

CROP PRODUCTION

Technical Programme - 2018-2019

AS-68 : Impact of integrated application of organics and inorganics in improving soil health and sugarcane productivity

Objective : To develop nutrient management strategy for sustaining soil health and sugarcane production.

Year of start : 2014 - 2015

Locations : All the participating centres

Cropping system : Sugarcane – Ratoon-I – Ratoon-II

Treatment & Methodology:

Treatments	Sugarcane (plant crop)	Ratoon-I	Ratoon- II
T1	No organic + 50% RDF	Application of trash at 10 tonnes/ ha + 50% RDF	Application of trash at 10 tonnes/ ha + 50% RDF
T2	No organic + 100% RDF	Application of trash at 10 tonnes/ ha + 100% RDF	Application of trash at 10 tonnes/ ha + 100% RDF
T3	No organic + soil test based recommendation	Application of trash at 10 tonnes/ ha + soil test basis (NPK application)	Application of trash at 10 tonnes/ ha + soil test basis (NPK application)
T4	Application of FYM/Compost @ 20 tonnes / ha + 50% RDF (inorganic source)	Application of FYM/Compost @ 20 tonnes / ha + 50% RDF (inorganic source)	Application of FYM/Compost @ 20 tonnes / ha + 50% RDF (inorganic source)
T5	Application of FYM/Compost @ 20 tonnes / ha + 100% RDF (inorganic source)	Application of FYM/Compost @ 20 tonnes / ha + 100% RDF (inorganic source)	Application of FYM/Compost @ 20 tonnes / ha + 100% RDF (inorganic source)
T6	Application of FYM/Compost @ 20 tonnes / ha + inorganic nutrient application based on soil test (rating chart)	Application of FYM/Compost @ 20 tonnes / ha + inorganic nutrient application based on soil test (NPK application)	Application of FYM/Compost @ 20 tonnes / ha + inorganic nutrient application based on soil test (NPK application)

T7	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + PSB) + 50% RDF	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + PSB) + 50% RDF	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + PSB) + 50% RDF
T8	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + PSB) + 100% RDF	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + PSB) + 100% RDF	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + PSB) + 100% RDF
T9	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + PSB) + soil test basis	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + PSB) + soil test basis (NPK application)	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + PSB) + soil test basis (NPK application)

Note:

1. The application rate of biofertilizer (*Azotobacter/ Acetobacter* + PSB) will be 5 kg/acre (solid based fertilizer 10^{7-8} cfu).
2. $ZnSO_4$ @ 25 kg/ha will be applied at the start of the cycle.
3. Trash will be inoculated with cellulolytic organism such as *Trichoderma viride* @ 500 g/tonne.
4. The experiment will be conducted in permanent field lay out.

Design : RBD
Replications : Three
Plot size : 6 rows of 6 m length
Planting season: February – March / Main season

Observations to be recorded:

1. Germination count/ plant population at 30 and 45 DAP / DAR
2. Tiller population at 120 and 150 DAP/DAR
3. Millable canes, length, girth and cane weight at harvest

4. Cane and sugar yield
5. Juice quality parameters (Brix, pol, purity) at 10 and 12 months age
6. Soil analysis initial and after harvest of each crop (bulk density, infiltration rate, organic carbon,
soil pH, EC, available N, P₂O₅, K₂O in kg/ha)
7. Economics
8. Nutrient uptake (N, P, K) at harvest (optional)
9. Soil microbial parameters (optional)

AS-70	: Scheduling irrigation with mulch under different sugarcane planting methods
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Objectives : To enhance crop and water productivity in sugarcane

Year of Start : 2016-17

Year of Completion : 2019-20

Participating centres : All centres

Treatment (A) : **North West, North Central and North East Zones**

Combination of planting methods and mulch practices

P₁ : Conventional flat planting (75 cm row spacing) with organic mulching @ 6 t/ha (sugarcane trash/paddy straw/any other available crop residue)

P₂ : Conventional flat planting (75 cm row spacing) without mulch

P₃ : Paired row trench planting (30:120 cm row spacing) with organic mulching @ 6 t/ha.

P₄ : Paired row trench planting (30:120 cm row spacing) without mulch.

Peninsular, East Coast Zones

Combination of planting methods, green manure and mulch practices

P₁ : Furrow planting (120 cm row spacing) without mulching

P₂ : Furrow planting (120 cm row spacing) with green manure (*dhaincha*/sunhemp/cowpea) sowing at 30 DAP, mulching at 75 DAP and earthing-up at 110 DAP.

P₃ : Furrow planting (120 cm row spacing) with alternate skip furrow irrigation* after earthing-up without mulching.

P₄ : Furrow planting (120 cm row spacing) with alternate skip furrow irrigation* after earthing-up + green manure/brown mulching.

Treatment (B)

*First irrigation to be given in furrow nos. 1, 3, 5. Second irrigation to be given in furrow nos. 2 & 4. Similar schedule should be followed in successive irrigation.

I₂ : 0.80

I₃ : 1.00

Irrigation water depth : 7.5 cm

Details of Methodology :

Recommended variety of sugarcane will be planted in spring season. Entire dose of N, P and K fertilizers as per recommendation of the region will be applied before onset of monsoon as per the recommendation.

- Treatments (12) : Planting methods : 4
Irrigation regime : 3
- Design : Strip plot design
- Replication : 3
- Plot size : 6m width x 8m length
- Observations to be recorded : **A. Soil parameters**
1. Initial and final soil fertility status as well as physical parameters (bulk density and infiltration rate)
 2. Moisture (%) before each irrigation up to onset of monsoon
 3. Quantity of water applied
 4. Water use efficiency
- B. Sugarcane:**
1. Germination (%)
 2. Periodic tiller population 90, 120, 180 DAP/DAR
 3. Plant height at 90, 120, 180 DAP/DAR
 4. Growth parameters i.e., NMC, cane length, diameter and cane weight
 5. Juice quality (brix, pol % and purity %)
 6. Cane and sugar yields (t/ha).

AS-71	: Carbon sequestration assessment in sugarcane based cropping system
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Objective : To improve the total soil organic carbon build-up and sustain crop yields

Year of start : 2016 – 2017

Locations : All centers

Duration : One cycle of 3 years crop rotation

Treatments : **North West and North Central Zones**

(Cropping system)

T₁ : Rice - Wheat – Rice – Wheat (residue retention without *Trichoderma*)

T₂ : Rice - Wheat – Rice – Wheat (residue retention with *Trichoderma*)

T₃ : Sugarcane – Ratoon (trash mulching without *Trichoderma*) - Wheat

T₄ : Sugarcane – Ratoon (trash removal without *Trichoderma*) - Wheat

T₅ : Sugarcane – Ratoon (trash mulching with *Trichoderma*) - Wheat

T₆ : Sugarcane – Ratoon - Wheat (trash incorporation through rotavator and *Trichoderma* incorporation before sowing of wheat)

T₇ : Sugarcane – Ratoon- Wheat (Zero tilled) without *Trichoderma*

T₈ : Sugarcane – Ratoon-Wheat (Zero tilled) with *Trichoderma*

Peninsular and East Coast Zones

T₁ : Soybean-wheat/maize/*toria*

T₂ : Sugarcane-Ratoon-cowpea/urd bean/moong bean

T₃-T₈ : Will be same as in North West and North Central Zones except wheat to be substituted by maize/*toria*/cowpea

Treatments : 8

Design : RBD

Replication : 3

Plot size : 6 rows of 6 meter length

Observations to be recorded : **Soil parameters**

1. Initial and final soil fertility status (0-30, 30-60 and 60-90 cm soil depths) as well as physical parameters (bulk density, infiltration rate, WHC)

2. Total soil organic carbon before start of the experiment and after harvest of every crop

Rice – Wheat/ Maize/Toria:

1. Germination count

2. No. of tillers at 30, 60 & 90 DAS

3. Days to maturity

4. Straw and grain yield

Sugarcane:

1. Germination at 35 & 45 DAP
2. Periodic tiller population 90, 120, 180 DAP/DAR
3. Plant height at 90, 120, 180 DAP/DAR
4. Growth parameters i.e., NMC, cane length, diameter and cane wt.
5. Juice quality (Brix, pol % and purity %)
6. Cane and sugar yields (t/ha)

Note:

All other trash management treatments will be same for both the regions.

Trichoderma viride solid based culture (10^7 cfu/g)

The experiment will be conducted in permanent field layout.

Planting season: February – March

AS-72	:	Agronomic performance of elite sugarcane genotypes
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Objective	:	To assess the performance of promising sugarcane genotypes of Advanced Varietal Trial (AVT)
Year of start	:	2016-2017
Duration	:	One year
Locations	:	All centres where post of Agronomist has been provided as well as any voluntary centre.
Planting time	:	North West, North Central & North East Zones: February-March Peninsular & East Coast Zones: 1 st fortnight of January
Treatments	:	<ol style="list-style-type: none"> 1. Genotypes : Varieties and checks of the centre's zone are given at the end. 2. Agronomy : Spacing : Spacing for all the entries(2) <ul style="list-style-type: none"> ▪ 90 cm and 120 cm (for North West, North Central, North East and East Coast Zones). ▪ 120 cm and 150 cm (for the Peninsular Zone). <p>Fertilizer levels: (2) 100 % and 125% of the recommended dose of NPK for the zone</p>
Design	:	RBD
Replication	:	2 or 3
Plot size	:	North West, North Central, North East and East Coast Zones: 5 rows of 6 m length. Peninsular Zone: 4 rows of 6 m length.

Note: 1. Seed material of the test varieties may please be obtained from concerned breeder of the center.

2. Separate trials to be laid out for early and mid-late maturity groups along with zonal checks.

Observations to be recorded	:	<ol style="list-style-type: none"> i) Initial soil fertility status for available NPK, soil texture, physico-chemical properties of the soil. ii) Data on germination, no. of millable canes, cane yield, Pol (%), CCS (t/ha).
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List of varieties (zone-wise) for the Experiment AS 72 during 2018-19

I. North West Zone (AVT II Plant)

Early maturing varieties (3): Co 13034, CoPb 13181, CoS 13231

Zonal Check (3): CoJ64, Co 0238 and Co 05009

Mid-late maturing varieties (5): Co 13035, CoH 13263, CoLk 13204, CoPant 13224, CoPb13182

Zonal Check (4): CoS 767, CoS 8436, CoPant 97222 and Co 05011

II. North Central & North East Zones (AVT II Plant)

Early maturing varieties (3): CoP13437, CoSe 13451, CoSe 13452

Zonal Check (3): CoLk 94184, CoSe 95422, CoSe 01421

Mid-late maturing varieties: No entries proposed

III. Peninsular Zone (AVT II Plant)

Proposed varieties (8): Co 12007, Co 12008, Co 12009, Co 12012, Co 12019, Co 12024, CoM 12085 and VSI 12121

Zonal Check (3): Co 86032, CoC 671 and CoSnk 05103

IV. East Coast Zone (AVT II Plant)

Early maturing varieties (3): Co 13023, CoA 14321, CoC 14336

Zonal Check (3): CoA 92081, CoC 01061 and CoOr 03151

Midlate maturing varieties (6): Co 13028, Co 13029, Co 13031, CoA 14323, CoC 14337 and PI 14377

Zonal Check (3): CoV 92102, Co 86249 and Co 06030

Note : Varieties other than listed above should not be included or substituted.

AS-73	:	Assessment of climate change impact on sugarcane productivity
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- Objective** : To assess long term variability in whether parameter and the change of sugarcane production.
- Year of start** : 2018-2019
- Duration** : One year
- Locations** : All centres where post of Agronomist has been provided as well as any voluntary centre.
- Methodology** : Long term daily weather data (30 years or more) is to be collected from nearest meteorological station for following parameters.
1. Daily maximum temperature
 2. Daily minimum temp.
 3. Daily relative humidity morning
 4. Daily RH noon
 5. Daily rainfall
 6. Daily wind velocity
 7. Daily evaporation
 8. Daily BSSH (Bright Sun Shine Hours)

Analysis for means and generate trends of weather over the years has to be performed by the stations at the following intervals.

1. Weekly
2. Monthly, seasonal
3. Annual
4. Decadal

Daily weather data and analyzed data is to be submitted to P.I. in soft format using MS and excel sheets along with following :

1. Representative cane yield for corresponding years
2. 10. Representative sucrose content for corresponding years
3. 11. Soil data
4. 12. Plant data (Biometric)
5. 13. Lat long information including elevation

AS-74	:	Evaluation of sugarcane varieties for drought tolerance
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- Objective** : Identification of drought tolerant varieties suitable for specific agro-climatic condition.
- Year of start** : 2018-2019
- Duration** : Long term (Based 2-years crop performance)
- Locations** : All centres where post of Agronomist has been provided as well as any voluntary centre.
- Planting time** : North West, North Central & North East Zones : February-March
Peninsular & East Coast Zones : 1st fortnight of January
- Treatments** : **(a) Newly released varieties :**
- Early maturing (3)
 - Mid-late maturing (3)
- (b) Irrigation regimes: 2**
- IW/CPE ratio 1.0
 - IW/CPE ratio 0.3
- Total no. of treatments :** 12
- Design** : Strip plot design
- Replication** : 3
- Plot size** : North West, North Central, North East and East Coast Zones : 8 rows of 8 m length.
Peninsular Zone : 8 rows of 8 m length.
- Methodology** : All the irrigation regimes would be applied 50 days after planting in the main season crop of the region.
- Observations to** :
- i) Root dry weight at 50, 100, 150 and 200 DAP.
 - ii) Relative leaf water content 24 hrs before and after each irrigation 50 DAP onwards.
 - iii) Soil moisture content before and after each irrigation.
 - iv) Leaf area index and specific leaf weight at 50, 100, 150 and 200 DAP.
 - v) Dry matter accumulation at 50, 100, 150, 200 and at harvest.
 - vi) Monthly tiller count and other plant biometric data.
 - vii) Yield attribute and cane yield
 - viii) Juice quality at 10 and 12 months stages including juice extraction percentage.

Protocol for determination of :

1. Relative leaf water content
2. Leaf area index (LAI) and specific leaf weight

Relative leaf water content (RWC):

1. Take LTM leaf & cut out 20 leaf disc using sharp cork borer.
2. Take the fresh weight of these leaf discs (20 discs). Take middle part of the leaf and avoid taking midrib.
3. Incubate the discs of leaf in distilled water for 6 hrs under proper illumination (use fluorescent tubes). Incubation can be done in petri dishes.
4. After 6 hrs, take out the discs, wipe out with tissue paper & weight the same, which is recorded as turgid weight.
5. Dry the discs (drying can be done at 60⁰C) and record the dry weight.
6. Calculate the RWC (Relative Water Content %) using following formula :

$$\text{RWC \%} = \frac{\text{Fresh weight} - \text{Dry weight}}{\text{Turgid weight} - \text{dry weight}} \times 100$$

Leaf area index can be calculated by following formula:

$$\text{Leaf area index} = \frac{\text{Leaf area}}{\text{Ground area}}$$

Specific leaf weight (SLW)

1. Take LTM leaf and measure the length (L) and width (W) (centre of the leaf). Multiply (LxW) with factor 0.627 to get leaf area of the leaf.
2. Dry the same leaf in oven at 60⁰C and take the weight of the dry leaf. SLW is calculated using following formula :

$$\text{SLW (g/cm}^2\text{)} = \frac{\text{Dry weight of leaf taken for the area}}{\text{Leaf area}}$$

Format for submission of Annual Report of Crop Production

1	Project No.	
2	Title	
3	Objectives	
4	Details of the treatment/ technical programme (in bullet form)	
5	Design	
6	Replications	
7	Plot size	
8	Climatic parameters (rainfall, Temperature-maximum & minimum, RH, etc.)	
9	Observations on soil health (initial and after harvest of crop: Bulk density, infiltration rate, organic carbon, available N, P ₂ O ₅ and K ₂ O in kg/ha)	
10	<p>Summary of results in 200 words (1) Germination count/ plant population at 30 and 45 DAP / DAR 2) Tiller population at 120 and 150 DAP or DAR 3) No. of millable canes, length, girth and cane weight at harvest 4) Cane and sugar yield (t/ha) 5) Juice quality parameters (Brix, pol, purity) at 10 and 12 months age of crop 6) Soil analysis initial and after harvest of each crop (bulk density, infiltration rate, organic carbon, soil pH, EC, available NPK) 7) Nutrient composition of organic source used 8 Economics 9) Nutrient uptake (NPK) at harvest (optional) 10) Soil microbial parameters (optional)</p>	

Note: The related analyzed data must be given in tabular form