SPECIFIC ISSUES FOR DISCUSSION DURING 80TH SCIENTIFIC WORKERS CONFERENCE IN LINE WITH STRATEGIC ACTION PLAN 2014-15

1. **Blockwise plan of action for three years may be suggested to achieve food grain production *viz*., normal, deficit and excess rainfall, with an aim to achieve 42.00 lakh hectare area coverage and strategies to achieve 125.00 lakh metric tonnes in deficit year, 150 to 155 lakh metric tonne in normal year and 175 lakh metric tonnes in favourable year.**

   A detailed action plan of suitable varieties and the availability of respective varieties for the above situations has been prepared in collaboration with the Department of Agriculture. The action plan will be brought out in the form of book entitled "Food Grain Mission in Tamil Nadu".

2. **Varieties with early maturity, drought tolerance, submergence tolerance, resistance to biotic stresses, market preference and less nutrient requirement may be suggested for both Delta and Non-Delta districts.**

   The following varieties are identified suitable for the above situations.

ADT(R)48, MDU5, CO41	Extra early variety (95 days)
Anna (R) 4	Drought tolerance
Swarna Sub1, CR1009 Sub1	Submergence tolerance
ADT40 (> 140 days) CO51(short duration) ADT49 (medium duration)	Market preference
Improved White Ponni, Swarna Sub 1, TRY(R)3	Better nutrient use efficiency at low inp level

   - Extra early maturity varieties like CO48, MDU5, CO41, Anjali and Prasanna are suited for both delta/non delta districts.
   - Seed multiplication is in progress to have large scale demonstration.
   - Submergence tolerant varieties like Swarna Sub1 and CR1009 Sub1 are being popularized. The version of CO43 with Sub1 gene is ready for field testing. A total of 75 new lines with Sub1 gene have been evolved through pedigree breeding and will be tested in the coming years.
   - Drought resistant varieties with superior market preference are in the first year of multi-location testing.
   - An advanced culture CB05022 is subjected to large scale demonstration in the fields of registered organic rice for its performance.

3. **Transplanter with spacing of 22.5cm x22.5cm to adopt single seedling for SRI method may be developed**

   Commercially available "Yanchi Sakthi Paddy Transplanter" was modified for SRI method of rice cultivation. In the field trials, it was observed that there were 65%, 30% and 5% of the hills with single seedling/hill, double seedlings/hill and multiple seedlings/hill respectively in an unit area. Perfect square planting was found very difficult to be achieved due to the occurrence of wheel slippage.

4. **Performance of Green Super Rice may be studied in various locations to provide consolidated report**

A set of 32 Green Super Rice lines (Phase I) received from the International Rice Research Institute, Philippines have been evaluated in four different locations *viz*, Coimbatore, Ambasamudrum, Paramkudi and Tirur along with checks ASD16, CO47, CO50 and Anna(R)4.

Outcome of the evaluation of GSR Phase I lines

- All the GSR lines are mid-early (115-125 days) in duration
- Under irrigated condition, the grain yield of GSR lines ranged from 6722 kg (EC725255) in Coimbatore to 2667 kg/ha (EC725250) in Ambasamudram. The mean grain yield worked out from Coimbatore, Ambasamudram and Tirur trials revealed that the grain yield of EC725255 (6218 kg/ha) was the highest and EC725250 (3093 kg/ha) was the lowest. The mean grain yield of all GSR lines were lesser than CO50 (6807 kg/ha); however, the yield of EC 725255 (6218 kg/ha) was alone found superior to ASD 16 (6203 kg/ha).
- In the rainfed direct sown situation at Paramakudi, a total rainfall of 216 mm was received during the cropping period spread over 20 rainy days. The crop suffered a drought spell of 16 days during initial establishment, 9 days during tillering, 22 days during booting stage and 25 days during grain filling stage. The grain yield of the GSR lines at Paramakudi ranged from 238 kg/ha (EC 725249) to 894 kg/ha (EC 725237). All the GSR lines recorded lesser yield than the local check Anna (R) 4 (1031kg/ha).
- The lines with short bold grain type in the trial viz., EC725250, EC725251, EC725252 and EC725253 were found not uniform. It seems they are still segregating. Except these four lines, all the other 28 lines possess long slender/long bold grain type.
- From the overall observation, three GSR lines EC725255 (6218 kg/ha), EC725254 (5978 kg/ha) and EC725224 (5661 kg/ha) are promising for further evaluation.

Performance of GSR Phase I lines in different locations (2012 and 2013)

Entry	Mean duration (Days)*	Grain Yield (kg/ha)				Mean Yield*
		CBE	ASD	TKM	PMK	
EC725224	124	6102	6500	4382	600	5661
EC725225	119	5343	4056	4743	700	4714
EC725226	120	4065	4222	4328	363	4205
EC725227	121	5009	4389	4963	550	4787
EC725228	120	4796	5000	5244	781	5013
EC725229	121	5232	5333	4648	781	5071
EC725230	122	5428	4444	5240	500	5037
EC725231	118	4917	4111	5313	575	4780
EC725232	120	4954	4278	5353	500	4862
EC725233	117	5231	4111	4631	788	4658
EC725234	115	3796	3777	4267	538	3947
EC725235	120	4630	5444	5656	747	5243
EC725236	117	4269	4278	4906	694	4484
EC725237	120	4824	4389	5115	894	4776
EC725238	118	5287	4889	4671	656	4949
EC725239	120	5463	5889	4765	569	5372
EC725240	114	5287	5167	5864	563	5439
EC725241	119	4907	5778	4160	403	4948
EC725242	120	4713	6333	5166	569	5404

EC725243	120	4444	4111	4590	441	4382
EC725244	119	4500	3889	4521	438	4303
EC725245	124	4296	5056	4264	500	4539
EC725246	125	5139	5444	4175	438	4919
EC725247	120	4685	3889	4144	375	4239
EC725248	120	4287	3944	4306	469	4179
EC725249	119	5120	5389	5851	238	5453
EC725250	121	3352	2667	3260	375	3093
EC725251	124	3917	5111	3540	338	4189
EC725252	124	5639	5222	5800	725	5554
EC725253	124	6681	5222	5719	419	5874
EC725254	120	6139	5667	6128	769	5978
EC725255	122	6722	6167	5766	709	6218
ASD 16	116	-	6389	6016	544	6203
CO 50	135	-	7389	6225	313	6807
CO 47	118	6972	-	-	-	6972
Anna(R) 4	122	-	-	-	1031	-
Date of sowing		20.06.12	11.10.13	31.08.13	03.10.13	

* Duration and Yield mean was worked out from CBE, ASD and Tirur data. Paramakudi data was not included in mean data.

5. **The movement of paddy power weeder in both directions may be facilitated and developed.**

The existing paddy power weeder can be used in both directions if transplanting is done following square planting method with exact spacing. However, this can be done only manually.

6. **Green manure crop to grow as intercrop in between row spacing along with rice crop for delta and canal irrigated area may be suggested.**

Daincha (*Sesbania aculeata* Poir), an indigenous and popular leguminous green manure was recommended for intercrop in wet seeded rice. The row to row spacing of rice should be 25 cm. In-between two rows of rice, one row of daincha can be simultaneously sown with rice + daincha drum seeder. The intercrop of daincha is also sown with a row spacing of 25cm and should be trampled in the soil at 30-35 days. TNAU rice cum daincha seeder is available at Zonal Research Centre, TNAU, Coimbatore.

7. **There are some varieties in China which are tolerant to water stress and do not need irrigation after 65 days. The performance of these varieties may be experimented by TNAU and evaluated in various locations.**

The Green Super Rice lines (Phase I) will be tested under delta conditions for their levels of water use efficiency. Two rice cultures *viz.,* CB08 702 and CB06 803 were found to be with for drought tolerance and they do not need irrigation after 60 days as confirmed by screening under rainout shelter and target production environment at ARS, Paramakudi. These cultures are in the ART stage.

8. **Action for the release of new varieties like ACM1010**

The culture *viz*. ACM 01010 from AC&RI, Madurai will be considered for release in the coming year with additional data from the ongoing Adoptive Research Trials.

9. **TNAU should come out with good market preferred varieties atleast two numbers before the potency of ruling varieties declines. The new varieties should be with more advantage to replace the ruling varieties. TNAU to identify genomes to evolve new varieties in paddy with following features.**

a. Varieties with short duration suitable for kuruvai and kodai season

A short duration fine grain culture AD09219 (ADT(R)45/ACK03002) has an average grain yield of 6147 kg/ha in 115 days with an yield advantage of 16.0% over ADT43. It is moderately resistant to stemborer, brown plant hopper, sheath rot and resistant to green leafhopper blast and sheath blight. Regarding quality aspects, it has a head rice recovery of 62% with higher volume expansion ratio (4.6 times) than ADT 43 (4.1times). The culture will be tested in ART Rice 14 during 2014-15. The recently released short duration variety CO 51 has been found out with good market preferences which replace the varieties ADT43 and ADT45.

b. Varieties to withstand inundation in samba season

Three genotypes *viz.,* AD12126, AD12139 and AD12173 (138 days) with yield superiority over CO(R) 50 and non-lodging plant type have been developed for samba/thaladi season to withstand water inundation. These cultures are in station yield trials. For water inundated areas, CR 1009 sub1 suits wells for samba season with 10% higher yield than CR 1009.

c. Varieties with better performance under low input conditions

The research has been initiated to evaluate the varieties for their input use efficiency in collaboration with the soil scientists.

d. Varieties with resistance to salinity and alkalinity suited to coastal region

Two cultures *viz*. TR05031 (ADT 39/CO 45) TR09030 **(**Mutant of TRY 2) were found to be with good for the above conditions with a mean grain yield of kg/ha in 135 days and 3842 kg/ha in 108 days respectively. Both the cultures are being tested under Adoptive Research Trials.

The varieties *viz*. CO43, CO47 and TRY3 with salinity tolerance are suitable for coastal regions.

10. **All non-performing varieties may be de-notified.**

The varieties not indented for breeder seeds will be identified and de-notification proposals will be sent.

11. **The high yielding varieties of all millets suitable for irrigated and rainfed conditions may be suggested.**

The following are the high yielding varieties/cultures with rich nutritional values.

Sorghum: CO(S)30, TNAU sorghum hybrid CO5
Cumbu: CO(cu) 9, TNAU cumbu hybrid CO9
Minor millets: Ragi : CO13, CO15
Samai: CO(Sa)4
Varagu: CO3, TNAU86
Kudiraivali: CO(KV) 2
Tenai: CO 6, CO(Te) 7
Panivaragu: CO(PV) 5, TNAU164, TNAU202.

12. **Redgram short duration variety which is suitable for early *kharif* may be evolved.**

The photo insensitive redgram variety, CO(Rg) 7 (120-130 days) is suitable for early *Kharif*.

13. **Yellow mosaic virus disease resistant pulses varieties with high yielding potential may be suggested so as to increase the pulses production and income of the farmers.**

The blackgram varieties *viz*. VBN(Bg)4, VBN(Bg)5, VBN(Bg)6 and CO6 are bold seeded and high yielding. These varieties are endowed with yellow mosaic virus resistance and are highly suited for rainfed and irrigated conditions and hence may be recommended.

14. **Pod borer resistant variety in redgram may be evolved.**

The long duration redgram varieties *viz.* TTB 7 and LRG 41 were identified as promising varieties with tolerance to pod borer and are being grown in Dharmapuri, Krishnagiri, Tiruvannamalai and Vellore districts.

15. **Drought tolerant varieties of blackgram, greengram should be evolved.**

The blackgram variety VBN(Bg)6 and greengram variety VBN(Gg)3 are drought tolerant and are suitable for rainfed conditions.

16. **The varieties of pulses with synchronized maturity, short duration and abiotic stress tolerance have to be promoted.**

Greengram variety CO 8 matures in 55 days and has determinate plant type with synchronous maturity making it is suitable for single/mechanical harvest. Blackgram CO6 and VBN6 and redgram CO(Rg)7 are short duration and synchronized maturing varieties.

17. **Development of suitable cotton variety with synchronized flowering and uniform bursting may be developed for enabling mechanical harvesting.**

The work on the development of variety with uniform boll bursting is in progress. The cultures TCH1818 and TCH1819 showing synchronized boll maturity are under evaluation in MLT.

18. **Low cost efficient cotton picking machine suited to all tracts may be developed.**

The pneumatic cotton picking machine has been developed at Department of Farm Machinery with capacity of 26.03 kg/h. The cost of the unit is around Rs.50000/-. However, the leaves have to be removed before picking by chemical means to avoid contamination of cotton.

19. **Efficacy of TNAU sugarcane booster may be evaluated and suggestion may be suggested.**

The efficacy of TNAU sugarcane booster has already been evaluated and recommended for adoption.

20. **Farmer friendly and low cost sugarcane harvester machine may be developed.**

Development of tractor operated whole-cane harvester is being attempted by Agricultural Machinery Research Centre in collaboration with M/s. Gomathi Engineering Services, Kunnathur.

21. **Presently PPFM helps to withstand the drought situation for 15 days to overcome severe moisture stress. Research should be carried out to identify and suggest new strains to withstand prolonged drought.**

The research is in progress to identify the stage specific microbial inoculants to circumvent the problems during the crop growth.

22. **To develop newer cost effective methods for conservation of soil moisture, both *in situ* and *ex situ* to improve soil moisture conservation.**

The following moisture conservations are recommended.

In situ

a. Tillage practices like summer ploughing, deep ploughing
b. Soil mulching and crop residue mulching
c. Vettiver plantation for bund stabilization
d. V bunds and crescent bunds
e. Micro catchments water harvesting

Ex situ

a. Broad bed and furrows with plastic mulching
b. Broad bed furrows with organic mulching

23. **Location specific Integrated Farming System model that is practically remunerative and sustainable is the need of the hour and hence it is requested to suggest a suitable model.**

Location specific IFS models based on the agro-ecological conditions and successful cropping systems adopted in each zone are already available in the Crop Production Guide (2012). These models can be used as a base for evolving new combinations depending upon the situations. The following are some of the IFS models for adoption in specific zones.

<u>Western zone</u>

<u>Wetland</u>

- Cropping (0.90 ha) + fishery (0.10 ha) + poultry (50 layers) + 5 kg oyster mushroom production /day.
- Cropping (0.90 ha) + polyculture fish rearing (0.10 ha), Pigeon (100 pairs) and 5kg mushroom production per day.
- Cropping (0.90 ha) + Goat (20 female + one male) + fish (400 numbers of polyculture) + Irrigated
- Integration of six crossbred milch animal with $2m^3$ biogas production, 2 kg mushroom production and 20 bottles of mushroom spawn with farm forestry and homestead garden.

<u>Rainfed land</u>

- Integration of grain crop cultivation + fodder production + silvipastoral
- trees involving trees like subabul, *Acacia* sp., and thorn less *Prosophis* interplanted with *Cenchrus* grass and rearing of 20 female + one male of Tellicherry goat.

North western zone

- Crop cultivation in rainfed lands can be integrated with 3 milch cows, 6 layers of poultry in 0.80 ha land area will fetch additional income (or) Integration of cropping with two milch cows, six goats in 1.25 ha rainfed land, out of which 0.25 ha with mulberry cultivation for sericulture.

Hilly zone

- To obtain higher income and regular employment in hilly zone, crop cultivation can be integrated with two milch cows, six poultry layers and nine broilers.

Cauvery delta zone

- Rice based cropping with two milch cows + mushroom
- Crop cultivation + goat rearing (6 Nos.) + mushroom
- Cropping with duck and fish rearing+ mushroom

Southern zone

- Rice based cropping + fish rearing + poultry in one ha in Periyar - Vaigai Command Area.
- Milch cow + fish rearing + rice based cropping system in wetlands of Tirunelveli district. In rainfed black clay soil, cropping + fruit tree cultivation + goat rearing

24. **Research on use of higher seed rate (Two seeds per drill)/High density planting in rainfed cultivation especially in maize, cotton practiced by the farmers.**

Two seeds per drill are not recommended. However high density planting with a spacing of 45x10 cm with plant density of 2.2 lakh plants/ha has resulted 15% yield increase compared to normal planting at CRS, Vappanthatai.

25. **Research to invent new farm machineries suitable for harvesting / threshing.**

Commercially available “Preet Maize Combine Harvester” and “Claas Combine” may be used for harvesting maize and pulses respectively. Commercially available “Claas Combine” may be used for harvesting pulses. “Reaper binders” are already available commercially which may be used for harvesting millets. After harvesting axial flow threshers may be used for threshing.

26. Suitable recommendations for the improvement of soil health on the following may suggested.

Crop-wise, nutrient-wise, district-wise critical levels are to be fixed for all micro-nutrients.

The critical limit is the limit which isolates the deficient plants or soils from the non deficient ones. Although plant analysis as compared to soil analysis can evaluate better micronutrient supplying capacity of soil, it is generally performed at a stage when crop has already suffered considerably from nutrient deficiency. Since the deficiency of micronutrient element appears early in the growing season, soil analysis has the advantage over plant analysis and visual deficiency symptoms indicating the extent of micronutrient deficiency or their requirement for crops prior to sowing. Hence, soil analysis

is extensively used as a diagnostic tool in monitoring nutrient status of soils for fertilizing crops.

In a district, more numbers of soil series were established and multi-various crops are grown. A series of experiments using various crops in different soil conditions in Tamil Nadu had been conducted during 1980 to 2000 to provide state-wise uniform micronutrient recommendations. Based on the above data, the following critical levels for various micronutrients in soils were fixed for adoption by the Agricultural University and State Department of Agriculture, Tamil Nadu.

Critical limit of micronutrients in soils adopted by Government of Tamil Nadu

Micronutrients	Critical Limit (ppm)	Extractant used
Zinc - loamy soil	1.2	DTPA
Zinc - clayey soil	2.0.	DTPA
Copper	1.2	DTPA
Iron- calcareous soil	6.3	DTPA
Iron- Non-calcareous soil	3.7	DTPA
Manganese	2.0	DTPA
Boron	0.46	Hot Water
Molybdenum	0.05	Ammonium Oxalate

Crop-wise, nutrient-wise, district-wise soil test based micro nutrients recommendations are to be evolved for all Agricultural and Horticultural Crops.

Besides macronutrients, soil testing for available micronutrients needs to be performed for giving micronutrient recommendations. When the soil test values go below the critical limit of a particular micronutrient, there is a need for micronutrient fertilisation. Based on the field experiments conducted using various crops in different soil conditions, micronutrient fertiliser recommendations were generated for agricultural and horticultural crops and the details of recommendations are given below**.**

Remedial Measures

Micronutrient recommendations for Agricultural crops (Irrigated)

Crops	Element	Mode of application	Recommendations
Wetland rice	Zinc	Soil	25 kg $ZnSO_4$ ha^{-1} as basal
	Zinc	Foliar spray	0.5 % $ZnSO_4$ thrice at 30, 40th and 50th days after transplanting
Wetland rice - Cauvery delta	Copper	Soil	Basal application of 5 kg $CuSO_4$ ha^{-1} combined with 0.2 % foliar spray of $CuSO_4$ thrice
Semidry and rainfed rice	Iron and Zinc	Soil	Combined application of 50 kg $FeSO_4$ along with 25 kg $ZnSO_4$ ha^{-1} as basal
		Foliar spray	Foliar spray of 1.0 % $FeSO_4$ and 0.5 % $ZnSO_4$ at 15, 25 and 35 days after sowing

Sorghum, Maize	Iron	Soil	50 kg $FeSO_4$ +12.5 t FYM ha^{-1} as basal
		Foliar spray	1 % $FeSO_4$ + 0.1 % citric acid thrice
Sorghum, Finger millet and Cumbu	Zinc	Soil	25 kg $ZnSO_4$ ha^{-1} as basal
	Zinc	Foliar spray	0.5 % $ZnSO_4$ foliar spray (Thrice at 30^{th}, 40^{th} and 50^{th} days after sowing
Maize (Variety)	Zinc	Soil	25 kg $ZnSO_4$ ha^{-1} as basal
Maize (Hybrid)	Zinc	Soil	37.5 kg $ZnSO_4$ ha^{-1} as basal
Groundnut	Zinc	Soil	25 kg $ZnSO_4$ ha^{-1} as enriched FYM as basal
	Boron	Soil	10.0 kg Borax ha^{-1} as basal
	Iron	Foliar spray	1.0 % $FeSO_4$ + 0.1 % citric acid
Sunflower	Zinc	Soil	25 kg $ZnSO_4$ ha^{-1} as basal
		Foliar spray	0.5 % $ZnSO_4$ 30, 40 and 50 DAS
Sesamum	Manganese	Soil	5 kg of $MnSO_4$ ha^{-1} as basal
Pulses	Zinc	Soil	25 kg $ZnSO_4$ ha^{-1} as basal
		Foliar spray	0.5 % $ZnSO_4$ foliar spray thrice
Sugarcane	Iron	Soil	100 kg $FeSO_4$ ha^{-1} + 12.5 t FYM ha^{-1} as basal
		Foliar spray	1 % $FeSO_4$ + 0.1 % citric acid on 90^{th}, 110^{th} and 130^{th} days after planting
	Zinc	Soil	37.5 kg $ZnSO_4$ ha^{-1} as basal
		Foliar spray	0.5 % $ZnSO_4$ foliar spray thrice on 90^{th}, 110^{th} and 130^{th} days after planting
Cotton	Zinc	Soil	50 kg $ZnSO_4$ ha^{-1} as basal
		Foliar spray	0.5 % $ZnSO_4$ thrice
Cowpea	Zinc and Boron	Soil	25 kg $ZnSO_4$ and 10 kg Borax ha^{-1}
Fodder grasses	Iron	Foliar spray	Repeated foliar spray of 1 % $FeSO_4$ + 0.1 % citric acid

Note : Foliar spray should be given during the early stage of crop growth at 7–10 days interval for short duration crops and 15 days interval for long duration crops

Horticultural crops (Irrigated)

Crops	Element	Mode of application	Recommendations
Cauliflower	Cooper	Soil	10 kg $CuSO_4$ + 12.5 t ha^{-1}
	Boron	Soil	20 kg Borax + 12.5 t ha^{-1}
Tomato	Boron	Soil	10 kg Borax + 12.5 t ha^{-1}
	Zinc	Soil	50 kg $ZnSO_4$ ha^{-1} as basal
Tapioca	Iron and Zinc	Foliar spray	1.0 % $FeSO_4$ + 0.5 % $ZnSO_4$ twice at 60 and 90 DAP
Turmeric	Zinc	Soil	50 kg $ZnSO_4$ ha^{-1} as basal
		Foliar spray	0.5 % $ZnSO_4$ thrice

	Iron	Soil	100 kg $FeSO_4$ + 12.5 t FYM ha^{-1} as basal
		Foliar spray	1.0 % $FeSO_4$ + 0.1% citric acid
Grapes	Multi nutrient	Foliar spray	$ZnSO_4$ 0.2 % + boric acid 0.1 % + 1 % urea twice during blooming and ten days after first spray
Banana	Multi nutrient	Foliar spray	0.5 % $ZnSO_4$ + 0.2 % $FeSO_4$ + 0.2 % $CuSO_4$ + 0.1 % boric acid at 3, 5 and 7 months after planting
Jasmine	Iron and zinc	Soil	25 g $FeSO_4$ and 4.0 g $ZnSO_4$ / plant
	Iron	Foliar spray	0.5 % $FeSO_4$ + 0.1 % citric acid spray at monthly intervals
Beet root	Zinc and Boron	Soil	25 kg $ZnSO_4$ and 10 kg Borax ha^{-1}
Radish	Zinc and Boron	Soil	25 kg $ZnSO_4$ and 10 kg Borax ha^{-1}
French beans	Zinc and Boron	Soil	25 kg $ZnSO_4$ and 10 kg Borax ha^{-1}

Note : Foliar spray should be given during the early stage of crop growth at 7 – 10 days interval for short duration crops and 15 days interval for long duration crops.

Secondary nutrient recommendation for specific crops (Irrigated)

Crops	Element	Mode of application	Recommendations
Cotton	Magnesium (reddening of leaves)	Foliar spray	0.5 % $MgSO_4$ + 1.0% urea + 0.1 % $ZnSO_4$
Potato	Magnesium	Soil as basal	50 kg $MgSO_4$ ha^{-1}
Rice	Calcium and Sulphur	Soil as basa	500 kg gypsum ha^{-1}
Maize	Sulphur	Soil as basal	30 kg S ha^{-1}
Sorghum	Sulphur	Soil as basal	30 kg S ha^{-1}
Groundnut	Calcium and Sulphur	Soil as basal	400 kg gypsum ha^{-1}
Sunflower	Sulphur	Soil as basal	40 kg S ha^{-1}
Sesame	Sulphur	Soil as basal	40 kg S ha^{-1}
Greengram/ Blackgram	Sulphur	Soil as basal	40 kg S ha^{-1}
Cotton	Sulphur	Soil as basal	55 kg S ha^{-1}
Onion	Sulphur	Soil as basal	30 kg S ha^{-1}
Sugarcane	Sulphur	Soil as basal	45 kg S ha^{-1}
Tapioca	Sulphur	Soil as basal	20 kg S ha^{-1}

27. Micro nutrient blanket application/foliar spray/fertigation dose to all crops may be suggested.

Similar to macronutrients, Soil testing for available micronutrients needs to be performed for micronutrient applications. When the soil test values go below

the critical limit of the a particular micronutrient, there is a need for micronutrient fertilisation. Without soil testing, indiscriminate application of micronutrient fertilisers needs to be avoided. In addition to the soil application, foliar sprays are found to correct nutrient disorders in crop plants during the crop growth period. The details of foliar spray recommendations are given below.

Generalized recommendation for foliar spray of micronutrient for crops

Element	Fertilizer	Concentration
Zinc	Zinc sulphate	0.5 %
Iron	Ferrous sulphate	1.0 %
Manganese	Manganese sulphate	0.2 %
Copper	Copper sulphate	0.2 %
Boron	Boric acid / Solubor / Agribor	0.2 %
Molybdenum	Sodium molybdate or Ammonium molybdate	0.05 %

So far, no work has been done for scheduling of micronutrient dose for fertigation in the Department of SSAC.

28. Feasibility of using currently notified micro nutrient mixtures for fertigation is to be assessed. Otherwise new solid or liquid micro nutrient formulations are to be evolved for Fertigation.

The currently notified micronutrient mixtures are meant for soil application and use of those mixtures for drip fertigation will create clogging in the delivery system. The feasibility of evolving new solid or liquid micro nutrient formulation for fertigation will be studied.

29. Evolving newer specialised chelated form of micro nutrient fertilizers.

So far, no work has been done in this line. The feasibility of evolving newer specialised chelated form of micronutrient fertilizers will be studied.

30. **Preparation of village wise water saving technique and soil fertility based nutrient management matrix and development of most suited crop matrix.**

Computer software DSSIFER can be used as a tool to arrive soil test based nutrient management using village soil fertility indices.

31. **Feasibility on the production of liquid MN mixture for different crops and its notification may be studied and suggestion may be provided.**

No work has been done in this line. However, the feasibility of evolving new liquid micro nutrient mixture for different crops will be studied in future.

32. **Fertigation schedule for notified MN mixtures may be suggested.**

The currently notified micronutrient mixture is meant for soil application and use of those mixtures for drip fertigation will create clogging in the delivery system.

33. **A clear plan for improving soil organic content may be evolved and provided.**

There are two approaches to improve soil organic matter content: (1) slowing down decomposition rates of soil organic matter and (2) Adding organic carbon inputs from organic materials

Plans for improving soil organic Carbon

- Practice of leaving residues of crops and cover crops in place, including root residues.
- Incorporation of legume crop residues in soil after harvesting pods,
- Regular Green manuring and Greenleaf manuring
- Annual crop rotation with a legume crop and legume residue incorporation is most effective in enhancing soil C. Tap root systems of legumes slowly decompose and build soil organic C considerably.
- Regular annual application of farmyard manure or organic amendments at 12.5 t ha^{-1}
- No-tillage management enhances soil organic C remarkably and followed by minimum tillage moderately. Frequent disk ploughing reduces soil organic C.
- Application of high-quality residues like vermicompost and biocompost having C:N ratio below 25 promotes rapid decomposition and mineralization of N and increase active soil organic matter.
- When crop residues are sold for profit, then there is need to apply compost or grow a cover crop to replace the residues and conserve the soil. Manure and compost additions are effective ways to build soil organic matter even with complete removal of maize stover.
- Effluents from industries which have been found environmentally safe can be applied in field at recommended levels.
- In long term fertilizer experiments it has been found that regular practice of Integrated nutrient management by way of application of farmyard manure at 12.5 t ha^{-1} along with recommended doses of N, P and K and bioinoculants to each crop improve and sustain soil organic C when compared to application of inorganic fertilizers alone.
- Soil organic Carbon build up sensibly occur over a long time frame, often taking a decade or more. It is important to test soil quality often to ascertain improvement in soil organic Carbon.

34. **Growth promoters and inoculators including bio-fertilizers to be applied at various stages of crop growth to be detailed.**

An experiment has been planned for applying growth promoters and different bio fertilizers at various stages of rice crop. The results will be available after the completion of the experiment.

35. **Technology interventions in rainfed areas for converting Crop residues/animal wastes especially poultry, duckery and piggery waste into manure for soil fertility improvement.**
To develop advance and cost effective technology for production of organic compost manures from vegetable/ organic wastes.
Effective ways for better utilization and management of crop residues and to suggest decomposition technologies using Effective micro organisms.
Evolving very low cost methods of vermi-composting.

Evolving and suggesting field in situ decomposition method for composting coir wastes.

Composting technology for composting crop residues, animal dung, birds dropping are developed in the Department of Environmental Sciences, Tamil Nadu Agricultural University, Coimbatore for adoption. The interested farmers may contact the nearby TNAU research stations for guidance and text materials for reading. If twenty farmers joins together, one day training on composting all recyclable material will be given to them.
Rapid composting methodologies are already available in Tamil Nadu Agricultural University.
Low cost "Silpaulin" Vermicomposting technology was already developed by TNAU and widely adopted by the farmers of Tamil Nadu.

36. **Research on use of biochar, biomineraliser *etc*., for soil fertility improvement.**

Biochar has no role in soil fertility improvement. It is a burnt material, it can't Improve soil fertility. Biomineralizer is meant for composting biodegradable waste.

37. **Promoting the practices of mulching.**

The research results on mulching technology for various crops are available with Precision Farming Development Centre (PFDC), Dept. of SWCE, AEC & RI, TNAU which can be popularised by the extension officials. It is a good strategy for sustainable organic agriculture.

38. **Evaluating and suggesting the benefits of humic acids in improvement of soil health and promoting crop growth.**

Humic acid has marked role on soil physical properties, sequestration and biological activities. The effect of humic acid on soil health with or without NPK was assessed in various crops. Application of humic acid as potassium humate has pronounced effect on increasing the organic carbon content and availability of NPK and micronutrients in soils. The efficiency of humic acid was found to increase when applied along with inorganic fertilizers.

Recommendations
Rice: 100% Recommended NPK + 10 kg humic acid/ha
Pluses: 75 % Recommended NPK + 20 kg humic acid /ha
Groundnut, sugarcane, onion and tomato: 100% Recommended NPK+20 kg humic acid /ha

39. **Enriched farm yard manure preparation procedure may be fine tuned.(For Example 50 kg P_2O_5 mixed with 750 kg of FYM)**

Preparation of enriched FYM
Macronutrients

- Mix the recommended dose of super phosphate per ha with well rotten FYM (750 kg)
- Sprinkle water to keep the mixture moist.
- Fill the mixture in a polythene gunny bag and tie it with rope to make it air tight

- Open the bag after one month of anaerobic incubation and mix with recommended dose of N and K fertilizers.
- Apply to soil during the last plough or before sowing

Micronutrients

For Zn enrichment the following steps are to be followed.

- Mix the recommended dose of $ZnSO_4$ (25 kg ha^{-1}) with well rotten FYM at 1:10 ratio
- Sprinkle water to keep the mixture moist.
- Fill the mixture in a polythene gunny bag and tie it with rope to make it air tight
- Open the bag after one month of anaerobic incubation and apply to soil at the time of sowing

40. **The gypsum recommendations to crops such as millets, pulses *etc*., based on different types of soils may be suggested.**

Gypsum is commonly applied to reclaim the soidc soils alone and not used as a nutrient source for millets. However for pulses, the required quantity of 10 and 20 kg S ha^{-1} for rainfed and irrigated situation respectively can be applied through gypsum (50-100 kg ha^{-1}) if single super phosphate is not used.

41. **Technology for increasing the NUE for N, P,K and Ca, S, Mg, and micro nutrients for each crop under irrigated/rainfed may be provided. Methods to increase fertilizer use efficiency**

- The modified urea forms are sulphur coated urea, tar coated urea, neem oil treated urea, neem cake treated urea, nimin coated urea, gypsum coated urea, etc. Among the modified forms some forms can be prepared by farmers themselves. By applying these modified forms 25 per cent fertilizer N can be saved.
- In rice fields, placement of urea super granule at 5 cm depth in between the planted rows has shown three times increase in nitrogen use efficiency. However there are no convenient applicators so far developed to place urea super granule in rice fields. Hence, urea super granule is not manufactured by fertilizer industries. In developed countries for large scale farming the technology of injecting liquid ammonia in to soil is being adopted with the help of machineries.
- Instead of applying nitrogen fertilizers completely as basal, application in 3 or 4 equal splits at critical growth stages upto flowering give more yield. In another method, based on the colour of rice leaves it is possible to assess the nitrogen supplying power of soil by comparing leaf colour with colour shades given in leaf colour chart (LCC). With the use of LCC whenever the intensity of green colour is found to be less, then application of fertilizer nitrogen can be resorted. This method is at present recommended to rice crop only.
- In rice fields one or two weeks before transplanting application of farm yard manure, crop residues, composts@12.5 t ha^{-1} / green manure @ 6.25 t ha^{-1} and incorporation in soil during ploughing make substantial supply of N to soil and hence there is a choice to reduce 1/3 of fertilizer nitrogen requirement. Similarly organic materials press mud, coir pith, poultry manure / residues that are available from nearby industries/ city composts yards can also be used as per recommendation.

- Adopting legume crops in crop rotation is a successful method to increase nitrogen fertility of soils, only if the residues of legumes are incorporated in soil during land preparation. In the same manner growing cowpea, sesbania, sunnhemp etc., as intercrop upto 50 days in between the rice rows and then incorporating them into soil will support rice crop by supplementing with nitrogen during the remaining period.
- Growing Azolla fern on the surface of flood water in rice field helps rice in many ways to utilize nitrogen. Azolla has atmospheric nitrogen fixing capacity upto 20–50 kg ha^{-1}. During growing itself Azolla releases NH3 in flood water. Due to spreading nature and shade effect, Azolla reduces the growth of wetland weeds. Azolla contains upto 4 per cent nitrogen in their tissue and hence contribute nitrogen to soil after senescence.
- When water soluble phosphatic fertilizers are applied to soil they become sparingly soluble after few weeks due to chemical fixation and surface reaction with minerals and hence are seldom available to crops. For rice crop diammonium phosphate is used in the nursery and super phosphate is used in the main field. For other crops, instead of broadcasting water soluble P fertilizers application at root zone as side dressing will enhance P use efficiency. To save on the cost of P fertilizer, rock phosphate can be used if the soil reaction of rice field is relatively acidic. For all crops rock phosphate can be applied in the form of enriched manures by blending with organic materials like farm yard manure/crop residues/composts and then incubating for 4 - 6 weeks.
- Potassium is abundantly available in many soil types. However, K content is low in sandy soils. In that case potassium fertilizer can be applied in two splits instead of applying as basal in full. Further, application of zinc sulphate and sulphur in deficient soils shall improve the fertilizer use efficiency of N and P.
- It is important to apply fertilizer nutrients as per soil test and yield target (STCR-IPNS) for achieving desired crop yields and enhanced NUE for fertiliser NPK.
- Crops raised in the suitable season utilize soil and fertilizer N effectively. Similarly use of herbicides in appropriate methods also reduces the count of weeds and increases nutrient use by crops.
- **Nutriseed Pack Technique:** In order to supply the whole nutrient requirement of crop at the root zone itself and maximize yield and fertilizer use efficiency, the Nutriseed Pack Technique can be used.

42. **Use of briquetted urea and other briquettes may be studied and recommendations may be suggested.**

Deep placement of urea briquette is an effective alternative method to the traditional method of applying urea by surface broadcasting in rice fields. Research findings indicate that by urea briquette placement average yield of rice can be increased by 10 to 15 per cent. Urea briquettes can be produced using commercial machinery by compacting prilled urea in to briquettes (globular or oblong shape). Thus briquetting involves additional cost in fabrication. In field with square planted rice, urea briquettes are to be placed at the centre of every 4 hills at basal and top dressings. It involves engaging of additional labour which increases cost of production. Hence yield benefits expected with urea briquettes are nullified by additional costs involved.

If suitable applicator can be developed to place urea briquettes in transplanted field it will reduce labour cost. Overall, by operating a small

scale briquetting machine in farm premises and using briquette applicator in field farmers can considerably reduce cost of crop production and increase net profit due to enhanced yield.

Studies on placement of single nutrient/ multi nutrient fertilizer briquettes for upland crops are limited.

43. **Customised and fortified fertilizers for each region/ soil series / each season may be suggested to all crops.**

Customized and fortified fertilizers are produced by fertilizer industries as per FCO norms and distributed to farmers in the region as per license granted for distribution by Government of India. According to crops, the recommended customized or fortified fertilizers can be prepared and applied instead of applying straight fertilizers. In recent years, customized fertilizers of 36 grades have been included in FCO for different crops. To promote secondary and micro nutrients on a large scale, 9 fortified fertilizers, and 5 bio-fertilizers (*Rhizobium*, *Azotobacter*, *Azospirillum*, phosphate solubilizing bacteria and mycorrhizae) and three organic fertilizers (city waste compost, vermicompost and castor de-oiled cake) have been included in the FCO to facilitate their use. When fertilizer industries come forward and obtain license for distribution, customized fertilizer will be available in Tamil Nadu according to crops grown in different regions.

44. **Suitability of the various organic products produced by Subhashri bio engineers private limited, Tiruchencode may be evaluated and suggestion may be provided.**

Bioefficacy testing of various products are being undertaken at TNAU only to facilitate the company for getting their products registered at appropriate bodies based on the results obtained. The testing of various products from Subhashri bio engineers, Tiruchencode are under progress in different departments of TNAU.

45. **The impact of pulse wonder, groundnut rich, maize maxim, sugarcane booster may be studied over present micro nutrient mixtures of the Department and recommended dose of using both or any one of them or combination may be established.**

The crop boosters are developed for various crops for increasing the yield. The boosters contain nutrients and plant growth regulators which are crop specific. The dose and correct concentration is important and hence it is not possible to mix with other compounds.

46. **The dose of pulse wonder to greengram/ blackgram, and redgram are same such as 2.2 kg /acre. This may be confirmed as the canopy area occupied by greengram/ blackgram, and redgram may be different and definitely redgram may require more dose.**

The pulse wonder was tested and recommended for blackgram and greengram and used for short duration redgram. Studies will be taken up to confirm the increased dose of pulse wonder for the redgram.

47. **The nutrient recommendations including micronutrients under organic farming to each crop and source of manures, time and method of applications may be suggested.**

Under well established organic farming the micro nutrient deficiencies does not arise. Major nutrients deficiencies are dealt with crop rotation, crop recycling, *in-situ* crop residue incorporation *etc.*

48. **The crop wise suitable varieties for organic farming for each crop may be suggested.**

Variety suitable for organic farming in rice crop is in progress. For the other crops, which are suitable for organic cropping system, studies will be initiated in the coming years.

49. **Maize maxim is being recommended on tassel initiation and grain filling stages. A study may be done and recommendation may be confirmed.**

The recommendation is based on the studies taken up. Maize maxim is recommended to be sprayed at tassel initiation and grain development stages and was found effective.

50. **A study may be done on the use of both 2%DAP spray and pulse wonder for increasing the yield of pulses rather than using either 2% DAP or Pulse wonder spray and recommendations may be suggested.**

Pulse wonder is recommended as a substitute for 2% DAP. If DAP is sprayed, no need to go for pulse wonder spray. The advantage is that pulse wonder need to be sprayed only once and hence save money on cost of spraying.

51. **Compatibility of using TNAU crop boosters with NPK complex fertilizers, micro nutrient fertilizers and micro nutrient fertilizer mixtures, plant protection chemicals and plant growth regulators, organic and bio pesticides may be suggested.**

The crop boosters are not compatible with plant protection chemicals and bio pesticides and it is better to go for without mixing with other compounds. Compatibility chart for pesticides/biopesticides/organic materials with individual macro/micro nutrient is available. The work on compatibility of TNAU boosters with plant protection chemicals, organic and bio pesticides has not been done so far.

52. **INM for each crop for different problem soils may be developed based on Cropping pattern and season wise and region/soil series wise INM may be suggested.**

Soil test crop response based IPNS (STCR-IPNS) has been developed for 25 major agricultural and horticultural crops on 15 soil series in six agro-climatic zones of Tamil Nadu. These packages are available in Crop Production Guide 2012 (Agriculture) and Crop Production Techniques of Hort. Crops -2013 (www.agriportal.tnau.ac.in).

53. **Combination of multi nutrient spray for boosting the yield may be devised for all crops.**

Already multi-nutrient boosters were developed for 5 major crops. Development of multi-nutrient boosters for other crops will be carried out.
Under the situations of occurrence of multi micronutrient deficiencies in soils, the multi nutrient foliar spray or soil application of micronutrient mixtures is advocated. The feasibility for boosting the crop yield through multi nutrient spray will be studied.
Spraying of TNAU pulse wonder @ 5.0 kg ha^{-1} is recommended at flowering stage as indicated in the Crop Production Guide.

54. **Soil test based fertigation schedule for all major agricultural / horticultural crops may be suggested.**

Soil test crop response based Integrated Plant Nutrition System (STCR-IPNS) has been developed for desired yield targets of transgenic cotton under drip fertigation on Perianaickenpalayam soil series. Also refer answer for question no. 49.

(a) Soil test based fertiliser doses for desired yield targets of transgenic cotton (kg ha^{-1})

Initial soil test values (kg ha^{-1})			NPK (kg ha^{-1}) + FYM @12.5 t ha^{-1} + A*zospirillum* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}		
SN	SP	SK	FN	FP_2O_5	FK_2O
2.5 t ha^{-1}					
240	18	500	62	40	41
260	20	550	54	35	32
280	22	600	46	31	23
3 t ha^{-1}					
240	18	500	104	62	74
260	20	550	96	57	65
280	22	600	88	53	56
3.5 t ha^{-1}					
240	18	500	147	84	107
260	20	550	139	79	98
280	22	600	131	75	89
4 t ha^{-1}					
240	18	500	189	106	120**
260	20	550	181	101	120**
280	22	600	173	97	120**

** maximum dose

(b) Fertigation schedule for cotton

Stage	No. of Split	Days	N (per cent)	P (per cent)	K (per cent)
Seedling	1	14	5	12.5	2.5
	2	21	5	12.5	2.5
Vegetative	3	28	2.85	12.5	3.57
	4	35	2.85	12.5	3.57
	5	42	2.85	5	3.57
	6	49	2.85	5	3.57
	7	56	2.85	5	3.57

	8	63	2.85	5	3.57
	9	70	2.85	5	3.57
Boll formation	10	77	9	5	6
	11	84	9	5	6
	12	91	9	5	6
	13	98	9	5	6
	14	105	9	5	6
Maturity	15	112	5	-	8
	16	119	5	-	8
	17	126	5	-	8
	18	133	5	-	8
	19	140	5	-	8

55. **To improve the bio-fertilizer usage the following may be suggested.**

Feasibility of using consortium of biofertilizers containing microbes for N, P, K, Zn, nutrients is to be suggested.

Instead of the microbial consortium where there may be competition between the microorganisms, stage specific microorganisms may be used. Already experiments were planned to identify suitable microorganisms at various stages of crop growth in rice.

Biofertilizers dose separately for liquid and carrier based materials, for all crops including horticulture and medicinal crops is to be suggested.

Biofertilizers dose for liquid and carried based materials have been standardised for different crops.

Technology for the production of K and Zn solubilising micro organisms may be provided.

Both “K” and “Zn” solubilising microorganisms are available. These cultures are being evaluated in multi location trials for their performance. After selecting the efficient strains the same will be available for large scale use.

The Use of “K” solubilising micro organism and dose may be decided in K rich soils and deficient Soils.
The Use of “Zn” solubilising micro organism and dose may be decided in Zn rich soils and deficient Soils.

Both “K” and “Zn” solubilising microorganisms are available. Experiments are being conducted for standardising the doses for K and Zn rich and deficient soils. After completion of the experiments, the recommendations on doses for K and Zn rich and deficient soils will be given.

Preparation of mother cultures for existing bio fertilizers from the native strains and provided for mass multiplication.

The quality and efficiency of mother cultures are regularly checked and pure and efficient mother cultures are being supplied to the existing biofertilizer production units every year for mass production. The best cultures are supplied after evaluating the performance in field trials conducted at various paces.

56. **Admissible limit of salinity (electrical conductivity) in irrigation water for using it for micro irrigation systems like drip, sprinklers and Rain gun is to be fixed.**

Irrigation water containing EC more than 1 dsm^{-1} may not be suitable for using in sprinkler and raingun irrigation as there will be possibility of scorching of plants.

57. **Renewable energy operated Mechanised Sprayers may be evolved to improve the spraying efficiency.**

Commercially available petrol operated sprayer can be converted in to solar operated sprayer by attaching required capacity solar photovoltaic module and battery.

58. **Suitable drought Tolerant Fodder Crops may be suggested for pasture lands (JDA, Karur).**

Under rainfed conditions, Kolukattai grass CO1 (grass fodder) + *Stylosanthes* or Velimasal (legume fodder) at 3:1 ratio is suggested for getting protein rich fodder from rainfed pasture land.

59. **In hilly or nearby hilly areas the crops are often damaged or fully destroyed by wild animals like wild pigs, elephant *etc*. Suggestions are needed to protect the crops from wild animals apart from power fencing (JDA,Erode).**

Migration of animals to agriculture lands from nearby hilly areas are mainly due to water shortage and non availability of food source. Hence, during drought period avoid planting attractive plants like sugarcane, banana, maize and sorghum in the agriculture lands closure to hills.
For wild pigs management, installation of white flags (2' x 1') randomly in the field that reduces the damage which may be followed by the farmers.

60. **During last year bad experience due to coconut slug caterpillar attack was witnessed in 200 Ha of Kaveripattinam Block. Immediate relief and prevention measure may be suggested to get rid-off this menace. (JDA, Krishnagiri).**

Spraying of dichlorvos 76 WSC @ 2 ml/lit along with a sticker solution @ 1ml/lit on the affected leaf surface will kill the slug caterpillars.
Root feeding of monocrotophos @ 10 ml+ 10 ml water may be done for once.

61. **Technology development and feasibility for admixing mycorrhiza with vermicompost for hilly zones may be suggested (JDA,Dindigul).**

Vermicompost can be used as a substrate for multiplication of AM fungi and can be used for application in hilly zones.

62. **Suitable Soil Reclamation measures may be suggested for dyeing effluent affected areas (JDA,Karur).**

The soils in the affected villages have to be reclaimed by adopting appropriate management technologies so that these soils could become productive and agriculture can be revitalized.

Following management practices are recommended:

- Irrigate the field with good quality water
- Provide adequate drainage system (development of either surface or sub-surface drainage)
- Blend (mix) good quality water with the contaminated water to reduce the concentrations of salts (dilution).
- The physical methods for reclamation of saline soils are deep ploughing, sub-soiling, profile inversion and scraping.
- Apply farm yard manure (FYM) at a rate of 5 t/ha 10 to 15 days before sowing or transplanting of crops.

Relative salt tolerance of some important crops

Crop	Threshold salinity (dSm^{-1})	Crop	Threshold salinity (dSm^{-1})
Cotton	7.7	Sugarcane	1.7
Sorghum	6.8	Mung bean	1.0
Soybean	5.0	Cluster bean	8.8
Cowpea	4.9	Cucumber	2.5
Groundnut	3.2	Tomato	2.5
Rice	3.0	Onion	1.2
Maize	1.7	Carrot	1.0

Reclamation and management of sodic (alkaline) soils

Soils with a pH more than 8.5 and Exchangeable sodium percent (ESP) more than 15 are found in many villages. These soils are considered as sodic (alkaline) soils. Amendments generally used to reclaim sodic soils are gypsum, phosphogypsum, iron pyrites and elemental sulphur. All these are inorganic in nature. Some of the organic amendments like pressmud, poultry manure and biocompost can also be used as they contain higher amounts of calcium.

- To reclaim the soil with high pH (above 8.5), plough the soil at optimum soil moisture regime and broadcast or incorporate gypsum (at 50% gypsum requirement) uniformly in the surface soil (0 to 10 cm depth).
- Impound water for a week and provide drainage for leaching out the soluble salts.
- Then apply green manure at a rate of 5 t/ha, 10 to 15 days before sowing or transplanting of crops. Application of gypsum can be made either directly or by mixing it with standing water to facilitate leaching of reaction products to hasten reclamation.
- Proper leveling of fields is an important pre-requisite. Fields should be provided with 35 – 40 cm high strong bunds to retain rain water and also to prevent entry of water from outside.
- Alternatively, elemental sulphur, lime-sulphur, sulphuric acid, iron sulphate, aluminiumsulphate and limestone may also be used. The quantities of these amendments to be applied in comparison with gypsum are given in the following Table.

Relative quantities of different amendments compared with gypsum

Amendments	Tonnes equivalent to onetonne of gypsum
Elemental sulphur	0.18
Lime-sulphur	0.75
Sulphuric acid	0.57
Iron sulphate	1.62
Aluminiumsulphate	1.27
Limestone	0.58

Relative tolerance of crops to alkalinity or sodicity

Crop	ESP range
Blackgram, peas, pigeon pea, safflower	10-15
Soybean, chickpea	16-20
Groundnut, cowpea, onion, pearl millet	20-25
Garlic, cluster bean	25-30
Cotton, tomatoes, mustard, sunflower	30-50
Sesbania	50-60
Rice	60-70

Soil management measures

- Deep ploughing to 60 cm loosens the aggregates, improves the physical condition of these layers, increases soil-water storage capacity and helps control salt accumulation Gypsum is by far the most common amendment for sodic soil reclamation, particularly when using saline water with a high SAR value for irrigation.
- Calcium chloride is highly soluble and would be a satisfactory amendment especially when added to irrigation water.
- Lime with a large amount of organic manure is an effective amendment for improving sodic conditions.
- Sulphur-containing amendments (sulphuric acid, iron sulphate, aluminiumsulphate) are similarly effective because of the sulphuric acid originally present or formed upon microbial oxidation or hydrolysis.
- Growing legumes and using green manure will improve soil structure.
- Application of 25 % extra nitrogen can be recommended. Phosphorus, potassium and other limiting nutrients may also be applied based on soil test values

Irrigation Practices

- Sodic hazard can be reduced considerably if water is used alternatively or mixed with canal water. Conjunctive use of alkali and canal water will help bringing more area under protective irrigation and also in controlling rise in ground water table and associated problem
- Use of 20 % extra seed rate and a quick post sowing irrigation (within 2 – 3 days) for better germination and crop stand

Alternate land uses

- Preferred tree species like *Prosopis julifera, Acacia nilotica,* and *Melia azadiracta* can be grown.
- The horticultural plants like amla, ber, and bael (*Aegle marmelos*) can be grown with water salinity of 12 dSm^{-1}
- Medicinal plants namely Tulsi, ashwagandha, aromatic plants like vettiver, lemon grass and flower crops like Chrysanthemum, german chamomile, and periwinkle can also be recommended for soils under saline irrigation.

Reclamation Cost per hectare

Details	Rupees
1. Provision of sub-surface drainage	60000
2. Amendments	
a). Gypsum (based on gypsum requirement of soil. This varies from land to land. (@ Rs. 2800 / ton, average 2 ton /ha)	5600
b). Compost (5 t/ha)(@Rs. 6/kg)	30000
3. Seedlings (halophytes)	1100
4. Contractual labours (Rs165x20)	3300
Total (Rs)	1,00,000

63. **Intrusion of sea water into the borewells/wells in seashore area i.e. Thirukalukundram, Thiruporur and Chithamur and Pavunjur blocks. When this water is irrigated to the crop, the crop withers. Electrical Conductivity of this water ranges from 4-7. Suitable remedial measures may be suggested. (JDA,Kancheepuram).**

The maximum tolerant limit for the EC in irrigation water is 1.50 dS m^{-1}which is suitable for all crops and all types of soils. However if the EC of irrigation water exceeds 1.50 dS m^{-1} dilution techniques may be adopted to bring down the EC to the desired level. As per the query, the EC of water is 4 to 7 dS m^{-1} which is highly saline and suitable only for light and medium textured soils to grown tolerant crops such as Cotton, Brinjal, Curry leaf and fodder grasses. For growing other crops, the water needs to be diluted with good quality water or rain water by 3 to 5 times (1:3 or 1:5). Aside, crops can be cultivated in ridges and furrows.

64. **Biofertiliser Seed Treatment technology can be modified for Bio inoculants treated Seed supply (JDA, Coimbatore).**

- Technology for seed treatment with mixed inoculants containing *Azospirillum*, Phosphate Solubilizing Bacteria and PPFM has been developed by the Dept of Agrl Microbiology. However, designer seed technology for treating all the bio inoculants such as bioferilizers, bio control agents has been developed by the Department of Seed Science and technology, TNAU Coimbatore which may be test verified and recommended for adoption.
- Crop specific biofertilizer treatments are available in Crop Production Guide. The compatability of the crop specific biofertilizers with other bioinoculants will be taken up and suitable recommendation will be given.

65. Tannery effluent affected area: Recommendation of remedial measures for Leather Tannery effluent affected areas of Vaniyambadi and Ranipet. Cropping system (or) pattern may be suggested by conducting trials in the farmers field (JDA,Vellore).

For Tannery effluent affected area the recommendations are given in Crop Production Guide.

Crops and Varieties Suitable for Tannery Waste Affected Soils (Crop production Guide 2012-Page No. 323)

Based on the results of field trials conducted at Vellore district, the following crops, trees and their varieties are recommended for the tannery waste affected soils.

Cereals	Rice (TRY 1, CO 43, Paiyur 1, ASD 16)
Millets	Ragi (CO 12, CO 13)
Oilseeds	Sunflower (CO 4, Morden) and Mustard
Cash crops	Sugarcane (COG 94076, COG 88123, COC 771)
Vegetables	Brinjal, Bhendi, Chillies, Tomato (PKM 1)
Flowering crops	Jasmine, Neerium, Tuberose
Trees	Eucalyptus, Casuarinas and Acacia.

66. **At present pesticide firms are manufacturing new pesticides especially Insecticides and Fungicides for Paddy and Cotton crop. Now we are recommending very old, outdated Pesticides which will not fulfil the needs of the farmers. So suitable newer pesticides for paddy, cotton may be recommended (JDA,Vellore).**

The newer pesticide molecules are included in the recommendation of Crop Production Guide 2012 for paddy and cotton.

67. **Effective PP Chemical recommendation to control mealy bug (JDA,Trichy).**

Spray any one of the following recommended chemicals

1. Profenophos 50 EC – 2ml / litre
2. Buprofezin 25 EC – 2ml / litre
3. Dimethoate 30 EC – 2ml / litre
4. Thimoethoxam 25WG – 0.6g/litre

Profenophos or dimethoate can be combined with neem oil 20ml/l or Azadirachtin 10000 ppm 2ml/l. Add one ml of sticker / litre.

68. **Feasibility of Fertigation through Raingun and Sprinkler System may be suggested. (JDA, Perambalur).**

Fertigation through raingun and sprinkler system is feasible provided care should be taken on fertilizer concentration and on specific crops.

69. **Crop wise recommendation of new generation molecules pesticides and Biocides may be incorporated in Crop Production Guide (JDA,Karur).**

The newer pesticide molecules are included in the recommendation of Crop Production Guide 2012.

70. **Integrated approach to manage and control the wild boar menace is needed because nearly 20 to 30% of crop and yield loss occur due to this menace (JDA, Tiruvallur).**
Development of eco friendly chemical repellant for wild boar menace in groundnut (JDA,Theni).
Control of wild boar in cultivated area adjoining to forest may be suggested (JDA,Theni).

- By erecting solar fence along the agricultural field boundary
- Installation of used fish nets along boundary of fields

- For wild pigs management installation of white flags (2' x 1') randomly in the field that reduces the damage may be followed by the farmers.

71. **Introduction of conservation technologies in paddy and pulses cultivation is required (JDA, Nagapattinam).**

Irrigation water can be conserved by adopting SRI method for paddy and micro-irrigation for pulses. Research results are already available which may be popularised by the state department of agriculture.

72. **Seed treatment using synthetic polymer based nutrients to tide over stress condition may be suggested (JDA,Nagapattinam).**

Seed treatment with coloured polymers @ 2.3 ml / kg is recommended in different crops (maize, vegetable, pulses) for pre-sowing seed invigouration. Treated seeds also survive well under low water holding capacities (60 %). The treatmental cost will be Rs.1.00 per kg and cost of polymer is Rs.250/- litre. The studies on seed treatment using synthetic polymer based nutrients to tide over stress condition will be taken up to provide suitable recommendation.

73. **In sugarcane crop; Fertigation schedule for getting economic yield in drip irrigation system may be advated. (JDA, Erode).**

The following fertigation schedule can be adopted for sugarcane under drip fertigation for realizing increased yield and remunerative income.

Fertigation schedule for sugarcane (kg ha^{-1})

Crop duration	Nitrogen	Phosphorus	Potassium
0-30 DAP	39.40	0.00	0.00
31-60 DAP	50.60	26.25	9.00
61-90 DAP	56.50	20.50	14.50
91-120 DAP	60.20	16.25	16.00
121-180 DAP	57.80	0.00	40.50
181-210 DAP	10.50	0.00	35.00
Total	275.00	63.00	115.00

Urea may be used as nitrogen source and Muriate of Potash as source of potassium. For supplying phosphorus through drip fertigation, a suitable water soluble fertilizer may be used in combination with Urea and MOP.

This information is available in Crop Production Guide 2012 (P.No.260)

Drip Irrigation

- Planting setts obtained from 6-7 months old healthy nursery and planted in paired row planting system with the spacing of 30x30x30 / 150 cm. for manual harvest and 30/150 cm for machine harvest.
- Eight setts per metre per row have to be planted on either sides of the ridge thus making it as four row planting system.
- 12 mm drip laterals have to be placed in the middle ridge of each furrow with the lateral spacing of 240 cm & 8 'Lph' clog free drippers should be placed with a spacing of 75 cm on the lateral lines. The lateral length should not exceed more than 30-40 m.
- Phosphorus @ 62.5 kg ha^{-1} has to be applied as basal at the time of planting.

- Nitrogen and Potassium @ 275:112.5 kg ha^{-1} have to be injected into the system as urea and muriate of potash by using "Ventury" assembly in 10-12 equal splits starting from 15 to 150- 180 days after planting.
- Low or medium in nutrient status soil to be given with 50 per cent additional dose of Nitrogen and Potassium.
- Irrigation is given once in three days based on the evapotranspiration demand of the crop.
- The double side planting of sugarcane with lateral spacing of 120+40 cm under subsurface drip fertigation system improves the yield.
- Application of 125 % recommended NPK (Recommended NPK-275:63:112.5 kg ha^{-1}) through fertigation under pit system of planting improves the yield and yield attributes.

Concept of fertigation

- Fertigation is the judicious application of fertilizers by combining with irrigation water.
- Fertigation can be achieved through fertilizer tank, venturi System, Injector Pump, Non-electric Proportional Liquid Dispenser (NEPLD) and Automated system.
- Recommended N & K @ of 275 and 112.5 kg. ha-1 may be applied in 14 equal splits with 15 days interval from 15 DAP.
- 25 kg N and 8 kg K_2O per ha per split.
- Urea and MOP (white potash) fertilisers can be used as N and K sources respectively
- Fertigation up to 210 DAP can also be recommended.

Advantages of Fertigation

- Ensures a regular flow of water as well as nutrients resulting in increased growth rates for higher yields

74. **Bio-waste gas Plant may be designed to effectively utilizing *Prosopis* Biomass for energy purpose (JDA,Sivagangai).**

The biogas cannot be produced from *Prosopis* biomass. However, the prosopis biomass can be converted into value added fuel through pyrolysis process which is already being practised in many places.

75. **Scientific study on the effective utilization of Farm Pond constructed throughout the State may be carried out. (JDA, Coimbatore).**

The study will be carried out if provided with funding and beneficiaries list.
If funds are provided, study can be taken up by TNAU in collaboration with the state Agricultural Engineering Department.

76. **Peacock problem is experienced in Perundurai, Chennimalai and Sathyamangalam blocks of Erode District wherein Maize and Groundnut crops are fully damaged by Peacocks. So suitable remedial measures to manage the Peacock problem is to be suggested (JDA, Erode).**

The entire field may be covered with used fish net to control the Peacock menace. For want of food during drought peacock migrates to agricultural crops like maize and ground nut. The damage can be minimized by providing alternate food crops like sunflower, sorghum etc., in the border areas or providing alternate food grains for feeding to peacock.

77. **Mitigation measures for water stagnation areas during excess rainfall may be Suggested (JDA,Thanjavur).**

Condition of the crop	Recommendation
Just planted and young seedlings became decayed and population lost partly or completely due to prolonged submergence.	Short duration varieties like ADT 36, ADT 37, ADT 42, ADT 45 and ADT 4 may be transplanted or directly sow with germinated seeds
Young seedlings became decayed and population lost in patches	Replanting may be done with reserv seedlings or through removing exces seedling from the hill.
The young crop becoming yellow and pale yellow due to prolonged submergence and non-draining of water	This is due to nitrogen and Zinc deficiency. 4 Kgs of Urea and 1 Kg o Zinc Sulphate are to be mixed and dissolved in 200 l of water per acre o spraying with hand sprayer.
Panicle initiation and flowering stage – suffered due to prolonged submergence and low temperature	Foliar spraying of 2 % DAP
In many places, the crop became sunken due to nutrient deficiencies due to prolonged submergence	Top dressing with Ammonium chlorid @ 42 kg/ac or Ammonium sulphate (50 kg / ac. (or) urea (22 kg) + gypsu (18 kg) + neem cake (4 kg) / acre (M urea, gypsum and neem cake thoroughly and keep it for overnight. then add 17 kg of MOP and apply)
Matured crops Completely submerged in water	Drain the maximum water and collec and dry the ear heads immediately

Plant protection measures

- **Leaf folder**: Spraying of Profinophos 50 EC @ 400 ml /acre or Manocrotophos 36 WSC @ 400 ml /acre or Chloripyriphos 20 EC @ 500 ml /acre is recommended when the crop damage crossed the ETL of 10 % leaf damage. If the adult moths are attracted in large number to the light traps, the egg parasitoid *Trichogramma chilonis* @ 2cc /acre has to be released at weekly intervals for three weeks. While top dressing, urea should be mixed with neem cake and applied
- **Rice blast**: Spraying of Carbendazim @ 200g/acre or Tricyclazole@200 ml/acre in 200 litre of water is recommended or Application of *Pseudomonus* @ 1 kg/acre (One kg of *Pseudomonus* mixed with 30 kg of sand thoroughly and evenly broadcasted in the field).

78. **Cost effective technology in water harvesting, may be suggested. (JDA,Thanjavur).**

Using abandoned/ defunct wells on farmer holdings for rainwater harvesting. Tamil Nadu state has large number of abandoned open well and their numbers is on the rise. The farmers may be encouraged to plan and execute structures on their farms to collect the rainwater, direct to the abandoned wells and thereby recharge the groundwater. This will help to harvest the rainwater in relevant areas besides utilizing the capital investments that have already been made by the farmers.

79. **Clarifications about Quality control regulations of Bio products (*viz* – Bio –N, Bio- K, Bio-P,Bio-Zn etc) are required (JDA,Madurai).**

Quality standards (BSI standards) are available for Nitrogen fixing microorganisms such as *Azospirillum, Azotobacter, Rhizobium ,* Phosphate solubilising microorganisms and mycorrrhizae only. The standards available for the above organisms are applicable for potash releasing bacteria. Refer the FCO recommendations for bacterial culture used for agriculture.

80. **Suitable Green Leaf Manure, Green Manure crop must be recommended and seeds made available in rainfed areas of Peraiyur, Usilampatti and Thirumangalam taluks (JDA, Madurai).**

Green manure seeds *viz.,* daincha and sunnhemp seed production have been taken up under NADP scheme. Around 20 tons of seeds are available in different seed production centres of TNAU.

81. **Farmers in Vellore district prefer fine grain variety. Normally improved white ponni variety is preferred by farmers for samba season. But this variety is susceptible to lodging nature and the quality of grains also varies according to the region and soil type. Hence a suitable fine grain variety to overcome the above problems may be recommended (JDA, Vellore). (CPBG)**
Popular super fine rice variety-Improved White Ponni (IWP) is lodging type and susceptible to neck blast disease. This variety may be improved further for Medium height, High Yielding and Blast resistance (JDA, Salem). (CPBG)
New fine variety of Paddy like IW Ponni withmedium duration may be suggested (Villupuram). (CPBG)
New fine grain variety with resistance to Blast and Leaf folder resistance required to replace JGL-1798 (JDA, Madurai).

Promising cultures, CB09123 and AD08142 have been tested under ART and large scale on-farm testing with fine grain type.
Rice cultures CBMAS14142, a fine grain variety developed through marker assisted selection has been identified as an alternate to I.W. Ponni. This is non-lodging, requires less water and is in the first year of multi-environment testing.
Another culture AD09493 is under first year of MLT.
The rice variety ADT49 may be recommended

82. **Traditional varieties such as Zeeraga samba and Kitchidi samba are highly preferred by farmers and have got good marketing potential. Varieties equivalent to or having the traits of the above said varieties may be evolved for Vellore district. Farmers of Vellore District need a suitable "Scented Paddy variety" for Samba (July- September) sowing season with high yield potential (JDA, Vellore).**

One culture VGD 09006 has the potential to double the yield with similar grain quality as Jeeraga samba. The culture is being tested under MLT in this year.

83. **Requirement of non-lodging varieties in paddy for Samba, Sufficient Hybrid paddy seeds availability may be ensured. Fine paddy varieties with short duration is needed for Samba (JDA, Thiruvanamalai).**

ADT49 is non-lodging and can be popularized during samba season. Cultures *viz.,* AD 12126, AD 12139, AD 12173 are non lodging and are being tested under ART.

84. **Saline / alkaline tolerant variety recommended for Thoothukudi district is TRY 2 which is medium in duration. We require a short duration saline alkaline tolerant variety suitable to tail end area of Thamirabarani River basin (JDA, Tuticorin).**

The variety CO47 maturing in 120 days maybe recommended for the saline patches.

85. **ASD 16 which is found to be normally grown variety in this district is showing variation in the recent past. Hence suitable alternate variety on par with ASD 16 may be suggested (JDA, Tuticorin).**

The variety TPS 5 is recommended as a alternate variety for ASD 16.

86. **Less water requiring drought tolerant variety suited to tail end area of Thamirabharani basin may be suggested (JDA, Tuticorin).**

The drought tolerant variety Anna (R) 4 may be suggested for the tail end area of Thamirabharani basin.

87. **The paddy MDU5 is best suited for Ramanathapuram with only 95 days duration. But the cooking quality of MDU-5 paddy rice is sticky and not preferred by farmers. But this variety is highly drought tolerant. Hence, this variety may kindly be improved for its cooking quality (JDA, Ramanathapuram).**

The rice cultures CB09512, CB08702 and CB06803 were found to be drought tolerant and maturing in 100-110 days with good grain quality and cooking characteristics. They were evaluated under MLT at ARS, Paramakudi and promoted for ART this year. The varieties may be evaluated under ART at Ramanathapuram district and results may be informed.

88. **In Ramanathapuram district, in Thiruvadanai taluk, nearly 45000 Ha is sown regularly with BPT-5204 paddy variety. But BPT- 5204 is susceptible to grain smut. So, the alternate variety ADT(R) 49 seeds are required. (JDA, Ramanathapuram)**

Seed strategic plan has been prepared by the State Government in consultation with TNAU during March - April at TNAU and Chennai. As per the requirements of Department of Agriculture TNAU has agreed to supply 80 tonnes of labelled seed. This base material can be utilized by the Department for further multiplication to cover the entire (45,000 ha) area.
ADT49 was released as a replacement for BPT 5204. Cultures *viz.,* CB 09123 , AD 08142 have been tested under ART and large scale on-farm testing as another potential replacement for BPT 5204.

89. **PADDY - In Vellore District short duration varieties like ADT43, ADT37 and ADT45 are being predominantly cultivated. But supply of breeder seeds is insufficient. Hence sufficient quantities of breeder seeds may be supplied (Vellore).**

Supply of breeder seed is done based on the indented quantity by the department. TNAU can supply the breeder seeds provided necessary indents are placed.

90. **2000 kg of ADT(R)49 Paddy foundation sees are required for samba 2014-15. This variety is suited for good rainfall situation (Ramanathapuram).**

The required quantity of breeder seeds of ADT(R)45 may be intended for further multiplication as foundation seeds by the Department of Agriculture as per the plan.

91. **The drought tolerant variety Anna(R)4 has been planned for nearly 15000 Ha in samba in Ramanathapuram district. For this 750 Mt of Anna(R)4 paddy certified seeds are required. Requested that 750 Mt of Anna(R)4 certified seeds may be arranged from TNAU. Also 250 kg of Anna(R)4 Breeder seeds may be given for seed multiplication in samba 2014-15. (Ramanathapuram)**

The University has committed to supply 70 tonnes of labelled seed as per the seed strategic plan prepared by the State Government during March – April. In addition, the required quantity of breeder seeds may be intended well in advance and will be utilized for multiplication in seed chain by the Department of Agriculture as per the seed plan.

92. **A new variety may be suggested to replace ADT-43 with non-lodging characters with same grain quality in Kuruvai season (JDA, Nagapattinam).**

The new variety CO 51 to replace ADT 43 which is non lodging and with similar grain quality has been released for kuruvai cultivation in Tamil Nadu.

93. **A new variety may be suggested to replace CR 1009 (or) SAVITHRI long duration paddy variety with higher grain yield with same grain quality since it is ruling for the past 40 years. (JDA, Nagapattinam).**

ADT 50 was released as a replacement for CR1009 with improved grain quality. A new version of CR1009, CR1009 sub1 with 10 per cent higher yield is being popularized.

94. **Since harvesting paddy is done by combined harvester, a large quantity roughly 5-8% is being wasted due to severe shedding at harvest. Hence research should be concentrated on less-shedding paddy varieties and such character should be introduced in the ruling varieties also. (JDA, Nagapattinam).**

Research will be concentrated on paddy varieties with moderate shedding since non-shattering varieties are also not preferred.

95. **A short duration Paddy variety with salt tolerance may be suggested. (JDA, Nagapattinam).**

The rice variety CO 47 maturing in 120 days is suggested for Nagapattinam district which has tolerance to salinity. Cultures *viz.,* TR 09030, TR 05031 are being tested under ART.

96. **In Namakkal District, Nearly 4500 hectares of areas are covered under IR20 variety. Even though several medium duration varieties have been evolved so far, this IR20 variety is still the ruling variety in Mettur canal system area (East Bank canal in Pallipalayam block of 11 Revenue Villages) of this district. Since it is high yielding and suitable for samba season of this particular paddy tract its performance in productivity-wise may be taken up for improvement study and released as "Improved IR20" as similar to "Improved white Ponni" variety (JDA, Namakkal).**

The variety IR 20 was released during 1970 and the variety CO43, is an improved variety of IR20 coupled with salinity tolerance and released during 1982. Recently to replace the variety CO43, s new variety CO50 was released during 2009, maturity in 135 days duration. The variety has an average yield of 6400 kg/ha with 10 per cent higher than ADT 46 and 15 per cent higher than IR 20.

Presently 8000 kg of TNAU labelled seeds are available in the Department of Rice and hence request the Department of Agriculture to popularize the variety CO50 among the farmers for replacing IR20 which is already in genetic deterioration over periods. Already a letter about the availability of seeds of this variety CO50 has been informed to the JDA, Namakkal and Karur.

97. **In Kolli hills block, hilly track (1200 MSL) of Namakkal District, during early samba season farmers are growing paddy Variety "Wyanad II" with longer (5 months) duration having lower yield potentiality. This paddy variety is non lodging, low tillering, bold grains and Red rice variety which is consumed by the tribal people of this tract. This variety is to be replaced by new paddy variety with high productivity suited for Kolli hills region (JDA, Namakkal).**

In Kolli hills, demonstrations with rice variety CO50, were conducted by the Dept. of Seed Science and Technology, TNAU, Coimbatore. The variety CO50 is blast resistant, high yielding, non lodging, high tillering and with white rice like IR20, CO43. The variety has also been evaluated in FLD in Gudalur, Ooty district and found to be have 50 per cent high yield than the local variety Bharathi. Hence the variety CO50 can be taken to tribal areas for adoption.

98. **For enrich of soil health suitable technology in the intercropping of green manures in SRI Field and incorporating in same by conoweeder at 20 DAS may be suggested.(Joint Directors of Agriculture, Cuddalure)**

Intercropping of green manuring in SRI field is not recommended.

99. **A high yielding fine grain blast resistant Variety may be suggested for samba season as an alternative for BPT5204. (JDA, Trichy).**
Paddy normal cultivation area is 25000 Ha. In 40-60% of area covered under BPT 5204 variety. It is most susceptible to BPH in Krishnagiri District. Hence the variety is to be replaced with a variety more resistant to BPH (JDA, Krishnagiri).
Blast resistant superfine medium duration Paddy variety may be suggested (JDA, Tirunelveli).

To replace BPT 5204 Paddy variety, suitable variety is requested for Villupuram district (JDA, Villupuram).

The rice cultures CB09123 and AD08142 are found to possess fine grain with resistance to blast and suitable as an alternative for BPT 5204.

100. **High yielding superfine short duration rice varieties with having high yield potential than the existing fine rice varieties may be suggested. (JDA, Erode).**

The rice cultures CB08504 and CB08513 identified as superfine short duration rice varieties with high yield potential than the existing fine rice varieties are evaluated under ART 3/2014-15 and ART 14/2014-15 in TN.

101. **Suitable control measures to control False Smut may be given and also an alternate variety to replace CO43 with False Smut resistance may be suggested (JDA, Tirunelveli).**

ADT46 and ADT38 are the medium duration varieties with moderate to low incidence of false smut.
Spraying of copper hydroxide (2.5g/lit) once at 10 % flowering and the second at 75% flowering. Resistant variety – CO50.

102. **Paddy variety suitable for area affected by sewage water may be evolved. Rainfed Paddy Variety suitable for the hilly tracts may also be suggested (JDA, Salem).**

Varieties to withstand problem soils such as CO43, TRY1, TRY2 and TRY3 may be tried.

103. **Alternative of Basmathi rice for Cauvery delta zone may be suggested (JDA, Thanjavur).**

Basmati rice is produced in North India only under “Geographical indicator”.

104. **Release of food varieties in different suitable for diabetic patients, arthiritis affected persons, small kids and lactating women may be suggested (JDA, Thanjavur).**

Traditional varieties are believed to have these traits and efforts are underway to scientifically validate their properties.

105. **Short duration (75- 80 days) varieties of rice for Cauvery delta zone may be suggested (JDA, Thanjavur).**
New short duration variety for Samba season under Tank fed area with less than 105 days duration may be suggested (JDA, Villupuram).

Five extra early rice varieties *viz.,* ADT48, MDU5, CO41, Prasanna and Anjali are to be evaluated in this year.

106. **Breeder seed for CR1009 *Sub 1* variety for submergence condition may be supplied. (JDA, Thanjavur).**

Breeder seeds of *CR1009 Sub1* will be supplied after the variety is released and notified.

107. **Non lodging varieties for paddy for Cauvery delta is needed (JDA, Thanjavur).**

CO51, ADT49 and CR1009 Sub1 are moderately lodging resistant.

108. **Suitable weed management practice for machine transplanted rice cultivation may be Suggested (JDA, Villupuram).**

Pre-emergence application (PE) Butachlor 1.25 kg a.i. /ha followed by hand weeding on 30 DAT **(or)**
PE pretilachor (Rifit 50 % EC) 1.0 kg a.i. /ha followed by Twin row rotary weeder weeding at 30 DAT **(or)**
PE Pyrazosulfuron ethyl (Sathi 10% WP) 20 g/ha followed by hand weeding on 30 DAT **(or)**
PE butachlor 0.75 kg a.i. / ha+ bensulfuron methyl (Londax 60% DF) 50 g /ha (Tank mix) followed by hand weeding / mechanical weeding on 30 DAT **(or)**
Pre-emergence application (PE) Butachlor 0.75 kg a.i. /ha followed by 2,4-D sodium salt (Fernoxone 80% WP) 1.25 kg a.i. /ha in 3 - 4 leaf stage of weed **(or)**
Early post emergence (EPOE) Bispyripac sodium (Nominee gold 10 % EC) 50 g /ha (2-3 leaf stage of weeds) followed by hand weeding on 45 DAT, if needed.
Early post emergence application of Bispyribac sodium 50 g a.i. ha^{-1} (2-3 leaf stage of weeds) +Hand weeding on 45 DAT is recommended.

109. **Drip Irrigation and agronomy practices required for drought condition (JDA, Villupuram). Popular super fine rice variety- Improved White Ponni (IWP) is lodging type and susceptible to neck blast disease. This variety may be improved further for Medium height, High Yielding and Blast resistance (JDA, Salem).**
Fine grain varieties suitable for cultivation under drip irrigation may be suggested (JDA, Dharmapuri).

Suitable varieties will be suggested after studying the feasibility of rice under drip fertigation.
All the high yielding variety of rice including fine grain varieties like BPT 5204 and ADT 45 are suitable for drip irrigation. However yields will be higher with CR1009 and hybrids under drip irrigation.

110. **Motorised single wheel Cono-weeder may be designed (JDA, Salem).**

TNAU SRI power weeder is an efficient machine for weeding in SRI method of cultivation.

111. **Improvement of existing direct sowing technology with reference to weeding, fertilisation *etc*. (JDA, Madurai).**

In direct wet seeded rice, pre-emergence application of pretilachlor 0.75 kg a.i. /ha on 8 DAS followed by one hand weeding on 40 DAS is recommended. Application of N and K in four equal splits at 21 DAS, active tillering, panicle initiation and heading stages.

112. **Suitable drought tolerant variety for Madurai District may be suggested (JDA,Madurai).**

The drought tolerant variety Anna(R)4 may be suggested for the tail end area of Thamirabharani basin.

113. **Poor performance of SRI method in low lying areas with no drainage (Ayacut areas) must be studied and new recommendation may be Suggested (Madurai).**

Perfect land levelling with proper drainage is the important pre- requisite for the adaption of SRI. SRI method of rice cultivation in low lying areas without proper drainage may not be feasible.

114. **Time and quantity of P recommendation required if ''P'' was not able to be applied before transplanting due to North East Monsoon heavy rain (JDA,Madurai).**

The same quantity of recommended dose of P should be applied after rain.

115. **Bengalgram - Variety with bold grains required for marketing (JDA, Coimbatore).**

Bold seeded bengalgram CO4 (30-32g/100 grain) may be recommended.

116. **Redgram - Variety suited to all seasons may be Suggested (JDA, Coimbatore).**
Redgram - SA1 variety is mainly grown in rain fed condition. But the average yield of Redgram was low as they were mostly raised as intercrops and not as pure crop. Hence, the Researchers are requested to suggest a Redgram variety with synchronized maturity for one time harvesting and a variety possessing complete resistant to sterility mosaic disease (SMD). VBN2 Redgram is also being introduced but its performance is not so good as SA1 (JDA, Vellore).

The photoinsensitive redgram varieties *viz*., CO(Rg)7 (120-130 days) and VBN(Rg)3 (110 days) are suitable for all the seasons.

117. **Farmers of Vellore Block needed Pulses hybrids especially. in redgram, blackgram and greengram-some private companies have already introduced hybrids in pulses. Suggestions and Recommendations on the suitability above hybrids may be provided (JDA, Vellore).**

The redgram hybrids development programme is in progress at Coimbatore. Two redgram hybrids *viz.*, CPH3 (120-130 days) and CPH09-03 (180 days) are in advanced stage of evaluation. ICRISAT has released redgram hybrid ICPH 2671(Pushkal) which is grown in Andhra Pradesh and Maharashtra.
Hybrid development programmes in blackgram& greengram are not pursued.

118. **High yielding Redgram varieties suitable for transplantation; probably with short duration period may be Suggested (JDA, Thiruvanamalai).**

Redgram CO(Rg)7 (120-130 days) evaluated under Transplanting with drip fertigation at Thanipadi in Thiruvannamalai dist. recorded higher yield (1684 Kg/ha) which can be recommended.

119. **Most of the rainfed farmers in Thoothukudi District are using weedicides like Pursuite, Turgasuper etc, in Pulses. Proper dosage and time of application for the above weedicides may be suggested. Moreover clarification regarding the ill effects in using the above said weedicides may be provided. (JDA, Thoothukudi).**

The recommended early post emergence weedicides like pursuit and Turgasuper with the dose of each at 500 ml ha^{-1} are to be sprayed on 15-20 days after sowing for pulses.
PE Pendimethalin 1.0 kg a.i. /ha followed by hand weeding on 30 DAS
EPOE quizalofop ethyl (Targa super 5 %EC) 50 g /ha + Imazethapyr (Pursuit 10% SL) 50 g / ha (Tank mix) 2-3 leaf stage of weeds.
The above herbicides are safe herbicides provided they have to be sprayed with right quantity at right time.
Under rainfed situation, herbicide has to be sprayed only when there is sufficient soil moisture.

120. **Blackgram seed rate has to be increased to 30 kg/Ha against the present 20 kg/Ha because of the crop loss due to machine harvesting of paddy crop. Suitable guidelines may be issued (JDA, Nagapattinam)**

For Rice fallow blackgram, 30 kg/ha is the recommended seed rate to maintain the optimum population

121. **Rice fallow pulses is the main cash crop in our district. Blackgram ADT3 is the ruling variety for more than 20 years. A good high yielding variety suitable for rice fallow condition may be suggested (JDA, Nagapattinam).**
Suitable variety to replace ADT3 for rice fallow sowing having drought resistant character and high yielding may be suggested (JDA, Cuddalore).

One Killikulam blackgram culture KKB-05-011 (COBG 643 x Vamban 3) with 70 – 75 days duration and moderately resistant to YMV is under OFT in rice fallow condition. This culture performing well in Thamirabarani delta area and it is under evaluation in the farmers holding of Thanjavur, Nagapattinam and Thiruvarur districts (Cauvery delta area) along with popular blackgram variety ADT 3 under rice fallow condition during 2014-15.
Three blackgram cultures *viz*., ADB13004, ADB13016 and ADB 13017 were performed well in station trials. Its performance will be confirmed in the ensuing season along with the pest and disease resistance and best performing culture(s) will be nominated for MLT.
The alternate variety for ADT3 is VBN4 blackgram may be adopted. The advanced blackgram culture *viz*., KKB 05-011 is being tested in OFT under rice fallow condition.

122. **In the case of greengram ADT3 and KM2 are very old varieties and still ruling the district. A high yielding variety to replace this may be suggested (JDA, Nagapattinam).**

The greengram mutants *viz*., ADG 13009, ADG13014, ADG13041 and ADG13044 were found to be performed well under rice fallow conditions. The performance of these greengram mutants will be re-evaluated for further confirmation. ADG13014 is also resistant to MYMV.

123. **In rice fallow pulses weed problem is increasing year by year. Hence the perfect solution has to be provided to control the weeds, especially weeds like *Panicum* species and *Cuscuta* species (JDA, Nagapattinam).**

Early post emergence (EPOE) application of Quizalfop ethyl @ 50g ai/ha and Imazethapyr @ 50g ai/ha recommended on 15-20 DAS are found to be effective under rice fallow condition.
Under rice fallow conditions application of EPOE quizalofop ethyl (Targa super 5 %EC) 50 g /ha + Imazethapyr (Pursuit 10% SL) 50 g / ha (Tank mix) at 2-3 leaf stage of weeds is recommended.
Quizalofop ethyl is an effective herbicide for the control of grassy weed *Panicum* sp.
Cuscuta is not a common problem under rice fallow condition.

124. **Suitable Rice fallow pulses sowing method required in combined harvester used field may be suggested (JDA, Cuddalure)**

At present broadcasting with 25 percent extra seed rate is recommended for machine harvesting field and sowing three days before harvesting is recommended.

125. **Drought resistant, water logging resistance varieties in blackgram and Greengram may be suggested for rice fallow cultivation (JDA, Trichy).**

The advanced blackgram culture *viz*., KKB 05-011 is being tested in OFT under rice fallow condition.

126. **Phyllody resistant, high yielding and drought resistant variety for Masipattam (February sowing) may be suggested (JDA, Trichy).**

The Sterility Mosaic Disease resistant redgram varieties *viz*., VBN (Rg) 3 and CO(Rg) 7 are recommended.

127. **Pulses intercropping in turmeric area has come down because of chemical weedicide usage. To bring pulses intercrop area in turmeric crop, suggestion of biological weed control method is needed (JDA, Erode).**

Biological weed control is for a specific weed. eg. Parthenium management with Mexican beetle (*Zygogramma bicolorata*) which will not feed on other crops. Where as in field condition, there will be a diversified weed flora, for which no biological method of weed control has not been evolved so far. At present no biological weed control is available.

128. **Redgram short duration variety is needed which is suitable for sowing is early kharif (JDA, Krishnagiri).**
Suitable poly bag photo insensitive Redgram variety may be suggested (JDA, Perambalur).
New variety may be suggested as high yielding, short duration redgram variety for Rabi in Villupuram District (JDA, Villupuram).

The photoinsensitive redgram variety , CO(Rg) 7 (120-130 days) is suitable for early *Kharif*.

129. **Alternative method of DAP Application may be recommended for rice fallow pulses as foliar spraying of DAP cannot be done, because of non availability of water during February and March (JDA, Cuddalore).**

Spraying of TNAU pulse wonder @ 5.0 kg $^{ha-1}$ is recommended at flowering stage may be advocated instead of 2 times DAP spray for pulses.
Broadcasting of 50 kg DAP per hectare to rice at last irrigation recorded 25.6 and 8.1 percent higher yield of rice fallow blackgram over control and over 2% DAP+1% KCl foliar spray twice on 30 and 40 DAS.

130. **Like Rice fallow Pulses crop in delta area , Rice fallow Gingelly variety and cultivation Technologies may be suggested (JDA, Cuddalore).**

Study will be carried out to develop the technology on rice fallow gingelly.

Gingelly Varieties viz., TMV 3, TMV 4, TMV 6, TMV 7, CO 1, VRI (SV) 1, SVPR1, VRI (SV) 2 are suitable. The technology details are given below.

Seed rate	:	5 kg/ha
Seed treatment	:	Azophos @ 1200g/ha of seeds
Spacing	:	30 x 30 cm
Blanket recommendation	:	23 : 13 : 13 kg NPK/ha as basal
Micronutrient	:	Apply Manganese Sulphate @ 5 kg/ha s basal.
Thinning	:	To be done on 15 and 30 DAS and maintain one seedling per hill.
Weed management	:	Apply pre emergence herbicide Pendimethalin @ 1 kg a.i. /ha and one hand weeding on 30 DAS.

131. **Seed treatment using synthetic polymer based nutrients to tide over stress condition may be suggested (JDA, Nagapattinam).**

To overcome stress condition, harden the blackgram seeds in 100 ppm ZnSO4 and greengram seeds in 100 ppm $MnSO_4$ for 3 hours in seed to solution ratio of 1:0.3 and dry back the seeds to original moisture content (8-9%) under shade.

132. **Suitable measures may be suggested to control yellow mosaic virus problem in Black gram (JDA, Karur).**

Growing resistant varieties, seed treatment with Imidachloprid @ 5g/kg of seed, spraying of Dimethioate @ 3 ml/lit of water are recommended to control whitefly, which is transmitting the disease.

- Grow resistant varieties such as VBN 4 and VBN 6
- Seed treatment with Dimethoate (or) Imidacloprid @ 5 ml /kg of seed
- Installation of yellow sticky traps 12 nos/ha
- Rogue out the infected plants up to 45 days
- Foliar spray of notchi leaf extracts 10% at 30 DAS or neem formulation 3 ml/lit.
- Spray methyl demeton 25 EC 500 ml/ha or dimethoate 30 EC 500 ml/ha or thiamethoxam 25 WG 100 g/ha and repeat after 15 days, if necessary.

133. **Severe problem is faced in the control of storage pest namely Bruchids in pulses. Proper control measures may be recommended for control of Bruchids (JDA, Tuticorin).**

- Dry the seeds adequately to reduce moisture level to 10 %.
- To monitor the presence of pulse beetle population in the stored produce, use pitfall traps or two in one model trap to assess the time of emergence of field carry over population of pulse beetle in storage.
- If the bruchids are present, the seeds may be sundried.
- Mix any one of the following for 100 kg of seed
- Malathion 5 D 1 kg or Pungam oil 1 lit. or Neem oil 1 lit.
- Pack in polythene lined gunny bags for storage

Reduce the seed moisture content around 8-10%. Seeds/grains meant for consumption purpose must be treated with edible oil @ 10 ml/kg. Seeds meant for consumption purpose may be stored as broken dhal. Seeds meant for sowing purpose may be treated with neem oil @ 10ml/kg of seed.

134. **Pulses is cultivated in an area of around 65000 ha in Thoothukudi district. Sphingid moth incidence is becoming a major problem in our district. It occurred in a wide spread area of northern tracts of Thoothukudi and devasted major area. Hence suitable variety resistant to sphingid moth may be evolved and suitable control measures for this area may be recommended (JDA, Tuticorin).**

Spray any one of the following insectcides (Spray fluid 500 l/ha)

- Emamectin benzoate 5 SG 220 g/ha
- Indoxacarb 15.8 SC 333 ml/ha
- NSKE 5% twice followed by triazophos 0.05%
- Neem oil 2%
- Phosalone 0.07%

There is no resistant variety against sphingid. Spraying of indoxacarb 15.8 EC@ 0.75 ml/lit may be recommended.

135. **Suitable technology for multi blooming may be fine tuned for yield increase in Blackgram (JDA, Villupuram).**

In Blackgram, application of 25-30 kg of Urea as top dressing at 40-45 days after sowing is recommended for multiblooming technology.

Technology for Multiblooming in Blackgram

- Sowing blackgram ADT 5 and T9 during *Chithirai pattam* (March 15- April 15) with multi blooming technique
- Optimum plant population 33/plants/m^2
- Seed treatment with bio-fertilizers and bio-control agents.
- Application of fertilizers @20:50:25:20 kg N:P:K:S/ha
- For multi-blooming. Additionally 25 kg N/ha is to be applied in 3 equal splits at 30, 45 and 60 DAS.
- Foliar sprayings of 2% DAP+1% KC1+40 ppm NAA on 30 and 45 DAS (or) Pulse wonder @5 kg/ha in 500 liters of water once
- Pheromone traps @ 13/ha to attract and kill prodenia
- To control leaf beetles and Pod borer, Neem seed kernal extract @ 5% or neem oil@ 3% can be sprayed.
- Seed treatment with *Trichoderma viride* @ 4 g/kg of seeds of *Pseudomonas* @ 10g/kg or Carbendazim @ 2 g/kg must be done to prevent root not disease.

136. **In Madurai district 70% of area under redgram crop is rainfed. Suitable alternate technology for transplanting for these areas may be suggested (JDA, Madurai).**

Transplanting of redgram is not feasible under rainfed situation.

137. **Bund cropping of blackgram in rice fields is traditionally followed in Melur Taluk. Since the bunds are narrow, suitable variety with less leaf area and with resistance to yellow mosaic is required. KM-2 Green gram though Old Variety, perform well in Peraiyur Taluk .But Breeder seeds are in short supply .(JDA, Madurai).**

The blackgram varieties, VBN (Bg) 5 and CO 6 may be recommended for bund cropping.

138. **Varieties tolerant to water stagnation is required(JDA, Madurai).**

Advanced culture *viz.,* KKB 05-011 in blackgram is being tested in OFT water stagnated condition.

139. **Suitable greengram variety with short duration with single/two harvests is required (JDA, Madurai).**

Greengram variety CO8 matures in 55 days and is determinate plant type with synchronous maturity, hence it is suitable for single/mechanical harvest.

140. **Fertilizer management under excess rainfall condition is required (JDA, Madurai).**
In some areas in Vellore district salinity problem exists. To combat this problem a saline tolerant Paddy variety may be suggested (JDA, Vellore).

Fertilizer recommendations are normally developed by considering the soil fertility and crop requirement and not based on the environmental situations. However, for overcoming the nutrient loss from applied fertilizer source during rainy season, crops can be grown with raised beds at 30 cm intervals having 5 m length, 80 cm width, and 15 cm height.
For reclaiming the saline soils (EC > 4 dS m^{-1}), providing lateral and main drainage channels (60cm deep and 45cm wide), application of green leaf manure at 5 t ha^{-1} at 10 to 15 days before transplanting, addition of 25% extra dose of N in addition to the recommended P and K and $ZnSO_4$ at 37.5 kg/ha at planting can be adopted. The paddy varieties viz., TRY 1 and TRY 3 are suitable for salt affected soils.
For Vellore district, the short duration rice variety CO 47 with duration of 120 days can be suggested to combat salinity problem. Already released high yielding varieties *viz*., CO43, TRY1 and TRY 3 are also available.

141. **Similar to cotton picking machine, mechanised harvester for pulses is also required in Thirumangalam (JDA, Madurai).**

Class combine harvester and Kartar combine harvester are suitable for harvesting of blackgram and greengram. Commercially available combine are suitable for blackgram and green gram. A wheel type CLAAS combine is under use at NPRC, Vamban. This machine can be used for twisely harvesting.

142. **Variety suitable for late sowing (August, September) may be suggested for transplanted Redgram (JDA, Dharmapuri).**

The photoinsensitive redgram variety, CO6 (180 days) may be recommended.

143. **The local variety called kona-kai is rust and drought tolerant and suitable for both rainfed and irrigated condition. This can be taken up for breeding work and may be released as improved variety (JDA, Dharmapuri).**

Local cowpea type Konakai seeds from Dharmapuri area were collected and evaluated along with Paiyur 1 variety at RRS, Paiyur. The yield performance of the local type was very low when compared with Paiyur 1. Paiyur 1 is high yielding, yellow mosaic virus resistant and suited for fodder purpose also.

144. **To encourage the farmers for cultivating major and minor millets suitable salt resistant, drought resistant varieties with high nutritional content may be suggested (JDA, Kancheepuram).**

In general, ragi and kudhiraivali crops are tolerant to salinity and varagu, tenai and Panivaragu are tolerant to drought. Hence, these crops can be recommended for abiotic stress.

145. **In cholam, 5 years back K8 was the predominant variety in Thoothukudi district. Now also K8 variety is performing better in our district. But we are facing heavy problem in procurement of K8 seeds from seed farms because of the poor germination percentage after harvest and processing. We require proper technology to increase the germination percentage of K8 Cholam. Moreover any other new variety suitable for black cotton soil of Thoothukudi district may be recommended. Recently, from the Multi Location Trial Conducted at ARS, Kovilpatty, a culture No. TKSV 0809 whose performance found to be satisfactory can be developed as a variety and seeds can be supplied to Thoothukudi District for distribution to farmers (JDA Tuticorin).**

The culture TKSV 0809 is recommended for release by the Crop Scientist Meet 2014 and the release proposal will be submitted for approval.

146. **Juicy type of sorghum variety suitable for grain and fodder in rainfed areas may be suggested (JDA Dindigul).**
Suitable Drought Tolerant Dual purpose Cholam varieties may be suggested. (JDA Karur).
Cholam- Need a variety suitable for both seed and fodder purpose as well as drought tolerant (JDA ,Coimbatore).

TNAU sorghum variety Co 30 is dual purpose variety with an average grain yield of 2800 and 3600 kg /ha and fodder yield of 7 and 9 tonnes/ha respectively in rainfed and irrigated conditions is recommended.

147. **Hybrid cholam having potential yield of 5 MT/Ha with short stature may be suggested (JDA Virudhunagar).**

In Tamil Nadu sorghum is grown for both grain and fodder purpose. With this consideration, a short duration dual purpose TNAU hybrid Sorghum Co 5

suitable for cultivation all over Tamilnadu both under rainfed & irrigated conditions with grain yield potential of 2792 kg/ha and 4355 kg/ha respectively had been released during the year 2011.

148. **Cholam - An improved variety may be suggested and sufficient Breeder seed may be supplied to replace Co.19 during Khariff season. (JDA, Vellore).**

CO 30 is an improved dual purpose variety. Based on the indent the breeder seed will be multiplied and supplied in sufficient quantity.

149. **Sorghum: In Namakkal District, Cholam Co.4 variety is highly preferred by farmers both in Rainfed and Irrigated seasons due to its palatability, Red colour grains, shorter duration (95 days) and compact earhead. Since it is a ruling variety of cholam tract, this variety may be improved and released with high yield potential. None of other redgrain sorghum varieties are suitable to this area.(JDA ,Namakkal).**

A short duration (95 days), high yielding (2100 kg/ha) red grain sorghum variety Paiyur 2 is recommended for rainfed areas of Salem district. It is also suitable for fodder with a dry fodder yield of 8.7 tons/ha.

150. **Cholam An effective short duration hybrid to replace private hybrid seeds in Black Cotton soil tract of Thoothukudi District is needed (JDA,Tuticorin).**

In Tamil Nadu sorghum is grown for both grain and fodder purpose. With this consideration, a short duration dual purpose TNAU hybrid Sorghum Co 5 suitable for cultivation all over Tamilnadu both under rainfed & irrigated conditions with grain yield potential of 2792 kg/ha and 4355 kg/ha respectively had been released during the year 2011.

151. **RAGI - In Vellore District farmers are widely cultivating GPU 28. A suitable variety for irrigated condition for November - December sowing may be suggested (JDA,Vellore).**

In particular, CO 15 has recorded 4175 kg/ha in Vellore district under irrigated condition which is 23 per cent increase over GPU 28 that recorded 3400 kg/ha. Hence, the high yielding ragi variety CO 15 can replace GPU 28 and be recommended for Vellore district suitable for irrigated condition.

152. **RAGI - Developing of high yielding and drought resistant varieties suitable for Thalavadi and Bargur hilly tracks of Erode Districts may be suggested. (JDA ,Erode).**

Ragi variety CO 15 is released during 2013 to replace GPU 28 in ragi growing areas. The average grain yield of CO 15 under rainfed condition over 78 trials is 2950 kg which is 22 per cent increase over GPU 28 (2425 kg/ha)

153. **Suitable drought resistant Hybrid variety in sorghum and cumbu may be developed for Rainfed conditions (JDA ,Trichy).**

Sorghum: TNAU sorghum hybrid Co 5 is recommended
Cumbu: TNAU cumbu hybrid Co 9 is recommended

154. **Minor millet having high iron content suitable for mechanical harvesting may be suggested (JDA,Virudhunagar).**

Kudhiraivali (15mg/100g) and varagu (12mg/100g) are having high iron content. Among them varagu is amenable for mechanical harvesting

155. **High yielding Samai variety performing good in rainfed condition may be suggested (JDA ,Thiruvanamalai).**

The high yielding samai variety CO4 is suitable for rainfed condition and can be recommended for Thiruvannamalai district. The success of this variety has already been established at Javadhu hills in the last five years through large scale demonstrations.

156. **Suitable Red Sorghum Drought tolerant variety for rainfed condition may be suggested for Thirumangalam and Peraiyur taluks (JDA, Madurai).**

Paiyur2 is a drought resistant red sorghum variety that can be recommended.

157. **Recommendation to quicken the ripening process in millet and post harvest technology are required (JDA, Madurai).**

Technologies for value addition of millets are available for traditional foods, bakery products, extruded products and instant mixes. Also regular training programmes are conducted at Post Harvest Technology Centre, Coimbatore and Home Science College and Research Institute, Madurai.

158. **Sufficient Breeder and Foundation seeds may be supplied for Maize – CO-6 , Cumbu CoCu-9, Kuthiraivali CoKV-2 and Varagu CO-3 to replace private hybrid and local seeds (JDA, Madurai).**

The breeder seed production are being taken up based on the indent and hence the indent for breeder seeds may be placed well in advance for further multiplication by Commissionarate of Agriculture.
The indented quantity of breeder seeds of all varieties and parents of hybrids in millet crops are produced and distributed without any shortfall. If any additional quantity is needed the indent may be placed in advance to the Director, CPBG,TNAU, Coimbatore.

159. **Suitable high yielding Maize hybrids may be suggested for the black soils Tracts (JDA,Tirunelveli).**
Alternate variety for CO1 Maize may be suggested (JDA,Coimbatore).
Vellore district is prone to drought condition and Irrigation water has become a most critical input. Maize crop has been introduced as an alternate crop and farmers were convinced with the performance .Mostly private hybrids and hybrid seeds from MNCs(Monsanto,Mahyco etc) are being cultivated. CO1 Maize variety has also been tried. But farmers prefer high yielding hybrids only. High yielding varieties and hybrids that could compete with private hybrids has to be developed and suggested by TNAU. (JDA, Vellore).
COH(M) 5 Hybrid is not performing well when compared to the private hybrids. Suitable TNAU Maize hybrid of short duration may be evolved for both Rainfed & irrigated condition to replace the existing expensive private hybrids. (JDA,Namakkal).

As poultry industry is predominant in this district, farmers are cultivating Maize in larger area as a poultry feed. They are growing Private Maize hybrids only COMH.5 and COMH.6 are not giving higher yield compared to private hybrids. As private hybrid seed cost is higher, Farmers are expecting low cost seed variety with higher potentiality than private hybrids. So, high yielding and potential maize hybrids suited as poultry feed may be suggested (JDA,Namakkal).
Suitable high yielding hybrid maize varieties may be suggested for irrigated and Rainfed conditions (JDA,Trichy).
In Erode district farmers are cultivating private hybrids. In irrigated conditions hybrids like pioneer-30B07,30B02, syngenta-NK6240, Cauvery-Super 244, Rabi 3022, Kargil and in Rainfed condition CP842 are mostly cultivated. So farmers need TNAU hybrids which is suitable for both irrigated and Rainfed condition (JDA,Erode).
Suitable High yielding Maize Hybrid Resistant to stem borer and Downey mildew, Drought tolerant may be suggested (JDA,Perambalur).
Availability of maize hybrids at an affordable cost (JDA, Thanjavur).
Private Hybrids are mainly used by the farmers. New TNAU hybrid and Variety Breeder seed should be sufficiently supplied for all millets (JDA, Madurai).

The high yielding late (TNAU MH CO6, COH (M)7) and medium (COH(M)8, COH(M)10) maturing single cross hybrids are highly suitable for cultivation in black soil tracts of Tamil Nadu including Tiruneveli district.
In general the composite variety CO1 is low yielder compared to hybrid maize cultivation and it's not recommending for cultivation. To double the production and productivity of maize crop, the research on Crop improvement was concentrated mostly for single cross hybrid development programme. Due to its research efforts, four high yielding single cross maize hybrids *viz.*, CO6 (105days), COH (M)7 (110days), COH(M)8 (90-95days) and COH(M)10 (90-95 days) have been released by Tamil Nadu Agricultural University during 2012 and 2013 for National level cultivation including Tamil Nadu state. These hybrids are highly suitable for cultivation both under irrigated and rainfed conditions for replacing maize hybrid COH(M)5 .The hybrids CO6, COH(M) 7, COH(M)8 and COH(M)10 showed multiple disease resistance against many diseases including sorghum downy mildew and also moderately resistant to stem borer and drought tolerant.
High yielding single cross TNAU maize Co6 was released during 2012 and it was compared (7400 Kg/Ha) with leading private maize hybrid NK6240 (6803 Kg/ha and 900M(G) (6656 Kg/ha) and recorded with increase yield of 28% over CoH(M)5 and 8-10% over NK6240 and 900M(G). It is suited both for rainfed and irrigated tracts of Tamil Nadu. It has yield potential of 13273 Kg/ha and 19 tons of fodder under irrigated conditions. Besides its disease resistance it can tolerant to drought and low input management conditions. The same hybrid also been released at National level during 2012 for adoption in the state of Gujarat, Chhattisgargh, Madhya Pradesh and Rajasthan.
It was notified for cultivation in Tamil Nadu during 2012 (S.O.1708(E) dt.26th July2012) and same was notified for national level cultivation during 2013 (S.O.2817(E) dt. Sept 2013). At present the hybrid seeds of Co6 is available at SSF, Pongalur (8 tones), Managing Director (Production), Gujarat State Seeds Corporation, Gujarat (150 tones) and Central State Seed Farm Corporation , GOI, Raichur, Karnataka (6 tones). The Breeder seeds of female and male parents of Co6 are available at ARS, Bhavanisagar. The cost of the hybrid is Rs150/-Kg. Under Front line demonstrations for

popularization of Co6 maize hybrid, 8 Kg hybrid seeds with 1 Kg Atrazine per acre / farmer will be supplied as free of cost for 15 farmers in each district during Kharif 2014.

Another hybrid culture CMH 08-287 has been released as COH (M)7 (110 days) for Kharif season at National level during 2013 for cultivation in the States of Uttar Pradesh, Bihar, Jharkhand, Odisha, Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra. The average grain yield of 7918 Kg/ha for mean yield of 3 years in over all Zones for Kharif season. It has consistent superiority in yield over qualifying checks *viz*., PMH 1 (11.57 %), PMH 3 (5.94 1 %), Seed tech 2324 (10.48%), Bio 9681 (13.08 %), HM 11 (28.18%) and HM 12 (33.34 %) . The Breeder seeds of female and male parents of CoH(M)7 are available at Central State Seed Farm Corporation, GOI, Raichur, Karnataka.

Another medium duration (90-95 days) single cross hybrid culture CMH 08-292 has also been released as CoH (M)8 for Kharif season at National level during 2013 for cultivation in the States of Punjab, Haryana, Delhi, Uttar Pradesh, Bihar, Jharkhand, Odisha, Andhra Pradesh, Tamil Nadu, Karnataka Maharashtra, Gujarat, Rajasthan, Madhya Pradesh and Chhattisgarh. It has an average grain yield of 7079 Kg / ha for mean yield of 3 years in over all Zones and 7194, 6812, 8455 and 5857 Kg /ha in Zone 2, 3, 4, and 5 respectively for mean yield of three years in India for kharif season. It has consistent superiority in yield over qualifying checks *viz*., Bio 9637 (15.12 %), HM 8 (34.20%) and HM 9 (32.09 %) trials. The Breeder seeds of female and male parents of CoH(M)8 are available at Central State Seed Farm Corporation ,GOI, Raichur, Karnataka

Another high *yie*lding modified single cross hybrid culture CMH 08-433 (90-95 days) has been released as COH (M)10 for Kharif season at National level during 2013 for cultivation in the States of Andhra Pradesh, Tamil Nadu, Karnataka , Maharashtra, Gujarat, Rajasthan, Madhya Pradesh and Chhattisgarh. The average grain yield of 7168 Kg /ha for mean yield of 3 years in overall zones and 8362 and 5975 Kg/ha in Zone 4 and 5 respectively for mean yield of three years in India for Kharif season. It has consistent superiority in yield over qualifying checks *viz*., Bio 9637 (14. 89 %), PMH 4 (1. 41%), HM 8 (26.89%) and HM 9 (27.29 %) in India.

Sorghum: TNAU sorghum hybrid CO5 is recommended
Cumbu: TNAU cumbu hybrid CO9 is recommended
Maize: Maize hybrid CO6 is recommended
Based on the advance indent the required quantity of seeds can be produced

The indented quantity of breeder seeds of all varieties and parents of hybrids in millet crops are produced and distributed without any shortfall. If any additional quantity is needed the indent may be placed in advance to the Director, CPBG,TNAU, Coimbatore.

160. **After harvest of Maize Cobs, the remaining Maize by-products, stalks are being left in the field itself for drying without use. we have to make use of dry Maize stalks in the fields for dry forage/silage purpose. Necessary maize by products usage technologies may be suggested (JDA,Namakkal).**

After harvest the maize stalks can be used for dry forage/silage purpose by using chaff cutter. For colleting the left out bio-mass in the field and to convert into fine particles / vermi compost the commercial (tractor PTO operated) shredders cum pulverises may be used.

After the harvest of maize cobs, stocks can be dried and stacked. The dried stocks may be used as fodder for livestocks. Silage can be prepared only by using the green fodder.

161. **Technology required to arrest multi cobs in Maize after prolonged water stress condition in rainfed situation may be suggested (JDA, Perambalur).**

Multi cob development is a genetic character and it occurs due to imbalanced N dose, increase in temperature, non availability of pollens and summer sowing.

162. **Method and recommendation for bio mineralizer for sugarcane trash, Maize stalk and Cotton stalk may be suggested (JDA, Perambalur).**

Biomineralizer application procedure

- The Biomineralizer is powder based one. The base material used is vermicompost prepared from cowdung. This supports the growth of microorganisms very well.
- The material which needs to be composted should be shredded into small particle size of 2 inch average. The shredding may be done by shredder machine or manually. Reduction in particle size accelerates the composting.
- The ideal condition for good performance of this organisms is maintaining the C:N ratio 30:1. It is advisable to mix both green colored waste and brown colored waste for maintaining the C:N ratio. If the material is dried waste it is advisable to add animal dung 20% in the place of green colored waste. The good indication of correct C:N ratio is lot of heat generation in the compost pile within one week after composting initiation. If heat is not generated within a week time more nitrogen source has to be added to narrow the C:N ratio. If green waste or animal dung is not available urea may be used @ 5kg per ton of waste. With out maintaining the C:N ratio the organism will never work on the waste materials.
- The recommended dose of microbial consortium (trade name is Biomineralizer) is 2 kg per ton of dried waste material
- The powder based inoculums should be mixed with water (For 2 kg of material 40 liters of water) to make it as slurry for convenient application over the waste. For one ton of waste two kg microbial consortium should be mixed with 20 litres of water to prepare the slurry. This slurry should be sprinkled over the waste material uniformly layer by layer. It is not advisable to sprinkle the inoculums after the heap or bed formation of waste material.
- Ensure that all the waste material are contacted with the microbial inoculum.
- While the composting process is going on minimum 30% moisture should be maintained for the survival and activity of organisms. Other wise the microbial populations start declining and their activity will be ceased.
- For lignin based waste materials (Example Coir dust) *Pleurotus*should be added in addition to the microbial consortium.
- The shelf life of microbial consortium is three months from date of manufacturing. All microbial consortium are prepared one week before dispatch to the customer.
- Always keep the microbial consortium in cool shady place
- Microbial consortium should not be mixed with fertilizers and other agro chemicals.

163. **Package of practices for 'system of maize intensification' may be suggested (JDA, Dindigul).**

- Adoption of optimum spacing of 60 x 25 cm
- Timely weed management through herbicides and power weeder
- Application of NPK fertilizers along with TNAU micronutrient mixture
- Foliar spraying of Maize maxim at the time of flowering and 10 days after flowering @ 7.5 kg/ha
- Drip fertigation may be followed based on the fertigation schedule given in the Crop production guide 2012.

164. **Paired row cultivation of maize and suitable inter crop suggested for doubling the yield per unit area may be suggested (JDA, Dindigul).**

Green gram, black gram and cow pea can be grown as intercrops in maize to enhance the yield per unit area.

165. **Development of Maize Growth Promoter suitable for application through fertigation may be suggested (Theni).**

Maize growth promoter has not been tried under fertigation.

166. **White grub Management in Maize under rainfed condition may be suggested (JDA, Perambalur).**

Collect the adult beetles during the month of June and July from neem trees by shaking: use of *Metarhizium anisopliae* fungus (1 X 10^{8} cfu/ml.) regularly during last plouging will reduce the damage.

167. **Groundnut - The other state varieties viz K6, JL24 perform better than the existing varieties of Tamil Nadu. Adequate quantity of breeder seeds and foundation seeds may be supplied for seed multiplication to meet out the farmers need (JDA, Tiruvallur).**

TNAU is not involved in breeder seed production and multiplication of other state varieties as per the ICAR policy. Hence the requirement could be programmed through NSC as well as the organizations responsible for the release.

The Spanish bunch variety Kadiri 6 (K 6)/(K 1240) was released during 2005 by the ARS, Kadiri, Andhra Pradesh. The suitability of K 6 for our climatic condition was not assessed. Only after evaluating the performance, the variety can be recommended. The Spanish bunch groundnut variety JL 24 was released in 1978 and cultivated sporadically. So many high yielding varieties (VRI gn 6, CO 7, and TMV Gn 13) better than JL 24 was evolved and cultivated widely in Tamil Nadu.

168. **Enhancement of genetic purity of TMV.7 Groundnut variety is required(JDA Theni).**

Genetic purity of the variety TMV 7 is being maintained through nucleus seed production.
Recently released high yielding variety CO 7 with pod yield of 2500 kg/ha may by adopted in place of TMV 7.

169. **Sprouting problem - Very Poor Dormancy has been noticed at the time of harvesting in Groundnut variety TMV 13 during Kharif season (Oct-Nov). More than 35% of seeds get germinated. Hence, drastic reduction in yield is experienced in the subsequent season when these seeds are utilized. Germination is noticed only when the pod is shelled. Suitable remedial measure may be suggested (JDA, Kancheepuram).**

There is no such problem in storability of groundnut cv. TMV 13 and the problem of vivipari is also not found in TMV 13. Studies will be taken to find out the problems to recommend suitable strategies. However, the dormancy can be induced by foliar application of ABA 500 ppm applied at 70 days after sowing.

Most of the high yielding Spanish bunch varieties are non-dormant types. Incorporation of seed dormancy for a shorter period in Spanish bunch genotype is required to avoid significant loss in pod yield and seed quality because of *in situ* germination during unpredictable rainfall. Late sowing of Spanish bunch varieties (TMV Gn 13) may be avoided. However, research work has been intensified to transfer fresh seed dormancy in Spanish bunch varieties.

Harvesting may be taken up as soon as the crop reaches the maturity. Alternate new bunch variety like CO 7 with the pod yield of 2500 kg/ha may be recommended to the farmers for cultivation.

170. **An alternate groundnut variety which can yield more than TMV.7 may be suggested. (JDA Tirunelveli).**

A new Spanish bunch variety VRI Gn 6 was released during 2006 to replace the existing old varieties. It is a cross derivative of ALR 2 X VG 9513. It matures in 105-110 days. Under rainfed situation it recorded a mean pod yield of 1916 kg, while the yield advantage is still superior under irrigated situations (2403 kg/ha). It recorded a higher shelling outturn (75.0%) and high oil content (50.0%). The new variety is tolerant to drought with basal pod setting.

Another high yielding Spanish bunch variety TMV Gn 13 was released during 2006. It is a pureline selection from Pollachi red. It matures in 100-105 days. The variety recorded a mean pod yield of 1613 kg and 2580 kg/ha during *kharif* and rabi/summer seasons respectively.

Recently, one more Spanish bunch variety CO 7 was released in 2013. It recorded a mean pod yield of 2600 kg/ha. The new variety not only gives superior yield but also drought tolerant and moderately resistant to rust and late leaf spot.

Recently released high yielding variety CO 7 with pod yield of 2500 kg/ha may by adopted in place of TMV 7.

171. **Cowpea, Maize, Groundnut - Drought tolerant varieties are needed. (JDA Coimbatore).**

The bunch variety VRI Gn 6 is tolerant to drought and recommended for rainfed tracts of Tamil Nadu. A new Virginia bunch drought tolerant variety VRI Gn 7 was released during 2008 exclusively for rainfed areas of Tamil Nadu. It was evolved by crossing TMV 1 X JL 24. It matures in 125-130 days. It recorded a mean pod yield of 1865 kg/ha with a shelling outturn of 72.0% and oil content of 48.0%.

Similarly, another high yielding Virginia bunch variety ICGV 00348 was released for commercial cultivation through Central Variety Notification

Committee. The duration is 125-130 days. It recorded a mean pod yield of 2013 kg/ha.
Another high yielding Virginia bunch drought tolerant variety CO 6 was released for commercial cultivation during 2010. It matures in 125-130 days. It recorded a mean pod yield of 1915 kg/ha. The shelling outturn is 73.5% with an oil content of 49.5%.

A high yielding (1915kg/ha) new semi spreading groundnut variety CO 6 and recently released high yielding bunch variety CO 7 with pod yield of 2500 kg/ha may be adopted.

172. **Varieties resistant to Tikka leaf spot and short duration varieties may be suggested (JDA Coimbatore).**

A new high yielding Spanish bunch variety VRI Gn 6 was released for commercial cultivation during 2006. The new variety is tolerant to tikka leaf spot, rust and peanut bud necrosis disease. This variety is highly suitable for areas where tikka leaf spot is endemic.
Similarly, the Virginia bunch variety ICGV 00348 showed resistance to tikka leaf spot and rust diseases can also be cultivated.
A Spanish bunch variety VRI 3 is the only early maturing variety with duration of 90 days. It was released during 1990. It is highly suitable for sugarcane intercropping system. Research works have also been taken up to develop a new short duration variety.
The Tikka leaf spot resistant bunch variety VRIGn 6 with pod yield of 2400 kg/ha may be adopted.

173. **Under Rainfed condition farmers normally take up Groundnut as pure crop and crops like Redgram, Cholam, Blackgram , Cowpea and lab lab as mixed crop or Inter crops. Except Redgram other crops are being broadcasted. In case of monsoon failure, farmers may get some income from any one of the above crops. Hence a suitable cropping programme to get maximum increase in yield may be suggested (JDA Vellore).**

Intercropping
i) Raise one row of cowpea for every five rows of groundnut wherever red hairy caterpillar is endemic.
ii) Raise intercrops like redgram, blackgram, sunflower, gingelly or other pulses.
iii) Cumbu can be raised as intercrop.
iv) Groundnut + Gingelly or Groundnut + Blackgram in the ratio of 4:1 or Groundnut Cowpea at 6:1 ratio and Groundnut + Sunflower at 6:2 ratio may be raised.

- Groundnut based cropping programme at Vellore District begins during June-July (Aanipattam)
- The ideal groundnut varieties for higher yield are TMV 7, VRI 2, VRIGn 5, VRI Gn 6, TMVGn 13.

Following are the intercrops in groundnut suggested to get higher yield

- Groundnut+cowpea (5:1) wherever red hairy caterpillar is endemic.
- Groundnut+Gingelly or Groundnut + Blackgram in the ratio of 4:1
- Groundnut+Cowpea / pigeonpea at 6:1 ratio and
- Groundnut+Sunflower at 6:2 ratio

174. In Vellore District Groundnut is being cultivated widely during Khariff season. The farmers are cultivating TMV 7 variety to a larger extent. Since it is an age old variety released during 1967, a new drought resistant variety, suitable for rainfed condition may be suggested with equal performance (JDA Vellore).
Old variety TMV 2 & TMV 7 shall be replaced with improved high yielding variety. (JDA, Krishnagiri).
Popular groundnut variety TMV-7 may be improved or replaced with New High yielding Variety (JDA, Salem).

Three Virginia bunch varieties viz., VRI Gn 7, ICGV 00348 and CO 7 and three Spanish bunch varieties viz., VRI Gn 6, TMV Gn 13 and CO 7 are highly suitable for rainfed cultivation. The Virginia bunch varieties mature in 125-130 days while the Spanish bunch varieties took 105-110 days.
Recently released high yielding bunch variety CO 7 with pod yield of 2500 kg/ha may be adopted in place of TMV 7.

175. **In parts of Arakkonam and Gudiyatham taluks red kernel variety migrated from nearby Andhrapradesh is being cultivated and it suits very well to the local Agro Climatic conditions. Hence a pure line selection may be derived and released as a variety for Vellore district (JDA Vellore).**

Already, a high yielding Spanish bunch red kernel variety TMV Gn 13 has been evolved.
The high yielding bunch variety TMV(Gn) 13 (2500 kg/ha) with red kernel type may be recommended

176. **In Groundnut bold seeded varieties is needed like GPBD4 (JDA Thiruvanamalai).**

GPBD 4 is a Spanish bunch variety with multiple disease resistance. Its hundred kernel weight is 37.3 g. It may not be considered as bold seeded variety. However, several crosses were made and the segregating populations are evaluated to develop large seeded groundnut.
Bunch type variety COGn 4 and semi spreading variety CO 6 with bold kernel types (50-60 g/100 kernels) may be recommended.

177. **Although many Groundnut semi-spreading varieties have been released, Rainfed Groundnut area of Tiruchengode and part of Paramathi taluks farmers are not yet interested in growing TMV.1 variety (Spreading type) though the variety has rejuvenating character during prolonged drought season, due to minimum yield obtained from this variety during monsoon failure. Hence this TMV.1 variety may be improved with high suitability to rainfed condition to fetch maximum yield. (JDA Namakkal).**

Keeping TMV 1 as a female parent and JL 24 as male parent, VRI Gn 7 was developed and released for general cultivation. It matures in 125-130 days. It is highly suitable for rainfed tract of Tamil Nadu.
Also, the Virginia bunch variety ICGV 00348 is highly suitable for the rainfed cultivation. Similarly, another high yielding Virginia bunch drought tolerant variety CO 6 was released for commercial cultivation. It also took 125-130 days to mature.

Recently released semi spreading variety CO 6 with pod yield of 1915 kg/ha is recommended for Tiruchengodu and Paramathi taluks.

178. **In Rainfed areas while going for Groundnut Crop, the labour availability problem is acute during harvest season. So, improved tractor drawn groundnut harvester is necessity. Hence mechanized groundnut harvester with suitable modification may be evolved (JDA Namakkal).**

Research work has been carried out to develop a tractor drawn groundnut harvester.

179. **High yielding, drought resistant leaf miner and Tikka leaf spot resistant variety is required for rainfed cultivation (JDA Trichy).**

VRI Gn 6 is a high yielding drought tolerant Spanish bunch variety. It is also tolerant to leaf miner and tikka leaf spot. The variety CO 7 is also a high yielding drought tolerant variety.

The Tikka leaf spot resistant bunch variety VRIGn 6 with pod yield of 2400 kg/ha may be adopted.

180. **Combined nutrient spray recommendation for obtaining high yield in groundnut (JDA Trichy).**

Soak DAP 2.5 kg, Ammonium sulphate 1 kg and borax 0.5 kg in 37 lit of water overnight. The next day morning it can be filtered and about 32 litre of mixture can be obtained and it may be diluted with 468 lit of water so as to made up to 500 litre to spray for one ha. Plano fix at the rate of 350 ml. can also be mixed while spraying. This can be sprayed on 25th and 35th day after sowing. or Spray TNAU Groundnut rich @ 5.5 kg/ha for 2 sprays at 35 (50 per cent flowering) and 45 DAS Pod developing stage).

Rainfed (CPG 2012 page No. 164)
Pod filling is a major problem especially in the bold seed varieties. To improve pod filling spraying of nutrient solution is to be given. This can be prepared by soaking DAP 2.5 kg, Ammonium sulphate 1 kg and borax 0.5 kg in 37 lit of water overnight. The next day morning it can be filtered and about 32 litre of mixture can be obtained and it may be diluted with 468 lit of water so as to made up to 500 litre to spray for one ha. Plano fix at the rate of 350 ml. can also be mixed while spraying. This can be sprayed on 25th and 35th day after sowing.

Irrigated (CPG 2012 page No. 167)
Pod filling is a major problem especially in the bold seed varieties. To improve pod filling spraying of nutrient solution is to be given. This can be prepared by soaking DAP 2.5 kg, Ammonium sulphate 1 kg and borax 0.5 kg in 37 lit of water overnight. The next day morning it can be filtered and about 32 litre of mixture can be obtained and it may be diluted with 468 lit of water so as to made up to 500 litre to spray for one ha. Plano fix at the rate of 350 ml. can also be mixed while spraying. This can be sprayed on 25th and 35th day after sowing. or Spray TNAU Groundnut rich @ 5.5 kg/ha for 2 sprays at 35 (50 per cent flowering) and 45 DAS Pod developing stage).

181. **Suitable agronomy practices for Groundnut cultivation under Drip Irrigation may be suggested (JDA, Villupuram).**

Research studies for groundnut cultivation under drip irrigation are in progress.

Groundnut being a closely spaced crop with short canopy, micro sprinklers is better than drip irrigation. Trials are initiated for the drip irrigation technology in groundnut at Aliyarnagar and Vridhachalam.

182. **Suitable high yielding variety, with bold kernal and suitable for candy making may be suggested to replace VRI.3 (JDA, Villupuram).**

Research work has been intensified to evolve a high yielding bold kernel variety.

Bunch type variety COGn 4 and semi spreading variety CO 6 with bold kernel types (50-60 g/100 kernels) may be recommended.

183. **New Groundnut variety may be evolved suitable for late monsoon set in rainfed condition (JDA, Salem).**

The Virginia bunch groundnut variety ICGV 00348 is a high yielding drought tolerant variety. When the sowing was either earlier or late, it will not affect the pod yield significantly. Hence, this variety could be grown even under late monsoon condition.

Recently released semi spreading variety CO 6 with pod yield of 1915 kg/ha is recommended.

184. **Suitable alternate high yielding white seeded variety of gingelly to replace SVPR-1 variety may be evolved (JDA, Salem).**

Research work is in progress to evolve high yielding white seeded sesame variety. An advanced breeding line VS 07-023 is under evaluation in ART.
High yielding cultures to replace SVPR 1 are being tested under MLT and ART.

185. **Groundnut variety suitable for late sowing (i.e August) under rainfed condition may be suggested (JDA, Dharmapuri).**

The Virginia bunch groundnut variety ICGV 00348 is a suitable for late sowing.
Recently released semi spreading variety CO 6 with pod yield of 1915 kg/ha is recommended**.**

Short duration variety VRI 3 (90 days) and TMV 13 (100 days) are suitable.

186. **Requirement of high yielding varieties in Niger and Sesame (JDA, Thiruvanamalai).**

Efforts are continuously being made to develop high yielding varieties.
High yielding sesame varieties TMV(sv) 7 and VRI(sv) 2 with high yield of 700-900 kg/ha may be recommended.

187. **Coconut: Black Headed Caterpillar menace is higher during summer and drought season. Parasites are being released to control the pest, besides root feeding of insecticides. Bio-control agents may be suggested to control the pest effectively and eco-friendly as an IPM Package (JDA, Namakkal).**

Remove and burn all affected leaves/leaflets.
Release of the larval parasitoids *viz.,* bethylid (*Goniozus nephantidis*) and braconid (*Bracon brevicornis*) at 20 nos. per palm and 30 nos / palm, respectively for six times at 15 days interval continuously may be recommended.

188. **Coconut - Leaf blight and wilt control technologies and wilt resistant varieties may be suggested. Whether PPFM (Pink pigmented facultative methanotrophps) spray may be applied. New type of Sprayer for Coconut and New type of Harvester are required (JDA, Coimbatore)**

The power operated HTP (Horizontal Triplex Plunger) sprayers with jet nozzles can be used to spray upto 6 metres height. The tractor mounted hoist developed at TNAU is suitable for harvest upto 15 metres height.

189. **Suitable biological measures to control Eriophyid mite in coconut may be suggested (JDA, Tirunelveli & Vellore).**

Conservation of predatory mites *Neoseiulus* sp. may be encouraged. Application of fungus *Hirsutella thompsonii* recorded only 40- 45% reduction of mite population under favourable (high humidity) conditions.

190. **Varieties suitable for high density Cotton planting may be suggested. (JDA, Coimbatore).**

The culture TCH 1818 and TCH 1819 suitable for HDP is in under MLT. However, the variety Suraj in recommended for HDP under rainfed and marginal soil.

191. **Evaluation of New hybrid cotton suitable for Theni district may be suggested (JDA, Theni).**

The intra *hirsutum* hybrid TSHH 0629 is in advanced stage of testing.

192. **Hybrid cotton suitable for high-density planting, synchronized maturity and suitable for mechanical harvesting may be suggested (JDA, Virudhunagar).**

Hybrid cotton not suitable for high density planting system.

193. **Cotton is being cultivated in Vaniyambadi and Thirupathur Taluks under Rainfed condition during July-August months. Mostly Hybrids like DCH 32, RCH 2, etc., are sown by the farmers. Through the department, we have introduced TCHB 213 during 2002-2003, but its performance was not encouraging when compared to Private Hybrids. Any other suitable hybrid may be suggested (JDA, Vellore).**

Interspecific hybrid (*G.hirsutum* x *G.barbadense*) is not recommended for rainfed area of Vaniyambadi and Thirupathur area.

194. **Hybrid variety suitable for Khariff season which is equivalent or better than Bt cotton for Rainfed sowing may be suggested for Vellore District (JDA, Vellore).**

SVPR 2 and KC 3 is recommended for rainfed area of Vellore district.

195. **Most of the farmers in Thoothukudi district prefer cultivation of Bt. Cotton. More than 15 Nos of Bt. varieties are available in our district. We require TNAU variety equivalent to Bt. Cotton or high yielding variety of Cotton may be recommended (JDA, Tuticorin).**

The pre-release culture TSH 0250 in under advanced stage of testing.

196. **In Cotton, Surabi is the ruling variety cultivated during summer season. Now-a-days its yield potentiality is getting into downstream. In this regard, new high yielding, medium staple and quality variety may be suggested for Namakkal tract (JDA, Namakkal).**

The culture TCH 1716 with 2.5% span length of 33 mm is now under advanced stage of testing.

197. **Suitable ELS Cotton Hybrid under rainfed condition may be suggested. (JDA, Perambalur, Ariyalur).**

No new ELS hybrid is available for rainfed condition. However, under protective irrigation private hybrids may be grown.

198. **Recommendation for foliar spray Multi K, 19;19;19 to cotton may be suggested (JDA, Perambalur).**

For increasing boll weight, fibre maturity foliar spray of 2% DAP (or) multik or 19:19:19 may be done on 75 and 90 days after sowing.

For increasing boll weight and improved fibre quality 1% foliar spray of 13:0:45 at 60 DAS and 19:19:19 at 90 DAS is recommended.

When plant tissue is in short supply of nutrients particularly N, K and B in high yielding hybrid cotton, foliar sprays can be done to improve plant and boll growth. Vegetative growth during stress, after heavy flowering and boll set can be enhanced by foliar feeding of water soluble fertilizers containing N, P and K at 7 to 10 days intervals. To prevent square drop, improve boll setting, enhance boll development, boll weight, lint quality, pest and disease tolerance, K application along with N and B may be effective.

- Foliar applications of 2% DAP + 1% KCl (or) Polyfeed and Multi-K may be sprayed to improve kapas yield.
- Foliar sprayof 0.5% $ZnSO_4$ thrice at 45, 60 and 75 DAS can be done in zinc deficient soils.
- When reddening occurs in leaves apply 5% $MgSO_4$, 1.0% Urea and 0.10% ZnSO4 as foliar spray on 50^{th} and 80^{th} day can be done.
- Foliar spray of 2% $MgSO_4$ + 1% urea during boll formation stage can be done in Mg deficient areas.

199. **Cotton Drought Mitigation Techniques during critical crop growth stage may be suggested (JDA, Perambalur).**

- Construction of Farm pond and installation of motile sprinker.
- Foliar spray kaolin 1% or kcL 2% if sufficient soil moisture is available.

Soaking the seeds in CCC 100 ppm for six hours and foliar spray of 1% KCl or kaoline is recommended.

200. **Stem weevil infestation is becoming a Major problem in Tuticorin district. Drenching with phorate granules and application of chlorpyriphos is not controlling the problem effectively. Hence suitable stem weevil resistant cotton variety may be suggested. (JDA, Tuticorin).**

At present, no cotton variety is available for stem weevil resistance. Screening germplasm is in progress to identify stem weevil resistant genotype.

Timely management with the following package.

1. Seed treatment with chlorpyriphos 20EC 10 ml/Kg of seed.
2. Drenching collar regin with chlorpyriphos 20EC 2.5ml/lit. two times on 15 and 30 days after sowing.
3. Earthing up of collar region without exposure.

201. **Mealy bug problem In Ramanathapuram district,: cotton is cultivated nearly in 200 Ha in Masi pattam. In this pattam, cotton mealy bug is a big problem. Every year, this cotton mealy bug is affecting the cotton crop. Hence, suitable resistant varieties and control measures may kindly be suggested (JDA, Ramanathapuram).**

At present no cotton variety is available for mealy bug resistance.

1. In the field, alternate hosts like *Abutilon indicum* (Thutti)_, bhendi, *Solanum nigrum* (Manathakkali/ Milaguthakkali), *Physalis minima* (Chodakku thakkali), Parthenium or any other malvaceous/ solanaceous weeds should be removed.
2. Carefully monitoring the emergence of nymphs (crawlers).
3. Spray dimethoate or profenophos 2ml/lit, thoroughly on all infested plant parts.
4. Spraying Neem oil 2%, Neem seed Kernel Extract 5%, Fish oil Rosin soap 25g/lit.

202. **Cotton Mealy Bug, Stem weevil & Miridbug, Alternate leaf spot disease is the complex problem. Suitable sucking insect management techniques may be suggested. (JDA, Perambalur).**

i.Mealy bug

1. In the field, alternate hosts like *Abutilon indicum* (Thutti), bhendi, *Solanum nigrum* (Manathakkali/ Milaguthakkali), *Physalis minima* (Chodakku thakkali), Parthenium or any other malvaceous/ solanaceous weeds should be removed.
2. Carefully monitoring the emergence of nymphs (crawlers).
3. Spraying Neem oil 2%, Neem seed Kernel Extract 5%, Fish oil Roasin soap 25g/lit.
4. Spray dimethoate or profenophos 2ml/lit, thoroughly on all infested plant parts.

ii.Stem weevil

1. Seed treatment with chlorpyriphos 20EC 10 ml/kg of seed.
2. Drenching collar regin with chlorpyriphos 20EC 2.5ml/lit. two times on 15 and 30 days after sowing.
3. Earthing up of collar region without exposure.

iii. Mirid bug

The following insecticides recommended for sucking pests control may be applied.

- ❖ Dimethoate 30EC 500ml/ha.
- ❖ Imidacloprid 70WG 30-35g/ha.
- ❖ Imidacloprid 17.8 SL 100-125ml/ha.
- ❖ Profenophos 50EC 1000ml/ha.
- ❖ Thiamethoxam 25WG 100g/ha.

iv. *Alternaria macrospora* blight

1. Foliar application of 0.1% tebuconazole on 60, 90 and 120 days after sowing.
2. Foliar application of difenaconazole @ 0.05% on 60,90,120 days after sowing.
3. Foliar application of chlorothalonil @ 500g/ha at 15 days interval after disease appearance is recommended.

203. **Supply of Breeder seed in Cotton varieties *viz*. Surabi and MCU 5 variety are low and it may be increased (JDA,Salem).**

Sufficient quantity of Surabhi and MCU 5 certified seed is available in SIMA.

204. **Management practices for stem weevil control is required since it is a severe problem in Bt. cotton (JDA,Madurai).**

Timely management with the following package.

1. Seed treatment with chlorpyriphos 20EC 10 ml/Kg of seed.
2. Drenching collar regin with chlorpyriphos 20EC 2.5ml/lit. two times on 15 and 30 days after sowing.
3. Earthing up of collar region without exposure.

205. **Sugarcane variety with high tillering with long internode is needed for this district (JDA, Tirunelveli).**

A promising pre release sugarcane clone, C 260628 has high yield potential. It is a tall erect cane with long internodes. The mean cane yield of the clone in the ART trials was 143.8 t/ha which is 8.69% increase over Co 86032. The CCS % and Sugar yield of this clone is on par with Co 86032.

Mean of ART	C 260628 Co 86032	143.8 132.3	11.71 12.46	16.92 16.46
	CD(P=0.05)	12.11	0.64	2.46

Co.G 94077 variety released by SRS, Melalathur is a high tillering variety with medium long internodes suitable both for jaggery and sugar production.

206. **A red rot resistant variety may be recommended to Vellore district. Drought tolerant, tannery effluent tolerant sugarcane variety may be suggested to Vellore District. (JDA, Vellore).**

The sugarcane varieties Co.G 93076 and Co.G.94077 are moderate resistant to red rot disease. Co.G 93076 is drought tolerant.
The sugarcane varieties Co.G.95076 and Co.G.5 are tannery effluent tolerant varieties.

207. **Sugarcane variety CO.86032 is being cultivated in sugar mill areas of this district for a long time. Improvement of this variety in productivity is needed. Farmers are expecting alternate varieties which may also be evolved to suit to sugar industry areas (JDA, Namakkal).**

A promising clone C 29442 which was selected from Co 86032 GC is in Multi Location Trials. It has high yield potential and quality attributes. It is an all season clone.

Trials	Entry	Cane Yield (t/ha)	CCS %	Sugar Yield (t/ha)
Station Trials	C 29442	146.8	12.66	18.58
	Co 86032	122.5	12.45	15.25
	CD	8.73	0.37	2.06

Co.G 94077 variety released by SRS, Melalathur is a high yielding variety suitable both for jaggery and sugar production. The yield and total sugar production also equals or more than Co.C.86032.
Rejuvenation can be made in CO 86032 by following three tier nursery system at each sugar factory so as to improve the purity and performance of the Co 86032.
Tissue culture seedlings can be used for raising primary nursery. Alternate varieties viz., TNAU Sugarcane Si 7 and TNAU Sugarcane Si 8 can be grown.

Special Features of TNAU Sugarcane Si 7
Parentage : Co. 99043 x Co G 93076

- Best suited for planting in early season.
- High cane yield – 156 t/ha
- High commercial cane sugar – 13.05%
- High sugar yield – 20.9 t/ha
- Thick and straight cane
- Light purple coloured cane
- Non-flowering
- Tolerant to drought and red rot
- No spines and easy to detrash
- High ratoon yield – 149 t/ha

208. **Suitable variety and technology for intercropping of pulses in Sugarcane, Drought resistant variety may be evolved (JDA, Trichy).**

Sugarcane variety Co.G 93076 is drought tolerant. Black gram varieties ADT 3 and ADT 5 can be intercropped in sugarcane. Technology details are incorporated in the crop Production manual of TNAU and Department of Agriculture, TN.
Pulses intercropping can be taken up in wider row spaced sugarcane crop viz., 4 feet, 5 feet and 5.5 feet. Black gram varieties viz., Vamban 5, Vamban 6, ADT 3, ADT 5 and MDU 1. Green gram varieties viz., Vamban 2, Vamban 3, Co 8 and Virinjipuram 1. Cowpea varieties viz., CoCP 7 and Vamban 1. Soybean Co3 can be grown as intercrop with sugarcane. The sugarcane varieties viz., TNAU Sugarcane Si 7 and TNAU Sugarcane Si 8 can able to with stand drought.

209. **Technology other than cowdung solution for mulching of harvested sugarcane trashes is needed (JDA, Tiruvallur).**

Sugarcane produces about 10 to 12 tonnes of dry leaves per hectare per crop. The detrashing is done on 5th and 7thmonth during its growth period. This trash contains 28.6%-organic carbon, 0.35 to 0.42% nitrogen, 0.04 to 0.15% phosphorus, 0.50 to 0.42% potassium. The sugarcane trash incorporation in the soil influences physical, chemical and biological properties of the soil. There is a reduction in soil EC, improvement in the water holding capacity, better soil aggregation and thereby improves porosity in the soil. Sugarcane trash incorporation reduces the bulk density of the soil and there is an increase in infiltration rate and decrease in penetration resistance. The direct incorporation of chopped trash increases the availability of nutrients leading to soil fertility. Sugarcane trash can be easily composted by using the fungi like *Trichurus, Aspergillus, Penicillium* and *Trichoderma.* Addition of rock phosphate and gypsum facilitates for quicker decomposition.

Technology developed by Department of Environmental Sciences, TNAU, Coimbatore

TNAU biomineraliser is the consortium of microorganism recommended for composting all the agro wastes. For one ton of trash, two kg inoculum is recommended. In TNAU biomineraliser, only the required microorganism meant for composting alone is present with high population. Therefore it is recommended to go for TNAU biomineraliser.

Work at Sugarcane Research Station, Cuddalore

The study for the development of microbial consortium for the insitu decomposition of sugarcane trash was carried out as pot culture experiment initially at Sugarcane Research Station, Cuddalore and the study at field level is under progress. The microbial consortia containing native *Bacillus sp., Cellulomonas cellulans., Pseudomonas sp*, *Aspergillus sp, Trichoderma viridae., Penicillium sp.,* and *Streptomyces sp* was formulated for the decomposition of the sugarcane trash. Application of 100 ml of the consortium/ 100 kg of trash recorded the maximum decomposition rate at 30th day after application of the consortium.

The sugarcane trash composting technology has already been evolved at SRS, Cuddalore.

210. **In Micro irrigation scheme under NMMI, the amount of Rs.43816 has been fixed for close spaced crops having the spacing of 1.2m*0.6m with the laterals of 12mm dia.But laterals with 12mm dia will be effective only up to 35m of lateral length. Exceeding this length the water flow will be inhibited by blocking in laterals. So Erode farmers need the closer spacing of 1.0m*0.5m with the lateral dia of 16mm. which may be recommended by TNAU. (JDA, Erode).**

Implementation of Micro Irrigation in Tamil Nadu is being governed by GOI guidelines. However need based and location specific changes could be made based on the farmer's preference and scientific basis.

211. **Palmarosa has huge market potential in India ie., India produces only 60 MT active ingredient against 5000 MT demand. Production may be increased – Tiruvannamalai**

Palmarosa is cultivated for geraniol, a rose scented aroma chemical. Success of palmarosa depends on following factors:

a. Palmarosa essential oil price is highly varying from year to year which is related to demand supply (Rs.600 to 1200/kg) and care must be taken for area expansion only in select clusters of Tiruvannamalai, Dharmapuri and Krishnagiri districts
b. Though, the current price of palmarosa is attractive, (Rs.1200-1400/kg), it is reported that the geraniol content from Indian cultivated sources are far below (<70%) against the prescribed minimum geraniol content of 90%). Through adoption of better variety and harvest practices, geraniol content can be improved which would fetch farmers to get higher price.

212. **Gloriosa is cultivated in around 150 Ha in Mulanur and Uthukuli block of Tirupur district. There is wide price fluctuation in the seeds and rhizome. Private agencies fully exploit the farmers and make good profit. The farmers don't know the proper markets. Please suggest the farmers on well market facilities and to get stable price for Gloriosa – Erode**

The basis of price fixation in Glory lily seed depends on the following:

1. Market rate for thiocolchicoside in the international drug market
2. Stock of previous year
3. As no company is willing to go for contract farming, production above 600 ton is considered to be surplus which means that the total area in Tamil Nadu to be confined within 5000 acres as against 7000 acres.
4. A Stake Holders Meet on major medicinal plants will be a viable option to link production and the industry

213. **Processing technology for senna – Tuticorin**

Major factor limiting senna export from Tamil Nadu is failure of senna processors and exporters in adhering global quality standards.

Senna processing in Tamil Nadu requires rejuvenation with upgradation and modernization of the existing processing units in compliance with GMP and value addition of senna products. Cultivation of senna needs to be on contractual system with assured price to attract farmers to opt for senna farming.

214. **Suitable potato variety should be developed for the chips making - The Nilgiris**

Kufri Chipsona I and Kufri Chipsona II developed by Central Potato Research Institute, Simla is suitable for chips making. The research on potato at Nilgris is being taken up by CPRI, substation at Muthorai, The Nilgris.

215. **Research activities in perennial Horticultural Crop is to be strengthened (Eg. Enhance the productivity of Jack Fruit including new varieties suitable for tropical & sub tropical regions)**

The University is already taking up research work in major fruit crops as below.

S.No	Crop	Centre where research taken up
1.	Banana, Papaya	HC & RI, Coimbatore
2	Mango, Guava, Sapota, Jack and acid lime	HC & RI, Periyakulam VRS, Palur (Jack alone)
3.	Grapes	GRS, Theni
4.	Arid Fruit Crops	RRS, Aruppukottai
5.	Amla	ARS, Bhavanisagar
6.	Mandarin Orange	HRS, Yercaud
7.	Apple, Per	HRS, Kodaikannal

Apart from these centers, other campuses like AC & RI, Killikulam, HC & RI (W), Trichy are also working on crops like Mango, Guava.

216. **Standardization of fertigation schedule for Flowers & Fruit Crops.**

With respect to fruit crops, the fertigation schedule has been standardized for some of the major fruit crops, like mango, banana, papaya and sapota.

Jasmine

100% of the recommended dose of fertilizers (6:12:12 g/plant) is applied through fertigation in splits at weekly intervals through water soluble fertilizers like Polyfeed (19:19:19), KNO_3 (13:0:45), Urea, Mono Ammonium Phosphate (12:61:0), Sulphate of Potash *etc*. The fertigation schedule furnished in the Table 2, starting from 7 days after planting. 75% of the recommended P is applied as SSP through basal soil application.

Fertigation schedule (100% RDF – 6:12:12 g/plant)

Crop stage	Duration in weeks	Fertilizer grade		Total fertilizer (kg /ha)	Nutrient supplied			% requirement		
					N	P	K	N	P	K
Planting to establishment stage (1^{st} – 4^{th} week) (Sep.)	4	i	19:19:19 + MN	132	25	25	25	10	10	10
		ii	13:0:45	166	22	--	75			
		iii	Urea	7.2	3.3	--	--			
		Sub total			50	25	100			
Vegetative stage (5^{th} – 20^{th} week) (Oct.-Jan.)	16	i	19:19:19 + MN	395	75	75	75	30	30	30
		ii	13:0:45	800	65	--	225			
		iii	Urea	22	10	--	--			
		Sub total			150	75	300			
Flowering & Harvesting stage (21^{st} – 42^{nd} week) (Feb.-May)	20	i	19:19:19 + MN	658	125	125	125	50	50	50
		ii	13:0:45	833	108	--	375			
		iii	Urea	108	16	--	--			
		Sub total			250	125	500			
Rest period (42^{nd} – 52^{nd} week) (June-Aug.)	12	i	19:19:19 + MN	132	25	25	25	10	10	10
		ii	13:0:45	166	22	--	75			
		iii	Urea	7.2	3.3	--	--			
		Sub total			50	25	100			
Total	52	--			500	250*	1000	100	100	100

Carnation

Nutrients	Quantity (g/m^2/week)	
	Till bud formation	Bud formation to harvest
Tank-A (Monday and Thursday)		
Ammonium Nitrate	3.0g	2.0 g
19:19:19	3.0 g	2.0 g
Magnesium Sulphate	2.5 g	2.5 g
Boron	1.0 g	1.0 g
Trace elements / micronutrients	1.0 g	1.0 g
Tank – B (Tuesday and Friday)		
Potassium Nitrate	5.0 g	5.0 g
Calcium Nitrate	8.0 g	9.0 g

217. **Technology to be evolved for cultivation and promotion of Minor fruits (Eg. Mangoteen, Rambutan, Litchi, Carambola, Loquat, Jamun, Ber and Wood Apple).**

The Regional Research Station, Arupukkottai is working on Ber. The HC&RI, Coimbatore centre has identified an elite type in wood apple which is under testing. The Horticultural Research Station, Thadiyankudisai is working on Litchi. No work is being carried out in other sub tropical fruit crops.

218. **Evolving Ultra High density planting technology for Mango & Banana.**

- Regarding Ultra High Density Planting System, it requires regular and vigorous pruning. This is not possible in banana. At same time the University has already popularized the High Density Planting Technology in banana (spacing 1.8 x 3.6 mtr with 3 suckers / pit).
- Regarding Mango, the University has already recommended a system called “Double Hedge Row System (spacing 10 x 5x 5 mt)” which is suitable for mercerized cultivation. By this system, a population of 266 plants can be adopted.
- Regarding Ultra High Density Planting, the University has not conducted any trial and in future, this can be tried.

219. **In hilly areas farmers are highly depend on private varieties in vegetable crop which is high cost in nature evolving improved varieties for TNAU.**

In HRS, Kodaikanal, two high yielding varieties in vegetables have been released.

a. KKL-1 Moringa beans with pod yield of 7 t/ha
b. KKL-1 Butter beans with pod yield of 3.47t/ha

The two varieties are being cultivated in an area of more than 350 ha. in both lower and upper Pulney hills.

1. A separate programme on evolving a high yielding, short duration variety of butter beans through mutation breeding is in progress (M_3 generation)
2. TNAU NILGIRIS KUFRI POTATO 1(KUFRI NEELIMA)
   High yielding (25 to 30t/ha.) Potato variety suitable for all the 3 seasons in The Nilgiris have been evolved.
   4.Ooty 1 Palak

5.Ooty 1 Carrot
6. Ooty 1 Cauliflower
Have been released from TNAU.

220. **Technology to be evolved for cultivation and promotion of minor fruits (eg. Mangosteen, Ranbutan, Litchi, Carambola, Loquat, Jamun, Ber and Wood apple**

The Regional Research Station, Arupukkottai is working on Ber.
The HC&RI, Coimbatore centre has identified an elite type in wood apple which is under testing. No work is being carried out in other sub tropical fruit crops.
At HRS Thadiyankudisai the following programmes are in progress.
1. Mangosteen - Ten seedlings obtained from SHF Kallar were planted at the station during 2011 and 2013 for evaluation and they are in vegetative phase
2. Rambutan – A better performing local cultivar was selected and planted during 2012-13 for evaluation.
3. Litchi - Eight varieties collected from U.P are under evaluation for off-season production and the cultivar Shahi was found to be the best .All other varieties are in vegetative phase.
4. Carambola- Two types i.e. Sweet and Sour types are under evaluation. Sour type is yielding and Sweet type is under vegetative phase.
5. Loquat –A better performing collection from Boys town, Perumparai was planted during 2010-11 and the seedlings are in vegetative phase.

221. **Multi tier cropping system of Horticulture crops to be formulated for tropical areas**

Coconut based multi species cropping system
In coconut based multi species cropping system, eight models were tested. Among them, Coconut + black pepper + banana + elephant foot yam + coriander combination recorded consistently higher BC ratio followed Coconut + banana + black pepper combination.Hence, this model most suitable intercropping system in coconut garden for the East Coast Region of Tamil Nadu.

Main Horticulture based farming system

Plantation Crops	:	Coconut, Arecanut and cashewnut
Spices	:	Black pepper, clove, nutmeg, cinnamon
Fruit crops	:	Banana, pineapple, guava, papaya, sapota
Vegetable	:	Bhendi, brinjal, chilli, cowpea, gourds, tomato, drumstick, leafy vegetables
Tuber crops	:	Elephant foot yam, tapioca, sweet potato
Flower crops	:	Marigold, crossandra and orchids
Medicinal plant	:	Noni, tulsi, kalmeg, pippli, pudina etc.

Among the various combinations, crops like coconut, Arecanut, clove and nutmeg have long gestation period (7-9 years), whereas coffee, cinnamon and pepper come to bearing in 3-4 years. Spices in coconut or Arecanut gardens significantly increase the net income per unit area with optimized use of resources like light, water and land. This also reduces the soil erosion to a greater extent. Intercropping of spices has given an additional return of Rs.9299/- and Rs.29428/- from 0.05 ha of land under arecanut + black pepper and coconut + ginger systems respectively. An additional employment

of 40 man days was also generated under intercropping system compared to mono crops.

222. **Evolving ultra high density planting technology for mango and Banana**

Regarding Ultra High Density Planting System, it requires regular and vigorous pruning. This is not possible in banana. At same time the University has already popularized the High Density Planting Technology in banana (spacing 1.8 x 3.6 mtr with 3 suckers / pit).
Regarding Mango, the University has already recommended a system called "Double Hedge Row System (spacing 10 x 5x 5 mt)" which is suitable for mercerized cultivation. By this system, a population of 266 plants can be adopted.
Regarding Ultra High Density Planting, the University has not conducted any trial and in future, this can be tried.

223. **The erratic rain fall, no. of rainy days, internsity of rainfall, floor and drought displaced in enriched top soil and the quality of soil has been degraded and deteriorated. The quality of retaining the moisture capacity of the soil has been reduced especially in Dry land and rain fed area. This causes severe hardship to dryland farmers. It is essential to promote soil and soil moisture conservation technologies extensively.**

The available in-situ and watershed based soil conservation and moisture conservation technologies pertaining to local conditions may be popularised by the extension officials in various dry land areas.

224. **Series of check dams across gullies would help to harvest excess water and recharge the ground water potential also. This would be much helpful for conjunctive use of ground water and surface water irrigation.**

Series of check dams may be constructed in the priority watersheds for effective water harvesting during monsoon rains, based on the availability of funds.

225. **Improved ground water recharge practices to borewells for augmenting the ground water depletion may be provided in Thanae affected areas.**

The water harvesting structures like check dams and percolation ponds will be useful in augmenting ground water recharge.

226. **Parts of coastal districts agricultural area is affected by sea water intrusion and the recommended treatment is construction of sub surface dyke which is costlier. Hence, low cost structures / measures to prevent sea water intrusion may be recommended.**

Sea water intrusion can be arrested by providing enough water harvesting structures in the coastal belt and also by restricting the high rate of pumping in severe problem areas.

227. **Efficient and self cleaning silt trapping system for irrigation water conveyance system**

One of the simple system is to expand the width of the channel so as to reduce the velocity below critical velocity, which will make the sediment particle to settle.

228. **A holistic approach should be adopted for treatment of the catchment, increasing the capacity tank / water bodies including Panchayat Union to bridge the gap areas.**

Water resources can be developed and protected by holistic approach for which cooperation of all the agencies connected with water is needed.

229. **Methods for more water saving and efficient irrigation applications for paddy cultivation.**

SRI method of cultivation will save water for paddy cultivation which may be popularised by the extension officials.

230. **After the harvest the drip laterals are to be rolled and kept over field boundry fo carrying out preparation activities for the next crop. In the absence of suitable rolling practices among the farmers the laterals are being damaged each and every time usage and hence getting spoiled and also require more labours. Hence it is required to have a technology of drip lateral bundler machine to overcome the above issued before and after the cropping period. Many of the farmers made representations for want to this technology**.

Tractor mounted hydraulically driven respoolers are being used in large farms tractor can be operated. However it is suitable only for long fields. Suitable tractor operated respooler will be developed.

231. **Development of multipurpose seed drills for paddy, minor millets and pulses. Sivaganagai district is a drought prone areas. The major crop in the district is paddy. Major cultivated area is under rainfed condition and the farmers very much interested in using seed drill machinery for sowing seeds. The machinery available today is not vety efficient to sow paddy seeds and pulses. Hence, a multipurpose efficient seed drill may be developed for paddy, minor millets and pulses.**

The TNAU cultivator mounted seeder can be used to sow pulses and millets. If more accurate metering is required, the inclined plate planter available commercially can be used. This implement had been promoted and demonstrated widely under FLD by AMRC.

232. **Development of multicrop harvester for harvesting paddy and maize**

Possibility of using existing paddy combine harvester for millet crop after modifying necessary modification in the cutting and threshing unit. Commercially available Preet maize combine harvester may be used for harvesting maize. Commercially available Class / combine may be used for harvesting pulses. Reaper binders are already available commercially which may be used for harvesting millets. After harvesting axial flow threshers may be used for threshing.

233. **Farmers find it difficult in harvesting groundnut and suitable groundnut digger cum harvester for different soils may be designed and developed. As such, there is no commercial manufacturers for groundnut differs and TNAU has to promote subsidiary companies for manufacturing groundnut differs.**

Already developed tractor operated groundnut digger can be used for harvesting groundnut crop. The groundnut combine harvester is under research.

234. **A modified turmeric harvester may be developed over the present harvester so as to enable excavation, clods and rhizomes separation and packing which reduce the major portion of the cultivation cost and also capable of reducing roots (Rhyzomes) damage than existing ones.**

The potato digger elevator had been modified by AMRC and was found to dig, and separate turmeric rhizomes. Similar machines are also being used by farmers.

235. **Mechanical detrasher for sugarcane crop - Sugarcane farmers are finding it difficult to detrash the sugarcane leaves especially after 3 months of transplanting. Currently there is no mechanized sugarcane detrashers are available in the market to detrash the leaves in the 3 months to 6 months old standing sugarcane crop. Hence a mechanizal power operated detrasher machinery may be developed for Tamil Nadu condition.**

Sugarcane farmers are finding it difficult to detrash the sugarcane leaves especially after 3 months of transplanting. Currently there is no mechanized sugarcane detrashers are available in the market to detrash the leaves in the 3 months to 6 months old standing sugarcane crop. Hence a mechanical power operated detrashing machinery may be developed for Tamilnadu condition.
Already a manual detrasher for standing sugarcane crop had been developed and released. Due to the height and row spacing contains detrashing in standing crop by powered machinery is not feasible.

236. **At present the cost of the sugarcane harvester is very high and due to that all categories of the farmer may not be in position to purchase. Hence, a miniature version of harvesters with lower cost for sugarcane is required.**

Development of tractor operated wholecane harvester is being attempted by Agricultural Machinery Research Centre in collaboration with M/s. Gomathi Engineering Services, Kunnathur. The harvester is suitable for sugarcane cultivated in 3 ½ feet row spacing. The capacity of the harvester is 80 tonnes / day. The cost of the harvester is approximately Rs.50 lakhs.

237. **Combine harvester with attachment suitable for minor millets, maize and pulses**

Development of multi crop harvester for harvesting paddy and maize
Possibility of using existing paddy combine harvester for millet crop after modifying necessary modification in the cutting and threshing unit.
Commercially available Preet maize combine harvester may be used for harvesting maize.
Commercially available Class / combine may be used for harvesting pulses.
Reaper binders are already available commercially which may be used for harvesting millets. After harvesting axial flow threshers may be used for threshing.

238. **Onion storage structures constructed at Trichy, Perambalur, Thirupur, Erode, Namakkal, Virudunagar, Madurai, Theni, Dindigul, Thirunelveli and Thoothukudi districts may be evaluated and improvements may be suggested for expansion to other districts.**

The storage structure constructed at Thoothukudi district has been visited and under evaluation. The faculty from this university will continue to co-ordinate the evaluation.

239. **Provision of solar powered pumping systems with automatic tracking system linked with micro irrigation system**

The tracking systems are available commercially and mostly utilized for power generation in large capacity solar power plants. However, if ordered, small size automatic tracking system for solar powered pumping system can be fabricated and supplied by the manufactures. The cost of automatic tracking system is 10 % in addition to the cost of solar PV powered pumping system for 3 to 5 HP range and it can be linked with micro irrigation system.

240. **Technology for Oryzanol (active ingredient) extraction from the rice bran oil which will triple the farmers income- Tiruvannamalai.**

The feasibility of extraction of oryzanol from rice bran oil will be explored and the research may be taken up in future**.**

241. **Intensive training to all commodity group members on value addition, food processing and post harvest technologies - Villupuram**

Regular training programmes on value addition of fruits, vegetables, millets, bakery products and spices to farmers, entrepreneurs, are organised at Post Harvest Technology Centre at Coimbatore, Home Science College and Research Institute, Madurai and KVKs.

242. **Value addition training Institute in district level to be set up - Villupuram**

In the KVKs at district level, value addition training programmes are conducted. Training centre / incubation facilities being established at Chettinad, Sivaganga, Srirangam, Trichy and Kinathukadavu, Coimbatore.

243. **Training for group/ cluster formation for farmers , growing identical crops to follow post harvest technologies and value addition - Salem**

Dissemination of post harvest technologies and Market information (Price about all the commodities to farmers from DEMIC and AMI &BPC) - Salem

In the KVKs at district level, value addition training programmes are conducted regularly. For more information the cluster/ group may be directed to Post Harvest Technology Centre at Coimbatore, Home Science College and Research Institute, Madurai.

244. **Training on value addition, packing and marketing to farmers through KVKs – Namakkal**

In the KVKs at district level, value addition training programmes – both on campus and off campus are conducted regularly. For more information the

cluster/ group may be directed to Post Harvest Technology Centre at Coimbatore, Home Science College and Research Institute, Madurai.

245. **Dehydration Technology required for Garlic - The Nilgiris**

Dehydration of garlic using vacuum dryer in order to retain the volatiles may be suitable. Studies will be taken up.

246. **Turmeric steam boiler is available in Erode district. Farmers reported that while using boiler, uneven boiling of turmeric is noticed. Better alternate boiler or technology may be suggested to reduce this problem- Erode**

The farmers are practicing non mobile type turmeric steam boiler for boiling rhizomes in Erode District. They may be advocated to use TNAU improved turmeric boiler for uniform boiling of turmeric rhizomes.

247. **Value addition techniques for groundnut is required – Trichy**

Technologies for production of groundnut chikki, groundnut milk, baked groundnut products are developed / available and value added products were also developed by utilizing groundnut oil cake.

248. **Small Onion rate is highly influenced by the season. In one season the rates are very low when the production is high and glut in market when arrival from nearby states. Farmers are not getting reasonable rate. The only option is store it and sell it in lean season or when the market rate is high. So storing of small onion in scientific method -needs to be evolved - Perambalur**

Farmers may be advocated to use Natural air ventilation type storage structure (Maharashtra model) promoted by AED, Chennai.

249. **In zonal workshops the season wise post harvest technology and Agribuisness information to be provided exclusively for the dept of marketing – Karur**

Possible through the Engineering / Food Science/ Home Science/ Social science faculty available at KVKs.

250. **Setting up of semi processing unit at village level**
Semi processing units on cleaning and grading may be developed at village level and the semi processed produce may be transported to cities for further processing. In villages the resources like land , labour, water and others are cheaper than cities. Also the village laborers will get employment at their village itself throughout the year. This will result in reduction in numbers of the villagers migrating to cities. Hence crop specific semi processing technology/unit may be suggested- Tanjore

The agro processing complex at village level may be established based on crops grown not only create employment opportunities in rural areas but also reduce the cost of processing.

251. **To get remunerative price for major agricultural commodities , value addition training may be imparted to farmers - Nagapattinam**

In the KVKs at district level, value addition training programmes are conducted regularly. For more information the cluster/ group may be directed to Post Harvest Technology Centre at Coimbatore, Home Science College and Research Institute, Madurai.

252. **Food processing Machineries:**
Cashew farmers are advocating road side country method nut processing of cashew and selling in road side. Small processing machineries can be evolved for their usage and which will result in quality processing and marketing of cashew at small scale – Pudukottai

Improved cashew nut shellers (hand cum pedal operated) are available and used in Cuddalore and Ariyalur. Number of manufacturers are available.

253. **Pulses Dhal Processor: Mini pulses dhal processor can be evolved and distributed to the commodity groups for village level processing - Pudukottai**

Mini dhal mill is available. They may be purchased from TNAU / authorised manufacturers for distribution to the commodity groups for village level processing.

254. **Paddy tray nursery preparatory machine and transplanter - Pudukottai**

Theses machineries are available in Tiruvarankulam Agri Business Centre and being under utilization by the farmers on hire basis. The cost of the machinery is on higher side hence small units can be developed at lesser cost in such a way to distribute the same to the more number of small farmers.
The automatic paddy tray seeder commercially available are smaller. In an hour 540 -600 trays can be filled with midea and seed. Possibility of hiring out of these machines in the potential areas may be explored. Transplanters are also available as small units.

255. **Farmers need adequate knowledge on post harvest technology and value addition of Agricultural produces which will help the farmers to get better profit – Dindigul**

In the KVKs at district level, value addition training programmes – both on campus and off campus are conducted regularly. The farmers can be advised to visit the nearby KVK and get information. For more information the cluster/ group may be directed to Post Harvest Technology Centre at Coimbatore, Home Science College and Research Institute, Madurai.

256. **Technology for increasing the shelf life of banana – Theni**

Shelf life of banana can be increased through Modified / Controlled atmospheric packaging. Also converting banana into value added products like osmo dried banana, banana flour, beverages from banana and pickling preservation of banana will extend its shelf life.

257. **Technology for flavoured tender coconut water in tetra packing required – Theni**

Tender coconut water has its original unique flavour and does not require artificial flavouring. Technology for bottling of is already available and being commercialized.

258. **In Virudhunagar district sapota is grown in the Western parts by farmers . Because of its drought tolerant, fruit quality and yield potential it thrive well even during adverse seasons and farmers are getting good yield. But the price is not remunerate as raw fruit . So scientific intervention is needed on value addition technologies to get spectrum of products in a modified size, shape , so that the farmers can get higher price for the fruits they produced – Virudhunagar**

Appropriate studies will be taken up.

259. **Rubber processing and curing equipments – Kanyakumari**

The processing technology developed by Rubber Board may be advocated.

260. **Precision farming technology in millets for each zone may be suggested.**

- Selection of high yielding variety
- Laser levelling
- In-situ moisture conservation
- Maintaining optimum plant population
- Uniform application of organic manures and fertilizers

261. **Nutrient management for hybrid maize under rainfed *vertisol* /Alfisols.**

Rainfed hybrid maize

- Apply NPK as per soil test recommendation as far as possible. If soil test recommendation is not available, adopt a blanket recommendation of 60 : 30:30 NPKkg/ha for Alfisols and40 : 20 : 0 NPK kg/ha for Vertisols.
- Apply half of N and full dose of P_2O and K_2O with enriched FYM as basal along with Azospirillum (10 packets/ha).
- Top dress remaining half of N at tasseling.
- Apply TNAU MN mixture @ 7.5 kg /ha as Enriched FYM (Prepare enriched FYM at 1:10 ratio of MN mixture & FYM; mix at friable moisture & incubate for one month under shade).

262. **Development of newer formulations of microbial inoculants and seed treatment methods for millets**

Research work is in progress for developing *in vitro* AM fungi inoculam following root organ culture technique for millets. Seed treatment method for combined application of AM fungi and *Pseudomonas fluorescens* with polymer coating is also being standardised.

263. **Enhancing the productivity of small millets by dry farming techniques**

- Chisel ploughing once in three years
- Broadbed furrow in black soil and compartmental bunding in red soil to conserve rain water
- Cultivation of high yielding and drought tolerant varieties
- Seed hardening with 1% KCl solution
- Line sowing using seed drill
- Spacing to be adopted: 25 x 10 cm
- Plant population : 4,00,000 plants/ha (40 plants /m^2)
- Bio fertilizer application: Azophos @ 2 Kg/ha
- Application of FYM/compost/composted coir pith @ 12.5 t/ha
- Two intercultivation and one hand weeding
- Recommended dose of fertilizers @ 44:22:0 Kg/ha NPK
- Harvesting at physiological maturity to avoid loss due to lodging
- Intercropping of cowpea or blackgram or lablab @ 8:2 or 4:1

Varieties of small millets recommended

Crop	Common name	Varieties
Samai	Little millet	CO(Samai) 4, Paiyur 2
Varagu	Kodo millet	CO 3, APK 1
Kudiraivali	Barnyard millet	CO(KV)2
Tenai	Foxtail millet	CO(Te) 7
Panivaragu	Proso millet	CO(PV)5

264. **Intercropping of groundnut in sugarcane**

Raising 3 rows of Groundnut at a row spacing of 30 cm in raised beds in the interspace of sugarcane is recommended.

265. **Developing multifunctional bio inoculants (*Burkholderia* sp) for groundnut, Altering crop geometry to suit mechanical weeding in oilseeds**

An externally funded project for studying the multifunctional role (Phosphate solubilisation, antagonistic activities against plant pathogens and nitrogen fixation) of *Burkholderia vietnamensis* is ongoing. Pot culture and field evaluation will be carried out this year.

266. **Standardization of seed invigoration treatment for seed quality enhancement in groundnut.**

The seed quality enhancement technique recommended for groundnut is as follows:
Soaking of kernals in 0.5 % $CaCl_2$ in equal volume for 4 h with small seeded varieties and for 6 h with bold seeded varieties.

267. **Focussed research on agricultural mechanization and designing of suitable implements for small and marginal land holdings.**

Manually operated, small engine operated and power tiller operated machines are already available for use in small and marginal land holdings.

268. **Research on dry land mechanization may be focussed.**

Many machines exclusively for dry land agriculture such as seeders, conservation equipment, etc have already been developed, which can well be used.

269. **Development of low cost Mini Dhal Mills.**

Mini Dhal mill operated with 0.5 hp single phase at the rate of Rs.12,000/- (approx.) are commercially available

270. **Development of low cost, high efficiency cotton picking machine suited to all tracts.**

The pneumatic cotton picking machine has been developed at department of Farm Machinery with capacity of 26.03 kg/h can be used. The cost of the unit is around Rs.50000/-. However the leaves have to be removed before picking by chemical means to avoid contamination of cotton.

271. **Development of low cost Farmer friendly sugarcane harvester machine**

Development of tractor operated whole cane harvester is being attempted by Agricultural Machinery Research Centre in collaboration with M/s. Gomathi Engineering Services, Kunnathur.

272. **Evolution of appropriate pre-processing and value addition technologies.**

Crop specific post harvest and value addition technologies have been developed. Studies will be taken up on crop specific post harvest issues.

273. **Technologies to improve the keeping quality of pulses.**

Pulse crops need to be dried well to a moisture content of 10-12% before storage.
Need to be cleaned well. Use of insect traps in both bins and gunny bags.