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RESEARCH ARTICLE

EFFECTS OF IRRIGATION SCHEDULES AND NUTRIENT LEVELS ON MUSTARD (*Brassica juncea* L.)

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ABSTRACT

A field experiment was carried out at the research farm of A. S. (PG) College, Lakhaoti, Bulandshahr, (U.P.) during *winter* 2009-10 and 2010-11. The soil of experimental field was sandy loam and slightly alkaline in reaction (pH 7.7). The treatments consisted of four irrigation schedules *viz*. I_0- no irrigation, I_1- one irrigation at pre-flowering, I_2- one irrigation at pod filling, I_3- two irrigations one each at pre-flowering and pod filling, three phosphorus levels *viz*. P_0- control, P_{30}- 30 kg P_2O_5 ha^{-1}, P_{60}- 60 kg P_2O_5 ha^{-1} and three sulphur levels *viz*. S_0- control, S_{20}- 20 kg S ha^{-1} and S_{40}- 40 kg S ha^{-1}. The treatments were laid out in split plot design and replicated thrice. The result revealed that plant height, dry matter, number of branches, siliquae $plant^{-1}$, 1000-seed weight, seed yield and oil content was observed significant with the application of 60 kg P_2O_5, 40 kg S ha^{-1} and two irrigations one each pre–flowering and pod filling stage.

INTRODUCTION

India is the fourth largest oilseed economy in the world. Among the seven edible oilseeds in India, rapeseed-mustered contributes 28.6% in the total oilseed production. Oilseeds play an important role in Indian agriculture and industries. India is one of the leading oil seed producing country in the world but now it is unable to fulfil the edible oil requirement of its burgeoning population. Globally, India accounts for 17.27 percent and 9.07 percent of the total acreage and production of rapeseed-mustard (USDA, 2016) respectively. In India, Rajasthan ranks 1st both in area (2.33 million hectare) and production (2.70 million tons). In U.P. mustard is grown on 12.95 lakh hectares area with production of 8.00 lakh tones and productivity of 730 kg ha^{-1}.The yield levels also have been variable ranging from 854 kg ha^{-1} (2002-03) to 1,142 kg ha^{-1} (2009-10) during the past eight years. This crop is often grown in association in North and North-Western part of India. One of the main reason of low productivity of the crop is inadequate nutrition specially phosphorus and sulphur. The phosphorus and sulphur requirements of the crop further influenced by available moisture conditions of the soil.Keeping all these points in view the present field investigation was carried out to study the effects of irrigation scheduling and nutrient levelson mustard yield and oil content.

MATERIALS AND METHODS

Field experiments were conducted during *winter* 2009-10and 2010-11 at the research farm of A. S. (PG) College, Lakhaoti, Bulandshahr, (U.P.).

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RESULTS AND DISCUSSION

A. Effect of irrigation

The growth components *viz.* plant height and dry weight were significantly affected by different irrigation regimes (Table1). The treatment I_3recorded the significantly higher plant height and dry weight in both the year of experimentation over other treatments. It might be attributed due to the sufficient availability of soil moisture in root zone area and increased the availability of plant nutrient like as nitrogen, phosphorus and

Table 1. Plant height, number of branches and dry weight of mustardas influenced by irrigation schedules and nutrient levels (Mean of two years' data)

Treatments	Plant height (cm)	No. of primary branches plant^{-1}	No. of secondary branches plant^{-1}	Dry weight(g plant^{-1})
Irrigation schedules				
I_0	86.95	5.36	7.55	24.86
I_1	139.01	5.89	10.30	27.24
I_2	163.22	7.01	11.37	29.51
I_3	180.30	7.10	12.42	32.66
SE(d)	1.22	0.06	0.07	0.18
CD (P=0.05)	2.67	0.13	0.15	0.39
Phosphorus levels				
P_0	138.34	5.92	9.63	27.78
P_{30}	142.06	6.36	10.68	28.63
P_{60}	146.70	6.75	10.91	29.30
SE(d)	1.21	0.05	0.08	0.19
CD (P=0.05)	2.38	0.11	0.16	0.38
Sulphur levels				
S_0	138.79	6.08	10.19	28.00
S_{20}	143.20	6.44	10.47	28.76
S_{40}	145.12	6.51	10.58	28.95
SE(d)	1.21	0.05	0.08	0.19
CD (P=0.05)	2.38	0.11	0.16	0.38

Table 2. Yield attributes and yield (q ha^{-1}) of mustard as influenced by irrigation schedules and nutrient levels (Mean of two years' data)

Treatments	No. of siliquae plant^{-1}	No. of seeds siliquae^{-1}	Test weight (g)	Grain yield (q ha^{-1})	Oil content (%)
Irrigation schedules					
I_0	187.56	8.77	3.57	7.48	37.60
I_1	211.39	10.56	4.03	9.13	38.71
I_2	233.28	11.83	4.24	10.36	39.09
I_3	263.94	13.30	4.70	11.79	40.12
SE(d)	1.89	0.11	0.03	0.12	0.03
CD (P=0.05)	4.11	0.23	0.07	0.26	0.06
Phosphorus levels					
P_0	209.95	10.57	3.87	8.93	38.61
P_{30}	222.99	11.09	4.13	9.83	39.88
P_{60}	239.18	11.74	4.41	10.52	39.91
SE(d)	1.82	0.12	0.04	0.13	0.03
CD (P=0.05)	3.58	0.24	0.07	0.26	NS
Sulphur levels					
S_0	214.54	10.75	3.94	9.01	38.61
S_{20}	225.44	11.21	4.19	9.96	39.00
S_{40}	232.14	11.44	4.28	10.31	39.04
SE(d)	1.82	0.12	0.04	0.13	0.03
CD (P=0.05)	3.58	0.24	0.07	0.26	0.06

sulphur to the mustard plant up to maturity of the crop. The results are in conformity with those already reported by Singh *et al.* 2010and Yadav *et al.* 2010.The yield attributing traitswere significantly improvedwith increasing frequency of irrigation. Number of primary branches plant^{-1}, secondary branches plant^{-1}, number of siliquae plant^{-1}, number of seeds siliquae^{-1} and 1000-seed weight (g) were significantly increased with the application of two irrigations (Table 1 &2). Maximum seed yield (q ha^{-1}) was recorded where crop was irrigated twice (I_3). Increase in yield might be attributed due to maximumplant height, more number of primary and secondary branches, more numbers of siliquae plant^{-1}and other yield contributing traitswith the application of twoirrigations. The same findings also reported by Yadav *et al.* 2010.

B. Effect of phosphorus

Growth and yield attributes of any crop are basic characters for increasing economic yield of crop. The most of research workers have reported significant response of mustard to different doses of phosphorus application in increasing growth and yield attributes under varied soil and climatic conditions.

The plant height (cm) of mustard upto maturity was significantly increased with the application of 60 kg P_2O_5ha^{-1} over lower doses (Table1). It might beattributed due to the increase of phosphorus availability to mustard plant and the plant was absorbed sufficent quantity of phosphorus upto the maturity of crop.In addition, the application of 30and 60 kg P_2O_5ha^{-1} produced significantly more dry matterthancontrol. It mightbe attributed due to the increasing the availability of phosphoruswith increasing application of phosphorus levels. The results are in conformity with those already reported by Prasad *etal.* 1991, Punia *et al.* 1994,Yadav *et al.* 2010, Singh *et al.* 2017and Singh and Thenua 2016.The yield attributing characters of mustard as like number of primary and secondary branches plant^{-1}, number of siliquae plant^{-1}, number of seeds siliquae^{-1} were found significantly superior with the application of 60 kgP_2O_5ha^{-1}to lower levels of phosphorus (Table2). It might be attributed due to increasingnumber of branches plant^{-1}(primary and secondary)and number of seeds siliquae^{-1}because of more availability of P_2O_5 nutrient to mustard plant.The results are in conformity those already reported by Yadav *et al.* 2010, Prasad *etal.* 1991, Punia *et al.* 1994, Singh and Thenua 2016, Singh *et al.* 2017 and

Arthamwar *et al.* 1996. Highest seed yield (q ha^{-1}) was obtained with the application of 60 kg $P_2O_5ha^{-1}$. Significant increase of yield might be due to more availability of phosphorus with increase in dose and positive association with plant height, number of primary and secondary branches $plant^{-1}$, number of siliquae $plant^{-1}$, number of seeds $siliquae^{-1}$ and 1000-seed weight. The same results also reported by Yadav *et al.* 2010, Singh and Thenua 2016, Jaggi and Sharma 1997 and Bhari *et al.* 2000. The oil content in mustard seeds was observed significantly highest with the application of 60 kg P_2O_5 ha^{-1}. It is attributed due to the assimilation of phosphorus in seed. The same findings also reported by Singh and Thenua 2016, Singh *et al.* 2017 andArthamwar *et al.* 1996.

C. Effect of sulphur

Sulphur is the constituent of amino acids (cysteine and methionine), vitamins and number of co-enzymes. It encourages the chlorophyll synthesis thereby increase vegetative growth. The positive effect of sulphur on plant growth and other traits of mustard was discussed by a number of research workers. The plant height of mustard was significantly increased with the application of sulphur upto 40 kg ha^{-1}over other treatments (Table 1). Significant increase of dry matter accumulation $plant^{-1}$ was due to the application of 40 kg S ha^{-1}which increased the availability of sulphur in root zone of mustard and easy absorptiontoreach the appreciable increase in plant height.Maximum dry matter $plant^{-1}$ was accumulated due to sulphur application of 40 kg S ha^{-1}. It might be attributed for the improvement of plant height and number of primary and secondary branches$plant^{-1}$. The same findings also reported by Dubey and Khan 1993, Khanpara *et al.* 1993, Kumar *et al.* 2017 and Sumui *et al.* 1997. The number of siliquae $plant^{-1}$and seeds $siliquae^{-1}$were recorded significantly highest with the application of 40 kg S ha^{-1} (Table 2). It is attributed due to the 40 kg S ha^{-1} increased the availability of sulphur to mustard plant and the more availability of sulphur to plant increased chlorophyll content in mustard leaves and the chlorophyll made more food material in the presence of sunlight, CO_2 and sufficient moisture. The same findings also reported by Singh and Thenua 2016, Sumui *et al.* 1997, Sharma 1994 and Kumar *et al.* 2002.1000-seeds weight (g) of mustard was significantly increased with the application of sulphur upto 40 kg ha^{-1} (Table 2).

It is attributed due to the sufficient availability of sulphur to mustard plant which increased the plant height, number of primary and secondary branches, number of siliquae $plant^{-1}$, number of seedssiliquae^{-1} and ultimately increased the 1000-seed weight. The same findings also reported by Singh and Thenua 2016, Sharma 1994 and Jain *et al.* 1996.The seed yield (q ha^{-1}) of mustard was significantly increased with the application of 40 kg S ha^{-1}(Table 2). It is attributed due to the application of 40 kg S ha^{-1} was significantly increased the plant height, number of branches $plant^{-1}$, number of siliquae $plant^{-1}$, number of seedssiliquae^{-1} and 1000-seed weight.The above findings also reported by Singh *et al.* 2010, Singh and Thenua 2016, Khanpara *et al.* 1993, Sharma 1994, Kumar *et al.* 2002,Tripathi *et al.* 2010, Sarkar *et al.* 2010, Bultar *et al.* 2010 andLakshman *et al.* 2010.Oil content in seeds of mustard was observed significantly highest with the application of 40 kg S ha^{-1} (Table 2). It is attributed due to the sulphur being an essential element of amino acids governed the oil content of mustard seed. The same findings also reported by Kumar *et al.,* 2017, Singh and Thenua 2016, Sumui *et al.* 1997and Singh *et al.* 1998).

Conclusion

On the basis of results of the two years experiment, it may be concluded that the application of 60 kg P_2O_5 $ha^{-1}$and 40 kg S ha^{-1} with two irrigations at pre-flowering and pod filling stagewould be suitable for the highest seed production and oil content of mustard.

REFERENCES

Arthamwar, D.N., Shelke, V. B and Ekshinge, B. S 1996. Effect of nitrogen and phosphorus on yield attributes, seed and oil yield of Indian mustard (*B.juncea*). *Indian Journal of Agronomy,* 41(2): 282-285.

Bhari, N. R., Siag, R.R. and Mann, P. S. 2000. Response of Indian mustard to Nitrogen and phosphorus on torrip samments of North-Western Rajasthan. *Indian Journal of Agronomy,*45 (4): 746-751.

Bultar, G. S., B.S. Sidhu, K. S. Sekhon and Anureet Kaur, 2010. Response of Indian mustard to different doses of sulphur and quality of water. *XIX National Symposium on "Management Approaches towards lively hood security"*2-4 December, 2010, Bangaluru.

Cochranand Cox, 1957.*Experimental Design*. Asia publishing co. Indian (2nd edn.)

Dubey, O.P. and Khan, R.A. 1993. Effect of N and S on dry matter, grain yield and nitrogen content at different growth stages of mustard under irrigated vertisol. *Indian Journal of Agronomy,*38 (2): 270-276.

Jaggi, R.C. and Sharma, D.K. 1997. Effect of sulphur and phosphorus on yield and their uptake by Indian mustard. *Indian Journal of Agronomy,*42 (2):352-356.

Jain, N.K., Vyas, A.K. and Singh, A.K. 1996.Yield and quality of Indian mustard as influenced by phosphorus and sulphur fertilization. *Indian Journalof Agricultural Sciences,*66 (9): 539-540.

Khanpara, V.D., Porwal, B.L., Sahu, M.P. and Patel, J.C. 1993. Effect of nitrogen and sulphur on growth and yield of mustard. *Indian Journal of Agronomy,*38 (2): 226-229.

Kumar Vishal, Singh Virendra, Singh Satybhan and Tiwari, N. K. 2017. Effect of Macro-nutrients and Farm Yard Manure on Productivity and Profitability of Mustard (*Brassicajuncea* L.) in Western Uttar Pradesh, India. *Asian Journal of Soil Science and Plant Nutrition,* 1(3): 1-6.

Kumar, P., Rathi K.S. and Prasad, K. 2002. Effect of component crops in intercropping of linseed+mustard under increasing rates of nitrogen. *Crop Research,* Hisar,23 (2): 283- 286.

Lakshaman, K., Shiv Kumar, B., Gand Gangiah, B. 2010. Performance of soybean-mustard cropping system as influenced by sulphur nutrition. *XIX National Symposium on "Resource management Approaches towards livelihood Security"* 2-4 December, Bengaluru.

Prasad, F.M., Chandra, A. and Verma, M.M. 1991. Growth, yield, dry matter and nutrient uptake by mustard in alluvial soil as influenced by phosphorus and organic matter. *New Agriculturist,*2 (1): 31-34.

Punia BS, Porwal, B.L. and Gaur, B.L. 1994. Response of mustard to phosphorus on vertisols of Rajasthan. *Indian Journal of Agronomy,*38 (1):142-143.

Sharma, R. S. 1994. Response of chickpea (*Cicer arietinum*) to irrigation and fertility levels under double cropping systems. *Indian Journal of Agronomy,*39 (2): 310-311.

Singh, A.K.,SB Singh, A. P. Singh, Awnindra, K. Singh, S.K. Mishra and A.K. Sharma, 2010. Effect of different soil moisture regimes on biomass partitioning and yield of chickpea genotypes under intermediate zone of J & K. *Journal of food Legumes,* 23 (2): 156-158.

Singh SB and Thenua O.V.S. 2016.Effect of phosphorus and sulphur fertilization on yield and NPS uptake by mustard (Brassica juncea L.). *Progressive Research an International Journal,* 11(1): 80-83 (2016).

Singh Virendra, Thenua O.V.S. and Shivay Y.S. 2017. Effect of phosphorus management on productivity of sunflower (*Helianthus annuus* L.). *Progressive Research- An International Journal*, 12(3): 348-352.

Thenua, O.V.S., S.P. Singh and B.G. Shiv Kumar, 2010. Productivity and economics of chickpea (*Cicer arietinum*)-fodder sorghum (*Sorghum bicolor*)cropping systemas influenced by P sources, bio-fertilizers and irrigation to chickpea. *Indian Journal of Agronomy,*55 (1):22-27.

Singh, M., Singh H.B. and Giri, G. 1998. Quality, biometric and economics aspects of mustard and chickpea as influenced by intercropping and N and P fertilization. *Annals of Agricultural Research,* 19 (1): 61-65.

Sumui, R.G., Pintoo Bandopadhyay and Bandopadhyay, Y.P. 1997. Effect of source, levels and method of application of sulphur on Indian mustard. *Indian Journalof Agricultural Sciences,* 67(8): 305-307.

Tripathi, M.K., Sumit Chaturvedi, D.K. Shukla and B.S. Mahapatra, 2010. Yield performance and quality in Indian mustard (Brassica juncea L.) as affected by integrated nutrient management. *Indian Journal of Agronomy,* 55 (2):138 142.

US Department of Agriculture 2016. Agricultural Research Service, Nutrient Data Laboratory. USDA National Nutrient Database for Standard Reference, Release 28 Current.

Yadav, R.P., M.L. Tripathi and S.K. Trivedi, 2010. Yield and quality of Indian mustard (Brassica juncea) as influenced by irrigation and nutrient levels. *Indian Journal of Agronomy,*55 (1): 56-59.

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