3% higher than the late check, Abhaya (1364 kg/ha).

In advanced varietal trial-set II, FDRS-79 recorded the highest pod yield of 1970 kg/ha and kernel yield of 1182 kg/ha over the best check Abhaya (pod-1421 kg/ha and kernel-995 kg/ha).

In multilocation varietal trial, MLTG-13 recorded highest pod yield of 1672 kg/ha which was 46% higher than the check variety, Abhaya (1148 kg/ha). With respect to kernel yield, the same entry recorded 1154 kg/ha which was 48% higher than TPT-25 (780 kg/ha) at Tirupati.

In advanced varietal trial (Set-I) conducted at Tirupati in *rabi* season, TCGS-1043 recorded the highest pod and kernel yield of 3746 kg/ha and 2997 kg/ha respectively, which is 15% and 20% increase over best check TPT-25 (3250 kg/ha pod yield and 2503 kg/ha kernel yield). TCGS-1043 recorded the highest shelling % (80%) and SMK (89%) followed by TCGS-1014 recorded pod yield of 3517 kg/ha and seed yield of 2708 kg/ha respectively.

In advanced varietal trial (Set-II), TCGS-894 recorded the highest pod yield of 3402 kg/ha followed by TCGS-969 (3389 kg/ha), TCGS-991 (3078 kg/ha) and TCGS-997 (2990 kg/ha) with percent increase of 20, 19, 8 and 5 respectively over best check Abhaya (2848 kg/ha). TCGS-969 recorded the highest kernel yield of 2610 kg/ha followed by TCGS-894 (2552 kg/ha) and TCGS-991 (2185 kg/ha) which is 29%, 26% and 8% increase over best check TPT-25 (2022 kg/ha) at Tirupati.

Crop Production

Pooled analysis of data revealed that groundnut pod yield (1633 kg/ha) was highest with 10mm depth on every 3rd day through surface drip method. The total quantity of irrigation water given in this treatment was 330 mm as against 600 mm in check basin method of irrigation. Irrigation water use efficiency was highest with 10 mm given on 4th day (5.0 kg ha/mm) followed by 10 mm on 3rd day (4.3 kg ha/mm) as against only 1.9 kg ha/mm with check basin method at Reddipalli.

Adoption of improved dryland technology increased the net returns (Rs.13260) and benefit

cost ratio (1.21) compared to farmer's practice (Rs.9557/ha) at Reddipalli.

Mechanized cultivation of groundnut improved net returns by 29% and additional benefit cost ratio of 0.77. Time taken for sowing and intercultivation was less compared to sowing with local seed drill and bullock drawn guntaka for intercultivation at Reddipalli. Groundnut and redgram intercropping system recorded highest groundnut equivalent yield of 980 kg/ha followed by greengram-groundnut (784 kg/ha) system.

In a study conducted at Kadiri on evaluation of post emergence herbicides in groundnut during *rabi* application of Quizalofop Ethyl @ 50 g a.i./ha and Imazethapyr @ 75 g a.i./ha at 20 DAS were equally effective. Among different doses tried, Quizalofop Ethyl @ 50 g a.i./ha and Imazethapyr @ 75 g a.i./ha was found optimum.

Evaluation of post emergence herbicides in groundnut revealed that among different herbicidal treatments, lowest weed density, dry matter, weed index and highest weed control efficiency, highest pod yield was with 'Pre emergence application of Pendimethalin @ 1.0 kg a.i./ha (+) 1 HW' followed by the 'Pre emergence application of Pendimethalin @ 1.0 kg a.i./ha (+) Quizalofop ethyl @ 50 g a.i./ha at 20 DAS' and 'Pre emergence application of Pendimethalin @ 1.0 kg a.i./ha (+) Imazethapyr @ 75 g a.i./ha at 20 DAS'. Among different doses tried, Quizalofop ethyl @ 50 g a.i./ha and Imazethapyr @ 75 g a.i./ha were found to be optimum at Jagtial.

Rhizobium-I (NRCG-9) strain recorded highest pod yield, dry matter, nodule number and weight at 40 & 60 DAS and was on par with *Rhizobium*-II (IGR-6) strain over the RDF and control plots at Jagtial.

Crop Protection

Insect Pest Management

Significant differences were observed among test chemicals in pre treatment control a day before imposing insecticidal spray. Imidacloprid 17.8% SL (@ 2ml/kg and 0.25 ml/lit) and Acetamaprid 20% SP (@ 1.0 g/kg and 0.2 g/lit) were found to be highly effective against thrips injury and which transmitted PSND and PBND diseases at Kadiri.

Among the different insecticides tested at Anantapur, under laboratory conditions indoxocarb was effective against *Spodoptera exigua* with lowest LC 50 value of 0.02 ug/larva followed by Novaluron (0.03 ug/larva).

The percent leaves damaged by thrips was high at vegetative stage (75.0%) whereas jassids (100.0%), aphids (20.0%), per cent defoliation by *Spodoptera litura* (40%), stem rot (10.0%), PBND (5.0%) and PSND (15.0%) were high at pod formation stage. However, higher incidence of late leaf spot (90.0%) and rust (80.0%) was recorded at harvesting stage at Jagtial.

Among all the treatments tested against *Spodoptera litura* for their efficacy, the treatment spinosad was found to be superior recording lowest number of *Spodoptera litura* (5.83) followed by thiodicarb (6.17) at Jagtial.

In the trial on testing new insecticides against sucking pests of groundnut, the percent leaf damage due to thrips (27.7) was least in the thiomethoxam treatment followed by dimethoate treatment. The yield of dry pods and haulms recorded was highest in the thiomethoxam treatment (1800 kg/ha and 3933 kg/ha) at Jagtial.

The regression analysis of GLM trap catches with weather parameters revealed that 61.38 per cent of population of *A. modicella* caught in pheromone traps was influenced by

weather parameters and the regression equation fitted to GLM pheromone trap catches is $Y = 18.5552 + 0.44472 RD + 0.097596 SShr + 0.015407 WV$. The step down regression analysis revealed that minimum temperature influenced the trap catches to the extent of 39.47% while maximum temperature up to 22.45% at Tirupati.

In MLTG, lowest incidence of 6.75% of groundnut leaf miner was recorded from MLTG 11 as against highest incidence of 14.62 % (MLTG 5). Among the late sown groundnut entries, lowest thrips incidence was recorded from AVT-873 (1.32%), ICGV-89280 (1.97%), TCGS-979 (2.59%), TCGS-771 (2.59%), green leaf hopper incidence ranged from 3.51% (AVT-873) to 16.90% (TCGS-913) and the GLM incidence was varied between 2.81% (ISK-1-08-16) to 11.59% (TCGS-944) at Tirupati.

Pre-treatment incidence of thrips was from 15.34% to 20.41% in different treatments. After treatments impositions, thrips incidence was low in emamectin benzoate (6.52%) followed by monocrotophos (7.01%) imidacloprid (7.01%), acephate (7.12%) and acetamiprid (7.71%) as against untreated control (12.92%) at Tirupati.

Among the 48 isolates of Bt: 31 found to be + ve with Lep 1 primer, 11 found to be + ve with Cry IIIF primer and 10 were found to be + ve with Cry IF primer at Tirupati.

Disease Management

Thirty six entries of elite and pre-released cultivars of groundnut were screened for foliar diseases and PSND. Lowest ELS of 1.0 scale was recorded in entries K-1463 (DT), K-1536 (IPR), K-1563 (IPR) and K-1310 at Kadiri. In the management of dry root rot of groundnut using bio-control agents the study revealed that seed treatment followed by soil application of

Trichoderma was found to be effective in controlling the disease.

Seed treatment with *P.fluorescens* @ 10 g/kg + soil application of *P.fluorescens* @ 2.5 kg/ha at 30 and 45 DAS was found significantly superior to other treatments in controlling the LLS and soil borne pathogens besides increasing the yield and yield parameters. The same treatment resulted in highest cost benefit ratio of 1:2.2 at Anantapur. Seed treatment with Tebuconazole @ 1 g/kg was found better than other treatments in controlling the seed and soil borne pathogens and also increased the yield and yield attributes. The same treatment resulted in highest cost benefit ratio of 1:10.

Seven newly isolated *Trichoderma* isolates were subjected to RAPD analysis with operon random primers. High variability existed among 7 isolates and some of them shown as distinct clusters. The SCAR marker linked to wilt resistance in pigeonpea was developed and validated in many cross combination of parents. About 109 F2 plants of ICPI-7035 x ICPL-8863 cross were screened with SCAR marker developed and inheritance of wilt disease was studied. Resistance was controlled by single dominant gene and population segregated into 3:1 ratio at Tirupati.

Of 125 operon primers tested to identify marker linked to sex in *Simarouba glauca* (biofuel crop), OPA 8 gave specific amplification at 830 bp in males and bi-sexual plants. The marker had high reproducibility. The 830 bp band was cloned and sequenced and it was converted into SCAR marker for precise identification of sex in Simarouba at Tirupati.

An efficient protocol was developed for transformation of Tirupati varieties (Narayani, Tir-25, APNL-888) with Cry 1F gene through *Agrobacterium* mediated transformation. About 30 plants were regenerated and transferred to

greenhouse and analysed by PCR for gene integration and found 3 plants positive for Bt gene at Tirupati.

Plant Physiology

In the experiment on screening of groundnut pre-released genotypes for WUE traits under rainfed conditions conducted at Tirupati, the entry TCGS-894 recorded highest pod yield (1386 kg/ha) highest filled pod number per plant (9.5) and highest shelling percent (71) followed by TPT-25 and TCGS-901.

In the experiment on genotypic variability for root traits among core germplasm of groundnut, two genotypes TCGS-864, TCGS-876 proved to contain higher drought tolerant traits and can be used as source parents in breeding programmes at Tirupati.

Quantification of total soluble sugar (g/100g fresh tissue) in kernels of eleven groundnut genotypes determined by Anthrone method. Among 11 groundnut genotypes Narayani showed highest TSS (22.169g/100g fresh tissue) followed by TPT-25 (21.825 g/100g fresh tissue) where as ISK 7 showed least (14.880 g/100g fresh tissue) at Tirupati.

In the experiment on molecular characterization and identification of non toxic *Aspergillus flavus* strains, two potential bioagents a non toxic *A.flavus* strain (TGF 34) and another strain is *Trichoderma virens* were identified. Application of gypsum was effective in minimizing the *A.flavus* population and aflatoxin in groundnut.

Least *A.flavus* soil count was observed in the soil treatment with gypsum followed by gypsum + non toxic *A.flavus* followed by gypsum + *T.virens* and toxic *A.flavus*. Kernel infection was found to be less than 12% in all the treatments imposed. Quantitative estimation of AFB1 in the groundnut kernels was also done through HPLC and it was found to be <0.5 ppb

in all treatments. It was found that, low *A.flavus* soil count and kernel infection was observed in the soil treatment with gypsum and gypsum + non toxic *A.flavus* at Tirupati.

3.3 Sunflower

Crop Improvement

In advanced hybrid trial the entry MDSFH-404 recorded highest seed yield of 1509 kg/ha followed by Sunbred 00997 (1465 kg/ha) and PAC 1091 with 1426 kg/ha at Nandyal.

Crop Production

In the experiment on introduction of non-traditional crops in high altitude and tribal zone of Srikakulam district, sunflower and mustard noticed higher horse gram equivalent yields with the same trend of highest net returns. An increase of 1076.8 and 906 kg of higher values were noticed. Regarding economics the highest gross and net returns were noticed with sunflower, followed by mustard and rajmah beans. Highest harvest index values were noticed with rajmah beans followed by mustard. CB ratio of 3.09 was noticed with mustard at Seethampet.

A field experiment was conducted at Kavali for three consecutive years (2006-07 to 2008-09) to study the response of sunflower to nitrogen levels and spacing. Results indicated that yield of sunflower significantly increased (2239 kg/ha) with increase in nitrogen levels upto 90 kg/ha. Maximum head diameter (13.15 cm) was recorded at 45 x 30 cm spacing at Kavali.

Application of 103 kg N, 135 kg P₂O₅ and 45 kg K₂O (150% RDF) resulted in significantly higher seed yield, 100 seed weight and plant height over 38 kg N, 45 kg P₂O₅ and 15 kg K₂O (50% RDF) which in turn was significantly superior over control but was on par with application of 75 kg N, 90 kg P₂O₅ and 30 kg K₂O (100% RDF). The interaction effect of

hybrids and fertilizer inputs was significant. Significantly higher seed yield was realized with DRSH-1 when applied with 90 kg N, 90 kg P₂O₅ and 45 kg K₂O (150% RDF) at Nandyal.

The irrigation method drip system in 40/80 cm paired rows gave the highest seed yield of 2980 kg/ha and was significantly superior to 60/90 cm drip (2467 kg/ha) and check basin (2245 kg/ha).

Disease Management

Among the treatments studied at Nandyal, seed treatment with Quintal (combination products of Iprodione + corbendazim) and spraying at 30, 40 and 60 DAS recorded significantly low incidence of *Alternaria* leaf blight disease (5.7%) with yield of 1354 kg/ha. In control plot the disease incidence was 51.7%.

3.4 Sesame

Crop Improvement

In AVT, Pragathi (586 kg/ha) recorded significantly superior yield over the check, Swetha (509 kg/ha). In AVST JCS-581 (754 kg/ha) & JCS-677 (748 kg/ha) recorded significantly superior yield over check Swetha (580 kg/ha) at Jagtial.

3.5 Safflower

Crop Improvement

Safflower entry TSF 1 completed second year minikit testing at Tandur. Seventeen high yielding wilt resistant lines were tested in AVT in comparison with Manjira for yield and yield components. The entries GMU 2894 (1227 kg/ha) followed by GMU 2914-15 (1153 kg/ha) and GMU 4452 (1147 kg/ha) were significantly superior in terms of yield.

Twelve entries were tested in AVT I & II in comparison with check variety Manjira for yield and yield components. The entries AVT-08-2

(1710 kg/ha) followed by AVT-08-8 (1414 kg/ha) and AVT-08-5 (1322 kg/ha) gave maximum seed yield at Tandur.

Crop Production

Significantly higher safflower seed yield was recorded with 100% P when preceding greengram received PSB + FYM @ 5t/ha (1550 kg/ha) which was on par with 100% P to both the crop components (1506 kg/ha) at Tandur.

4. Commercial Crops

4.1 Cotton

Crop Improvement

Out of the 50 non Bt hybrids tested against Bt checks, Mallika and bunny, two hybrids viz., ADBH-43 (2530 kg/ha) and ADBH-49 (2500 kg/ha) were significantly superior to the check Mallika Bt (2283 kg/ha) while none of the tested hybrids were superior to other Bt check Bunny (3178 kg/ha) at Adilabad.

In advanced yield trial-I, ADB-558 gave significantly high yield of 2530 kg/ha over ADB-28 (1975 kg/ha) and Narasimha (1913 kg/ha) followed by ADB-560 (2376 kg/ha) and ADB-556 (2299 kg/ha). In advanced yield trial-II two entries ADB-531 (3772 kg/ha) and ADB-532 (3263) recorded significantly superior yield over Narasimha (2106 kg/ha) and ADB-39 (2453 kg/ha) at Adilabad.



ADB-28 early (140 days) cotton genotype developed at Adilabad

The entries viz., F 1861 (CLCuV check) (2465 kg/ha), SCS-415 (2367 kg/ha), NDLH-1938 (2361 kg/ha), LH-2132 (2320 kg/ha) and CSH-3129 (2297 kg/ha) recorded highest seed cotton yield and were significantly superior over the zonal check entry Surabhi (1898 kg/ha) at Lam.

The entries viz., RHCB 001 (1565 kg/ha), GSB-41 (1339 kg/ha) and DB 1 (1256 kg/ha) recorded highest seed cotton yield and were significantly superior over the check entry Suvin (CC) (632 kg/ha). Among the eighteen entries evaluated the entries 1616 (2622 kg/ha) and 1602 (2273 kg/ha) have recorded significantly superior seed cotton yield to the local check LAHH (1901 kg/ha) at Lam.

Among the sixteen entries were tested along with check L 604, the entries viz., L 943 (2625 kg/ha) and L 927 (2392 kg/ha) recorded highest seed cotton yield and were significantly superior over the check L 604 (2260 kg/ha) at Lam.

In advanced varietal trial, the yields of seed cotton ranged from 965 kg/ha to 2057 kg/ha. Among the entries tested NDLH-1938 (2057 kg/ha) followed by NDLH-1939 (1939 kg/ha), NDLH-1839 (1674 kg/ha), NDLH-1927 (1658 kg/ha) and NDLH-1905 (1590 kg/ha) recorded significantly superior yields of seed cotton compared to the check Narasimha (1304 kg/ha) at Nandyal.

In Multilocation varietal trial of cotton, the entries MLTV-8 (2009 kg/ha) followed by MLTV-2 (1508 kg/ha), MLTV-5 (1438 kg/ha), MLTV-6 (1265 kg/ha), MLTV-3 (1211 kg/ha) and MLTV-4 (1172 kg/ha) recorded significantly superior yields of seed cotton compared to the check Narasimha (898 kg/ha) at Nandyal.

Crop Production

Maize-safflower crop sequence recorded same cotton equivalent yield (2543 kg/ha) as

cotton (2459 kg/ha). Greengram – chickpea crop sequence recorded significantly lower cotton equivalent yield (701 kg/ha). Higher net returns (Rs.50174/ha) were realized with maize-safflower followed by cotton (Rs.48770/ha). Net returns (Re) were more with greengram – safflower cropping system (1.99), followed by maize – safflower (1.97) at Warangal.

Vermicompost was successfully prepared from uprooted cotton stalks which contained 1.12% N, 0.93% P & 0.12% K in addition to micronutrients like copper (270 ppm), Iron (2791 ppm), Manganese (366 ppm) at Mudhol.

Different cropping systems tested in cotton, Bt cotton – sunflower; Bt cotton – chickpea; Bt.cotton – maize; Bt.cotton – sesamum and Bt.cotton – cucumber + methi were found ideal under double cropping system in black cotton soils under irrigated conditions at Lam. Application of paraquat @ 1.5 kg a.i./ha helped in forced boll opening and consequently early maturity by 10 days which is advantages for taking up an early *rabi* crop.

Crop Protection

Insect Pest Management

Chemical control of sucking pests through foliar spray revealed that, fipronil 5% SC @ 800 ml/ha was found significantly superior in reducing the jassid population and realizing higher yields. The next best treatment was imidacloprid 200 SL @ 200 ml/ha at Lam. The influences of IPM practices were evaluated in Bt genotypes viz., Bollgard I (BG I) and Bollgard II (BG II) along with counterpart of NBt hybrid in comparison with farmers method of control and untreated control blocks. Bollgard (BG) genotype performed well under farmers method of control with CB ratio of 1:2.17.

All the entries recorded the jassid injury grade of IV except Narasimha which recorded

III. Boll damage ranged from 1.51 per cent (Narasimha) to 8.73 per cent (CPD 03-2). The lowest percent open boll damage was recorded in the entry CPD 03-2 (13.10) followed by RAH 3 (17.09) and 17.84 (24.63) at Nandyal.

Disease Management

Pooled data analysis of 2007-08 and 2008-09 showed that Taqat at 500 g/ha at fortnightly intervals starting immediately after the first appearance of the disease protects cotton crop effectively with benefit cost ratio of 1.42 from important fungal leaf sport diseases caused by *Alternaria*, *Heliminthosporium*, *Myrothecium* and *Cercospora* at Lam.

Pooled data analysis (2006-2008) seed treatment with *Pseudomonas fluorescens* Pf 1 followed by 0.2% foliar sprays at 10 day interval starting from 30 days after sowing was cost effective with benefit cost ratio of 1.92 in managing important foliar diseases viz., bacterial blight and leaf spots caused by *Alternaria*, *Helminthosporium* and *Myrothecium* at Lam. Pooled data analysis (2005-2008) Propiconazole 0.1% sprays at 15 days interval up to 95 days resulted in avoidable yield losses to the tune of 38.23%.

Plant Physiology

Different treatments tried at different stages of crop growth, revealed that foliar application of Etherel @ 3000 ppm at 130 DAS has given significantly superior yield (2958 kg/ha) which was on par with foliar application of Etherel @ 3000 ppm at 145 DAS (2612 kg/ha) and foliar application of Etherel @ 1500 ppm at 130 DAS (2532 kg/ha) at Lam.

In Hirsutum cotton, out of 17 varieties highest leaf area index at 90 DAS was recorded in NDH-1905 (1.73 and at 120 DAS in NDH-1929 (4.59). Highest seed cotton yield was recorded in NDH-1938 (2057 kg/ha) at Nandyal.

Agricultural Economics

The farmers growing Bt cotton recorded 44.17 per cent more yield, realized 64.70 per cent more gross returns and 302 per cent more net returns because of Bt technology at Lam.

The incremental benefit cost ratio was 0.87 for Bt cotton. The area under Bt cotton was increased by 31.5 per cent due to secured yield and net returns at Lam.

4.2 Sugarcane

Crop Improvement

In advanced varietal trial (Early) of ratoon CO M 9902 (19.95 t/ha) clone alone recorded significantly higher CCS yield, compared to the best check, Co 94008 (16.41 t/ha) at Rudrur. In advanced varietal trial (Midlate) maximum CCS yield was recorded by the clones, Co 0325 (14.66 t/ha) and Co 0218 (13.96 t/ha) on par with that of the best check, Co 86032 (13.89 t/ha)

The clone 2003 V 46 recorded significantly higher cane yield (125.26 t/ha) and CCS yield (16.13 t/ha) in MYT (Early) – II plant and also recorded highest cane (100.52 t/ha) and CCS (12.60 t/ha) yield in MYT (Early) – Ratoon at Vuyyuru. In MYT (Mid-late) Ratoon, the clone 2002 V 48 recorded significantly higher cane yield of 110.71 t/ha while the clone 2003 V 27 recorded highest CCS yield of 13.33 t/ha.

In main yield trial (Mid late) of sugarcane crop, the clone 2004 A 128 (93.31 t/ha) recorded highest cane yield in comparison with best standard Co 7706 (81.72 t/ha). The standard Co 7219 (17.50% and 9.78 t/ha) recorded highest per cent juice sucrose and CCS yield. The clone 2004 A 15 (99.99 t/ha) recorded highest jaggery yield at Anakapalle.

Co A 06321 recorded significantly more number of millable canes (124.0 thousands /ha) than best standard Co C 01061 (126.00 thousands /ha). The clone Co A 060321 recorded

significantly higher cane yield (118.50 t/ha) than standard Co C 01061 (108.0 t/ha). The standard Co 92081 recorded highest per cent juice sucrose of 18.60 where as Co A 06321 recorded maximum CCS per cent (14.35 %) and CCS yield (17.00 t/ha) than standard Co A 92081 (14.58 % and 16.00 t/ha) at Anakapalle.

In advanced varietal trial (mid late) the clone Co A 05323 recorded significantly more number of millable canes (112.00 thousands/ha) and cane yield (128.00 t/ha) and CCS yield (16.65 t/ha). The clone Co A 05322 recorded maximum juice sucrose per cent of 18.23 and CCS % 13.21% at Anakapalle.

The clone Co C 03063 recorded highest per cent juice sucrose of 18.87 and found significantly superior to the best standard Co 7219 (17.53 per cent). CCS yield ranged from 4.59 t/ha (Co J 3129) to 12.85 t/ha (Co V 03102) at Anakapalle.

Crop Production

Highest cane yield of 141.16 t/ha was recorded in paired row (75/105 cm) + fertigation with 100% RDF where as farmers practice (Normal spacing + pocketing of fertilizer) gave the sugarcane yield of 108.22 t/ha. Juice quality and sugar yield reduced on application of 75% and 50% RDF at Utukur.

Under different nutrient levels tested, sugarcane responded positively to the applied biofertilisers. 100% RDF gave significantly highest cane yield of 127.14 t/ha and was on par with 75% RDF + Azospirillum @ 10 kg/ha + VAM @ 12.5 kg/ha at Perumallapalle.

Different planting techniques in sugarcane crop revealed that the higher sucrose percentage was recorded for 4' method of planting (19.8%) followed by 5' (19.6%) compared to all other methods of planting at Basanthapur.



Sugarcane crop at Basanthapur

Among 12 sugarcane clones tested for their post harvest deterioration in quality of sugarcane, clone Co 94008 maintained its cane quality up to 60 hours after harvest with a minimum reduction of 3.59% and 5.32% sucrose and CCS followed by Coc 9201 (4.13% & 5.13%) at Basanthapur.

The planting methods differed significantly with respect to NMC and cane yield but sucrose percentage did not differ significantly. Among the planting methods, the paired row method of sugarcane planting recorded significantly higher NMC of 108.6 (000/ha) and cane yield of 130.4 t/ha as compared to 3¹ and 5¹ planting methods. This was followed by 5¹ planting method which recorded significantly higher NMC of 96.7 (000/ha) and cane yield of 114.3 t/ha as compared to 3¹ method of planting at Rudrur.

The interaction effect between planting techniques and irrigation method indicated that the paired row method of planting with surface drip recorded significantly higher NMC of 112.4 (000/ha) and 139.5 t/ha at Rudrur. Among the organic manures, application of FYM @ 25 t/ha resulted in significantly higher NMC of 93.9 (000/ha) and 119.5 t/ha than compared to dry press mud cake application or no manure treatment. Application of dry press mud cake @ 12.5 t/ha

resulted in significantly higher NMC of 87.2 (000/ha) and cane yield of 100.3 t/ha over no manure application.

Among the four clones tested for jaggery preparation 97 R 129 maintained highest juice extraction percent (54.64) and jaggery recovery percent (9.9). The jaggery prepared with 97 R 129 recorded highest sucrose percent (82.3) with reducing sugars percent (9.5), TNS percent (8.2), Moisture percent (9) and Hardness (3 cm) at Rudrur.

Among the varieties, Co6907, recorded highest yield followed by 2003 V 46 and 2000 V 59. Regarding percent juice sucrose in Co6907 quality was maintained upto 11th month. By seeing all the parameters 11th month was the optimum time for harvesting all the three varieties at Vuyyuru.

Spraying of Ethrel @ 250 ppm (77.2 t/ha) or maleic hydrazine @ 100 ppm (75.2 t/ha) reduced the flowering to a considerable extent and resulted in significantly higher yield than control (69.4 t/ha). In a study on seed economy in sugarcane, planting two bud setts registered higher cane yield (92.7 t/ha) or three bud setts (90.9 t/ha) as compared to single bud setts (84.1 t/ha). Similarly, significant higher cane yield was recorded with normal seed rate of 1,20,000 buds/ha (92.3 t/ha) than lower seed rate of 80,000 buds/ha (86.2 t/ha) at Anakapalle.

Among different alternate cropping systems tested, Bhandi-greengram, Marigold-greengram was found to be more profitable than rainfed sugarcane with a net income of Rs.27,950/-, Rs.21,665/- and 2.2, 2.8 benefit cost ratio respectively. In terms of sugarcane equivalent yield, rainfed sugarcane recorded significantly higher (594 q/ha) sugarcane equivalent yield than any other cropping systems at Anakapalle.

Crop Protection

Insect Pest Management

Efficacy of insecticides against key pest of sugarcane was studied and results revealed that the mean cumulative incidence of early shoot borer up to 120 DAP was range from 37.34 per cent (Acephate 75 SP @ 1 gm/lit of water) to 60.04 per cent in control. All the treatments were significantly superior to the control at Rudrur. Highest NMC and yield recorded in profenophos 50 EC + Neem Oil 87445 per ha and 84.98 t/ha respectively followed by acephate 75 SP.

In demonstration of integrated pest management, the IPM practices recorded very less incidence of early shoot borer (1.25%), internode borer (2.33%), scale insect (1.50%) and scale incrustation (23 mg/cane) whereas, the incidence in farmer's practice was 8.5%, 4.5%, 5.65% and 84 mg/cane. The cane yield in IPM plot was 82.35 t/ha as compared to 78.24 t/ha in farmers practice. The cost benefit ratio was 1:1.25 at Anakapalle.

In evaluation of new formulations against early shoot borer and internode borer trial, carbofuron 3G @ 33 kg/ha recorded lowest incidence of early shoot borer (10.22%) and internode borer (2.52%) followed by fipronil 4G @ 25kg/ha (15.56%; 3.5%) compared to untreated control (27.99%; 11.50%). The highest cane yield was recorded in carbofuron 3G (88.72 t/ha) compared to untreated control (84.46 t/ha) at Anakapalle.

Disease Management

The varieties, 98 V 95, Co V-05-356, 2000 V 59, 2003 V 46, 2004 V 96 2004 V 105, were found promising in yield and quality with an advantage of red rot resistance to all the three pathotypes at Vuyyuru.

Soil application of mycorrhiza was found to reduce of disease intensity along with

biocontrol agents. Accordingly the growth and quality parameters and cane yield improved due to limited spread of red rot infection in the canes at Vuyyuru.

Foliar spray thrice with tridemorph (1 ml/lit) or mancozeb (3 g/lit) at monthly intervals starting from the first appearance of the disease, not only significantly reduced the disease (64% to 78%) but also increased the cane yield (5.8 to 7.5 t/ha) and juice quality of the cane (1 to 1.4 units) at Anakapalle.

Plant Physiology

Among the 13 sugarcane clones tested in screening of sugarcane clones / genotypes under rainfed conditions (June planting), 98 A 168 (88.16 t/ha), 99 A 5 (89.28), Madhurima (86.38 t/ha), Madhumathi (82.39 t/ha), 97 V 118 (86.42 t/ha), 2000 A 226 (84.63 t/ha) and 97 A 85 (84.32 t/ha) performed well and recorded higher SPAD (SCMR) values indicating drought tolerance efficiency under rainfed conditions at Anakapalle.

Among 10 sugarcane clones tested for their tolerance to post harvest deterioration during 11th (January), 12th (February), 13th (March) months after harvesting, sugarcane clones Co C 01061, 2001 A 63, 2001 A 241, 2000 A 175 and 2000 A 226 performed well with less percentage of reduction in terms of sucrose per cent, pH and per cent reducing sugars. More over these clones also recorded less glucose ratio and dextran formation and less cane weight reduction at 84 hours after harvest than other clones at Anakapalle.

Post Harvest Technology

Jaggery samples of AVT (Mid-late) showed highest sucrose (>86%) in CoV 03102 with superior cane and jaggery yields among different genotypes.

Quality characteristics of crystals (<3.0mm) and agglomerates of small and big

(3-5 mm and >5.0 mm, respectively) were studied and the results showed decrease in sucrose content due to heating and grinding of small agglomerates (3-5 mm) and also discoloration was observed. The discoloration was not observed due to grinding of big size agglomerates (> 5mm) and also without heating.

4.3 Tobacco

Crop Improvement

In hybrid trial of bidi tobacco, the hybrids NyBTH-1 (3254 kg/ha), NyBTH-2 (3176 kg/ha), NyBTH-3 (3172 kg/ha), NyBTH-4 (3140 kg/ha) and NyBTH-5 (3033 kg/ha) have recorded significantly superior cured leaf yield than the check hybrid GTH-1 (2384 kg/ha). The increased yield over the check hybrid GTH-1 ranged from 27 to 36 per cent at Nandyal.

In bulk yield trial of bidi tobacco, the varieties NBD 154 (2737 kg/ha) and ABD 100 (2581 kg/ha) have recorded superior cured leaf yield than the check variety A 119 (2190 kg/ha). The increased yield over the check variety ranged from 18 to 25 per cent at Nandyal.

Crop Production

Higher cured leaf yield was recorded with application of two irrigations over the other treatment. Application of 110 kg N/ha recorded significantly higher cured leaf yield than application of 130 kg N/ha. As regards the interaction effect, application of 90 kg N/ha with two irrigations recorded significantly higher cured leaf yield at Nandyal.

Crop Protection

Insect Pest Management

Experiment on IPM for tobacco revealed that Jowar as barrier crop against aphid played a major role in obstructing the movement of aphid in to the main field. As a result aphid incidence was low in IPM plot (9.5%) compared to Non IPM

plot (11.5%). Like wise, trap crop castor played an important role in trapping the larvae and egg masses of *Spodoptera* with score of 1.0 and grown up larva 2.8. Aphid score recorded in IPM plot was less than one, compared to non-IPM plot where it was more than one at Nandyal.

C. DISCIPLINE ORIENTED RESEARCH

1. Agronomic Research

1.1 AICRP on Cropping Systems

Rajendranagar

In the trial on identification of need based cropping systems conducted at Rajendranagar, the rice equivalent yields of maize-onion system were higher (7770 kg/ha) while most remunerative systems based on net returns and profitability were maize-groundnut, rice-maize and maize-castor. The results clearly favoured diversification to other crops rice-rice system.

In the trial on organic farming in maize-onion cropping system the performance of maize during *kharif* was better with 100% NPK through fertilizers or with INM (50% NPK + 50% N through FYM) while the bulb yield of onion during *rabi* was higher with integrated nutrient management practice over 100% RDF (120-60-60 maize, 150-60-60 onion). Sole organic treatments for onion resulted in bulb yield higher than that with inorganics (100% NPK). The practice of integrated nutrient management (50% NPK through fertilizers + 50% N through FYM) in maize-onion sequence resulted in more than 9 t/ha of maize grain equivalent yield which is much better than any other practice.

Rudrur

In the minimum tillage experiment for soybean based double cropping system, yield of soybean ranged from 702 to 1326 kgs/ha. Among the tillage methods, conventional method recorded highest yield (1239 gs/ha) followed by minimum tillage 1025 kgs/ha.

In turmeric sesamum cropping system, the rhizome yield of turmeric (dry weight) was higher in 100% recommended NPK (4720 kg/ha) followed by 50% recommended N as FYM (4598 kg/ha).

1.2 AICRP on Weed Control

Rajendranagar

In direct seeded upland rice, pre emergence application of Butachlor at 1.5 kg/ha followed by one hand weeding at 30 DAS was effective in realizing higher yield and efficient weed control and comparable with two hand weedings at 20 and 40 DAS.

In maize-sunflower system, conventional-conventional system resulted in higher seed yield of sunflower (1177 kg/ha) which was significantly superior to zero-zero tillage and conventional-zero tillage. Maximum sunflower seed yield was with hand weeding (1285 kg/ha) which was significantly superior to the rest of the treatments.

The residues of cyhalofop-p-butyl and 2, 4-D applied to rice crop persisted up to 30 days in soil after herbicide application. The residues of cyhalofop-p-butyl and 2, 4-D in rice grain collected at harvest time were below the detectable limit (BDL) and did not pose residual problem or environmental pollution.

1.3 Agro-Forestry

Rajendranagar

Yield potential of medicinal herbs (*Withania sominifera* and *Andrographis Paniculata*) declined in association with medicinal trees (*Terminalia chebula* and *Emblica officinalis*) when compared to the respective

crops grown as sole crops. However these medicinal herbs performed better in association with *Emblica officinalis* than *Terminalia chebula*.



Terminalia chebula + *Andrographis paniculata*



Emblica officinalis + *Withania sominifera*

In standardization of spacing and nutritional requirements on *Jatropha* studies, it was observed that wider spacing in alleys (4 m X 2 m) with 250 g as well as 125 g fertilizer mixture per plant improved the growth and seed yields of *Jatropha* when compared to other narrow alley widths (3 m X 3 m and 3 m X 2 m) irrespective of fertilizer mixture combination.

The incremental growth in height and girth of *Pongamia* grafts increased with the application of 300g NPK mixtures when compared to 150 g and 225 g of NPK mixture.



A High Yielding *Jatropha* germplasm line

It was observed that the nutrient status of litter of *Jatropha* was 1.23% N, 0.14% P and 1.26% K when compared in terms of NPK addition to soil, it was accounted as 3.26 kg N, 0.37 kg P₂O₅ and 3.34 K₂O kg/ha.

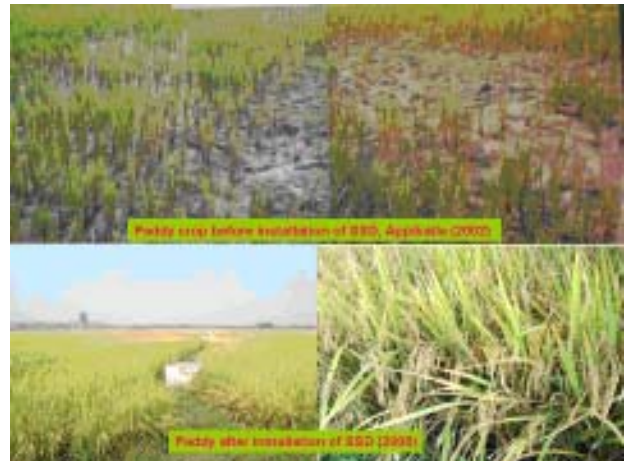
Tirupati

Accession Pasuvulabanda collection (JC-35) recorded the highest number of capsules per plant (598), capsule yield per plant (1859.0 g), number of seeds per plant (1587) and seed yield per plant (1193 g) followed by Chowdepalli collection (1153g), Peddakothuru collection (932 g) Gangipadu collection (928.0g) and Borramamidi collection (927 g) in respect of seed yield per plant. The highest oil content of 34.9% was recorded in accession Ananthasevakendram (JC 27) followed by LOT 1 (34.1%), Thangedigunta (33.4%), Pollachi (32.8%), C-S-17-17 (32.2%) Neemuch (31.6%), C-S-17-19 (31.6%) and Hosur Bulk-I (31.2%).

The Plants with spacing of 7x6m recorded the highest plant height (196.25 cm), stem girth (19.08 cm), number of primary branches per plant (9.75), number of secondary branches (17.75), E-W spread (158.33 cm) and N-S spread (153.75 cm) followed by 7x7 m spacing compared to 7x5 m spacing under irrigated conditions.

1.4 Saline Water Management, Bapatla

In the trial on monitoring of subsurface drainage system at Appikatla pilot area the initial drained water salinity was 1.71 dS/m during August 2008 and increased to 4.2 dS/m during January 2009, after the harvest of paddy crop, the quantity of water flow from laterals to main sump was reduced, thereby the salt concentration increased at the end of the crop period.



The ECe of soil decreased from initial level of 16.5 to 3.15 dS/m at the end of 7 years. The paddy grain yield increased from initial level of 1.8 to 6.75 t/ha (73.0%) and straw yield increased from 2.1 to 7.20 t/ha at the end of 7 years while the rice fallow crops viz., pillipesara, sunhemp, fodder jowar and mustard established well from second year onwards giving optimum yields after 7 years of installation.

2. Soil Science and Agricultural Chemistry

Continuous use of manure (FYM) and fertilizers over a period of 27 years increased pod yield of rainfed groundnut significantly over no fertilized crop (control). NPK+ Gypsum @ 250 kg/ha + ZnSO₄ @ 25 kg/ha has recorded significant pod yield 1286 kg/ha. FYM @ 5 t/ha, NP, NPK, NPK + lime and NPK + Gypsum @ 250 kg/ha were significantly superior over control (744 kg/ha). Nitrogen (20 kg/ha), phosphorous

(10 kg/ha) and potash (25 kg/ha) along with gypsum and zinc sulphate (25 kg/ha once in three years) continuously recorded higher yield compared to any other treatments tested. The highest shelling percentage was observed in the treatment NPK + Lime (70.6%) on par with NPK + Gypsum + ZnSO₄ (69.3%), NPK (68.8%) and the lowest was observed in control (59.7%) at Tirupati.

2.1 Radio Tracer Laboratory, Rajendranagar

Application of sulphur to soybean has significantly increased the seed yield by 1 and 18 per cent over control due to application of S @ 30 and 40 kg/ha, respectively over control in S-deficit soil. Application of 30 kg S/ha in two splits may be recommended to soybean crop.

Application of FYM @ 10t/ha, vermicompost @ 5 t/ha, neem cake @ 5 t/ha and karanj cake @ 5 t/ha increased the grain yield of rice by 8.6, 16.6, 17.1 and 32.6% respectively over control. Among the varieties RNR 2465 recorded maximum yield of 4442 kg/ha followed by RNR 147 (4210 kg/ha) and Sumathi (4057 kg/ha) N and K content and uptake of P and K by rice grain was more with application of Karanj cake @ 5 t/ha when compared to other organic manures.

2.2 Micro and Secondary Nutrients and Pollutant Elements in Soils and Plants

In the experiment on nutrient indexing in rice-rice cropping system the mean grain and straw yields recorded in Suryaraopalem village are 53.1 and 64 q/ha.

Pod and haulm yields ranged from 1875 to 2678 and 2452 to 3686 kg/ha respectively when different doses of boron fortified DAP was applied to soil as basal application. Boron content in the index leaves ranged from 26.67 to 38.96 mg/kg and the content increased with the increase in dose from 0.1 to 0.75% boron fortified

DAP treatment. There was a significant built up in the boron status of soil over control, from 0.3% boron fortified DAP treatments.

The heavy metal and micro nutrient contents of all the soil samples collected were in the normal range in the samples collected at the end of the crop season. Micronutrient and heavy metal contents of all the plant samples were in the higher range except Cd and Co. The contents were high in the grain samples also except Ni and Cd. The reduction is more in the grain samples but found to be more than the permissible limits.

2.3 Soil Test Crop Response Studies

The following targeted yield equations for attaining an yield of 15 and 20 q/ha of redgram were developed from the basic data of nutrient requirement, soil contribution and fertilizer contribution.

$$FN = 4.71 T - 0.21 SN; F P_2O_5 = 5.83 T - 2.93 SP \&$$

$$FK_2O = 6.96 T - 0.31 SK$$

Based on these targeted yield equations, for soils having 200 kg N, 12 kg P and 250 kg K/ha, the following fertilizers doses are required for production of 15 q/ha of redgram.

$$N - 29 \text{ kg/ha}; P_2O_5 - 52 \text{ kg/ha} \text{ and } K_2O - 27 \text{ kg/ha}$$

Highest rhizome (cured) yield (41.23 q/ha) in turmeric was recorded in STCR 45 q/ha yield target followed by STCR 40 q/ha yield target (39.09 q/ha); fertilizer application based on soil test value (38.30 q/ha) and recommended dose of fertilizers (38.17 q/ha) in the Field Validation Trial on turmeric conducted at RARS, Jagtial.

Highest seed yield (11.86 q/ha) in *ragi* was recorded in STCR 12 q/ha yield target

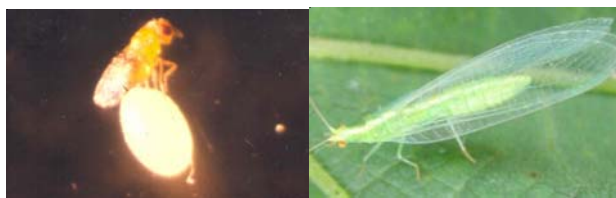
followed by STCR 8 q/ha yield target (9.63 q/ha); recommended dose of fertilizers (8.42 q/ha) and fertilizer application based farmer's practice (38.30 q/ha) in the Field Validation Trial on *ragi* conducted at RARS, Palem.

3. Entomology

3.1 Biological Control

In the trial on demonstration of Bio-intensive pest management (BIPM) in Bt cotton. Bt cotton + BIPM recorded 1823 kg/ha while Bt cotton + Farmers' practice recorded 1757 kg/ha. The net returns were higher in Bt cotton + BIPM with 1:1.81 CB ratio while it was 1:1.27 in Bt cotton + FP.

Among all the tested dosages, spray application of 1.0 and 1.5 billion nematodes/ha resulted in better suppression of pod borer complex (3.8 larvae/plant) and also recorded good yield returns (1692 kg/ha).



Trichogramma

Chrysoperla



Chrysoperla

Chrysoperla grub



Lady bird beetle

Syrphid Fly

In the experiment on evaluation of *trichogrammatids* against castor capsule borer, about 32.7 per cent parasitization was recorded by *T.chilonis* followed by *Trichogrammatoidea bactrae* (29.2% parasitization). *T.japonicum* and *T.achae* recorded 16.5 and 19.8 per cent parasitization, respectively under glass house conditions.

3.2 Pesticide Residues Research

The initial deposits of \hat{a} -*cyfluthrin* (0.224 mg/kg) dissipated to below detectable level at 5 days after third spray in tomato fruits when sprayed at standard dose (18 g a.i./ha) while in double dose (36 g a.i./ha), the initial deposits of \hat{a} -*cyfluthrin* on tomato fruits (0.341 mg/kg) dissipated to below detectable level in 5 days after third spray.

The initial deposits of imidacloprid on tomato fruits (0.361 mg/kg) dissipated to below detectable level at 7 days after third spray in standard dose (42 g a.i./ha) while in double dose (84 g a.i./ha) the initial deposits (0.443 mg/kg) dissipated to below detectable level in 7 days after third spray.

The penconozole (0.05%) sprayed thrice initiated at flowering which recorded initial deposits 0.702 mg/kg dissipated to below detectable level at 15 days after third spray. The hexaconozole (0.1%) sprayed thrice at flowering with initial deposits 0.431 mg/kg dissipated to below detectable level at 15 days after third spray. The myclobutanil (0.1%) sprayed thrice at flowering recorded initial deposits 1.712 mg/kg dissipated to below detectable level at 15 days after third spray.

3.3 Ornithology

In Andhra Pradesh, 63 paddy fields in different agro zones were surveyed and recorded around 81 spp. of birds. These birds utilize paddy fields predominantly for breeding (68%)

activity. The damage extent in different growth stages showed less than 3-5%. The bird damage in maize ranges between 10 to 40 per cent and the damage is mainly caused by Rose ringed parakeet.



Integrated bird management practices in Sorghum

The main crop (maize) was fully protected from bird damage by using maize (1643 kg/ha) and sorghum fodder (1428 kg/ha) as border / screen crop, when compared to control (1074 kg/ha).

The damage incidence by Wild boar at farmers fields of Ranga Reddy district in Maize ranging from 20-46% (n=23) during maturity stage, while in groundnut the incidence of damage ranges between 19-33%. Chain link fence & GI wire fence showed promising results. Spraying of Ecodon @ 1 lit. in 75 liters of water proved effective in crops like maize and groundnut. In groundnut 4 rows of thick planting of safflower around the main crop protected the crop to extent of 90%.

4. Agricultural Engineering

4.1 Farm Implements and Machinery

Testing of self propelled 4 row cono weeder in paddy fields indicated that the weeding efficiency was observed 65-70%. The field capacity was 0.15 ha/h where as field efficiency was 60 to 70%. The fuel consumption was found to be 0.70 lt/h.



Power weeder for sugarcane crop

The power weeder used in sugarcane crop for loosening the soil between the rows and weeder worked with a speed of 2.0 km/h. The weeding efficiency was 77% and the field capacity was 0.1 and 0.065 ha/hr for 90 cm 120 cm spacing respectively. The cost of operation worked out for 90 cm spacing was Rs.880/- and for 120 cm spacing was Rs.1350/- per hectare.

10-row paddy seeder implement would float on puddled soils with a forward speed of 2 kmph. The field capacity was 0.038 ha/h.

4.2 Agricultural Engineering Research

Groundnut seed sown with 9 tyne CRIDA seed drill with helical plate mechanism gave highest yield of 1105 kg/ha when compared with farmer's practice yield of 1025 kg/ha at Tirupati.

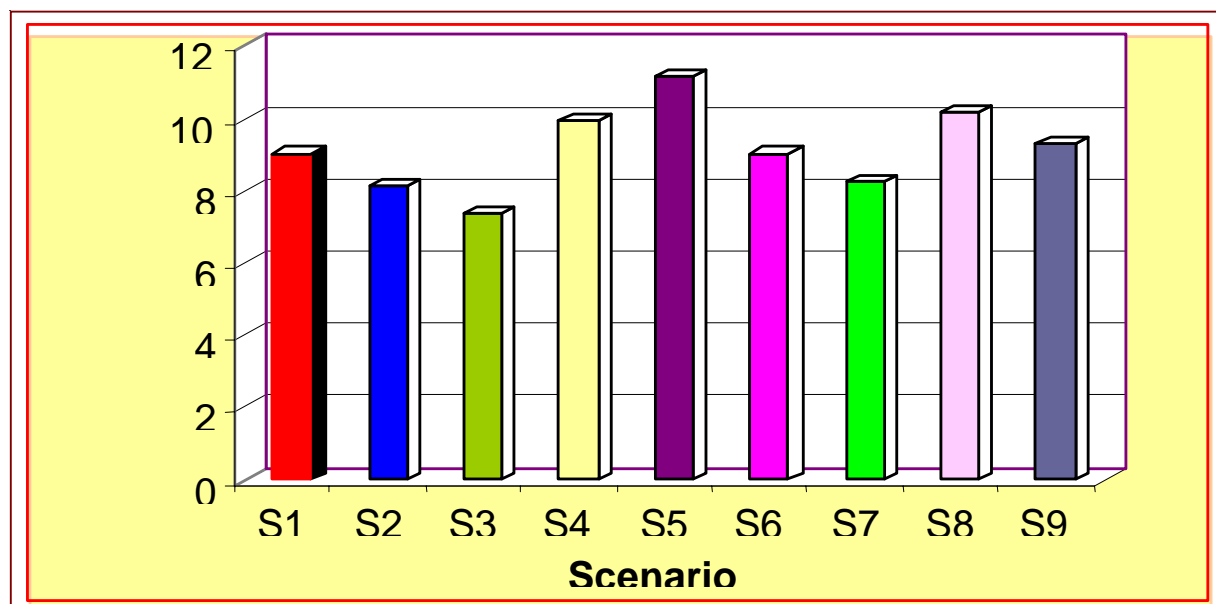
Different irrigation methods viz., check basin, drip method (40/80, 60/60, 60/90) were tried in sunflower. Significant differences were observed among irrigation methods with respect to seed yield kg/ha, seed yield/head and 1000 seed weight. The irrigation method drip system in 40/80 cm paired rows gave the highest seed yield of 2980 kg/ha and was significantly superior to 60/90 cm drip (2467 kg/ha) and check basin (2245 kg/ha) at Tirupati.

5. Agro-met Cell

CERES-rice model was used for predicting the grain yield of rice during last week

of September and at the time of harvest. The model simulated the grain yield of 6.0 t/ha, 5.5 t/ha during last week of September and at harvest

respectively. These yields were closely related with actual yield of 5.2 t/ha.



S1 – Normal

S2 - Increase in maximum and minimum temperature by 1oC

S3 - Increase in maximum and minimum temperature by 2oC

S4 - Increase in CO2 level to 450 ppm

S5 - Increase in CO2 level to 600 ppm

S6 – S2+S4

S7 – S3+S4

S8 – S2+S5

S9 – S3+S5

Simulated grain yield (t/ha) of rice under different climate change scenarios

Simulation of cotton yields using APSIM model in Mahbubnagar district based on historical weather data indicated that with increasing levels of nitrogen there was an increase in the lint yield of cotton during wet year. Higher lint yield of 530 kg/ha was simulated with the application of 160 kg N/ha in wet years, while in dry years the response was observed only up to 60 kg N/ha and beyond this level there was no further increase in lint yield. Based on these observations it was evident that during dry

season the production costs of the cotton could be reduced by minimizing the use of nitrogen.

6. Post Harvest Technology

Bapatla

Experimental data on multipurpose poly house solar drier developed at Bapatla suggested that drying of chilli hybrid BJ 304 could be completed in 6 to 8 days compared to 13-15 days in open yard drying method and 4 to 5 days for LCA-334 variety when compared to 10 days in farmers method. The moisture was reduced from 78-80% to 10% (w b). Experiments indicated that the EOA colour values of poly

house dried samples were significantly higher, 16800 to 18900 colour units in comparison to 13900 to 14700 for the open yard sun dried chillies. The percentage white pods were only 2-3% in comparison to 8-9% in farmers method.

Experiments conducted to establish the most effective cooking method for turmeric (*Curcuma Longa Linn*) based on the drying time, curcumin content, colour and physical appearance of the product at Bapatla revealed that cooking of turmeric by small scale boiler was better in terms of highest yield recovery (22.42%), curcumin content was high in the rhizomes cooked in water at 80°C, whereas turmeric cooked at 10 psi (0.6798 kg/cm²) in autoclave gave lowest drying time. Considering all the quality aspects it was concluded that cooking of turmeric in small scale steam boiler was easy, economical and feasible in field conditions giving improved quality attributes in comparison to other methods of cooking.

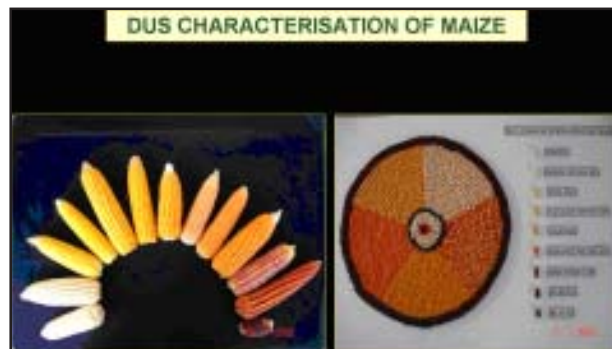
7. Seed Research and Technology Centre

A total indent of 15548.84 q (1705.89 q under Gol, 7273.10 q under state and 6569.85 q under 100% SRR) of breeder seed was produced in 121 varieties of 17 crops. In studies on age of seedlings and spacing under SRI system paddy, seedlings planted at 12 days age with 20 x 20 cm spacing recorded highest yield of 64.70 q/ha followed by 12 days aged seedlings with 30 x 30 cm spacing (60.55 q/ha).

In studies on standardization of spacing and fertilizers for enhancing seed yield and quality in sweet corn, spacing of 45 x 15 cm with 120:60:45 kg NPK/ha recorded highest yield of 26.85 q/ha followed by 45 x 15 cm spacing and 150:75:45 kg NPK/ha.

Soybean cv. JS-335 seeds treated with Thiram + Carbendazim @ 2 g/kg (1:1) followed by *T. viride* (6 g/kg) recorded less seed rot and

seedling decay (2.5% and 5%) over untreated seeds (12.5%).



Seed Production, Certification and Varietal Characterization

Genetic contamination in hybrid rice seed production plot can be reduced with physical barrier from 19.17% (control) to 16.58% (*Dhaincha* 2 m), 11.26% (*Dhaincha* 5 m) and 4.14% (HDPE curtains). Space isolation distance can be reduced using physical barrier of HDPE curtains / *Dhaincha*.

Blackgram plants raised from ODV seeds showed correctness of identification ranging from 67% in LBG-402, 70% in LBG-20 and 73% in T9. Similarly plants of paddy raised from ODV seeds showed 98.32% of correctness of identification.

Seed Physiology

Among the vigor evaluation methods, first count, cold test and accelerated ageing test were found effective for vigor assessment in soybean, sunflower, castor and maize.

Rice seed packed in vapour proof containers like polyethylene bag or HDPE was effective in extending the shelf life of the seed from 6 to 14 months in areas with high humidity.

Seed Pathology

Out of twenty varieties tested for bunt infection by NaOH seed soak method only 15

varieties were infected with bunt. IR-64, MTU-1042, MT-7029, MTU-3626 and MTU-2716 were prone to rice bunt infection.

Deep freeze blotter method was found effective for detection of *Fusarium oxysporum* (22%) in sorghum hybrid CSH-9.

Soybean cv. JS 335 seeds treated with Thiram + Carbendazim @ 2 g/kg (1:1) followed by *T. viride* (6 g/kg) recorded less seed rot and seedling decay (2.5% and 5%) over untreated seeds (12.5%).



Location of *A. helianthi* in sunflower seed was detected by planting different components of seed. Presence of *A. helianthi* was highest in pericarp (22 to 32%) followed by endosperm (6.5 to 12.9%) and embryo (1.0 to 2.08%) which indicated that the fungus was both externally and internally seed borne in nature.

Seed Entomology

Spinosad @ 4 ppm/kg was found to be effective against storage pests of maize with no insect damage and high germinability (93%) and vigour compared to control where insect damage was 7.86% upto six months of storage.

Emamectin benzoate @ 4 ppm was found to be effective against pulse beetle on greengram with low insect damage (0.5%) and high germinability (82%) compared to control upto six months of storage. Spinosad and Emamectin benzoate could be used as seed protectants against storage pests for the safe storage of greengram and maize upto six months period without any loss of seed viability.



Pulse beetle damage in greengram

The studies on insecticidal seed treatment on seed viability of stored maize and greengram revealed that the biopesticide, Emamectin benzoate @ 4 ppm was found to be

effective against pulse beetle on greengram with low insect damage (0.85%) and high germinability (82%) compared to control, where highest insect damage (37.3%) and lowest germinability (38%) was recorded.

Neem India @ 2.5 ml/kg and Econeem @ 5 ml/kg were found to be effective against pulse beetle damage (<0.5%) in blackgram upto 21 months of storage. The germinability of seed also maintained above certification standards (>80%). Even though, Neem oil was effective against pulse beetle, the seed germinability (57.3%) decreased in this treatment.



Enhancement of blackgram seed quality through use of bio agents at SRTC

8. Biotechnology Unit

Rajendranagar

Anthers from five different varieties of sesame viz., Madhavi, Hima, Swetha, Rajeswari and Chandana and one wild variety were inoculated onto medium having different concentrations of auxin and cytokinin. Callusing to an extent of 80% was observed on media having MS + Casein hydrolysate + NAA + 2, 4, D+BAP @ 25+0.1+0.2 to 0.25+0.05 mg/l respectively. Among the genotypes, swetha responded better in callusing (67%). Wild genotype yielded 100% callusing. Regeneration was not observed on transfer of callus to high cytokinin media.

Out of 120 primers used to determine the sex in kakrol (*Momordica dioica* Roxb) OPC 5 repeatedly amplified female specific band 1054 bp. This band was eluted, cloned into vector, sequenced and forward primer was designed in the direction of development of SCAR (sequence characterized amplified region). Meanwhile DNA from 55 random seedlings prior to flowering was isolated and screened with OPC 5 primer for expression of specific band i.e. 1054 bp. These laboratory results were correlated with original sex expression in the field.

One hundred and twenty random operon primers (20 each of OPA, OPAE, OPC, OPD, OPF and OPM) were used for screening DNA templates collected from male and female kakrol vines of the 120 primers, seven primers were identified as polymorphic. Bulk seggrent analysis (BSA) with two polymorphic primers was carried out and a male specific allele (320 bp) and a female specific allele (around 500 bp) were observed.

Tirupati

In the experiment standardization of transgenic protocol in greengram through *agrobacterium* mediated transformation the seeds after sterilization were decoated and the two cotyledons were carefully separated. The cotyledon along with embryonal axis was inoculated on MS + BAP (1.0-4.0 mg/l) + IAA (1 mg/l) or MS + BAP (1.0-4.0 mg/l) + NAA (1mg/l). Initiation of plantlets was observed on MS + BAP (1.0 mg/l) + IAA (1mg/l) / MS + BAP (2.0 mg/l) + IAA.

9. Forage Crops

In AVT 2 (Dual) the entry NDFB-5 recorded highest Green Fodder Yield (GFY) (189.9 q/ha) while the check variety Gaint Bajra showed superior performance for dry fodder yield, crude protein yield and seed yield.

In forage cowpea out of six entries evaluated against two checks, the entry AV-5 outyielded green fodder yield (243.1 q/ha) and dry matter yield (63.9 q/ha) followed by cross-3 (203.5 and 56.7 q/ha respectively) it also recorded highest crude protein yield of 12.2 q/ha.

In AVTCC trial, highest green fodder (300.0 q/ha) and dry fodder (88.0 q/ha) yields were recorded by the entry CC-06-3, where as highest CPY (6.3 q/ha) was recorded by CC-06-7.

Highest seed yield (28.7 q/ha) of dual purpose sorghum was recorded with application of 100% N, P & K through poultry manure and it was on par with 100% N through inorganic fertilizer (21.9 q/ha). Higher seed yield of maize was obtained with application of 10 kg Zn/ha every year through Zn Cl₂ and it was on par with application of sulfur @ 20 kg/ha through gypsum. Application of sulfur through gypsum @ 20 kg/ha and 5 kg ZnSO₄ every year gave highest crude protein followed by application of 10 kg/ha Zn Cl₂.

Fodders grown in and on the banks of Musi river were found laden with traces of organochloro pesticide residues especially PPDDD. The soils contained residues of organochloro pesticides viz., isomers of HCH, and Aldrin and few other OC residues. The residues of OP compounds were negligible. The water had residues of OC and OP compounds fortunately their channelisation into fodder was negligible thus leaving the cultivated forages of Musi safe for animal consumption in Hyderabad.

The incidence of shoot fly and stem borer was less when sorghum crop was intercropped with cowpea and flowering non-chemical pest management practices like seed treatment with *T. viridae* @ 5 g/kg seed + FYM @ 4 t/ha followed by foliar spray of neem seed extract at 30 and 40 Days after sowing.

Seed treatment with carbendazim @ 2 g/kg seed and soil application of carbofuran granules recorded lower number of aphids (6.7/tiller), lower number of jassids (3.31/tiller) and lower score for rust disease (1.3) and higher green fodder yield (71.67 q/ha) followed by seed treatment with neem seed powder and foliar application of NSKE 5% at 7 days after each cut. The untreated control recorded more number of pests and lower yields when compared to the treatments.

10. Experiments on Integrated Cropping Systems

The expenditure on fertilizers and plant protection chemicals (24.68%) accounted for the highest share in total operational costs per hectare of maize under zero tillage technology followed by threshing (19.41%), seeds (18.53%), sowing (14.22%) and herbicides (10.67%) at Warangal. The cost benefit ratio worked out to be Rs. 2.16 which indicated that the maize crop under zero tillage in rabi ensure at least Rs. 3.16 on every rupee invested.

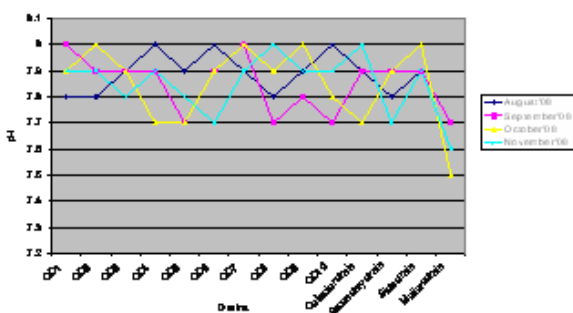
11. A.P. Water Management Project Bapatla

Rice grown under semi dry situation recorded highest grain yield (7.1 t/ha) and Water Use Efficiency (7.9 kg/ha) when compared to farmers practice (6.0 t/ha) in the farmer's fields of KWD (Krishna Western Delta) at Bapatla. In a study to evaluate the performance of open subsurface drainage system under Mutluru channel command, 2.7 t/ha increase in the average grain yield of rice was observed in fourth year after installation of open subsurface drainage system (4.9 t/ha) when compared to pre-drainage conditions (2.2 t/ha). Further, the salinity decreased considerably after installation of open sub-surface drainage system (0.69 – 32.3 dSm⁻¹) when compared to pre-drainage conditions (1.6 – 61.3 dSm⁻¹).

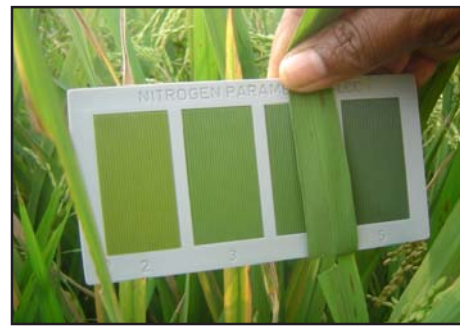


Semidry rice – field demonstrations at APWMP, Bapatla

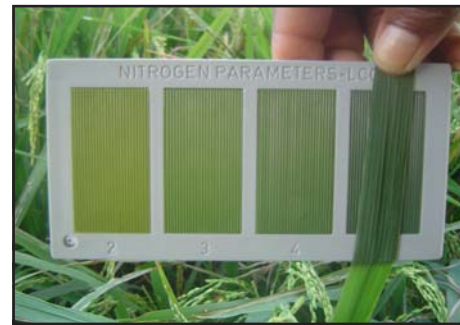
Leachate studies in sub-surface drainage system under Mutluru channel command indicated, that 111.0 t of total major nutrients viz., N, P₂O₅ and K₂O removed during the crop growth period from closed sub surface drainage system were 219, 21 and 146 kgs respectively. Two sub-surface drainage systems viz., open and closed were studied at Mutluru. The rice yield, which was 4.4 t/ha during 2005-06, increased by 20.45% at Kovelamudi, after the installation of CSSD (Closed sub-surface drainage) during 2007-08 with the increase in net income by 37% during 2007-08.



Variation in pH in open drains in open drainage system of Mutluru pilot area



LCC based fertilizer application (148-164 N kg/ha)



Farmers practice (175 N kg/ha)

At Jagtial, highest B.C. ratio was observed in maize + turmeric cropping system in DP-4, 3L and 2AL pilot areas during *kharif* and in groundnut in 2AL and 3L pilot areas during *rabi*.

Garikapadu

Rice cultivation under SRI method resulted in highest WUE (7.99 kg/ha. mm) and grain yields of 6700 kg/ha when compared to the line planting with recommended irrigation (WUE of 5.25 kg/ha. mm and grain yield 6400 kg/ha) and conventional practice (4.18 kg/ha. mm and grain yield 6000 kg/ha).

Experiment on puddling with various tractor drawn implements revealed that, grain yield improved by 4% with 27% water saving when puddled with Rotovator (6.0 t/ha, 991 mm) compared to farmers practice of using puddler (5.8 t/ha, 1349 mm).

STCR equation based fertilizer dose (170-40-80 kg NPK/ha) in paddy resulted in highest grain yield (7000 kg/ha) followed by application of RDF (PK) + 150% Nitrogen and RDF + 'N' through LCC (6800 kg/ha) when compared to RDF of 120-60-40 kg NPK ha⁻¹ (6200 kg/ha).



Groundnut under sprinkler during *rabi* 2008-09

Groundnut crop was grown under sprinkler irrigation at pilot area, Ganapavaram and the results were revealed that 14% yield increase and 24% saving of water when compared to check basin irrigation.

Undi

Computer model 'CRIWAR' was run for the Kalipatnam extension channel command for calculating the water requirement of the paddy

crop. The actual water applied to the command was measured using current meter. For *kharif* 2007, the gross water requirement was calculated as 488.37 mm using CRIWAR and actual water applied was 442.44 mm indicating that farmers have applied 9.4% less water than required in *kharif*. In *rabi* 2007-08, the gross water requirement was calculated to be 805 mm where as actual water applied was 1123.51 mm.

Growing of green manure crops during summer fallows was found best for controlling capillary rise of salts followed by deep summer ploughing while paddy straw application as soil mulch was least effective in arresting capillary rise of salts during summer fallow period.

Before implementation of project the average yield of the pilot area was 3.8 t/ha and after installing sub surface drainage system in 2005 during *Kharif* 2008 pilot area recorded 5.55 t/ha and significant increase in yield is due to SSD system.

12. Seed Production

S.No.	Station	Crop	Variety	Production (q)
1.	APRRI & RARS, Maruteru	Rice	MTU (10 varieties)	780
2.	ARS, Pulla	Rice	MTU 1010 MTU 3626 PLA 1100	47.70 92.40 80.10
3.	ARS, Kadiri	Groundnut	Kadiri-6	1600
4.	RS&RRS, Rudrur	Rice	MTU 1010	70.50
5.	RS&RRS, Rudrur	Soybean	JS 9305	1.5
6.	ARS, Jangamaheswarapuram	Rice	BPT 5204 MTU 1010 MTU 1001 LRG 30	133.20 231.00 329.40 4.00

13. AINP on Biofertilisers, Amaravathi

A total number of 54163 R.I packets were produced and supplied for groundnut, soybean and pulses crops. The *Rhizobium* population count ranged from 5.3×10^8 to 6.4×10^8 . Among the strains collected from different sources, AZS 303 was found to be more effective. Produced 15254 kg of *Azospirillum inoculant* packets out of which 14065 kg supplied to farmers.

The population count ranged from 6.3×10^8 to 6.4×10^8 . Produced 34047 numbers (1 kg) and 61302 numbers (200g) 4.6×10^8 to 5.8×10^8 supplied 30802 numbers (1000g) 61302 numbers (200g) of PSB inoculant packets for all crops. The population of PSB count ranged from 4.6×10^8 to 5.8×10^8 .

14. Agricultural Economics

Tirupati

Data collected on market prices and arrivals of paddy, groundnut and sunflower for a period 15 years from 1994 to 2008 at Kadapa regulated market. Prices have increased every year by 12.68 per cent in paddy, 6.15 percent in groundnut and 6.52 percent in sunflower. While arrivals increased by 29.96 per cent in sunflower every year, in case of groundnut it decreased by 4.32 per cent. The correlation between prices and arrivals indicate negative relationship (-0.67) in groundnut and positive relationship (0.73) in sunflower.

Growth rate analysis carried out by collecting the data on area, production and productivity of major crops for period 1990-91 to 2007-08 indicated a decline in paddy area in the three districts as well as zone. The decline was more in Chittoor (4.56%) followed by Kadapa and Nellore which was mainly due to negative growth in period II (1999-2007) compared to period I (1990-1999). In case of production except in Nellore where positive growth was observed, in

first and second periods, in remaining two districts negative trend was observed. In groundnut area, production and productivity indicated negative growth in the three districts as well as zone. Highest decline in area (9.03%) and production (6.89%) was observed in Nellore followed by Chittoor and Kadapa districts. In sugarcane area declined in the zone as well as districts with highest decline in Kadapa (6.04%) followed by Chittoor (3.9%) and Nellore (1.5%). The production and productivity increased by 6.32% and 5.3% respectively in Nellore followed by Chittoor district.

D. Home Science

AICRP on Home Science

1.1 Foods & Nutrition

1.1.1 Model Kitchen Garden

Model nutrition gardens were established in each adopted village as a demonstration plot to the other identified households. Kitchen gardens were developed from nursery beds raised in their own plot.

Majority of the families utilized produce from nutrition gardens for their household consumption followed by distribution to neighbors and relatives and very few families sold surplus produce for supplementing family income.

1.1.2 Processing of region specific under utilized foods

Three lehyam samples were developed using cauliflower leaves as the base. These three products were standardized, tested for acceptability and evaluated for sensory qualities by a panel of 10 judges using 9 point Hedonic scale. The two products prepared were accepted and scored between 6 to 8 on the 9 point Hedonic scale and one product was scored between 4 & 5. The analysis of data revealed that 100 g of the products on dry weight basis

contained 18.27 mg and 15.99 mg of iron respectively for two products.

1.2 Family Resource Management

1.2.1 Technology Interventions

Women prioritized improved sickle, harvest bag, ring & plier cutter, improved hand weeder, winnower and improved cap for field validation. Men prioritized seed cum fertilizer drill, hand rake, power weeder and neem seed pulverizer as important technologies for them in Malkapur and Kandawada villages.

A large gap was found between expected and observed scores on awareness which indicate that farmers (Men & Women) were not familiar with the drudgery reducing technologies. Impact of technology on user indicated that preference for technology by men and women on field validation indicated that cent per cent of women showed preferences towards sickles, winnowing fan, spreading tool, improved cap and cent per cent of men preferred seed cum fertilizer drill in the Malkapur village. Forty per cent of women felt that ring cutter needs modification. Forty per cent of farmers indicate modification in wheel hoe.

1.2.2 Empowerment of farmwomen in resource management practices

Awareness programmes were conducted in adopted villages on micro irrigation facilities in collaboration with AP micro irrigation project, in Ranga Reddy district.

1.3 Apparel and Textiles:

1.3.1 Machinery and equipment for making fibre products

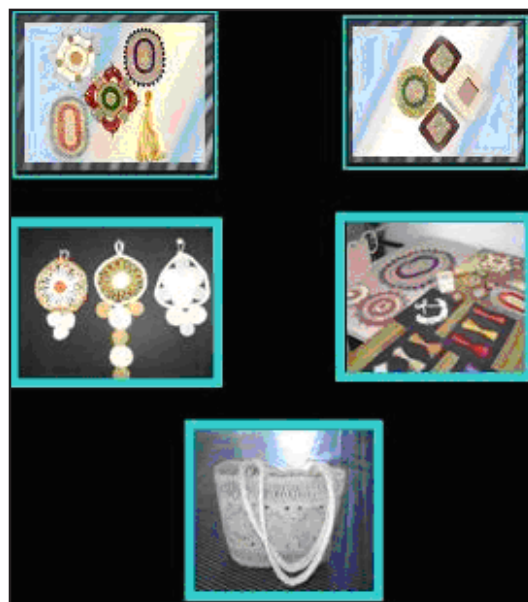
The rope making machine could provide employment to three persons and each worker earned about Rs.50 per day. The vimla loom used for weaving decorative tablemats had product capacity of 2 to 3 mats per day. The loom

operated by a single person earned Rs.40 to 50 for eight hours of work. Scraper was used for extraction of fibre from sisal leaves, pine apple leaves and banana stems. The machine while providing employment to one person had an output of 1-2 kg of different varieties of fibres per day. The worker earned about Rs.40-50 for eight hours of work.

1.4 Home Science Extension:

1.4.1 Utilization of non-degradable farm waste for consumer products

Farm women were trained at Pallagutta and Kandavada villages for utilization of non degradable farm waste i.e. fertilizer bags for production of big bags, shopping bags, hand bags etc with objectives for designing the bags, utilization of leftover tailored pieces, cost estimation and marketing. Some of the participants designed and stitched bags with fertilizer polyethylene waste. These were sold in local shandies @ Rs.30-35/- whereas fertilizer polyethylene waste bag was sold at Rs.5/-. By utilizing one fertilizer bag two hand bags were made by value addition with an additional profit of Rs.70/-.



Utilization of non-degradable farm waste for consumer products