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Research Article

EFFECT OF SEED PELLETING ON SEED QUALITY PARAMETERS OF BELL PEPPER (*CAPSICUM ANNUUM* L.) UNDER LABORATORY AND NURSERY CONDITIONS

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Abstract- The laboratory and nursery experiments were conducted for two consecutive years (2016-17 and 2017-18) to evaluate the effect of seed pelleting on seed quality parameters of bell pepper (*Capsicum annuum* L.) using cv. Solan Bharpur. There were 15 different pelleting treatments used and replicated four times in the laboratory and nursery studies. The results revealed that seed pelleting significantly influenced the seed quality parameters. Maximum germination (93.87 % and 87.00 %), seedling length (10.12 cm and 11.12 cm), seedling dry weight (2.96 mg and 5.79 mg), seedling vigour index-Length (950.25 and 967.86) and seedling vigour index-Mass (278.22 and 504.13) were recorded in seed pelleted with zinc sulphate (P_4) under laboratory and nursery conditions, respectively. However, the speed of germination was recorded only under nursery conditions and maximum speed of germination (38.99) was recorded in unpelleted seeds (P_0).

Keywords- *Bell pepper, laboratory and nursery conditions, pelleting, seed quality*

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Introduction

The Bell pepper (*Capsicum annuum* L.) commonly known as sweet pepper, capsicum, green pepper or Shimla mirch, belongs to family Solanaceae. It originated in Meso-America (Mexico and Central America) and South America which is now cultivated all over the world [1]. Bell pepper was brought to India by the Portuguese from Brazil prior to 1885. It was introduced to Himachal Pradesh by the British in the 19th century. Seed is being basic and crucial input; the production of quality seeds becomes an important pre-requisite for the agricultural production. The quality of the seed, either for production of fresh or seed crop cultivation depends on several practices which influence the planting value of seed. It has been realized that high quality seed is stepping stone for higher productivity of the crops. The seed quality enhancement practices like seed pelleting has a potential to increase the seed quality. Seed quality and vigour are the essential factors which determine the seedling development in nursery and plant establishment in the field in order to get the higher yield of high-quality seed [2]. In pelleting seed is coated with filler material and active ingredient of desired chemicals for value addition. The inert material creates natural water holding media and provides small amount of nutrient to young seedlings. Through seed pelleting accurate dosing of seed with chemicals is possible and wastage is prevented. With this background the present investigation entitled "effect of seed pelleting on seed quality parameters of bell pepper (*Capsicum annuum* L.) under laboratory and nursery conditions" is undertaken.

Materials and Methods

The laboratory and nursery experiments were conducted at Laboratory of Department of Seed Science and Technology, Dr Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, HP during *Kharif* season 2016-17 and 2017-18. The present studies comprised of 15 seed pelleting treatments *viz*. Po: control (unpelleted), P_1: NPK (19: 19: 19), P_2: Multiplex, P_3 : Potassium dihydro orthophosphate (KH_2PO_4), P_4: Zinc sulphate ($ZnSO_4$), P_5 : Boric acid (H_3BO_3), P_6 : Magnesium sulphate (MgSO4), P_7 : Copper sulphate ($CuSO_4$) , P_8 : NPK (19: 19: 19) + Multiplex, P_9 : NPK (19: 19: 19) + KH_2PO_4, P_{10} : NPK (19: 19: 19) + $ZnSO_4$, P_{11} : NPK (19: 19: 19) + H_3BO_3, P_{12} : NPK (19: 19: 19) + $MgSO_4$), P_{13} : NPK (19: 19: 19) + $CuSO_4$, P_{14} : Wood ash. NPK and multiplex were used @ 5g/kg seed, all other micronutrients were used @ 300 mg/ kg of seed and filler material (wood ash) was used @ 3000 g/kg of seed. Carboxy methyl cellulose @ 0.8 % was used as adhesive in all treatments except control. Paper roll method of testing was used under laboratory conditions while pro trays were used for nursery raising under laboratory conditions. The experiments were laid out in Completely Randomized Block Design with four replications. The observations were recorded on germination percentage (%), seedling length (cm), seedling dry weight (mg), seedling vigour index-Length & seedling vigour index-Mass under laboratory and nursery conditions. However, the speed of germination was recorded only under nursery conditions. Seedling vigour-Length and Seedling vigour-Mass was calculated as per the formula given by [3]. The statistical analysis of recorded observations was done as per design of the experiment as suggested by [4].

Results and Discussion

The pooled analysis of data in [Table-1 & 2] revealed that seed pelleting treatments had significant effect on seed quality parameters under laboratory and nursery conditions. Maximum germination (93.87 % and 87.00 %) was obtained in seeds pelleted with zinc sulphate (P_4), whereas minimum germination (59.37 % and 54.00 %) was obtained in seeds pelleted with copper sulphate (P_7) under laboratory and nursery conditions, respectively. This increase in germination in seeds pelleted with zinc sulphate may be due to involvement of zinc sulphate in maintaining the structural integrity and in the cell protection against damage caused by reactive oxygen species [5]. It is the only metal represented in the six classes of enzymes *i.e.* oxidoreductases, transferases, hydrolases, lyases, isomerases, ligases responsible for the mobilization of stored food material in seed which ultimately led to the increased seed germination [6]. Moreover, zinc is actively involved in the cellular metabolism because it is present in many proteins.

Table-1 *Effect of seed pelleting treatments on seed quality parameters of bell pepper cv. Solan Bharpur under laboratory conditions, pooled mean (2016-17 and 2017-18)*

Treatments	Characters				
	Germination (%)*	Seedling length (cm)	Seedling dry wt.(mg)	SVI Length	SVI Mass
P_0	89.12 (70.73)	8.06	2.22	718.91	198.52
P_1	90.00 (71.54)	8.25	2.27	742.60	204.98
P_2	90.00 (71.55)	8.31	2.36	748.01	212.52
P_3	92.00 (73.55)	9.98	2.66	918.27	245.17
P_4	93.87 (75.67)	10.12	2.96	950.25	278.22
P_5	90.87 (72.40)	9.89	2.55	898.97	231.73
P_6	87.12 (68.95)	9.64	2.42	839.98	211.49
P_7	59.37 (50.38)	7.57	1.99	449.61	118.63
P_8	89.25 (70.84)	9.04	2.22	807.27	198.36
P_9	90.37 (71.91)	9.04	2.25	817.43	203.34
P_{10}	89.87 (71.44)	9.71	2.46	872.68	221.32
P_{11}	89.62 (71.19)	9.14	2.33	819.84	209.38
P_{12}	89.00 (70.61)	9.10	2.29	810.45	204.26
P_{13}	73.87 (59.23)	7.83	2.07	578.91	152.90
P_{14}	88.5 (70.16)	8.05	2.20	712.96	194.80
$CD_{(5\%)}$	0.88	0.06	0.03	9.87	3.11

**Figures in the parenthesis represent angular transformation, P - Seed pelleting treatments*

P_0 - Control (unpelleted), P_1 - NPK (19: 19: 19), P_2 - Multiplex, P_3 - Potassium dihydro orthophosphate (KH_2PO_4), P_4 - Zinc sulphate ($ZnSO_4$), P_5 - Boric acid (H_3BO_3), P_6 - Magnesium sulphate ($MgSO_4$), P_7 - Copper sulphate ($CuSO_4$), P_8 - NPK (19: 19: 19) + Multiplex, P_9 - NPK (19: 19: 19) + KH_2PO_4, P_{10} -NPK (19: 19: 19) + $ZnSO_4$, P_{11} - NPK (19: 19: 19) + H_3BO_3, P_{12} - NPK (19: 19: 19) + $MgSO_4$, P_{13} - NPK (19: 19: 19) + $CuSO_4$, P_{14} – Wood ash

Table-2 *Effect of seed pelleting treatments on seed quality parameters of bell pepper cv. Solan Bharpur under nursery conditions, pooled Mean (2016-17 and 2017-18)*

Treatments	Characters					
	Speed of Germination	Germination (%)*	Seedling length (cm)	Seedling dry wt. (mg)	SVI Length	SVI Mass
P_0	38.99	79.63 (63.17)	9.28	5.14	738.33	409.72
P_1	25.22	81.50 (64.53)	9.30	5.22	758.07	425.16
P_2	26.65	81.88 (64.79)	9.30	5.22	761.19	426.98
P_3	29.08	84.50 (66.82)	10.40	5.58	878.59	471.30
P_4	31.58	87.00 (68.88)	11.12	5.79	967.86	504.13
P_5	28.75	83.25 (65.84)	10.27	5.41	854.58	450.68
P_6	25.05	79.75 (63.25)	9.77	5.32	779.41	424.48
P_7	21.21	54.00 (47.28)	7.61	4.85	410.99	262.03
P_8	25.25	80.38 (63.73)	9.43	5.18	757.45	416.60
P_9	28.02	81.50 (64.51)	9.83	5.26	800.70	428.59
P_{10}	28.60	82.00 (64.89)	10.44	5.38	855.94	440.78
P_{11}	27.61	81.13 (64.24)	9.78	5.25	793.19	425.72
P_{12}	23.89	79.88 (63.38)	9.64	5.20	769.78	414.87
P_{13}	21.79	69.25 (56.31)	8.16	4.89	565.44	338.41
P_{14}	24.74	79.00 (62.74)	9.33	5.17	737.24	408.13
$CD_{(5\%)}$	4.29	2.24	0.18	0.13	29.37	21.89

**Figures in the parenthesis represent angular transformation, P - Seed pelleting treatments*

P_0 - Control (unpelleted), P_1 - NPK (19: 19: 19), P_2 - Multiplex, P_3 - Potassium dihydro orthophosphate (KH_2PO_4), P_4 - Zinc sulphate ($ZnSO_4$), P_5 - Boric acid (H_3BO_3), P_6 - Magnesium sulphate ($MgSO_4$), P_7 - Copper sulphate ($CuSO_4$), P_8 - NPK (19: 19: 19) + Multiplex, P_9 - NPK (19: 19: 19) + KH_2PO_4, P_{10} - NPK (19: 19: 19) + $ZnSO_4$, P_{11} - NPK (19: 19: 19) + H_3BO_3, P_{12} - NPK (19: 19: 19) + $MgSO_4$, P_{13} - NPK (19: 19: 19) + $CuSO_4$, P_{14} – Wood ash

The present results are in accordance with the findings of [8] who reported that seeds pelleted with zinc sulphate improve germination over control and all other pelleting treatments in sunflower [7,8]. Speed of germination was recorded only under nursery conditions. Among seed pelleting treatments maximum speed of germination (38.99) was recorded with unpelleted seeds (P0), whereas minimum speed of germination (21.21) was recorded in seeds pelleted with copper sulphate (P_7). The most probable reason for delayed speed of germination in pelleted seeds is that pelleting material which encloses the seed needs to be dissolved first after that the process of seed germination can take place. However, the seedlings from pelleted seeds as well as unpelleted seeds were transplanted at the same time. The macro and micro nutrients present in the seed pelleting material ensures the continuous supply of nutrients to the developing seedling which resulted in increased seedling growth rate during the later stages of seedling development and supersede the seedling growth rate of unpelleted seeds. Hence decoating of pelleted seeds appears essential for increased speed of germination. The present findings are in agreement with those of [9] they reported that seed coating presumably acts as barrier that delays the emergence of tomato seedling and coated seeds require decoating for enhanced speed of germination and seedling emergence. According to [10], speed of germination was late in all the pelleting treatments due to physical hardiness of the pelleted seed which restrict the radical emergence from the seed as compared to unpelleted seeds. Maximum seedling length (10.12 cm and 11.12 cm) was obtained in seeds pelleted with zinc sulphate (P_4), whereas, minimum seedling length (7.57 cm and 7.61 cm) was obtained in seeds pelleted with copper sulphate (P_7) under laboratory and nursery conditions, respectively. Maximum seedling length in seeds pelleted with zinc sulphate may be due to the fact that zinc enhances efficient translocation of the nutrients from the seed into the initially heterotropic seedling. The zinc content in seedling had beneficial effect on the promotion of shoot length and zinc content in the endosperm may contribute to the increased seedling length through auxin metabolism [11]. These results are in line with the findings of [12] who reported enhanced root and shoot length due to seed pelleting with $ZnSO_4$ + clay in sunflower. Maximum seedling dry weight (2.96 mg and 5.79 mg) was obtained in seeds pelleted with zinc sulphate (P_4), whereas, minimum dry weight (1.99 mg and 4.85 mg) was obtained in seeds pelleted with copper sulphate (P_7) under laboratory and nursery conditions, respectively. The increased seedling dry weight in seeds pelleted with zinc sulphate may be due to the complementary participation of zinc in catalytic activity and breakdown of complex substances into simple form glucose, amino acids and fatty acids that helps in better accumulation of food reserves. Maximum seedling vigour index-Length (950.25 and 967.86) was obtained in seeds pelleted with zinc sulphate (P_4), whereas minimum seedling vigour index-Length (449.61 and 410.99) was obtained in seeds pelleted with copper sulphate (P_7) under laboratory and nursery conditions, respectively. Enhanced seedling vigour index-Length in seed pelleted with zinc sulphate, may be because maximum germination and seedling length was recorded in the same treatment *i.e.,* seeds pelleted with zinc sulphate which attributed to the increased seedling vigour index-Length. Results of the present study are in line with the findings of [13] who reported increased vigour index in paprika due to seed pelleting with $ZnSO_4$ + captan + imidacloprid. Maximum seedling vigour index-Mass (278.22 and 504.13) was obtained in seeds pelleted with zinc sulphate (P4), whereas minimum seedling vigour index-Mass (118.63 and 262.03) was obtained in seeds pelleted with copper sulphate (P_7) under laboratory and nursery conditions, respectively. Enhanced seedling vigour index-Mass was recorded in seed pelleted with zinc sulphate, this may be due to the fact that zinc ascribes to the efficient protein synthesis which results in increased accumulation of dry matter [14]. The present results are in line with the findings of [15] who concluded that in cowpea maximum seedling vigour index-II was derived from seeds pelleted with $ZnSO_4$.

Conclusion

The present studies have demonstrated the benefits of seeds pelleting with zinc sulphate (P_4) and it was found superior over all other treatments in terms germination (%), seedling length, seedling dry weight, seedling vigour index-Length and seedling vigour index-Mass under laboratory and nursery conditions. However, maximum speed of germination was recorded in un pelleted seeds (P_0) under nursery conditions. Therefore, zinc sulphate can be used for seed pelleting to improve the seed quality parameters of bell pepper.

Application of research: Results of the present study strongly reflected that the seed pelleting is one of the important factors that can be used for improving the seed germination and vigour of bell pepper.

Research Category: Plant sciences

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Cultivar / Variety name: Solan Bharpur

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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