

# RESEARCH HIGHLIGHTS 2015

## CROP IMPROVEMENT

### FOR ADOPTION

#### NEWLY RELEASED VARIETIES DURING 2015

##### RICE TKM 13

Derived from the cross of two rice varieties viz., WGL 32100 / Swarna, TKM 13 variety has medium slender fine grain with lesser 1000 grain weight (13.5 g). It matures in 130 days which is 7-10 days earlier than BPT 5204. The average grain yield of this variety is 5938 kg/ha which is 6.2 and 10.1 per cent increase over CO (R) 49 and BPT 5204 respectively. TKM 13 is moderately resistant to leaf folder, stem borer, green leaf hopper, blast, rice tungro disease, brown spot and sheath rot. This variety has high milling yield (75.5percent) and head rice yield (71.7percent), which is on par with the check variety BPT 5204.



##### RICE CR 1009 SUB1



This is an improved version of CR 1009 with *Sub 1* gene conferring submergence tolerance at seedling level for 15 days immediately after transplantation and the work was undertaken at International Rice Research Institute (IRRI), Philippines. This variety has given a mean grain yield of 5759 kg/ha in 155 days with moderate resistance to brown spot, blast, brown plant hopper (BPH) and white backed plant hopper (WBPH). This long duration variety is suitable for *samba* season for the long duration rice cultivating tracts of Tamil Nadu which are prone to flood. CR 1009 sub 1 possesses short bold rice with high milling percentage and head rice recovery. Rice contains high amylose with intermediate gelatinization temperature and soft gel consistency which is suitable for idly making and this variety is recommended as an alternate to CR 1009.

##### RICE MDU 6

Derived from the cross MDU 5 / ACM 96136, this variety matures in 110-115 days and yields 6118 kg/ha in irrigated condition. Highest yield of 9388 kg/ha was recorded at Ayyampalayam, Erode District. It has long slender rice with intermediate amylose content, gelatinization temperature and high linear



elongation ratio on cooking, superior cooking quality with good taste and highly suitable for raw rice, variety rice, aval and pori making. This variety is suitable for cultivation as transplanted rice throughout Tamil Nadu except Nilgiris district.

### **SORGHUM K 12**



This is a dual purpose sorghum variety maturing in 95 days. Tolerating drought, K 12 can yield on an average of 3123 kg/ha of pearly white grains and 11.9 t/ha of dry fodder yield. It has yielded upto 5300 kg/ha in Senkottai of Tirunelveli District. This photo insensitive variety is moderately resistant to shootfly, stemborer and resistant to downy mildew. This variety is suitable for cultivation in rainfed vertisol tracts of southern districts of Tamilnadu and also suitable for summer irrigated tract of Tenkasi region.

### **WHEAT CO W 3**

This is a high yielding bread variety suitable for southern hill zones and adjoining areas in Tamil Nadu under restricted irrigation as a best alternative winter cereal. This variety recorded 12 per cent increased yield (4076 kg/ha) over the check COW(W)1 (3641 kg/ha) in a total of 131 trials and has the ideal plant height (90 cm) with erect plant type, strong and resilient stem providing resistance to lodging. It also possesses high degree of resistance to stem, leaf and stripe rusts under both artificial and natural epiphytotic conditions.



### **RICE CULTURES IN ADVANCED STAGE OF TESTING**

The following rice cultures which have completed two years of testing in Adaptive Research Trials will be submitted for consideration and release if the cultures are outstanding than the respective checks and have specific advantages over the ruling varieties.

#### **SHORT DURATION CULTURES**

##### **1. TM 07335**

- Parentage : ADT 43 /CO 47
- Duration : 115 days suitable for Sornavarai/ Kar/ Kuruvai/ Navarai season
- Average yield : 6569 kg/ha with an yield advantage of 11.1 percent over ADT (R) 45
- Moderately resistant to BPH, blast (score 3) RTD , BLB (score 3)
- High head rice recovery (61.2percent) and milling percentage (69.5percent)

## 2. AS 10024

- Parentage : ADT 39 /BPT 5204
- Duration : 110-115 days suitable for Kar and *Pishanam*
- Average yield : 5991 kg/ha with an yield advantage 19.7 percent over ADT 43
- Medium slender white rice and possess good cooking qualities equivalent to ADT 43
- Tolerant to blast and BLB

## 3. CB 08504

- Parentage : Raskadam / IR 50
- Duration : 113 days suitable for Sornavari/ Kar/ Kuruvai/ Navarai
- Average yield : 6419 kg/ha which is 6.4 and 7.0 per cent higher yield \ over CO 51 and ADT(R)45
- Medium slender grains with good head rice recovery
- Resistant to brown spot and green leaf hopper
- Moderately resistant to BLB, RTD and BPH

## MEDIUM DURATION CULTURES

### 1. CB 09123

- Parentage : BPT 5204 / CO 50
- Duration : 135 days suitable for Thaladi season
- Average yield : 5982 kg/ha which is 4.67 and 8.40 per cent yield increase over ADT 49 and BPT 5204
- Moderate resistance to BPH, WBPH , GLH and brown spot and tolerance to blast and sheath rot diseases
- Medium slender grains with intermediate amylose

### 2. TR 05031

- Parentage : ADT 39 / CO 45
- Duration : 135 days suitable for Thaladi season
- Average yield : 5433 kg/ha with an yield advantage of 17.47 per cent over TRY 3
- Suitable for saline/alkaline areas
- Resistant to BLB and leaf spot diseases
- Moderately resistant to stem borer, leaf folder and blast

## FOR ON FARM TESTING

### a. Cultures recommended for adaptive research trials 2015-16

Sl. No	ART No. & Season	Cultures with Parentage / checks	Mean grain yield, duration and yield advantage over checks	Special attributes	Locations
1	<b>Rice 3 / 2015-16</b> Transplanted (Sornavari/Kar/ Kuruvai, April-July) 105-115 days	<b>TM 10085</b> (ADT 43/CO 47)  <b>Checks:</b> ADT (R) 45, CO 51	5961 kg/ha  10.8 percent - ADT (R) 45 7.9 percent - Rice CO 51	Resistant to Blast, Medium slender grains and head rice recovery of 58.0percent, LER -1.33.	All districts except Virudhunagar, Ramnad, Sivagangai and The Nilgiris
2.	<b>Rice 6/2015-16</b> Transplanted (August 15 - September 10 sowing) 140-160 days	<b>AD 09367 (R)</b> (BPT 5204/I.W. Ponni) <b>Checks:</b> CR 1009, ADT 50	7244 kg/ha in 158 days 7.0percent - CR 1009 10.0percent - ADT 50	Resistant to sheath blight and moderately resistant to blast, BLB, sheath rot. Medium slender grains with high HRR (66.2percent)	Cuddalore, Trichy, Perambalur, Karur, Pudukkottai, Thanjavur, Thiruvavur and Nagai
3.	<b>Rice 10/2015-16</b> Rainfed Early (Sept. – Oct)	<b>TM 09132 (R)</b> (IR 82590- B-B-14-3)	3234 kg/ha in 112 days 88.3percent - TKM (R) 12 75.1percent - Anna (R) 4	Drought tolerant	Ramnad, Sivaganga, Virudhunagar, Thoothukudi, Thiruvallur, Villupuram, Kanchipuram
		<b>CB 06803 (R)</b> (PMK (R) 3/ Norungan)	2603 kg/ha in 117 days 51.6percent - TKM (R) 12 40.9percent - Anna (R) 4	Drought tolerant	
		<b>CB 08702 (R)</b> (IR 80013-B-141-4)	2528 kg/ha in 122 days 47.2percent - TKM (R) 12 36.9percent - Anna (R) 4	Drought tolerant	
		<b>TM 09135</b> (Selection from IR 82639-B-B-115-1) <b>Checks:</b> TKM (R) 12, Anna(R) 4	3848 kg/ha in 118 days 14.5percent - TKM (R) 12	Drought tolerant	

4.	<b>Rice 13/2015-16</b> Salt stress Medium (Sep sowing)	<b>TR 09030 (R)</b> (Mutant of TRY 2) <b>Checks:</b> TRY 2, TRY 3	3842 kg/ha in 108 days	Long slender rice Score 3 for stem borer, BPH & GLH, score 5 WBPH, score 1 for leaf folder & Gall midge	Trichy, Karaikal, Ramnad, Nagapattinam, Thoothukudi Thiruvallur
5.	<b>Rice 14/2015-16</b> Special transplanted (May-June sowing:105-115 days)	<b>AD 09219</b> (ADT (R) 45/ ACK 03002)	6147 kg/ha in 115 days 16percent increase over ADT 43	Moderately resistant to sheath blight, blast and BPH Medium slender grains with HRR of 62.1percent, good LER of 1.68 and VER (4.6)	All districts except Virudhunagar, Ramnad, Sivagangai and The Nilgiris
		<b>AD (Bio) 09518</b> (ADT 43/ IRBB 60- 5-1) <b>Checks:</b> ADT 43, CO 51	5767 kg/ha in 118 days 9.1 percent yield advantage over ADT 43	Moderately resistant to leaf folder Medium slender grains with an HRR of 57.7percent. The LER is 1.66 and VER is 4.1 with soft GC	
6.	<b>Rice 15/2015-16</b> Special transplanted (September- October sowing:125-140 days)	<b>AD 08142 (R)</b> (ADT 43/IR 64)	6156 kg/ha in 134 days 12.3percent - ADT 49 12.9percent- BPT 5204	Moderately resistant to BPH, GLH, blast and sheath rot. Medium slender grains, more LER (2.0),less BER (1.35), more VER than BPT 5204	All districts except Virudhunagar, Ramnad, Sivagangai, and The Nilgiris
		<b>AD 09493</b> (I.W.Ponni/Bansakti)  <b>Checks:</b> ADT 49, BPT 5204	6295 kg/ha in 131 days  14.50 percent - ADT 49	Non lodging, resistant to blast, brown spot, leaf folder, 'MR' to stem borer, BLB and	

			22.20 percent - BPT 5204	sheath rot. Medium slender grains with HRR 63.05percent. It has good elongation ratio upon cooking (LER-1.78)	
7.	<b>Rice 16/2015-16</b> Hybrid rice Early	<b>TNRH 280 (R)</b>  <b>Checks:</b> CORH 3 Rice CO 51	6197 kg/ha in 134 days On- par with CORH 3 11.9percent over ADT (R) 45 15.9percent over CO 51	Resistant to BPH, GLH. Medium slender grains with more LER and int. alkali spreading value.	All districts except Viridhunagar, Ramnad, Sivagangai and The Nilgiris
8.	<b>Rice 17/2015-16</b> Hybrid rice – Medium Transplanted(Sept – Oct)	<b>TNRH 241 (R)</b>	6435 kg/ha in 133 days 6.1percent over CORH 4 On par with CO (R) 50	Moderately resistant to WBPH, resistant to sheath rot and sheath blight	All districts except Ramnad, Viridhunagar, Sivagangai and The Nilgiris
		<b>TNTRH 40</b>  <b>Checks:</b> CORH 4, ADT (R) 46, CO (R) 50	6321 kg/ha in  10.4percent over CORH 4 8.3 percent over CO(R) 50	MR to stem borer, brown spot and leaf blast. It has an LER of 1.55 with moderate volume expansion ratio (3.60) and intermediate amylose content (21.0percent).	

**b. Rice cultures recommended for on-farm trials 2015-16**

Short duration : AD 08010, CB 10553, TM 07030 and AD 07073  
Mid early duration : ACM 07001  
Medium duration : CO 43 sub1  
Long duration : AD 07250



## MILLETS

### FOR ADOPTION

#### MAIZE

(Varieties released at National level during 2015)

##### 1. Maize hybrid CMH 08-381

Hybrid culture CMH 08- 381 is a late maturing (105-110 days), single cross (UMI 1211 x UMI 1221), normal hybrid with bold grains of orange yellow colour with dent type. It has high shelling (81percent), high test weight (40g/100 kernels) and stay green trait which can fetch high price in the market for grain and fodder. It gave an average grain yield of 9359 kg/ha in Zone 3 and 4 over three years testing in *Kharif* season. It has consistent superiority in yield over qualifying national checks viz., PMH 1 (16.65 percent), PMH 3 (9.46 percent), Seed Tech 2324 (18.06 percent) and Bio 9681 (23.57 percent).

It exhibited multiple disease resistance viz., Maydis leaf blight, Common rust, Turcicum leaf blight, Brown stripe downy mildew, *Curvularia* leaf spot, Erwinia stalk rot and post flowering stalk rot under artificial conditions and moderate resistant to stem borer *Chilo partellus* over qualifying check varieties. It possesses special attributes such as high starch (76.42 percent), high protein (10.57 percent) and high beta-carotene (0.47 mg/ 100g) with moderate level of fat (4.56 percent) and crude fibre (1.43percent). It was identified by VIC for National release as CoH (M) 11 during 2014 for adoption in the states of Bihar, Jharkhand, Odisha, Eastern Uttar Pradesh, Maharashtra, Karnataka, Andhra Pradesh and TamilNadu for *Kharif* season.

##### 2. Maize hybrid CMH 09-464

Hybrid culture CMH 09-464 is a late maturing (105-125 days), modified single cross (UMI 1200 x UMI 1210') x UMI 1223) normal hybrid with bold grains, orange yellow colour with dent type and stay green. It has high shelling (80percent) and high test weight (41g/100 kernels). It gave an average grain yield of 8320 kg/ha in Zone-3 over three years in *Kharif* season. It has consistent superiority in yield over qualifying checks viz., PMH 1 (6.27percent), PMH 3 (1.45 percent), Seed tech 2324 (16.07 percent) and Bio 9681 (14.92percent). This entry has multiple disease resistance with moderate resistance to stem borer.

It possesses special attributes such as high starch (76.52 percent), high protein (11.51 percent) and high beta-carotene(0.48 mg/100g) with moderate level of fat (4.52 percent) and crude fibre (1.44 percent). For single cross hybrid seed production, the male parent UMI 1223 should be sown four days earlier than female parent (UMI 1210'x UMI1200) in a ratio of 1:3 for flowering synchronization. For sister line crossing, the male parent UMI 1200 and female parent UMI 1210' can be sown simultaneously for flowering synchronization (1:4). It specifically identified by VIC for National release as CoH (M)12 during 2014 for adoption in the states of Bihar, Jharkhand, Odisha and Eastern Uttar Pradesh for *kharif* season.

### 3. Maize hybrid CMH 08-282

CMH 08-282 is another late maturing (105-125 days) single cross (UMI 1200 x UMI 1230), normal hybrid having bold orange yellow grains with semi dent type. It has high shelling (80percent), high test weight (41g/100 kernels) and stay green at maturity. It gives an average grain yield of 8951 kg/ha in zone-4 for mean yield of three years in *Rabi* season. It has consistent superiority in yield over qualifying checks *viz.*, seed tech 2324 (10.70percent), Buland (19.47 percent) and Bio 9681 (9.48percent) in breeding trials during *Rabi* season (Zone -4). It is moderately resistant to Turcicum leaf blight, Sorghum downy mildew, Post flowering stalk rot and Common rust disease under artificial conditions and stem borer over qualifying check varieties. It recorded 4 t/ha of single cross hybrid seed yield, the male UMI 1200 and female UMI 1230 parents can be sown simultaneously for flowering synchronization in a ratio of 1:3 or 1:4. It specifically identified by VIC for National released as CoH (M) 13 during 2014 for adoption in the states of Tamil Nadu, Andhra Pradesh, Telangana, Karnataka and Maharashtra for *Rabi* season under irrigated condition.

### 4. Maize hybrid CMH 08-287

CMH 08-287 is a late maturing (115-128 days), single cross (UMI 1210 x UMI 1220), normal hybrid with bold grains that are orange yellow in colour with dent type. It has high shelling (80percent) and high test weight (41g /100 kernels). Stay green at maturity makes it a good fodder after harvest. It gives an average grain yield of 9478 kg/ha in zone-4 as mean yield of three years in *Rabi* season. It has consistent superiority in yield over qualifying checks *viz.*, seed tech 2324 (17.21percent), Buland (26.51 percent) and Bio 9681 (15.92percent) in breeding trials during *Rabi* season (Zone-4). This hybrid is specifically identified by VIC for National release as CoH (M) 14 during 2014 for adoption in the states of Tamil Nadu, Andhra Pradesh, Telangana, Karnataka and Maharashtra for *Rabi* season under irrigated condition.



**Maize hybrid CMH 08-381**



**Maize hybrid CMH 09-464**





**Maize hybrid CMH 08-287**

**FOR ON FARM TESTING**

**SORGHUM**

The culture TNS623 (2219B x SPV 1390) is dual purpose, short duration culture with average grain yield potential of 2742 kg/ha and moderately resistant to shoot fly and stem borer. The culture TNS 623 has been tested as SPV2174 in AICSIP IVT and AVT trials. This culture is in third year ART trial.

The culture TNS 648 with grain yield potential of 2531 kg/ha having an increased yield of 12 per cent over CO 30 is in second year of MLT. TNS 660 recorded grain and fodder yield of 3892 kg and 15037 kg/ha with an increased yield potential of 19.4 and 27.4 per cent respectively with favorable plant height of 189 cm. The culture TNS 662 recorded 3996 and 16367 kg of grain and fodder yield with an increase of 20.2 and 38.6 per cent over the check CO 30. These two cultures have been promoted to MLT 2015-16.

**PEARL MILLET**

The composite UCC 32 performed well both under rainfed and irrigated situations in Tamil Nadu. This composite is medium in stature (160-180cm) with 85-90 days duration. It produced 4-6 productive tillers and recorded a mean grain yield of 3474 kg/ha under irrigated condition which is about 17 and 23 per cent increase over the checks CO (Cu) 9 and ICMV 221 respectively. The mean grain yield under rainfed condition is 2916 kg/ha which is 15 and 24 per cent increase over CO (Cu) 9 and ICMV 221 respectively.



Hybrid TNBH 08804 tested under ART recorded an average yield of 2950 kg/ha which is 16.6 percent increase over 86M52 and 7.9 percent over TNAU cumbu hybrid CO 9. This hybrid possess compact ear head with bold grains.

## PULSES

### BLACKGRAM

- The culture VBG 09-005 is a cross derivative of VBN 3 x VBN 04-008 maturing in 65-70 days and suitable for all seasons. The average yield is 958 kg/ha which is 20.20 and 24.25 percent increase over VBN 6 (797 kg/ ha) and CO 6 (771 kg/ha) respectively. The culture possesses special advantages like synchronized maturity, multiple disease resistance to Mungbean Yellow Mosaic Virus (MYMV), powdery mildew and leaf crinkle diseases. The culture VBG 09-005 had a protein content of 21.9 percent and arabinose content of 7.5 percent with good battering quality. It has bold seeds with a 100 grain weight of 4.5 g.
- The culture VBG10-024 is a selection from IPU-99-3. Duration of this culture is 65 – 70 days with an average yield of 1383 Kg/ha. In addition to high yield, it is highly resistant to MYMV with synchronized maturity.
- The culture VBG 10-010 is a cross derivative of VBN 2 x VBG 04-003. The average yield is 1095 kg/ha in 65 days. It is a synchronous maturing type and is moderately resistant to Mungbean Yellow Mosaic Virus (MYMV) and powdery mildew.
- The culture COBG 10-05 is a cross derivative of VBN (Bg) 5 x *V. mungo* var *silvestris*. This culture matures in 60-65 days. The average grain yield is 997 kg/ha which is 10.3 percent increase over the best check CO 6 (716 kg/ha) and is resistant to MYMV. The 100 seed weight is 5.5 g.
- The culture COBG 11-02 is a cross derivative of VBN 4 x *V. mungo* var *silvestris*. This culture matures in 60-65 days. The average grain yield is 748 kg/ha which is 16.8 percent increased yield over the best check VBN 6 (640 kg/ha) and is resistant to mung bean yellow mosaic virus. The 100 seed weight is 6.0 g.



### REDGRAM

- The culture CRG 10-01 is a cross derivative of APK 1 x LRG 41. This culture matures in 108 days with SMD resistance. This culture has recorded the highest grain yield of 1156 kg/ha while the local check VBN 2 recorded 1056 kg/ha which is 9.46 percent yield increase over the VBN 2.

### COWPEA

- The culture VCP 09-013 is a cross derivative of TLS 38 x VCP 16-1. The mean grain yield is 1099 kg/ha with a duration of 70-75 days. This culture is resistant to pod borer.
- The culture VCP 09-019 is a cross derivative of TY 860 38 x CO (Cp) 7. The mean grain yield is 1370 kg/ha with a duration of 75 days.

## CULTURES IN ADVANCED STAGE OF TESTING

### OILSEEDS

#### GROUNDNUT

##### 1. Groundnut VG 09220

This spanish bunch culture recorded a mean pod yield of 2229 kg/ha which is 10.9 and 8.9 per cent increased pod yield over VRI Gn 6 (2043 kg/ha) and TMV Gn 13 (2062 kg/ha) respectively in ART during *kharif* 2011. The culture was also evaluated during 2013-14 through ART. This culture has 49 percent oil content.

Parentage	:	ALR 3 X AK 303
Duration (in days)	:	105-110 days
Yield (kg/ha)	:	2229 kg
Per cent increase over VRI Gn 6	:	10.9
Percent increase over TMV Gn 13	:	8.09
Shelling percentage	:	70.4
Oil content (per cent)	:	49.0
100 kernel weight	:	51.0 g
Special features	:	High yield, foliar disease resistant

#### FOR ON FARM TESTING

#### GROUNDNUT

##### 1. Groundnut ICGV 06146

This spanish bunch culture recorded 2040 kg/ha yield which is 39.3 percent increased yield than VRIGn 6 in the multilocation trial conducted during Kharif 2013 and 2014. It has high oil content of 52 percent. This culture will be evaluated in ART during 2015-16.

Parentage	[(ICGV 92069 x ICGV 93184) x (ICGV 96246 x 92 R/75)]
Duration (in days)	105-110 days
Yield (kg/ha)	2040 kg
Yield increase over VRI (Gn) 6	39.3 percent
Special features	High yield, high oil (52 percent), acceptable pod traits

##### 2. Groundnut TVG 0856

This spanish bunch culture recorded 1890 kg/ha which is 29.4 percent increased pod yield than the VRIGn 6 in MLT during kharif 2014 and 2015. It has foliar disease resistance with 49 percent oil content. This culture will be evaluated in ART during 2015-16.

Parentage	VRI (Gn) 6 x R 2001-2
Duration (in days)	105-110 days
Yield (kg/ha)	1890 kg
Yield increase over VRI (Gn) 6	29.4percent
Special features	High yield, rust resistant, LLS -2.0, shelling 72 percent, SMK – 92 percent, 100KW – 38 g and oil content -49 percent

## SUNFLOWER

### CSFH 12205

This sunflower hybrid matures in 85-90 days with seed yield of 2010 kg/ha which is an increase of 17.3 per cent over CO 2 hybrid in MLT during kharif 2014 and 2015. It has high oil content of 42 percent with high volume weight (46g/100 ml). This hybrid will be evaluated in ART during 2015-16.

Parentage	COSF 6A x IR 6
Duration (in days)	85-90 days
Yield (kg/ha)	2010 kg
Yield increase over CO 2 Hybrid	17.3percent
Special features	High oil content (42 percent), volume weight (46g/ 100ml)

## CASTOR

### YRCH 1116

This castor hybrid matures in 180 days with seed yield of 2100 kg/ha which is an increase of 22 per cent over YRCH 1. It has resistance to wilt and green leaf hopper. This hybrid will be tested in ART during 2015-16.

Parentage	M 619 x SKI 215
Duration (in days)	180 days
Yield (kg/ha)	2100 kg
Yield increase over YRCH 1	22.0percent
Special features	High yield, basal branching, triple bloom, resistant to wilt and GLH

### YRCH 1205

This castor hybrid matures in 180 days with seed yield of 1620 kg/ha. It is 49.8 per cent increased seed yield than the check TMV 6. It has bold seed with resistance to wilt and green leaf hopper. It can be maintained as perennial. This variety will be tested in ART during 2015-16.

Parentage	TMV 6 x Salem local
Duration (in days)	180 days
Yield (kg/ha)	1617 kg

percent increase over TMV 6	49.8
Special features	High yield, bold seed (40g), can be maintained as perennial, resistant to wilt and GLH

## SESAME

### VS 07-023

VS 07-023 white seeded sesame culture matures in 75 days with a seed yield of 650 kg/ha. It recorded 12.4 and 11.7 percent increased seed yield than SVPR 1 and TMV 7 in MLT. It has resistance to shoot webber. This culture will be evaluated in ART during 2015-16.

## COTTON

### CULTURES IN ADVANCED STAGE OF TESTING

#### 1. Cotton TCH 1716 (*G. hirsutum*)

Centre : Dept. of. Cotton, TNAU, CBE  
 Parentage : (MCU 5 x TCH 92-7) x MCU 5-1  
 Duration : 150 days

Yield/ quality traits	TCH 1716	MCU 13 (C)	Percent increase over check
Seed cotton yield (kg/ha)	1748	1463	19.5
Ginning outturn (percent)	35.0	34.5	-
Fibre length (mm)	35.0	31.5	-
Fibre strength (g/tex)	23.4	19.6	-
Micronaire value	3.4	3.8	-
Elongation (percent)	5.9	5.0	-

Salient features : ELS (35.0 mm) with fine fibre

#### 2. Cotton hybrid TSHH 0629 (Intra *hirsutum* Hybrid)

Centre : Cotton Research Station, Srivilliputtur  
 Parentage : TSH 311 x TSH 306  
 Duration : 165 days

Yield/ quality traits	TSHH 0629	Bunny (C)	Percent increase over check
Seed cotton yield (kg/ha)	2487	2083	19.2
Ginning outturn (percent)	35.8	34.2	-
Fibre length (mm)	28.5	30.7	-
Fibre strength (g/tex)	21.2	23.4	-
Micronaire value	4.0	3.6	-

Salient features: LS (28.5 mm), Tolerant to jassid

## FOR ON FARM TESTING

### Cultures for ART

Season	Culture	Yield	Yield increase over check (percent)	Special Features
Winter Irrigated	TCH 1716	1748	19.5 (MCU 13)	Extra Long Staple
	TCH 1777	1874	20.3 (MCU 13)	Long staple
Winter Rainfed	TKH 0250/2	1560	19.1 (SVPR 2)	Drought tolerant
Summer Irrigated	TSH 0499	1740	18.7 (SVPR 4)	Suitable for Summer irrigated condition



TCH 1716



TCH 1777



TSH 0499

## FORAGE CROPS

### CULTURES IN ADVANCED STAGE OF TESTING

#### 1. FODDER COWPEA CULTURE TNFC 0924

Parentage	CO 5 x Bundel lobia 2
Duration	55-60 days
Season	<i>Kharif</i> and Summer
Yield	Green fodder yield - 25 t / ha Dry matter yield – 5.25 t / ha Crude protein content - 22.3 percent

- Ranked first at National level in IVT (*kharif* 2012) and AVT I (*kharif* 2013) for GFY and DMY in the AICRP trials

#### Mean green fodder yield of fodder cowpea culture TNFC 0924

S. No.	Trials	No. of trials	Green fodder yield (t/ha)		percent increase over CO (FC) 8
			TNFC 0924	CO (FC) 8	
1.	Research Station Trial (2010 - 2012)	3	24.25	20.80	<b>16.60</b>
2.	OFT (2013 and 2014)	60	29.02	24.73	<b>17.35</b>
3.	MLT (2014)	14	22.39	18.53	<b>20.83</b>
	<b>Over all mean</b>		<b>25.22</b>	<b>21.35</b>	<b>18.13</b>

## FOR ON FARM TESTING

### 1. Hedge Lucerne culture TND 1308

A promising mutant TND 1308 (450 Gy) superior to the introduced variety for fodder yield has been identified from mutation breeding programme commenced during 2010. It was subjected for continuous evaluation against the introduced variety for two years (2013-14 and 2014-15).

The results revealed that the mutant TND 1308 had registered a mean green fodder yield of 81.9 t/ha /yr compared to check (70.45 t/ha /yr). It will be proposed for conducting MLT from *kharif* 2015 onwards for two years.

### 2. Lucerne culture TNLC 14

The promising lucerne culture *viz.*, TNLC 14 identified from completed poly-cross breeding programme (2003 – 2010) has been subjected for evaluation against the recently released lucerne variety CO 2 for two successive years (2013-14 and 2014-15).



The results revealed that the entry TNLC 14 accomplished a mean green fodder yield of 136.5 t/ha /yr as compared to check CO 2 (121.5 t/ha /yr). The percent increase in green fodder yield over the check CO 2 was 12.3. Based on its superior performance, it has been proposed for AICRP perennial trial from *rabi* 2013-14 onwards and now it is in the second year of perennial trial.

### 3. *Cenchrus*

The promising *Cenchrus* culture FDC 265 has been evaluated under MLT against CO 1 during 2014-15 in 14 centres. Being perennial, it will be tested for one more year under MLT in the same centres during 2015-16 to ascertain its consistency in performance.



## BREEDER SEED PRODUCTION

### VARIETAL SPECTRUM IN BREEDER SEED PRODUCTION OF DIFFERENT CROPS 2015-16

S. No.	Crop	Varieties	Total Numbers
1.	<b>PADDY</b>	ADT 36, ADT 37, ADT 38, ADT 39, ADT 42, ADT 43, ADT 44, ADT (R) 45, ADT (R) 46, ADT (R) 48, ADT (R) 49, ADT (R) 50, CO 43, CO (R) 48, CO (R) 49, CO (R) 50, CO (R) 51, CR 1009, CR 1009 SUB 1, MDU5, MDU 6, IR 20, IR 36, IR 50, ASD 16, ASD 18, ASD 19, I.W.Ponni, TRY 1, TRY 3, TPS 5, TKM 9, TKM 13, Anna (R) 4	34
2.	<b>MILLETS</b>		
	Sorghum	CO (S) 29, CO (S) 30, K 11, K 12	4
	Ragi	CO (Ra) 14, CO (Ra) 15, Paiyur 2	3
	Bajra	CO (Cu) 9	1
	Maize	COH (M) 6, COH (M) 8, COH (M) 9 Parental lines	3
	Samai	CO (Samai) 4	1
	Varagu	CO 3	1
	Tenai	CO (Te) 7	1
	Kudiraivali	CO (Kv) 2	1
3.	<b>PULSES</b>		
	Redgram	VBN 3, CO(Rg) 7,	2
	Blackgram	ADT 3, ADT 5, VBN 3, VBN (Bg) 4, VBN (Bg) 5, VBN (Bg) 6, VBN (Bg) 7, CO 6, MDU 1	9
	Greengram	ADT 3, VBN 2, VBN 3, CO 6, CO(Gg)912 (CO7), CO(Gg)8.	6
	Cowpea	CO (Cp) 7	1
	Horsegram	Paiyur 2	1
4.	<b>OILSEEDS</b>		
	Groundnut	VRI (Gn) 6, VRI (Gn) 7, CO (Gn) 6, CO (Gn) 7, TMV (Gn) 13.	5
	Sesame	VRI Sv.1, VRI Sv.2, TMV 3, TMV 4, TMV 5, TMV 6, TMV 7, SVPR 1.	8
	Castor	TMV 5	1
	Sunflower	CO (SFV) 5	1
5.	<b>COTTON</b>	MCU 5, MCU 7, SVPR 2, SVPR 3, SVPR 4.	5
6.	<b>FORAGE</b>	CO (FS) 29	1
7.	<b>VEGETABLES</b>	Tomato – PKM 1, Chilies – K 1, K2 , Bittergourd – CO 1, Ridge gourd – PKM 1, Ash gourd – CO 2 Cluster bean – MDU 1, Snake gourd – CO 2	8
		<b>Grand Total</b>	<b>97</b>



## ABSTRACT

### Breeder seed production programme for the year 2013-14 (For supply during 2014-15 to State, GOI and private)

Crop / Variety	Indented Quantity 2013-14				Distribution of breeder seeds 2014-15			
	State	GOI	Priv.	Total	State	GOI	Priv.	Total
PADDY	16080	2400	77190	95670	16883	3112	78603	98598
MILLETS	593	-	10	603	384	693	447	1524
PULSES	6795	3992	2260	13047	5419	1972	3146.5	10537.5
OILSEEDS	42737	7501	130	50368	28191	7502	13	35706
COTTON	55	30	54	139	57	-	143	200
FORAGE CROPS	-	275	-	275	-	275	-	275
VEGETABLE CROPS	-	-	132	132	2	-	351.815	353.815
<b>TOTAL</b>	<b>66260</b>	<b>14198</b>	<b>79776</b>	<b>160234</b>	<b>50936</b>	<b>13554</b>	<b>82704.315</b>	<b>147194.315</b>

### Breeder seed production programme during 2014-15, supply during 2015-16

Crop / Variety	Indented Quantity 2014-15				Supply of breeder seeds 2015-16 *			
	State	GOI	Priv.	Total	State	GOI	Priv.	Total
PADDY	16617	2830	81545	100992	17617	2830	81545	+ 101992
MILLETS	396	-	36	432	416	-	36	452
PULSES	4346	2550	4162	11058	4346	2550	4162	11058
OILSEEDS	27168	9200	215	36583	27168	9200	215	36583
COTTON	-	4	225	229	-	4	225	229
FORAGE CROPS	-	325	-	325	-	325	-	325
VEGETABLE CROPS	-	-	223	223	-	-	223	223
<b>TOTAL</b>	<b>48527</b>	<b>14909</b>	<b>86406</b>	<b>149842</b>	<b>49547</b>	<b>14909</b>	<b>86406</b>	<b>150862</b>

\* Despatch instruction issued and supply is in progress.

### Breeder seed production programme for the year 2015-16 (For supply during 2016-17 to State, GOI and private)

Crop / Variety	Indented Quantity 2015-16			
	State	GOI	Priv.	Total
PADDY	22159	2750	108225	133134
MILLETS	1266	216	5	1487
PULSES	10546	720	5085	16351
OILSEEDS	64653	-	442	65095
COTTON	50	-	139	189
VEGETABLE CROPS	-	-	115.5	115.5
<b>TOTAL</b>	<b>98674</b>	<b>3686</b>	<b>114011.5</b>	<b>216371.5</b>

## CENTRE FOR PLANT MOLECULAR BIOLOGY AND BIOTECHNOLOGY

A short duration rice culture, AD (Bio) 09518 (ADT 43 x IRBB60-5-1) (115-120 days) has been developed through marker assisted breeding (MAB) and evaluated under MLTs during 2012-13 & 2013-14. AD (Bio) 09518 gave 9.1 per cent higher yield (5767 kg/ha) than ADT 43. It has medium slender grains with high head rice recovery (80.6 percent). Based on the performance under MLT, this culture has been promoted for ART. This line has three Bacterial Leaf Blight (BLB) resistance genes (*xa5*, *xa13* and *Xa21*) and showed higher level of resistance (1.15 to 1.5 cm lesion length) against *Xoo* isolates. The culture is being further evaluated for its reaction against BLB.

Another rice culture, AD (Bio) 13042 (ADT 43/IRBB60) pyramided with three BLB resistance genes viz., *Xa5*, *Xa13*, *Xa21* and with a duration of 125 days was evaluated for three years. It gave a mean yield of 5928 Kg/ha with 21 percent increase over ADT43 and 12.2 percent increase over ADT39. This culture is proposed for evaluation under MLT.



A rice culture, CB 012015 with high yield (6837 kg/ha) and a major blast resistance gene *Pi54* and a gall midge resistance gene *Gm1* has been developed through MAB and proposed for MLT in 2015. CB 012015 showed high level of resistance against gall midge (4.52 percent silver shoot) compared to CO43 (43 percent silver shoot). CB012015 was moderately resistant to blast (score: 3.2) compared to CO 43 (score 4.97).



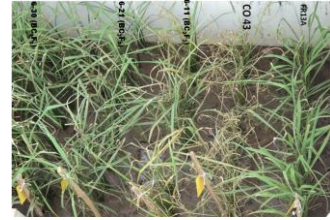
Drought is a serious production constraint especially in rainfed ecosystems. IR20 backcross derived lines with QTLs for deep and thick roots from CT9993 have been developed using MAB and evaluated under drought in rainfed ecosystem. Lines with higher grain yield (2.5 to 3.0 t/ha) under drought have been identified.

Two rice lines CBMAS 14142 and CBMAS 14065 derived from Improved White Ponni x Apo having higher yield and superior grain quality were evaluated under MLT. CBMAS 14142 is a short duration (115-120 days) culture possessing long slender grain (length = 7.3 mm; breadth = 1.9 mm and L/B ratio 3.8), higher grain yield (4928 kg/ha) over Pusa Basmati-1 (4429 kg/ha) with high head rice recovery (61.8 percent). This line also has three QTLs for yield under drought from Apo.



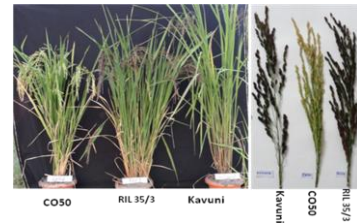
CBMAS14065 is a medium duration (130-135 days) culture possessing short slender grain (L = 5.4 mm; B = 2 mm and L/B ratio 2.6), higher grain yield (5616 kg/ha) than BPT5204 (5026 kg/ha) and better head rice recovery (62 percent). This culture also has two QTLs for yield under drought from Apo.

Submergence/flooding is a serious threat to rice cultivation. Submergence tolerant CO43 (CO43-*Sub1*) has been developed using MAB and tested under MLT during 2014-15. Under seven days of submergence, CO43 *Sub1* gave higher yield (5500 kg/ha) as compared to CO43 (5000 kg/ha).



Salinity is a major limitation affecting rice cultivation. Improved White Ponni with *saltol* has been developed using MAB and tested under MLT (2014-15). IWP-*saltol* performed better under saline conditions and gave 16.6 percent higher yield than IWP.

Kavuni is a traditional rice genotype known for its nutritive and therapeutic values but not remunerative to the farmers due to its low yield (1000 – 1500 kg/ha), photosensitivity and susceptibility to lodging. High yielding (3.0 – 3.5 t/ha), non-lodging and photo-insensitive “Kavuni” have been developed through molecular breeding.



# CROP MANAGEMENT

## TECHNOLOGIES IN ADVANCED STAGE OF EVALUATION

### RICE

#### 1. Split application of N and K in semi dry cultivation

Performance of three rice varieties viz., Anna (R) 4, ADT (R) 45 and Norungan local varieties were evaluated with split application of N and K in semi dry cultivation. Among the varieties, Anna (R) 4 performed better with the recommended dose of NPK 75:25:37.5 kg/ha applied as full doses of P and 1/4<sup>th</sup> doses of N and K as basal and the remaining dose of N and K in three equal splits on 25, 45 and 60 days after sowing (DAS) and recorded 43 percent increased grain yield (3290 kg/ha) over basal application of recommended dose of NPK.



#### 2. Weed management in drum seeded rice



Pre emergence application of pyrazosulfuron ethyl at 20 g a.i /ha on 3 DAS followed by cono weeding on 25 DAS had higher weed control efficiency (94percent), increased grain yield (6450 kg/ha) and BC ratio (2.45). It was also found that cono weeding on 10 and 25 DAS is an alternative to chemical weed management.

#### 3. Weed management in wet seeded rice

Suitable pre and post emergence herbicides were evaluated in wet seeded rice during *kharif* and *rabi* season with varieties viz., CO (R) 51 and CO (R) 50. Among the herbicides, pre-emergence application of pendimethalin 1.0 kg/ha at 3 DAS followed by post emergence application of bispyribac sodium 25 g/ha at 25 DAS along with one hand weeding 45 DAS effectively reduced weed density, increased the grain yield (6039 kg/ha and 5937 kg/ha) with higher net return of Rs.44,221/ha and 42,877/ha during *kharif* and *rabi* respectively.

#### 4. Weed management in transplanted rice

Performance of pre and post emergence herbicides were tried in transplanted rice during *kharif* and *rabi* season with rice varieties CO (R) 51 and CO (R) 50. Among the herbicides, pre emergence application of pretilachlor 750 g/ha at 3 days after transplanting (DAT) followed by post emergence application of chlorimuron and metsulfuron 4 g / ha at 25 DAT had higher weed control efficiency (97 percent and 96 percent), grain yield (6038 and 6044 kg/ha) and net return (Rs.47,001 /ha and 47,223 /ha) during *kharif* and *rabi* season respectively.

## MILLETS AND FORAGE CROPS

### 1. Agronomic interventions for enhancing moisture use efficiency in rainfed maize

Land configurations with tillage and mulching (pearl millet crop residues & coir pith) evaluated to enhance moisture use efficiency in rainfed maize revealed that Broad Bed Furrow (BBF) with basal coirpith incorporation @ 5 t/ha or crop residue as mulch @ 5 t/ha with 3 supplemental irrigations on 20, 45 and 70 DAS recorded higher grain yield (6305 kg/ha) and net return (Rs. 48,060 / ha) due to higher soil moisture content in vertisol.



### 2. Micronutrient fertilization for cumbu napier hybrid fodder grass-CO (CN) 4

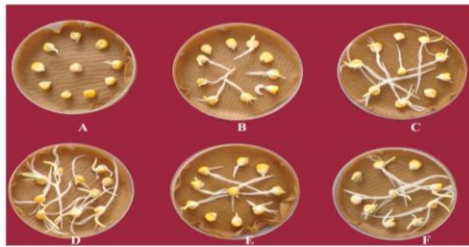
Application of 150:50:40 kg NPK/ha (75 kg N, entire P & K as basal and 75 kg N at 25 days after planting) with 50 kg  $\text{FeSO}_4$  and 25 kg  $\text{ZnSO}_4$  in seven equal splits recorded high green fodder yield (394 t/ha/year) with higher crude protein percentage and net return (Rs. 3,64,446 /ha/year) is CO (CN) 4 cumbu napier grass.



### 3. Physiological, biochemical and molecular basis of seed biopriming with biocontrol agents and liquid biofertilizers in maize

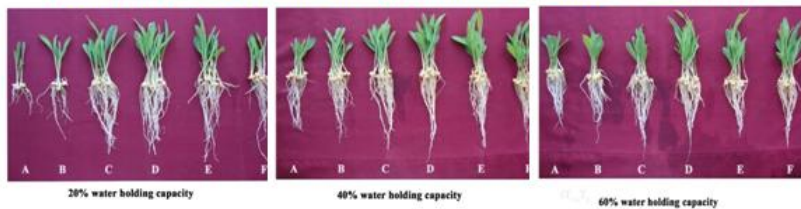
In maize hybrid COH (M) 5, seeds bioprimed with 8 percent *P. fluorescens* for 12 h, 20 percent *Azospirillum* for 12 h, 20 percent phosphobacteria for 12 h and 80 percent *Trichoderma viride* for 6 h enhanced the seed quality through increased seed germination, seedling growth and vigour. Also seeds bioprimed with 8 percent *P. fluorescens* for 12 h performed well under extreme salt stress and low moisture conditions.

**Seedling vigour of maize COH(M)5 at 7th day after of germination**



- A - Nonprimed seed**
- B - Hydropriming 12h**
- C - *Trichoderma sp.* 80percent 6 h**
- D - *Pseudomonas flurescens* 8percent 12h**
- E - *Azospirillum* 20percent 12h**
- F - Phosphobacteria 20percent 12h**

**Seedling growth of bioprimered maize (COH(M)5) under water stress condition**



**PULSES**

**1. Conservation tillage and supplemental irrigation for rainfed blackgram**

Minimum tillage with crop residue application @ 5 t/ha combined with supplemental irrigation (two nos.) through rain gun at vegetative and flowering stages recorded increased water use efficiency (2.52 kg/ha/mm) and higher seed yield (930 kg/ha) in rainfed blackgram.



**2. Sprinkler irrigation on different blackgram varieties under summer irrigated condition**

Blackgram variety ADT 5 registered higher seed yield (1227 kg/ha) under sprinkler irrigation at 100percent PE followed by VBN (BG) 6. Sprinkler irrigation at 100percent PE recorded lower water usage of 308.7 mm and saved the water (25.4percent) than conventional irrigation.



### 3. Weed management in machine sown redgram under dry land condition

Weed management practices viz., power weeding and mulches were evaluated for machine sown redgram under dry land condition. Power weeding at 20 and 40 DAS with intra row weeding registered higher weed control efficiency (79.5percent) and seed yield (922 kg/ha). Mulching with crop residue @ 5.0 t/ha reduced broad leaved weeds and grassy weeds at all stages of crop growth.



Power weeding on 20 DAS



Crop Residue Mulching

## OILSEEDS

### 1. Nutrient management in groundnut - blackgram cropping system for irrigated condition

Application of 100 percent N (25 kg/ha) + 150 percent PK (75:112.5 kg /ha) to groundnut and 100 percent RDF to blackgram (25:50:25 kg NPK/ha) recorded the highest pod yield (2503 kg/ha) in groundnut and seed yield of blackgram (820 kg/ha) with higher net return of Rs.81,160/ha (Rs. 62,693/ha in groundnut and Rs.18,467/ha in blackgram) and BCR of 2.02 (2.21 for groundnut and 1.82 for blackgram) in groundnut – blackgram cropping system under N,P,K.



### 2. Integrated nutrient management in blackgram – sunflower cropping system

In blackgram – sunflower cropping system, application of FYM @ 5 t/ha + STCR based NPK (66:67:44 kg/ha) + gypsum @ 500 kg/ha + borax @10 kg/ha and incorporation of blackgram crop residues (4.5 t /ha) produced the higher sunflower seed yield (2586 kg/ha) with net return of Rs. 63,440/ha.

### 3. Management practices for yield maximization in TNAU SFH CO2 sunflower

Agronomic management practices viz., spacing and fertilizer levels with and without FYM were evaluated in sunflower (SFH CO2). Application of FYM @ 5 t/ha with a spacing of 60 x 30 cm (55,555 plants/ha) and 125percent NPK (75:113:75 kg/ha) was found to be the best management practice for maximising the yield (2011 kg/ha) of TNAU SFH CO2 Sunflower hybrid.



### 4. Seed pelleting for increased seed yield and quality in sesame



Sesame seeds cv. TMV 7 pelleted with 760 g neem leaf powder+ 360 ml Carbon Methyl Cellulose (CMC) (2 percent) + *Azospirillum* 120 g + Phosphobacteria 120 g/kg of seed enhanced the germination (86percent) , seedling vigour index (1350) and seed yield (955 kg/ha).

## COTTON

### 1. *In-situ* water harvesting and crop residue addition for rainfed cotton in black soil

Mulches viz., coir pith and crop residues were evaluated under different land configuration methods (compartmental bunding, Broad Bed Furrow (BBF), ridges and furrow) in rainfed cotton (RCH 2 BG II) under black soil. The results revealed that BBF system with coir pith application @ 5 t/ha registered higher soil moisture at different soil depth and increased yield attributes i.e.. number of sympodial branches / plant, number of bolls / plant, boll weight and seed cotton yield (2918 kg/ha) with net profit of Rs. 58,764 / ha and BC ratio of 2.10.

### 2. Integrated weed management in cotton

Early post emergence (EPOE) application of pyriithobac sodium @ 62.5 g a.i./ha + quizalofop ethyl @ 50 g a.i /ha at 2 to 4 leaf stage and hand weeding at 45 DAS recorded lower weed density and dry weight and higher weed control efficiency (98 percent) in summer irrigated cotton. PE application of pendimethalin @1.0 kg a.i./ha on 3 DAS followed by EPOE quizalofop ethyl @ 50 g a.i./ha and one hoeing on 45 DAS (or) EPOE pyriithobac sodium @ 62.5 g a.i./ha + quizalofop ethyl @ 50 g a.i./ha and one hoeing on 45 DAS were found to be the alternative weed management strategies in cotton.

## SUGARCANE

### 1. Plant geometry under drip fertigation in SSI system

Plant geometry under drip fertigation in SSI system was evaluated. Double row planting at 150 cm x 30 cm in SSI system registered higher tiller production (2,25,600 /ha), millable cane (2,03,300 /ha), cane yield (178.9 t/ha) and B C ratio of 3.20. It also recorded higher sugar yield (21.6 t/ha) with CCS of 12.1percent.



## 2. Sustainable intercropping for SSI in western zone of Tamil Nadu

Sugarcane (Co 86032) inter cropped with small onion recorded the cane yield of 141.6 t/ha and 1333 kg/ha bulb yield from intercropped onion (CO 5). Sugarcane + small onion (3 row) intercropping system registered the net income of Rs.2,54,240 /ha with a B C ratio of 3.33. Sugarcane + blackgram (4 row) intercropping system can also be adopted to get higher net income as well as to improve soil fertility.

## 3. Sub surface drip fertigation in sugarcane

Comparative performance of water soluble fertilizers (WSF) and normal fertilizers (NF) were evaluated under sub surface drip fertigation. In sugarcane var. 86032, 100percent RDF (300:100:200 NPK kg/ha) with water soluble fertilizers was found to be superior in registering higher cane yield of 177.4 t/ha, water use efficiency (161.2 kg/ha mm), water saving (24.2 percent) and higher net income of Rs. 2,15,799 /ha compared to surface irrigation. Considering economics, subsurface drip fertigation at 100percent RDF with normal fertilizer was found to be superior in registering higher return per rupee invested (B:C ratio 2.55).



## AGRO CLIMATE RESEARCH CENTRE

### 1. Revalidating pre- monsoon sowing week with higher resolution for changing climate of Tamil Nadu

For identifying shift in rainy season and revalidating existing pre-monsoon sowing weeks and developing pre-monsoon sowing week at block level, the rainfall for the period from 1950 – 2010 data were collected from TNAU Research Stations, TN State Dept. of Economics and statistics, State Ground & Surface Water Data Centre and Indian Meteorological Department (IMD). The monsoon onset week was shifted over a period from 1950 to 2010. Shift has both temporal and spatial variation. Shift was one or two weeks on either side. Two weeks earlier onset has been notified in southern districts of Tamil Nadu. One week earlier onset was observed in north western and western parts of Tamil Nadu. In particular, one week delayed onset was noticed at coastal, western ghats and north eastern parts of Tamil Nadu.

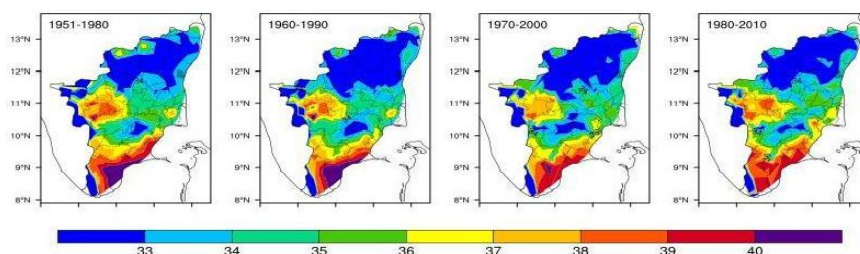
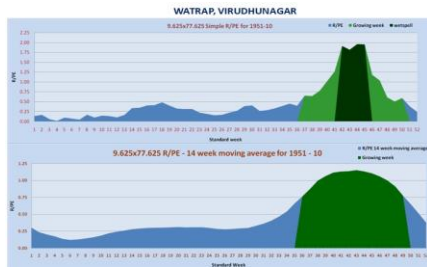


Figure 1. Monsoon onset weeks over different moving periods in Tamil Nadu

The shift in the rainfall pattern for the Watrap village, Virudhunagar district is given below.



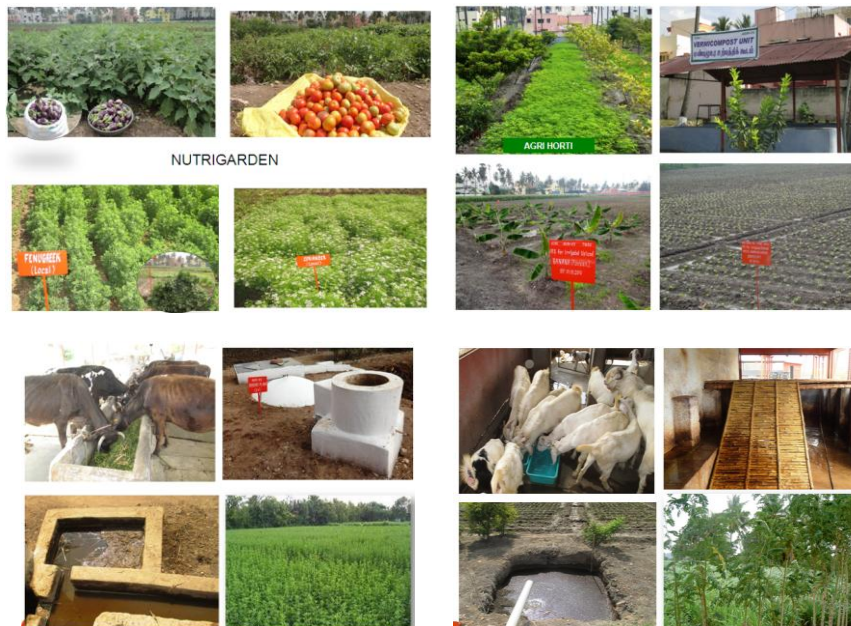
Long period Seasonal Average 1980 - 2010												
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Ave. mm	35.9	34.3	21.8	35.4	76.4	80.1	41.8	44.3	84.0	174.7	156.5	744.8
Long period Seasonal Average 1980 - 2010												
Season	Winter			Summer			South West Monsoon			North East Monsoon		
Ave. mm	30.2			332.8			199.4			382.4		
Standard Week	1951 - 50	1951 - 50	1951 - 50	1951 - 50	1951 - 50	1951 - 50	1951 - 50	1951 - 50	1951 - 50	1951 - 50	1951 - 50	1951 - 50
Premonsoon sowing week	36	35	35	34	35	35	35	35	35	35	35	35
Rainy season start week	37	36	36	35	36	36	36	36	36	36	36	36
Rainy season end week	51	50	51	50	51	51	51	51	51	51	51	51
Length of growing period	17	17	18	18	18	18	18	18	18	18	18	18
Wet spell start week	42	42	42	42	42	42	42	42	42	42	42	42
Wet spell end week	45	45	45	45	45	45	45	45	45	45	45	45

From the analysis, the proposed pre-monsoon sowing week for Virudhunagar district comes during 35<sup>th</sup> Standard Meteorological Week (SMW) over a period of 1950 to 2010. Similarly, the start of rainy season comes during 36<sup>th</sup> SMW while the end of rainy season comes during 51<sup>st</sup> SMW. The length of growing period comes around 18 weeks for the study district. The start of wet spell is 42<sup>nd</sup> SMW and ends during 45<sup>th</sup> SMW. Similarly, the rainfall atlas for all the blocks of Tamil Nadu is worked out and it is available for adoption.

## INTEGRATED FARMING SYSTEM

### 1. Integrated farming system for irrigated drylands

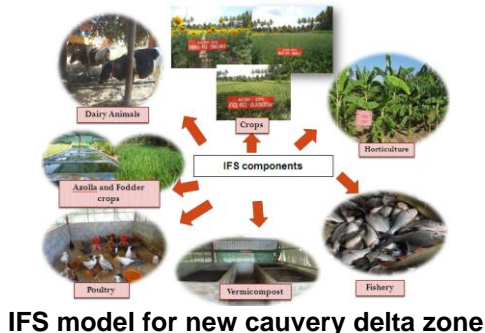
To enhance the system productivity, profitability and resource recycling in irrigated / dryland ecosystem, crop component with horticulture, dairy, goat rearing, biogas and vermicompost can be adopted. This system could give a net return of Rs. 2,66,485 / year from 1.20 ha farm unit with additional nutrients viz., 244 kg N, 132 kg P and 177 kg K by recycling livestock wastes and crop residues. Employment generated was 688 mandays through IFS.



**Crop component with horticulture + dairy + goat rearing + biogas + vermicompost**

## 2. Integrated farming system for the marginal farmers of new cauvery delta zone

An IFS model suitable for new cauvery delta zone was developed. Crop components integrated with horticulture, dairy, poultry and fishery units gave a net return of Rs. 1,00,012 / ha. The total produce of 29,977 kg was recycled within the IFS unit with an input value of Rs.20,471 and it saved the production cost to the tune of 16.3percent.



## 3. Integrated farming system for sustainable agriculture in dryland vertisols

To increase the farm productivity, income, employment and to recycle farm and livestock waste / residue effectively, various components were linked in dryland IFS. Crop components with milch animals and goat recorded higher system productivity of 16,978 kg/ha with a net income of Rs.1,16,098 /ha besides an employment of 410 mandays in the dryland vertisols of southern zone. Integration of livestock components helped to enhance the farm productivity and tide over the risks of crop failure even during drought years.



**Crop components with milch cow and goats**

## 4. Organic farming package for major cropping systems

Organic packages for chilli (K2) – cowpea (Co CP7) - babycorn (G5417 F1 hybrid) were studied. Application of 100percent required N as organic viz., enriched FYM + vermicompost + neem cake -1/3<sup>rd</sup> each with *panchagavya* 3percent foliar spray thrice recorded chillies equivalent yield of 15035 kg/ha and net return of Rs. 1,01,125 /ha.



Organic package for maize (NK 6240) – rice (ADT 49) - greengram (KM 2) system was evaluated. The highest rice equivalent yield of 15,546 kg/ha/yr was recorded by the application of 100percent organics through FYM + vermicompost+ neemcake+ *panchagavya* 3percent spray. The maximum net return of Rs.70,523 /ha/yr was obtained by the application of 100percent organics+ intercropping (maize + blackgram, rice + daincha).

# WATER TECHNOLOGY CENTRE

## 1. Enhancing water productivity thro' AWDI in rice farming

- Improvisation of the water management techniques adopted by the farmers for the production of rice is the main theme adopted in this attempt.

An unique method to save water in irrigated rice cultivation is the intermittent drying of the rice fields instead of keeping them continuously flooded. This method is referred to as Alternate Wetting and Drying Irrigation (AWDI). This method was found to increase the productivity of water at the field level considerably by reducing seepage and percolation during the crop growing period.

In conventional practice, water is ponded to a depth of 5cm for each irrigation and subsequent irrigation was given one day after the disappearance of ponded water which consumed very high quantity of irrigation water. The surface moisture had been considered to be the index for further irrigation. As revealed by several research reports, the moisture was still available to support the crop growth even after surface drying occurred.

With these concepts in background, approaches were made to evaluate the safe AWDI levels in rice cultivation. According to IRRI, depletion of ponded water (DPW) 15 cm below the soil surface was reported to be the safe AWDI practice for transplanted rice. In line with this, the WTC initiated field trials to determine the safe AWDI.

Scheduling irrigation after 15 cm depletion of ponded water (DPW) below the ground level from 7 DAT upto maximum tillering and continuous submergence upto 10 days prior to harvest registered favorable plant growth and higher grain yield (5855 kg ha<sup>-1</sup>) which was comparable to that of conventional irrigation practice of ponding 5 cm submergence one day after disappearance of ponded water. Further confirmatory trials are under progress.

## 2. Drip fertigation in rice

Aerobic rice cultivation is considered as a viable water saving agro-technology to cope up with the looming crisis of water resources. With the objectives of determining the optimal drip lay out for aerobic rice, field experiments were conducted during DS 2013 with different lateral distances and fertigation under different rice cultivars.

Higher grain yields (5703 kg/ha) was recorded with the hybrid JKRH 3333 followed by CORH 4 (5460 kg/ha). The total water applied was 721.4 mm for conventional irrigation as against 533.8 mm in the case of drip system. The grain and straw yields were higher in the 0.8 m lateral distance SDI @ 1 lph Solar pump especially with the hybrid JKRH 3333 due to increased grain yield and higher water productivity values over the other treatments.

The drip irrigation is being adopted in a larger area ( around 20 ha) in Govindapuram village of Dharapuram taluk wherein the performance of rice was good when raised under rice-onion-maize cropping system.

### 3. Sustainable Sugarcane Initiative (SSI) – An unique system to increase water productivity in sugarcane

Water is increasingly becoming a major limiting factor for agriculture, especially where irrigated crops and dry land agriculture are maintained. The impact of irrigated crops on dry land agriculture is significant, particularly in semiarid regions where irrigation is primarily based on ground water, leading to decline in soil moisture and seriously reducing the productivity. During the past 10 years, sugarcane production in India has been fluctuating between 233 million tonnes to 355 million tonnes. The production and productivity was continuously stagnant for the past 4 decades. To increase the production and productivity, Water Technology Centre, Tamil Nadu Agricultural University introduced Sustainable Sugarcane Initiative (SSI) with the financial help of National Bank for Agriculture and Rural Development (NABARD). Sustainable sugarcane initiative is a package of practice based on the principle of “more with less” in agriculture. The technology implies reduced inputs like water, fertilizer, labour and seed material with increased sugarcane production and productivity. The main aim of the technique is to make sugarcane cultivation simple, affordable and profitable for industry, both small and large farmers.

#### Comparative performance of SSI over Conventional method

S.No.	Characters	SSI	Conventional
1.	Plant height (cm)	322.4	277.2
2.	Inter node length (cm)	13.24	10.54
3.	Number of internodes	26.2	22.6
4.	Girth (cm)	4.74	4.36
5.	Single cane wt (kg)	2.11	1.68
6.	Milleable cane (No.)	18	14.2
7.	Brix content	18.10	17.24
8.	Pol	14.96	13.55
9.	Purity	82.49	78.50
10.	Cane yield (tonnes/ha)	115.16	84.86
11.	Water consumption (mm)	1778	2020
12.	Water productivity (kg m <sup>-3</sup> )	6.56	4.19

Farmers recorded a maximum yield of 128 tons/ha with purity of 83.6percent. Capacity building to the farmers and cane officials have enhanced the SSI technology.

### 4. Study on impact of artificial recharge structures in recharging groundwater in Parambikulam - Aliyar- Palar (PAP) basin

It was estimated that the storage structures in the watershed alone contributed 11.5percent of the annual rainfall as potential recharge. The efficiency of Rain Water Harvesting (RWH) structure is a function of infiltration and structure shape and size rather than rainfall amount. These factors also influenced the amount of rainfall that becomes recharge. Percolation pond and check dams are significantly different during higher rainfall years. The aquifer response due to rainfall study indicated that one- month lag period was required for the rainfall to recharge all the observation wells in the

watershed which was clearly reflected in recharge values. The recharge values from the wells were much lower than the estimates of potential recharge from the RWH structures. This suggested that either the recharge from RWH was not reaching the aquifer, or the aquifer had large transmissivity and therefore strong lateral flow. The analysis in this study suggested that about 30percent Rep was stored in the soil while at least another 38percent moved laterally. The groundwater recharge zones were identified and validated through SCS Curve number technique.

## NATURAL RESOURCE MANAGEMENT

The average productivity of the major crops grown in Tamil Nadu is around 60 per cent of the potential yield. The major reasons for low productivity is decline in soil health, lack of awareness on the latest technologies and lack of suitable advisory services. The adoption of suitable crop production techniques will pave way for enhanced crop productivity and sustained soil fertility.

### TECHNOLOGIES IN ADVANCED STAGE OF TESTING

#### Demand driven nutrient supply for hybrid maize - tomato sequence on Alfisols

In order to maintain soil health and avoid nutrient mining, demand driven nutrient supply is utmost essential. To mitigate these issues, Soil Test Crop Response based Integrated Plant Nutrition System (STCR-IPNS) technology provides a scientific basis wherein the fertilizer doses for specific yield targets of crops are computed taking into account the contribution of NPK from soil, fertilizers and organic manure. Being a site specific technology, STCR-IPNS ensures balanced nutrition, increased productivity and efficiency of applied NPK. In this context, fertilizer prescription equations (FPEs) under IPNS were developed on Palaviduthi soil series (Typic Rhodustalf - red non-calcareous sandy loam soils) for maize - tomato sequence, one of the dominant sequences in Dindigul district of Tamil Nadu.

#### Fertiliser Prescription Equations

$FN = 3.96 T - 0.62 SN - 0.69 ON$        $FN = 0.45 T - 0.63 SN - 0.72 ON$   
 $FP_2O_5 = 1.56 T - 1.93 SP - 0.60 OP$        $FP_2O_5 = 0.42 T - 4.18 SP - 0.73 OP$   
 $FK_2O = 1.66 T - 0.27 SK - 0.49 OK$        $FK_2O = 0.40 T - 0.48 SK - 0.66 OK$

where, FN,  $FP_2O_5$  and  $FK_2O$  are fertiliser N,  $P_2O_5$  and  $K_2O$  in  $kg\ ha^{-1}$  respectively; T = yield target in  $q\ ha^{-1}$ ; SN, SP and SK are available N, P and K in  $kg\ ha^{-1}$  respectively; ON, OP and OK are N, P and K in  $kg\ ha^{-1}$  supplied through FYM.



Location: Kuppanur, Coimbatore District



Location: Kendayagoundanur, Dindigul District

These equations were test verified in farmer's holdings at six locations in Coimbatore and Dindigul districts during 2012-2015. The mean increase in yield due to STCR-IPNS ([NPK+FYM @12.5](#) t ha<sup>-1</sup>) over blanket fertilizer recommendation was 31.2 and 18.3 per cent for targeting maize @ 10 t ha<sup>-1</sup> and tomato @ 90 t ha<sup>-1</sup> respectively with sustained soil fertility at the end of the sequence. Therefore, Soil Test Crop Response based IPNS (STCR-IPNS) can be adopted for maize-tomato sequence on Palaviduthi (Typic Rhodustalf - red non-calcareous sandy loam soils) and allied soil series of Tamil Nadu for achieving aimed yield target, higher response ratio and BCR with sustained soil fertility.

### Demand driven nutrient supply for rainfed maize on Inceptisols

In rainfed production systems, due to minimal use of various sources of nutrients, deficiencies are increasing resulting in deterioration of soil health. At this juncture, with a view to extend the benefits of demand driven nutrient supply to rainfed maize, fertiliser prescription equations (FPEs) were developed on Irugur soil series (Typic Ustropept - red non-calcareous soils).

#### Fertiliser Prescription Equations

$$FN = 3.23 T - 0.42 SN - 0.52 ON$$

$$FP_2O_5 = 1.51 T - 1.98 SP - 0.94 OP$$

$$FK_2O = 1.73 T - 0.21 SK - 0.48 OK$$

where, FN, FP<sub>2</sub>O<sub>5</sub> and FK<sub>2</sub>O are fertiliser N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O in kg ha<sup>-1</sup> respectively; T = grain yield target in q ha<sup>-1</sup>; SN, SP and SK are available N, P and K in kg ha<sup>-1</sup> respectively; ON, OP and OK are N, P and K in kg ha<sup>-1</sup> supplied through FYM.



Asaripatti, Dindigul district



Pethappampatti, Tiruppur District

These fertilizer prescription equations were test verified in farmer's holding at seven locations in Dindigul and Tiruppur districts and in three locations at TNAU research farms (one each at ARS, Kovilpatti, MRS, Vagarai and ARS, Bhavanisagar) during 2013-15. The mean increase in yield due to STCR-IPNS-5 t ha<sup>-1</sup> ([NPK+FYM @12.5](#) t ha<sup>-1</sup>) over blanket fertilizer recommendation was 49.5 per cent. Therefore STCR- IPNS can be adopted for rainfed maize on Irugur and allied soil series of Tamil Nadu for achieving aimed yield target, response ratio and BCR with sustained soil fertility.



## Sulphur nutrition of rainfed groundnut in red and black soils of Tamil Nadu

On farm trials conducted at six locations across Tamil Nadu revealed that recommended NPK (10:10:45 kg ha<sup>-1</sup>) along with 400 kg gypsum ha<sup>-1</sup> (50percent basal + 50percent top dressing (30 to 45 days on receipt of rain) registered the highest mean pod yield of 1295 kg ha<sup>-1</sup> with yield increase of 31.3 per cent over NPK control and 8.8 per cent over the existing practice. The B:C ratio was also higher (3.30) when compared to 3.09 in the existing practice. Higher number of root nodules (27.4) per plant was recorded in the above said split application treatment. Higher uptake of Ca (40.2 kg ha<sup>-1</sup>) and S (17.8 kg ha<sup>-1</sup>) was also accounted by gypsum application in splits.

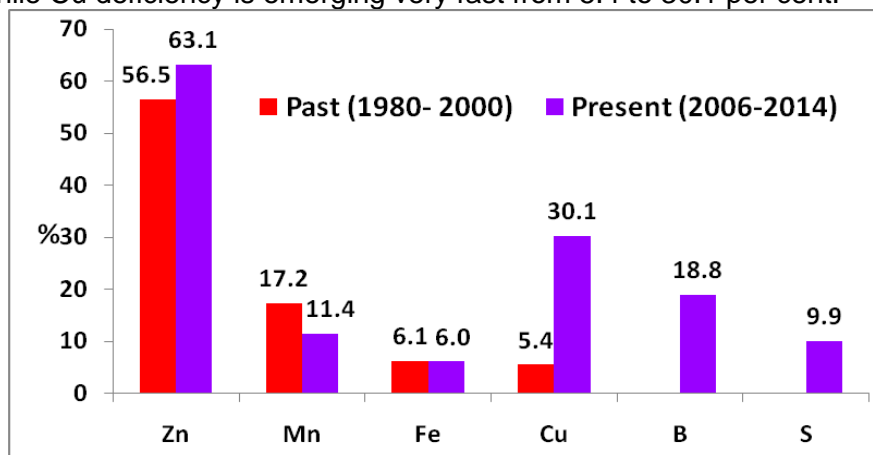
### FOR ON FARM TESTING

For *Kharif* season, a dose of 200:75:75 kg N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O ha<sup>-1</sup> was found to be optimum for enhancing the yield of hybrid rice (CORH 3) to 7.07 t ha<sup>-1</sup> with high AE of 10.04 and BCR of 1.68 as compared to RDF (175:60:60 kg N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O ha<sup>-1</sup>) with 5.54 t ha<sup>-1</sup> with AE of 6.71 and BCR of 1.34.

In case of *Rabi* season, an increased dose of 225:75:75 kg N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O ha<sup>-1</sup> was found to be optimum for enhancing the yield of hybrid rice (CORH 4) to 6.37 t ha<sup>-1</sup> with high AE of 8.27 and BCR of 1.64 when compared to RDF (175:60:60 kg N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O ha<sup>-1</sup>) with 5.24 t ha<sup>-1</sup> with AE of 6.53 and BCR of 1.37.

### Micronutrients and sulphur status of soils of Tamil Nadu

The assessment of micro - and secondary nutrients in the soils of different districts of Tamil Nadu is highly warranted to determine the nature and extent of nutrient deficiencies. A comparative analysis was made to find out the status between 1980 - 2000 assessment and present reassessment during 2006 to 2014 in 19 districts. The data indicated that the deficiency of micronutrients in the soils of all 19 districts showed some spectacular changes. In general, Zn deficiency is increasing from 56.5 to 63.1 per cent while Cu deficiency is emerging very fast from 5.4 to 30.1 per cent.

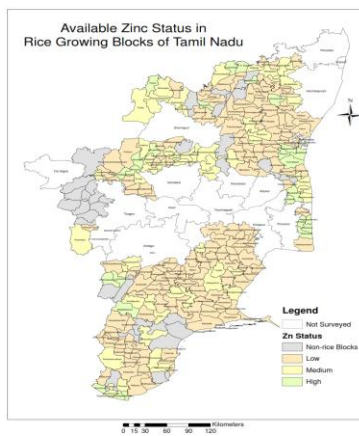


There are no apparent changes in Fe and Mn status of the reassessed 19 districts. The B and S status was not made in the previous assessment, however in the present delineation and reassessment, their average deficiency was 18.8 and 9.9 per

cent respectively. The deficiency of micronutrients can be managed by soil and foliar application of concerned micronutrient fertilizers depending upon the crop.

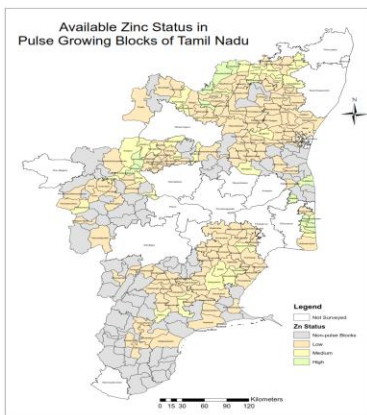
### Zinc status of rice growing areas of Tamil Nadu

By using the data on available Zn status in soils of 18 districts of Tamil Nadu so far delineated viz., Coimbatore, Cuddalore, Kanyakumari, Krishnagiri, Madurai, Nagapattinam, Pudukottai, Ramanathapuram, Sivagangai, Theni, Thiruvannamalai, Thoothugudi, Tirunelveli, Villupuram, Virudhunagar, Salem, Vellore and Erode, soil samples falling under rice grown fields in each block of a district were analyzed and Zn status in those soils were categorised into low, medium and high, based on the critical limit of Zn (< 1.20 ppm (Low) ; 1.20 to 1.80 ppm (Medium) ; > 1.80 ppm (High)). Of the total soil samples (30,899) collected from the 18 districts surveyed, 35.4 per cent (10,953) falls under rice grown area. Out of this, 60.5, 17.4 and 22.2 per cent samples falls under low, medium and high status respectively.



A block level thematic map to depict Zn deficiency in rice growing areas has been prepared which will be useful for block specific Zn recommendation for rice soils.

### Zinc status of pulse growing areas of Tamil Nadu



From the data on available Zn status in soils of 17 districts of Tamil Nadu so far delineated viz., Coimbatore, Cuddalore, Krishnagiri, Madurai, Nagapattinam, Pudukottai, Ramanathapuram, Sivagangai, Theni, Thiruvannamalai, Thoothugudi, Tirunelveli, Villupuram, Virudhunagar, Salem, Vellore and Erode, soil samples falling under pulse grown fields in each block of a district were analyzed and Zn status in those soils were categorised into low, medium and high, based on the critical limit of Zn viz., < 1.20 ppm (Low); 1.20 to 1.80 ppm (Medium) and > 1.80 ppm (High). Of the total soil samples collected from the 17 districts, 21.3 per cent falls under pulse grown area. Out of this, 62.3, 15.0 and 21.1 per cent samples falls under low, medium and high Zn categories respectively.

A block level thematic map to depict Zn deficiency in pulse growing areas has been prepared and the map will be useful for block specific Zn recommendation for pulse crops.

### Simplified crop production technology through nutriseed pack

Nutriseed Pack Technology is a new method of crop production developed. The Nutriseed Pack contains seed at top, enriched manure in the middle and encapsulated fertilizer at bottom. This pack gives support for individual plant in the root zone in terms of optimum nutrient supply and consequently enables the fullest utilization by plants

without much wastage. These packs are meant for single time placement in soil at the time of sowing to act as nutrient pile for slow release of nutrients. Yield improvements on an average from 10 to 30 per cent have been recorded in crops like maize, cotton, carnation, marigold and, cauliflower. The adoption of this technique lies with the production of Nutriseed Packs in large numbers and making it available to the farmers adequately at the time of crop season.



## REMOTE SENSING AND GIS

**Village level soil fertility mapping:** Village level (Cadastral level) thematic maps on soil NPK and micronutrients were generated for six blocks of Tamil Nadu viz., Manikandam (Trichy), Kodavasal (Tiruvrurur), PN Palayam (Coimbatore), TN Palayam (Erode), Kaniyambadi (Vellore) and Sattur (Virudhunagar). Survey number wise soil fertility information can be obtained for all the villages of above six blocks for making site specific nutrient recommendation.

**Hyperspectral remote sensing for crop stress monitoring:** This is a ground based observation technique followed to detect crop stress especially nitrogen deficiency and pest damage in crops so as to prevent the crop damage. Nitrogen deficiency in maize and rice could be detected and predicted in advance. Crop damage due to red spider mite, mealybug and aphids can also be detected in brinjal through this technique.

**Coconut area mapping:** Mapping coconut area was completed for Tamil Nadu and soil based production constraints were generated. Coimbatore has largest area under coconut followed by Tiruppur, Thanjavur and Dindigul. In terms of percentage of coconut area to the total geographical area of the district, Tiruppur, leads the list, followed by Kanyakumari, Coimbatore and Thanjavur. The district wise maps of coconut growing areas are presented as Web Map Applications at <http://sites.tnau.ac.in/rsgis/maps> and <http://agritech.tnau.ac.in>

**Rice area mapping using Radar Satellite Image in Tamil Nadu:** Rice area was mapped and yield was predicted for Cauvery Delta Zone, Cuddalore and Sivaganga region. Rice area and start of Season maps were generated with classification accuracies from 87 per cent and 92 per cent respectively. Remote sensing products in integration with ORYZA model was used for deriving crop variables such as LAI, Relative Growth Rate for estimating yields on a spatial scale. A reliable yield simulation accuracy of more than 82 per cent at field level was achieved in this study.

**Monitoring of drought at regional level using multisensor remote sensing data:** MODIS and TRMM satellite sensor images were used to calculate various drought indicators (indices) for Tamil Nadu. Drought indices which can best predict the drought condition were generated and validated with *in-situ* meteorological data and compared with NADAMS (National Agricultural Drought Assessment and Monitoring), Reports of Government of India. Also, using the above satellite data, Water Requirement Satisfaction Index was derived to identify risk zone for growing rainfed crops. The risk zones were identified in each district for growing rainfed cotton, sorghum, maize and groundnut.

### **Efficient, cost-effective laccase enzymes for industrial manufacturing**

Laccases (benzenediol: oxygen oxidoreductase EC 1.10.3.2) are versatile enzymes that act on wide range of organic and inorganic substrates, including aromatic amines, diamines, diphenols, and polyphenols as well as highly recalcitrant environmental pollutants with wide applications spanning from biofuels to organic synthesis including food, pulping and textile industries, wastewater treatment, bioremediation including delignification agricultural and forest woody biomass.

Researchers at the Department of Agricultural Microbiology, Tamil Nadu Agricultural University have found an unreported high level laccase secreting basidiomyceteous fungus and developed a method for low cost laccase production. A novel laccase producing wood degrading basidiomycete has been identified, which produces 1944.44 U.ml<sup>-1</sup> on 12<sup>th</sup> day in a glucose yeast extract media supplemented with an inducer. The laccase (Lcch) production increased by several fold when grown under solid and submerged fermentation conditions using natural substrates such as corncob that could significantly reduce the cost of the Lcch production.

### **Rhizoremediation of micropollutants (antimicrobials, pharmaceuticals and metals) in sewage contaminated soils**

The greens *Amaranthusdubius* (Araikeerai), *Amaranthuscaudatus* (Thandukeerai) and *Trigonellafoenum* (Vendhayakeerai) grown in Coimbatore city have been collected and analyzed for micro pollutants (antimicrobials, Pharmaceuticals and metals). These plants were grown in the area contaminated with treated sewage water. It was observed that, all the greens contain beyond the permissible limit of Chromium, Nickel and Cadmium. Apart from heavy metals, the pharmaceutical compounds (Imidazoles and Cosanols), Hazardous Volatile Organics (Decene and Decanols), Antibacterials (Naphthalenedione) and Steroids (Stigmastanol, Cholestanol) were present. A technique Rhizoremediation is being developed to remove the pollutants from sewage water contaminated soils.



**Soil health improvement through cocoa intercropping in coconut**

An environmental impact of cocoa as an intercrop in coconut in comparison with coconut monoculture plantations indicated that the average quantity of leaf litter accumulation ranged from 3 to 7.5 tonnes ha<sup>-1</sup> year<sup>-1</sup> in 2 to 10 years old cocoa plantations. The total biomass carbon accumulated in the ten year old cocoa plantation was 4.39 t ha<sup>-1</sup> indicating the fixation of 16.1 tonnes of CO<sub>2</sub>. Soil organic content increased with the age of cocoa intercropped coconut soils to a range of 22.24 to 24.72 per cent. The cocoa leaf litter is estimated to supply N, P, and K to a range of 80 to 160.3, 4.7 to 9.4 and 42.1 to 84.4 kg ha<sup>-1</sup> respectively in a year under one hectare of cocoa plantation. The increase in the soil available N, P and K ranged from 10.45 to 22.12, 10.76 to 21.92 and 4.21 to 7.55 per cent respectively over coconut monoculture.



## CROP PROTECTION TECHNOLOGIES

Crop protection technologies developed by the Tamil Nadu Agricultural University for the management of insect pests, diseases and nematodes in different crops are given in the crop production guide and TNAU Agri portal. In addition, the technologies developed during the year 2014-2015 are included in this chapter for further reference.

### RICE

#### Diversity of rice stem borers

- Yellow stem borer, *Scirpophaga incertulas* was the dominant species in Coimbatore and Thirupathisaram whereas in Killikulam the pink borer, *Sesamia inferens* was predominant during the period. Peak incidence of *S.inferens* was recorded during April-June, October-December and February. At Aduthurai, yellow stemborer constitutes 75 – 85 percent during *kuruvai*.

#### Weather correlation with rice stem borer

- Seasonal incidence data observed at fortnightly intervals correlated with weather parameters indicated that every increase in one unit of minimum temperature and relative humidity, the incidence of rice stem borer lowered by 5.12 and 0.11 unit (percent) respectively, whereas with every increase in one unit of maximum temperature stem borer incidence increased by 4.15 unit.

#### Trap crop for rice yellow stem borer

- Rice varieties Pusa basmathi and TN 1 when raised as trap crop @ 9:1 with TPS 5 variety, the yellow stem borer incidence was reduced in the main crop TPS 5.

#### Biological control of rice pest

- Field parasitization of stem borer egg masses by *Tetrastichus* sp.was observed. Maximum adult emergence of 33 and 36 parasitoids/egg mass was observed at tillering stage during *kuruvai* and *Thaladi* seasons.
- *Bacillus subtilis* formulation was found to have ovicidal action when used @ 2 and 4 ml/l of water. It was also found to have similar effect on eggs of black bug.
- Chlorantraniliprole 18.5 SC and 0.4 G was effective in controlling rice stem borer and comparatively safe to egg parasitoid, *Trichogramma japonicum*.

#### Integrated Pest and Disease Management (IPDM)

- TNAU IPDM practices (wet seed treatment with *Pseudomonas fluorescens* TNAU Pf 1 @ 10g/kg of seed, installing TNAU pheromone trap for stemborer @ 5/ac for monitoring, release of *Trichogramma chilonis* egg parasitoids for leaf folder management (2 cc/ac/release) based on pest monitoring, foliar spraying of TNAU Pf talc formulation @ 5g/l two times from 45 DAP, ETL based application of profenophos 50 EC (400 ml/ac) or cartap hydrochloride (250 g/ac) indicated lesser damage by stemborer (white ear) was less in IPM plots (5.4

percent) as against farmers' practice (8.4 percent). More yield was recorded in the IPM plots (5227 kg/ha) with net income of Rs.33,205/-. In the farmers' practice the yield was 4408 kg/ha with net income of Rs.18,418/-.

### **Management of False smut**

- Foliar application of trifloxystrobin 25 percent + tebuconazole 50 percent (0.4 g / l) at booting and 50 percent panicle initiation recorded the minimum percent of infected spikelets / panicle (2.79), infected panicles / hill (25.00), infected hills (42.24 percent) and higher yield (4022 kg/ha) and was on par with kresoxim methyl 44.3 SC 1 ml/lit. Untreated control recorded 10.76 percent of infected spikelets / panicle, 42.68 percent of infected panicles / hill, 60.72 percent of infected hills with a yield of 3211 kg/ha.

## **MILLETS**

### **SORGHUM**

#### **Management of stem borer in rainfed sorghum**

- Whorl application of carbofuran 3G @ 1 kg a.i./ha on 15 DAS or foliar spray of acetamiprid 20 SP @ 40 g a.i./ha or spinosad 45 SC @ 75 a.i./ha or novaluron 10 EC @ 62.5 a.i./ha on 30<sup>th</sup> and 45<sup>th</sup> days after sowing recorded the least dead heart damage. In addition, stem and peduncle tunneling damage was also low at the time of harvest.

### **MAIZE**

- Seed treatment with imidacloprid 600 FS @ 8 ml/kg in maize was effective in controlling termite and shoot fly. The treatment has resulted in maximum yield and no phytotoxicity.

#### **Management of maydis leaf blight**

- The maydis leaf blight of maize was controlled by the treatments viz., Seed treatment (ST) with TNAU-Pf1 @ 10 g/kg seed + foliar spray of propiconazole (0.1 percent) or ST with TNAU-Pf1 @ 10 g/kg seed + foliar spray of tebuconazole (0.1 percent) at 40 DAS which recorded the lowest PDI (3.25) of leaf blight caused by *Helmithosporium maydis* and maximum grain yield of 58.67 and 57.80 q/ha, respectively as against untreated control with PDI of 22.64 and grain yield of 39.94 q/ha.

### **RAGI**

#### **Management of ragi blast**

- The leaf and neck blast disease was controlled by seed treatment with of *P. fluorescens* @ 10g combined with *T. viride* @4g /kg of seed followed by foliar application of tricyclazole + mancozeb @ 2g/lit at maximum tillering and heading phase which recorded the lowest PDI (3.2 & 0.0) of leaf and neck blast,

respectively with maximum yield of 3848 kg/ha as against untreated control with higher PDI (18.7 & 7.1) of leaf and neck blast with a yield of 3048 kg/ha.

## **PULSES**

### **REDGRAM**

#### **Population dynamics**

- The extent of pod damage by pod fly in different months revealed that it was maximum (45.25 percent) during the observation period of February 2015 and minimum 16.08 percent during October 2014.
- Stem fly incidence was maximum during August second fortnight (8.0 percent). Sucking pests incidence was more from January to March 2015.

#### **Management of pulse pests**

- *Maruca vitrata* and *H. armigera* damage was less in plots sprayed with lufenuron 5.4 EC @ 30 g a.i./ha followed by indoxacarb 15.8 EC @ 73 g a.i./ha.
- Plume moth damage was less in plots treated with acephate 75 SP @ 750 g a.i./ha and dimethoate 30 EC @ 600 g a.i./ha.
- Acephate 75 SP @ 750 g a.i./ha and indoxacarb 15.8 EC @ 73 g a.i./ha were found to be equally effective in managing blue butterfly.
- Pod fly damage was low in plots sprayed with indoxacarb 15.8 EC @ 73 g a.i./ha and lufenuron 5.4 EC @ 30 g a.i./ha
- Two sprays of chlorantraniliprole 18.5 SC @ 30g a.i./ha (first spray at the time of flower initiation and second spray 15 days later) were effective in reducing the redgram pod borers and pod bug damage and recorded the highest yield
- Two applications of fipronil 5SC @ 1ml/l or acetamiprid 20SP @ 0.3g/l were effective against thrips in mung bean.

#### **Integrated management package for redgram pod borer**

- In redgram, cumulative pod borer damage was 5.5 percent in the fields followed with IPM component (seed treatment with *Trichoderma viride* @ 4g/kg and intercropped with mungbean at 4:2 ratio in a ridges and furrow system, installing *Helicoverpa* pheromone trap @ 12/ha and erecting bird perches @ 50/ha, spraying neem soap 1percent concentration at the vegetative stage and two spray of chlorantraniliprole 18.5 SC @ 30g a.i./ha applied during flower initiation and podding stages) while, it was 45.0 percent in non IPM component fields. In IPM plot pod bug, pod fly and pod wasp affected pods were 7.5, 19.0 and 2.0 percent as against 17.0, 31.0 and 9.0 percent in non IPM plot, respectively. Yield of the main crop in IPM plot was 1032 kg/ha and from intercrop blackgram, 320 kg/ha yield was obtained. Cost benefit ratio in the treatment with IPM component was 1:3.34 as against 1:2.75 in non IPM component.

#### **Management of soil borne diseases of pigeonpea**

- Seed treatment with *Bacillus subtilis* strain CcB7 @ 10g/Kg + soil application of CcB7 @ 2.5 kg/ha followed by soil drenching with carbendazim @ 0.1 per cent



on 45 days after sowing reduced the incidence of wilt and root rot by 85 and 83 percent respectively under field condition.

### **Integrated management package for greengram pests**

- In greengram, the IPM module having seed treatment with imidacloprid 17.8 SL @ 5ml/kg and *Trichoderma viride* @ 4g/kg of seed, two applications of one percent neem oil soap at 7 days interval 30 DAS, installation of yellow sticky trap @ 50/ha and application of chlorantraniliprole 18.5 SC @150ml/ha was the most effective with highest yield of 850 kg/ha and maximum benefit cost ratio of 1: 4.1.

### **Storage pests and their management**

- The seeds treated with spinosad 45 SC @ 0.5 ml/kg seed registered the maximum mortality (75.25percent) of *Tribolium* beetles within 24 hours after seed treatment and cent per cent mortality on 5 DAT.
- Among the botanical powders tested against bruchid beetle, less number of eggs was laid on turmeric powder treated seeds and adult emergence was less in *Acorus* rhizome powder treated seeds.
- Cent percent mortality of pulse beetle was observed in sweet flag 6 EC @ one percent concentration (1ml of sweet flag 6 EC/100 gm of seed) on second day after treatment.

### **Management of yellow mosaic disease and powdery mildew of blackgram and greengram**

- Seed treatment with imidacloprid @ 5g/kg + carbendazim at 2 g /kg followed by foliar spray with imidacloprid @ 0.05percent at 25 DAS and the second spray with tebuconazole+trifloxystrobin @ 0.1 percent on initial appearance of disease effectively reduced both MYMV incidence (80 percent reduction over control) and powdery mildew incidence (87 percent reduction over control).

## **OILSEEDS**

### **GROUNDNUT**

#### **Management of groundnut pests**

- Acephate 75SP @ 1.30 kg/ha was effective in managing groundnut thrips.
- Fipronil 5 SC @100 g/ha, imidacloprid 200SL @200 ml/ha and novaluran 10EC @1.0 l/ha was effective against leafhoppers in groundnut.
- Imidacloprid 200SL 200ml/ha was safer to the natural enemies which recorded maximum of 0.3 spider/plant and 1 ladybird beetle/plant.
- Seed treatment with thiamethoxam 30 FS @ 2 ml/kg seed (1:2 C:W) was effective in reducing thrips (2.34/10 plants) and jassids (1.42/10 plants) population in groundnut with increased yield (1800 kg/ac wet weight) compared to control (1600 kg/ac).

## **IDM strategies for major diseases of groundnut**

- IDM treatment comprising seed treatment with tebuconazole 1.5g/kg seed + furrow application of *T. viride* @ 4kg amended in 50kg FYM /ha+ broadcasting *T. viride* 4kg amended in 50kg FYM/ha at 40DAS+ two sprays of tebuconazole @1ml/l was found to be effective in reducing the severity of collar rot (5.2 percent), root rot (15.7 percent ), late leaf spot (PDI 26.22) and rust (PDI 25.02) as compared to control for the respective diseases (9.7 percent, 26.4 percent, PDI 73.58 and PDI 57.97). The maximum pod yield of 2123 kg/ha with ICBR (7.57) was obtained from the IDM treatment as compared to 1325 kg/ha in control.

## **Disease management through organic practices in groundnut**

- Seed treatment with mixture of *T. viride* and *P. fluorescens* @ 10g / kg+ furrow application of *T. viride* and *P. fluorescens* @ 2 kg each along with FYM @ 300 kg/ha + foliar application of NSKE @ 5 percent at 30 and 45 DAS was found to be very effective for managing collar rot (5.2 percent), root rot (8.7percent), stem rot (10.7 percent) and late leaf spot (PDI 46.72 ) as compared to control 8.7 percent, 24.0 percent, 16.6 percent and PDI 75.48. The organic practice also recorded a higher pod yield of 2013 kg/ha with ICBR (4.36) as compared to 1346 kg/ha in control.

## **COCONUT**

### **Management of rhinoceros beetle *Oryctes rhinoceros* in coconut gardens**

- Crown application of chlorantraniliprole 0.45 GR 5g + 150 g sand/ palm (12.2 percent) followed by phorate 10 G 10g + 150 g sand/palm (13.0 percent) was found effective.

## **CASTOR**

### **Management of castor pests**

- Flubendiamide 39.35 SC @ 0.2 ml/l was effective in reducing population of castor semilooper and hairy caterpillar with 0.74 larva/plant and 0.96 larva/plant accounting 87.32 and 75.61 percent reduction respectively over control.
- Chlorantraniliprole 18.5 SC@ 0.3ml/l registered the lowest larval population of *Spodoptera litura* 0.63 larva/plant with 83.42 percent reduction over control in castor.
- Profenophos 50EC @ 2ml/lit registered lowest castor capsule damage by castor capsule borer and thrips with 79.50 and 88.75 percent reduction respectively over control.
- Clothianidin 50 WDG @ 0.1 g/l reduced the leafhopper population up to 89 percent compared to control.

## Management of castor wilt

- Seed treatment with carbendazim @ 2g/kg + soil drenching with carbendazim @ 1g/l at 60 and 75 DAS were effective in managing castor wilt with less severity of 18.8 percent and high seed yield of 1354 kg/ha as compared to control (61.4 percent and 725 kg/ha). The ICBR was higher (9.94) when compared to control.
- Seed treatment with either *T. viride* (Tv1 isolate) or *T. harzianum* (DOR isolate) @ 10g/ kg and soil application @ 2.5 kg/ha was also effective against castor wilt.

## SESAME

### Management sesame pests

- Application of emamectin benzoate 5 SG @ 200g/ha was effective in reducing the sesame shoot webber damage. Fipronil 5 SC and spinosad 45 SC were the next best alternatives for the management shoot webber in sesame.

### Management of sesame phyllody vectors

- Seed treatment with imidacloprid 17.8percent SL @2 ml/kg seed + two sprays of thiamethaxam @ 0.25 g / l recorded the lowest incidence of phyllody (11.53 percent), with minimum vector population (2.2 no./plant), higher yield of 647 kg/ha and ICBR 2.01 as compared to control with 26.93 percent phyllody incidence, 7.8 vector population and yield of 484 kg/ha.

## COTTON

### Integrated pest and disease management (IPDM) technology for cotton

- Seed treatment with imidacloprid 70 WS (10 g/kg seed)
- Soil drenching with chlorpyrifos 20 EC (1.25 l/ha) on 25 days after sowing
- Soil drenching with *Bacillus subtilis* (BSC5) on 30 days after sowing
- Foliar application of *B. subtilis* (BSC5) @ 10g/l on 60 days after sowing
- Monitoring with yellow sticky traps for whitefly (12/ha)
- Monitoring with pheromone trap for *Spodoptera* (12/ha)
- Need based application of insecticides - imidacloprid 17.8 SL (25 g.a.i./ha)
- Need based application of fungicide 0.1 percent trifloxystrobin 25 percent + tebuconazole 50 percent WG or mancozeb 75 WP - 0.25 percent.
- Raising of trap crop (castor and maize) along bunds.

IPDM tentatively was effective in reducing the incidence of cotton disease, seedling rot, root rot, tobacco streak virus and pests, whitefly, leaf hopper and thrips with better yield and cost benefit ratio when compared to farmers practice. Large scale demonstration of IPDM with SVPR 4 cotton recorded an yield of 17.8 g/ha compared to farmers practice (11.0 q/ha).

## **Management of sucking pests**

- Diafenthiuron 50 WP @ 600 g/ha was effective for the management of sucking pests in cotton and it was comparatively safer to the natural enemies present in the cotton ecosystem.

## **SUGARCANE**

### **Management of sugarcane woolly aphid (SWA)**

- Technology packages comprising of paired row planting under drip irrigation and application of 25 percent organic source of nitrogen, growing intercrops, removal of infested leaf and trash mulching and releasing of *Dipha* pupae (500 nos./ha) and *Micromus* (500 nos./ha) after noticing SWA reduce the SWA incidence to 78.24 percent, increased cane yield (118.59 t/ha) and quality parameters (12.37 percent of CCS) and contributed additional sugar yield of 30.19 percent.

### **Integrated management of sugarcane internode borer**

- Release of egg parasitoid *Trichogramma chilonis* @ 1.00 CC/acre from 4<sup>th</sup> to 6<sup>th</sup> months at fortnightly interval.
- Installation of INB sex pheromone trap for monitoring and mass trapping @ 20/ha.
- Detrashing at 5<sup>th</sup> and 7<sup>th</sup> month after planting.

## **FOR INFORMATION**

### **FRUITS**

#### **CITRUS/ ACID LIME**

- Citrus greening has been recorded in Theni, Dindigul, Tirunelveli, Virudhunagar and Madurai districts of Tamil Nadu in the roving survey.

#### **Spray schedules against leaf miner in citrus**

- Spraying of neem formulation 10,000 ppm @ 5 ml/l followed by spinosad (0.002 percent) at 7 days interval significantly reduced the leaf miner incidence in citrus.

### **GRAPEVINE**

- Soil application of carbofuran @ 60g/vine was effective for the management of root-knot nematode.
- Soil application of *P. fluorescens* @ 100g /vine with FYM (50 kg/vine) after pruning was effective for the management of nematode fungal disease complex.

## VEGETABLES

### TOMATO

#### Occurrence of new pest

- Occurrence of South American tomato pinworm, *Tuta absoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae) also known as the tomato leaf miner was recorded in Dharmapuri district.



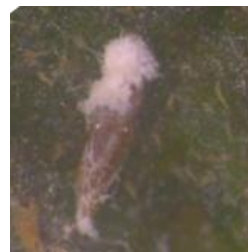
Tomato pinworm, *Tuta absoluta*

#### Development of oil based formulation of entomopathogenic fungi for the management of major thrips spp. infesting vegetable crops

- Entomopathogenic fungal (EPF) isolate viz., *Beauveria bassiana* (Bb 112) was highly virulent against all the thrips species (onion, chilli and tomato thrips) and the field experiments conducted on onion, chilli and tomato at farmer's field revealed that the application of oil formulation of Bb 112 at  $10^8$  spores/ml was more effective with the highest cumulative per cent reduction of thrips next to imidacloprid.



Thrips



*B. bassiana* (Bb 112) infested

## INTEGRATED NEMATODE MANAGEMENT

### Vegetables (tomato and brinjal)

#### Nursery

- Changing nursery site once in two years and selection of nematode free nursery site.
- Soil solarization (covering of nursery bed with transparent polythene tarps having 100 $\mu$  thickness for a month during summer before sowing seeds) for transplanted vegetable crops.

#### Main field

- Crop rotation with non-host cereals and use of nematode free transplants

- Growing cowpea as trap crop before planting main crop and removal of cowpea 45 days after sowing.
- Summer ploughing and soil application of FYM (20t / ha), neem cake (500 kg / ha), *P.fluorescens* (2.5 kg / ha) or carbofuran (1 kg a.i. / ha).

## BRINJAL

### Biological control of brinjal mealybug, *Coccidohystrix insolita*

- Two releases of *Cryptolaemus montrouzieri* adults @ 1,500 / ha on noticing the incidence of mealybugs recorded superior performance with enhanced yield (67.8 t/ha).

## WATERMELON

### IPM strategies for *Watermelon Bud Nectrosis Virus (WBNV)*

- Seed treatment with *Pseudomonas fluorescens* (Pf 1) @ 10 g/kg + SA of *P. fluorescens* @ 2.5 kg/ha
- Soil application of FYM @ 12.5t/ha
- Soil application of neem cake @ 250 kg/ha
- Growing maize as border crop
- Installation of yellow sticky traps @ 12/ha

Treatments	IPM	Farmers Practice
<i>Watermelon Bud Nectrosis</i> incidence (percent)	15.6	39.2
Fruit yield (t/ha)	18.9	16.2

## HILL VEGETABLES

### NEMATODE MANAGEMENT

#### CARROT

- Application of *Paecilomyces lilacinus* @ 2.5 kg/ha.
- Application of carbofuran @ 1kg a.i./ha.

#### BEET ROOT/GOURDS

- Growing marigold as intercrop between two rows of main crop reduces the incidence.



Beetroot showing galls due to root knot nematode



Profuse root knot galling in gourds

## **CROSSANDRA**

- Application of carbofuran @ 9 g/m<sup>2</sup> nursery.
- Application of phorate @ 1g / plant at 7 days after planting in main field.

## **TUBEROSE**

- Application of carbofuran 3G @ 2g / plant.
- Application of neem cake @ 0.5 t / ha. reduces the incidence.

## **PEST MANAGEMENT**

### **CHILLIES**

#### **Biointensive management of murda complex on chillies**

- Basal application of *Pseudomonas fluorescens* (Pf 1) @ 2.5 kg/ha in 50 kg FYM combined with foliar application of white halo fungus, *Lecanicillium lecanii* @ 1x10<sup>8</sup> spores/ml two rounds at 15 days interval suppressed aphid and thrips on chillies effectively next to profenophos (0.1 percent)

### **TURMERIC**

#### **Management of rhizome rot of turmeric**

- Rhizome treatment with *Pseudomonas fluorescens* (0.2 percent) for 20 min. and soil application of *P. fluorescens* at 2.5 kg/ha at 3, 5 and 7 months after planting reduced the rhizome rot incidence viz., 12.86 and 10.86 per cent, respectively.

### **CORIANDER**

#### **Management of coriander powdery mildew**

- Foliar spray with propiconazole (0.15 percent) immediately after the appearance of disease recorded the minimum powdery mildew disease incidence of 5.14 PDI as against 91.55 PDI in control.

### **CARDAMOM**

- Diafenthiuron 50 WP @ 800 g/ha was effective for management of shoot and capsule borer and thrips on cardamom. It was found to be safer to the natural enemies in cardamom ecosystem
- The half life values calculated for diafenthiuron was 1.6 days for 800 g a.i./ha and 3.9 days for 1600 g a.i./ha. The waiting period was 1.57 days at 800 g a.i./ha and 2.52 days at 1600 g a.i./ ha in cardamom.

### **TAPIOCA**

#### **Biointensive pest management (BIPM) of spiralling whitefly in tapioca**

- BIPM package (installation of yellow sticky traps @ 12/ha, release of *Chrysoperla zastrowi sillemi* @ 50000 eggs/ha, release of *Cryptolaemus* grubs @ 2500 /ha, application of entomopathogen *Lecanicillium lecanii* @ 2X10<sup>9</sup>

conidia/ml, application of neem oil one percent) reduced the population of spiralling whitefly with increased yield and BC ratio.

## **POTATO**

- Imidacloprid 600 FS @ 10.5 g a.i./100 kg of seeds was effective in control of aphid and whiteflies in potato without any phytotoxicity symptoms.

## **MEDICINAL PLANTS**

### **Management of thrips in *Gloriosa superba***

- Foliar application of fipronil 5percent SC (750 ml/ha) or spinosad 45 percent SC (200 ml/ha) twice at 15 days interval was effective for the management of thrips and *Gloriosa* necrosis.

### **Management of yellow mite, *Polyphagotarsonemus latus* infesting *Solanum nigrum***

- Foliar application of spiromesifen 240 SC @ 500 ml/ha was superior with maximum mean percent reduction of mites and marketable leaf yield over control followed by propargite @ 2 ml/l and triterpenoid @ 1 ml/l.

## **HONEY BEES MITE MANAGEMENT**

- Application of sugar powder at 5 g per brood frame or sulphur powder at 2 g per brood frame effectively controlled the *Varroa* mite on Indian honey bees, *Apis cerana indica*.

## **CABBAGE**

### **Insecticide resistance in cabbage aphid *Brevicoryne brassicae***

- Chlorpyrifos, dimethoate, malathion and acephate recorded susceptibility indices of 2.241, 4.456, 3.891 and 2.963 respectively and the field population recorded resistance to the respective insecticides.
- The level of resistance assessed using the discriminating doses (65 ppm) in the field collected *Brevicoryne brassicae* populations of Oddanchatram to dimethoate showed 16.67percent resistance.

### **Insecticide residues**

- Out of 1065 market samples of fruits, vegetables, spices, tea, rice, pulse and fish analyzed for pesticide residues, the MRL values (FSSAI/CODEX) exceeded only in 34 samples consisting of vegetables (5), grapes (1), cardamom (27) and rice (1).
- The newer insecticides chlorantraniliprole and dinotefuran were compatible (physical and biological) with fungicides carbendazim, mancozeb and validamycin without causing any phytotoxicity.



## MUSHROOM

- A system for the cultivation of oyster mushrooms in reusable polypropylene bottles (1800 ml) and carton boxes (36 x 18 x 12 cm) has been standardized.



**Carton boxes**

**Reusable polypropylene bottles**

# HORTICULTURE

## FOR ADOPTION

### CLUSTER BEAN MDU 1

This culture is the first release in cluster bean from Agricultural College & Research Institute (AC&RI), Madurai. It has a cluster bearing nature (7-9 fruits/node) with long attractive green colored fruits measuring 13-14 cm. Plant matures in 90-100 days and has more number of fruits / plant (150-175 fruits) with an attainable yield of 250-300 g/plant. Fruits are rich in fiber content (4.5g/100g of the fruit) and the plants can tolerate powdery mildew.



### COCONUT HYBRID VPM 5



This is the first hybrid of Tall x Tall type to be released in India. This hybrid has Laccadive Ordinary Tall (LCOT) as female parent and Cochin China Tall (CCNT) as male parent. This hybrid comes to bearing from 48-50 months onwards and reaches stabilized bearing from 8 - 10 years onwards and likely to bear economically up to 60 years at least. On an average, it yields 161 nuts/tree/year and a copra content of 24.12 kg / palm / year.

## FOR INFORMATION

### FRUIT CROPS

#### BANANA

A new banana hybrid H-916 (Poovan x Erachivazhai ) appears to be promising for bunch weight (16.5 kg/ bunch ) and its tolerance ability to nematodes (*Radopholus similis* and *Helicotylenchus multincinctus*) and *Fusarium wilt*.



### Fertigation technology for mango cv. Alphonso under UHDP

Application of 100 per cent recommended dose of nutrients (120:75:100 g NPK / tree / year) along with 24 liters of water per day per plant has resulted in enhanced yield (20.50 t /ha) and quality attributes of mango cv. Alphonso under UHDP against the national average of 8.00 t / ha at normal density.



## Organic nutrient schedule for banana cv. Grand Naine (AAA)

Complete organic package with FYM @ 10 kg + neem cake @ 1.25 kg + vermicompost @ 5 kg and Wood ash @ 1.75 kg / plant + triple green manuring with sunnhemp (One time) and cowpea (two times) + biofertilizers viz., AM @ 25g, *Azospirillum* @ 50 g, PSB @ 50 g and *Trichoderma harzianum* @ 50g / plant registered higher yield (28.03 kg / bunch as against 26.96 kg / bunch in INM treatment), better quality and post harvest life apart from better growth attributes. The B: C ratio was however better with INM (3.80) treatment i.e. (110:35:330 g NPK /plant + 10 kg FYM + 20 g *Azospirillum* + 20 g *Phosphobacteria*) as compared to complete organic package (1.71).

## Shelf life and quality improvement through 1 Methyl Cyclo Propene (1MCP)

The shelf life of grand naine and ney poovan banana fruits harvested at 25percent ripening stage and treated with 1-MCP @ 600 ppb enhanced to 17 and 15 days respectively under cold storage conditions (17 °C) while the untreated control fruits showed a shelf life of 12 days in grand naine and 10 days in ney poovan. The increase in shelf life can be attributed to higher level of firmness, lesser physiological loss in weight, delayed change of colour, reduced PPO activity and higher levels of titrable acidity and ascorbic acid.

## Validation of fertilizer adjustment equation for banana cv. Ney Poovan

The results indicated that the fertilizer dose 195: 30: 265 g NPK per plant arrived through fertilizer adjustment equation considering initial soil N ( $144 \text{ kg ha}^{-1}$ ), P ( $144 \text{ kg ha}^{-1}$ ), K level and NPK contribution from organic manure (vermicompost) for the targeted yield of 42 t/ha recorded the highest bunch yield of 47.6 t/ha with 13 percent increase over the targeted yield with high BC ratio of 1:3.5. Maintenance of higher leaf area index (3.93) with high leaf nutritional status, high stomatal conductance ( $0.66 \text{ cm}^2/\text{sec}$ ) and high photosynthetic rate ( $23.93 \mu\text{mol}/\text{m}^2/\text{sec}$ ) were found to be the physiological bases for this improved bunch yield of ney poovan banana.

## VEGETABLE CROPS

### CULTURES UNDER EVALUATION

#### BHENDI HYBRID CBhH 3

It is a  $F_1$  hybrid of AE 64 x AE 66. Plants are tall (135-150cm), medium branched. The lower leaves are broad and narrowly furrowed and the upper leaves are deeply furrowed. Plants are early in flowering (35 days after sowing). Stem is green with light pubescent. The fruits are dark green, medium robust and long (14.5 cm) with beak tapering apex. About 30 fruits are borne in a plant at short internodes (4.8 cm). The hybrid recorded the yield of 25.7 t/ha which is 18.7 percent increased yield over COBhH 1 and 16.2 percent over Sakthi and also possess resistance to YVMV disease (PDI 3.8).



### **RIDGE GOURD HYBRID CRgH 1**

The identified f1 hybrid (IC 410147 x IC 373361) is suitable for medium and long duration cultivation as fruits are available up to 14 harvests. The fruit is 30.5 cm length and 15.55 cm girth which is ideal for packing and transport. Each fruit is weighing about 274.5 g. It contains 0.50 mg/100 gm crude fiber. Each plant bears 26.7 fruits with the total weight of 8.11 kg. The yield is 27.0 t/ha which is 35.15 percent increased over check Ankur Latha.



### **SNAKE GOURD CSgH 1**



The F<sub>1</sub> hybrid CSgH1 (Kethanur Short x CO 2) showed superior performance with an estimated yield of 60.42 t/ha which was 33.3 percent increase over the check hybrid (BSS 694). The hybrid CSgH1 recorded 53.00 fruits per plant in 14 harvests. The average fruit weight is 378.2 g with the yield of 24.22 kg/plant. Fruits are 33.5cm long with a girth of 27.6 cm. Fruits are fleshy, attractive greenish white with white streaks with good cooking quality.

### **ONION Aca 15**

Screening of small onion germplasm was done to identify a short duration seed propagated aggregatum onion. Over three years of evaluation, the Acc No. Aca 15, a selection from Puttarasal recorded the highest bulb yield of 19.12 t/ha which is 27.99 percent increased yield over the check CO (On) 5. The bulbs of Aca 15 are bold pink coloured with 20.1 °brix TSS and 2.85 mg/ 100 g pyruvic acid. The duration of the crop is 65-70 days for bulb to bulb crop and 90 days for seed to bulb crop. Seed yield is 300 kg/ha.



### **SALAD BOTTLE GOURD LS 6-1**

A high yielding salad type bottle gourd L6-1 was identified with the yield of 30 t/ha. Average fruit length and girth of the culture was 39.5 and 13.5 cm respectively. The average fruit weight was 550 g and yield was 39 t/ha.



## AMRANTHUS (Sirukeerai) AP 12

A new Amaranthus (Sirukeerai) culture - AP12 which is highly suitable for both one time seedling pulling and multiple clipping/cutting is identified. The average yield was 10 t/ha with 26 percent increased yield over PLR1. This culture is suitable for harvesting multiple yields from single sowing/cropping.



## GARLIC As 72



The accession As 72 recorded the highest bulb yield of 19.5 t/ha. Accession As 72 has maximum plant height, pseudostem length, and average bulb weight. Culture As 72 recorded the highest content of TSS (47°Brix), poly phenol (3.514 mg/g) and alliin (3.08 percent). This accession is suitable for cultivation in Nilgiris as a substitute of the existing local type grown.

## FRENCH BEAN FBP 5

Among the bush bean types, accession number FBP-5 (Thoothoormattam village) has recorded the highest pod yield of 1.65 kg/plant, pod length of 19.08 cm, pod weight of 20.4 g/ pod. The pod yield produced per ha is 39.80 t/ha. The protein content of the pods is 1.51 percent, carotene content 1.92 µg /mg).



## Grafting technique in brinjal

Grafting is a method of propagation in crop plants to boost up plant growth and development by increasing the uptake of nutrients and also to bring in resistance to soil borne diseases with suitable rootstocks. Grafting can also be practiced in brinjal as that of fruit crops like mango and sapota. Brinjal is a crop which is highly susceptible to root knot nematodes, dry root rot and *Fusarium* wilt causing a yield loss up to 70percent. These problems can be controlled by grafting technique by using a resistant rootstock. Grafted brinjal becomes a perennial with extended duration of 2-3 years. Higher yield can be obtained through extended harvest and also by 2-3 ratooning.

Rootstock used	: non bitter <i>Solanum torvum</i> 09-05
Grafting method	: Wedge grafting
Scion	: Any commercial variety / hybrid

Method of raising of rootstock was standardized. Seedlings were raised in potray and used for grafting. Large scale trials were conducted in the Orchard and also in the farmer's field. The results of the trials conducted are presented below.

Sl. No.	Particulars	Main crop	Ratoon crop	Non graft
1.	Scion	Ravaiya	Ravaiya	Ravaiya
2.	Season	March – August, 2014	Sept. – Dec, 2014	March – July, 2014
3.	Spacing	1.0 x 1.0 m	1.0 x 1.0 m	0.75 x 0.60 cm
4.	Population /ac	4000 plants	4000 plants	8850 plants
5.	Total yield /ha	70 t/ha	45 t/ha I ratoon 40 t/ha II ratoon	50.0 t/ha
6.	Duration	7 months	4 months	6 months

### **Weed control in vegetable cowpea during *Kharif* season**

The treatment combination of mulching with black polythene recorded the highest yield of 201.5 q/ha in vegetable cowpea followed by weed free check with the yield of 186.0 qt/ha against the weedy control (107.9 q/ha). The highest BC ratio was recorded in the treatment combination of Pendimethalin @1kg ai/ha + one hand weeding with the value of 3.06.

### **Evaluation of integrated nutrient management module for garlic**

Application of 75:40:40:40 kg NPKS + 5 t / ha Fym + 2.5 t poultry manure + 2.5 t vermi compost / ha recorded the maximum plant height (68.65 cm), number of leaves (8.17), neck thickness (3.47cm), polar diameter (40.03 mm), equatorial diameter(36.83cm) average weight of 10 bulbs( 203.34 g), total yield (10.61 tonnes/ ha), B:C ratio(3.95).

### **Response of tapioca to different levels of potassium in relation to tuber yield and starch content**

Application of potassium @ 125percent blanket recommendation (RDF 90:90:240 kg of NPK/ha) recorded the maximum tuber yield (39.4 t ha<sup>-1</sup>) and starch content (23.7percent). Application of 125percent blanket K dose with two equal splits recorded the maximum tuber yield (42.6 t ha<sup>-1</sup>) and starch content (25.3percent). Soil potassium availability was significantly higher (427 and 414 kg ha<sup>-1</sup>) at 175percent recommended dose of potassium and four equal splits of application.

## **SPICES AND PLANTATION CROPS**

### **LEAFY CORIANDER CS 38**

At HC&RI, Coimbatore, a high leaf yielding coriander culture CS 38 has been forwarded to MLT to 15 centres during 2014-15. The results recorded from seven centres revealed its significant performance with the highest leaf yield (5.88 t/ha) which is 22.27 percent increase over the check variety CO (CR)-4 (4.57 t/ha).



### Single bud rhizome technology in turmeric

At HC & RI, Coimbatore, OFT on turmeric single bud rhizome technology has been conducted at 25 places during 2012-13 to 2014-15. Single bud rhizome technology of turmeric resulted in high fresh rhizome yield of 46.20 t/ha with 25.23 percent yield increase over the conventional method and recorded the highest C:B ratio of 1:2.47 and also recorded reduction in the quantity and cost of seed rhizome with C:B ratio of 1:1.35 in the nursery.

### FLORICULTURE AND LANDSCAPING

**J. nitidum clone Acc. Jn.1** has been identified as the most promising genotype for year-round flowering (12 months); availability of flowers during lean season/off-season (Nov-Feb); good keeping quality (buds remain unopened for 12 hrs under room temperature and for 60 hrs under refrigeration); attractive bold buds (comparable with Jathi malli); bright pink buds and pure white open flowers; mild fragrance and are completely free of pests and diseases.



### Quality testing of Jasmine (*Jasminum sambac*) flowers and concrete using Hand Held Electronic Nose (HEN) – 'E nose'



The system is a small handheld device, touch-screen based user interface with integrated odour delivery unit. The Handheld Electronic Nose (HEN) is used for gradation of jasmine flowers and concrete based on aroma characteristics. HEN is having the following features viz., both battery / AC Adapter operated, data storage in SD memory card in FAT32 file system, results in graphics display, sensor array consisting of five (5) MoS sensors (Metal Oxide Sensors) and the report can also be viewed through PC based report generation tool.

### MEDICINAL AND AROMATIC PLANTS

#### **Solanum nigrum – Accession TNSn 19**

High yielding solanum genotype TN Sn 19 was identified at HC&RI, Coimbatore. It is selection from Kalipalayam local. It produces the fresh herbage yield of 454 g/plant and dry herbage yield of 90 g/plant.



# AGRICULTURAL ENGINEERING

## FOR ADOPTION

### Tractor drawn turmeric rhizome planter

This unit can be operated by 35-45 hp tractor which has the facility to plant three rows at a time in the required spacing. Row spacing is adjustable and can cover 1.2 ha per day. Cost of the unit is Rs.50,000/-.



### Hydraulic brake for two wheel tractor trailer system

The two wheel tipping trailers are not provided with any separate brake arrangement for stopping the trailer. They are stopped by the braking action of the tractor alone. When brakes are applied to a tractor with a loaded two wheel tipping trailer, the tractor first stops and then the trailer rams into the tractor and stops due to its inertia. This causes potential jack knifing situation leading to subsequent over turning. Realizing the situation, the Government of India has issued a Govt. notification dated 11.04.2014 insisting for making provisions in the tractor for taking hydraulic drive to operate the trailer brakes. This hydraulic brake system is powered by tractor hydraulic internal gear pump with a flow rate of 32 lpm (at engine rated rpm). Trailer braking and tipping control systems are provided for smoother braking of the two wheel trailer attachment. The additional cost involved in providing the hydraulic brake system is Rs.41,000/-.



## FOR ON FARM TESTING

### 1. Self propelled groundnut combine

A self propelled groundnut combine harvester was developed for harvesting ground nut crop cultivated in ridges and furrow system. It consists of a prime mover (30 hp diesel engine), main frame or chassis, power transmission, digging assembly, gathering assembly, chain conveying, stripping, pod collecting and cleaning systems.



In the trials conducted, threshing efficiency was found to be 98 per cent while manually feeding the groundnut crop. The harvester was evaluated in the groundnut crop raised in ridges and furrows and the unit worked well resulting in 98 per cent digging efficiency. In the case of ridges and furrow system, 70 cm spacing was provided between the ridges for mobility of the combine harvester and the crops were sown in single row at 10 cm plant to plant spacing. The digging blade assembly always positioned in line with the crop rows sown on the ridges.



The unit was working perfectly for harvesting, conveying and threshing of single row sown groundnut crop. The maximum harvesting efficiency, conveying efficiency and stripping efficiency of the groundnut harvester were 96.34, 96.15 and 97.22 per cent respectively at 1.5 km h<sup>-1</sup> forward speed of operation. The operation of self propelled groundnut combine harvester resulted in 22.38 per cent saving in cost when compared to conventional method of manual digging and hand stripping.

## **2. Safety kit for the spraying operation**

A study on personal protective equipments like mask, hand gloves, eye protectors and aprons was made for the development of a safety kit for the spraying operation. The developed safety kit consists of following equipments.

### **i. Face Mask**

For chlorpyrifos, the absolute filtering efficiency was found to be maximum (84.19 percent) in double layered poly propylene with water repellent quality and the actual filtering efficiency was also found to be maximum (74.43 percent). Therefore double layered poly propylene material with water repellent quality can be used as filter material in masks to prevent pesticides.

Wearing comfort was the highest in mask of flexible plastic body with exhale valve. The temperature raise inside the mask was found to be minimum. Hence the filtering material of double layer polypropylene was selected as filter and fitted in the face mask of flexible plastic body with exhale valve.

### **ii. Hand gloves**

The construction materials of the hand gloves used are made of nitrile, cotton, PVC and rubber. Among the four hand gloves, the wearing comfort was almost same for all the gloves. The gripping comfort was higher for PVC and also the temperature raise in the PVC hand gloves was found to be minimum. Hence the hand gloves made of PVC material was found to be the best among the selected hand gloves.

### **iii. Eye protectors**

All the eye protectors are made up of same material of plastic frame with fiber glass ocular except transparent visor. Wearing and visual comfort was found to be maximum in plastic frame with fiber glass which is having a lens area of 105 cm<sup>2</sup> and weight of 66 g. The eye protector made of plastic frame with fiber glass was found to be good for spraying operation.

### **iv. Apron**

Six types of apron fabrics namely cotton/nylon blend, stain guard cotton, cotton/polyester blend, Rexene, Polyester, Water proof polyester were used to make the aprons to be used by the spray operator. Laboratory studies were conducted to evaluate the pesticide penetration percentage through these fabrics. For chlorpyrifos and cypermetrin chemicals, only 1.5 percent and 1.3 percent of the pesticide penetrated through apron made of water proof polyester. Light discomfort was observed for apron made of water proof polyester. Based on the study, among the selected fabrics, apron

made of water proof polyester is recommended as personal protection clothing for spraying operation.

The developed safety kit costs Rs 620/- only (Apron made of water proof polyesters-Rs.300, Face Mask made of double layer polypropylene filter-Rs.130, Hand Gloves of PVC-Rs.100 and Eye protectors made of fiber plastic frames-Rs. 90)



**Developed safety kit**

### 3. Centrifugal dehuller suitable for millets

Extensive dehulling studies were done on millets too assess the efficiency of dehulling with available machines. Since the dehulling efficiency was around 50percent only, a double chambered centrifugal dehuller was developed. The centrifugal dehuller machine is working with more than 90percent efficiency for small millets. It is suitable for little millet, foxtail millet, proso millet and kodo millet.



Double chambered centrifugal dehuller

- Capacity : 75 kg/hr
- Power : 3 hp motor
- Efficiency : 93-95percent
- Breakage : 5-7percent
- Cost : Rs.85,000
- Cost of operation : Rs. 3/kg

#### Recovery of kernel from millets (per 100kg of grain)

Millets	Available kernel (with bran), kg	Conventional Processing methods, kg	Double chamber Centrifugal dehuller, kg
Little Millet	78 (6)	65	75
Foxtail Millet	75(6)	64	72
Pearl Millet	68(7.5)	56	65
Kodo Millet	67(8)	55	64

#### 4. Farm level bio ripening chamber for fruit ripening

A low cost ripening tent was developed for carrying out the ripening studies at lab level. The size of the structure is 1 x 1.5 m<sup>2</sup>.

Another ripening chamber developed is a collapsible plastic chamber of polypropylene with a dimension of 7'x7'x7'. The ripening chamber has a capacity to hold and ripen 500 to 700 kg of mango/banana fruits. It is supported by a framework of 1.5" PVC pipes with a thickness of 0.33 mm. The polypropylene plastic makes the ripening chamber airtight. The chamber has four outlets at the base of the four corners of chamber which are closed tightly with a plastic string and released manually as and when required to have a ventilating effect inside the chamber. A known quantity of the fruits were exposed to the ethylene gas at different intervals. The optimum condition suitable for individual fruit (banana, mango and papaya) were standardized to use at farmers and traders level.



#### Optimized conditions for different fruits

Fruit	Ethylene Concentration (ppm)	Exposure time (h)
Banana	200	25
Mango	600	25
Papaya	600	25

Fruits ripened within 3-4 days.

#### 5. Subsurface drainage system with amendments for alleviating water logging and sodicity / salinity

An observation experiment was conducted in one acre rice field by designing a Subsurface Drainage system (SSD) with 25 m lateral spacing and 75 mm dia perforated PVC pipes using steady state Hooghoudt's equation. The system was laid in a field adjoining to the downstream of a lake where seasonal water logging due to heavy seepage and poor internal drainage characteristic of the soil prevails. Crop cultivation was done from the inception of the college (24 years).

#### Amendments tried with the drainage system @ 2 tons/ha :

- (i) Green Leaf manure
- (ii) Pressmud
- (iii) Gypsum
- (iv) Control (without SSD and amendments)

## Perforated PVC drainage pipe wrapped with coir fibre installed in the field



## Salient results

- Water table was lowered from 0.20 m to 0.50 m below soil surface (0.30 m reduction)
- Reduction in root zone soil from level of pH level of 9.20 to 8.02 (SSD with Green leaf manure).
- Reduction from EC of 1.50 to 0.30.
- The highest rice crop yield recorded was 4.96 t/ha in the plot with SSD using green leaf manure, associated with yield attributes of more no. of tillers per plant (41 to 48) compared to control (22 to 37). Organic carbon increased from 0.6percent to 1.3percent in green leaf manure treatment with SSD.
- SSD with gypsum and press mud treatments recorded grain yields of 3513 kg/ha and 2790 kg/ha respectively.

## Amendments in the field



Press mud



Gypsum



Green leaf manure



Control

## 6. Development and evaluation of biogas scrubbing system for sago waste based biogas system

A 10 m<sup>3</sup>/h capacity biogas water scrubbing system was installed at M/s. Selliamman sago factory, Vennandur, Namakkal Dist and it was evaluated for its performance. The scrubbed biogas was used to dry the sago and it was compared with drying of sago using raw biogas.

- The methane content of scrubbed biogas varies from 87 to 91.5percent
- For the biogas flow rate of 10.0 m<sup>3</sup>/h, water flow rate of 8.8 m<sup>3</sup>/h is needed.
- The efficiency of the burner with raw biogas is 19.7 percent and the efficiency of the burner with scrubbed biogas is 34.3 percent.
- The cost of production of 1 m<sup>3</sup> of biogas from the UASB reactor is Rs.2.50
- The total cost of roasting with raw biogas is Rs. 1.50/kg
- The total cost of roasting with scrubbed biogas is Rs. 0.80/kg
- When raw biogas is used for roasting of sago in pipe burners, 2.38 tonnes of sago in 10 h can be roasted. When scrubbed biogas is used for the roasting of sago in pipe burners, 3.75 tonnes of sago in 10 h can be roasted.
- Utilization of scrubbed biogas for sago roasting results in the roasting of an additional quantity of 1370 kg of sago per day. Further, the reduction in the cost of roasting per kg of sago of 46.6 per cent, is obtained in the case of scrubbed biogas compared to the raw biogas.



Biogas scrubbing columns with splash tower

## 7. Biodigested slurry value added to supplement organic agriculture

Field experiments were conducted in TNAU farmlands and farmers' fields to determine the manure value of bio-digested slurry and enriched compost on vegetable, fruit and commercial crops. Application of poultry litter waste bio-digested enriched compost to the crops at 12.5 t ha<sup>-1</sup> level biometric and yield qualities resulted in better. Sugarcane: more number of millable canes (112.00±4.10 (000' ha<sup>1</sup>), single cane weight (1.31±0.08 kg), highest cane yield (131.25±8.68 t ha<sup>-1</sup>) and sugar yield (15.98±0.98 tha<sup>-1</sup>) than application of 12.5 t ha<sup>-1</sup> farm yard manure.



- Bhendi : maximum plant height (112.50±1.11 cm) with the highest pod yield (19.55 ± 0.27 t ha<sup>-1</sup>)
- Turmeric : maximum plant height (57.47±0.23 cm) and rhizome yield (32.24 ± 6.77 t ha<sup>-1</sup>).
- Banana : bunch yield (20.73±0.19 kg/Plant).
- The values were significantly superior than FYM application.

Application of poultry litter waste bio-digested slurry @ 75percent of slurry N ha<sup>-1</sup> improved the biometric and yield parameters.



Sugarcane: cane yield ( $161.19 \pm 7.10 \text{ t ha}^{-1}$ ); sugar yield ( $21.02 \pm 0.73 \text{ t ha}^{-1}$ ); number of millable canes ( $109.33 \pm 3.88$  (000' ha<sup>-1</sup>) and single cane weight ( $1.47 \pm 0.07 \text{ kg}$ ).

Bhendi: maximum plant height ( $112.28 \pm 0.27 \text{ cm}$ ) and pod yield ( $19.67 \pm 0.16 \text{ t ha}^{-1}$ )

Turmeric: maximum plant height ( $58.40 \pm 0.19 \text{ cm}$ ) and rhizome yield ( $28.87 \pm 4.96 \text{ t ha}^{-1}$ )

Banana: maximum bunch yield ( $19.83 \pm 0.08 \text{ kg/Plant}$ ) @ 50percent of slurry N ha<sup>-1</sup>.

The farmers adopting application of bio-digested compost and slurry can qualify for organic agriculture. It is advantageous as a rich nutrient source; increases yield when applied in the proper dilution; saves a huge amount of money spent on commercial fertilizers by the farmers. The real goodness is quality boost of crops like greenness in bhendi and turmeric curcumin and tomato lycopene. Hence the organic biodigestate application in agricultural fields could benefit the farmers in water, nutrient and cost saving.

# FORESTRY

## FOR ON FARM TESTING

### 1. Annatto- *Bixa orellana* (Bixa MTP-1)

- Mother plant : TNBi - 4
- Spacing: 3 x 3m
- Irrigation: Drip (12 l/plant/ week)
- Rotation: 40 years
- Seed Yield: 1.3 - 1.5 t ha<sup>-1</sup>
- Bixin content: 3.03percent



### 2. *Dalbergia sissoo*

A promising clone has been identified in *Dalbergia sissoo* as a multi-purpose industrial wood species amenable for biomass power industry and paper industry. The species exhibited superiority in terms of wood quality and could be harvestable in 4 years for use in multiple wood based industries.

- Variety - Clonal selection (DS18)
- Wood Yield - 0.125 m<sup>3</sup>/tree (150 tonnes / ha)
- Basic density - 505 to 565 kg/m<sup>3</sup>
- Pulp yield - 51.92percent (4 years)
- Kappa number - 18.60

### 3. *Melia dubia*

- A superior clone in *Melia dubia* (FCRI MD 15) has been identified as high yielding variety (60 tonnes) compared to 45-50 tonnes in *Melia* MTP 1.
- This clone expressed its superiority in terms of pulp quality and recorded higher pulp yield (52.1percent), acid insoluble lignin (21.8percent), hollocellulose (74.5percent), kappa number (19.6), tear index (10.2 mNm<sup>2</sup>g<sup>-1</sup>), tensile index (87 Nmg<sup>-1</sup>) and burst index (5.9 K Pa m<sup>2</sup> g<sup>-1</sup>).
- This clone is amenable for harvest from 18 months onwards due to the wood quality suitability towards pulp recovery.

### 4. *Casuarina* improvement programme

- The clone CJ27 in *Casuarina* is identified as high yielding and short duration clone.
  - Variety - Promising Clone - CJ 27
  - Wood Yield - 160 – 240 tonnes / ha

- Rotation - 36 months
- Wood Density - 470 kg/m<sup>3</sup>
- Pulp yield - 45-47 percent
- Kappa number - 21-23

## 5. Subabul

A new progeny FCLL 15 has been identified as a high yielding short rotation variety and has recorded an yield of 125 tonnes / ha in 30 months through amplified test. This progeny is found suitable both for paper (pulp yield 44-46percent, kappa number 22-24percent) and dendro power generation (calorific value 3800 – 4200 Kcal).

## 6. *Acrocarpus fraxinifolius*

This species is one of the fast growing tree species and the progeny evaluation test carried out for the last four years one progeny AF2 with resulted in identification of higher volume.

- Promising Genotype (FCRI AF2)
- Yield - 0.23m<sup>3</sup>/tree
- Density - 513 kg/m<sup>3</sup>
- Pulp yield - 49.5percent
- Kappa number - 20.5
- Calorific value - 4450 kcal

## 7. *Anthocephalus cadamba*

The cadam improvement programme has identified one superior progeny (cadam 13) which expressed higher volume coupled with acceptable wood properties for match and plywood utility.

- Promising Genotype (FCRI AC 12)
- Height - 8.35 m<sup>3</sup>
- GBH - 35.32 cm
- Volume - 0.071m<sup>3</sup>
- Density - 0.60 g/cm<sup>3</sup>
- Tensile strength - 840 kg/cm
- Bending strength - 421 kg/cm
- Nail holding - 640 kg
- Splints recovery - 16500/kg

## FOR INFORMATION

### 1. Carbon sequestration potential of trees

The tree species namely *Dalbergia sissoo*, *Butea monosperma*, *Gmelina arborea*, *Pterocarpus marsupium*, *Anthocephalus cadamba*, *Dalbergia latifolia* had high carbon sequestration potential and they can be recommended for promoting farm cultivation.



## 2. Pollution abatement

- *Tectona grandis*, *Alstonia scholaris*, *Terminalia catappa*, *Anthocephalus cadamba* and *Ficus religiosa* are dust efficiency tree species and suitable for Dust polluted areas.
- *Delonix regia*, *Syzygium cumini*, *Cassia siamea*, *Lannea coromandelica* and *Samanea saman* are the tree species suitable for NOx polluted areas.
- *Thespesia populnea*, *Ficus racemosa*, *Ficus religiosa*, *Mangifera indica* and *Anthocephalus cadamba* are the tree species suitable for SO<sub>2</sub> polluted areas.

## 3. Presowing seed treatment in *Melia dubia*

For enhancing the seed germination, have endocarp has to be break open using a vice to extract the seeds (to overcome mechanical dormancy); seeds to be soaked in GA<sub>3</sub> (250 ppm) for 24 h and subjected to humid invigouration (humigouration) for 2 days followed by drying of seeds to original moisture content (to invigourate the seeds). Treated seeds sown in poly houses with high relative humidity (to improve the mobilization of stored seed reserves to germinating embryo) help a germination of 48 per cent (control 12 per cent). Germination period was also reduced from 35 days to 20 days.

