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Effect of Drip Irrigation on Yield and Water Expense Efficiency of Castor (*Ricinus communis* L.)

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Proper management of critical inputs like water can overcome the productivity constraints to a great extent if high frequency irrigation systems are used. An attempt has, therefore been made to study the effect of drip irrigation on the yield and water expense efficiency in castor.

The experiment was conducted at Narmada Irrigation Research Project, Khandha, Gujarat during 1992-93 to 1995-96 except 1994-95 on castor GCH-4 in Typic chromustert soil. The treatments were flood irrigation of 80 mm depth and fractions of pan evaporation i.e. 0.2, 0.4, 0.6 and 0.8 through drip on alternate day. Basal dose of 40-40-0 kg/ha N, P_2O_5 and K_2O were applied as per recommendation. Nitrogen was applied in two splits. The crop was sown during second to third week of August and harvested in last week of January every year. The water expense efficiency was computed as yield divided by total water (mm) applied include effective rainfall received during crop season. The soil characteristics were pH 7.1, $EC_{2.5}$ $^{-1.01}$ dsm^{-1}, total N 0.033%, Olsen's P_2O_5 19.4 kg/ha and available K_2O 1206 kg/ha. During cropping season of 1992-93, 1993-94 and 1995-96, the total rainfall was 737, 978 and 696 mm, while effective rainfall was only 525, 600, 475 respectively. In case of rainfall during the weeks of cropping season, the amount of rainfall was substracted from the cumulative pan evaporation of the preceding week and rest of the amount was used to calculate the amount of water to be applied. If rainfall during any week exceeded pan evaporation, the irrigation was skipped during that week.

Irrigation scheduled at different fractions of pan evaporation (FPE) i.e., 0.2, 0.4, 0.6 and 0.8 gave significantly higher yield over surface irrigation of 80 mm depth (Table 1). All FPE were at par statistically. The higher yield obtained under different FPE was mainly due to better soil water regime. The results corroborate the findings of Goldberg *et al.* (1976).

The results further indicate that there is saving of water from 31 to 73 per cent under different fractions and highest was with 0.2 fPE. The water expense efficiency (WEE) was higher (3.0 kg/ha-mm) with 0.2 FPE and decreases with increase in the fraction of pan evaporation. This may be due to better utilization of irrigation water at lower fraction where as in higher fraction the rate of water loss as evaporation may be high and relative

TABLE 1

Seed yield, total water applied, per cent water saving, water expense efficiecy (WEE) and economics under different treatments.

Treatment	*Seed yield kg/ha*	*Total water applied (WRR=IR+ER) mm*	*WEE kg/ha -mm*	*% saving of water over control*	*Gross income Rs/ha*	*Total cost Rs/ha*	*Total net income Rs/ha*	*Net income over control Rs/ha*	*Net return per mm water applied Rs/ha*
Drip (FPE)									
0.2	2122	706	3.0	73	20159	15640	16720	9674	97
0.4	2315	797	2.9	59	21993	15895	14635	7589	55
0.6	2309	885	2.6	45	21898	16158	16332	3286	29
0.8	2222	977	2.3	31	21109	16455	6981	–	16
Surface irrigation	1728	1178	1.5	–	16416	9370	7046	–	11
S. Em. ±	92.5	–	–	–	–	–	–	–	–
C. D. 0.05%	261.7	–	–	–	–	–	–	–	–

Average effective rainfall is 533 mm.

increase in yield was not proportional to the increase in consumptive use of water. These results are in close association with the findings of Fox *et al.* (1986) and Malik *et al.* (1994) in pulse and vegetable crops.

The economical analysis showed that the gross income was maximum in all the drip treatments as compared to surface irrigation. Considering the additional area that can be cultivated through drip due to saving of water, the total net income is higher than surface method of irrigation for the same quantity of water. The net income (Rs. 9674=00) was higher in 0.2 FPE. The net return per mm water applied was also higher i.e. Rs. 97/mm of water with 0.2 FPE which is 782 per cent more than the surface.

The results suggest that the irrigation of castor at 0.2 fraction of pan evaporation through drip after cessation of monsoon i.e. October to January was better to harvest full potential of castor crop and higher net return.

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