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Enhancing Seed Germination and Vigor of Chickpea by Using Potential and Effective Strains of *Trichoderma* Species

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Abstract

In this study, potential and effective strains of *Trichoderma* such as *T. harzianum* (Th. Azad) and *T. viride* (01PP) have been investigated and their effect of pre sowing seed treatment on germination, seedling establishment, seedling dry weight and vigour in chickpea genotype (Radhey) was observed. The different pre sowing seed treatments showed different responses against all seven seed quality parameters. Chickpea seeds were treated with different concentrations of *Trichoderma* bioformulation such as 5%, 10%, 20% gm/kg seed followed by treatment with 0.2% Bavistin. As a result, the percentage of seed germination was found to be higher in *T. harzianum* (Th. azad) & *Trichoderma viride* (01PP) treated seeds with 5% bioformulation as compared to the other concentrations. Various attributes with their observations include seed germination (92% and 90%), root length (12.38 and 12.19 cm) shoot length (4.97 and 4.32 cm) seedling length (17.38 and 16.50 cm), dry weight (1.19 and 1.88 cm), vigour index I (5197.12 and 1485) and vigour index II (109.48 and 169.20). Among all treatments, control showed the poorest performance for all seven seed quality attributes.

Keywords: Germination; *Trichoderma*; Vigour; Chickpea

Introduction

Chickpea (*Cicer arietinum L.*) remarkably predominates among other pulse crops in terms of both area and production and the crop is widely growing in` India as well as other tropical, sub-tropical and temperate regions of the world. Its seeds contain high amounts of protein (25.3-28.9%), even after dehulling [1]. Chickpea seeds are eaten fresh as green vegetables, parched, fried, roasted, and boiled; as snack food, sweet and condiments; seeds are ground and the flour can be used as soup, dhal, and to make bread; prepared with pepper, salt and lemon it is served as a side dish. Among various factors attributed to the low productivity of chickpea, such as susceptibility to wilt diseases is the most important. Chickpea is also affected by biotic and abiotic constraints and seed treatment is an important aspect to obtain higher germination and good quality seedlings. Wilt (*Fusarium oxysporum* f. sp. *ciceri* (Pad.) Snyd and Hans is one of the serious diseases of chickpea causing heavy loss upto 10-100% depending on fungal inoculum and environmental conditions). Chemical control of the disease is less effective against *Fusarium oxysporum* f. sp. *ciceri* as it survives in the soil for a longer period of time due to the presence of chlamydospores. Therefore, cultivation of resistant varieties is an economical approach available for the disease when only a few resistant varieties are available [2]. As such, in the present context, biological control of dry root rot of chickpea offers great promise. The species of *Trichoderma* have attracted attention because of their effectiveness against various plant pathogens [3]. They have shown impressive results against many phytopathogenic fungi [4] including *M. phaseolina* [5]. The isolates of *Trichoderma* species included in the present study were evaluated earlier against several seed and soil borne plant pathogens.

Materials and Methods

Freshly harvested seed of chickpea (Radhey) was obtained from seed processing plant of C.S. Azad University of Agriculture & Technology, Kanpur. One hundred seeds were counted and weighted to apply the recommended dose of *Trichoderma* bioformulations into three replications. The test included four treatments base materials viz., bio-control agent (*Trichoderma harzianum* (Th. Azad) as well as *Trichoderma viride* (01 PP) @ 5% g/kg -T1), 10%@g/kg seed-T-2), 20%@gm/kg seed- T3, Bavistin @0.2%/kg- T4) and control –T5. Four treatments of different formulation of *Trichoderm harzianum* such as 5%, 10%, 20% furrow application of *Trichoderma harzianum* 2% w.p.@ 2.5 kg h- and bavistin included with control. All the treatments were tested as dry seed treatment method [6]. Different combination of *Trichoderma* formulation along with 100 seeds of chickpea was used for studies. Seed treatment was carried out with the help of paper towel method [7]. The treated seeds were subjected to assess the germination and vigour as per the procedure recommended by ISTA at laboratory of Department of Seeds Science & Technology, C.S. Azad University of Agriculture and Technology, Kanpur. Seed germination was recorded 5 days after treating in all the experiments. Seed germination was recorded on the basis of number of the seed germinated out of total germination. Seedling length of the seed was recorded 10 days after treatments in all the experiments. Shoot and root lengths of the seeds were recorded on the basis of randomly selected ten plants per treatment in lab experiment [8]. The dry weight of the seedling were measured on the basis of randomly selected 10 germinated seeds per experiment were placed in hot air oven at 60° C for 36 hours. Two recommended methods viz., germination per cent x seedling length for vigour index I [9] and germination x dry weight for vigour index-II was adopted during the course of investigation.

Results and Discussion

In the current study, it was observed that all the seed treatments were significantly superior over control (untreated seeds). Among the seven seed quality parameters viz. germination, shoot length, root length, seedling length, seedling dry weight, vigour index I and vigour index II (Figures 1 and 2). Treatment T1- 5% gm/kg (both *Trichoderma harzianum* (Th. azad) and *Trichoderma viride* (01 PP) was found to be significantly superior and effective with 92% and 90% percent germination of chickpea variety Radhey from control followed by T5 (79 and 58%), T2 (92 and 90%), T3(86 and 85%)T4(84 and 81%)) similarly the beneficial impact of seed treatment was also recorded for root length, shoot length, seedling length and dry weight vigour index-I and vigour index-II similarly T1 treatment (5% gm/kg) excelled overall significant superior performance by contributing root length (12.38, 12.19), shoot length (4.97, 4.32), seedling length (17.36, 16.50), dry weight (1.19, 1.88), vigour index I (1597.12, 1485.00), vigour index- II (109.48, 169.20) respectively followed by T5 treatment (Control) for all these physiological attributes by contributing as Germination (79,58) root length (8.13, 8.68), shoot length (3.53, 3.49), seedling length (11.66, 12.17), dry weight (0.79, 0.32), vigour index- I (921.14, 705.86) and vigour index-II (62.45, 18.56) respectively. Germination and seedling length along with seedling dry weight are important attributes, which determine the quality of seed of any seed lot. Besides these quality seed parameters seed vigour index also plays very crucial role in predicting the fate of any seed lot under biotic and abiotic stress conditions. Shukla and Cokkizgin (10,11) also reported germination per cent, plumule length, radical length and vigour index in case of lentil and *Terminalia arjuna* showed better performance for all these attribute with chemical treatments. The data given (Tables 1, Table 2), it is also revealed that over all superior performance was contributed by T1 treatment (5%) achieving the highest vigour index-I as well as vigour index-II by scoring (1597.12, 14.85) and (109.48, 169.20) value, respectively followed by T2- (1282.48, 1361.70) and (104.88, 158.40), T3 (1106.82, 1218.05) and (76.54, 136.00), T4 (1023.12, 1060.29) and (72.24, 89.91). The impact of control treatment (T5) for germination was poor compared to T1 (5%) while T4, T3 and T2 showed least impact on root length, seedling length and for dry weight. Similarly, T5 was found also poor for all seven seed quality attributes. Dubey and Shahid (8,12) also suggested the effect of soil application and seed treatment with *Trichoderma* species on seed germination shoot, root length dry root in case of chickpea. The above result concluded that out of five treatments including control T1 treatment (5%) are better seed treatments to enhance quality seed parameters in chickpea seed (Radhey), which can finally be converted into superior yield even in adverse conditions.

Treatment	Germination	Root Length	Shoot Length	Seedling length	Dry weight	Vigour Index I	Vigour Index II
T1(5%)	90	12.19	4.32	16.50	1.88	1485.00	169.20
T2 (10%)	90	10.98	4.14	15.13	1.76	1361.7	158.40
T3 (20%)	85	10.22	4.10	14.33	1.60	1218.05	136.00
T4 (Bavistin)	81	9.44	3.65	13.09	1.11	1060.29	89.91
T5 (Control)	58	8.68	3.49	12.17	0.32	705.86	18.56
C.D at 5%	5.74	1.38	0.29	1.24	0.43	84.74	12.75
S.D.	2.58	0.62	0.13	0.56	0.18	38.04	5.72

Table 1: Effect of different seed treatments on quality of chickpea seeds. *Trichoderma harzianum* (Th. azad)

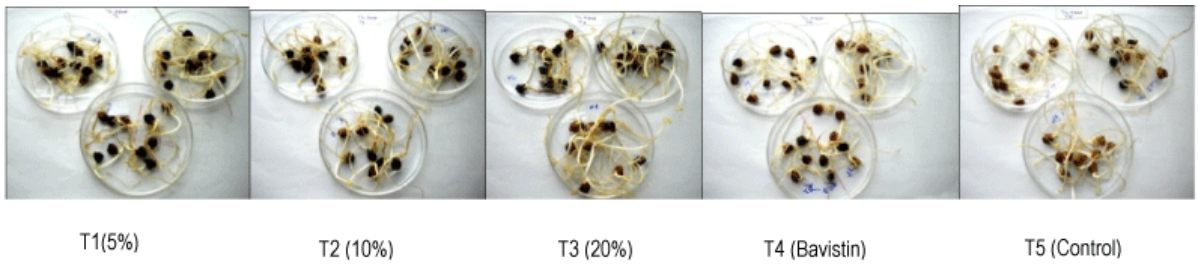

Figure 1: Effect of different seed treatments on quality of chickpea seeds

Treatment	Germination	Root Length	Shoot Length	Seedling length	Dry weight	Vigour Index I	Vigour Index II
T1(5%)	92	12.38	4.97	17.36	1.19	1597.12	109.48
T2 (10%)	92	9.5	4.44	13.94	1.14	1282.48	104.88

T3 (20%)	86	8.76	4.11	12.87	0.89	1106.82	76.54
T4 (Bavistin)	84	8.21	3.97	12.18	0.86	1023.12	72.24
T5 (Control)	79	8.13	3.53	11.66	0.79	921.14	62.41
C.D at 5%	3.35	1.19	0.31	1.46	0.29	78.96	7.70
S.D.	1.50	0.53	0.14	0.65	0.13	35.45	3.46

Table 2: Effect of different seed treatments on quality of chickpea seeds. *Trichoderma viride* (01PP)

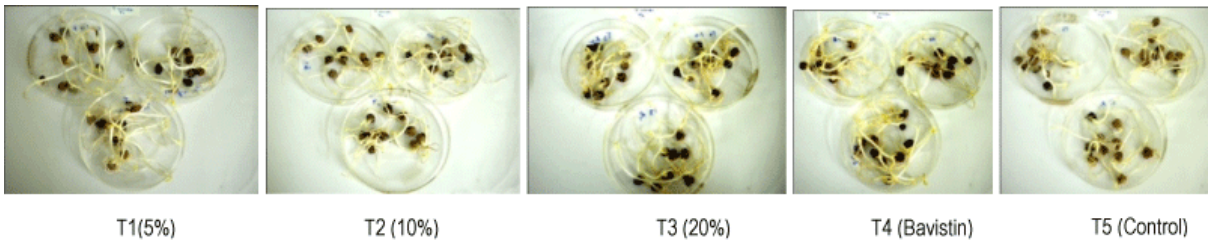

Figure 2: Effect of different seed treatments on quality of chickpea seeds

Conclusion

In this study, potential and effective strains of Trichoderma such as T. harzianum (Th. Azad) and T. viride (01PP) have been investigated and their effect of pre sowing seed treatment on germination, seedling establishment, seedling dry weight and vigour in chickpea genotype (Radhey) was observed. The different pre sowing seed treatments showed different responses against all seven seed quality parameters. Chickpea seeds were treated with different concentrations of Trichoderma bioformulation such as 5%, 10%, 20% gm/kg seed followed by treatment with 0.2% Bavistin. As a result, the percentage of seed germination was found to be higher in T. harzianum (Th. azad) and Trichoderma viride (01PP) treated seeds with 5% bioformulation as compared to the other concentrations. Various attributes with their observations include seed germination (92% and 90%), root length (12.38 and 12.19 cm) shoot length (4.97 and 4.32 cm) seedling length (17.38 and 16.50 cm), dry weight (1.19 and 1.88 cm), vigour index I (5197.12 and 1485) and vigour index II (109.48 and 169.20). Among all treatments, control showed the poorest performance for all seven seed quality attributes.

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