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# Performance of Gobhi season (*Brassica napus* L.) as influenced by different date of sowing and nitrogen levels under irrigated condition of central Punjab

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## Abstract

A field experiment was carried out to assess the effects of different date of sowing and nitrogen levels on growth and yield of Gobhi sarson (*Brassica napus* L.) during *rabi* season of 2018-19. The experiment was laid out in split plot design with three replications with the three date of sowing as main plot treatment *viz.,* 10th October, 25th October and 15th November and four levels of N as sub-plot treatments *viz.,*0, 40, 80 and 120 kg/ha. The results revealed that highest values of growth parameters, yield attributes and yield of crop were recorded under 25th October date of sowing which was remained at par with 10th October but it was recorded significantly superior over the 15th November. In case of N levels, the maximum values of growth parameters, yield attributes and yield of crop were recorded under 120 kg N/ha which was found at par with 80 kg N/ha but significantly superior over the other N levels. Therefore, 25th October sowing with 120 kg N/ha can be beneficial in enhancing the growth and yield attributes of the Gobhi sarson.

***Keywords :*** *Date of sowing, Gobhi sarson, N levels, yield attributes, yield*

## Introduction

India is one among the leading oil seed producing countries in the world. Oilseed brassica shares 24.4 % area and 26.8 %production of total oilseeds in the country (Choudhary *et al.,* 2019). It contributes more than 33 % of vegetable oil production (Langadi *et al.,* 2021). Gobhi sarson (*Brassica napus* L.) is the new emerging oilseed crops having limited area of cultivation. Sowing date is one of the most important agronomic factor and nonmonetary input which pave the way for better use of time and play an important role to fully exploit the genetic potentiality of a variety as it provides optimum growth conditions such as temperature, light, humidity and rainfall (Irradi, 2008; Singh *et al.,* 2019). Optimum time of sowing can provide congenial conditions to have maximum light interception, best utilization of moisture and nutrients from early growth stage to seed filling stage (Keerthi *et al*., 2017). The significant reduction in yield of mustard due to delay in sowing of crop from September to December has been reported by many workers (Khushu and Singh, 2005; Alam *et al.,* 2014). Further, Kumar *et al*. (2018) also reported that the values of yield and yield attributes were highest on 16th October sowing while 21st November sowing dates showed lowest values of yield and yield attributing traits. Similarly, the maximum seed yield was recorded when crop sown on 25th October followed by 15th October sowing (Jat *et al*., 2019). Furthermore, plant nutrition is a key input to increase the productivity of mustard seed crop. Nitrogen (N) is the most important nutrient, for the crop to activate the metabolic activity and transformation of energy, chlorophyll and protein synthesis and being a constituent of protoplasm and protein (Bhattacharya, 2014). When nitrogen supplies are optimum and conditions are favourable for growth, proteins are formed from the manufactured carbohydrates. Nitrogen also affects uptake of other essential nutrients and it helps in the better partitioning of photosynthates to reproductive parts which increase the seed: stover ratio and enhances the yield of rapeseed mustard group of crops (Singh and Meena, 2004). Significantly higher values of primary as well as secondary branches, siliquae/plant and seed yield of Indian mustard was reported with the application of N up to 120 kg/ha (Yadav *et al*., 2007). The plant height, leaf area index and dry matter production were significant increased with increasing levels of N rates from 40 to 120 kg/ha (Rasool *et al*., 2013). Hence, identification of a suitable combination of date of sowing and nitrogen level could be helpful in maximizing the yield of Gobhi sarson in the Punjab.

## Materials and Methods

A field experiment was conducted at experimental farm, Mata Gujri College, Fatehgarh Sahib during *Rabi* season of year 2018-19. The experiment was laid out in split plot

design with three replications. The three dates of sowing were taken in main-plot, viz. D1 – 10th October, D2 – 20th October, and 10th November while, four levels of N were kept in sub-plots, *viz.,* N1- 0 kg/ha, N2- 40 kg/ha, N3- 80 kg/ha, N4- 120 kg/ha. The soil of experimental field was Gangetic alluvial having study clay loam texture with pH 8.5. It was moderately fertile, with available nitrogen (325.1 kg N/ha), available phosphorus (22.4 kg $P_2O_5$/ha), available potassium (206.3 kg $K_2O$/ha), organic carbon (0.8 %) and electrical conductivity (0.59 dS/m). Crop (var. GSC 7) was sown in the experimental field as per the treatments. The crop was sown manually using seed rate 4 kg/ha at row-to-row distance of 45 cm. The recommended dose of phosphorus (60 kg $P_2O_5$/ha) and potash (60 kg $K_2O$/ha) were applied to all treatments at the time of sowing through single super phosphate and muriate of potash, respectively. Nitrogen dose was applied as per the treatments during the experimentation. Nitrogen fertilizer *i.e.,* urea was applied in three equal splits at sowing as basal and top dressed at 30 and 50 DAS. Irrigations were applied at critical stages of crop. The weed management was done by pre-emergence application of pendimethalin @ 1 kg *a.i.* /ha followed by 1 hand weeding at 30 DAS. The crop was harvested on 27th March 2019, 2nd April 2019 and 7th April 2019 under the D1, D2 and D3 treatments, respectively. Biometric observations were recorded at periodic intervals at 30, 60, 90 DAS and at harvest stage. Yield parameters were observed just before the harvesting of crop from five randomly tagged plants. The seed yield and stover yield was recorded from 7.5 $m^2$ area from each plot and converted in hectare. All the data obtained were statistically analyzed by applying the techniques of analysis of variance (ANOVA) and the significance of variance was tested at the probability level of 0.05 (Panse and Sukhatme,1978).

## Results and Discussion

### Growth parameters

The data pertaining to growth attributing characters *viz.* plant height, no. of primary and secondary branches, LAI and dry matter accumulation have been presented in Table 1 & 2. The maximum values of these growth parameters were recorded with the 25th October sowing which was at par with 10th October sowing and significantly superior over the 15th November sowing at all the growth stages. This might be due to higher interception of photosynthetic active radiation for a longer duration. The higher rate of photosynthesis due to more opening of stomata for longer period of time has been reported by Kumar *et al.* (2013). The optimum sowing time plays an important role to exploit the genetic potentiality of a variety as it provides optimum crop growing environment such as temperature, humidity and light (Bhagat *et al.,* 2022). The late sown crop faced lower temperature at time of emergence and flowering stage which have harmful effect. Similar findings have also been reported by Singh *et al.* (2014) and Kaur *et al*. (2018). The growth attributing characters were also influenced significantly due to different levels of N. Among N levels, application of 120 kg N/ha resulted the maximum values of growth parameters which was at par with 80 kg N/ha and significantly superior over the other treatments at all the growth stages of crop. This might be due N being the basic constituent of chlorophyll, protein and cellulose required for the process of photosynthesis and tissue formation for proper growth. The interaction

Table 1: Effect of different date of sowing and levels on plant height and Primary branches

| Treatment | Plant height (cm) | | | | Primary branches per plant | | | |
|---|---|---|---|---|---|---|---|---|
| | 30 DAS | 60 DAS | 90 DAS | At harvest | 30 DAS | 60 DAS | 90 DAS | At harvest |
| Date of sowing | | | | | | | | |
| 10th Oct | 21.6 | 67.6 | 152.7 | 176.0 | 1.9 | 13.2 | 29.0 | 31.7 |
| 25th Oct | 22.9 | 71.7 | 162.5 | 189.2 | 2.0 | 15.8 | 34.6 | 34.4 |
| 15th Nov | 20.3 | 66.4 | 142.2 | 135.9 | 1.3 | 10.3 | 23.5 | 24.8 |
| SEm± | 0.4 | 1.0 | 3.4 | 3.6 | 0.1 | 0.7 | 1.3 | 1.2 |
| CD 5 % | 1.6 | 4.1 | 13.2 | 14.2 | 1.2 | 2.8 | 5.3 | 4.5 |
| Nitrogen level (kg/ha) | | | | | | | | |
| 0 | 19.7 | 66.0 | 143.5 | 147.7 | 1.6 | 10.0 | 26.8 | 29.3 |
| 40 | 20.9 | 67.0 | 148.7 | 159.5 | 1.6 | 11.8 | 27.3 | 29.5 |
| 80 | 22.5 | 69.9 | 155.2 | 174.8 | 1.8 | 14.7 | 28.2 | 30.3 |
| 120 | 23.2 | 71.4 | 162.5 | 186.1 | 1.9 | 15.9 | 33.7 | 32.1 |
| Sem± | 0.4 | 1.3 | 3.1 | 4.1 | 0.1 | 0.6 | 2.1 | 0.9 |
| CD 5 % | 1.3 | 3.8 | 9.0 | 11.8 | 0.2 | 1.7 | 6.1 | 2.6 |
| Interaction | NS | NS | NS | NS | NS | NS | NS | NS |

Table 2: Effect of different date of sowing and levels on Secondary branches per plant, dry matter accumulation per plant and LAI

| Treatment | Secondary branches per plant | | | Dry matter accumulation per plant (g) | | | | LAI | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 60 DAS | 90 DAS | At harvest | 30 DAS | 60 DAS | 90 DAS | At harvest | 30 DAS | 60 DAS | 90 DAS |
| Date of sowing | | | | | | | | | | |
| 10th Oct | 13.6 | 33.3 | 33.2 | 1.6 | 21.0 | 77.8 | 124.0 | 2.1 | 4.8 | 3.9 |
| 25th Oct | 14.7 | 34.1 | 34.5 | 1.7 | 22.6 | 80.2 | 126.6 | 2.2 | 5.1 | 4.3 |
| 15thNov | 10.9 | 25.6 | 25.7 | 1.4 | 15.7 | 59.0 | 110.7 | 1.8 | 3.0 | 2.2 |
| SEm± | 0.3 | 0.6 | 0.8 | 0.0 | 0.5 | 3.0 | 3.1 | 0.1 | 0.1 | 0.1 |
| CD 5 % | 1.3 | 2.2 | 3.2 | 0.2 | 1.8 | 11.8 | 12.2 | 0.3 | 0.5 | 0.5 |
| Nitrogen Level (kg/ha) | | | | | | | | | | |
| 0 | 11.0 | 28.9 | 29.3 | 1.2 | 17.7 | 68.5 | 115.6 | 1.9 | 3.7 | 2.9 |
| 40 | 12.2 | 30.4 | 30.2 | 1.4 | 19.1 | 70.7 | 116.8 | 2.0 | 4.1 | 3.3 |
| 80 | 14.1 | 31.7 | 32.0 | 1.8 | 20.6 | 74.1 | 121.8 | 2.1 | 4.5 | 3.7 |
| 120 | 15.1 | 33.0 | 33.1 | 1.8 | 21.7 | 76.1 | 127.6 | 2.3 | 4.8 | 3.9 |
| Sem± | 0.3 | 0.6 | 1.0 | 0.1 | 0.4 | 1.6 | 2.4 | 0.1 | 0.2 | 0.1 |
| CD 5 % | 1.0 | 1.8 | 2.9 | 0.2 | 1.2 | 4.5 | 7.0 | 0.2 | 0.4 | 0.3 |
| Interaction | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

effects of date of sowing and nitrogen application on different growth attributing characters at various growth stages were found non-significant.

## Yield attributes

Yield attributes are the result of co-ordinate interplay of various growth attributing characters. Crop yield is the net resultant of various agronomic inputs influencing growth and yield attributing characters during life cycle of crop. A perusal of data showed that different date of sowing and N levels brought out significant variation in different yield attributing characters (Table 3). The maximum yield attributing characters *viz*. number of siliqua/plant, length of siliqua, number of seeds/siliqua and test weight were obtained under 25$^{th}$ October sowing which was at par with10$^{th}$ October and found significantly higher over 15$^{th}$ November. Under different levels of nitrogen application, the maximum values of these yield attributes were observed with 120 kg N/ha which was statistically at par with 80 kg N/ha but it was significantly superior over the rest of the treatments. Similar findings have also been reported by (Keerathi *et al.* 2017). The interaction effects of date of sowing and nitrogen application on different yield attributes were found non-significant.

Table 3: Effect of date of sowing and nitrogen levels on yield attributing and yield of crop

| Treatment | No. of siliquae | No. of seed siliqua$^{-1}$ | Length of siliqua (cm) | Test weight (g) | Seed yield (q/ha) | Stover yield (q/ha) | Biological yield (q/ha) | HI (%) |
|---|---|---|---|---|---|---|---|---|
| Date of sowing | | | | | | | | |
| 10th Oct | 321 | 13.7 | 7.2 | 4.3 | 15.6 | 54.3 | 69.9 | 22.2 |
| 25th Oct | 325 | 14.3 | 7.4 | 4.6 | 16.2 | 56.7 | 73.0 | 22.2 |
| 15th Nov | 294 | 12.0 | 6.2 | 4.0 | 14.4 | 49.9 | 64.3 | 22.4 |
| SEm± | 6.2 | 0.3 | 0.1 | 0.1 | 0.4 | 1.3 | 1.0 | 0.8 |
| CD 5 % | 24.2 | 1.0 | 0.4 | 0.3 | 1.4 | 5.1 | 3.9 | NS |
| Nitrogen level (kg/ha) | | | | | | | | |
| 0 | 296 | 11.4 | 5.9 | 3.4 | 13.4 | 51.3 | 64.7 | 20.78 |
| 40 | 311 | 12.8 | 6.8 | 4.4 | 15.2 | 52.6 | 67.8 | 22.45 |
| 80 | 319 | 13.9 | 7.4 | 4.7 | 16.2 | 54.2 | 70.4 | 23.01 |
| 120 | 328 | 15.2 | 7.5 | 4.8 | 16.8 | 56.5 | 73.2 | 22.91 |
| Sem± | 6.3 | 0.4 | 0.3 | 0.1 | 0.3 | 1.1 | 1.3 | 0.37 |
| CD 5 % | 18.3 | 1.3 | 0.7 | 0.3 | 0.9 | 3.3 | 3.9 | NS |
| Interaction | NS | NS | NS | NS | NS | NS | NS | NS |

**Crop yield and harvest index**

The data pertaining to seed yield, stover yield and biological yield of Gobhi sarson were significantly influenced by application of different treatments. However, harvest index was not significantly influenced by different treatments (Table 3). From the data it is evident that the maximum seed yield, stover yield and biological yield were observed in 25th October sowing which was at par with 10th October and which was significantly superior over the 15th November. Further, it was higher 4.18 %, 4.23 % and 4.23 % to 10th October sowing and 11.33 %, 12.09 % and 11.92 % to 15th November sowing in seed yield, stover yield and biological yield, respectively. Because in optimum sowing time the crop may be ascribed mainly to prolonged duration of reproductive period indicated more time available for utilization of assimilates for seed setting which led to increase seed yield. The biological yield also increases because there is positive and significant correlation also existed between stover and biological yield. Similar findings have also been reported by (Keerathi *et al.* 2017). Among nitrogen application, the maximum seed yield, stover yield and biological yield were observed in 120 kg N/ha which was statistically at par with 80 kg N/ha and which was significantly superior over other treatments. It is higher 3.52 %, 3.96 % and 3.86 % to 80 kg N/ha and 19.9 %, 9.12 and 11.62 % to 0 kg N/ha in seed yield, stover yield and biological yield, respectively. It is due to that the increase in stover yield with nitrogen application may attribute to favorable effect of nitrogen growth parameters and yield attributes of crop with application of higher doses of nitrogen over lower doses accounted for increased seed yield. Interaction effect of date of sowing and nitrogen application were do not affect significantly on seed yield, stover yield and biological yield. Similar results have been reported by Kaur *et al.* (2018). In case of harvest index, the maximum harvest index was observed in 15th November sowing which was closely followed by 25th October sowing of crop. It is due to the good supply of nutrition which ultimately increases in harvest index. Similar results have been given by Kaur *et al.* (2018). Under nitrogen effect, maximum harvest index was observed in 80 kg N/ha which was closely followed by 120 kg N/ha while minimum was observed in 0 kg N/ha during experimentation.

## Conclusion

It can be concluded that growth contributing parameters and yield attributes of Gobhi sarson were positively influenced due to date of sowing and nitrogen levels. Hence, the crop sown on 20th October with nitrogen 120 kg/ha resulted the better growth parameters, yield attributing traits and yield of Gobhi sarson under irrigated conditions of central Punjab.

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