Annual Report of All India Coordinated Research Project on Sugarcane
(Agronomy & Soil Science) for the year 2016-17
Centre- Uchani (Karnal)

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
Cropping system	**:**	Sugarcane (Plant)-ratoon-I- ratoon-II
Year of start	**:**	2014-15 (Plant crop)

Treatment:

Tr.	Sugarcane (plant crop)	Ratoon-I	Ratoon- II
T1	No organic + 50% RDF	Application of trash at 10 t/ ha + 50% RDF	Application of trash at 10 t/ ha + 50% RDF
T2	No organic + 100% RDF	Application of trash at 10 t/ ha + 100% RDF	Application of trash at 10 t/ ha + 100% RDF
T3	No organic + soil test based recommendation	Application of trash at 10 t/ ha + soil test basis (NPK application)	Application of trash at 10 t/ ha + soil test basis (NPK application)
T4	Application of FYM/Compost @ 20 t/ ha + 50% RDF (inorganic source)	Application of FYM/Compost @ 20 t/ ha + 50% RDF (inorganic source)	Application of FYM/Compost @ 20 t / ha + 50% RDF (inorganic source)
T5	Application of FYM/Compost @ 20 t/ ha + 100% RDF (inorganic source)	Application of FYM/Compost @ 20 t/ ha + 100% RDF (inorganic source)	Application of FYM/Compost @ 20 t/ ha + 100% RDF (inorganic source)
T6	Application of FYM/Compost @ 20 t / ha + in organic nutrient application based on soil test (rating chart)	Application of FYM/Compost @ 20 t/ ha + in organic nutrient application based on soil test (NPK application)	Application of FYM/Compost @ 20 t/ ha + in organic nutrient application based on soil test (NPK application)
T7	Application of FYM/Compost @ 10 t/ ha + biofertilizer (*Azotobacter/ Acetobacter* + *PSB*) + 50% RDF	Application of FYM/Compost @ 10 t/ ha + biofertilizer (*Azotobacter/ Acetobacter* + *PSB*) + 50% RDF	Application of FYM/Compost @ 10 t/ ha + biofertilizer (*Azotobacter/ Acetobacter* + *PSB*) + 50% RDF
T8	Application of FYM/Compost @ 10 t/ ha + biofertilizer (*Azotobacter/ Acetobacter* + *PSB*) + 100% RDF	Application of FYM/Compost @ 10 t / ha + biofertilizer (*Azotobacter/ Acetobacter* + *PSB*) + 100% RDF	Application of FYM/Compost @ 10 t/ ha + biofertilizer (*Azotobacter/ Acetobacter* + *PSB*) + 100% RDF
T9	Application of FYM/Compost @ 10 t/ ha + biofertilizer + soil test basis	Application of FYM/Compost @ 10 t/ ha + biofertilizer + soil test basis (NPK)	Application of FYM/Compost @ 10 t/ ha + biofertilizer + soil test basis (NPK)

The second ratoon crop of early maturing variety CoH 160 was initiated during last week of February 2016. Phosphorus and potash as per treatments were applied at the time of field preparation for ratoon initiation whereas, N as per treatment was applied in four equal splits as top dressing (At ratoon initiation, April, May and June months). Recommended dose for ratoon crop for Haryana state is 225-50-50 NPK kg/ha. The values for nitrogen, phosphorus and potash on soil test basis were 212, 52 and 58 NPK kg/ha, respectively. The crop was irrigated at 8-10 days interval during pre-monsoon and at 20 days interval during post monsoon period.

All other practices of ratoon crop were followed as per the package of practices of CCSHAU, Hisar. The crop was harvested on January 02, 2017.

Applications of FYM @ 10 t or 20 t/ha resulted in significant increase in yield and yield attributing characters over no organic manure application irrespective of fertilizers doses. FYM @ 10 t/ha along with bio-fertilizers proved equally effective in comparison of FYM @ 20 t/ha without biofertilizers in terms of growth characters and cane yield. Application of FYM @ 20 t/ha with 100 %RDF and soil test based fertilizer application being at par with FYM @ 10 t/ha +biofertilizers with 100 % RDF and soil test based fertilizer recorded significantly highest number of tillers, NMC and cane yield over 50% RDF with and without FYM, 100 % RDF and soil test based fertilizer without FYM. IN other words T6, T5, T9 and T8 were found best and at par treatment in terms of yield and yield attributing characters as compared to rest of the treatments. So continuous application of FYM @ 10 t/ha + biofertilizers in sugarcane plant-ratoon-I and ratoon-II will be equally effective in comparison to FYM @ 20 t/ha.

Summary: Significantly highest number of tillers (137.9, 136.0 thousands/ha), NMC (114.9, 113.2 thousands/ha) and cane yield (93.6, 91.9 t/ha) and sugar yield were recorded under treatment of FYM @ 20 t/ha with soil test based fertilizer application or 100 % RDF. However these treatments were found at par with application of FYM @ 10 t/ha+ biofertilizers along with fertilizers on soil test basis or 100 % RDF. So continuous application of FYM @ 10 t/ha + biofertilizers in sugarcane plant-ratoon-I and ratoon-II will be equally effective in comparison to FYM @ 20 t/ha.

Table 1: Effect of different treatments on sugarcane ratoon (II) at Uchani centre

Tr.	Treatments (Ratoon-II)	Tillers (000/ha)	NMC (000/ha)	Cane weight (g)	Cane yield (t/ha)	CCS (%)	Sugar yield (t/ha)
T1	Application of trash at 10 t/ ha + 50% RDF	83.1	64.6	620	38.7	11.85	4.59
T2	Application of trash at 10 t/ ha + 100% RDF	122.2	97.5	785	74.1	11.91	8.83
T3	Application of trash at 10 t/ ha + soil test basis (NPK)	124.5	99.6	780	75.1	12.08	9.07
T4	Application of FYM/Compost @ 20 t/ ha + 50% RDF (inorganic)	100.0	81.6	684	54.0	12.12	6.54
T5	Application of FYM/Compost @ 20 t/ ha + 100% RDF (inorganic)	136.0	113.2	840	91.9	11.90	10.94
T6	Application of FYM/Compost @ 20 t/ ha + inorganic nutrient based on soil test (NPK)	137.9	114.9	843	93.6	12.10	11.33
T7	Application of FYM/Compost 10 t/ ha + biofertilizer (*Azotobacter Acetobacter + PSB*) + 50% RDF	95.1	78.1	680	51.4	12.04	6.19
T8	Application of FYM/Compost 10 t / ha + biofert. Azoto/ *Aceto + PSB*) + 100% RDF	131.5	109.8	835	88.8	12.01	10.66
T9	Application of FYM/Compost @ 10 t/ ha + biofert. (*Azotobacter/ Acetobacter + PSB*) + soil test basis(NPK application)	133.5	111.6	832	89.9	12.10	10.88
	CD at 5%	8.8	7.8	36	5.3	NS	0.48

AS 69	**:**	**Use of plant growth regulators (PGRs) for enhanced yield and quality of sugarcane**
Objective	**:**	To accelerate rate and extent of sugarcane germination through the use of PGRs
Year of start	**:**	2015-16

Treatments

Tr. No.	Treatment detail
1	Conventional planting/ (3-bud setts)
2	Planting of setts after overnight soaking in water
3	Planting of setts after overnight soaking in 50 ppm ethrel solution
4	Planting of setts after overnight soaking in 100 ppm ethrel solution
5	T1+GA_3 spray (35 ppm) at 90, 120 and 150 DAP
6	T2+ GA_3 spray (35 ppm) at 90, 120 and 150 DAP
7	T3 + GA_3 (35 ppm) spray at 90, 120 and 150 DAP
8	T4 + GA_3 (35 ppm) spray at 90, 120 and 150 DAP

Mid maturing variety CoH 167 was planted at 75 cm row spacing in spring season on March14, 2016. The experiment consisting of eight treatments was conducted in randomized block design with three replications. The soil of experimental field was loam in texture having pH 7.8, EC 0.4 dSm^{-1}, organic carbon 0.38, available P 11.9 kg/ha and available K 193 kg/ha. The crop was raised as per package of practices for the Haryana state. The crop was harvested on March 05, 2017.

Dipping of setts in 50 ppm and 100 ppm ethrel being at par recorded significantly higher germination at 20, 30, 40 and 50 DAP as compared to control and water soaked treatments. Lowest germination was recorded in conventional practices i.e. T1 and T5 treatments. Germination was hastened in soaking of setts in 50 ppm and 100 ppm ethrel treatments. Even at 20 days after planting, 14-16 % germination was recorded in soaking of setts in 50 ppm and 100 ppm ethrel treatments.

Treatments of soaking of setts in 50 ppm ethrel+ GA3 spray (T7) and 100 ppm ethrel+GA3 (T8) being at par recorded significantly higher number of tillers, NMC, cane yield (101.3, 103.4 t/ha) and sugar yield were recorded in treatments as compared to soaking of setts in ethrel at 50 and 100 ppm ethrel alone, conventional practices with and without GA3 and water soaking treatments with and without GA3 spray at 90, 120 and 150 Days after planting.

Summary: Dipping of setts in 50 ppm and 100 ppm ethrel being at par recorded significantly higher germination at 20, 30, 40 and 50 DAP as compared to control and water soaked treatments. Soaking of setts in 50 ppm ethrel+ GA3 spray (T7) and 100 ppm ethrel+GA3 (T8) being at par recorded significantly higher number of tillers, NMC, cane yield and sugar yield as compared to soaking of setts in ethrel at 50 and 100 ppm ethrel alone, conventional practices with and without GA3 and water soaking treatments with and without GA3 spray at 90, 120 and 150 Days after planting.

Table 2: Effect of different treatments on germination and shoot population at Uchani centre

Treatments		Germination (%)					Shoot population (000/ha)			
		10 DAP	20 DAP	30 DAP	40 DAP	50 DAP	90 DAP	120 DAP	150 DAP	180 DAP
1	Conventional planting/ (3-bud setts)	0.4	4.3	22.5	37.5	38.2	94.0	128.9	126.5	105.8
2	Planting of setts after overnight soaking in water	0.7	8.6	27.9	41.9	42.8	106.9	145.0	142.0	112.9
3	Planting of setts after overnight soaking in 50 ppm ethrel solution	3.6	14.0	34.2	48.3	50.0	126.0	168.6	166.6	128.9
4	Planting of setts after overnight soaking in 100 ppm ethrel solution	4.2	16.4	36.8	52.8	54.2	130.8	173.4	171.9	130.6
5	T1+GA_3 spray (35 ppm) at 90, 120 and 150 DAP	0.6	4.4	22.9	37.2	38.5	95.3	130.3	129.5	112.2
6	T2+ GA_3 spray (35 ppm) at 90, 120 and 150 DAP	0.7	8.5	27.8	42.4	43.1	107.7	147.4	145.5	119.9
7	T3 + GA_3 (35 ppm) spray at 90, 120 and 150 DAP	3.5	14.3	33.8	48.6	49.7	124.7	168.4	166.1	134.4
8	T4 + GA_3 (35 ppm) spray at 90, 120 and 150 DAP	4.4	16.1	36.8	52.5	54.4	130.0	173.8	172.6	137.2
	CD at 5%	0.4	0.9	3.3	5.8	6.0	14.3	15.6	14.3	13.1

Table 3: Effect of different treatments on cane yield and its parameters at Uchani centre

Treatments		NMC (000/ha)	Single cane weight (g)	Cane yield (t/ha)	CCS (%)	Sugar yield (t/ha)
1	Conventional planting/ (3-bud setts)	101.6	774	76.1	12.01	9.14
2	Planting of setts after overnight soaking in water	109.2	788	82.3	12.16	10.01
3	Planting of setts after overnight soaking in 50 ppm ethrel solution	123.0	795	94.6	12.33	11.66
4	Planting of setts after overnight soaking in 100 ppm ethrel solution	124.2	797	95.7	12.18	11.66
5	T1+GA_3 spray (35 ppm) at 90, 120 and 150 DAP	106.9	802	82.9	11.98	9.93
6	T2+ GA_3 spray (35 ppm) at 90, 120 and 150 DAP	112.6	817	89.1	12.11	10.79
7	T3 + GA_3 (35 ppm) spray at 90, 120 and 150 DAP	126.5	826	101.1	12.28	12.41
8	T4 + GA_3 (35 ppm) spray at 90, 120 and 150 DAP	129.0	829	103.4	12.08	12.50
	CD at 5%	7.2	32	5.1	NS	0.60

AS 70	**:**	**Scheduling irrigation with mulch under different sugarcane planting methods**
Objective	:	To enhance crop and water productivity in sugarcane
Year of start	:	2016-17

Treatments

Planting methods

1. Conventional flat planting (75 cm row spacing) with trash mulching
2. Conventional flat planting (75 cm row spacing) without trash mulching
3. Paired row trench planting (30:120 cm row spacing) with trash mulching
4. Paired row trench planting (30:120 cm row spacing) without trash mulching

Irrigation schedule (IW/CPE)

1. 0.6
2. 0.8
3. 1.0

This experiment was conducted on mid maturing variety CoH 167 during spring season. Sugarcane was planted on March 6, 2016 as per treatments. Conventional sugarcane furrow opener was used to open the furrows at 75 cm in conventional planting whereas, paired row trench making machine was used to open the trench at 30: 120 cm. The soil of the experimental field was sandy loam in texture with bulk density of 1.68 g/cm3, infiltration rate 1.72 mm/hours(basic), low in organic carbon (0.32) medium in available phosphorus (11.2 kg/ha) and medium in available K (190 kg/ha). Pan evaporation rate readings were recorded from pan evaporimeter installed at the farm. Average pan evaporation rate values were 3.1, 6.1, 8.7 and 7.8 mm/day for the month of March, April, May and June 2016 (Pre-monsoon period), respectively. Highest values of pan evaporation rate were recorded in the month of May 2016. Soil moisture per cent (on volume basis) before each irrigation in 1.0, 0.8 and 0.6 IW/CPE treatments recorded during pre-monsoon period was 13.6-14.0 %, 10.8-11.5% and 8.0-8.6 %, respectively. The crop was irrigated as per treatments up to June end. The crop was irrigated as per requirement during post monsoon period. The crop received 721.1 mm total rainfall during the crop season out of which 137.2 mm during pre-monsoon, 490.3 during monsoon (July 2016 to September 2016) and 93.6 mm during post monsoon (October 2016 to March 2017). Maximum rainfall of 283.7 mm was recorded during the month of August 2016. No rainfall was received in the month of April 2016, October 2016, November 2016 and December 2016 months. Monthly average maximum temperature of 28.3, 37.6, 38.4 and 37.7 ^{0}C was recorded during March, April, May and June 2016 (Pre-monsoon period), respectively. Maximum monthly average temperature values ranges from 38.4 ^{o}C (May 2016) to 19.1 ^{o}C (January 2017) during crop season. Minimum monthly average temperature values ranges from 26.6 ^{o}C (June 2016) to 6.8 ^{o}C (January 2017) during the crop growth season.

Table 4: Mean monthly meteorological data from March 2016 to March, 2017 at Uchani centre

Month	Max. Temp. (^{o}C)	Min. Temp. (^{o}C)	Rainfall (mm)	Total Evaporation (mm)	Monthly Average Evaporation rate (mm/day)
March 2016	28.3	13.1	46.2	94.9	3.1
April 2016	37.6	18.6	0.0	182.7	6.1
May 2016	38.4	23.6	48.6	270.0	8.7
June 2016	37.7	26.6	42.4	234.3	7.8
July 2016	33.3	26.4	185.0	141.3	4.6
August 2016	32.4	25.5	283.7	96.4	3.3
September 2016	33.2	24.1	21.6	100.7	3.4
October 2016	33.1	17.8	0.0	89.4	2.9

November 2016	28.7	11.1	0.0	78.3	2.6
December 2016	22.0	8.3	0.0	35.9	1.2
January 2017	19.1	6.8	85.8	28.1	0.9
February 2017	23.1	8.4	0.0	56.5	2.0
March 2017	28.0	11.6	7.8	89.8	2.9

Significant differences were observed among different method of planting in terms of germination, tillers, NMC, cane yield and sugar yield. Significantly higher germination, tillers, NMC, cane weight, cane yield and sugar yield were recorded in paired row trench planting (30:120 cm) as compared to conventional planting at 75 cm row spacing. Trash mulching resulted in significantly higher cane and sugar yield as compared to without mulching treatments. CCS percent was not affected due to different planting methods.

Germination was not affected due to irrigation schedule as the irrigation schedule was followed after complete germination. Significant differences were observed among irrigation schedules in all the parameters except germination and CCS per cent. Irrigation schedule of 1.0 produced significantly higher number of tillers, NMC, cane weight, cane yield and sugar yield as compared to irrigation schedule of 0.8 and 0.6 IW/ CPE. Lowest value of all the sugarcane parameters was recorded in irrigation schedule of 0.6 IW/CPE. Interaction between method of planting and irrigation levels was found non significant.

Table 5: Effect of different treatments on growth and yield of sugarcane at Uchani centre

Treatments	**Germination (%)**	**Tillers (000/ha)**		**NMC (000/ha)**	**Cane wt. (g)**	**Cane yield (t/ha)**	**CCS (%)**	**Sugar yield (t/ha)**
		90 DAP	**120 DAP**					
Planting methods								
Conventional planting with trash mulching	43.7	99.0	117.7	107.4	811	83.9	12.43	10.43
Conventional planting without trash mulching	43.0	94.5	111.7	103.3	781	77.8	12.44	9.67
Paired row trench with trash mulching	48.2	111.4	131.6	120.8	843	97.9	12.45	12.20
Paired row trench without trash mulching	48.4	106.7	126.2	116.1	832	92.9	12.44	11.56
CD at 5%	3.2	4.2	6.3	6.1	43	4.7	NS	0.60
Irrigation schedule (IW/CPE)								
0.6	46.1	92.4	109.3	101.2	772	75.2	12.42	9.35
0.8	45.6	104.5	123.5	113.4	837	91.1	12.45	11.34
1.0	45.9	111.8	132.2	121.1	843	98.0	12.46	12.21
CD at 5%	NS	6.9	8.1	7.5	39	3.3	NS	0.40

Irrigation was given on wet area basis. Irrigation of 7.5 cm was applied in conventional planting whereas; it was worked out as 4.5 cm on wet area basis (60 % of total plot area). Total irrigation water applied during pre-monsoon season of 45, 60 and 75 cm in conventional planting and 30, 39 and 48 cm in paired row trench planting method was calculated at 0.6, 0.8 and 1.0 IW/CPE schedule, respectively. During post monsoon, 60 and 50 cm irrigation water was applied in conventional and trench planting, respectively. Total (pre+ post monsoon) irrigation water of 105,120 and 135 cm in conventional planting and 80, 89 and

98 cm in paired row trench planting was applied at 0.6, 0.8 and 1.0 IW/CPE irrigation schedule, respectively. Total (Irrigation+ rainfall) water was calculated as 177.1, 192.1 and 207.1 cm in conventional and 152.1, 161.1 and 170.1 in paired row trench planting at 0.6, 0.8 and 1.0 IW/CPE irrigation schedule, respectively. Highest yield of cane produced/1000 litres of irrigation water applied was recorded in trench planting at 0.8 IW/CPE irrigation schedule.

Summary: Significantly higher germination, tillers, NMC, cane weight, cane yield and sugar yield were recorded in paired row trench planting (30:120 cm) as compared to conventional planting at 75 cm row spacing. Trash mulching resulted in significantly higher cane and sugar yield as compared to without mulching treatments. CCS percent was not affected due to different planting methods and irrigation levels. Interaction between method of planting and irrigation levels was found non significant. Total (Irrigation+ rainfall) water was calculated as 177.1, 192.1 and 207.1 cm in conventional and 152.1, 161.1 and 170.1 in paired row trench planting at 0.6, 0.8 and 1.0 IW/CPE irrigation schedule, respectively. Highest yield of cane produced/1000 litres of irrigation (11.23 kg) water was recorded in trench planting at 0.8 IW/CPE irrigation schedule

Table 6: Irrigation water applied and rainfall received during the crop season at Uchani centre

Planting methods	IW/ CPE	No. of irrigation as per schedule	Irrigation depth (cm)	Total irrigation including first irrigation (cm)	Post monsoon irrigation (cm)	Total irrigation (cm)	Total rainfall (cm)	Total water (Irrigation + rainfall) (cm)	Cane yield (t/ha)	Cane produced per 1000 litres of irrigation water (kg)
Conventional planting with trash mulching	0.6	5	7.5	45	60	105	72.1	177.1	70.4	6.71
Conventional planting with trash mulching	0.8	7	7.5	60	60	120	72.1	192.1	86.7	7.23
Conventional planting with trash mulching	1.0	9	7.5	75	60	135	72.1	207.1	94.6	7.00
Conventional planting without trash mulching	0.6	5	7.5	45	60	105	72.1	177.1	63.3	6.03
Conventional planting without trash mulching	0.8	7	7.5	60	60	120	72.1	192.1	81.3	6.78
Conventional planting without trash mulching	1.0	9	7.5	75	60	135	72.1	207.1	88.7	6.57
Paired row trench with trash mulching	0.6	5	4.5	30	50	80	72.1	152.1	88.0	11.00
Paired row trench with trash mulching	0.8	7	4.5	39	50	89	72.1	161.1	99.9	11.23
Paired row trench with trash mulching	1.0	9	4.5	48	50	98	72.1	170.1	105.9	10.80
Paired row trench without trash mulching	0.6	5	4.5	30	50	80	72.1	152.1	79.2	9.90
Paired row trench without trash mulching	0.8	7	4.5	39	50	89	72.1	161.1	96.4	10.83
Paired row trench without trash mulching	1.0	9	4.5	45	50	98	72.1	170.1	103.1	10.52

AS 71	**:**	**Carbon sequestration assessment in sugarcane based cropping system**
Objective	:	To improve the total soil organic carbon build-up and sustain crop yields
Year of start	:	2016

Treatments (Cropping systems)

T_1 : Rice - Wheat – Rice – Wheat (residue retention without *Trichoderma*)
T_2 : Rice - Wheat – Rice – Wheat (residue retention with *Trichoderma*)
T_3 : Sugarcane(Spring) – Ratoon (trash mulching without *Trichoderma*) - Wheat
T_4 : Sugarcane (Spring – Ratoon (trash removal without *Trichoderma*) - Wheat
T_5 : Sugarcane (Spring) – Ratoon (trash mulching with *Trichoderma*) - Wheat
T_6 : Sugarcane(Spring) – Ratoon - Wheat (trash incorporation through rotavator and *Trichoderma* incorporation before sowing of wheat)
T_7 : Sugarcane (Spring)– Ratoon- Wheat (Zero tilled) without *Trichoderma*
T_8 : Sugarcane (Spring)– Ratoon-Wheat (Zero tilled) with *Trichoderma*

Sugarcane variety CoH 167 (Mid maturing) was planted during spring seasons on March15, 2016 at row to row spacing of 75 cm in treatment from T3 to T8. The crop was fertilized with recommended dose of fertilizers (150-50-50 NPK kg/ha). Full dose of phosphorus and potash was applied in furrows at the time of planting. Nitrogen was applied in three equal splits (April, May and June months). Rests of the inputs were applied as per university recommendation. The crop was harvested on March 10, 2017 to take ratoon crop. Soil sampling was undertaken just after harvesting of plant crop of sugarcane. The treatments have been applied in ratoon crop as per technical programme. In rice –wheat cropping system treatments (T1 and T2), non scented rice variety HKR 47 was transplanted on July 5, 2016 and fertilized with 150-60-60 NPK kg/ha. Rests of the inputs were applied in rice crop as per state recommendation. The rice crop was harvested on October 20, 2016. After harvesting of rice crop, the soil sampling was undertaken for measuring the required parameters in this experiment. Wheat variety HD 2967 was sown on November 5, 2016 by Happy Seeder in full residue load after harvesting of rice crop. The wheat was fertilized with 150-60-60 NPK kg/ha. Wheat crop was harvested on April 15, 2017. Soil sampling was again done after harvesting of wheat crop in treatment T1 and T2.

Grain yield of rice and sugarcane yield of plant crop was not affected due to different treatments, as no treatment was applied in rice and sugarcane plant crop. These crops were grown as a general crop as per package of practices of the state. Numerically higher grain yield of wheat was recorded in T2 treatment where residue was retained with *Trichoderma* inoculation as compared to T1 treatment where residue was retained without *Trichoderma*.

Physical properties of soil were adversely affected in treatment T1 and T2 after harvest of puddled transplanted rice. The bulk density increased from 1.63 (initial) to 1.72 g/cc after harvest of rice crop. The bulk density and WHC improved after rice residue retention in wheat crop through happy seeder machine in treatment T1 and T2. Sugarcane proved superior in maintaining soil physical properties in comparison to puddled transplanted rice- wheat rotation. No changes were recorded in pH, EC and soil texture.

Summary: Grain yield of rice and sugarcane yield of plant crop was not affected due to different treatments, as no treatment was applied in rice and sugarcane plant crop. Numerically higher grain yield of wheat was recorded in T2 treatment (Rice—wheat rotation) where residue was retained with *Trichoderma* inoculation as compared to T1 treatment where residue was retained without *Trichoderma*. Physical properties of soil were adversely affected in treatment T1 and T2 after harvest of puddled transplanted rice. The bulk density increased from 1.64 (initial) to 1.72 g/cc after harvest of rice crop. The bulk density and WHC improved after rice residue retention in wheat crop through happy seeder machine in treatment T1 and T2.

Table 7: Effect of different treatments on growth and yield of paddy/wheat/sugarcane plant crop at Uchani centre.

Tr. No.	Treatment detail	Paddy (Kharif 2016)			Wheat (Rabi 2016-17)		
		Grain yield (q/ha)	Straw yield (q/ha)	Harvest Index	Grain yield (q/ha)	Straw yield (q/ha)	Harvest Index
T1	Rice-Wheat-Rice-Wheat (residue retention without *Trichoderma*)	64.2	70.8	47.6	56.8	57.1	49.9
T2	Rice-Wheat- Rice-Wheat (residue retention with *Trichoderma*)	63.8	70.0	47.7	58.0	57.7	50.1
	CD at 5%	NS	NS	NS	NS	NS	NS
	Sugarcane (Plant crop)	**Germination (%)**	**Tillers at 90 DAP (000/ha)**	**Tillers at 90 DAP (000/ha)**	**NMC (000/ha)**	**Single cane wt (g)**	**Cane yield (t/ha)**
T3	S.cane (Spring) – Ratoon (trash mulch without *Tricho*) - Wheat	48.3	131.7	139.8	107.9	848	88.3
T4	S.cane (Spring) – Ratoon (trash removal without *Tricho*) - Wheat	49.3	129.0	142.5	110.9	846	90.5
T5	S.cane (Spring) – Ratoon (trash mulch with *Trichoder*) - Wheat	48.0	130.1	142.5	110.7	845	90.3
T6	S.cane (Spring) – Ratoon - Wheat (trash incorporation through rotavator & *Tricho* incorporation before sowing of wheat)	47.8	129.9	143.6	111.6	842	90.5
T7	S.cane (Spring)– Ratoon- Wheat (ZT) without *Trichoderma*	48.8	129.6	143.7	111.8	840	90.6
T8	S.cane (Spring)– Ratoon- Wheat (ZT) without *Trichoderma*	48.5	132.5	143.2	111.3	839	90.2
	CD at 5%	NS	NS	NS	NS	NS	NS

Table 8: Effect of different treatments on soil physical properties after rice-wheat rotation/ sugarcane plant crop (one year cycle) at Uchani centre

Tr. No.	Treatment detail	Soil texture	Bulk density (g/cc)	Infiltration rate (mm/day)	Water holding capacity	pH	EC	OC	Available nutrients (kg/ha)	
									P	K
T1	Rice-Wheat-Rice-Wheat (residue retention without *Trichoderma*)	Sandy loam	1.67	3.58	28.3	7.8	0.4	0.41	12.3	180
T2	Rice-Wheat- Rice-Wheat (residue retention with *Trichoderma*)	Sandy loam	1.67	3.62	28.6	7.8	0.4	0.41	12.6	176
T3	S.cane (Spring) – Ratoon (trash mulch without *Tricho*) - Wheat	Sandy loam	1.65	3.62	29.6	7.8	0.4	0.42	12.5	178
T4	S.cane (Spring) – Ratoon (trash removal without *Tricho*) - Wheat	Sandy loam	1.65	3.62	29.7	7.8	0.4	0.42	12.5	178

T5	S.cane (Spring) – Ratoon (trash mulch with *Tricho*) - Wheat	Sandy loam	1.65	3.62	29.6	7.8	0.4	0.41	12.4	177
T6	S.cane (Spring) – Ratoon - Wheat (trash incorporation through rotavator & *Tricho* incorporation before sowing of wheat)	Sandy loam	1.65	3.62	29.6	7.8	0.4	0.42	12.5	177
T7	S.cane (Spring)– Ratoon- Wheat (ZT) without *Trichoderma*	Sandy loam	1.65	3.62	29.6	7.8	0.4	0.41	12.4	178
T8	S.cane (Spring)– Ratoon- Wheat (ZT) without *Trichoderma*	Sandy loam	1.65	3.62	29.5	7.8	0.4	0.41	12.5	179
	Initial status	Sandy loam	1.63	3.64	30	7.8	0.4	0.39	12.1	186

AS-72	**:**	**Agronomic evaluation of elite sugarcane genotypes**
Objective	:	To assess the performance of promising sugarcane genotypes of AVT at wider row spacing
Year of start	:	2016

Treatments (Genotypes)

Early maturing varieties (6**)**	CoH 11262, CoLk11201, CoLk11202, CoLk 111203, Co 0238 (Check) and CoJ 64 (Check)
Mid late maturing varieties (9)	Co 11027, CoH 11263, CoLk 11204, CoLk11206, CoPb 11214, CoS 11232, CoS 767 (C), CoS 8436(C) and CoPant 97222 (C)

All the above mentioned varieties were planted at 120 cm with 125 % of recommended dose of NPK i.e. 187.5+ 62.5+62.5 NPK kg/ha during spring season on March 4, 2016. Recommended dose of fertilizers for Haryana state are 150-50-50 NPK kg/ha. Full dose of P and K was applied at the time of planting in furrows through Di-amonium phosphate and Murate of potash fertilizers, respectively. Nitrogen through Urea was applied in three equal splits (April, May and June months). The soil of the experimental field was sandy loam in texture with pH 7.5, EC 0.4 dSm^{-1}, organic carbon 0.38, available P 11.8 kg/ha and available K 194 kg/ha. The crop was irrigated at 8-10 days interval during re-monsoon seasons and 15-20 days interval during post monsoon seasons. Rests of the inputs were applied as per package of practices of CCSHAU, Hisar. The crop was harvested on March 3, 2017.

Early maturing group: Varieties did not differ significantly in terms of germination per cent recorded at 40 days after planting. Varieties CoLk 11203 and CoJ 64 being at par produced significantly higher number of tillers and NMC as compared to rest of the varieties whereas; CoJ 64, CoLk 11201, CoLk 11202 and Co 0238 were found at par with each other. Varieties CoH 11262, CoLk 11202 and Co 0238 being at par recorded significantly highest cane weight, cane yield and sugar yield as compared to CoLk 11201, CoLk 11203 and CoJ 64. Varieties CoLk 11201 and CoJ 64 being at par recorded lowest cane weight and cane yield. CCS per cent was not significantly affected by different entries.Variety CoLk 11201 produced significantly lowest sugar yield among all the varieties.

Table 9: Performance of early maturing varieties of sugarcane at Uchani centre

Varieties	Germination (%)	Tillers (000/ha)	NMC (0000/ha)	Cane weight (g)	Cane yield (t/ha)	CCS (%)	Sugar yield (t/ha)
CoH 11262	58.7	128.4	108.2	986	101.2	12.48	12.63
CoLk11201	57.8	136.0	114.3	740	79.8	12.58	9.99
CoLk11202	61.0	136.3	115.0	952	103.1	12.46	12.85
CoLk11203	62.5	153.4	126.8	768	91.8	12.57	11.53
Co 0238 (Check)	60.3	131.5	112.8	978	107.5	12.64	13.59
CoJ 64 (Check)	61.0	145.9	120.9	776	88.5	12.66	11.21
CD at 5%	NS	12.8	9.4	74	8.8	NS	1.14

Mid late: Varieties did not differ significantly in terms of germination per cent recorded at 40 days after planting. Varieties CoH 11263, CoLk 11204, CoLk 11206, Co Pb 11214, CoS 11232, CoS 767 and CoPant 97222 being at par recorded significantly higher number of tillers as compared to Co 11027 and CoS 8436, the latter two being at par with each other. Similar trend was observed in terms of millable canes recorded at harvest. Significantly highest cane weight was recorded in variety CoH 11263 and lowest in CoS767. Varieties CoH 11263, CoLk 11206 and CoPb 11214 being at par produced significantly higher cane yield as compared to checks and rest of the varieties. Varieties CoS 767, CoS 8436, Co 11027 and CoPant 97222 being at par recorded significantly lowest cane yield among all the varieties. Varieties did not differ significantly for CCS % at harvest. Varieties CoH 11263 and CoLk 11206 being at par produced significantly highest sugar yield among all the varieties.

Summary: In early group, varieties CoH 11262, CoLk 11202 and Co 0238 being at par recorded significantly highest cane weight (986, 952, 978 g), cane yield (101.2, 103.1, 107.5 t/ha) and sugar yield (12.63, 12.85, 13.59 t/ha) as compared to CoLk 11201, CoLk 11203 and CoJ 64. Varieties CoLk 11201 and CoJ 64 being at par recorded lowest cane weight (740,776 g) and cane yield (79.8, 88.5 t/ha). CoLk 11201 produced significantly lowest sugar yield among all the varieties. In mid late group, Varieties CoH 11263 (102.9 t/ha), CoLk 11206 (100.3 t/ha) and CoPb 11214 (97.1 t/ha) being at par produced significantly higher cane yield as compared to checks and rest of the varieties. Varieties CoS 767, CoS 8436, Co 11027 and CoPant 97222 being at par recorded significantly lowest cane yield among all the varieties. Varieties did not differ significantly for CCS % at harvest. Varieties CoH 11263 (12.99 t/ha) and CoLk 11206 (12.35 t/ha) being at par produced significantly highest sugar yield among all the varieties.

Table 10: Performance of mid late varieties of sugarcane at Uchani centre

Varieties	Germination (%)	Tillers (000/ha)	NMC (0000/ha)	Cane weight (g)	Cane yield (t/ha)	CCS (%)	Sugar yield (t/ha)
Co 11027	46.8	120.2	103.0	882	85.5	12.24	10.45
CoH 11263	49.6	135.4	112.5	942	102.9	12.62	12.99
CoLk 11204	50.1	145.8	120.2	780	91.8	12.05	11.06
CoLk 11206	48.4	144.0	119.6	865	100.3	12.31	12.35
CoPb 11214	47.3	136.7	113.6	880	97.1	12.00	11.66
CoS 11232	47.6	135.0	112.2	844	92.2	12.50	11.52
CoS 767 (c)	45.9	138.5	115.2	745	83.4	12.00	10.03

CoS 8436(c)	46.4	119.8	99.7	881	85.2	12.40	10.56
CoPant 97222 (c)	46.0	131.0	109.0	828	87.7	12.60	11.07
CD at 5%	NS	12.8	11.1	35.1	7.1	NS	1.30

Summary of experiments conducted by Crop Production group (Agronomy& Soil Science) CCSHAU, RRS, UCHANI, KARNAL

Following experiments were allotted during 2016-17 and all the allotted experiments were conducted

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

Significantly highest number of tillers (137.9, 136.0 thousands/ha), NMC (114.9, 113.2 thousands/ha) and cane yield (93.6, 91.9 t/ha) and sugar yield were recorded under treatment of FYM @ 20 t/ha with soil test based fertilizer application or 100 % RDF. However these treatments were found at par with application of FYM @ 10 t/ha+ biofertilizers along with fertilizers on soil test basis or 100 % RDF. So continuous application of FYM @ 10 t/ha + biofertilizers in sugarcane plant-ratoon-I and ratoon-II will be equally effective in comparison to FYM @ 20 t/ha.

AS 69: Use of plant growth regulators (PGRs) for enhanced yield and quality of sugarcane

Dipping of setts in 50 ppm and 100 ppm ethrel being at par recorded significantly higher germination at 20, 30, 40 and 50 DAP as compared to control and water soaked treatments. soaking of setts in 50 ppm ethrel+ GA3 spray (T7) and 100 ppm ethrel+GA3 (T8) being at par recorded significantly higher number of tillers, NMC, cane yield and sugar yield were recorded in treatments as compared to soaking of setts in ethrel at 50 and 100 ppm ethrel alone, conventional practices with and without GA3 and water soaking treatments with and without GA3 spray at 90, 120 and 150 Days after planting.

AS70: Scheduling irrigation with mulch under different sugarcane planting methods

Significantly higher germination, tillers, NMC, cane weight, cane yield and sugar yield were recorded in paired row trench planting (30:120 cm) as compared to conventional planting at 75 cm row spacing. Trash mulching resulted in significantly higher cane and sugar yield as compared to without mulching treatments. CCS percent was not affected due to different planting methods and irrigation levels. Interaction between method of planting and irrigation levels was found non significant. Total (Irrigation+ rainfall) water was calculated as 177.1, 192.1 and 207.1 cm in conventional and 152.1, 161.1 and 170.1 in paired row trench planting at 0.6, 0.8 and 1.0 IW/CPE irrigation schedule, respectively. Highest yield of cane produced/1000 litres of irrigation (11.23 kg) water was recorded in trench planting at 0.8 IW/CPE irrigation schedule

AS71: Carbon sequestration assessment in sugarcane based cropping system

Grain yield of rice and sugarcane yield of plant crop was not affected due to different treatments, as no treatment was applied in rice and sugarcane plant crop. Numerically higher grain yield of wheat was recorded in T2 (Rice-wheat rotation) treatment where residue was retained with *Trichoderma* inoculation as compared to T1 treatment where residue was retained without *Trichoderma*. Physical properties of soil were adversely affected in treatment T1 and T2 after harvest of puddled transplanted rice. The bulk density increased from 1.64 (initial) to 1.72 g/cc after harvest of rice crop. The bulk density and WHC improved after rice residue retention in wheat crop through happy seeder machine in treatment T1 and T2.

AS72: Agronomic evaluation of elite sugarcane genotypes

In early group, varieties CoH 11262, CoLk 11202 and Co 0238 being at par recorded significantly highest cane weight (986, 952, 978 g), cane yield (101.2, 103.1, 107.5 t/ha) and sugar yield (12.63, 12.85, 13.59 t/ha) as compared to CoLk 11201, CoLk 11203 and CoJ 64. Varieties CoLk 11201 and CoJ 64 being at par recorded lowest cane weight (740,776 g) and cane yield (79.8, 88.5 t/ha). CoLk 11201 produced significantly lowest sugar yield among all the varieties. In mid late group, Varieties CoH 11263 (102.9 t/ha), CoLk 11206 (100.3 t/ha) and CoPb 11214 (97.1 t/ha) being at par produced significantly higher cane yield as compared to checks and rest of the varieties. Varieties CoS 767, CoS 8436, Co 11027 and CoPant 97222 being at par recorded significantly lowest cane yield among all the varieties. Varieties did not differ significantly for CCS % at harvest. Varieties CoH 11263 (12.99 t/ha) and CoLk 11206 (12.35 t/ha) being at par produced significantly highest sugar yield among all the varieties.