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Research Paper :

Effect of modified intercultural CAET-hand tools on onion crop under trickle irrigation system

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ABSTRACT

Increasing economic of water productivity which is crucial for sustainable agriculture production and its becomes vital in the areas of water scarcity. Adoption of trickle irrigation system and modified intercultural tools facilitate this to great extent. An attempt has been made to evaluate the response of trickle irrigation and modified intercultural tools on growth and yield of onion at CAET-farm Etawah. The overall efficiency of intercultural operations with traditional tools was considerable low as compared to intercultural practices done through CAET-modified hand tools and hoe, under trickle irrigation system. Labour and water saving was also observed upto 25 to 35% and 40 to 60 %, respectively while utilizing modified CAET-hand tools and trickle irrigation system. Height of plant was also observed 26.5% more and net return was found maximum of Rs. 66,422 per hectare and benefit cost ratio was also found 3.62:1 rather than traditional farming system of onion crop.

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Key words : Intercultural tool, Trickle irrigation system, Fertigaiton, Yield, Infiltrometer, Pan evaporimeter

This study revealed that the designed of two intercultural tools, named CAET hand tool and hoe under the recommended doze of fertigation with traditional and trickle method of irrigation at CAET farm Etawah, U.P. Trickle irrigation provides an efficient method for fertilizer delivery and allows precise timing and uniform distribution of applied nutrients. Fertilizer application through trickle irrigation can reduce fertilizer used and minimize ground water pollution due to overdose of fertilizer leaching from excessive irrigation. Fertigation events can be scheduled as often as irrigation, upto several times per season. Optimum fertigation interval for drip irrigated crops in general and for onion in particular, is meagre. Rajput and Patel, 2002 worked on response of drip irrigation system on yield of different vegetable crops as well as onion crop and found maximum yield and growth of onion crop under drip system of irrigation. Ali (2004) reported that benefit cost ratio was higher under different nutrients management practices of marigold cultivation. Kumar *et al.* (2008) also worked on yield and net return of onion crop under different level of irrigation using drip irrigation system and found maximum yield and net return while using drip irrigation system. Sivanappan and Dixit, 1994 carried out experiment on water requirement and response of chilli crop under drip system and found 62% of water saving and 25% increase in yield using drip system of irrigation. Kataria and Michael (1990) conducted field trials as response of vegetable crop, dynamic of soil moisture and nitrogen in grop root zone to drip and furrow method of irrigation on tomato crop. They observed an increase of crop yield by 52.5% and 42.3%, respectively under drip irrigated plot over the furrow irrigated plots with the identical amounts of water supply.

METHODOLOGY

This chapter deals about the methodology of the experiment with the response and economics of onion cultivation by utilizing various modified intercultural hand tools with constant level of fertigation and irrigation through trickle irrigation system and compared with traditional farming of onion cultivation. The present study was based on the following objectives:

– Response and economics of onion cultivation under trickle system of irrigation with constant level of fertigation and irrigation, compared with traditional farming system.

– Study of the intercultural practices with newly fabricated manually operated hand tools.

– Development of the relationship of net return and

benefit cost ratio at constant level of irrigation and fertigation to maximize the profit.

The present experiment was conducted at CAET-research station, Etawah which is situated at an elevation of 85 meter above sea level at 25.87^{0}N latitude and 81.15^{0}E latitude and has a tropical to subtropical climate with extremes of summer and winter. During winter months average temperature reneges from 5^{0}C to 15^{0}C while in summer season the temperature varies from 25^{0}C to 48^{0}C. An average winter rainfall does not exceed more than 911mm. Initially the land was ploughed twice by disc harrow and planked properly and then the ridges were raised upto a height of 20 cm and other package of practices for onion cultivation was used before transplanting the onion seeding. Single Factor Randomized Block Design was used for the statistical analysis of the experimental data. The various intercultural practices were followed with CAET-modified hand tool and traditional tool weekly or two week interval at instant level of fertigation and irrigation. The plant spacing was kept as 15 cm x 10 cm as per requirement of the statistical design and the experiment was conducted by using four replications along with four treatments thus sixteen plots of 6m x 2m, size of each were randomly used and the layout of the experimental field is shown in Fig. 1.

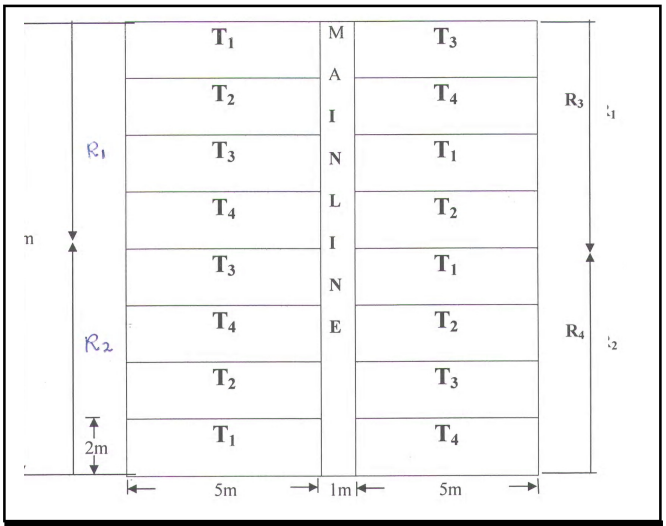

Fig. 1 : Layout of experimental field at CAET-Etawah

Statistical design = Randomized block design (RBD)
Length of plot = 6 m
Width of plot = 2 m
Size of each plot = 2 x 6 = 12 sq. m.
Total Area of 16 plots = 16 x 12 = 192 sq. m
where :

T_1 = Traditional intercultural tool (Khurpi) along with constant level of fertigation and irrigation supply.

T_2 = Utilizing CAET-hand hoe as intercultural instrument with constant level of fertigaiton and irrigation supply.

T_3 = Utilizing CAET-hand tool as intercultural instrument with constant level of fertigation and irrigation supply.

T_4 = Utilizing modern weeder with constant level of fertigation and irrigation supply.

R_1= Replication I
R_2= Replication II
R_3= Replication III
R_4 = Replication IV

The view of drip irrigation system has been shown in Fig. 2.

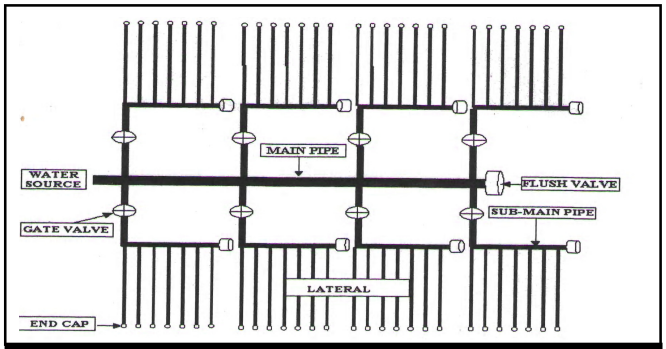

Fig. 2 : A view of drip system

The experiment consisted of four intercultural operational levels of work with CAET-hand tool, CAET-hand hoe, modern weeder and traditional tool (Khurpi) at weekly or two weekly interval at constant level of fertigation and irrigation with drip system. The planting density (spacing 15cm x 10 cm) was 6,66,667 plant per hectare. This method of intercultural operation with different hand tools were accessed and their performance was evaluated precisely. In order to access the economic viability of onion cultivation under constant level of fertigation, both variable and fixed cost were included, total cost, gross return and net return were computed mathematically which is delineated below:

CRF= $1(1+1)^n / (1+I)^{n-1}$ .....(i)
where
CRF = Cost recovery factor
I= Interest rate in per cent
n= Useful life of components in a year

Annual fixed cost per ha = CRF x fixed cost per ha .....(ii)

B/C ratio=Gross return / total cost of production in

Rs. /ha .....(iii)

B/C = benefit cost ratio

Net return in Rs./ha = Gross return (Rs./ha) – total cost of production (Rs./ha) ..... (iv)

Now monthly irrigation water requirement (in litre) was computed by the following equation.

$$V_M = K_e \times K_p \times C_c \times E_p \times A \quad \text{.....(v)}$$

where,

V_m = monthly irrigation water requirement in litre

K_e= Crop coefficient (1.0) for closely spaced

E_p= Normal monthly pan evaporation rate in mm

A= Irrigated area in m^2

C_c= Crop coefficient for onion crop

K_p= Crop factor

RESULTS AND DISCUSSION

This deals with the results obtained by conducting field experiments of onion crop (*Rabi*) along with various treatments of intercultural practices with different hand tools and constant level of fertigation and irrigation supply. Treatment (T_3=7644.00kg/ha) was given the highest mean marketable yield with respect to T_2, T_4 and T_1 (6186, 5557 and 5567kg/ha), respectively, when CAET-hand tool was used as weekly basis in intercultural operation. The minimum yield was obtained in treatment T_1 was found 5567 kg/ha. The average marketable yield of onion crop in shown is Table 1.

Table 1 : Average yield of onion crop (*Rabi*) in quintal/ha

Sr. No.	Treatments	Yield in q/ha
1.	T_1	55.67
2.	T_2	61.86
3.	T_3	76.44
4.	T_4	55.57

The saving of labour in intercultural operation with CAET-hand tool was estimated and obtained by 25% which was higher than using traditional hand tool. The vigorous growth of plant canopy was also obtained in Intercultural operation with CAET-hand tool which was imposed significant role on yield of onion crop in sandy loam soil. The benefit cost ratio of onion crop under various treatment are given in Table 2.

The net return, was obtained under different treatments which given in Table 3.

The benefit cost ratio of treatment T_3 was found 3:62:1 which was higher than treatment T_1,T_2 and T_4 (2.45:1, 2.86:1 and 2.71:1) shown in Table 2. The net return (Table 3) of onion crop (*Rabi*) of treatment T_3 was computed Rs. 66422/ha which was higher than treatment T_1, T_2 and T_4 (Rs. 39558.00, 43336.00 and 44438.00/ha, respectively).

Table 2 : Benefit cost ratio of onion crop (*Rabi*)

Sr. No.	Treatments	Benefit cost ratio
1.	T_1	2.45:1
2.	T_2	2.86:1
3.	T_3	3.62:1
4.	T_4	2.71:1

Table 3 : Net return of onion crop in Rs/ha

Sr. No.	Treatments	Net return (Rs/ha.)
1.	T_1	39558.00
2.	T_2	43336.50
3.	T_3	66422.00
4.	T_4	44438.00

Conclusion:

Under this study it was concluded that the yield of onion crop (*Rabi*) was higher under intercultural operation with CAET-hand tool rather than traditional intercultural tools. It was found the saving of labour upto 25 to 35% and fertilizer saving upto 70% while using fertgation unit, respectively when adopting CAET-hand tools under uniform irrigation through trickle irrigation system rather than traditional intercultural practices. In the same manner, size of test weight and rate of plant growth was also found better under intercultural practices with CAETS-hand tool rather than traditional intercultural tools. Height of plant was observed 26.5% more under treatment T_3 rather tan T_1, T_2 and T_4 treatments. Benefit cost ratio was higher under treatment T_3 in comparison to treatment T_1, T_2, and T_4. Weed density was also found very poor under intercultural practices with CAET-hand tool while weed density was higher in traditional system of cultivation of onion crop in *Rabi* season.

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REFERENCES

Ali, Munawar (2004). Benefit cost ratio of different nutrient management practices on marigold plants B. Tech. Thesis, College of Agriculture and Technology, Etawah, U.P. (India).

Kataria, D.P. and Micheal, A.M. (1990). Comparative study of drip and furrow irrigation methods. Proc. XI International Conference in the use of Plastics in Agriculture B. 19-20 IBH-Publishing Co. Pvt. Ltd., New Delhi. pp. 25-64.

Kumar, Satentra, Imtiyaz, Mohd. and Kumar, A. (2008). Studies on the feasibility of using mirco-irrigation systems for vegetable production in a canal command area. *Irrigation & Drainage Engg. J.*, **58** : 86-93.

Rajput, T.B.S. and Patel, N. (2002). Drip irrigation Annual publication, IARI-WTC, Delhi, pp. 4-11

Sivanappan, R.K. Rao and Dixit, A.S.l. (1994). Drip irrigation in India, Indian National Committee on Irrigation & Drainage, Jolly Reprographics, New Delhi, 176 pp.

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