



RAS/5/070: Developing Bioenergy Crops to optimize Marginal Land Productivity through Mutation Breeding and Related Techniques (RCA)

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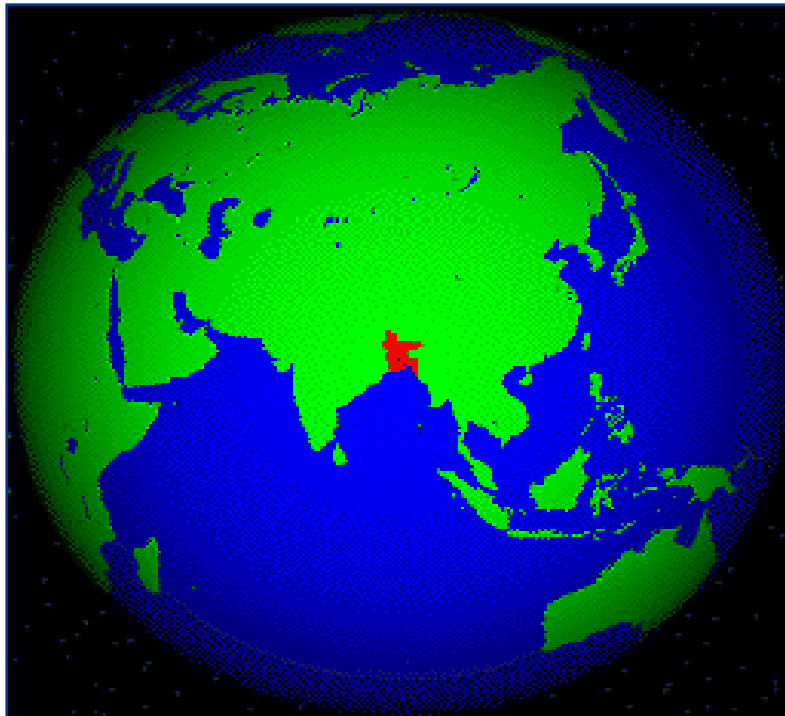
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Sub title: Improvement of Sugarcane Cultivar Using Mutation Breeding and *In Vitro* Technique for high yield and abiotic stress tolerance (Soil-water-nutrient management)

Global Position



Bangladesh



- ▶ 24° N Latitude and 90° E Longitude
- ▶ Area: 147000 sq. km.
- ▶ Population: 160 million
- ▶ Population density: 1000 per sq km

Topography and Climate



- **Terrain:** Mostly flat alluvial plain, hilly & costal region in Southeast part, 20% costal region, 8% terrace and hilly region
- **Climate:** Sub-tropical; hot summer (March to June) and humid rainy monsoon (July to October) with temp. averaging 32°C and mild winter (Nov. to Feb.) with temp. averaging 14°C
- **Rainfall:** Average 1525 mm.

Bangladesh Agriculture

- **Marginal Land: Any land with low fertility**
- **Cultivable land: 8 million hectares**
- **Current fallow land: 0.469m hectares**
- **Sugarcane cultivated: 0.14 million ha**
- **Annual Sugarcane Production: 5.0m MT**
- **Annual Sugar production: 0.21m MT**
- **Annual demand: 2.4m MT**
- **Isd 26 only the mutant variety so far**

- **Cropping intensity 179%**
- **Irrigated land 56%**
- **Surface water:21% groundwater:79%**
- **Land-man ratio: .06 ha**
- **Mainly subsistence farming**
- **Inadequate agro-processing**
- **Non-mechanized farming**
- **Fragmented land/plots**
- **Dependence largely on nature**

Objectives

- **To evaluate the physicochemical characters of soil for better crop management**
- **To observe the potentiality of different levels of N fertilizer (urea) on yield and yield contributing characters**

Sugarcane & it's by-product

- Sugarcane is one of the most important food-cum cash crop in Bangladesh and 15 sugar mills are now in operations for only sugar production except Keru & Co. Ltd.
- Molasses and Sugarbagasse are byproduct of sugar industry. Molasses contains 50-55% concentration of sugar which yielded alcohol (energy) by 72 hrs. fermentation process.
- 75% of energy supply in the country is provided by indigenous natural gas & 25% imported oil.

- **Rapid depletion of coal, gas and crude oil reservoir enforced the study of alternative fuel and such types are biofuels i.e.; bioethanol**
- **Ethanol can be used as a pure or blended with gasoline for vehicles**
- **At present sugarcane getting tremendous attention due to its versatile use**
- **It's by product press mud in combination with microorganism are also used as a organic manure in the country**

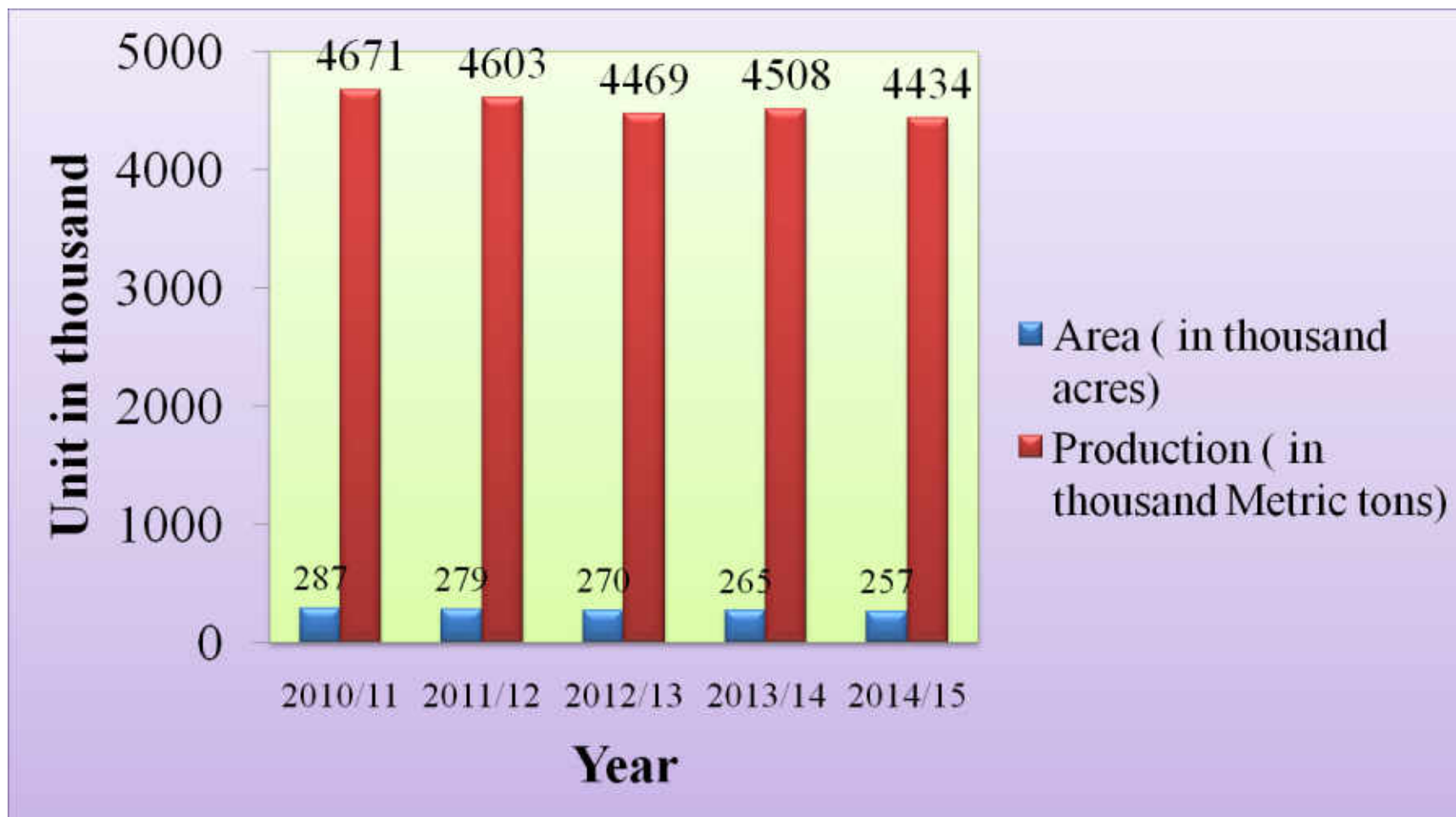


Fig. Past 5 years sugarcane cultivation in Acres and yield

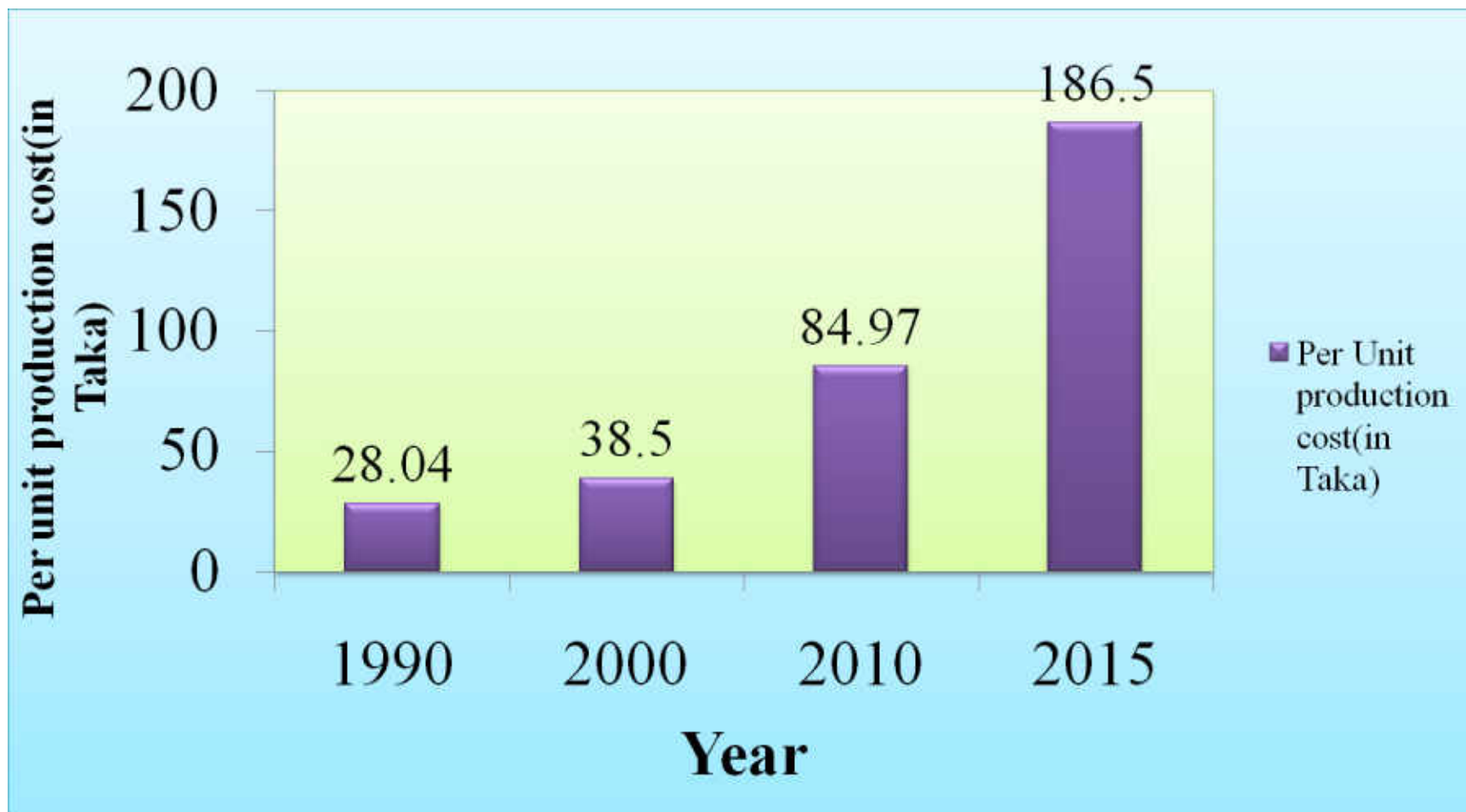


Fig. Per unit production cost of sugar from sugarcane

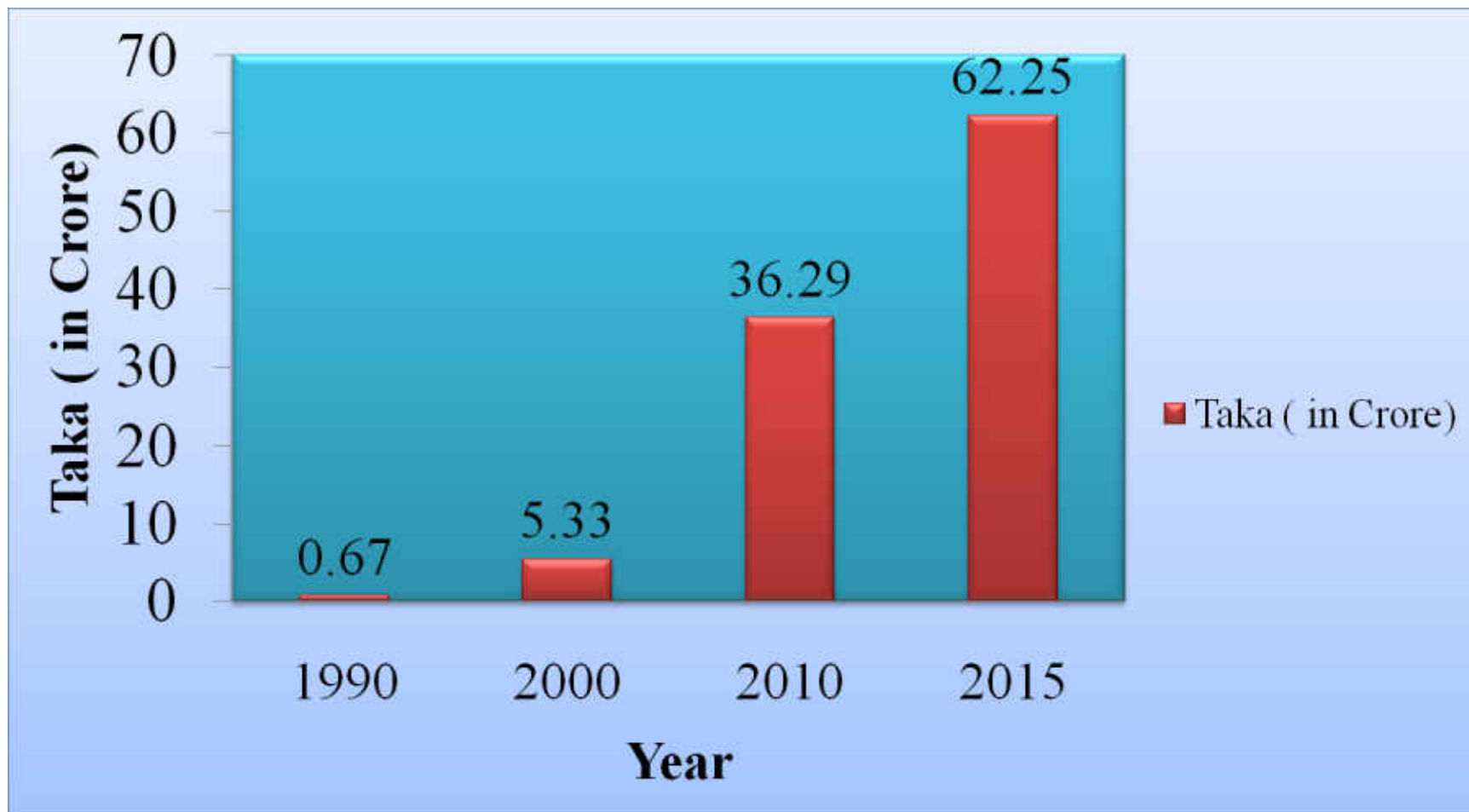


Fig. Profit from sugarcane by-product after harvesting sugar

Soil Status of Bangladesh

Soil fertility status-

- Moderate to low
- Organic matter content below 2%
- Nitrogen, Phosphorus, Potassium and Sulphur content also below the int.standard

Annually a big amount of soil nutrient removed due to cultivation of HYV and soil health was affected

Major Fertilizer used for Sugarcane Production

- Urea
- Triple Super Phosphate (TSP)
- Muriate of potash (MOP)

Trends of fertilizer use showed highest for nitrogen fertilizer

Field Operation

- **Experimental Design-RCBD**
- **Replication-3**
- **Plot size-5mX2m**
- **Plant spacing-33cmX100cm**
- **Fertilization-N fertilizer (urea) applied in 3 splits**
- **Irrigation done-Dry-wet method 21 dys interval & when needed and using porous cup**

Laboratory Methods

Soil pH: 1:2.5 pH Meter

OM: Walkley and Black

Total N: Kjeldahl

Available P: Bray And Kartz (pH<7)

Available K : Flame Photometer

Soil Texture: Hydrometer (NRS Soils-USDA)

Available S: Turbidimetrically by Spectrophotometer

Sodium: Flame Photometer

Calcium: Atomic Absorption

Spectrophotometer(AAS)

Physical properties of soil

Sample ID	Depth (cm)	pH	Particle Size Distribution (%)			Textural Class
			Sand	Silt	Clay	
B1	0-15	6.18	54	14	32	SCL
	15-30	6.15	51	16	33	
	30-45	6.12	50	17	33	
B2	0-15	6.09	56	19	25	SCL
	15-30	6.05	54	20	26	
	30-45	6.03	53	19	28	
B3	0-15	6.19	52	21	27	SCL
	15-30	6.18	51	20	29	
	30-45	6.16	51	19	30	
B4	0-15	6.03	54	19	27	SCL
	15-30	5.99	53	19	28	
	30-45	5.95	53	18	29	
B5	0-15	5.98	55	21	24	SCL
	15-30	5.94	53	22	25	
	30-45	5.93	50	23	27	

***SCL- Sandy Clay Loam**

Typical Contents of some essential elements in soil

Composite Sample	Organic Carbon (%)	Organic matter (%)	Total Nitrogen (%)	Phosphorus ppm	Potassium ppm	Sulphur ppm	Calcium ppm	Sodium ppm
B1	0.58	0.96	0.22	50.95(A) 203.8(T)	246.33(A) 825.32(T)	169.88(A) 679.52(T)	486.10	182.52
B2	0.52	0.95	0.24	48.83(A) 185.32(T)	255.36(A) 901.44(T)	161.87(A) 567.48(T)	517.09	189.25
B3	0.56	1.02	0.23	44.31(A) 177.24(T)	247.57(A) 910.28(T)	156.04(A) 554.16(T)	490.88	192.21
B4	0.61	1.01	0.25	49.13(A) 186.52(T)	240.39(A) 961.56(T)	158.38(A) 577.52(T)	618.93	201.47
B5	0.63	1.04	0.21	55.12(A) 220.32(T)	263.08(A) 1002.32(T)	165.88(A) 693.52(T)	578.90	204.35
Typical content (Mean)	2.0%	3.44%	0.20%	400 (T)	1800(T)	433(T)	20000(T)	11000(T)
Range	0.7-5.0%	1.2-8.6%	0.002-2.5%	20-6000	50-79000	3-320000	100-320000	50-100000

Main effect of nitrogen fertilizer (urea) on yield and yield contributing parameters of sugarcane variety china

Treatment (kg/ha)	%Germination (Count 1 month)	No. of tiller (X10 ³ /ha)	No. of millable cane (X10 ³ /ha)	Stalk length (cm)	Stalk girth (cm)	Unit stalk Weight (kg)	Cane yield (t/ha)	%Brix
N ₀	63.7	151.33	109.50	180.50	3.0	0.48	89.76	15
N ₁	67.3	190.10	119.90	201.77	4.0	0.65	107.35	16
N ₂	77.9	215.80	177.33	210.99	4.5	0.73	114.50	16
N ₃	88.6	290.50	210.23	242.33	5.0	0.89	127.33	16
N ₄	62.5	220.11	140.88	197.88	4.1	0.79	92.23	14.5

N₀=Urea 0 + TSP 205 + MOP 200, N₁=Urea 90 + TSP 205 + MOP 200, N₂= Urea180 + TSP 205 + MOP 200,
N₃=Urea 270 + TSP 205 + MOP 200, N₄=Urea 360 + TSP 205 + MOP 200

Management practices in sugarcane field



M1V4 population in the field



M1V3 population in the field



New technology & Challenges

- **To conduct N-15 experiment with legume crop and Data analysis**
- **To improve soil health by crop rotation, nutrient & water management**

Future plan

- **To conduct N-15 experiment with legume crop at the upcoming rabi season (winter season) October '17**

EBD



EBD



