Effect of irrigation level and nitrogen levels on economics, quality and water productivity of Garden Cress (*Lepidium Sativum* L.)

ABSTRACT: A field experiment was conducted at krishi vigyan kendra, Sawaimadhopur, Rajasthan in two consecutive years of 2018-19 and 2029-20 on "Effect of irrigation level and nitrogen levels on economics, quality and water productivity of chandrasur". In terms of economics highest net return was found in three irrigations (25,50 & 75 DAS) I_3 (57517 Rs ha^{-1}) which was at par with I_2 two irrigations (25 & 50 DAS) in the pooled data of both the yeas. Highest BC ration was also found under three irrigations (25, 50 & 75DAS) I_3 (2.60) which was at par with (I_2) two irrigations (25 & 50 DAS) in the pooled data of both the yeas. Highest net return and BC ratio was found with application of 80 Kg N ha^{-1} (57628 Rs ha^{-1}) and (2.65) which was at par with 60 Kg N ha^{-1}. In terms of oil yield Kg ha^{-1} highest oil yield was found with (I_2) two irrigations (25 & 50 DAS) and 60 Kg N ha^{-1}. Water productivity (kg m^{-3}) was found lowest in the treatment (25,50 & 75DAS) (I_3) and 80 Kg N ha^{-1} which was at par with (I_2) two irrigations (25 & 50 DAS) and 60 Kg N ha^{-1} .

Key Words: Garden Cress, Oil Yield, water productivity, Irrigation level, Nitrogen levels.

INTRODUCTION:

Garden cress (*Lepidium Sativum* L.) is also known as Chandrasur and it belongs to family: Brassicacace. It is a annual herbaceous plant which is native to asia and north Africa. It is very nutritious and medicinal values which can use as green leafy vegetables as salad purpose. It can use to treat liver diseases and infectious diseases to use as immune system enhancer, antibacterial etc. (Amin, 2005). Due to its fumigant properties it can also use to treat insect repellent and in the form of insect bite also. It can also use to increase traditionally height of childrens and milk in lactating women. In India it is cultivated mostly M.P., Rajasthan, U.P. etc. In Rajasthan it is cultivated as fodder for grazing purpose for animals. Sowing method of chandrasur was broadcasting and it is low water requiring crop. But irrigation scheduling at specific time is very important for the maximum yield of crop.

Fertilization is very important for the mostly agricultural production. When we applied in injudiciously is can make loss and pollution of water also. Excessive application losses results in emission of green house gases nitrogen oxides. (Güler, 2004).

Nitrogen fertilization plays a very important role in structural and yield component of plant. In plants many enzymatic activities and chlorophyll and other structural components depends upon nitrogen. Garden cress is considered as spicies of high nitrate accumulating ((Cavarianni *et al*., 2008). Vegetable plants require high amount of nitrogen because its vegetation period is short. (Maynard *et al*., 1976). That's why there is a need to find out proper irrigation schedule and nitrogen level for the chandrasur for zone III B of Rajasthan.

MATERIAL AND METHOD

The study was conducted at the agronomic farm of Krishi Vigyan Kendra, sawaimadhopur, Agriculture University, Kota. The soil of experimental site was sandy loam soil, moderately fertile, low in available organic carbon 0.30 %, low in available nitrogen 243 kg ha^{-1}, medium in available phosphorus 20.52 kg ha^{-1}, and high in available potash 279 kg ha^{-1} . Sawaimadhopur consist in Zone III-B of Rajasthan (Flood Prone Eastern Plain) and Zone-V of Rajasthan (Sub Humid South- Eastern Plain) of Rajasthan. Mean annual rainfall was 623 mm. chandrasur sowing was done in the second week of October during both the years. Design of experiment was laid out in Split plot design in which three treatments of Irrigation levels ((One at 25 DAS) (I_1), Two Irrigation (at 25 & 50 DAS) (I_2), & Three irrigation (25, 50 & 75 DAS) (I_3)) were placed in main plot and 4 level of nitrogen (20kg N ha^{-1}, 40kg N ha^{-1}, 60kg N ha^{-1}, 80kg N ha^{-1}) were placed in sub plots. Sowing was done at spacing of 30×10 cm and 6 kg ha^{-1} seed rate was used during experiment. Main irrigation channel was 1.5 m wide and sub irrigation channel was 1.0 m wide. Different level of nitrogen were applied through urea in two split doses first basal application and second after first irrigation 25 DAS. Full Dose of phosphorus was applied as basal in the form of SSP. Source of Irrigation was rain water. Net return and BC ratio was calculated after the harvesting of crop on the basis of following formula:-

Net return = Gross return-Cost of Cultivation

BC ratio = Net return / Cost of cultivation

Oil content (kg ha^{-1}) was analysed in laboratory of agriculture university, Kota. Water productivity was measured by following formula:

Water Productivity (kg m^{-3})= Grain yield (kg ha^{-1})/ total water applied (m^{-3})

The statistical calculation were done by as per analysis of variance described by gomez and Gomez 1984 to analysis the test of significant of treatments. Gomez, K. A. and Gomez A. A. 1984.

RESULT AND DISCUSSION

Oil yield (Kg ha^{-1})

Data presented in table -1 revealed that was obtained with Three irrigation (25, 50 & 75 DAS) ($I_{3)}$ 353.91 kg ha^{-1} which was at par with two Irrigation (25 & 50 DAS) (I_2). Application of 80 kg N ha^{-1} found highest Oil yield 344.20 kg ha^{-1} which was found statistically at par with 60 kg N ha^{-1}328.92 kg ha^{-1} . With increasing the no of irrigation the oil content in garden cress will increases significantly upto a certain level but I_3 and I_2 found at par with each other. Similar results was found by (Khalil *et al.*, 2012) explained that by increasing the irrigation interval the oil percentage of garden cress will increased to its maximum values. The result of this study also stated that with increasing level of nitrogen oil yield in seeds of garden cress was also increases.

These results are in agreement with those of who stated that fertilization increases the fatty acid presence, percentages and ratio of fatty acids in canola seed oil (Gao et al., 2010) (Mohamed *et al*., 2020).

Table 1: Effect of Irrigation and Nitrogen levels on Oil yield (Kg ha^{-1}) and Water productivity (kg m^{-3}) of Chandrasur (*Lepidium sativum*)

Treatments	Oil yield (Kg ha^{-1})			Water productivity (kg m^{-3})		
Irrigation levels	**2018-19**	**2019-20**	**Pooled**	**2018-19**	**2019-20**	**Pooled**
Irrigation (One at 25 DAS) (I_1)	**263.53**	**271.83**	**267.68**	**2.49**	**2.57**	**2.53**
two Irrigation (25 & 50 DAS) (I_2)	**320.77**	**324.92**	**322.85**	**1.41**	**1.53**	**1.47**
Three irrigation (25, 50 & 75 DAS) ($I_{3)}$	**351.82**	**355.99**	**353.91**	**1.06**	**1.07**	**1.06**
SEm±	**10.23**	**9.14**	**6.86**	**0.09**	**0.08**	**0.06**
CD (P=0.05)	**35.40**	**31.63**	**21.14**	**0.33**	**0.29**	**0.20**
Nitrogen levels						
20kg N ha^{-1} (N_1)	**280.42**	**290.48**	**285.45**	**1.50**	**1.58**	**1.54**
40 kg N ha^{-1} (N_2)	**299.42**	**301.93**	**300.68**	**1.56**	**1.66**	**1.61**
60 kg N ha^{-1} (N_3)	**327.75**	**330.10**	**328.92**	**1.73**	**1.75**	**1.74**
80 kg N ha^{-1} (N_4)	**340.57**	**347.83**	**344.20**	**1.83**	**1.90**	**1.86**
SEm±	**6.66**	**8.10**	**5.24**	**0.06**	**0.06**	**0.04**
CD (P=0.05)	**19.33**	**23.51**	**14.87**	**0.16**	**0.17**	**0.11**

Water productivity (kg m^{-3})

The results presented in table 1 eminated that during both the years highest water productivity (kg m^{-3}) was found with three irrigations (25, 50 & 75 DAS) (I_3) 1.06 kg m^{-3} which was at par with two Irrigation (25 & 50 DAS) (I_2) 1.47 kg m^{-3} **.** Same trend was found during each year. These results are in close confirmity with Shivran *et al*., 2018 who reported that with increasing no. of irrigations upto three consumptive use of water was also increases. Increased no of irrigation would tends to higher consumptive use of water due to higher seed yield.

Table 1 represented that highest water productivity was found with application of 80 kg N ha^{-1} 1.86 kg m^{-3} which was significantly higher over 20 kg N ha^{-1} and 40 kg N ha^{-1} .The results confirm the findings of Pradhan *et al.,* (2013) reported the water productivity significantly increases with the level of Nitrogen. The higher water productivity was due to higher grain yield with efficient utilization of water per drop of water. Similarly (Tadayon *et al*., 2012) reported that highest water productivity was obtained with application of 100 Kg N ha^{-1} which was significantly higher over 0 and 50 kg N ha^{-1}**.**

Nitrogen content in grains (%)

The results presented in table-2 determined that highest content of nitrogen was found under three irrigations (25,50 & 75 DAS) (I3), 1.42% which was significantly higher over one irrigations (25 DAS) and at par with two irrigation (I2) (25 & 50 DAS) 1.37 %. With higher no of irrigations nitrogen content in grains was also found higher. This might be due to adequate moisture content helps to increase the nutrient content and uptake in plants. This results are in close conformity with (Umale *et al*., 2015).

In terms of application of nitrogen fertilization highest nitrogen content was found in application of 80 kg N ha^{-1} which was at par with 60 kg N ha^{-1} and significantly higher over 20 & 40 Kg N ha^{-1}. These results are in close conformity with (Inne *et al*., 2021) who stated that highest no3 content was found in application of highest amount of nitrogen 150 kg ha^{-1}.

Nitrogen uptake in grains (Kg ha^{-1})

The results in table -2 represented that highest nitrogen uptake in grains (kg ha-1) was found in three irrigations (25, 50 & 75 DAS) (I^3) 22.71 kg ha^{-1} which was at par with two irrigations (25 & 50 DAS) (I^2) 20.18 kg ha^{-1} and significantly higher over one Irrigation (25 DAS). (Razmjoo *et al.,* 2008) reported that scarcity of water is the main factor in low yield and productivity of medicinal plants. Deficiency of moisture induce many different physiological and metabolic responses like stomata closure, decrease in growth and photosynthesis. This might also leads to decrease in nutrient uptake and finally affects yield of crops. These results are in close conformity with (Jibrin *et al*., 2008).

In different level of nitrogen highest nitrogen uptake 23.67 kg ha^{-1} was found with application of 80 kg N ha^{-1} which was significantly higher over 20 and 40 kg N ha^{-1} and at par with 60 kg N ha^{-1} 20.62 kg ha^{-1} . These results are closely related to (Raghuvanshi et al., 2018) who stated that

with higher nitrogenfertilization uptake of nitrogen by seed and strover was also increases in mustard. At higher levels of fertilizers assures higher accessibility of nutrient in adequate amount for the plant to uptake. Plant can uptake higher nutrient content with higher amount of nutrient content. (Nayak *et al*., 2020)

Table 2: Effect of Irrigation and Nitrogen levels on Nitrogen content in grains and Nitrogen uptake in grains (kg ha^{-1}) in Chandrasur (*Lepidium sativum*)

Treatments	**Nitrogen content in grains (%)**			**Nitorgen uptake in grains (kg ha^{-1})**		
Irrigation levels	**2018-19**	**2019-20**	**Pooled**	**2018-19**	**2019-20**	**Pooled**
Irrigation (One at 25 DAS) (I_1)	1.23	1.31	1.27	15.44	17.00	16.22
two Irrigation (25 & 50 DAS) (I_2)	1.33	1.41	1.37	18.72	21.64	20.18
Three irrigation (25, 50 & 75 DAS) ($I_{3)}$	1.37	1.47	1.42	21.84	23.58	22.71
SEm±	0.02	0.02	0.02	0.63	0.52	0.41
CD (P=0.05)	0.07	0.08	0.05	2.20	1.78	1.26
Nitrogen levels						
20kg N ha^{-1} (N_1)	1.18	1.26	1.22	15.32	17.28	16.30
40 kg N ha^{-1} (N_2)	1.28	1.36	1.32	17.10	19.34	18.22
60 kg N ha^{-1} (N_3)	1.34	1.43	1.38	19.71	21.53	20.62
80 kg N ha^{-1} (N_4)	1.44	1.54	1.49	22.53	24.82	23.67
SEm±	0.04	0.04	0.03	0.72	0.83	0.55
CD (P=0.05)	0.10	0.11	0.07	2.09	2.40	1.55

Net return (Rs ha^{-1})

Data presented in table-3 elaborated that in pooled data of both the years highest Net return (Rs ha-1) and BC ratio was found with Three irrigations (25, 50 & 75 DAS) (I^3) 57517 Rs ha^{-1} and

2.60 during both the years.which was at par with two irrigations (25 & 50 DAS) (I^2) 51699 Rs ha^{-1} and 2.38 respectively.

In terms of application of different nitrogen levels highest net return and BC ratio was found with application of 80 Kg N ha^{-1} (57628 Rs ha^{-1} and 2.65) which was at par with 60 kg N ha^{-1} (52932 Rs ha^{-1} and 2.46) and significantly higher over 20 & 40 Kg N ha^{-1}.

Highest net return and BC ratio was obtained with two irrigation and 60 kg N ha^{-1} . This might be due to highest seed yield and optimum use of nutrient applied through fertilization. With two irrigations (25 & 50 DAS) availability of moisture was sufficient to crop growth and it gave higher yield which was at par with three irrigations. Availability of moisture also helps to enhance the accessibility and uptake of nutrient by the plants. Ultimate results was higher yield. These results are in close conformity with (Saraswathi *et al*., 2014) (Choudhary *et al*., 2022).

Table 3: Effect of Irrigation and Nitrogen levels on Net returns (Rs ha^{-1}) and BC ratio of chandrasur (*Lepidium sativum*)

Treatments	**Net return (Rs ha^{-1})**			**B C ratio**		
Irrigation levels	**2018-19**	**2019-20**	**Pooled**	**2018-19**	**2019-20**	**Pooled**
Irrigation (One at 25 DAS) (I_1)	**42713**	**43657**	**43185**	**2.17**	**2.11**	**2.14**
two Irrigation (25 & 50 DAS) (I_2)	**49272**	**54125**	**51699**	**2.33**	**2.44**	**2.38**
Three irrigation (25, 50 & 75 DAS) ($I_{3)}$	**57547**	**57487**	**57517**	**2.66**	**2.54**	**2.60**
SEm±	**2621**	**2213**	**2341**	**0.13**	**0.10**	**0.12**
CD (P=0.05)	**9069**	**7657**	**9357**	**0.45**	**0.36**	**0.41**
Nitrogen levels						
20kg N ha^{-1} (N_1)	**43910**	**46575**	**45242**	**2.14**	**2.16**	**2.15**
40 kg N ha^{-1} (N_2)	**45970**	**48826**	**47398**	**2.21**	**2.24**	**2.23**
60 kg N ha^{-1} (N_3)	**52613**	**53251**	**52932**	**2.51**	**2.42**	**2.46**
80 kg N ha^{-1} (N_4)	**56882**	**58375**	**57628**	**2.68**	**2.63**	**2.65**

SEm±	**2212**	**2023**	**2176**	**0.11**	**0.09**	**0.07**
CD (P=0.05)	**6419**	**5872**	**6745**	**0.31**	**0.27**	**0.20**

Conclusion

On the basis of the results emanated from present investigation conducted during Rabi 2018-19 & 2019-20, Based on two year study, results revealed that application of two irrigations (25 & 50 DAS) with application of 60 Kg N ha^{-1} gives higher net return, BC ratio. Higher water productivity was also found under two irrigations and application of 60 kg N ha^{-1}.

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