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Research Article

IMPACT AND RESPONSE OF IRRIGATION METHODS ON GROWTH AND YIELD OF MARIGOLD CROP IN ETAWAH DISTRICT OF UTTAR PRADESH

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Abstract: In India, Marigold (*Tagets erecta*) is one of the most commonly grown floriculture crops. Its natural tendency of profuse flowering of short duration to produce market flower, wide spectrum of attractive colours, shape, and size with good keeping quality attracted the attention of people. It is extensively used on religious ceremonies, social functions as offering and also for decoration purpose all over the sub-continent. The estimated area on which flowers are grown in India is about 65,000 hectares. Major growing states are Karnataka, Tamil Nadu, West Bengal, Andhra Pradesh and Maharashtra. The present study is confined on an impact and response of different methods of irrigation *e.g.*, Border, Check basin, Drip and Sprinkler with a four treatment and our replication along with randomized block design on growth and yield of marigold cultivation at Etawah District of Uttar Pradesh.

Keywords: *Drip Irrigation, benefit cost Ratio, Irrigation efficiency, Performance and Marketable yield*

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Introduction

Marigold plants originally from Central America, probably in Mexico. Today they are naturalized in the tropics and subtropics of the old new worlds. They are cultivated in India and Pakistan as a medicinal flowering, dye and ornamental plant. A simply grown half-hardy annual, marigolds are especially popular to cultivate in gardens all over the world. They are not fussy about where they grow provided, they have plenty of sun shine. In north India, the small-scale farmers of Himachal Pradesh, are growing marigold and other flower crops for garlands and decoration. They are relatively easy to cultivate and do not require expensive packing or processing. The present investigation has been carried out with four treatments and four replications and sixteen plot of size 2m x 5m each, in which treatment T_1, is the border method of irrigation, T_2 is the check basin, T_3 is the Drip irrigation and T_4 is the sprinkler method of irrigation respectively and R_1, R_2, R_3, and R_4 are the replication of research work at Agriculture Farm, Janta College, Bakewar, Etawah, 206124. Single factor randomized block design used for the statistical analysis for the experiment. The plant spacing was kept 50cm x 50 cm as per requirement of the statistical design of the experiment. The present experiment is conducted to determine the irrigation efficiencies of the different methods of irrigation, net return, benefit cost ratio, optimum water requirement and yield of the crops under different treatments in sandy loam soil [1-3].

Material and Methods

Marigold is even helping to play a vital role as a cash crop to poor small and marginal farmers in north India. Marigold flowers are soil sold in the farm of garlands for decoration, medicinal and also various religious occasions. Much of what is produced which is consumed in India, although the Indian government is looking into expending in export market. This investigation is deals with installation of drip irrigation system, filter with controls unit, Land preparation, experimental design and layout of the experiment, fertilizer dozes, irrigation water requirement and economies analysis of the experiment [4-6]. Research work based on comparison of irrigation efficiencies of various methods of irrigation, net return and benefit cost ratio, gross return, total cost of production and optimum water requirement of marigold crop. Studied about the response of vegetables like onion, radish, okra and marigold crop at Hisar and Haryana on drip, border and check basin method of irrigation [7-9].

They reported that drip system saved about 30% less water than traditional method of irrigation with the increased in yield about 50%. Hansen and Pasian (1999) [10] conducted a study on loam soil at San Diego, California in USA to compare water use efficiency and crop yield of marigold, onion and sweet coriander drip, border, & Check basin methods of irrigation. They reported that drip method of irrigation produced highest yield of marigold. Keeping in view present study revealed that net return and benefit cost ratio was found Rs. 16,464.00 per hectare and 1.690 (BC-ratio) respectively.

Installation Of Drip Irrigation System and Fitter with Control Unit

The system required for maintenance by trained skill persons. Equipment must be checked regularly. Operating pressure and clogging or damage of drip lines and drippers discharge should be maintained properly. There should be minimum used of fitting such as elbows, socket, and bends. The connections of pump delivery should be directly to the sand/screen filter & it can be easily connected to main pipe lines.

Hard surface and cement concrete foundation to be made for sand filter to avoid the collapsing of sand filter due to vibration and loads. PVC main and sub main pipe line was laid 30 60 cm below the ground surface to avoid damage during cultural operations. The poly tube should be containing water fixing drippers. A desired pressure the discharge of drippers at the minimum of three place and check the working of air release valve at the subs main.

Table-2 *Maximum border length and width for various soil type with Border Slope*

Soil Type	Border Slope (%)	United Flow (m)	Border width (m)	Border Length (m)
Loam soil	0.2 - 0.4	7-May	12 - 30	90 - 250
Infiltration Rate	0.4 - 0.6	6-Apr	6 - 12	90 - 180
Less than 1mm/hrs	0.6 - 1.0	4-Feb	Jun-00	90 - 0

Table-3 *Average water saving of marigold crop in different treatment*

Treatment	Total cost of production (Rs/ha)	Gross return (Rs/ha)	Net Return (Rs/ha)	Benefit cost ratio
T_1	22996	31200	8204	1.35
T_2	22047	33600	11552	1.52
T_3	23533	40000	16464	1.69
T_4	21996	34800	12804	1.58

Land Preparation and Experimental Design

Initially the land at research station was ploughed twice by disc harrow followed by cultivator and planking, these ridges were farmed to a height of 20 cm. The plot size was made 2 x 5m of each with 16 plots of total area was 176m^2, Single factor randomized block design (RBD) for statistical design the experiment. The plant spacing was kept us 50 x 50 cm row to row with four replication R_1, R_2, R_3 & R_4 and four treatments T_1, T_2, T_3 and T_4 respectively.

Transplantation and Fertilizer Application

The plants were transferred from nursery to the experimental site and plants as per the predetermined spacing of 50cm x 50 cm plant to plant & row to row in last week of October. Fertilizer application was done to as per recommendation of agronomist on different growth stage of crop.

Irrigation Water Requirement of Crop

Maximum pan evaporation rate was expected in the month of March 2018 was 263 mm and minimum pan evaporation rate in the month of November 2018 was 52mm. The crop coefficient for marigold was taking as 0.90 with according to growth stages of the plant. The canopy factor increases with the average canopy area of 3 to 4 cm² and canopy factor was taken as 1.0. The monthly irrigation water requirement can be estimated on the basis of monthly pan evaporation data and crop coefficient by using following equation:

$V_m = K_c \times K_p \times C_c \times E_p \times A$ (i)

Where, V_m= Monthly irrigation water requirement, K_c = Crop coefficient, K_p= Per evaporation factor (0.80), C_c= Canopy factor (usually 1.0 for closed spaced crop), E_p = Normal monthly per evaporation in mm and A = Area to be irrigated.

The capacity of Drip system may be computed by using following mathematical relationship

$Q=V_d \times T/ (N_a \times t)$ (ii)

Where, Q=Capacity of drip system in LPS, V_d=Daily water requirement,

T= Irrigation Interval in days, N_a =Water application efficiency infraction and t =duration of each irrigation in hours.

The size of basin and border depends not only on the slope but also on the soil type and the available water flow or stream size to the basin size as well, length and width of border which was shown in [Table-1] and [Table-2] respectively.

Table-1 *Maximum Basin Area for Various Soil Type and Available Stream Litre/Sec.*

Stream Size (Litre/Sec.)	Basin Area for Loam Soil
5	100
10	200
15	300
30	600
60	1200
90	1800

Economic Analysis

The fixed cost including water development (tube well, pump, motor and pump house and other accessories) and irrigation system with other accessories were calculated for different irrigation schedule and plant spacing with the help of following approach (James and Lee, 1971)-

$CRF= I (1+1)^n / (1+1)^{n-1}$ (iii)

Whereas,

CRF= Cost recovery factor,

I= Interest rate in Percentage and

n= Useful life of components in year.

Annual Fixed cost per ha= CRF x Fixed cost/ha (iv)

Annual Fixed cost/ha/season = Annual fixed cost/ha / 2 (v)

Net return (Rs/ha) = Grass return (Rs/ha) - Total cost of production (Rs/ha) (vi)

The benefit cost ratio (B/C)=Gross return (Rs/ha)/ Total cost of production (Rs/ha) (vii)

Results and Discussion

The experimental studies reveal about irrigation efficiencies, yield, net return, benefit cost ratio and water requirement of marigold crop in loam soil under various treatments of methods of irrigation *viz*. drip, sprinkler, check basin and border.

The highest water application and storage efficiency of drip system was obtained under treatment T_3 (93.65%) followed by T_2, T_1 and T_4 respectively. Water saving was found in 52% in treatment T_3 under drip irrigation while treatment T_1, T_2 and T_4 (15%, 20% and 25%) were less. Net return on treatment T_3 (Rs. 16464/ha) was observed highest with respect to treatment T_1, T_2 and T_4 (Rs. 8204/ha, 11552/ha, 12803/ha) respectively. Effect of different irrigation practices on benefit cost ratio was found highest in treatment "T_3" (1.69) rather than T_1, T_2 and T_4 (1.35, 1.52 and 1.58) respectively. The effect of various irrigation methods on marigold crop, the total cost of production, gross return, net return and benefit cost ratio was shown in [Table-3] and [Fig-1] given below.

Table-4 *Application and storage efficiency for various treatments*

Treatment	Application efficiency	Storage efficiency
T_1	70	87
T_2	75	90
T_3	92	97
T_4	80	78

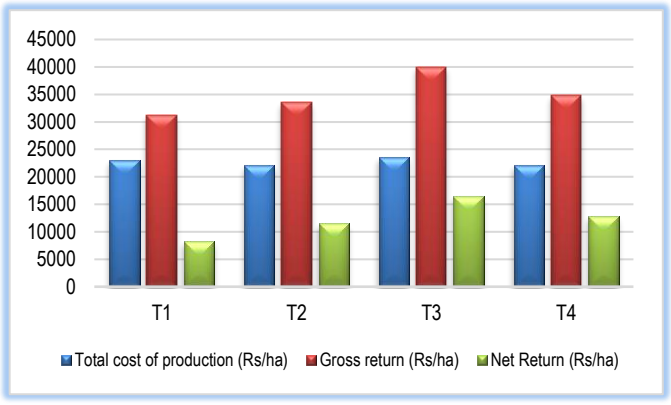

Fig-1 Average water saving of marigold crop in different treatment

Conclusion

The Conclusion drawn regarding response and economics of different methods of irrigation for marigold crop was delineated below: Irrigation application and water storage efficiency was observed maximum in drip irrigation as compared to other surface irrigation methods *viz*. border, check basin and sprinkler.

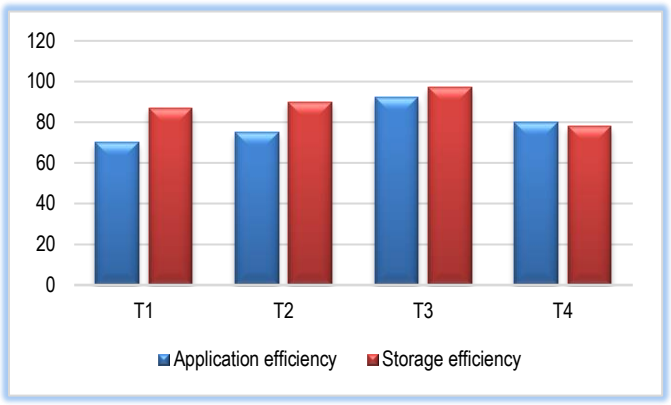

Fig-2 Application and storage efficiency for various treatments

Yield of marigold flower was observed maximum under the drip irrigation methods as compared to other method like border, check basin and sprinkler method of irrigation. Water saving was observed under drip irrigation was 52% rather than other surface methods of irrigation & also saves pumping and labour cost. Quality of marigold flower, no. of buds and leaves was better under drip irrigation as compared to other methods of irrigation. Water use efficiency was observed maximum in drip irrigation method in comparison to other methods like border, check basin and sprinkler methods of irrigation. Drip and sprinkler irrigation system required more initial cost & skill person for its maintenance & repairing with respect to other methods of surface irrigation.

Application of research: This experiment is applicable in the research work based on comparison of irrigation efficiencies of various methods of irrigation, net return and benefit cost ratio, gross return and total cost of production and optimum water requirement of marigold.

Research Category: Drip Irrigation

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Study area / Sample Collection: Agriculture Farm, Janta College, Bakewar, Etawah, 206124

Cultivar / Variety / Breed name: Marigold (*Tagets erecta*)

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

References

[1] Douglas J.L. and Lee R.R. (1971) *Economics of Water Resources Planning, McGraw-Hill Inc., USA*, ISBN-13:978-0070322639, 640.
[2] Raddy K.S. and Rajput T.B.S. (1995) *Indian Journal of Water Management*, 3(1&2), 4-7.
[3] Tagar A., Chandio F.A., Mari I.A. and Wagan B. (2012) *World Academy of Science, Engineering and Technology*, 69, 863-867.
[4] Jat M.L., Gupta R.K., Erenstein O. and Ortiz R. (2006) *Chronica horticulturae*, 46(3), 27-31.
[5] Sujitha E. and Kumarasamy S. (2017) *International Journal of Plant & Soil Science*, 19(3), 1-9.
[6] Torre−Neto A., Schueller J.K. and Haman D.Z. (2000) ASAE Paper No. 001158. ASABE, St.Joseph, MI
[7] Sivanappan R K. (1994) *Irrigation and Drainage Systems*, 8(1), 49–58.
[8] Punia M.S. and Gill H.S. (1994) *Helia*, 17(20), 7-11.
[9] Bhanu Rekha K. and Mahavishnan K. (2008) *Agricultural Reviews*, 29(4), 298-305.
[10] Hansen R.C. and Pasian C.C. (1999) *Applied Engineering in Agriculture*, 15(5), 483-490.