J. Soils and Crops 28 (1) 209-211, June 2018 ISSN 0971-2836
NAAS Rating - 4.46
Scientific Journal Impact Factor (2017) 4.338

EFFECT OF HOMOBRASSINOLIDE ON GROWTH AND YIELD OF INDIAN MUSTARD

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ABSTRACT

An Agronomic investigation entitled "Effect of homobrassinolide on growth and yield of Indian mustard" was carried out at Agriculture College Farm, Nagpur during *rabi* 2016-17. The experiment was laid out in randomized block design consisting seven treatments of homobrassinolide application *viz*., control (T_1), seed soaking in 0.5 ppm HBL for 8 hrs (T_2), seed soaking in 1 ppm HBL for 8 hrs (T_3), foliar spray of 0.5 ppm HBL at 30, 45 and 60 DAS (T_4), foliar spray of 1 ppm HBL at 45 and 60 DAS (T_5), foliar spray of 0.5 ppm HBL at 45 and 60 DAS (T_6) and foliar spray of 1 ppm HBL at 30, 45 and 60 DAS (T_7), replicated thrice. The results of the study indicated that the foliar spray of 1 ppm HBL at 30, 45 and 60 DAS and 1 ppm foliar spray of HBL at 45 and 60 DAS and seed soaking in 1 ppm HBL for 8 hrs were recorded higher growth, yield and yield attributing characters viz., number of branches plant^{-1}, dry matter accumulation plant^{-1}, leaf area plant^{-1} ,leaf area index plant^{-1} , number of seeds siliqua^{-1}, number of siliquae plant^{-1}, seed yield plant^{-1}, test weight and seed yield (kg ha^{-1}) but plant height was not influenced significantly. On the basis of GMR foliar application of 1 ppm HBL at 30, 45 and 60 DAS was significantly superior over rest of the treatments but NMR was not significant. NMR and B:C ratio(2.49) were more in the treatments of seed soaking in 1 ppm HBL for 8 hrs. Hence, this treatment can be considered as beneficial treatment.

(Key words: Mustard, brassinosteriods, homobrassinolide, growth and yield)

INTRODUCTION

Rapeseed and mustard is the third important oilseeds crop in the world after soybean (*Glycine max)* and palm (*Elaeis guineensis* Jacq.). Among the seven edible oilseed cultivated in India, rapeseed-mustard (*Brassica* spp.) contribute 26.9 per cent in the total production of oilseeds. In India it is the second most important edible oilseeds after groundnut. India is one of the largest Rapeseed-mustard growing country in the world, occupying the first position in area and second position in production after China.

Brassinosteroids are a new group of plant hormones with significant growth-promoting activity. Stimulation of growth is considered as the important physiological role of brassinosteroids in plants due to both cell division and cell elongation. Brassinosteroids play crucial roles in diverse aspects of plant biology, including cell elongation, cell division, root growth, photo-morphogenesis, stomatal and vascular differentiation, seed germination, immunity and reproduction. Brassinosteroids are also involved in regulating the metabolism of plant oxidation radicals, ethylene synthesis and root gravitropic response and have a role in mediating plant responses to stress, such as freezing, drought, salinity, disease, heat and nutrient deficiency. This subfamily of hormones regulates a broad range of processes in plant development and responses to environmental stresses and their analogs have been shown to bring substantial increases in grain yield, depending on growth status (Tang *et al*., 2016).

Application of homobrassinolide in mustard is one of the important aspect for the enhancement of yield and yield contributing parameters. Treatment of seeds with 28-homobrassinolide improved the growth, chlorophyll content, photosynthetic parameters and antioxidant enzymes in mustard (Fariduddin *et al.,* 2009). Homobrassinolide application increases yield and oil content in sesame significantly due to increase in morphological, physiological and biochemical parameters (Prakash *et al.,* 2008). Considering the above facts present investigation was undertaken to study the effect of homobrassinolide on growth and yield of Indian mustard.

MATERIALS AND METHODS

A field experiment was conducted at Agronomy farm, College of Agriculture, Nagpur during *rabi* season of 2016-17.The experiment was laid out in randomized block design consisting seven treatments of homobrassinolide

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application *viz.*, control (T_1), seed soaking in 0.5 ppm HBL for 8 hrs (T_2), seed soaking in 1 ppm HBL for 8 hrs (T_3), foliar spray of 0.5 ppm HBL at 30, 45 and 60 DAS (T_4), foliar spray of 1 ppm HBL at 45 and 60 DAS (T_5), foliar spray of 0.5 ppm HBL at 45 and 60 DAS (T_6) and foliar spray of 1 ppm HBL at 30, 45 and 60 DAS (T_7), replicated thrice.The soil of experimental plot was clayey in texture, low in available nitrogen (256.52 kg ha^{-1}), medium in phosphorus (19.78 kg ha^{-1}) and organic carbon (0.60%) and very high in available potash (406.06 kg ha^{-1}) and slightly alkaline in reaction (pH 7.98).

The crop variety NRCHB – 101 was used with spacing of 45 cm x 10 cm. Gross plot size was 5.4 m × 4.0 m and net plot size was 4.5 m × 3.6 m. Full dose of phosphorus and half dose of nitrogen were applied at sowing and remaining half dose of N was applied at 30 DAS. In order to represent the plot, five plants of mustard from each net plot were selected randomly and labeled properly. The growth attributing characters *viz.,* plant height, number of branches plant^{-1} and dry matter accumulation plant^{-1} were recorded at harvest and leaf area plant^{-1}, leaf area index plant^{-1} were recorded at 90 DAS and yield attributing characters *viz.,* number of seeds siliqua^{-1}, number of siliquae plant^{-1}, seed yield plant^{-1}, test weight and seed yield (kg ha^{-1}) were also recorded at harvest. The gross monetary and net monetary returns along with B:C ratio were calculated. The data were analysed as per the method suggested by Panse and Sukhatme (1971).

RESULTS AND DISCUSSION

Effect on growth attributes

The data pertaining to various crop growth attributes studied *viz.,* mean number of branches plant^{-1} and dry matter accumulation plant^{-1}at harvest and leaf area plant^{-1} at 90 DAS were recorded as influenced by various treatments are presented in table 1.

Numbers of branches plant^{-1}, leaf area plant^{-1} and dry matter accumulation plant^{-1} were significantly increased due to foliar spray of 1ppm HBL at 30, 45 and 60 DAS followed by foliar spray of 1 ppm HBL at 45 and 60 DAS (T_5) and seed soaking in 1 ppm HBL solution for 8 hrs (T_3) when compared with control. The dry matter accumulation plant^{-1} depends on leaf area, photosynthetic rate and dry matter partitioning. The positive increase in number of branches plant^{-1} due to HBL application might have offered higher chance for the increased production of leaves plant^{-1}, which subsequently resulted in higher dry matter accumulation plant^{-1}. Latha and Vardhini (2016) exhibited improved shoot growth of mustard plants grown in semi-arid soils of Nizamabad due to all the three concentrations applied viz., 0.5 μM (0.2 ppm), 1 μM and 2 μM over control plants. Prakash *et al*. (2008) reported that foliar spray of 1 ppm HBL at 30, 45 and 60 DAS increased the number of branches plant^{-1}and dry matter production in sesame.

Effect on yield attributes and yield

The data pertaining to various yield attributes and yield studied *viz.,* number of seeds siliqua^{-1}, number of siliquae plant^{-1}, seed yield plant^{-1}, test weight and seed yield (kg ha^{-1}) as influenced by various treatments are presented in table 1.

The number of seeds siliqua^{-1} was significantly higher with all the treatments of HBL application compared to control. The treatment foliar spray of 1 ppm HBL at 30, 45 and 60 DAS (T_7) recorded maximum and significantly higher number of siliquae plant^{-1} (211.9), seed yield plant^{-1} (5.30 g), test weight (5.23 g) and seed yield ha^{-1} (891 kg ha^{-1}) as compared to control and all other treatments except T_5 (foliar spray of 1 ppm HBL at 45 and 60 DAS) and T_3 (seed soaking in 1 ppm HBL solution for 8 hrs). This might be due to cumulative effect of higher growth parameters *viz*., number of branches, leaf area plant^{-1}and dry matter accumulation due to HBL application at 1 ppm concentration either as foliar spray or seed soaking.

Application of 0.2 ppm brassinolide at budding + flowering stages significantly recorded higher value of yield parameters and yield as compared to brassinolide spraying at budding stage alone and at control in sunflower (Pramanik and Bera, 2013). Prakash *et al*. (2008) reported that, yield and oil content were significantly enhanced in plants treated with 1 ppm HBL thrice at vegetative, flowering and capsule formation stages. Fariduddin *et al.* (2008) also reported that the application of 28-homobrassinolide on mungbean as seed treatment by seed soaking (0.4 ppm) and foliar spray (0.04 ppm) increased pod number and yield significantly. The order of response to HBL treatment was seed soaking + foliar spray > foliar spray only > seed soaking > control. Seed soaking + foliar spray (15 DAS) gave 32% more yield than the control.

Economic studies

Data on gross monetary return, net monetary return and B:C ratio were affected by various treatments of HBL application are presented in table 1.

Application of 1 ppm spray of HBL at 30, 45 and 60 DAS (T_7) recorded significantly higher value of GMR (Rs. 32975 ha^{-1}) compared to control (T_1), followed by 1 ppm foliar spray of HBL at 45 and 60 DAS and were at par with T_7 (Foliar spray of 1 ppm HBL at 30, 45 and 60 DAS). Seed soaking in 1 ppm HBL solution for 8 hrs (T_3) gave the highest NMR of Rs 17306 ha^{-1}, but the results were non significant. B:C ratio was highest (2.49) in seed soaking in 1 ppm HBL for 8 hrs (T_3) as compared to control (T_1).

Table 1. Effect of homobrassinolide application on growth, yield contributing parameters , yield and economics of mustard

Treatments	Growth attributes			Yield attributes and yield					Economics		
	No. of branch-es plant^{-1} at harvest	Dry matter plant^{-1} at harvest (g)	Leaf area (dm^2) at 90 DAS	No. of seeds siliqua^{-1}	No. of siliquae plant^{-1}	Seed yield plant^{-1} (g)	Test wt. (g)	Yield (kg ha^{-1})	GMR	NMR	B:C ratio
T_1- Control	3.90	23.76	5.98	9.85	163.4	4.09	4.70	643.2	23799	12267	2.06
T_2-Seed soaking in 0.5 ppm HBL solution for 8 hrs	4.50	23.92	6.13	12.39	164.5	4.11	4.87	683.0	25272	13676	2.18
T_3-Seed soaking in 1 ppm HBL solution for 8 hrs	5.10	25.79	8.46	13.18	176.9	4.42	5.10	781.6	28921	17306	2.49
T_4-Foliar spray of 0.5 ppm HBL at 30, 45 and 60 DAS	4.40	25.34	6.24	12.64	174.0	4.35	4.83	737.0	27270	12525	1.85
T_5-Foliar spray of 1 ppm HBL at 45 and 60 DAS	4.75	28.73	8.22	13.19	196.5	4.91	5.07	811.7	30034	14352	1.92
T_6-Foliar spray of 0.5 ppm HBL at 45 and 60 DAS	4.43	25.09	6.40	12.60	172.2	4.31	4.87	722.4	26728	12921	1.94
T_7-Foliar spray of 1ppm HBL at 30, 45 and 60 DAS	5.19	31.03	9.29	13.36	211.9	5.30	5.23	891.2	32975	15418	1.88
SE (m) +	0.23	1.39	0.38	0.75	9.26	0.23	0.09	45.8	1695	1695	-
CD at 5%	0.68	4.15	1.12	2.21	27.53	0.69	0.27	136.2	5024	-	-
GM	4.61	26.24	7.25	12.46	179.9	4.50	4.95	752.9	27857	14066	2.04

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Rec. on 27.06.2017 & Acc. on 15.07.2017