

Number of normal seedlings from each replication were counted and germination percentage was calculated by using formula given by Piri et al. (2009):

$$\text{Seed germination percentage} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds}} \times 100\%$$

Mean germination time (MGT) was the time taken for a lot to germinate. The lower the MGT the faster the population of seeds were germinated (Dhakal and Subedi, 2020):

$$\text{MGT} = \frac{\sum (D \times n)}{\sum n}$$

Where, D = the number of days counted from the beginning of germination, n = number of seed germinated on each day.

Seedling Vigour Index (SVI) was calculated by using following formula (Dhakal and Subedi, 2020):

$$\text{SVI-I} = \text{Germination percentage} \times \text{Total seedling length (cm)}$$

$$\text{SVI-II} = \text{Germination percentage} \times \text{seedling dry weight (mg)}$$

Where, SVI-I indicates vigour of seed in relation with length of seedling while SVI-II indicates vigour of seed in relation with dry matter accumulates of seedling.

Days to 50% germination was the time taken to get 50% germination of final germination percentages (Coolber et al., 1990).

Speed of germination (BRI) was calculated by using following formula (Bartlett, 1937):

$$\text{BRI} = \frac{p_1 + (p_1 + p_2) + (p_1 + p_2 + p_3) + \dots + (p_1 + p_2 + p_3 + \dots + p_n)}{N(p_1 + p_2 + \dots + p_n)}$$

Where, $p_1 + p_2 + p_3 + \dots$ and p_n are the germination (%) at 1st, 2nd, 3rd and nth day, respectively and 'N' is the total number of days taken for germination.

2.7 Seedling growth measurement

Seedling growth was evaluated by sampling plants at 21 days after sowing. The sampled seedlings were carefully uprooted to avoid damaging the roots. After collection, the roots were separated from the stem portions and different growth parameters were measured. For each treatment, ten representative seedlings were selected, and the mean values were calculated and recorded for further analysis.

Root length was measured after the seedlings were uprooted. The measurement was taken from the tip of the root apex to the base of the root system at 21 days after sowing, following the method described by Dhakal and Subedi (2020). Shoot length was determined by measuring the distance from the base of the growing medium to the tip of the shoot apex.

For fresh weight determination, sample plants from each experimental unit were collected and separated into root and shoot portions by cutting with a knife. The stem portion was weighed using a weighing machine to determine shoot fresh weight, and the values were recorded in grams. Similarly, the root portion was weighed separately to obtain root fresh weight, and the average values were calculated for each treatment.

To determine dry weight, the shoot portions were first weighed to obtain fresh weight and then placed in envelopes. These samples were dried in a hot air oven at 105 °C for 24 hours and then allowed to cool as described by Khatiwada and Adhikari (2020). After drying, the shoot samples were weighed and the shoot dry weight was recorded in milligrams. The same procedure was followed for the root portions: after measuring fresh weight, the root samples were packed in envelopes, dried in a hot air oven at 105 °C for 24 hours, cooled, and then weighed to obtain root dry weight in milligrams. The average values were calculated for analysis.