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Effect of Seed Size and Osmo-Priming on Yield and its Component Characters in Indian Mustard (*Brassica nigra* L.)

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ABSTRACT: Rapeseed mustard is a major oilseed crop of India. Rapid seedling establishment is an important requirement for successful crop production. Seedling establishment and speed of emergence influence the time required for seedling to reach the autotrophic phase. The present investigation showed that, influence of seed size differed significantly for two traits viz No. of secondary branches and days to 50% flowering and it was non-significant for other traits. The effect of priming treatments differed significantly for five traits; viz days to flowering, days to 50% flowering, No. of primary branches, No. of secondary branches and seed yield per plant ; whereas, it was non-significant for other yield attributing traits. Hydro priming had a prominent effect on most of the characters and is a preferable method for improving seed yield. This was followed by KCl treatment, which showed its positive effect on yield related traits like number of seeds per pod and 100 seed weight. The NaCl treatment has good effect in increasing primary branches and reducing number of days required to flowering. Bold seed showed higher number of secondary branches, 100 seed weight and took more number of days to first flowering and 50% days to flowering. Medium sized seeds gave better mean performance for most of the traits under consideration and this was followed by small size seed. All the traits showed positive correlation with yield and were non-significant, indicating that Bold/large seed size and seed priming produces more seed weight.

Key words: Indian mustard, Osmo-priming, Seed size

INTRODUCTION

Rapeseed mustard is a major oilseed crop of India. Rapid seedling establishment is an important requirement for successful crop production. Seed size, as a characteristic of seed quality, influences seedling growth and establishment. Studies of the relationship between seed size and early growth have been reported since early last century. Seedling establishment and speed of emergence influence the time required for seedling to reach the autotrophic phase. Most investigators have a positive relationship between seedling vigor, improved stand establishment and higher productivity of oilseed crops with plants originating from large seed compared to those grown from smaller seed. Seed size plays a major role in germination and establishment of vigorous seedlings and is essential to achieve higher yield. The present investigation was carried out to determine the optimum seed size for improved crop growth and its yield, and the promising treatment combination for seed size and priming.

MATERIALS AND METHODS

The experiment was conducted at the Indian Ag ricultural Research Institute, regional station, Karnal, Haryana during *Rabi* 2012-13. The seed samples were divided in to three categories based on sieving sizes. Seed that remained on top of 1/12" sieve was considered as Bold, that which passed through 1/12" sieve but, failed to pass through 1/15" sieve was considered as Medium and the seed that passed through 1/15" as Small. These seed samples were subjected to five different priming treatments *viz.*,

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Hydration, NaCl (1%), KNO_3 (2%), KCl (0.5%) and Poly Ethylene Glycol-6000 (3%) for 14 hrs at ambient condition then shade dried before sowing. The field experiment was laid out in split plot design with two replications. The three seed size treatments were considered as main and the five priming treatments plus Control as sub plot treatments. Observations were recorded on eight features viz., plant height (m), days to flowering, days to 50% flowering, No. of primary branches, No. of secondary branches, number of seeds/pod, 100-seed weight (g) and plant seed yield (g). The plant height was recorded from the base of the plant to the tip of the shoot apex at 30 and 60 DAS ; and plant height at 60 days is reported in the Results. The day on which 50% of plants showed flowers in the plot was recorded as 50% flowering. The seed yield parameters were recorded by using the standard procedures.

RESULTS AND DISCUSSION

Analysis of variance for different traits

Analysis of variance of the effects of seed size and seed priming on yield and its different attributing traits are presented in Table 1. Seed size influenced significantly for two traits viz No. of secondary branches and days to 50% flowering and it was non-significant for other traits. Priming treatments influenced significantly for five traits viz., days to flowering, days to 50% flowering, No. of primary branches, No. of secondary branches and seed yield per plant whereas, it was non-significant for other yield attributing traits. On the other hand, the interaction of seed size and priming treatments showed significant effect for days to 50% flowering, No. of primary branches, No. of secondary branches and seed yield per plant.

Effect of priming treatments and Seed Size

These are presented in Table 2.

Effect of priming treatments

Seeds primed with NaCl took lesser number of days to flower followed by seeds treated with KCl and hydro priming. Almost a different trend was observed with respect to days to 50% flowering wherein KCl treated seeds required lesser no of days to 50% flowering followed by Control and NaCl treated seeds.

Plants raised from seeds treated with hydropriming showed higher plant height (208.93) over those raised from seeds treated with other priming chemicals. Apart from hydropriming, PEG 6000 treated seeds showed more plant height followed by Control. However, the plant height of KNO_3 and NaCl treated seeds were on par. The increased plant height in hydropriming may be attributed to early emergence and robust growth observed due to soaking of seeds in H_2O one day before sowing. Higher No. of primary branches was observed in NaCl treated seeds (9.67), followed by hydropriming and KNO3 treated seeds. The secondary branches were more

Table 1. Analysis of variance of the effects of seed size and seed priming on field performance of mustard

Source of variation	df	Plant height (m)	Primary branches	Secondary branches	No. of seed/ pod	Days to flowering	Dates to 50% flowering	100-seed weight (g)	Plant seed yield (g)
Replication	1	6357.889	6.934	39.480	0.012	4.694	9.000	0.050	4900
Main plot	2	857.778	11.974	216.268*	5.515	11.861	59.250**	0.004	6458.08
Error(a)	2	109.639	0.861	4.242	3.634	4.861	0.250	0.027	503.58
Sub plot	5	125.478	5.174**	14.405**	0.169	28.761*	30.000**	0.009	5207.26**
Main x Sub	10	118.140	7.885**	16.849**	1.719	15.894	17.750**	0.012	6098.05**
Error(b)	15	231.047	0.963	2.939	4.070	21.072	3.967	0.012	266.32

*-Significant at 5%; **-Significant at 1 %

in hydroprimed seeds followed by KNO_3 treated seed and control plots.

The number of seeds per pod and 100 seed weight are important yield components and represent reproductive efficacy of the crop. Plants raised from KNO_3 treated seeds showed higher No. of seeds per pod (13.05) followed by KCl treated (13.03) and NaCl (13.00) treated seeds. Among different priming treatments, KCl treated seeds recorded higher seed weight (0.30g) followed by NaCl (0.27g) treated and hydro primed seeds (0.26g).

The priming treatments were ranked based on their mean performance for each character ; and the data were pooled so as to see the overall effect of priming treatments on different plant characters. This showed that, simple hydro priming had a prominent effect on most of the characters and is a preferable method for improving seed yield. This was followed by KCl treatment, which showed its positive effect on yield related traits like number of seeds per pod and 100 seed weight. The NaCl treatment has good effect in increasing primary branches and reducing no of days required to flowering. All other priming treatments failed to show any significant positive effect on most of the observed traits.

Effects of seed size

Seed size influenced all the traits. Bold seed showed higher number of secondary branches, 100 seed weight and took more number of days to first flowering and days to 50 % flowering, Medium sized seeds gave better mean performance for most of the traits under consideration. This was followed by small seeded ones. The smaller seed tend to have decreased seed production. A previous study suggested that seed size effects were predominant at the early stage of seedling establishment, with very little

Table 2. Means of field traits for mustard influenced by seed priming treatments and seed size

Treatments	Plant height (m)	Primary branches	Secondary branches	No. of seed/ pod	Days to flowering	Dates to 50% flowering	100-seed (g)	Plant weight seed yield (g)
				Priming treatments				
Control (C)	208.93	7.47	6.78	13.00	43.50	47.00	0.21	153.50
Hydropriming (H)	206.68	7.77	7.88	12.87	42.67	50.00	0.26	201.00
$KN0_3$ (2%) K)	198.76	7.53	7.12	13.05	45.83	51.33	0.21	192.67
KCl (0.5%)	202.83	7.47	6.07	13.03	42.17	46.50	0.30	187.50
NaCl (1%)	198.77	9.67	**3.87**	12.90	40.67	48.33	0.27	128.50
PEG 6000 (3%)	208.10	7.07	**4.57**	12.60	46.33	51.83	0.21	145.83
CD@5%	32.00	2.00	4.00	4.00	10.00	4.00	0.41	35.00
				Seed size				
Bold (B)	194.48	7.42	10.59	12.13	42.42	46.67	0.26	170.83
Medium (M)	210.62	8.97	5.37	13.39	43.83	49.92	0.25	189.92
Small (S)	206.93	7.10	2.18	13.20	44.33	50.92	0.22	143.75
CD@5%	34.00	2.00	5.00	5.00	10.00	4.00	1.58	48.00

Table 3. Correlation coefficients of field parameters

	Plant height (m)	Primary branches	Secondary branches	No. of seed/pod	Days to flowering	Days to 50% flowering	100-seed weight (g)
Primary branches	0.126						
Secondary branches	–0.403	–0.023					
No. of seeds/pod	0.461	0.197	–0.171				
Days to flowering	0.303	–0.168	–0.088	0.001			
Days to 50% flowering	0.386	0.067	–0.297	0.115	0.825**		
100-seed weight (g)	–0.021	0.036	0.194	–0.372	–0.109	–0.053	
Seed yield/plant	0.050	0.077	0.364	0.151	0.062	0.074	0.105

*- Significant at 5%; **-Significant at 1 %

seed size effect afterward. In our study for the most part, plants were thinned to leave only the healthiest seedlings and tried to avoid its initial effects. Although it is often the case that plants from small seedswere more vulnerable to environmental stress. The overall growth of plants was reduced and they have less no of primary and secondary branches and took slightly more days to flower.

Correlation study

The correlation coefficients of yield and different yield attributing traits are presented in Table 3. All the traits showed positive correlation with yield and were non-significant, indicating that increasing seed size and seed priming produces more seed weight. Whereas, negative correlation was observed between plant height with secondary branches and 100 seed weight, secondary branches with days to flowering and number of seeds per pod and 100 seed weight with number of seeds per pod. Only correlation of days to flowering with days 50% flowering was significant (0.825).

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