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Response and economics of intercultural hand tools on growth and yield of onion under drip system of irrigation

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Abstract **:** The present investigations revealed that response of newly developed intercultural CAET-hand tools, hoes, traditional intercultural tool and modern weeder on a growth, yield and benefit cost ratio, with the constant level of irrigation and fertilizers used on onion crop. Under this experiment two intercultural hand tools and hand hoe were designed, fabricated and compared with the response of traditional equipment and modern weeder in onion cultivation. By utilizing these tools it was found that there was increase in labour use efficiency, saving in labour cost and increase production and productivity of onion crop. These tools performed batter intercultural operations, good aeration into the soil and also saved labour and irrigation supply. In this experiment drip irrigation provided an efficient method of fertilizer delivery and allowed precise timing and uniform distribution of nutrients. Fertilizer application through drip irrigation (fertigation) can reduce fertilize dozes and minimize ground water pollution due to fertilizer leaching from excessive irrigation. Fertigation events can be scheduled as often as irrigation upto several times per season. It was observed that the highest mean marketable yield in treatment T_3 (76.44 kg/ha) while in treatment T_2, T_1 and T_4 was obtained to be 61.86 kg/ ha, 55.67 kg/ ha and 55.57 kg/ ha, respectively when CAET hand tool, hoe, modern weeder as well as traditional hand tools were used in intercultural operation of onion crop as shown in Table 1, the benefit cost ratio of onion crop has been found highest in treatment T_3 (3.60:1) with respect to treatment T_2, T_4 and T_1 (2.80:1, 2.70:1, 2.45:1), respectively, as shown in Table 2. It is also observed that net return, and gross revenue were maximum in treatment T_3 inspite of treatment T_2, T_4 and T_1 which was minimum as shown in Table 3.

Key words **:** Intercultural tool, Hoes, Weeder, Fertigation, Benefit cost ratio

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In India more than 70 per cent of farmers serving on agricultural farming. Our economics is based on agricultural production because most of the farmer worked as hired labour who are receiving 50 per cent or more income from agricultural operations during the year. A large farmers have a tendency to employ a labour to the points whose marginal productivity is equal to the prevailing wage rate. The present study is based on design and fabrication of intercultural CAET- hand tool, hoe, modern weeder which was compared the performance with traditional equipment for intercultural operations in onion crop at CAET- farm, Etawah. By utilizing hand tools and hoe to increase labour use efficiency and aeration in intercultural operation after transplanting till harvesting of crop. Under this experiment 16 plots of 6m x 2m size each with a total area of experimental plots was 192m², with a constant level of irrigation and fertigation. Vedecke (1993) conducted an experiment on effect of irrigation for the yield and quality of strawberry on various suction of pressure and recommended that quality of fruits was better with increase in irrigation rate. Sivanappan *et al.* (1994) carried out experiment on water requirement and response of drip and other methods of irrigation on chilli crop and found saving of water was 62 per cent, increase in yield was 25 per cent and also 50 per cent of lesser infestation of weeds in drip irrigation method. Rajput and Patel (2002) conducted an experiment of drip irrigation on various fruits and vegetable crops and observed that an increase in yield and better crop growth under drip system of irrigating rather than traditional method of irrigation. They also observed that crop coefficient of dry onion and green onions were 0.90 and 0.80, respectively. Paul and Paul (2002) studied the response and economics of strawberry cultivation under drip irrigation

with variable level of irrigation and found highest mean marketable yield when irrigation applied at 150 per cent of pan evaporation replenishment.

METHODOLOGY

The methodology adopted for the study of response and economics of onion cultivation by utilizing different modified intercultural CAET- hand tool, hoe and weader compared with traditional intercultural tool to a constant level of irrigation and fertigation. The effect of different CAET-hand tool, hoe, modern weeder and traditional intercultural tool under drip irrigation method on yield, total cost of production, gross revenue net returns and benefit cost ratio in onion cultivation, was studied.

Kumar *et al*. (2008) studied about the feasibility and micro- irrigation system for vegetables production in a canal command area. Response of these systems were compared with existing flood irrigation method for onion production with four irrigation levels, *viz.,* 0.60, 0.80, 1.00 and 1.20 of irrigation water to cumulative pan evaporation ratio (IW/CPC).

Total area of experimental field was 192 sqm. With each plot size of 6m x 2m, followed by Randomized Block Design (RBD), opted with four treatments and four replications (T_1, T_2, T_3, T_4 and R_1, R_2, R_3, R_4) of 16 plots were selected for experimental purpose. Field was ploughed two times with disc harrow followed by cultivator and planking. Drip irrigation system along with fertigation unit with a skilled trained person was installed. After wards 35 days, onion seedling transferred from nursery to the experimental plot in the mid of November. After 20 days of interval the various intercultural practices were followed with CAET- modified hand tool, CAET hand hoe, modern weeder and traditional hand tool (Khurpi) along with constant level of irrigation and fertigation.

The plant spacing was kept 10cm x 15 cm (plant to plant and row to row) as per requirement of the statistically design of the experiment. The experimental layout is shown in Fig. 1.

Total No. of plot = 16

Statistical design = RBD

	T_4		T_2	
R_4	T_2		T_3	R_1
	T_1		T_4	
	T_3		T_1	
	T_1		T_3	
	T_3		T_2	
R_3	T_2		T_4	R_2
2 m	T_4		T_1	
	6m	1m	6m	

Fig. 1 : Layout of experimental field at research farm Etawah

Length of plot = 6m

Width of plot = 2m

Size of plot = 2x6=12 sq m.

Total area of plots = 16x12 = 192 sqm.

where:

T_1= Traditional system of intercultural practices (Khurpi) along with constant level of irrigation and fertilizer application.

T_2= Using CAET hand hoe as intercultural instrument with constant level of irrigation and fertilizer application.

T_3= Using CAET hand tool as intercultural instrument with constant level of irrigation and fertilizer application.

T_4= Using modern weeder with constant level of irrigation and fertilizer application.

R_1, R_2, R_3 and R_4 are the four replications of different treatments for statistical analysis of the experiment.

The response and economics of different CAET – hand tool, hand hoe, modern weeder and traditional equipment in onion grown field to break the upper crust of the soil and increase aeration , loosened the soil and increase infiltration rate, which effect yield, growth, gross revenue and benefit cost ratio of the experiment under different treatments *viz.,* T_1,T_2,T_3 and T_4, respectively. The crop was harvested in the mid of april and yield data and also other parameters for analysis of the experiment was procured.

RESULTS AND DISCUSSION

The result were obtained by conducting field experiment of onion crop along with various treatments of intercultural operations with the CAET hand tool, hand hoe , modern weeder and traditional intercultural equipments under constant level of irrigation and fertilizer application. The observed data where analyzed and estimated marketable yield, labour saving, growth parameters, test weight of bulb, average bulb weight per treatment, benefit cost ratio, net return gross revenue and total cost of production.

The highest mean marketable yield was observed in treatment T_3 (7640.00 kg/hc) while the treatment T_2, T_1 and T_4 was found to be 6186.00kg/hc, 5567.00kg/hc and 5557.00kg/ha, respectively, when CAET hand tool was used in intercultural operations of onion crops. The average marketable yield of onion crop is shown in Table 1 and benefit cost ratio of onion crop has been shown in Table 2. The net return, gross revenue and average labour saving for different treatments of onion crop is deleneated in Table 3.

Table 1: Average yield of onion crop in kg/ ha

Sr. No.	Treatments	Yield in kg/ha
1.	T_1	5567
2.	T_2	6186
3.	T_3	7644
4.	T_4	5557

Table 2 : Benefit cost ratio of onion crop under different treatments

Sr. No.	Treatments	Benefit cost ratio
1.	T_1	2.45:1
2.	T_2	2.80:1
3.	T_3	3.60:1
4.	T_4	2.70:1

After analyzing the data we observed that benefit cost ratio of onion crop under treatment 'T_3' was obtained as 3.60:1, which was highest with respect to treatment T_2, T_4 and T_1 was lowest as 2.80:1, 2.70:1, 3.45:1, respectively, as shown in Table 2.

It was also observed that net return was highest in treatment 'T_3' (Rs. 66422.00/ha) followed by T_4, T_2 and T_1 (Rs. 44438., 43336 and 39558/ha), respectively. Gross revenue and average labour saving was also found highest in treatment T_3 as Rs. 91728 and 25 per cent, respectively, as compare to treatment T_4, T_2 and T_1, respectively, as shown in Table 3.

Table 3 : Net return gross revenue and average labour saving for different treatments for onion is deleneated

Sr. No.	Treatments	Net return Rs./ ha	Gross revenue in Rs.	Average labour saving in percentage
1.	T_1	39558	66804	0
2.	T_2	43336	74232	6
3.	T_3	66422	91728	25
4.	T_4	4448	70284	13

Conclusion:

The over all efficiency and performance of intercultural operations with traditional tools was considerably low as compared to intercultural operations with CAET – modified hand tools and hand hoe. The observations based on performance evaluation of onion cultivation under intercultural practices with CAET – modified hand tools at constant level of irrigation and fertilizer application. The following conclusion was ellucidated :

– While utilizing CAET modified hand tools in inter cultural operation of onion crop, mean markatable yield was found highest as compared to using hand hoe, weeder and traditional instruments as intercultural tools.
– It was estimated that labour saving was up to 25- 35 per cent under intercultural practices with CAET modified hand tools but it was found less when utilizing other hand hoe, weeder and traditional equipments.
– Water and fertilizer saving was also observed upto 70 per cent under drip method of irrigation.
– Quality, test weight, size of bulb and height of plant was also observed better under intercultural operations with CAET hand tool rather than other hand tools, hoe and weeder.

Weed population was poor and net return, benefit cost ratio and gross revenue was maximum under intercultural operations through CAET hand tools in comparision to other hand tools, hoe and weeder using as intercultural tool iun onion cultivation.

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