https://doi.org/10.29321/MAJ.10.A03708

Effect of Manures and Irrigation on the Yield of Sugarcane

by

H. N. PANDEY[1] and K. K. MUKHARJEE[2]

Experiments conducted in U. P. (Anon 1951) on Sugarcane revealed that hot weather irrigations consisting of 3–4 premonsoon and 1 to 2 post-monsoon irrigations increased the cane yield. In south Bihar (Anon 1940) three hot weather irrigations in addition to one immediately following planting was considered the most effective treatment. Additional Irrigation upto a maximum of 11 were beneficial but not economical. Chakravarti *et al* (1956) found that the postmonsoon irrigation increased tonnage in Bihar. An experiment on Sugarcane was conducted at the Irrigation Research Station, Bikramganj for three years, 1960–61, 1961–62 and 1963–64 to find out the frequency, depth of irrigation at two levels of manures for optimum cane yield.

Material and Methods: (a) *Soil:* The Soil was loam textured having coarse sand 17.5, fine sand 43.7, silt 14.9 and clay 21.05 percents. The specific gravity and apparent specific gravity of the soil were 2.62 and 1.54, respectively. The values of field capacity and wilting point were 31 and 18.48 percents respectively.

(b) *Water measuring devices:* Rectangular weirs of 30.48 cm crest length and having sliding gates were provided in the secondary channels for measuring irrigation water at plot heads. For the maintenance of regulated flow over the weirs, over flow type escapes were provided in the main channel. Trial readings were taken before turning the flow in to the experimental plots. Each plot was irrigated individually to a pre-determined depth based on soil moisture deficit to bring the root zone to field capacity.

(c) *Design:* The experiment was laid out in split plot design with four replications, plot size being 21.3 m × 4.5 m. Two levels of manures, M_1—at the rate of 89.6 kg/ha N and 67.2 kg/ha P and M_2 – 134.4 kg/ha N and 100.8 kg/ha P were applied in the main plots. Irrigation treatments given in the sub plots were :

(I_1) Four Irrigations at 25 days interval. (I_2) Six Irrigations at 18 days interval. (I_3) Eight Irrigations at 13 days interval. (H_1) No preharvest Irrigation and (H_2) A single pre-harvest irrigation 15 days prior to harvesting.

---

1. Agricultural Engineer (Irrigation Research), Patna, Bihar and

2. Assistant Agronomist, Irrigation Research Station, Bikramganj, Shahabad, Bihar.

Received on 3-3—1967.

Nitrogen was applied in the form of ammonium sulphate and phosphate as single superphosphate. Half of N and the full dose of P were applied in the furrows at the time of planting the setts at both the levels of manures and the remaining half of the N levels was applied as top dressing at the time of earthing up the crop.

(d) *Seed bed preparation:* After harvesting late *Aman* paddy in mid December, a light irrigation of 76 mm was applied. The first ploughing was done with a mould board plough. Final seedbed preparation was completed after another light irrigation of similar amount, ploughed twice, rolled and levelled. Furrows were opened with ridging plough, manured and sets laid in them, covered and planked in February.

Soil samples for moisture studies were taken with the help of soil auger from 7.5, 22.5 and 75 cm depths a day prior to the date of irrigation, oven dried at 110°C and moisture percentages calculated to arrive at soil moisture deficit within the root zone.

(e) *Crop weather:* The mean monthly crop weather data in respect of rainfall, temperature, humidity and evaporation as recorded at the Research Station observatory are presented in Table 1.

TABLE 1. *Monthly Crop Weather Data (Mean of 1960–61, 1961–62 and 1963–64)*

Month	Temperature °C		Humidity % (7. a.m.)	Rainfall mm	Evaporation mm
	Max.	Min.			
January ...	22.5	9.1	86.0	8.1	79.3
February ...	22.6	12.1	81.6	6.6	107.6
March	32.3	17.3	69 0	23.6	214.4
April ...	37.7	23.0	47.4	1.0	335.8
May ...	41.2	26.4	56.1	10.9	395.7
June ...	37 0	27.6	78.3	194.8	243.3
July ...	32.3	26.8	89.1	340.4	98.0
August	30.4	26.6	90.0	397.0	68.7
September ...	31.6	25.2	38.9	208.0	92.5
October ..	30.7	21.4	86.6	85.6	104.7
November ...	27.7	14.0	85.5	3.3	96.3
December ...	23.3	9.3	82.3	Nil	78.0

Results: Data in respect of levels of irrigation, rainfall and evaporation (average of three years) are presented in Table 2.

TABLE 2. *Levels of Irrigation, Rainfall and Evaporation (Mean of three years)*

Crop stages	Period (weeks)	Irrigation (mm)			Rainfall (mm)	Evaporation (mm)
		I_1	I_2	I_3		
Germination ..	7	46.59	69 40	57.60	36.70	250.00
Tillering ...	13	291.30	314.10	406.30	178.80	936.00
Growth ..	26	37.27	44 40	25 40	1017 00	414.00
Maturity ...	6	114.30	114.30	114.30	15.10	273.00
Total ..		489.46	542.20	603 60	1247.60	1873.00

Table 3 presents data concerning plant height and tiller number for the years 1960–61, 1961–62 and 1963–64.

TABLE 3. *Average height of plants and tiller number*

Character	Year	Treatments			C.D. at 5%
		I_1	I_2	I_3	
Plant height (cm)	1960–61	347	375	407	39.73
	1961–62	306	338	370	23.47
	1963–64	352	391	414	20.10
	Mean	335	368	397	Sig. C.D.–31.51
Tiller number	1960–61	2.58	3.29	3.03	0.56
	1961–62	2.90	2.96	3.25	0 27
	1963–64	2.90	3.40	3.50	0.50
	Mean	2.79	3.22	3.26	Sig. C.D.–0.38

The effect of irrigation treatment was significant in all the years of trial both in respect of height of plants and tiller numbers. The results of combined analysis turned out to be significant in respect of both these characters. Treatment I_3 was found to be superior to both I_1 and I_2 except during the year 1960–61 where I_2 and I_3 were at par in respect of height. In the case of tillers treatment I_3 remained superior to I_1 during the years 1961–62 and 1963–64 but during 1960–61 treatment I_2 was better than I_1. In respect of both these characters the treatments I_3 and I_2 remained at par while both were significantly superior to the treatment I_1 as observed in the pooled data.

The yield of sugarcane for the years 1960–61, 1961–62 and 1963–64 is presented in Table 4.

TABLE 4. *Cane yield of sugarcane (q/ha) Mean of 3 years*

Year	Treatments			C.D. at 5%
	I_1	I_2	I_3	
1960–61	446.20	486.68	544.64	55 84
1961–62	207.69	301 80	308.20	63.94
1963–64	495.42	634.78	655 50	62.00
Mean	383.10	474.42	502.78	54.84 (1)

The effect of irrigation was significant in all the years which is confirmed by the pooled data. Treatment I_2 being on par with I_3 was superior to treatment I_1.

TABLE 5. *Cane yields at the two levels of manures and pre-harvest irrigation (q/ha)*

Year	M_1	M_2	H_1	H_2	C.D. at 5%
1960–61	451.72	533.60	486 68	498·64	N. S.
1961–62	238.28	306.36	295.32	296.32	Manure–41.16 Sig.
1963–64	554.76	636 64	520.00	661.48	Manure–Sig. Pre-harv. Sig.
Mean	414.92	492.20	437.00	470.12	Manure–20.75 Pre-harv. N. S.

The effect of manures turned out to be significant during the years 1961–62 and 1963–64 as well as in the combined data. The Higher dose of manure, M_2 significantly increased the cane yield over the lower dose, M_1. The effect of pre-harvest irrigation treatment was found to be non-significant.

Discussion : Normally sugarcane is planted in the month of February and germination is completed in six weeks time. The period following germination enters the tillering phase of sugarcane which witnesses a long spell of hot, dry and dessicative westerly winds embracing the months of April, May and June with little or no rainfall. It is during this long period stretching over three months that irrigation sustains the crop and creates favourable condition for crop growth and development. The amounts of water lost due to evaporation during the months of April, May and June were 335.8, 395.7 and 243.3 mm respectively (Table 1). The treatment I_2 received on an average 427.90 mm irrigation excluding the amount applied at preharvest while, the treatment I_1 and I_3 received 375.16 mm and 489.30 mm respectively (Table 2). The effect of preharvest irrigation on cane yield was non-significant and therefore it may be treated as superfluous. The mean effective levels of irrigations due to the treatments I_1 and I_2 work out to 375 and 428 mm respectively which account for a difference of 53 mm. During two out of three years the difference between these two irrigation treatments in respect of the height of plants, tiller number (Table 3) and the yields of cane (Table 4) were statistically significant. The same trend was observed with respect to pooled data of height of plants, tiller number and cane yield. The mean yield differences in respect of the treatments I_1 and I_2 account for 91.31 q/ha (Table 4). The mean levels of irrigations due to the treatments I_1 and I_3 work out to 375 and 489 mm respectively which account for a difference of 114 mm

in all the three years. The difference between these two irrigation treatments in respect of height of plants tiller number (Table 3) and cane yield (Table 4) were statistically significant. The same trend was observed with respect to the pooled data of these characters. The mean yield differences in respect to the treatments I_1 and I_3 account for 119 68 q/ha (Table 4). The treatments I_2 and I_3 remained at par in respect of tiller number, plant height and cane yield in two out of three years trial as well as with respect to the pooled data. On the basis of the above discussions it can be concluded that six irrigations between planting and commencement of monsoon at 18 days interval were most conducive for optimum cane yields. Based on the data of irrigation and rainfall of three years the effective water requirement of sugarcane worked out to 1675 mm. From the rainfall, irrigation and evaporation data for the different stages of the crop (Table 2) it is clear that the major portion of normal rainfall amounting to roughly 1000 mm occurs during grand growth period while the maximum quantity of supplemental irrigation is necessary during the tillering phase due to maximum evaporation and less rainfall. The cane yield in respect of higher dose of manure (M_2) was significantly superior to the lower dose (M_1) (Vide Table 5).

Summary: With a view to study the influence of irrigation frequences and levels, as well of manures on the yield of sugarcane, an experiment was conducted at the Irrigation Research Station, Bikramganj, Shahabad, Bihar for three years and the conclusions arrived at are summarised as follows: Six irrigations totalling 428 mm between planting to onset of the monsoon scheduled at 18 days interval were most conducive for optimum can yield under the conditions of experimentation. The total water requirements of sugarcane was 1675 mm of which rainfall accounted for nearly 1247 mm. The higher dose of fertilizers consisting of 134.4 kg/ha N in combination with 100.8 kg/ha P significantly increased the cane yields over the lower dose of fertilizers i. e 89.6 kg/ha N and 67.2 kg/ha P Application of the preharvest irrigation was ineffective in raising sugarcane yields.

REFERENCES

Anon. 1940. Ann. Rep Sugarcane Research Station, Bihar, 1940.

———. 1951. Ann. Rep. Sugarcane Research Station, Muzaffar-nagar, 1951.

Chakravarti, A. S., D. P. Shrivastava and K. L. Khanna. 1956. Cold weather irrigation of Sugarcane: Its effect on yield and Sugar recovery. *Indian Sugarcane*. 5 : 633.