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Effect of Polymer Seed Coating with Micronutrients on Seed Quality of Sunflower

BASAVE GOWDA*, PRAMOD GOLASANGI, NM SHAKUNTALA, SR DODDAGOUDAR AND I SHANKER GOUD

University of Agricultural Sciences, Raichur 584 104 (Karnataka), India
*bavaniseeds@gmail.com

ABSTRACT: The laboratory experiment was conducted to investigate the effect of polymer seed coating with micronutrients on seed quality of sunflower. The seeds were treated with different concentrations of polymer *i.e.*, 2, 4, 6, 8 and 10 ml kg^{-1} and twenty five different concentrations of zinc and boron and their combination treatments were studied. Among the different treatment seeds coated with combination of zinc (4g) and boron (4g) and polymer (6 ml/ kg^{-1}) recorded significantly higher germination percentage (88.00%), shoot length (11.90 cm), root length (14.30 cm), seedling length (26.20 cm), seedling dry weight (55.00 mg) and seedling vigour index-I & II (2309 & 4696) as compared to control.

Keywords: Micronutrients, Polymer seed coating, Seed quality, Seed treatment, Sunflower

Sunflower (*Helianthus annuus* L.) known as "Golden Girl of American Agriculture", belongs to the family Asteraceae (Compositae). Its name originated from Greek words "Helios" means "Sun" and "Anthois" means flower. It is native to southern USA and Mexico. It is a rich source of edible oil (40-52%) and considered as good quality oil from health point of view due to the presence of polyunsaturated fatty acids with 55-60 per cent of linoleic acid and 25-30 per cent of oleic acid which are known to reduce the risk of cardiac related problems.

In India sunflower is being grown over an area of 0.69 million hectares with a production of 0.54 million tonnes. Presently Karnataka is the leading state in the country contributing 63.36 and 53.70 per cent of total area and production, respectively [1]. It is the second important oilseed crop after groundnut in the state having an area of 0.44 million hectares with production of 0.29 million tonnes. However, productivity (670 kg ha-1) is lesser than the national average of 791 kg ha-1 [2].

Micronutrient carriers has higher efficiency when they are supplied through seed treatment, as their requirement is very less and in the close vicinity of absorption thereby leaving less scope for losses especially fixation. Therefore, studies on the seed quality of sunflower hybrid as influenced by polymer seed coating with zinc and boron as micronutrients in sunflower hybrid were carried out.

MATERIALS AND METHODS

The laboratory experiment was conducted during 2014-15 to investigate the effect of polymer seed coating with micronutrients on seed quality of sunflower hybrid RSFH-130. The standardization of polymer experiment consisted of different concentrations of polymer *i.e.*, 2, 4, 6, 8, and 10 ml kg^{-1} of seed which was laid out in simple CRD design with four replications. For standardization of zinc and boron the experiment consisted of twenty five different concentrations of zinc and boron and their combination treatments along with polymer (6ml kg^{-1} of seed) which was selected as best polymer dosage in polymer standardization experiment, which was laid out in CRD design

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with four replications. Then the sunflower hybrid seeds were treated with polymer (6ml kg^{-1} of seed) and different concentrations of zinc and boron and their combinations with the help of seed treater. After the seed treatment the seeds were dried under shade and dried back to original moisture content and analyzed for seed quality parameters.

The treated seeds were subjected to germination percentage, shoot length (cm), root length (cm), seedling length (cm), seedling dry weight tests as per procedure [3], seedling vigour index [4] and mean data of the laboratory experiments were statistically analyzed by adopting completely randomized design [5]. The critical differences were calculated at one per cent level of probability wherever 'F' test was found significant.

RESULTS AND DISCUSSION

Among the different concentrations of polymer, the sunflower hybrid seeds treated with polymer @ 6 ml kg^{-1} of seed recorded significantly higher germination percentage (84.75 %), shoot length (10.80cm) and root length (12.53cm), seedling length (23.33cm), seedling dry weight (54.50 mg) and seedling vigour index-I & II (1977 & 4616) were registered in seeds treated with polymer @ 6 ml kg^{-1} of seed as compared to the control (Fig. 1 & 1a). As the concentration of the polymer increased more than 6 ml kg^{-1}, decreasing trends in seed quality parameters were noticed. Increase in seed quality parameters might be due hydrophilic polymer coating material, which might have activated the metabolic activity of seed resulting in improved rate of water uptake [6] as reported in sweet corn seeds.

The increase in shoot length and root length might be due to beneficial effect of polymer and could also be due to enhanced metabolic activity resulted in early germination [7] as reported in maize. The increase in seedling vigour index and seedling dry weight was due to increased germination percentage, root length and shoot length of seedlings.

These results were in agreement with findings in chilli [8], who reported that higher germination and field emergence percentage can be seen in polymer coated seeds, mainly due to increase in the rate of imbibition where the fine particles in the coating acts as a "wick" or moisture attracting material or perhaps to improve germination.

These results were also in line with the findings in sugar beet [9], who reported that the germination percentage decreased as the dosage of polymer increased, where reduction was related to restricted oxygen supply to the enclosed embryo and to the retention of water soluble germination inhibitors. Similar results were also reported in Russian wild rye [10]. Similarly the beneficial effects of polymer were attributed to enhancement of mitochondrial activity leading to the formation of more high energy compounds and vital biomolecules, which were made available during the early phase of germination [11].

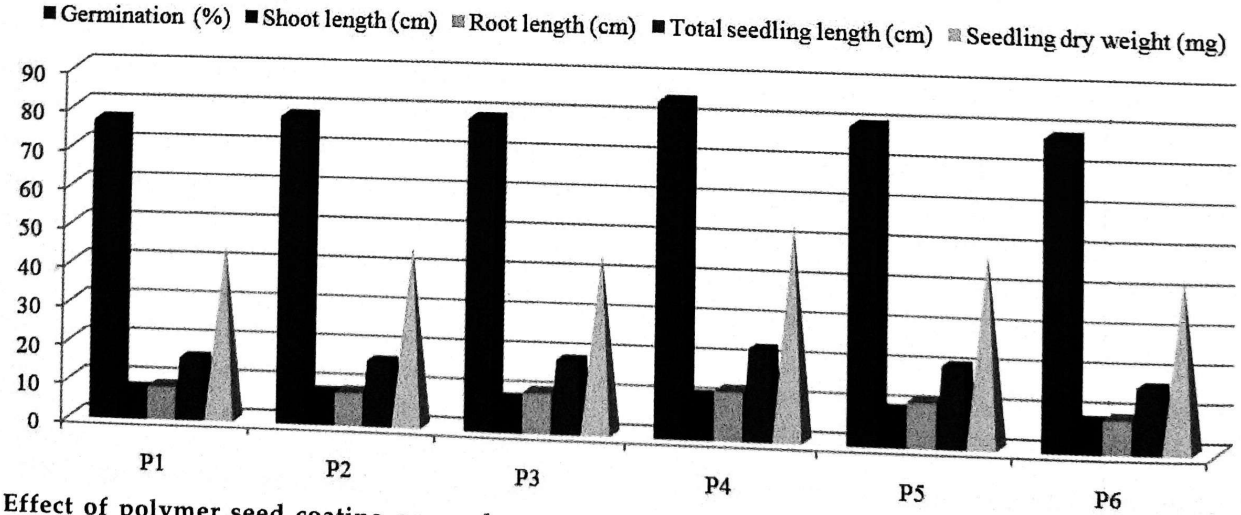

Fig. 1. Effect of polymer seed coating on seed germination, shoot length, root length, total seedling length and seedling dry weight in sunflower hybrid RSFH-130

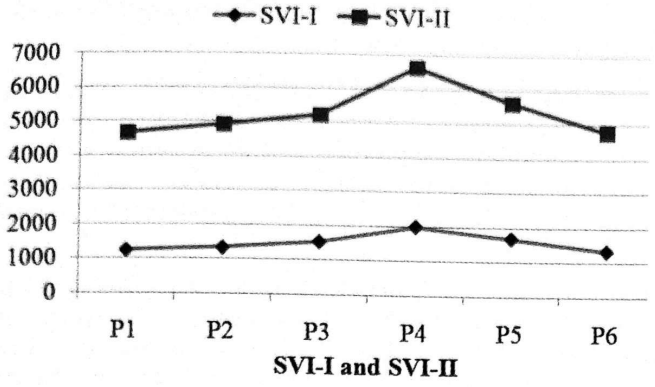

Fig. 1a. Effect of polymer seed coating on seedling vigour in sunflower hybrid RSFH-130. Treatments: P_1- Control, P_2- 2 ml kg^{-1} seed, P_3- 4 ml kg-1 seed, P_4- 6 ml kg-1 seed, P_5- 8 ml kg-1 seed, P_6- 10 ml kg-1 seed

Among different treatment combination, with zinc and boron, sunflower hybrid seeds RSFH-130 treated with zinc (4g/ kg of seed) + boron (4g/kg of seed) recorded significantly higher seed germination percentage (88 %), shoot length (11.90 cm), root length (14.30 cm) as compared to the control and the negative effect was noticed as the concentration of these micronutrients increased (Fig. 2).

Significantly higher seedling length (26.20 cm), seedling dry weight (55.00 mg) and seedling vigour index-I & II (2309 & 4696) were also noticed in the seeds coated with combination of zinc (4g) + boron (4g kg-1) of seed (Fig. 3 & 3a). The increased seed quality parameters by zinc might be due to

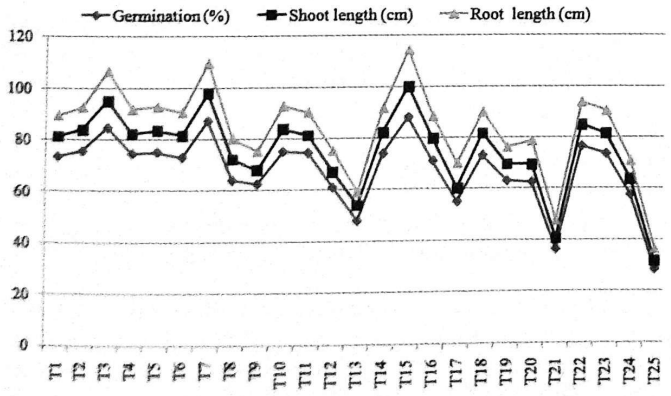

Fig. 2. Effect of seed polymerization with zinc and boron micronutrients on seed germination, shoot length and root length in sunflower hybrid RSFH-130

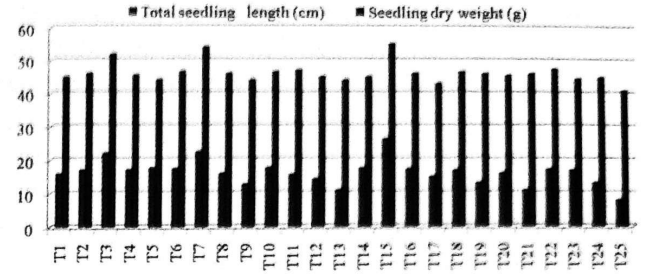

Fig. 3. Effect of seed polymerization with zinc and boron micronutrients on total seedling length and seedling dry weight in sunflower hybrid RSFH-130

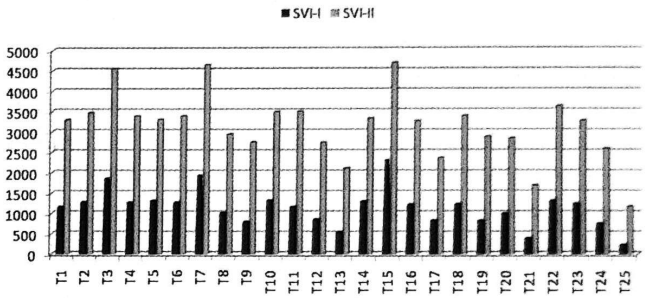

Fig. 3a. Effect of seed polymerization with zinc and boron micronutrients on seedling vigour index in sunflower hybrid RSFH-130

Details of the treatments

T_1	Control
T_2	$ZnSO_4$@2g/kg
T_3	$ZnSO_4$@4g/kg
T_4	$ZnSO_4$@6g/kg
T_5	$ZnSO_4$@8g/kg
T_6	Boron@2g/kg
T_7	Boron@4g/kg
T8	Boron@6g/kg
T_9	Boron@8g/kg
T_{10}	$ZnSO_4$@2g/kg+ Boron@2g/kg
T_{11}	$ZnSO_4$@2g/kg+ Boron@4g/kg
T_{12}	$ZnSO_4$@2g/kg+ Boron@6g/kg
T_{13}	$ZnSO_4$@2g/kg+ Boron@8g/kg
T_{14}	$ZnSO_4$@4g/kg+ Boron@2g/kg
T_{15}	$ZnSO_4$@4g/kg+ Boron@4g/kg
T_{16}	$ZnSO_4$@4g/kg+ Boron@6g/kg
T_{17}	$ZnSO_4$@4g/kg+ Boron@8g/kg
T_{18}	$ZnSO_4$@6g/kg+ Boron@2g/kg
T_{19}	$ZnSO_4$@6g/kg+ Boron@4g/kg
T_{20}	$ZnSO_4$@6g/kg+ Boron@6g/kg
T_{21}	$ZnSO_4$@6g/kg+ Boron@8g/kg
T_{22}	$ZnSO_4$@8g/kg+ Boron@2g/kg
T_{23}	$ZnSO_4$@8g/kg+ Boron@4g/kg
T_{24}	$ZnSO_4$@8g/kg+ Boron@6g/kg
T_{25}	$ZnSO_4$@8g/kg+ Boron@8g/kg

involvement of zinc in a number of physiological processes of plant growth and metabolism including protein synthesis, enzyme activation, carbohydrates, lipids, auxins, nucleic acid metabolism and gene expression [12]. The results were also in accordance with the findings of Sayed *et al.* [13], they reported that root length, shoot length and seedling dry weight increased with the application of zinc in rice. The significant increase in seed quality parameters at low concentration of boron could be due to its involvement in cell elongation or cell division and meristematic growth [14]. The increase in seedling vigour index and seedling dry weight was due to increased germination percentage, root length and shoot length of seedlings. Mixture of two micro elements application increased the seed quality parameters compared with control which might be due to the synergistic effects of microelements on each other as evidenced in sunflower [15].

From this study it could be concluded that combined application of zinc (4g) + boron (4g) along with polymer (6ml kg^{-1}) of seed was found to be most efficient for increasing the seed quality in sunflower hybrid RSFH-130. Hence, seed coating with polymer (6ml) + zinc (4g) + boron (4g) of seed could also be used for enhancing the seed quality parameters of other sunflower hybrids.

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