Assessment of Seed Hardening on Morpho-physiological and Yield Parameters of Mustard (Brassica juncea L.)

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Abstract

The present investigation was carried out for assessment of seed hardening on morpho-physiological and yield parameters of mustard (Brassica juncea L.). For this purpose, twelve seed hardening treatments including control on mustard seeds variety (T-59) were used to study under filed conditions during Rabi, 2019-20 field experiment was laid out in Randomized Block Design (RBD) with three replications during Rabi 2019-20. Analysis for the data in field experiment revealed significance mean sum of squares due to seed hardening treatments for all the characters under study. The treatment were T0 - Control, T1 - Potassium nitrate (KNO3) 2% @12hrs, T2 - Zinc sulphate (ZnSO4) 2% @12hrs, T3 - Calcium chloride (CaCl2)2% @12hrs, T4 - Mono potassium phosphate (KH2PO4)2% @12hrs, T5 - Potassium chloride (KCl)2% @12hrs, T6 - Gibberellic acid (GA3)2% @12hrs, T7 - Indole Acetic Acid (IAA)2% @12hrs, T8 - Pungam leaf extract2% @12hrs, T9 - Prosopis leaf extract 2% @12hrs, T10 - Neem leaf extract5% @12hrs, T11 - Cow dung10% @12hrs, T12 - Panchagavya3% @12hrs. Maximum field emergence, leaf dry weight, leaf area was recorded in T3-CaCl2(2%) (12hrs). Minimum days to 50% flowering were recorded in T3. Maximum plant height at 30 DAS (cm), 60 DAS (cm) and 90DAS (cm) and Number of branches per plant was recorded in T3. Number of primary branches, number of secondary branches, number of silique per plant, number of seeds per silique, seed yield, test weight, biological yield and harvest index were also recorded high in T3 treatment CaCl2@2% followed by T6-GA3@2%.

Introduction

Mustard (Brassica juncea L.) a member of Brassicaceae family and is an important oil seed crop of the world. Mustard belongs to family Brassicaceae or Cruciferae and chromosome number is 2n=36. The Brassica species commonly called as rapeseed-mustard are one of the economically important agricultural commodities (Tripathi et al., 2010).

Indian mustard (Brassica juncea L.) is majorly grown in Rajasthan, UP, Haryana, Madhya Pradesh and Gujarat. It is also grown under some nontraditional areas of south
India including Karnataka, Tamil Nadu and Andhra Pradesh. The crop can be cultivated under both irrigated and rainfed conditions. Mustard yield potential is good and has wider adaptability and has high oil content with good quality.

Indian mustard is nutritionally rich and its oil content vary from 37-49%. The seed and oil are used as a condiment in preparation of pickles, flavouring, curries and vegetables as well as for cooking and frying purposes. Its oil is used in many industrial products, cake as cattle feed and manure and green leaves for vegetable and green fodder.

Mustard seed is the third leading source of vegetable oil in the world after soya bean oil and oil palm oil. Mustard seed containing about40-50% protein. It is world’s second leading sources of protein meal after soya bean meal.

In India, it is the second most important edible oilseed after groundnut sharing 27.8% in the oilseed economy (FAO, Stat, 2018).

Materials and Methods

The experiment was carried out under the field condition during Rabi (2019-20) at field experimental center and seed testing laboratory, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj the experiment was laid out in Randomized Block Design with three replications and twelve treatments.

T0 = Control, T1 = Potassium nitrate (KNO₃), T2 = Zinc sulphate (ZnSO₄), T3 = Calcium chloride (CaCl₂), T4 = Mono potassium phosphate (KH₂PO₄), T5 = Potassium chloride (KCl), T6 =Gibberellic acid (GA₃), T7 = Indole Acetic Acid (IAA), T8 = Pungam leaf extract, T9 = Prosopsis leaf extract T10 = Neem leaf extract, T11 = Cow dung, T12 = Panchagavya

Results and Discussion

In different seed hardening treatments T3-CaCl₂@2% has performed the best results when compared to all the other seed hardening treatments and the lowest results were showed by control. The T3-CaCl₂@2% performed the best results in all the parameters i.e., field emergence (94.04%), days to 50% flowering (42.33), plant height 30DAS (18.36), plant height 60DAS(108.02), plant height 90DAS (148.41), number of primary branches per plant (5.56), number of secondary branches (7.30), leaf area (238.64), leaf dry weight (2.10), number of siliqua per plant(111.94), number of seeds per siliqua(12.16), seed yield per plant (5.12), test weight (5.14), biological yield(4904.25), harvest index(23.00) and it was followed by T6-GA₃ performed the better results in all the parameters i.e., field emergence (93.23), days to 50% flowering (44.00), plant height 30DAS (17.44), plant height 60DAS(103.46), plant height 90DAS (145.84), number of primary branches per plant (5.00), number of secondary branches (5.80), leaf area (225.07), leaf dry weight (2.04), number of siliqua per plant (108.74), number of seeds per siliqua (12.05), seed yield per plant (4.88), test weight (4.61), biological yield(4874.54), harvest index(21.00)

Seed hardening is one of the best methods that results in modifying the physiological and biochemical characters of seed so this leads to favorable for drought resistant. Seed hardening is the results of extensive physiological reorganization induced by hydration and dehydration (Sujatha et al.,2013). Similar results were found in chickpea, significantly higher seeds yield was recorded in seed treatment with CaCl₂ - 2% (Table 1).
| S.No | Treatments | Field emergence (%) | Days to 50% flowering | Plant height at 30 DAS | Plant height at 60 DAS | Plant height at 90 DAS | No. of primary branches per plant | No. of secondary branches per plant | Leaf area (cm²) | Leaf dry weight (g) | No. of siliquae per plant | No. of seeds per siliquae | Seed yield per plant (g) | Test weight (g) | Biological yield (Kg/ha) | Harvest Index (%) |
|------|------------|---------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------------------|----------------------------------|----------------|-------------------|-------------------------|--------------------------|-----------------------------|----------------|----------------------|-------------------------|
| 01   | T₀         | 82.02               | 51.33                 | 15.14                 | 80.19                 | 103.20                | 2.80                             | 3.20                             | 117.68         | 0.95              | 67.36                   | 10.13                    | 2.80                        | 3.39            | 2722.25              | 17.00                   |
| 02   | T₁         | 85.57               | 48.66                 | 15.69                 | 84.56                 | 111.52                | 3.33                             | 3.56                             | 143.39         | 1.35              | 97.71                   | 11.39                    | 4.04                        | 4.25            | 3594.88              | 18.67                   |
| 03   | T₂         | 84.23               | 49.00                 | 16.33                 | 83.91                 | 122.83                | 4.66                             | 3.26                             | 130.51         | 1.82              | 103.43                  | 10.73                    | 3.78                        | 3.43            | 3874.71              | 18.67                   |
| 04   | T₃         | 94.05               | 42.33                 | 18.36                 | 108.02                | 148.41                | 5.56                             | 7.30                             | 238.64         | 2.10              | 111.94                  | 12.16                    | 5.12                        | 5.14            | 4904.25              | 23.00                   |
| 05   | T₄         | 85.78               | 46.66                 | 15.94                 | 82.14                 | 121.15                | 4.00                             | 4.06                             | 159.35         | 1.94              | 85.25                   | 11.33                    | 3.88                        | 4.26            | 3780.21              | 18.67                   |
| 06   | T₅         | 90.39               | 48.00                 | 16.61                 | 88.62                 | 120.87                | 3.53                             | 3.53                             | 136.69         | 0.98              | 77.43                   | 11.59                    | 3.76                        | 3.51            | 3607.91              | 19.67                   |
| 07   | T₆         | 93.23               | 44.00                 | 17.44                 | 103.46                | 145.84                | 5.00                             | 5.80                             | 225.07         | 2.04              | 108.74                  | 12.05                    | 4.88                        | 4.61            | 4874.54              | 21.00                   |
| 08   | T₇         | 89.97               | 46.00                 | 16.31                 | 82.11                 | 127.79                | 3.40                             | 4.73                             | 132.82         | 1.90              | 92.35                   | 11.48                    | 3.85                        | 3.60            | 4054.79              | 17.00                   |
| 09   | T₈         | 87.84               | 50.33                 | 17.13                 | 82.44                 | 121.58                | 3.93                             | 4.06                             | 143.24         | 1.73              | 73.81                   | 10.39                    | 4.08                        | 4.27            | 3896.25              | 18.00                   |
| 10   | T₉         | 87.14               | 48.00                 | 15.67                 | 95.77                 | 124.16                | 4.90                             | 4.40                             | 156.82         | 1.53              | 90.14                   | 11.36                    | 3.94                        | 3.65            | 3939.27              | 17.33                   |
| 11   | T₁₀        | 92.57               | 45.66                 | 17.28                 | 100.07                | 132.87                | 4.96                             | 5.00                             | 198.84         | 2.02              | 105.24                  | 11.73                    | 4.44                        | 4.35            | 4066.41              | 18.67                   |
| 12   | T₁₁        | 86.77               | 49.66                 | 17.10                 | 82.17                 | 120.11                | 3.80                             | 4.20                             | 138.16         | 1.49              | 102.93                  | 10.26                    | 3.45                        | 4.03            | 3508.88              | 17.33                   |
| 13   | T₁₂        | 82.71               | 49.33                 | 15.52                 | 86.13                 | 116.84                | 3.83                             | 3.63                             | 155.43         | 1.04              | 84.66                   | 11.41                    | 3.02                        | 4.10            | 3693.36              | 18.00                   |
|      | Grand Mean | 87.86               | 47.61                 | 16.50                 | 89.19                 | 123.63                | 4.06                             | 4.36                             | 155.82         | 1.60              | 92.38                   | 11.23                    | 3.88                        | 4.04            | 3886.05              | 18.69                   |
|      | F test     | S                    | S                    | S                    | S                    | S                    | S                                | S                                | NS              | S                 | S                       | S                        | S                             | S                | NS                   | S                       |
|      | SE(m)      | 0.953                | 0.804                 | 0.902                 | 1.00                 | 1.68                 | 0.135                            | 0.15                             | 8.29           | 1.07              | 2.43                    | 0.74                     | 0.539                        | 0.587           | S                    | S                       |
|      | CD at 5%   | 2.814                | 2.37                 | 2.25                 | 2.97                 | 4.97                 | 0.39                             | 0.47                             | 17.49          | 0.22              | 6.19                    | 1.29                     | 0.454                        | 0.25            | 109.21               | 1.7                      |
|      | C.V.       | 1.871                | 2.93                 | 2.418                | 3.95                 | 2.34                 | 1.01                             | 2.67                             | 7.78           | 1.97              | 3.54                    | 2.72                     | 4.724                        | 1.18            | 8.54                 | 2.4                      |

Table 1
Drought tolerance capacity of chickpea seed was increased by seed hardening with CaCl2@2% (Manjunath, et al., 2010). Some other authors are also found similar results i.e., maximum increase in growth, yield and seed vigour traits when chickpea seeds are hardening with CaCl2@2% (Akshay Kunghatkar et al., 2018). Similar seed hardening results were obtained in growth and yield parameters when blackgram seeds are imposed with various seed hardening treatment. They concluded that prosopis@1% recorded the highest seed yield and yield attributing characters compared to other treatments and control under drought conditions (Sathiya Narayanan, G. 2016).Some others also found the similar results i.e., pre sowing seed hardening treatment CaCl2@1% significantly increased the yield attributing characters when compared to control in case of rice crop. (Satheesh Kumar et al., 2019).

The overall performance of treatments under study judged on the basis of positive results obtained indicated the treatments T3 (CaCl2 @ 2%) and T6 (GA3 @ 2%) had performed well with respect to morpho-physiological, plant growth and seed yield parameters. The fore cited treatments found to be promising than other treatments.

The treatment T3 (CaCl2 @ 2%) recorded (5.14 g 1000 seed weight), (biological yield of 4905.25 Kg/ha) and (harvest Index of 23%) found to be most promising amongst the treatments considered for the experiment. The effect of at par treatments T6 (GA3 @ 2%) and T10 (Neem leaf extract @ 5%) were also found to be good as seed primers in case of Mustard.

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