A) PLANT BREEDING (CROP IMPROVEMENT):

The following 25 rice varieties were developed and released from this research station.

S. No	Variety (Paddy)	Year of release	Special Characters
1.	BCP 1	1948	Traditional long duration Molagolukulu rice
2.	BCP 2	1948	-do-
3.	BCP 3	1950	-do-
4.	BCP 4	1950	-do-
5.	BCP 5	1951	-do-
6.	BCP 6	1965	-do-
7.	Bulk H9	1965	-do-
8.	Kotha Molagolukulu-72	1977	First cross derivative with blast resistance
9.	Kotha Molagolukulu-74	1977	Long duration molagolukulu rice cultures
10.	Pinakini (NLR9672-96)	1987	-do-
11.	Tikkana (NLR27999)	1988	-do-
12.	Simhapuri (NLR28600)	1991	-do-
13.	Sreeranga (NLR28523)	1991	-do-
14.	Swarnamukhi (NLR145)	1991	Medium duration rice with blast resistance
15.	Bharani (NLR30491)	1996	Short duration rice with RTV resistance
16.	Sravani (NLR33359)	1996	Short duration rice with Blast resistance
17.	Swathi (NLR33057)	1996	Medium duration rice with Blast resistance
18.	Penna (NLR33365)	1996	Long duration rice with Blast resistance
19.	Somasila (NLR33358)	1999	Short duration rice with Blast resistance
20.	Vedagiri (NLR33641)	1999	Long duration rice with Blast resistance
21.	Apoorva (NLR33654)	2002	Medium duration rice with Blast resistance
22.	Parthiva (NLR33892)	2006	Long duration rice with Blast resistance
23.	Nellore Mahsuri (NLR34449)	2009	Fine grain Short duration (125 days) rice with Blast resistance
24.	Nellore Sona (NLR3041)	2012	Fine grain medium duration (145 days) rice with blast tolerance
25.	Swetha (NLR40024)	2012	Short duration rice variety suitable for early kharif with blast and lodging tolerance.

Popular Pre-release cultures

1. **NLR 33671:** Short duration rice culture matures in 120-125 days. Suitable for both Rabi and E. Kharif. Tolerance to both Blast and BPH.
2. **NLR 34242:** Short duration rice culture matures in 115 days. Suitable for E. Kharif season

3. **NLR 20084:** Long duration rice culture matures in 150-155 days. Suitable for kharif season. Resistant to blast.
4. **NLR 40058:** Short duration rice culture matures in 125 days. Suitable for E. Kharif season.

Rice cultures under minikit testing:

1. **NLR3083:** Medium duration rice culture matures in 130-135 days. Tolerant to both blast and BPH. Suitable for Rabi season. 2nd year of testing.
2. **NLR40065:** Short duration (120-125 days) rice culture with long slender grain with blast tolerance suitable for Early kharif and Rabi seasons, First year
3. **NLR 20104**: Long duration (155 days) rice culture with fine grain and blast tolerance.

AGRONOMY (CROP PRODUCTION):

- Among different N levels for different long, medium and short duration rice varieties, 80 kg N/ha to long and 120 kg N/ha to medium and short duration rice varieties, gave significantly higher grain yield.
- 160 Kg N/ha is required for NLR34449 for realizing higher grain yields.
- Application of urea in three splits at basal, tillering and panicle initiation stage gave significantly higher grain yield over total basal application.
- To manage over aged seedlings, application of 100 kg N/ha at two splits (1/2 basal, 1/2 at panicle initiation) with close planting (15x15cm) gave significantly higher grain yields over normal fertilizer dose (80 kg N/ha) applied at three splits with 20x15cm spacing.
- Application of Bio-fertilizers significantly increased rice yields. 30kgs nitrogen through fertilizer can be saved due to soil application of Azospirillum @ 5kg/ha (or) Azatobactor @ 2.5 kg/ha (or) soil application of blue green algae @ 10 kg/ha.
- 50% of recommended nitrogen as FYM or poultry manure or neem cake + 50% nitrogen as urea recorded significantly higher grain yield of 4.5, 4.4 and 4.5 ton/ha, respectively than recommended doses of inorganic fertilisers.
- Application of 80 kg N as urea + soil application of Azospirillum @ 5 kg/ha (or) 80 kg N as urea + BGA @ 10 kg/ha (or) 80 kg N as urea +Azolla 500 kg/ha gave significantly higher yields than recommended dose of 120 kg N as inorganic fertiliser, indicating possibility of saving of 40 kg N through biofertilisers.
- There is no significant yield improvement with top dressing of Phosphatic fertilizers in rice

Time of planting

- Transplanting of long duration varieties during 1st week to 3rd week of September gave higher yields in kharif season and transplanting of short duration varieties in first fortnight of November has given highest grain yield compared to other dates in rabi season.

Cropping Systems

- Sesamum-paddy cropping system has given maximum net returns under tankfed areas of Nellore district.
- The cropping systems of rice - rice- greengram was found to be more remunerative over monocropping of rice in all three seasons.

System of rice intensification (SRI):

- SRI Method of cultivation resulted in 31.6% increased yield (5410 kg/ha) over farmers method of cultivation (4110 kg/ha) due to increased number of productive tillers and more number of filled grains/ panicle. 30%of irrigation water can be saved under SRI method of cultivation.
- Under SRI method of cultivation highest grain yield was obtained with transplantation of 16 days old aged seedlings at 25 x25 cm spacing with one seedling/hill.
- SRI is not suitable for early kharif season as yields were low under SRI compared to normal plantings.

Organic farming:

- Organic package of incorporaton of dhaicha with the seed rate of 30 kg/ha, application of FYM @ 12 t/ha, Vermicompost @ 1t/ha, Neem cake @ 500 kg/ha and application of Azospirillum and PSB @ 2-4 kg/ha recorded similar results with the application of 160 kg N/ha in inorganic. Decreased grain yield (18 %) was observed in organic farming plot (4312 kg/ha) when compared to inorganic farming with normal dose of fertilizers (5265 kg/ha) but the incidence of pests are comparatively low in organic farming plot. Continuous cultivation under organic farming over five years resulted in reduced low yields with gap of 3.2 %.

Transplanting with machines:

- Transplanting of 16 days aged seedlings with a seed rate of 20 kg/ac and with a spacing of 14 cm recorded the highest grain yield with Yanjishakti 8 row paddy transplanter.
- There is no significant yield difference with different age of seedlings from 12-18 days and also with different intra row spacings i.e from 12-21 cm (Inter row spacing of 30 cm is constant) when transplanting was done with 6 row Kubota transplanter.

Weed management.

- Application of Benthiocarb @ 1.0 kg a.i/ha at 6-8 DAT mixed with 50 kgs sand performed well in controlling weeds followed by Butachlor @ 1.25 kg a.i/ha and Oxadiargyl @ 90 grams a.i/ha during late kharif.
- Application of Pretilachlor @ 500 ml/ ac or Oxadiargyl @ 35 g/ac along with 20 kg sand/ac as pre emergence herbicide at 3-5 DAT proved better in controlling the weeds. Spraying of Cyhalofop- P- butyl @ 400 ml/ac against grasses at 12-15 DAT was effective.

A**lternate cropping in rice based cropping systems.**

- Studies on alternate cropping in rice based cropping systems during summer season revealed that baby corn recorded the highest net returns of Rs 91197/- /ha followed by cluster bean when grown as vegetable with net returns of 74750/-/ha and maize 31057/-/ha.

Grain Discoloration:

- The highest grain yield of 7253 kg/ha was obtained when NLR 34449 was transplanted during December I F.N which was on par with November II F.N. With regard to application of nitrogen fertilizers it was revealed that application of nitrogen @ 160 kg/ha recorded significantly highest grain yield (6310 kg/ha) There is no significant difference in percent discoloration on rice kernel due to time of sowing and Nitrogen doses.

Aerobic Rice:

- Somasila, Nellore mahsuri and Swarnamukhi performed well in aerobic cultivation of rice. Significant increase in grain yield was observed with increase in nitrogen levels up to 160 kg/ha (2117 kg/ha) and it was comparable with 200 kg/ha nitrogen application in Aerobic rice. The grain yields differed significantly with different irrigation levels and irrigation at 4 days interval gave significantly higher yield (1943 kg/ha). Aerobic rice responded significantly to the foliar application of iron and zinc and the response was more with iron application compared to the zinc application. The yields were comparable within different doses of iron and zinc when sprayed for three times at 40, 55 and 70 DAS. In aerobic rice cultivation highest grain yield was recorded in weed free check followed by application of pretilachlor (as pre emergence) +post emergence herbicides + one hand weeding at 40 DAS. Among the pre emergence herbicides, the performance of pendimethalin was better compare to pretilachlor and among post emergence herbicides, the performance of bispyriback- sodium was better followed by ethoxy-sulfuron compared to cyhalofop-p-butyl and allmix.

ENTOMOLOGY (CROP PROTECTION):

I. Ecological Studies

- The light trap studies over several years indicate two major broods emergence by the stem borer i.e., during September and February and one major brood emergence during February with regard to gall midge.
- The leaf mite incidence was severe in SRI cultivated rice compared to farmers practice during early kharif season.

- Organic manured plots recorded slightly higher incidence of stem borer and thrips but yields were comparable to farmers practice and cost benefit ratio was in favour of organic plots
- The yield recorded was more in organic farming when compared to inorganic farming. The incidence of leaf mite was on par in both the situations. In inorganic farming leaf folder incidence was beyond ETL i.e., 28.35 % in NLR 34242, 7.03% in NLR 34449 and 18.16% in NLR 40024. The mean yield recorded was highest in organic treatments in all the entries tested (NLR 40024 with 6064kg/ha followed by NLR 34242 with 5735 kg/ha and NLR 34449 with 5041 kg/ha).
- Rice gallmidge activity in field was observed during November-February months and gaining momentum to become major and regular pest.
- During early kharif, 2013, pest incidence was low at 30 DAT. Incidence of mite was beyond ETL irrespective of the nitrogen source given to each treatment. Leaf folder incidence recorded at 50 DAT was beyond ETL in the treatment with recommended dose of fertilizer and low incidence in all the organic treatments. Highest yield of 7119kg/ha was recorded in the treatment with karanj cake@3t/ha.

II. Taxonomic studies.

- The existing species of leaf folder in SPSR Nellore district was *Cnapholocrocis medinalis* Guenee and that of stem borer was *Scirpophaga incertulas* Walker
- Based on the differential reaction the existing population of gall midge in SPSR Nellore district resembles to that of RRSS pattern indicating existence of biotype 5.

III. Loss Estimation Studies.

- Leaf mite activity was observed during May-July months and yield losses due to this pest was 10-15 per cent.
- Peak activity of yellow stem borer in field was found to be during July-September and February-May months and yield losses were found to be 15-20 per cent. Leaf folder incidence was high during November-January months and yield losses were significant if affected during reproductive stage rather than vegetative stage.

IV. Chemical control

- Effective, adoptable and economic IPM tactics were developed to manage the major insect pests and tested the same in farmers fields.
- Gallmidge was effectively controlled by application of phorate10G @1.25kg a.i/ha and it was on par with carbofuran3G @ 1 kg a.i/ha
- Monocrotophos 0.05% was effective against leaf mite and was on par with dicofol @ 0.09%
- Spinosad 45SC @ 45g.a.i/ha was found effective against leaf folder

- Flubendiamide 36% + Fipronil 30% @ 33g.a.i/ha was effective against stem borer and leaf folder

V. Screening for Host plant Resistance

- No source of resistance was identified against stem borer and leaf folder, the key pests of SPSR Nellore district. However, entries like JGL 20, WGL 2 etc. showed nil incidence of gall midge and in general Jagtial entries recorded less incidence of gall midge.

VI. Pesticide Compatibility

- Though, Cartap hydrochloride 50 SP was physically compatible with fungicides. It is phytotoxic to plants at recommended dose and at double dose.

PLANT PATHOLOGY (CROP PROTECTION):

Rice blast is most important disease in southern region of A.P followed by sheath blight, Bacterial blight, Stem rot and brown spot. Rice Tungro Disease is sporadic in nature.

I. Screening for host plant resistance.

- Due to continuous screening of rice breeding material for blast disease, blast resistant varieties viz., Kotha Molagolukulu-72, 74 Swarnamukhi, Simhapuri, Tikkana, Sriranga, Sravani, Swathi, Penna, Somasila, Vedagiri, Apoorva, Parthiva and Nellore Mashuri were developed.
- In addition to the above released varieties, the following cultures were found to have horizontal resistance to blast disease with slow blasting characters. NLR 33235, NLR 32972, NLR 33636, NLR 26706, NLR 33639, NLR 33650, NLR 33638 and NLR 33640.

II. Variability studies of rice blast fungus and Bacterial blight pathogen of rice:

It was found that IC – 9 race of *Pyricularia grisea* , was prevalent over years at Nellore. However of late the racial pattern was continuously changed year after year. The other blast races identified include IE-18, IM-1, IB-62, IB-31 and IA-5.

During the earlier years it was found that pathotype I of *Xanthomonas oryzae* pv. *oryzae* (Bacterial blight pathogen) was prevalent in Southern Zone. However, during the last five years testing at Nellore, the bacterial blight pathogen was found to be similar to pathotype II. It was also found that under Nellore conditions IR BB-5 (Xa 5 gene) and IR BB – 21 (Xa 21 gene) can be used as donors in the bacterial blight resistance Breeding program.

III. Forecasting of blast disease

Blast forecasting studies indicate that favorable period for blast disease incidence was found to be from the last week of December to March. Night temperatures ranging from 18

to 20^{o}C and morning RH of 90% and above is highly favourable for Blast disease initiation and spread.

IV. Chemical Control of major rice diseases

Blast:

- Seed treatment with carbendazim 25 SD @ 4g/kg seed + spray of carbendazim 50 WP @ 1g/l at late booting + two sprays of Edifenphos 50 EC @ 1ml/l at flowering.
- Seed treatment with tricyclozole 75 WP @ 4g/kg seed or Fongoren 50 WP @ 4g/kg seed protected the crop upto 50 DAS.
- Spray of tricyclozole 75 WP @ 0.6g/l or Strobulurim (Amistar) 25 SC @ 0.75 and 1.0 ml/l or Kasugamycin @ 2.5 ml/l.
- Application of pyroguilon granules @ 40 kg/ha at the initiation of disease.

Stem rot:

- Among different fungicides tested against stem rot disease of rice, hexaconazole @ 2 ml/l and propiconazole @ 1 ml/l significantly reduced the disease incidence.

Grain discoloration:

- Among different fungicides tested against grain discoloration of rice, Spraying of mancozeb @ 2.5g/l and propiconazole @ 1 at ml/l have significantly reduced the grain discoloration.