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Short Note

Effect of Seed Fortification with Bio-inoculants, Nutrients and Growth Regulators on Seed Germination and Seedling vigour of Tomato (*Lycopersicon esculentum*), Brinjal (*Solanum melongena*) and Chilli (*Capsicum annum*)

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Studies were conducted to find out the influence of seed fortification with bio-inoculants, nutrients and growth regulators on seed germination and seedling vigour of Tomato, Brinjal and Chilli. The fortification treatments included were soaking in water, Cowpea extract 2%, $ZnSO_4$ Horse-gram extract 3%, Bone Meal Extract 2%, Gelatin1000 ppm, KH_2PO_4 1%, KNO_3 2%, 0.1%, $FeSO_4$ 0.2%, Na_2SO_4 0.1%, $MnSO_4$ 0.2%, IBA 100ppm and SA 200 ppm for 12h with dry seeds and dry seeds as control. The results of the study revealed that tomato, brinjal and chilli seeds fortified with gelatin 1000 ppm, KH_2PO_4 1%, KNO_3 2% and SA 200 ppm performed better significantly in terms of germination and seedling vigour.

Key words: Tomato, brinjal, chilli, seed fortification, bioinoculants, nutrients, growth regulators.

Seed fortification is a physiological method of seed invigouartion that aids in improving the initial stamina of the seed through higher germinability, seedling vigour and initial field stand. Seed fortification with plant growth regulators and nutrient solution have been reported to be effective in increasing germination of seeds, vegetative growth of plants and their yield (Quiser Hayat *et al.*,2009). In the last two decades, seed fortification has become a common seed treatment method to increase the rate and uniformity of emergence and crop establishment in most vegetable and flowers especially in advanced countries.

Materials and Methods

Commercially available seeds of tomato cv. PKM 1, brinjal cv. CO 2 and chilli cv. PKM 1with 8% moisture content were obtained for the fortification experiment. Three months old seeds were subjected to fortification treatments *viz*., soaking in water, soaking in bio inoculants (Cowpea extract 2%, Horsegram extract 3%,- Bone Meal Extract 2%, Gelatin1000 ppm), soaking in nutrients and chemicals (KH_2PO_4 1%, KNO_3 2%, $ZnSO_4$ 0.1%, $FeSO_4$ 0.2%, Na_2SO_4 0.1%, $MnSO_4$ 0.2%), soaking in growth regulators (IBA 100ppm, SA 200 ppm) and dried back to the original moisture content. The fortified seeds were tested along with dry seeds as control. The experiment was conducted in a factorial Completely randomized design (FCRD). Observations on germination (%), root length (cm), shoot length (cm), dry matter production (mg seedlings^{-10}), Vigour index were recorded. The germination test was carried out as per the procedure prescribed by ISTA with four replicates of 100 seeds each in roll towel medium. Observations for seedling traits were recorded on ten randomly selected seedlings by drying under shade for 24 h and then in hot air oven maintained at 85 ± 1°C for 48 h. It was cooled in a desiccator for 30 min and weighed. The values were expressed as mg seedlings^{-10}. Vigour index was calculated by using the formula of Abdul Baki and Anderson (1973).

Vigour index = Germination % x Seedling length (cm).

The data recorded were analyzed statistically as per Panse and Sukhatme (1985).

Results and Discussion

Among the different fortification treatments the tomato seeds fortified with 2% KNO_3 recorded the higher germination and vigour index (87 %, 1128) and this was on par with gelatin 1000 ppm, KH2PO4 1%, and SA 200 ppm in germination (86 %, 85% and 85 % respectively) and vigour index (1106, 1084 and 1094 respectively). The untreated control recorded significantly lower germination (77%), and vigour index (887) (Table 1).

In brinjal, seeds fortified with gelatin 1000 ppm, KH_2PO_4 1%, KNO_3 2% and SA 200 ppm enhanced the germination (12 %, 10%, 13% and 11 % respectively over control), higher dry matter production (12.51, 12.40, 12.67 and 12.45 mg seedlings -10 respectively) and vigour index (1051, 1017, 1078 and 1033 respectively) than untreated seeds (11.28 mg seedlings^{-10}, 807 respectively)

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Table 1. Effect of seed fortification on seed quality enhancement in Tomato

Treatment	Germination %	Dry matter production (mg seedlings $^{-10}$)	Vigour index
Control	77 (61.34)	11.59	887
Water	80 (63.43)	12.32	980
Cowpea 2%	83 (65.65)	12.54	1034
Horsegram 3%	81 (64.15)	12.39	1004
BME 2%	83 (65.65)	12.53	1034
Gelatin1000 ppm	86 (68.02)	12.86	1106
KH_2PO_4 1%	85 (67.21)	12.75	1084
KNO_3 2%	87 (68.86)	12.96	1128
$ZnSO_4$ 0.1%	81 (64.15)	12.43	1001
$FeSO_4$ 0.2%	82 (64.89)	12.47	1017
Na_2SO_4 0.1%	81 (64.15)	12.54	1010
$MnSO_4$ 0.2%	83 (65.65)	12.68	1046
IBA 100 ppm	81 (64.15)	12.51	1007
SA 200 ppm	85 (67.21)	12.87	1094
Mean	83 (65.65)	12.53	1031
SEd	1.017	0.0511	15.49
CD (P = 0.05)	2.18**	0.1095**	33.23**

(Table 2). Chillies seeds fortified with gelatin 1000 ppm, KH_2PO_4 1%, KNO_3 2% , and SA 200 ppm also recorded the similar result as brinjal seeds (Table 3). Rapid, uniform and early germination is a prerequisite for good establishment and survival of the seedlings in the field of any crop species. In the present investigation higher germination and seedling vigour were observed due to seed fortification with Gelatin 1000 ppm, KH_2PO_4 1%,

Table 2. Effect of seed fortification on seed quality enhancement in Brinjal

Treatment	Germination %	Dry matter production (mg seedlings $^{-10}$)	Vigour index
Control	72 (58.05)	11.28	807
Water	73 (58.69)	11.41	833
Cowpea 2%	77 (61.34)	11.83	890
Horsegram 3%	75 (60.00)	11.70	872
BME 2%	76 (60.66)	11.82	899
Gelatin1000 ppm	84 (66.42)	12.51	1051
KH_2PO_4 1%	82 (64.89)	12.40	1017
KNO_3 2%	85 (67.21)	12.67	1078
$ZnSO_4$ 0.1%	75 (60.00)	11.77	883
$FeSO_4$ 0.2%	76 (60.66)	11.90	899
Na_2SO_4 0.1%	75 (60.00)	11.62	866
MnSO4 0.2%	79 (62.72)	11.88	939
IBA 100 ppm	75 (60.00)	11.79	878
SA 200 ppm	83 (65.65)	12.45	1033
Mean	78 (62.02)	11.93	925
SEd	1.439	0.053	17.72
CD (P=0.05)	3.087**	0.114**	38**

KNO_3 2% and SA 200 ppm. The results were in agreement with the findings of Renugadevi and Selvaraj (1994) in bitter gourd seeds, who reported the positive role of potassium in improving germination. According to Woodstock (1969) germination rate and percentage could be increased in tomato seeds by soaking in solution of 2% KNO_3 and 2% KH_2PO_4 and then drying back.

Table 3. Effect of seed fortification on seed quality enhancement in Chillies

Treatment	Germination %	Dry matter production (mg seedlings $^{-10}$)	Vigour index
Control	66 (54.33)	11.11	734
Water	69 (56.16)	11.55	797
Cowpea 2%	72 (58.05)	11.74	846
Horse-gram 3%	70 (56.79)	11.70	819
BME 2%	72 (58.05)	11.79	843
Gelatin1000 ppm	75 (60.00)	12.55	946
KH_2PO_4 1%	75 (60.00)	12.52	939
KNO_3 2%	77 (61.34)	12.64	967
$FeSO_4$ 0.2%	70 (56.79)	11.79	826
Na_2SO_4 0.1%	69 (56.16)	11.93	823
IBA 100 ppm	69 (56.16)	11.90	815
SA 200 ppm	76 (60.66)	12.57	955
Mean	72 (58.05)	11.98	859
SEd	1.457	0.059	16.81
CD (P=0.05)	3.17**	0.12**	36.64**

The results revealed that all fortification treatments enhanced the seed germination and seedling vigour. The probable reason for higher germination in fortification treatments could be due to greater hydration of colloids, higher viscosity and elasticity of protoplasm, increase in bound water content, lower water deficit, more efficient root system and increased metabolic activities (Joseph and Nair, 1989).The study thus revealed that fortification of tomato, brinal and chillies seeds in gelatin 1000 ppm, KH_2PO_4 1%, KNO_3 2% and SA 200 ppm significantly recorded higher germination and seedling vigour than unfortified seeds.

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