

## EFFECT OF PHYSICAL AND CHEMICAL MUTAGENS ON SEEDLING TRAITS OF BERSEEM (*TRIFOLIUM ALEXANDRINUM* L.)

D. S. JATASRA, A. K. CHHABRA AND R. P. S. KHARB

Department of Plant Breeding,  
Haryana Agricultural University, Hisar-125004, India

### ABSTRACT

The effect of ethyl methyl sulphonate (EMS) and gamma-rays + EMS on seedling traits of three berseem cultivars was investigated during 1983 and 1984. The cv Mescavi had highest germination and recorded maximum root length and shoot length. EMS alone affected germination more than the combination of gamma-rays + EMS. The treatments with EMS (0.5% and 0.75%) proved most effective for increasing root and shoot lengths.

### INTRODUCTION

Stagnation in the varietal development in berseem crop (*Trifolium alexandrinum* L.) is attributed to the lack of genetic variability. Hybridization is very difficult due to small size of flowers and mutation breeding offers a significant possibility for inducing variability. Barring a few reports (Hasan, 1967; Sidhu and Mehn-diratta, 1971; Jatasra, 1981, and Shukla, 1982), information on mutation breeding in berseem is scanty. Therefore, present study was planned to investigate the effects of physical and chemical mutagens on four seedling traits in berseem.

### MATERIALS AND METHODS

The dry seeds of three cultivars viz., Mescavi, BL 1 and Wardan were exposed to gamma-rays at 20, 40 and 60 kilorads during 1983. Seeds were also treated with unbuffered solution of 0.25, 0.50, 0.75 and 1.00 per cent ethyl methyl sulphonate (EMS) for 12 hours. Combined doses of 20 kr + 0.25% EMS, 20 kr + 0.50% EMS, 40 kr + 0.25% EMS, 40 kr + 0.50% EMS, 60 kr + 0.25% EMS and 60 kr + 0.50% EMS were also given to all the varieties. After the EMS treatment, seeds were washed thoroughly with water.

Hundred seeds from each of the 11 treatments including control (untreated, soaked in water for 12 hours) were put on moist filter paper in petri dishes kept in seed germinator at 20°C. There were three replications of each treatment and variety. The data on germination (%) were recorded after three days. Observations on root and shoot length (cm) were taken after 5 days. The experiment was repeated during 1984.

Table 1. Analysis of variance for seeding traits in berseem

| Source       | Year | Seeds      |         | Root length | Shoot length |
|--------------|------|------------|---------|-------------|--------------|
|              |      | Germinated | Normal  |             |              |
| Replications | 1983 | 1.35       | 1.53    | 1.27        | 1.27         |
|              | 1984 | 20.25      | 10.56   | 0.06        | 0.65         |
| Treatments   | 1983 | 22.91**    | 46.29** | 0.70**      | 1.01**       |
|              | 1984 | 15.66**    | 20.74** | 1.38**      | 2.09**       |
| Error        | 1983 | 1.59       | 1.28    | 0.15        | 0.13         |
|              | 1984 | 3.54       | 4.60    | 0.15        | 0.74         |

\*\* Significant at 1 per cent level

Table 2. Effect of mutagens on seeds and their germination in three cultivars of berseem (M - Mescavi, B - BL1, W - Wardan)

| Treatment<br>γ-ray<br>(kr) | EMS<br>(%) | Normal Seeds (%)     |       |       |    |      |    |                  |    |      |    |      |    |
|----------------------------|------------|----------------------|-------|-------|----|------|----|------------------|----|------|----|------|----|
|                            |            | Germinated Seeds (%) |       |       |    |      |    | Normal Seeds (%) |    |      |    |      |    |
|                            |            | 1983                 |       | 1984  |    | 1983 |    | 1984             |    | 1983 |    | 1984 |    |
| Control                    | 0.25       | M                    | B     | M     | B  | M    | B  | M                | B  | M    | B  | M    | B  |
|                            |            | 96                   | 88    | 90    | 77 | 96   | 83 | 96               | 83 | 96   | 83 | 90   | 67 |
|                            |            | 86                   | 85    | 82    | 62 | 83   | 80 | 83               | 80 | 83   | 80 | 80   | 57 |
|                            |            | 90                   | 76    | 82    | 77 | 86   | 71 | 80               | 71 | 80   | 60 | 80   | 60 |
|                            |            | 83                   | 75    | 77    | 67 | 80   | 71 | 80               | 71 | 77   | 65 | 77   | 65 |
|                            |            | 93                   | 73    | 92    | 48 | 88   | 63 | 88               | 63 | 90   | 40 | 90   | 40 |
|                            |            | 86                   | 60    | 82    | 58 | 83   | 58 | 83               | 58 | 70   | 50 | 70   | 63 |
|                            |            | 95                   | 58    | 85    | 60 | 93   | 55 | 93               | 55 | 70   | 83 | 70   | 48 |
|                            |            | 98                   | 56    | 90    | 57 | 93   | 55 | 93               | 50 | 51   | 87 | 45   | 53 |
|                            |            | 88                   | 60    | 77    | 65 | 83   | 55 | 83               | 55 | 60   | 70 | 58   | 57 |
|                            |            | 91                   | 56    | 82    | 57 | 70   | 62 | 70               | 51 | 65   | 80 | 50   | 60 |
|                            |            | 93                   | 66    | 83    | 68 | 91   | 60 | 91               | 60 | 68   | 82 | 67   | 70 |
| SEM ±                      |            | 3.65                 | 5.45  | 6.20  |    | 3.25 |    |                  |    |      |    |      |    |
| CD (5%)                    |            | 10.10                | 10.85 | 17.15 |    | 9.05 |    |                  |    |      |    |      |    |

## RESULTS AND DISCUSSION

Highly significant mean squares due to treatments for all the characters during both the years indicated significant treatment effects due to irradiation on seed germination, normality of seeds, root length and shoot length (Table 1).

A comparison of germination percentage of seeds in three cultivars indicated that the cv Mescavi, followed by BL 1 and Wardan had maximum germination during both the years (Table 2). All the EMS treatments decreased germination of Mescavi, however, significant reduction was with 0.25% and 0.75% doses during both the years. In case of BL 1, significant decline was observed with 0.75% and 1.00% EMS doses during both the years. Out of the three varieties, maximum decline in germination was observed in BL 1. Almost linear decrease was noticed during both the years in case of Mescavi and BL 1 except that Mescavi with 1.00 EMS dose. Similar trend was observed for the percentage of normal seeds. The differential response to radio-sensitivity of three cultivars is attributed to their varied genetic constitution (Jatasra, 1982).

Combined effects of gamma-rays and EMS were less detrimental to germination as compared to EMS alone: With equal gamma-ray doses, both germinated seeds and normal seeds were higher with 0.5% EMS dose as compared to 0.25% EMS dose during both the years. Decline in germination was maximum in BL 1 and minimum in Mescavi. A similar trend was observed for per cent normal seeds.

There was no significant effect of EMS on root length of Mescavi during both the years (Table 3). However, 0.50 and 0.75% enhanced the root length of BL 1 and Wardan. The combined effect of Mescavi was non-significant. The treatment 20 kr + 0.25% EMS significantly reduced the root length of BL 1 and Wardan, whereas rest of the combined treatments had almost always enhanced this trait in these two cultivars. Shoot length in Mescavi seedlings was increased by only four treatments viz., 0.50 EMS, 0.75 EMS, 20 kr + 0.25 EMS and 20 kr + 0.50 EMS all the shoot lengths in the varieties BL 1 were and Wardan were increased by all mutagenic treatments.

Berseem variety Mescavi had the maximum germination as well as root and shoot lengths. Seedling traits of this cultivar were least affected by mutagenic treatments.

Table 3. Effect of mutagens on root and shoot length in three cultivars of berseem (M-Mescavi, B - BL1, W - Warden)

| Treatment | γ-rays<br>(kr) | EMS<br>(%) | Root length (cm) |     |      |      |      |     | Shoot length (cm) |     |      |      |      |     |
|-----------|----------------|------------|------------------|-----|------|------|------|-----|-------------------|-----|------|------|------|-----|
|           |                |            | 1983             |     |      | 1984 |      |     | 1983              |     |      | 1984 |      |     |
|           |                |            | M                | B   | W    | M    | B    | W   | M                 | B   | W    | M    | B    | W   |
| Control   |                |            | 3.6              | 2.6 | 2.5  | 3.2  | 2.6  | 2.1 | 5.6               | 4.5 | 4.0  | 5.4  | 4.0  | 3.8 |
|           | 0.25           |            | 3.6              | 2.4 | 2.5  | 3.1  | 2.3  | -   | 5.4               | 5.0 | 4.5  | 4.5  | 4.9  | -   |
|           | 0.50           |            | 3.4              | 3.0 | 2.8  | 2.9  | 2.8  | -   | 6.3               | 4.9 | 4.3  | 6.1  | 4.4  | -   |
|           | 0.75           |            | 3.5              | 2.9 | 2.9  | 3.3  | 2.9  | -   | 5.9               | 4.7 | 4.6  | 5.9  | 4.4  | -   |
|           | 1.00           |            | 3.1              | 1.8 | 2.5  | 3.0  | 2.0  | -   | 5.4               | 4.9 | 3.9  | 5.5  | 4.6  | -   |
|           | 0.25           |            | 3.6              | 1.9 | 2.4  | 3.6  | 1.9  | 2.2 | 6.0               | 4.7 | 4.5  | 6.2  | 4.4  | 5.0 |
|           | 0.50           |            | 3.3              | 2.8 | 3.3  | 3.2  | 2.2  | 3-1 | 5.8               | 5.3 | 4.2  | 5.6  | 5.6  | 4.6 |
|           | 0.25           |            | 3.4              | 3.5 | 2.2  | 3.5  | 2.7  | 2.8 | 5.3               | 4.6 | 4.1  | 4.5  | 4.8  | 4.3 |
|           | 0.50           |            | 3.4              | 3.0 | 2.7  | 3.3  | 2.7  | 2.5 | 5.0               | 4.5 | 5.5  | 5.5  | 4.8  | 6.0 |
|           | 0.25           |            | 3.2              | 2.9 | 3.6  | 2.9  | 2.5  | 3.1 | 5.5               | 4.7 | 4.9  | 4.9  | 4.9  | 5.1 |
|           | 0.50           |            | 3.2              | 2.8 | 3.1  | 2.9  | 2.5  | 3.0 | 5.5               | 4.5 | 5.3  | 5.8  | 4.8  | 5.1 |
| SEm±      |                |            | 0.22             |     | 0.22 |      | 0.22 |     | 0.21              |     | 0.21 |      | 0.29 |     |
| CD (5%)   |                |            | 0.61             |     | 0.62 |      | 0.62 |     | 0.57              |     | 0.57 |      | 0.78 |     |

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