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Effect of Date of Sowing and Varieties on Yield of Brown Sarson (*Brassica Rapa* L.) Under Temperate Kashmir

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ABSTRACT : *A field experiment was conducted in Kashmir valley during rabi season 2011-12 to study the effect of date of sowing and varieties on yield of brown sarson (Brassica rapa L.) under temperate Kashmir. The results indicated that, days taken to different phenological stages, yield components, seed, stover, biological and oil yield were affected by treatments. Early planting on 1st October has taken more number of days to reach maturity. Highest yield and yield components were obtained in first sowing date and P-3 variety was superior in many traits. Also in interaction of sowing date and varieties, the highest seed yield was obtained in first sowing date and P-3 variety. There was no significant difference among the sowing dates and varieties with respect to oil percentage. Thus, it can be suggested that use P-3 and first sowing date (1st October).*

KEY WORDS*: Brown Sarson varieties, seed yield, sowing date and yield components.*

I. INTRODUCTION:

Rapeseed and mustard are the major oilseed crops, traditionally grown everywhere in the country due to their high adaptability in conventional farming systems. Brown sarson (*Brassica rapa* L.) is the only crop of the rapeseed-mustard group which fits well in the oilseed – paddy rotation prevailing in the valley of Kashmir and is the dominant *rabi* crop of the Kashmir valley. Rapeseed-Mustard is considerably sensitive to weather as evidenced from the variable response to different dates of sowing (Kumar *et al.,* 2007). Time of sowing is very important for mustard production (Mondal *et al.,* 1999). Optimum sowing time plays an important role to fully exploit the genetic potential of a variety as it provides optimum growth conditions such as temperature, light, humidity and rainfall (Iraddi, 2008). The growth phase of the crop should synchronize with optimum environmental conditions for better expression of growth and yield. Chahal *et al.* (2009) reported highest seed yield in 5th October sowing as compared to 30th October and 25th November sowing. The obtained results of Shargi *et al.,* 2011, demonstrated that one month delay in seed sowing can decrease seed yield from about 10 to 50 per cent in different canola cultivars. The seed yield was significantly higher in 20th October (2049.73 kg ha^{-1}) than 10th November (1437.3 kg ha^{-1}) and 30th November (915.08 kg ha^{-1}) sowing dates (Yadav *et al.,* 2011). Maximum seed yield of 11.0 q ha^{-1} was recorded for YBS-2 which was 12.35% more than the Gulchein (9.79 q ha^{-1}) (Sheikh *et al.,* 2011). Shargi *et al.* (2011) recorded the highest biological yield from GKH group cultivars and recorded lowest biological yield from Zarfam cultivar. Hokmalipour *et al.* (2011) reported that Hyola-410 had highest (4759 kg ha^{-1}) and Sarigol had lowest biological yield (3628 kg ha^{-1}). So higher productivity of brown sarson when grown with adequate monetary inputs is dependent upon adjustment with optimum thermal and radiation environment. Keeping in view of these facts, the present investigation was carried out to study the effect of date of sowing and varieties on yield of Brown Sarson (*Brassica rapa* L.) under temperate Kashmir.

II. MATERIALS AND METHODS

A field experiment was conducted at KVK, Gandarbal, Shuhama, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir during *rabi* season 2011-12 situated at 34° 11′ 40.87″ N latitude and 74° 49′ 33.42″ E longitude at an altitude of 1639.5 meters above mean sea level. The soil was silty clay loam, neutral in reaction (pH 7.9), high in organic Carbon (1.14%) and medium in available nitrogen (516 kg ha^{-1}), phosphorus (16 kg ha^{-1}) and potassium (248 kg ha^{-1}). During crop growth period (39th to 23rd Standard Meteorological Weeks) total rainfall received was 435.7 mm and the maximum temperature ranged between -1 to 35.5°C, while minimum ranged between -6.6 °C to 20 °C with relative humidity of 38 to 97 per cent at morning hours and ranged between 21 to 96 per cent minimum at afternoon. The experiment was laid out in split plot design and consisted of three dates of sowing, *viz.*, 1st October, 15th October and 30th October in main plot and four varieties, *viz.*, KOS-1, Gulchein, Shalimar Brown Sarson-1 and P-3 in sub plot replicated four times. KOS-1 has adoptability for low temperature and moderately resistant to aphids.

Gulchein (KS 101) is suitable for Valley conditions and high altitude areas of Jammu. It is tolerant to *Alternaria* leaf spot and white rust. Shalimar Brown Sarson-1 and P-3 has tolerance to *Alternaria* blight and white rust and suitable for rice-sarson cropping system. These are the released varieties of SKUAST-Kashmir. Full recommended dose of phosphorus and potassium through Diammonium phosphate (DAP) and Muriate of Potash (MOP) at the rate of 60 Kg P_2O_5 ha^{-1} and 30 Kg K_2O ha^{-1}, respectively was uniformly applied to each plot at the time of sowing. Nitrogen @ 60 Kg ha^{-1} in the form of urea was applied in two split doses, 1st split dose @ 30 Kg ha^{-1} was applied at the time of sowing and 2nd split dose @ 30 Kg ha^{-1} was applied at the time of initiation of flowering. Brown sarson was sown manually using a seed rate of 7.5 Kg ha^{-1} at row spacing of 30 cm. Plant population was maintained by thinning and gap filling before rosette stage of the crop. The gaps were filled by transplanting the seedlings, taken from the dense stands of population. The soil texture was determined by International Pipette method, soil pH by using Systronics pH meter, Organic carbon by Walkley and Black method, available N was determined by Alkaline permanganate method, available phosphorus was determined by Olsen's method and available potassium was determined by Flame photometer method. The observations recorded were yield, yield components and days taken to different phenological stages. Oil content (%) of sun dried seeds was estimated by Nuclear Magnetic Resonance (NMR) method. The yield from each plot was recorded separately as kg $plot^{-1}$ and then converted in q ha^{-1}. Oil yield was calculated by using following formula.

$$\text{Oil yield (kg/ha)} = \frac{[\text{Seed oil content (\%)} \times \text{Seed yield (kg ha}^{-1})]}{100}$$

III. RESULTS AND DISCUSSION

Effect of date of sowing : Early planting on 1st October has taken lesser number of days for seedling emergence and rosette stage as compared to later sowing dates. It might be due to favourable higher soil and air temperature on 1st October sowing which play an important role in seed germination and emergence and low soil and air temperature in delay sowing. These results were in conformity with the results of Nykiforuk and Johnson-Flanagan (1994), Pavlista *et al.* (2011). However, from flower bud initiation stage delayed sowing decreased the number of days to reach different phenological stages, it might be due to higher temperature after flower bud initiation stage which fulfil the requirement of growing degree days and thermal units of crop for achieving different phenological stages in lesser days as compared to early sown crop when day and night temperature was lower at later stages (Table 1). Similar findings were reported by Bhuiyan *et al.* (2008), Aziz *et al.* (2011) and Hokmalipour *et al.* (2011). In the present investigation delayed planting of brown sarson resulted in a significant decline in the yield contributing components *i.e*., number of primary and secondary branches $plant^{-1}$, number of siliqua $plant^{-1}$, number of seeds $siliqua^{-1}$ and 1000 seed weight (Table 2). This might be due to reduced growing period and higher temperature which increased the respiration rate of plant at later stages which results in reduced net photosynthesis and its translocation from source to sink during reproductive stage. These results are in consonance with the study of Rafiei *et al*. (2011) and Shargi *et al.* (2011). Significantly maximum seed yield, stover and biological yield was obtained with 1st October sowing (Table 3), it might be due to the fact that the early sown crop got longer time period to utilize available resources and favourable temperature at later growth stages while shorter time available for the late sown crop to utilize available growth factors (light, nutrients, moisture *etc.*) responsible for lower LAI and poor plant growth which results poor dry matter accumulation for the production and partitioning of assimilates to sink for better vegetative growth, leading to a decline of yield and yield contributing components than the timely sown crop. These results are in agreement with the results of Shargi *et al.* (2011), Walton *et al.* (2011) and Rafiei *et al.* (2011). Variety P-3 sown on 1st October recorded significantly higher seed yield of 19.13 q ha^{-1} (Table 4). The higher seed yield in this interaction might be due to significantly higher number of primary and secondary branches per plant, higher number of siliqua per plant and 1000 seed weight. These results are in accordance with those of Iraddi, (2008), Kushwaha *et al.* (2009) and Hokmalipour *et al.* (2011). 1st October sowing recorded significantly higher oil yield (633.58 kg ha^{-1}). It might be due to higher seed yield. These results are in conformity with the findings of Singh *et al.,* 2002, Iraddi, 2008 and Shargi *et al.***,** 2011. It was observed from the investigation that Oil content (%) was not influenced significantly by sowing time and varieties (Table 3). These results were inconformity with the results of Pavlista *et al.* (2011).

Effect of varieties : There was non significant difference between varieties in days taken to different phenological stages. It might be due to same maturity period. Similar results were obtained by Gunasekera *et al.* (2001) (Table 1). In the present investigation variety P-3 resulted in the increase in yield components like number of primary and secondary branches $plant^{-1}$, number of siliqua $plant^{-1}$, number of seeds $siliqua^{-1}$ and 1000-seed weight (Table 2). It might be due to genetic potential of the varieties. These results are in conformity with the findings of Anjum *et al.* (2005), Rehman *et al.* (2009) and Hokmalipour *et al.* (2011). Maximum seed, stover, oil and biological yield were obtained from variety P-3 (Table 3).

The higher yield with this variety might be attributed to significantly higher number of primary and secondary branches plant^{-1}, number of siliqua plant^{-1} and number of seeds siliqua^{-1}. These results are in conformity with the findings of Iraddi (2008).

Table I: Days taken to reach different phenological stages as influenced by date of sowing and varieties

Treatments	Emergence	Rosette stage	Flower bud initiation	Flower Initiation	80% plants start flowering	Physiological maturity
Sowing date						
1st October	6.4	46.6	131.3	159.8	165.5	225.1
15th October	7.4	57.06	122.1	156.9	160.4	221.4
30th October	12.4	67.31	121.5	145.3	150.9	208.7
SEm±	0.11	0.43	2.0	1.31	1.1	0.80
CD (p=0.05)	0.4	1.58	6.7	4.5	3.6	2.7
Varieties						
KOS-1	8.6	56.41	122.0	153.4	159.0	217.7
Gulchein	8.5	56.75	125.9	154.1	158.3	219.0
Shalimar Brown Sarson-1	8.5	57.66	125.5	154.4	159.3	218.6
P-3	9.1	57.25	127.1	153.6	159.0	218.3
SEm±	0.18	0.61	1.8	1.17	1.6	1.9
CD (p=0.05)	NS	NS	NS	NS	NS	NS

Table II: Yield attributes of Brown sarson as influenced by sowing date and varieties

Treatments	No. of primary branches plant^{-1}	No. of secondary branches plant^{-1}	No. of siliqua plant^{-1}	No. of seeds siliqua^{-1}	Siliqua length (cm)	1000-seed weight
Sowing date						
1st October	4.4	9.8	367.6	21.4	6.1	2.27
15th October	3.8	8.3	339.9	20.6	6.1	2.14
30th October	3.7	7.4	299.5	16.8	6.0	2.08
SEm ±	0.07	0.06	7.3	0.26	0.54	0.36
CD (p=0.05)	0.24	0.22	25.5	0.9	NS	0.12
Varieties						
KOS-1	3.9	7.5	335.9	20.2	6.1	2.15
Gulchein	3.8	6.9	320.6	18.2	6.0	2.11
Shalimar Brown Sarson-1	3.9	9.0	337.6	18.6	5.9	2.15
P-3	4.4	10.6	348.5	21.5	6.2	2.23
SEm±	0.6	0.13	5.9	0.17	0.08	0.33
CD (p=0.05)	0.18	0.38	17.24	0.51	0.23	NS

Table III: Yield (q ha^{-1}), oil content (%) and oil yield (kg ha^{-1}) as influenced by date of sowing and varieties

Treatments	Seed yield	Stover yield	Biological yield	Oil content	Oil yield
Sowing date					
1st October	17.72	56.73	74.45	35.73	635.07
15th October	13.62	39.93	53.56	35.40	483.08
30th October	6.60	20.85	27.46	36.85	244.49
SEm ±	0.29	0.98	0.76	0.81	9.85
CD (p=0.05)	1.02	3.41	2.63	NS	34.06
Varieties					
KOS-1	12.15	37.29	49.45	36.01	433.30
Gulchein	11.61	38.01	50.28	35.71	410.11
Shalimar Brown Sarson-1	12.59	39.49	52.09	36.13	458.02
P-3	14.24	41.23	55.48	36.12	515.42
SEm±	0.37	0.76	1.04	0.76	19.54
CD (p=0.05)	1.09	2.22	3.02	NS	56.70

Table: IV: Interaction effect of sowing date and varieties on the seed yield (q ha^{-1}) of Brown sarson

Treatments	KOS-1	Gulchein	Shalimar Brown Sarson-1	P-3
1st October	15.78	17.74	18.23	19.13
15th October	12.87	12.25	13.83	15.55
30th October	7.81	4.85	5.72	8.04
	Difference between varieties at same level of sowing date.		Difference between sowing date at same or different types of varieties	
SEm±	0.65		0.64	
CD (p=0.05)	1.89		1.93	

IV. SUMMARY AND CONCLUSION

The results of the investigation showed that amongst different dates of sowing and varieties, the combination of 1st October sowing and variety P-3 realized significantly higher seed and oil yield of brown sarson. The delay in sowing time resulted a decline in the yield. In view of the findings it could be recommended that for realising economically higher seed and oil yield timely sowing with variety P-3 is suitable. However, for delayed sowing after P-3, KOS-1 is more beneficial over Shalimar brown sarson -1 and Gulchein in temperate Kashmir

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