Journal of Oilseed Brassica, 9 (2) : 164-167, July 2018

Effect of seed size and osmo-priming on yield and its component characters in *Brassica nigra L*

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(Received: 05 May 2018; Revised: 16 May 2018; Accepted: 11 June 2018)

Abstract

Indian mustard is a major edible oilseed crop cultivated in India. Rapid seedling establishment is an important requirement for successful crop production in wetland and dry land farming systems. Seedling establishment and speed of emergence influence the time required for seedling to reach the autotrophic phase. The present investigation showed that, Seed size differed significantly for the traits secondary branches and days to 50% flowering and it was non-significant for other traits. The priming treatments differed significantly for traits; days to flowering, days to 50% flowering, primary branches, secondary branches and seed yield per plant whereas, it was non-significant for other yield attributing traits. The hydro priming had a prominent effect on most of 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. It has been observed that the medium sized seeds gave better mean performance for most of the traits under consideration. This was followed by small seeded ones. All the traits showed positive correlation with yield and were non-significant, indicating that increasing seed size and seed priming produces more seed weight.

Key words: *Brassica nigra, seed size, osmo-priming, yield*

Introduction

Rapeseed-mustard is the group of crops cultivated as major oilseed in India. Rapid seedling establishment is an important requirement for successful crop production in wetland and dry land farming systems. 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 this century (Zavits, 1908). Seedling establishment and speed of emergence influence the time required for seedling to reach the autotrophic phase. Most investigators have reported 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 study effective seed size for improved crop stand and its yield, to develop promising treatment combination for seed size and priming.

Materials and Methods

The experiment was conducted at Indian Agiricultural Research Institute, Regional Station, Karnal, India during *Rabi* 2011-12. The seed samples were divided in to three different parts based on sieving sizes. The seed failed to pass through 1/12"sieve were considered as bold, seeds which pass through 1/12" sieve but, failed to pass through 1/15" inch sieve were considered as medium and passed seeds as small. These seed samples were subjected to different priming treatments *viz.*, Hydration, NaCl (1%), KNO_3 (2%), KCl (0.5%) and Poly Ethylene Glycol-(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 priming treatments as sub plot treatments. Observations were recorded on days to flowering, days to 50% flowering, plant height (m), primary branches, 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. 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 different yield and its attributing traits are presented in Table 1. Seed size differed significantly for the traits secondary branches and days to 50% flowering and it was non-significant for other traits. The priming treatments differed significantly for traits; days to flowering, days to 50% flowering, primary branches, 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 differed significantly for days to 50% flowering, primary and secondary branches and seed yield per plant.

Effect of priming treatments

Seeds primed with Nacl (1%) took lesser number of days to flower followed by seeds treated with Kcl and hydropriming. Almost 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 higher 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 in hydroprimed seeds followed by KNO3 treated and control seeds plots.

The number of seeds per pod and 100 seed weight are the major yield components and determine the final seed yield those significantly contribute to the seed yield and represent reproductive efficacy of a seed 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 (1%) treated and hydro primed seeds (0.26).

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 %

Table 2: Means of field traits for mustard affected 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 weight (g)	Plant 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
KN03 (K)	198.76	7.53	7.12	13.05	45.83	51.33	0.21	192.67
Kcl	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	208.10	7.07	4.57	12.60	46.33	51.83	0.21	145.83
CD (P=0.05)	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 (P=0.05)	34.00	2.00	5.00	5.00	10.00	4.00	1.58	48.00

Table 3: Correlation coefficients of different breeding parameters

Parameters	Plant height (m)	Primary Branches	Secondary Branches	No. of seed/pod	Days to flowering	Dates to 50% flowering	100-seed weight (g)
Primary Branches	0.126						
Secondary Branches	-0.403	-0.023					
No. of seed/pod	0.461	0.197	-0.171				
Days to flowering	0.303	-0.168	-0.088	0.001			
Dates 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 %

The treatments were assigned a rank based on their mean performance for each character and pooled the data, so as to see the overall effect of priming treatments on different plant characters. This showed that, the hydro priming had a prominent effect on most of 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 treatments failed to show positive effects on most of the observed traits.

Effects of seed size

Seed size category affects all traits. 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, it has been observed that the 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 seed size effect afterward. In our study for the most part, plants were thinned to leave only the biggest, healthiest seedlings and tried to avoid its initial effects. Although it is often the case that small seeded plants were more vulnerable to environmental stress. The overall growth of plants was reduced and they have less no of primary and secondary branches and took very less no of days to flower.

Correlation study

The correlation coefficients of different yield and yield attributing traits were 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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