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Effect of sowing environments on yield attributes and yield of Gobhi Sarson (*Brassica napus* L.) cultivars under sub-tropics of Jammu region

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Abstract

A field experiment was conducted to study the effect of sowing environments on yield attributes and yield of Gobhi Sarson (*Brassica napus* L.) cultivars during *Rabi* season 2018-19. The results revealed that yield attributes *viz.,* number of branches per plant, number of siliquae per plant and number of seeds per siliqua were recorded significantly higher under the crop sown on 20th October in comparison to 30th October and 9th November sown crop. While, cultivar GSL-1 recorded significantly higher yield attributes than DGS-1 but at par with ONK-1. The seed yield of gobhi sarson was recorded significantly higher under 20th October sown crop to the extent of 29.91 and 61.45% than delayed sowing on 30th October and 9th November, respectively. The cultivar GSL-1 recorded significantly higher seed yield than DGS-1 but found at par with ONK-1.

Keywords: *Cultivars, gobhi sarson, sowing environments, seed yield, yield attributes*

Introduction

Rapeseed-mustard is one of the major oilseed crops, traditionally grown everywhere in the country due to their high adaptability in conventional farming systems. Among nine oilseeds, soybean (39 %), groundnut (26 %), and rapeseed-mustard (24 %) account for more than 88 % of the total oilseeds production in the country. However, rapeseed-mustard (31 %) contributes the most in edible oil production in the country, followed by soybean (26 %) and groundnut (25 %). During 2019-20, rapeseed-mustard was grown on 6.86 million ha in India, with a production of 9.12 million tonnes and a productivity of about 1.33 t/ha (Anonymous, 2021). The yield of *Brassica* species largely depends upon change in environment during crop growth. The physical factors mainly climatic factors cannot be manipulated under field conditions but sowing time can be adjusted to meet the optimum thermal requirements of crop at various phenological stages to avoid any adverse effect on the yield of gobhi sarson. The growth phase of the crop should synchronize with optimum environmental conditions for better expression of output as yield through the change in environment with many practices including sowing dates. Therefore, sowing at optimum time gives higher yields due to suitable environment that prevails at all the growth stages (Shekhawat *et al.*, 2012). The change in crop environmental conditions due to sowing environment is bound to affect the production potential of the crop. Different sowing environments provide variable environmental condition within the same location for growth and development of crop (Panda *et al.*, 2004). Moreover, optimum sowing time is an important agronomic factor and non-monetary input which plays a key role in achieving the potential yield of a crop in any region by creating suitable environment for optimum growth and development that converts into better yield attributes (Singh *et al.*, 2002). Delay in sowing affects growth of the crop plant by causing early maturity which results in drastic yield reduction mainly due to rising temperature during reproductive phase. Thus, sowing time plays an important role in exploiting the genetic potential of a variety and provides optimum growth conditions for efficient utilization of natural resources *viz.* temperature, light, humidity and rainfall (Jeromela *et al.,* 2009). Being a thermo-sensitive crop, choice of suitable variety for different seeding time further gets prime importance. Non-adoption of recommended varieties is the main reason for low productivity of rapeseed-mustard in sub-tropical regions of Jammu division (Ajrawat *et al.*, 2013). The adverse effect of delayed sowing can also be minimized by selecting suitable cultivars due to their tolerance capacities to thermal stress. Hence, keeping the above facts in the fore front for developing the hypothesis of the problem at hand, a study entitled effect of sowing environments on yield attributes and yield of gobhi sarson (*Brassica napus* L.) cultivars under sub-tropics of Jammu was undertaken.

Materials and Methods

Field experiment was carried out at the research farm of Agrometeorology Section, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu (SKUAST-J), Chatha during *rabi*, 2018-19. The location was situated at 32^0 402 N latitude and 74^0 822 E longitude with an altitude of 293 meters above mean sea level in the sub-tropical foothill lands of Shivalik in Jammu and Kashmir. The soil of the experimental site was sandy clay loam in texture having pH of 7.60 with low organic carbon content (0.41%) and available nitrogen (219.5 kg/ha), while, medium in available phosphorus (14 kg/ha) and potassium (132.46 kg/ha). The experiment consisted of nine treatment combinations which were comprised of three sowing environments viz., 20th October (D_1), 30th October (D_2) and 9th November (D_3) with three cultivars GSL-1 (V_1), ONK-1 (V_2) and DGS-1 (V_3) replicated three times in factorial randomized block design under irrigated conditions. The spacing adopted for all three cultivars of gobhi sarson was 45 × 10 cm. The crop was supplemented with 60 kg/ha nitrogen, 40 kg/ha phosphorus and 20 kg/ha potassium. The nutrients were supplied in the form of urea (130.44 kg/ha), single superphosphate (250 kg/ha) and muriate of potash (33.4 kg/ha). Entire quantity of phosphorus and potassium along with 1/2nd of nitrogen was applied as basal at the time of sowing and remaining half of the nitrogen was applied as top dressing at 40 DAS. Yield and yield attributing characters were determined using standard procedures and finally the yield is expressed in kg/ha. Harvest index was calculated by dividing the economic (seed) yield to the biological yield as per the formula given by Nichiporovich (1967) :

$$\text{Harvest index (\%)} = \frac{\text{Economic/seed yield (kg/ha)}}{\text{Biological yield (kg/ha)}} \times 100$$

The statistical analysis of the data was done by using OP stat software developed by CCSHAU, Hisar.

Results and Discussion

The data of yield attributes showed that sowing environments had significantly affected the yield attributes *viz.*, number of branches/plant, number of siliquae per plant and seeds per siliqua of gobhi sarson crop but the number of plants/m^2 and test weight were found non-significant with respect to sowing environments (Table 1). The 20th October sown crop recorded significantly higher number of primary branches (5.17), secondary branches (12.91) per plant, number of siliquae per plant (149.76) and number of seeds per siliquae (19.22) as compared to the crop sown on 30th October and 9th November due to translocation of more photosynthates from source to sink and longer reproductive phase with favourable temperature conditions under early sowing as compared to delayed sowing. Similar results substantiate with the findings of Kumari *et al.* (2012) and Khajuria *et al.* (2017). The different cultivars differed significantly for number of primary and secondary branches/plant, siliquae/plant and seeds/siliqua. The cultivar GSL-1 was found superior than DGS-1 but at par with ONK-1 in terms of number of branches/plants, siliquae/plant and seeds/siliqua under sub-tropical condition. The varietal difference in several yield

Table 1: Effect of sowing environments and cultivars on yield attributes of Gobhi Sarson

Treatment	No. of plants /m^2	Primary branches /plant	Secondary branches /plant	No. of siliquae /plant	No. of seeds /siliqua	Test weight (g)
Sowing environments						
20th October	20.3	5.2	12.9	160.2	19.2	3.05
30th October	20.2	4.5	11.6	149.8	18.2	3.02
09th November	20.1	4.0	10.1	130.8	17.1	2.91
SEm±	0.18	0.08	0.18	2.05	0.20	0.07
CD (p=0.05)	NS	0.27	0.54	6.15	0.61	NS
Cultivars						
GSL-1	20.6	4.8	12.0	152.3	18.6	3.11
ONK-1	20.2	4.6	11.7	148.6	18.5	2.98
DGS-1	19.9	4.2	10.8	140.3	17.7	2.89
SEm±	0.18	0.08	0.18	2.05	0.20	0.07
CD (p=0.05)	NS	0.27	0.54	6.15	0.61	NS

attributes may be attributed as inherent variation due to their genetic makeup. The similar type of findings was reported by Meena *et al.* (2017) and Singh *et al.* (2015).

The highest seed (1774 kg/ha), biological (7849 kg/ha) and stover (6074 kg/ha) yields were recorded under October 20th sowing followed by October 30th and November 9th (Table 2). Among cultivars, the cultivar GSL-1 (1519 kg/ha) produced significantly higher seed, biological (6650 kg/ha) and stover (5131 kg/ha) yields followed by cultivar ONK-1 and DGS-1, due to their genetic constitution of *Brassica* species. Similar types of results were reported by Kumar *et al.* (2017) and Patel *et al.* (2017). However, the interaction between sowing environments and cultivars showed that the seed yield of various cultivars differed significantly with different sowing environments. The results revealed that the all cultivars sown on 20th October yielded significantly higher seed yield than delay in sowing by ten days interval.

The cultivar GSL-1 exhibited significant reduction in seed yield with respect to delayed sowing. Overall, the sowing environments had significant impact on the performance of various cultivars in terms of seed yield as depicted in Figure 1. The mean seed yield with respect to sowing environment were recorded of about 1774, 1366 and 1104 kg/ha for the crop sown on 20th, 30th October and 9th November, respectively. Whereas, the mean seed yield with respect to cultivars were 1519, 1457, 1269 kg/ha for GSL-1, ONK-1 and DGS-1, respectively. Moreover, when the sowing of gobhi sarson cultivars was done on 9th November, the cultivar ONK-1 (1233 kg/ha) had recorded significantly higher yield than DGS-1 (1000 kg/ha) but at par with GSL-1 (1080 kg/ha) and this might be attributed to development of superior yield attributing characters *viz.*, number of branches/plant, siliquae/plant and seeds/siliqua. The decrease in seed yield per hectare with delay in sowing occurred primarily due to the lower biomass build up which led to reduced bearing capacity owing to slower growth on account of lower temperatures during early vegetative growth phase and the overall shorter life span and reduced seed filling span and sink strength (siliqua number). The late sown gobhi sarson crop had found a decline in growth, leaf area and faster maturation due to more accumulation of GDD in less number of days resulting in decreased seed yield.

Table 2: Effect of sowing environments and cultivars on yield and harvest index of gobhi sarson

Treatments	Seed yield (kg/ha)	Biological yield (kg/ha)	Stover yield (kg/ha)	Harvest Index (%)
Sowing environments (D)				
20th October	1774	7849	6074	22.7
30th October	1366	6060	4694	22.6
09th November	1104	4906	3801	22.5
SEm±	40.05	290.15	184.02	0.75
CD (p=0.05)	125.10	871.39	543.71	NS
Cultivars (V)				
GSL-1	1519	6650	5131	22.8
ONK-1	1457	6491	5034	22.6
DGS-1	1269	5673	4404	22.5
SEm±	40.05	290.15	184.02	0.75
CD (p=0.05)	125.10	871.39	543.71	NS
Interaction (D × V)	S	NS	NS	NS

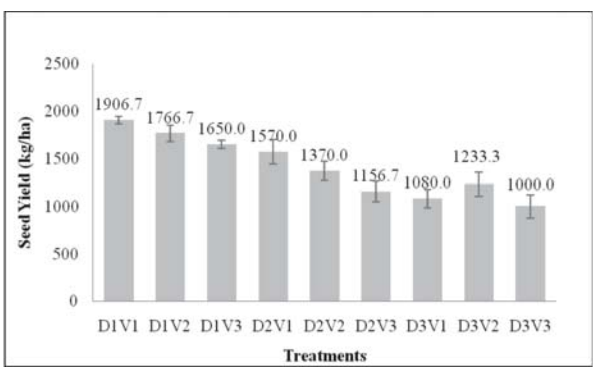

Fig. 1: Interaction effect of sowing environments and cultivars on seed yield (kg/ha) of gobhi sarson

Similar findings had also been reported by Kumari *et al.* (2012), Kumar *et al.* (2017), Patel *et al.* (2017), and Khajuria *et al.* (2017). The reduction in seed yield under delayed sowing could also be due to less translocation of photosynthates towards reproductive parts and early maturity which resulted in less number of siliquae/plant and less siliqua filling duration due to unfavourable temperature conditions under delayed sowing. High temperatures and long days accelerated rapid maturity and reduce the seed yield (Choudhary *et al.*, 2018). The biological yield was significantly highest in October 20th sowing as compared to 30th October and 9th November. The reduction in biological yield under delayed sowing occurred primarily due to the decreased in growth characters. The slower growth on account of lower temperature during early vegetative growth phase and the overall shorter life span of crop caused reduction in biomass production. Harvest index did not differ significantly with sowing environments and cultivars due to similar ratio of seed with stover yield among different sowing environments and cultivars. Similar results were also reported by Khajuria *et al.* (2017).

Conclusion

The gobhi sarson crop sown on 20th October resulted in better seed and biological yields in comparison to the other sowing environments (30th October & 9th November) and cultivar GSL-1 performed better as compared to ONK-1 and DGS-1 in sub-tropical conditions of Jammu region.

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