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Growth and yield attributes of mustard (*Brassica juncea* (L.), *Var*. pant *Brassicca*-21 scheduled on irrigation level and row spacing

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Abstract
The proposed work was conducted at S.G.R.R (P.G) College, Dehradun, Uttarakhand. 2017-18. The experiment was laid out in split plot design with three replications. The main plot treatments consisted of three irrigation levels *viz*., No-post sowing irrigation (I_0), one irrigation at 35 Days after sowing (I_1) and 2 irrigations at 35 and 70 Days after sowing. The sub-plot treatments consisted of three row spacings *viz*., 15 cm, 25 cm and 35 cm. Yield of mustard is greatly control by irrigation and better results both in terms of biometric components and seed yield can be achieved by the application of optimum irrigation. Deficiency of enough irrigation water as per requirements of mustard crop causes moisture stress at critical stages of growth and development. Under such circumstances to find out some appropriate solution for minimizing the irrigation requirement of mustard crop without reduction yield should receive top most concern.

Soil moisture content in I_2 treatment was higher than in I_1 and I_0 treatments. That is lowest moisture content of 28.0%, 33.2% and 35.2% at harvest was recorded in I_0, I_1 and I_2 treatments. Among row spacing, soil moisture content was recorded higher throughout the growing season in 35 cm (S_3) row spacing than 25 cm (S_2) and 15 cm (S_1). The lowest moisture content of 26.6%, 34.1% and 35.2% at harvest was recorded in S_1, S_2 and S_3 treatments, respectively.

Keywords: split plot design, biometric components, moisture stress, replications, circumstances etc.

Introduction

Mustard (*Brassica spp*.) is one of the most important oil crop of the world. Brassica belongs to *Brassicacea* (formally *cruiceferae).* It is the most important winter (*rabi*) oil seed crop grown northern parts of India. It is a thermo sensitive as well as photosensitive crop (Ghosh and Chatterjee, 1988) [6]. It also serves as an important raw material for industrial use such as in soap, paints, vernishes, hair oils, lubricants, textile auxiliaries, pharmaceuticals, etc. The global production of rapeseed–mustard and its oil is around 38-42 mt and 12-14 mt, respectively. India contributes 28.3% and 19.8% in world acreage and production. India produces around 6.7 mt of rapeseed mustard next to China (11-12 mt) with significant contribution in the world rapeseed-mustard industry. Indian mustard is the second important oil seed crop in India, next to groundnut. Presently rapeseed mustard sown area in India is 6.36 mha, with a production of 8.03 mt. the average productivity is 1262 kg^{-1} (Directorate of Economics and statistics Department of Agriculture and cooperation 2012-13) which needs to be enhanced upto 2562 $kgha^{-1}$ by 2030 for ensuring edible oil for self-reliance (DRMR,2011) Important physiological attributes such as planting dates, row to row spacing, plant density, planting method, seed rate, application of fertilizers, plant height, No. of leaves $plant^{-1}$,No of siliqua $plant^{-1}$,No. of seed $siliqua^{-1}$1000 seed weight (test weight) plot $^{-1}$, yield $plot^{-1}$, Leaf index (LIA), Crop growth rate (CGR), Relative crop growth rate (RGR), Net assimilations productivity.

Irrigation has been found to increase seed yield (Majid and simpson, 2003) [10]. Irrigation has also an effect on mustard to increase nitrogen uptake along with other nutrients (Reddy *et al.*, 1989) [18] resulting in improved yield and yield attributes. It is well known that water management is one of the major factors responsible for achieving better harvest in crop production. Efficient irrigation through timely supply of water in desirable amount and with proper irrigation method not only improves the crop yield but also improve water use efficiency. Row spacing *i.e* planting geometry is one of the very important practices for mustard production (Mondal *et al.*, 1999) [13, 14, 15]. Improved varieties of mustard or hybrids are capable of higher yields when grown under optimum row spacing and fertility level. Decreasing crop yield in improper spacing has been reported by many workers McDonald *et al.*, 1983 [11].

The major row spacing of Mustard decrease seed yield through synchronization of siliquae filling period with high temperatures, the decrease in assimilates production.

Material and Method

Experimental site

The experimental field was located at S.G.R.R (P.G) college of Agriculture Dehradun, Uttarakhand.

Climate

Dehradun is situated in the north-eastern part of Uttarakhand at 30°15' North latitude and 79° 15' East longitude at an altitude of 437m mean sea level. The average maximum temperature during the month of May – June varies between 16 to 36 °C, while the average minimum temperature varies between 23 to 5.2 °C during Dec-Jan. The average annual rainfall of this region is about 2073.3 mm which is mostly received between June to Sep.

Observations recorded

Pre -harvest observations

Plant height (cm)

The height was taken at 30, 45, 60, 75, 90, 105 Days after sowing and at harvest from point of root-shoot interaction to the top of main raceme with scale for five tagged plants and their average was worked out.

Number of primary branches (per plant)

The number of primary branches were counted separately from five selected plants drawn for biomass observation at 30, 45, 60, 75, 90, 105 Days after sowing and at harvest and their average was worked out.

Post -harvest observations

Yield attributing characters

The yield attributes listed below were studied from the sample of already tagged 5 plants, collected at the time of harvest.

Number of siliquae (per plant)

Total number of siliquae were counted on five selected plants and then converted into number of siliquae per plant.

Number of seeds (per siliqua)

Fifty siliquae were drawn randomly from five selected plants and were threshed and cleaned. The number of seeds was counted by numegral seed counter and then the average number of seeds per siliqua was calculated.

1000-seed weight (g)

1000 seed (randomly drawn seed sample out of net plot produce) were counted on numeral seed counter and then weighed by electronic balance to record 1000-seed weight (test weight) in grams.

Seed yield (g) per plant

The five selected plants were threshed, cleaned and seeds were weighed and then converted into seed yield (g per plant).

Final yield

Seed yield (kg ha^{-1})

The crop harvested from net plot area of 4.0 m x 2.4 m (9.6 m^2) was threshed manually after 4-5 days of sun drying. The seed yield was then converted into kg ha^{-1}.

Moisture studies

Soil profile moisture content (%)

Soil profile moisture content was determined by gravimetrical method. Plot- wise soil samples were drawn at depth intervals of 0 to 15 cm, 15-30 cm, 30-45 cm, 45-60 cm, 60-75 cm, 75-90 cm and 90-105 cm soil layers at sowing, before and after each irrigation and at harvest using a screw auger and weighed the samples to obtain fresh weight (W_1). Thereafter, soil samples were oven dried at 105 °C for 48 h to obtain dry weight (W_2). Soil moisture content of soil samples was worked out by using the following formula:

$$\textbf{Soil moisture content (\%)} = \frac{W_1 - W_2}{W_2} \times 100$$

Where,
W_1= Fresh Weight of Soil (g)
W_2= Dry weight of Soil (g)

Water use efficiency (kg ha^{-1}mm)

The water use efficiency (kg ha^{-1} mm) for a given treatment was calculated by dividing the seed yield (kg ha^{-1}) with the respective total consumptive water use (mm) for the crop period. The water use efficiency was worked out with the help of the following formula:

$$\textbf{WUE} = \frac{\text{Seed yield (kg ha}^{-1}\text{)}}{\text{Consumptive water use (mm)}}$$

Results

Table 1: Effect of different treatments on plant height (cm) at different stages of plant growth (Days after sowing) at different irrigation level

Plant height in Days/Irrigation	After 30 Days	After 60 Days	After 75 Days	After 90 Days	After harvest
I_0: (No post sowing irrigation	6.44	81.9	116.98	102.9	91.1
I_1: One irrigation at 35 Days after sowing	7.37	88.3	100.2	105.9	96.8
I_2: Two irrigations at 35 & 70 Days after sowing	7.33	88.2	99.8	110.8	100.8

Table 2: Effect of different treatments on number of primary branches per plant at different stages of plant growth (Days after sowing) at different irrigation level

Branches per plant/ Irrigation	After 45 Days	After 60 Days	After 75 Days	After 105 Days	After harvest
I_0: (No post sowing irrigation	2.73	3.8	4.11	4.36	4.36
I_1: One irrigation at 35 Days after sowing	2.92	4.11	4.82	5.04	5.07
I_2: Two irrigations at 35 & 70 Days after sowing	3.05	4.31	4.71	5.39	5.40

Table 3: Effect of different treatments on yield attributes

Treatments/Irrigation levels	Number of siliquae (per plant)	Number of seeds (per siliqua)	1000-seed weight (g)	Seed yield (g per plant)	Seed yield Kg ha^{-1}	Biological yield Kg ha^{-1}
I_0: (No post sowing irrigation	71.7	13.4	5.34	2.36	618.1	2671
I_1One irrigation at 35 Days after sowing	91.5	13.7	5.43	4.76	1067.2	3808
I_2: Two irrigations at 35 & 70 Days after sowing	106.9	14.1	5.72	5.75	1237.4	4187

Conclusion

Effect of irrigation

Two irrigations, each at 35 and 70 Days after sowing (I_2) were recorded significantly greater plant height at harvest over one irrigation at 35 Days after sowing (I_2) and no-post sowing irrigation (I_0). However, plant height between I_1 and I_2 treatments were found non-significant at harvest. Two irrigations, each at 35 and 70 Days after sowing (I_2) exhibited higher number of primary branches (per plant) at harvest as compared to one irrigation at 35 Days after sowing (I_2) and no-post sowing irrigation (I_0). The number of siliquae (per plant) were recorded significantly higher with the application of 2 irrigations, each at 35 and 70 Days after sowing (I_2) followed by application of one irrigation at 35 Days after sowing (I_1) and no-post sowing irrigation (I_0). The number of seeds (per siliqua) were recorded significantly higher with the application of 2 irrigations, each at 35 and 70 Days after sowing (I_2) followed by application of one irrigation at 35 Days after sowing (I_1) and no-post sowing irrigation (I_0). However, the number of seeds (per siliqua) between no-post sowing irrigation and application of one irrigation at 35 Days after sowing did not differ significantly. The irrigation frequency was failed to influence the 1000-seed weight (g). However, numerical value of 1000-seed weight was recorded higher with the application of 2 irrigations, each at 35 and 70 Days after sowing (I_2) followed by application of one irrigation at 35 Days after sowing (I_1) and no-post sowing irrigation (I_0). Seed yield (g per plant) was recorded significantly higher with the application of 2 irrigations, each at 35 and 70 Days after sowing (I_2) followed by application of one irrigation at 35 Days after sowing (I_1) and no-post sowing irrigation (I_0). Significantly higher seed yield (kg ha^{-1}) was recorded with the application of 2 irrigations, each at 35 and 70 Days after sowing (I_2) followed by application of one irrigation at 35Days after sowing (I_1) and no-post sowing irrigation (I_0). Irrigation frequency increased the seed yield considerably and an increased in seed yield by application of 2 irrigations (I_2) and one irrigation (I_1) was 50.9% and 42.9%, respectively over no-post sowing irrigation(I_0).Significantly higher biological yield (kg ha-1) was observed with the application of 2 irrigations, each at 35 and 70 Days after sowing (I_2) followed by application of one irrigation at 35 Days after sowing (I_1) and no-post sowing irrigation (I_0).

Effect of row spacing

Plant height was recorded significantly greater at harvest with 15 cm row spacing (S_1) followed by 25 cm (S_2) and 35 cm (S_3) row spacings. The number of primary branches (per palnt) was found significantly higher at harvest with 35 cm row spacing (S_3) followed by 25 cm (S_2) and 15 cm (S_1) row spacings. The number of siliquae (per palnt) was found significantly higher with wider row spacing of 35 cm (S_3) followed by 25 cm (S_2) and 15 cm (S_1) row spacings. The number of seeds (per siliqua) were recorded significantly higher with wider row spacing of 35 cm (S_3) followed by 25 cm (S_2) and 15 cm (S_1) row spacings. However, the number of seeds (per siliqua) between 15 cm (S_1) and 25 cm (S_2) row spacing was found non-significant. The seed yield (g pant-1) was recorded significantly higher with wider rows pacing of 35 cm (S_3) followed by 25 cm (S_2) and 15 cm (S_1) row spacings. The wider row spacing of 35 cm (S_3) and 25 cm (S_2) exhibited 51.2% and 50.0% higher seed yield (kg ha-1) over closer row spacing of 15 cm (S_1). The seed yield (kg ha-1) was recorded significantly higher with wider rows pacing of 35 cm (S_3) followed by 25 cm (S_2) and 15 cm (S_1) row spacings. Wider row spacings of 35 cm (S_3) and 25 cm (S_2) resulted into 51.2%and 50.3%, respectively increased in seed yield over 15 cm (S_1) row spacing. However, seed yield (kg ha-1) between 35 cm (S_3) and 25 cm (S_2) row spacing did not differ significantly. The biological yield (kg ha-1) was recorded significantly higher with 30cm row spacing (S_2) followed by 35 (S_3) and 15 cm (S_1) row spacings.

References

1. Anindita Das *et al*. Yield and Yield Attributes of Hybrid Mustard as Affected by Crop Geometry and Varieties. International Journal of Current Microbiology and Applied Sciences. 2019; 8(4):2160-2166.
2. Abraham T, Sharma UC, Thenua OVS, Shivakumar BG. Effect of levels of irrigation and fertility on yield and economics of chickpea (*Cicerarietinum*) and Indian mustard (*Brassica juncea*) under sole andintercropping systems. Indian Journal of Agricultural Sciences. 2010; 80(5):372-376.
3. Arif M, Hassan FU. Response of white mustard (*Sinapis albal* L.) to spacing under rainfed conditions. Journal of Animal and Plant Science. 2012; 22(1):137-141
4. Chauhan JS, Singh KH, Singh VV, Kumar S. Hundred years of rapeseed-mustard breeding in India: Accomplishments and Future Strategies. Indian Journal of Agricultural Sciences. 2011; 81(12):1093-1109.
5. DRMR. Vision 2030. Directorate of Rapeseed-Mustard Research, Bharatpur, 321-303 Rajasthan, 2011, 30.
6. Ghosh RK, Chalterjee BN. Effect of dates of sowing on oil content and fatty acid profiles of Indian mustard. Journal of Oilseed Research. 1988; 5:144-149.
7. Hossain MB, Alam MS, Ripon MA. Effect of irrigation and sowing method on yield andyield attributes of mustard journal of life & earth and agricultural sciences. 2013; 41:65-70.
8. Kardgar V, Delkhosh B, Noormohammadi G, Shiranirad AH. Effects of nitrogen and plant density on yield of field mustard (*Brassica campestris*) Plant Ecophysiology. 2010; 2:157-164.
9. Keivanrad S, Delkhosh B, Rad ASH, Zandi P. The effect of different rates of nitrogen and plant density on qualitative and quantitative traits of Indian mustard. Advances in Environmental Biology. 2012; 6(1):145-152.
10. Majid A, Simpson GM. Physiological effect of irrigation on mustard growth and yield. Pakistan J. of Agril. Res. 2003; 17(3):221-230.
11. McDonald GK, Sutton BG, Ellison FW. The effect of time of sowing on the seed yield of mustard in the Namoi valley, New South Wales. Australian journal experimental agriculture and animal husbandry. 1983; 34:229-240.

12. Md. Mahbubul Alam, Ferdousi Begum, Pryanka Roy. Yield and Yield Attributes of Rapeseed–Mustard (*Brassica*) Genotypes Grown Under Late Sown Condition Bangladesh J. Agril. Res. 2014; 39(2):311-336.
13. Mondal RI, Biswas M, Hydar-Ali MK, Akbar MA. Response of rapeseed genotype Dhali to seed rate and seeding date. Bangladesh J. Agril. Res. 1999; 24(1):83-90.
14. Mondal RI, Biswas M, Hydar-Ali MK, Akbar MA. Response of rapeseed genotype Dhali to seed, 1999.
15. Mondal RI, Biswas M, Hydar-Ali MK, Akbar MA. Response of rapeseed genotype Dhali to seed rate and seedling date. Bangladesh Journal of Agricultural Research, 1999; 24(1):8390.
16. Pirri ISSSA, Nik MM, Abolfazl TB, Fatemeh R, Babaeian M. Effect of irrigation frequency and application levels of sulphur fertilizer on water use efficiency and yield of Indian mustard (*Brassica juncea* L.) African Journal of Biotechnology. 2011; 10(55):11459-11466.
17. Razaq M, Sajid M, Aslam M, Sarfraz AS, Afzal M. Effect of Plant Spacing on Aphid Population, Yield Components and Oil Contents of Late Sown Canola, *Brassica napus* L. (Brassicaceae). Pakistan Journal of Zoology. 2012; 44(4):991-995.
18. Reddy BN, Jana PK, Das SK. Effect of nitrogen on yield and yield contributing characters of mustard at different moisture levels. Indian Agric. Res. 1989; 19(4):347-350.
19. Somayeh R, Babak DR, Shirani AH, Peiman Z. Effect of Sowing dates and Irrigation regimes on Agronomic traits of Indian mustard in semi-arid area of Takestan. Journal of American Science. 2011; 7(10):724-728.
20. Verma Hari Kishor, Singh MM, Singh MK, Kumar Santosh. Response of Indian mustard (*Brassica juncea* L.) varieties to irrigation for better growth, yield and quality of mustard crop International Journal of Agricultural Sciences. 2014; 10:426-429.