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SHORT NOTE

Effect of Temporal and Varietal Variability on Growth and Developmental Parameters of Brown Sarson (*Brassica rapa* L. Var. *Oleifera*) Under Temperate Kashmir Condition

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ABSTRACT

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 to study the effect of temporal and varietal variability on growth and developmental parameters of brown sarson (*Brassica rapa* L. var. Oleifera) in split plot design, consisted of three dates of sowing in main plot and four varieties in sub plot replicated four times. The results revealed significant increase in growth parameters, like plant height, dry matter accumulation and partitioning, leaf area with 1st October sowing as compared to 15th and 30th October sowing. Among varieties, P-3 revealed significant increase in growth parameters than Shalimar Brown Sarson-1, Gulchein and KOS-1. Maximum seed yield i.e. 17.72q ha^{-1}, stover yield (56.73 q/ha)and oil yield (635.07 kg/ha)was obtained with 1st October sowing, than 15th October and 30th October sowing. However, in respect of varieties P-3 recorded higher yields of seed, stover and oil.

***Keywords*:** Sowing date, Dry matter partitioning, Phenology, LAI

INTRODUCTION

Rapeseed and mustard are the major oilseed crops, traditionally grown everywhere in the country due to their high adaptability in conventional farming systems (Singh *et al.*, 2014). Brown sarson 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.However, the productivity of oilseed (brown sarson) in Kashmir valley is very low (6-8 q/ha). The low productivity is mainly attributed to the fact that the farmers mainly grow the traditional varieties and land races which are not only low yielding but highly susceptible to biotic and abiotic stresses. Among the abiotic stress, climatic factors are responsible for lower productivity of brown sarson as lower temperature restricts the cultivation of high yielding mustard varieties in the temperate valley condition. Brown sarson is mainly grown in valley on stored moisture regimes of winter snowfall. 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). Due to variable topography of Kashmir valley the environmental condition are varied with little spatial variationwhich affect the temperature variability in pockets and a common recommendation of sowing time and varieties are not suitable for all the site of valley. Therefore, there is need to find out the suitable sowing time and variety in relation to site specific environmental condition. The growth phase of the crop should synchronize with optimum environmental conditions for better expression of growth, development and yield. Keeping in view of these facts, the present investigation was carried out to study the effect of temporal and varietal variability on growth and developmental

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parameters of Brown Sarson (*Brassica rapa* L. var. Oleifera) under temperate Kashmir.

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 34º 11¢ 40.87¢¢ N latitude and 74º 49¢ 33.42¢¢ E longitude and at an altitude of 1639.5 meters above mean sea level. During crop growth period (39th to 23rd Standard Meteorological Weeks) the maximum temperature ranged between -1 to 35.5ºC, while minimum ranged between -6.6^{0}C to 20ºC with relative humidity of 38-97% maximum and ranged between 21% to 96% minimum.The soil was silty clay loam in texture, slightly alkaline in reaction and medium in available nitrogen, phosphorus and potassium with high organic carbon.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. The crop was fertilized with 60: 60: 30 kg NPK/ha. Brown sarson was sown manually using a seed rate of 7.5 Kg/ haat row spacing of 30 cm. The observations recorded were phenology, plant height,Leaf area, dry matter accumulation and partitioning at various phenological stages, yield and yield attributes.Leaf area was measured by disc method as suggested by Vivekanandan *et al.* (1972).

RESULTS AND DISCUSSION

Data presented in table 1 indicated that days taken to various phenological stages viz., emergence, rosette stage, flower bud initiation, flower initiation, 80 % plants start flowering and physiological maturity differed significantly with respect to sowing time but there was the non-significant effect of brown sarson varieties on days taken to various phenological stages. 1st October sowing has taken lesser number of days to emergence and rosette stage (6.4, 46.6 days) as compared to 15th October (7.4, 57.06) and 30th October (12.4, 67.31) sowing, respectively. But for reaching to flower bud initiation, flower initiation, 80 % plants start flowering and physiological maturity, sowing of brown sarson at 1st October has taken significantly more number of days (131.3, 159.8, 165.5 and 225.1 days)) as compared to 15th October (122.1, 156.9, 160.4 and 221.4 days) and 30th October sowing (121.5, 145.3, 150.9 and 208.7 days), respectively.

Table 1 : Days taken to reach different phenological stages, plant height at maturity and leaf area (cm^2/plant)as influenced by date of sowing and varieties.

Treatments	Phenological Stages							Leaf Area				
	Emergence	Rose its Stage	Flower bud initiation	Flower Initiation	80% plants start flowering	Physiological maturity	Plant height (cm)	Rosette stage	30 days after rosetee stage	Flower bud initiation	Flower initiation	80% plants start flowering
1st October	6.4	46.6	131.3	159.8	165.5	225.1	144.7	23.90	54.28	123.90	203.64	226.4
15th October	7.4	57.06	122.1	156.9	160.4	221.4	130.8	8.95	31.68	61.86	143.51	185.70
30th October	12.4	67.31	121.5	145.3	150.9	208.7	108.9	7.54	9.40	22.99	105.58	126.51
SEm ±	0.11	0.43	2.0	1.31	1.1	0.80	1.2	0.34	0.65	0.45	2.70	5.06
CD (P=0.05)	0.4	1.58	6.7	4.5	3.6	2.7	4.2	1.18	2.26	1.57	9.52	15.9
Varieties												
KOS-1	8.6	56.41	122.0	153.4	159.0	217.7	127.6	9.77	28.72	63.91	134.84	139.25
Gulchein	8.5	56.75	125.9	154.1	158.3	219.0	120.1	10.90	29.18	66.56	137.29	163.28
Shalimar Brown Sarson-18.5 196.64			57.66	125.5	154.4	159.3	218.6	123.8	15.40	31.05	70.46	164.03
P-3	9.1	57.25	127.1	153.6	159.0	218.3	141.1	17.78	38.21	77.40	167.49	219.01
SEm±	0.18	0.61	1.8	1.17	1.6	1.9	2.5	0.23	0.51	1.13	3.3	4.79
CD (P=0.05)	NS	NS	NS	NS	NS	NS	7.2	0.66	1.50	3.28	9.72	13.90

Early planting on 1st October has taken lesser number of days to seedling emergence and to reach rosette stage as compared to later sowing dates. It might be due to favourable higher soil and air temperature on 1st October sowing and low soil and air temperature in delay sowing. However, except emergence, rosette and flower bud initiation stage delayed sowing decreased the number of days to reach different phenological stages, 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. These results are quite similar to the results of Bhuiyan *et al.* (2008)

Among varieties, variety P-3 recorded significantly higher plant height, higher leaf area plant^{-1}and higher dry matter accumulation followed by Shalimar Brown Sarson-1, KOS-1 and Gulchein. Higher plant heightmay be attributed to its genetic potential. Higher leaf area plant^{-1}might be due to taller plants as it is a well-known fact that concurrent increase in plant height tend to increase the number of leaves/ plant, which in turn increases the leaf area/plant. Higher dry matter accumulation in P-3 variety might be due to better partitioning of dry matter into various plant partswith taller plant sand higher leaf area/ plant which might have contributed more dry matter production. Similar findings were reported by Kushwaha *et al.* (2009).

Table 2a: Dry mater accumulation (g/m^{-2}) and partitioning at rosette stage,30 days after rosette stage and flower bud initiation as influenced by date of sowing and varieties.

Treatments	**Rosette stage**				**30 days after rosette stage**				**Flower bud initiation**			
	Roots	**Stem**	**Leaves**	**Total**	**Roots**	**Stem**	**Leaves**	**Total**	**Roots**	**Stem**	**Leaves**	**Total**
Sowing date												
1st October	3.92	9.49	26.94	40.36	21.12	31.28	70.21	122.62	59.72	104.56	135.22	299.5
15th October	2.66	6.45	17.30	26.41	8.54	18.30	34.86	61.70	9.19	33.07	36.73	79.00
30th October	1.95	3.59	9.60	15.15	3.19	5.15	10.73	19.07	4.12	10.04	15.64	29.81
SEm ±	0.07	0.11	0.16	0.22	0.31	0.36	0.33	0.42	0.63	1.16	2.06	2.12
LSD 0.05	0.27	0.39	0.58	0.78	1.08	1.25	1.15	1.48	2.18	4.03	7.15	7.35
Varieties												
KOS-1	2.29	4.03	10.35	16.68	7.78	11.07	24.07	42.94	15.89	32.97	42.14	91.01
Gulchein	2.37	4.23	12.51	19.12	10.01	15.03	26.77	51.82	20.23	34.19	51.07	105.51
Shalimar Brown Sarson-1	2.64	7.17	19.20	29.01	11.01	20.21	33.41	64.53	27.52	54.49	64.73	146.75
P-3	4.07	10.62	29.72	44.42	14..99	26.66	70.15	111.81	33.72	75.23	92.18	201.75
SEm±	0.09	0.15	0.31	0.42	0.37	0.44	0.69	0.90	0.98	1.02	1.84	1.89
LSD 0.05	0.28	0.46	0.91	1.22	1.08	1.28	2.01	2.63	2.85	2.96	5.3	5.47

The 1st October sowing recorded significantly taller plants with more dry matter accumulation and leaf areaas compared to 15th October and 30th October sowing because of the fact that the early sown crop got longer time period to utilize available resources fully and favourable temperature at later growth stages which results in better accumulation of photosynthates and better partitioning of dry matter into various plant parts*viz.*, in roots, leaves, stem and siliqua, favourable for increasing leaf area. These results are in agreement with the findings of 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, number of siliqua/plant, number of seeds/siliqua and 1000 seed weight etc. This might be due to reduced growing period, higher temperature increased the respiration rate of plant at later stage which results in reduced net photosynthesis and its translocation from source to sink during reproductive stage. This result is in consonance with the study of Rafiei *et al.* (2011).

Maximum seed yield i.e. 17.72 q/ha was obtained

Table 2b : Dry mater accumulation (g m^{-2}) and partitioning at flower Initiation, 80 % plants start flowering and physiological maturity as influenced by date of sowing and varieties

Treatments	Flower Initiation				80 % Plants Start Flowering					Physiological Maturity				
	Roots	Stem	Leaves	Total	Roots	Stem	Leaves	Inflo-rescence	Total	Roots	Stem	Leave	Siliqua	Total
1st October	81.43	299.9	143.47	524.80	112.63	641.64	154.49	88.45	997.21	66.80	1758.45	96.77	640.43	2562.46
15th October	21.80	78.72	56.41	156.94	64.61	403.41	57.60	47.10	572.74	38.50	966.26	48.95	384.69	1434.48
30th October	9.97	36.68	26.31	72.97	35.19	294.13	40.06	32.73	402.11	22.24	791.23	34.95	225.59	1077.95
SEm ±	1.39	5.82	1.56	6.28	2.41	3.83	1.48	0.26	6.38	0.47	5.23	1.76	6.25	10.43
LSD 0.05	4.83	20.14	5.41	21.73	8.33	13.23	5.13	0.90	22.06	1.64	18.08	6.10	21.61	36.07
Varieties														
KOS-1	32.93	85.57	52.45	170.96	62.27	401.29	65.71	48.36	577.64	39.00	1022.20	37.19	341.29	1439.69
Gulchein	34.03	84.56	62.22	180.82	72.01	413.88	81.10	52.90	619.90	42.39	1103.03	52.66	353.10	1552.03
Shalimar Brown Sarson-1	41.95	173.55	79.31	294.82	73.18	463.56	90.41	58.23	685.97	43.71	1231.03	74.68	455.00	1804.44
P-3	42.01	210.04	107.60	359.68	75.76	506.83	98.99	64.88	745.90	44.96	1330.83	76.35	518.22	1970.37
SEm±	1.14	9.66	3.24	5.38	1.56	7.49	1.45	0.72	8.18	0.96	5.3	1.65	5.90	8.46
LSD 0.05	3.30	26.2	9.40	15.61	4.54	21.75	4.21	2.09	22.31	2.78	15.47	4.79	17.13	24.56

with 1st October sowing. The delayed sowing (30th October) recorded a decline in the seed and stover yield, because of 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 various sink for better vegetative growth, leading to a decline of yield and yield contributing components than the timely sown crop. Other reason for lower yield under delayed sowing might be due to prevalence of higher temperature during flowering and grain filling phases which caused forced maturity to the crop. These results are in agreement with the results of Shargi *et al.* (2011).

Table 3: Yield attributes and yield of brown sarson as influenced by sowing date and varieties.

Treatment	No.of primary branches	No. of secondary branches/ plant	No.of Silqua/ plant	No. of seeds siliqua	Silliqua length (cm)	1000 seed weight (g)	Seed yield (q/ha)	Stover yield (q/ha)	Oil content (%)	Oil yield (kg/ha)
1st October	4.4	9.8	367.6	21.4	6.1	2.27	17.72	56.73	35.73	635.07
15th October	3.8	8.3	339.9	20.6	6.1	2.14	13.62	39.93	35.40	483.08
30th October	3.7	7.4	299.5	16.8	6.0	2.08	6.60	20.85	36.85	244.49
SEm ±	0.07	0.06	7.3	0.26	0.54	0.36	0.29	0.98	0.81	9.85
LSD 0.05	0.24	0.22	25.5	0.9	NS	0.12	1.02	3.41	NS	34.06
Varieties										
KOS-1	3.9	7.5	335.9	20.2	6.1	2.15	12.15	37.29	36.01	433.30
Gulchein	3.8	6.9	320.6	18.2	6.0	2.11	11.61	38.01	35.71	410.11
Shalimar Brown Sarson-1	3.9	9.0	337.6	18.6	5.9	2.15	12.59	39.49	36.13	458.02
P-3	4.4	10.6	348.5	21.5	6.2	2.23	14.24	41.23	36.12	515.42
SEm±	0.6	0.13	5.9	0.17	0.08	0.33	0.37	0.76	0.76	19.54
LSD 0.05	0.18	0.38	17.24	0.51	0.23	NS	1.09	2.22	NS	56.70

It is concluded from the experiment that the date of sowing had a non-significant effect on oil content (%) of the crop.These results were inconformity with the results of Pavlista *et al.* (2011). Oil yield also followed similar trend as that of seed yield. 1st October sowing recorded significantly higher oil yield (633.58 kg/ha). The higher oil yield in early sowing might be due to higher seed yield. These results are in conformity with the findings of Iraddi, 2008 and Shargi *et al.*, 2011.

CONCLUSION

It was concluded that significant increase in growth parameters, like plant height, dry matter accumulation and partitioning,leaf area with 1st October sowing as compared to 15th and 30th October sowing. Among varieties, P-3 revealed significant increase in growth parameters than Shalimar Brown Sarson-1, Gulchein and KOS-1. The same trend was followed for seed, stover yield and oil yield.

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