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Effect of irrigation and nitrogen on performance of Indian mustard (*Brassica juncea*) and sunflower (*Helianthus annuus*) under two dates of sowing

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ABSTRACT

An experiment was conducted on comparative performance of Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson] and sunflower (*Helianthus annuus* L.) during the winter (*rabi*) season of 1995–96 and 1996–97 at New Delhi. Indian mustard outyielded sunflower. Indian mustard sown in the third week of October gave higher yields. Higher levels of irrigation and nitrogen did not bring significant improvement in the yields over lower levels.

Key words : Indian mustard, Sunflower, Dates of sowing, Irrigation, Nitrogen

Indian mustard is a potential winter season oilseed crop in north-western plains of India. Sunflower can be successfully grown in all the seasons. However, it takes more time when grown in winter season in north-western zones. Sometimes farmers are not able to sow the Indian mustard at optimum time, and late sowing may cause considerable loss of yield due to heavy infestation of aphids (*Lipaphis erysimi* Kalt.) and white rust (*Albugo candida*). Under such circumstances, there is a need to study possible substitution of late-sown Indian mustard by sunflower. Therefore an experiment was planned to study the comparative performance of Indian mustard and sunflower in relation to dates of sowing, irrigation and nitrogen.

MATERIALS AND METHODS

An experiment was conducted during the winter (*rabi*) seasons of 1995–96 and 1996–97 at the Division of Agronomy, Indian Agricultural Research Institute, New Delhi. The treatments consisting of combination of crops, viz. Indian mustard and sunflower, and 2 dates of sowing (third week of October and November) formed the main plots and combination of 2 levels of irrigations, viz. (1 irrigation and 2 irrigations) and 2 doses of N (40 and 80 kg/ha) were assigned to the subplots. Thus 16 treatments were tested in split-plot design with 3 replications. The soil of the site was sandy loam, tested low in organic carbon (0.34%), medium in available P (11.3 kg/ha) and K (165.2 kg/ha), with pH 7.8.

Indian mustard 'Pusa Jaikisan' and sunflower hybrid 'MSFH 8' were sown at a row distance of 50 cm on 19 October and 17 November in 1995 and 16 October and 18 November in 1996 under respective treatments. A basal dose of 40 kg/ha P_2O_5 was applied through single superphosphate at sowing. Nitrogen was applied through urea in 2 splits. Irrigation in 1 irrigation treatment was applied at full bloom stage of Indian mustard and bud-formation stage in sunflower, whereas in 2 irrigation treatments, first and second irrigations were applied at flower initiation and pod-development stages in mustard and vegetative and flowering stages in sunflower. Indian mustard was harvested 153 and 141 days after sowing in respective dates. Whereas sunflower was harvested at 126 and 131 days in the first year and 139 and 142 days in the second year under respective dates of sowing. In respective seasons, 24.0 and 7.0 mm rains were received in the third week of January and the first week of February. Daily mean temperatures remained below 20°C between the third week of November and February in 2 seasons as during this period minimum temperatures dropped below 10°C. In 1996–97 minimum temperatures remained below 5°C during the second week of December and third week of January.

RESULTS AND DISCUSSION

Comparison of crops

Data on seed yield of 2 oilseeds (Table 3) indicated that in both the years Indian mustard outyielded sunflower. Seed yield of Indian mustard was 91.7 and 81.1% higher than sunflower yield in respective years.

Table 1. Effect of date of sowing, levels of irrigation and nitrogen on dry matter and yield attributes of Indian mustard

Treatment	Dry matter (g/plant) at harvest		Branches/ plant		Pods/ plant		Seed weight/ plant (g)	
	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97
Date of sowing								
October 3rd week	125.4	86.5	7.3	7.4	489	318	41.3	25.6
November 3rd week	86.5	68.0	7.7	7.9	401	283	24.2	17.9
CD (P=0.05)	29.1	14.8	NS	NS	41	25	10.5	4.9
Irrigation								
1 irrigation	105.0	79.2	7.6	7.9	455	324	32.5	21.7
2 irrigations	107.1	75.4	7.5	7.3	434	277	33.0	21.8
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Nitrogen								
40 kg/ha	101.0	73.0	7.1	7.3	413	300	31.5	21.0
80 kg/ha	111.1	81.5	8.0	7.9	476	301	33.9	22.5
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS

Table 2. Effect of date of sowing, level of irrigation and nitrogen on dry matter and yield attributes of sunflower

Treatment	Dry-matter (g/plant) at harvest		Capitulum diameter (cm)		Seed weight/ capitulum (g)	
	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97
Date of sowing						
October 3rd week	224.8	107.8	15.1	13.7	20.8	17.8
November 3rd week	180.8	103.2	13.0	13.4	29.2	28.1
CD (P=0.05)	13.3	NS	NS	NS	7.1	8.2
Irrigation						
1 irrigation	192.4	93.0	14.3	13.7	23.9	21.5
2 irrigation	213.2	118.0	13.8	13.4	26.1	24.8
CD (P=0.05)	NS	18.2	NS	NS	NS	NS
Nitrogen						
40 kg/ha	212.8	100.7	13.9	13.4	24.1	22.9
80 kg/ha	192.8	110.4	14.2	13.7	25.9	23.0
CD (P=0.05)	NS	NS	NS	NS	NS	NS

Table 3. Effect of date of sowing, level of irrigation and nitrogen on seed yield of Indian mustard and sunflower

Treatment	Seed yield (q/ha)					
	1995–96			1996–97		
	October	November	Mean	October	November	Mean
Crops × dates						
Indian Mustard	34.69	19.81	27.25	27.99	13.19	20.59
Sunflower	12.02	16.39	14.21	6.95	15.79	11.37
Mean	23.36	18.10		17.46	14.49	
CD (P=0.05)	*Crops*	*Dates*	*Crops × dates*	*Crops*	*Dates*	*Crops×dates*
	1.71	1.71	2.51	1.59	1.59	2.28
Irrigation						
1 irrigation	24.62	17.97	21.30	17.31	14.37	15.81
2 irrigations	22.08	18.22	20.16	17.64	14.65	16.14
CD (P=0.05)	*Irrigation*	*Dates × irrigation*		*Irrigation*	*Dates × irrigation*	
	NS	NS		NS	NS	
Nitrogen (kg/ha)						
40	22.24	18.78	20.51	16.96	13.42	15.19
80	24.48	17.42	20.95	17.98	15.57	16.77
CD (P=0.05)	*Nitrogen*	*Dates × nitrogen*		*Nitrogen*	*Dates × nitrogen*	
	NS	2.17		1.37	NS	

Effect of date of sowing

Date of sowing recorded distinct influence on growth and development of both the crops in 2 years (Table 1). Indian mustard sown in the third week of October produced higher dry matter/plant than that in November sown in 2 years. Significantly higher number of pods and seed weight/plant were also recorded from October-sown crop in 2 years (Table 1).

As a result of increase in dry matter and yield attributes of Indian mustard, crop sown in the third week of October gave significantly higher seed yield than November-sown crop (Table 3).

Low temperatures at vegetative and flowering stages caused slow growth and delayed phenological stages in November-sown crop. This also resulted in poor development of individual plant of Indian mustard. Hence November-sown crop of Indian mustard gave lower seed yield. Similar observations were made by Saran and Giri (1987).

Effect of date of sowing on growth of sunflower was also recorded as crop sown in the third week of October produced higher dry matter/plant than the crop sown in November third week (Table 2). However, seed weight/capitulum was significantly higher in November-sown crop. This resulted in significantly higher seed yield of sunflower sown in the third week of November over the crop sown in third week of October (Table 3).

Low temperatures in November-sown crop at early stage resulted in low dry-matter accumulation and delayed the bud-formation and flowering stages of the crop. However, vegetative growth stage of October-sown crop coincided with congenial temperatures which resulted in higher dry-matter accumulation/plant. Contrary to this, October-sown crop encountered with temperatures below 20^0C at reproductive stage which resulted in poor seed filling. November-sown crop remained in vegetative stage for longer period, came to bud formation in mid-February and to flowering in the first week of March. At this time, temperature had reached at the level suitable for development of sunflower. Diepenbrock (1988) reported the optimum temperatures for the good growth and development of sunflower as above 20^0C.

Effect of irrigation

Growth and yield attributes of Indian mustard (Table 1) and sunflower (Table 2) revealed that there was no significant difference between 1 and 2 irrigations in 2 years in respect of these parameters except dry-matter accumulation/plant in sunflower in 1996–97 where 2 irrigations proved to be significantly better than 1 irrigation.

As evidenced by yield attributes of 2 crops, seed yield of 2 oilseeds (Table 3) also did not significantly differ due to irrigation levels in either of the years. This was because these crops under both the dates of sowing were sown with pre-sowing irrigation. Moreover, winter rains (7.0 and 24.0 mm in respective years) at reproductive stages mitigated the effect of irrigation.

Effect of nitrogen

Application of 40 and 80 kg N/ha remained at par for dry-matter accumulation and yield attributes of Indian mustard and sunflower in 2 years (Tables 1, 2).

However, application of 80 kg N/ha recorded significantly higher seed yield of 2 oilseeds over 40 kg N/ha in 1996–97.

Interaction effect

Interaction between dates of sowing and crops on seed yield was significant (Table 3). Indian mustard when sown in October recorded significantly higher seed yield than that sown in November, whereas sunflower recorded significantly higher seed yield from the November–sown crop in 2 years. This was because ideal time of Indian mustard sowing is mid-October in north–western plains of India (Saran and Giri, 1987). Bhargava *et. al.* (1983) also reported that late-formed flowers develop pods with fewer and lighter seeds and adversely affect the final seed yield in Indian mustard. This is also evident from the observation on growth and yield attributes of Indian mustard (Table 1). Low temperatures under late-sown crop delayed the flowering. Hence this crop had short pre-siliqua growth and development phase, whereas October-sown crop had longer period for development of siliqua and seed. Contrary to this, temperature, below 20^{0}C at seed-filling stage was responsible for low seed yield under October-sown crop of sunflower. However, congenial temperatures at seed-filling stage in November-sown sunflower crop caused to produce higher seed yield.

Interaction between dates of sowing and nitrogen levels was also significant in 1995–96 (Table 3). This indicated that October-sown crops gave significantly higher seed yield with 80 kg N/ha, whereas seed yield recorded form November-sown crops remained at par at 2 levels of N.

REFERENCES

Bhargava, S.C., Tomar, D.P.S. and Sinha, S.K. 1983. Physiological basis of plant type in different brassica. (In) *Sixth International Rapeseed Conference,* Paris, held during 7–19 May 1983.

Diepenbrock, W. 1988. Yield development in sunflower a survey. *Plant Research and Development* **27** : 38–59.

Saran, G. and Giri, G. 1987. Influence of dates of sowing on *Brassica* species under semi-arid rainfed conditions of north-west India. *Journal of Agricultural Science, Cambridge* **108** : 561–566.