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Efficacy of chemicals and biologicals seed treatments on yield attributing characters of chickpea (*Cicer arietinum* L.)

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Abstract
The present investigation aims to know the effect of fungicidal, insecticidal and biological seed treatment individually and in combination at yield attributing characters of chickpea. Chickpea variety KWR-108 seed were treated with following treatments carbendazim @ 0.1% (T_1), imidacloprid @ 0.1% (T_2), rhizobium + PSB @ 2.5 g each /100g seed (T_3), Trichoderma harzianum @ 0.2% (T_4), carbendazim @ 0.1% + imidacloprid @ 0.1% (T_5), [rhizobium + PSB] @ 2.5 g each /100g seed + (Trichoderma harzianum) @ 0.2% (T_6), carbendazim @ 0.1% + imidacloprid @ 0.1% + rhizobium + PSB @ 2.5 g each /100g seed (T_7), carbendazim @ 0.1% + imidacloprid @ 0.1% +([rhizobium + PSB) @ 2.5 g each /100g seed + Trichoderma harzianum @ 0.2% (T_8) and control (T_0) and sowed in Randomized Block Design at Oil Seed Farm of C. S. Azad University of Agriculture & Technology Kanpur. Recommended package and practices were applied and yield attributing characters *viz*. number of pod plant^{-1}, number of seed plant^{-1}, seed yield plot^{-1} (kg.) and test weight of seed were recorded and this investigation revealed treatment T_8 showed significantly superior performance followed by treatment T_7.

Keywords: Seed treatments, seed yield, carbendazim, imidacloprid, rhizobium, trichoderma, chickpea

Introduction
Chickpea, (*Cicer arietinum* L.) is one of the major pulse crop grown during the rabi season. Its feed and straw are highly rich in nutrients and are mostly used as productive ration for animals. Chickpea is one of major pulse crop of world which is a huge source of vegetable protein, minerals and essential amino acids required for growth of human body. Chickpea contain 22% protein, 56% carbohydrates and it has a considerable amount of ash, calcium, phosphorous and iron. It is also a good source of vitamin A, thiamin, riboflavin nicotinic acid and vitamin C. Beside human consumption it is an excellent concentrate for horse. It is important pulse crop occupying third position among the grain legumes in the world. Among the pulses grown in country, gram occupies a predominant position and is considered as a king of pulses. An Indian sub-continent accounts for 70 and 80 percent area and production respectively. Chickpea yield are constrained by several disease and insect pest which may cause up to 100% yield loss in adverse conditions. Seed treatment is the cheapest and most effective means of management of seed and soil born pathogen which are most serious cause of yield loss. Seed treatment has a huge significance in controlling disease & pest and improving yield also. Chemical seed treatment is the cheapest and most effective means of controlling most seed borne pathogens. Fungicidal seed treatment may kill or inhibit seed borne pathogen and may form a protective zone around seeds that can reduce decay and seedling blight caused by soil borne pathogens, resulting in healthy and vigorous seedlings (Nene & Thaphyl, 1993) [4]. Carbendazim, a systemic benzimidazole broad spectrum fungicide, that is used to help control the growth of unwanted fungus and mold as seed treatment as well as foliar spray. Imidacloprid is a systemic insecticide that acts as an insect neurotoxin. Biological seed treatment differ from chemical ones in respect of that microorganism are alive and must grow well if they are to be useful. An important criterion for a successful biological seed treatment is the preparation of bio-agent from in which it must have a long self life. *Trichoderma* was the first fungus demonstrated as an antagonist for control of soil borne pathogens, such as *Rhizoctonia saloni* (Weindling, 1934) [11]. Rhizobium a symbiotic bacterium, colonizes on the roots of specific legumes to form root nodules, the

organism entering into the roots derive carbohydrates from the root tissue of the host plant, fix nitrogen from atmosphere and synthesize amino acids, and protein to make the cell material. In return, the host plants receive nitrogenous compounds synthesized by the bacteria for their own growth and development. Thus, the two organism, the legume and bacteria live in association and helps each other in their growth. Phosphate solubilizing bacteria (PSB) are beneficial bacteria capable of solubilizing inorganic phosphorus from insoluble compounds. The use of phosphate solubilizing bacteria as inoculants simultaneously increases phosphorus uptake by the plant and enhances crop yield. Strains from the genera Pseudomonas and Bacillus are among the most powerful phosphate solubilizers. The principal mechanism for mineral phosphate solubilization is the production of organic acids, and acid phosphatases which play a major role in the mineralization of organic phosphorous in soil which results in better crop stand, plant health, and increase in yield and seed quality. Hence, an attempt has been made to find out the best seed treatment combinations for improving yield of chickpea (*Cicer arietinum* L.).

Material and Methods

The present investigation were conducted at oil seed farm of C. S. Azad University of Agriculture & Technology Kanpur during Rabi seasons of 2017-18. For investigation chickpea variety KWR-108 (breeder seed) were taken from seed processing unit of the University. 100 gram of seed for each chemicals and biological inoculant concentration were treated with following treatments carbendazim @ 0.1% (T_1), imidacloprid @ 0.1% (T_2), rhizobium + PSB @ 2.5 g each /100g seed (T_3), Trichoderma harzianum @ 0.2% (T_4), carbendazim @ 0.1% + imidacloprid @ 0.1% (T_5), [rhizobium + PSB] @ 2.5 g each /100g seed + Trichoderma harzianum @ 0.2% (T_6), carbendazim @ 0.1% + imidacloprid @ 0.1% + [rhizobium + PSB] @ 2.5 g each /100g seed (T_7), carbendazim @ 0.1% + imidacloprid @ 0.1% + [rhizobium + PSB] @ 2.5 g each /100g seed + Trichoderma harzianum @ 0.2% (T_8) and control (T_0). Then the seeds were shade dried to contain the seed moisture content of 11-13%. The treated seeds along with control (untreated) were sown in three replications by using Rendomized Block Design of nine treatments in three replications in a plot of 4 x 2.5 m^2 (10 m^2) size each. The crop was grown by using all required agronomical practices and mature crop was harvested and processed. The observations were recorded at physiological maturity stage for number of pod $plant^{-1}$ (10 random plant averaged), number of seed $plant^{-1}$ (10 random plant averaged) and after processing for seed yield $plot^{-1}$ (kg.) in 10 m^2 area and test weight of seed (g.) all. The data thus recorded was evaluated statistically for Rendomized Block Design as per the procedure given by Chandel (1984) [2].

Result and Discussion

Table 1: Data presented in clearly reveled that all treatment used in this study differed significantly from control for all the characters

Treatment	No. of pod $plant^{-1}$	No. of seed $plant^{-1}$	Seed yield $plot^{-1}$ (kg.)	Test wt. of harvested seed
T_0 (Control)	12.4	24.5	1.97	150.3
T_1(Carbendazim @ 0.1%)	14.8	29.4	2.19	156.4
T_2 (Imidacloprid @ 0.1%)	15.4	29.9	2.20	156.0
T_3 (Rhizobium+PSB* @ 2% each)	15.3	28.8	2.13	156.1
T_4 (*Trichoderma harzianum* @ 0.2%)	14.1	28.1	2.09	154.7
$T_5 = T_1 + T_2$	15.6	30.8	2.36	156.5
$T_6 = T_3 + T_4$	15.3	29.8	2.20	154.9
$T_7 = T_1+T_2+T_3$	15.6	31.1	2.42	158.3
$T_8 = T_1+T_2+T_3+T_4$	17.1	33.8	2.79	162.5
Average	15.0	29.6	2.27	156.3
SE (diff)	0.658	0.952	0.098	0.869
CD at 5%	1.407	2.037	0.210	1.858

As the data presented in table 1 clearly reveled that all treatment used in this study differed significantly from control for all the characters. The number of pod $plant^{-1}$ and number of seed $plant^{-1}$ were recorded highest 17.1 and 33.8 respectively in Treatment T_8 (Carbendazim + Imidacloprid + (*Rhizobium leguminosarum*+PSB) + *Trichoderma harzianum*) were highest followed by Treatment T_7 (Carbendazim + Imidacloprid + (*Rhizobium leguminosarum* +PSB)) 15.6 and 31.1 respectively. While, all treatments effect were significantly superior over control. It may be due to reduction in pest and disease incidance These findings were supported by several scientist *viz*., Sarawgi *et al*. (1998) [8] in chickpea, Pan *et al*. (2011) [5] in cowpea, Anitha *et al*. (2012) in soyabean and Mummigatti *et al*. (2013) [3] in soyabean, while not supported by Ladsingh Bakodiya (2010) in chickpea.

The effect of seed treatment was significantly superior with respect to seed yield $plot^{-1}$ due to most of the treatments. Treatment T_8 (Carbendazim + Imidacloprid + (*Rhizobium leguminosarum* +PSB) + *Trichoderma harzianum*) 2.79 kg. was highest followed by Treatment T_7 (Carbendazim + Imidacloprid + (*Rhizobium leguminosarum* +PSB)) 2.42 kg. in both attributes. However, all treatments were superior over control. It may be due to neurotoxin effect of imidacloprid which restrict pest incidence or more availability of nutrient caused by rhizobium ad PSB or control of soil born pathogen by trichoderma The finding are in agreement with previous study of Podder *et al*. (2004) in chickpea, Kamedi *et al*. (2012) in chickpea, Anitha *et al*. (2013) [1] in soyabean, Mummigatti *et al*. (2013) [3] in soyabean and Venkatesh M. Kanti *et al*. (2013) [10] in soyabean. These results differed from results of Rajput and Singh (1996) [6] in cowpea, Rathore *et al*. (1996) [7] in chickpea and Srivastava *et al*. (2006).

The effect on test weight were significantly superior over control from all the treatments. Treatment T_8 (Carbendazim + Imidacloprid + (*Rhizobium leguminosarum* +PSB) + *Trichoderma harzianum*) was highest 162.5 g. followed by Treatment T_7 (Carbendazim + Imidacloprid + (*Rhizobium leguminosarum* +PSB)) 158.3 g. Similar results have been reported by Anitha *et al*. (2013) [1] in soyabean and Mummigatti *et al*. (2013) [3] in soyabean.

Conclusion

It may be concluded that the number of pod plant^{-1}, number of seed plant^{-1}, seed yield plot^{-1} and test weight of seed were significantly superior over control due to the treatments. Treatment T_8 (Carbendazim + Imidacloprid + (*Rhizobium leguminosarum*+PSB) + *Trichoderma harzianum*) was singnificantly superior among all treatments followed by treatment T_7 (Carbendazim + Imidacloprid + *Rhizobium leguminosarum* +PSB).

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