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Plant growth promoting response in chickpea (Indira Chana-1) following seed bio-priming with Tricho BARC mutant

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Abstract
Seed bio-priming can be a preferred method of delivering the potential Trichoderma mutants to different crops and can be one of the successful strategy to scale up the microbial products at regional to global levels. Growth promoting response in chickpea (Indira Chana-1) following seed bio-priming with BARC mutant showed increased value on different growth promoting parameters over control. Plant height (16.33%, 29.09%), No. of branches (37.06, 33, 52%), No. of Plants per sq. m. (34.43%, 39.34%) and No. of pods (23.45%, 32.40%) in year 2018 and 2019 respectively.

Keywords: Seed bio-priming, BARC mutant, chickpea

Introduction
Trichoderma is a important genus of fungi in the family Hypocreaceae, which shows their adaptability to various ecological conditions, and are highly opportunistic and have been isolated from a diverse range of substrates (artificial and natural), (Druzhinina *et al*., 2011, 2012) [4]. Species importance in the fungal genus *Trichoderma* can well be understood because they serve as sources of variety of antibiotics, enzymes, plant growth promoters, xenobiotic degraders, and importantly, as commercial bio-fungicides (Mukherjee, 1999) [9]. Improved nutrient use efficiency, mycoparasitic and plant growth promoting ability, ability to produce diverse array of secondary metabolites, SAR against invading pathogen, makes *Trichoderma* spp. as one of the most preferred bioinoculant agriculture (Mukharjee *et al*., 2013, Lamdan *et al*., 2015, Salas-Marina *et al*., 2015; Chagas *et al*., 2017) [10, 7, 11, 1].
Trichoderma spp. interacts with plant once it colonizes rhizosphre/ rhizoplane. Bipartite interaction results in root colonization which triggers morphologic changes in the roots (Contreras-Cornejo *et al*., 2009, 2015) [3, 2] and promote growth of plant in the form of increased density of rot, enhanced uptake of nutrient, mineral solubilization, and induced defense response against biotic and abiotic stresses (Harman 1992; Mastouri *et al*., 2010) [6, 8]. Selected strains of *Trichoderma* interact with the plant by root colonization, establishing communication with help of chemicals and altering the expression of numerous plant genes systemically. In the recent past *Trichoderma* isolates have been identified to act as root endophytic plant symbionts stimulating significant modulation in gene expression in shoots. Such modulation in gene expression alter plant physiology and that may improve resistance to biotic / abiotic stress, nitrogen fertilizer uptake, improves photosynthetic efficiency and the net result of such effects is an increase in plant growth and productivity (Hermosa *et al*., 2012) [13]. Use of microbial products has recently received increased attention owing to its sustainable and eco-friendly nature and therefore are becoming a critically needed component of agriculture. Bio-inoculants provide unique opportunities for crop production and protection. Because they grow and proliferate, they colonize the emerging root and rhizosphere of the planted seed, colonize and stimulate the entire subterranean plant portions. Owing to the unique capabilities of *Trichoderma*, the present investigation was therefore undertaken "Field evaluation of potential Trichoderma mutants on growth and yield attributing characters of different crops and vegetables following seed dressing.

Material and Methods

Field experiments was conducted at Research cum instructional Farm, College of Agriculture, I. G. K. V., Raipur, to study the efficacy of potential *Trichoderma* mutants on growth and yield attributing characters following seed bio-priming in chickpea (INDIRA CHANA-1). Seed bio-priming was done by spraying potential BARC mutant @ 10 gm/kg of seed dose on seeds and talcum powder was sprinkled so that fungal culture could coat the seeds completely and shade dried. Seed bio-priming was done prior to sowing and seeds were incubated for 24 hours. Control and treated plot was maintained separately. Observation such as plant height, no. of primary branches, total no. of plants (per sq. metre) and no. of pods were recorded randomly from control and treated plot in per metre square area.

Result and Discussion

Bio-priming treatment is most prominent approach to induce profound changes in characteristics of plant and to encourage more rapid and uniform seed germination. Seed bio-priming forms protective covering around the seed coat which ensures better seedling germination and reduces pre and post emergence mortality of seedling due to different seed and soil borne pathogens (Entesari *et al*., 2013) [5].

We then undertook extensive field evaluation (on-farm demonstration trials) of mutant-based formulation (BARC) for plant growth promoting activity following seed bio-priming in chickpea (Indira Chana-1). Field experiments were carried out at research cum instructional farms, of College of Agriculture, I.G.K.V., Raipur during *rabi*-2017-2018 and 2018-2019. Based on the results of statistical analysis of chickpea field data traits like plant height, no. of pods, no. of primary branches, no. of plants (per sq. meter), no. of leaves and no. of nodules were significantly different at 5% and 1% level of significance. In field experiment, all the parameters attributing growth and yield in Indira Chana-1 of chickpea and C.G. soya-1 of soybean were influenced by treatment of BARC mutant presented in the table 1 and 2, figure 1 and 2, plate 1 and 2.

Significant increase in plant height, no. of pods, no. of primary branches and no. of plants (per sq. meter) was observed in chickpea at crop harvesting stage. It was observed that plants derived from seed bio priming with BARC mutant culture consistently at two locations over two years improved germinations and plant growth. Growth promotion improved pod bearing (Table 1 & 2) (Plate 1 & 2). Data presented in table 1 & 2 indicates percent improvements in Plant height, No. of branches, No. of Plants / Sq.M and No. of pods as compared to control at two locations for two consecutive years 2018 and 2019.

1. **KVK Raipur *rabi*-2018:** Plant height, No. of branches, No. of Plants / Sq.M and No. of pods was 16.33%, 37.06%, 34.43% and 23.45% improved as compared to control.
2. **KVK Raipur *rabi*-2019:** Plant height, No. of branches, No. of Plants / Sq.M and No. of pods was 29.09%, 33.52%, 39.34 and 32.40% improved as compared to control.

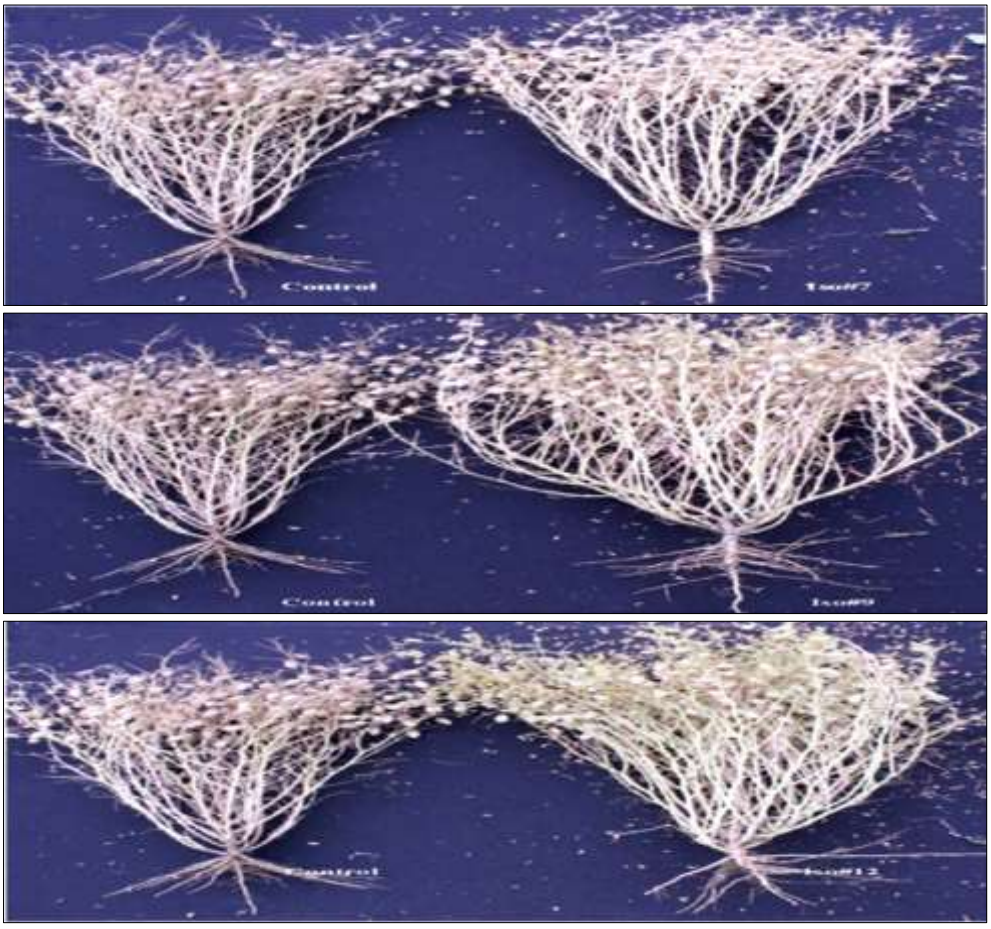

Plate 1: Seed bio-priming effect on plant growth promoting activity of BARC mutant in Chickpea (Indira Chana-1) in KVK Raipur *rabi* 2018-2019

Plate 2: Seed bio-priming effect on plant growth promoting activity of BARC mutant at flower initiation stage in Chickpea (Indira Chana-1) at KVK Kawardha *rabi* 2018- 2019

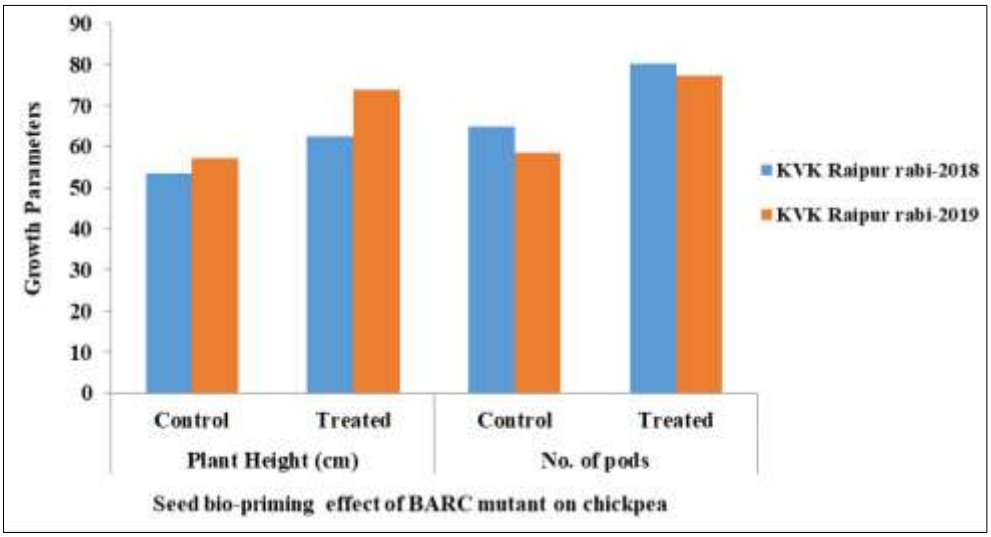

Fig 1: Effect of seed bio-priming with BARC mutant on growth and yield attributing characters of chickpea at KVK Raipur field *rabi* 2018 and 2019

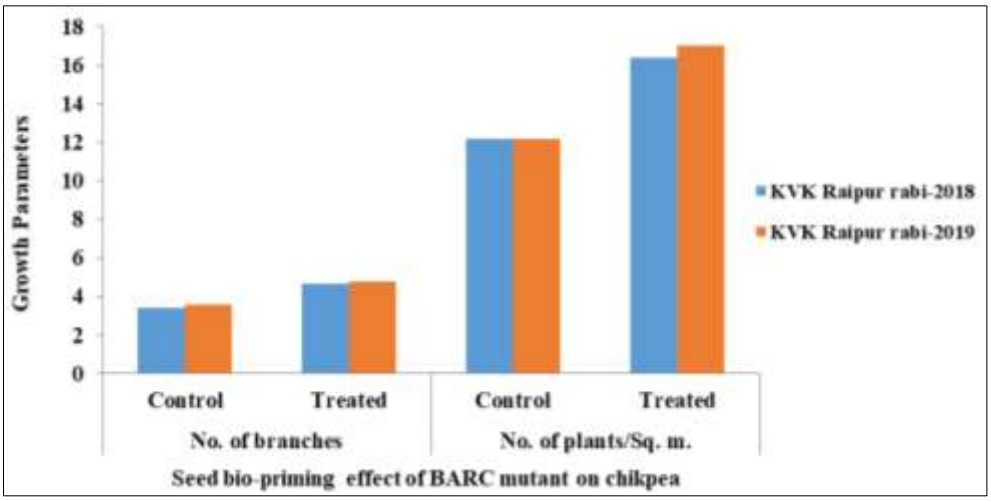

Fig 2: Effect of seed bio-priming with BARC mutant on growth and yield attributing characters of chickpea at KVK Raipur field *rabi* 2018 and 2019

Table 1: Evaluation of growth promoting response of chickpea (Indira Chana-1) following seed bio-priming with BARC mutant

	Plant Height (cm)*		No. of Branches*		No. of Plants / Sq. M*		No. of Pods*	
	Control	Treat	Control	Treat	Control	Treat	Control	Treat
KVK Raipur *rabi*-2018								
Mean	53.63	62.39	3.4	4.66	12.2	16.4	64.9	80.12
SD	0.99	1.91	0.18	0.32	0.83	1.14	9.2	2.03
CV	0.98	3.68	0.03	0.1	0.7	1.3	8.47	4.14
Cal. T	9.07		7.58		6.64		3.6	
KVK Raipur *rabi*-2019								
Mean	57.16	73.79	3.58	4.78	12.2	17	58.46	77.4
SD	1.53	3.24	0.19	0.44	0.99	5.33	2.25	5.83
CV	2.34	10.52	0.03	0.2	0.98	28.44	5.09	34.2
Cal. T	7.08*		5.48		9.28		6.77	

*= Average of 50 plants

Table 2: Evaluation growth promoting response in chickpea (Indira Chana-1) following seed bio-priming with BARC mutant

	Plant Height (cm)*		No. of Branches*		No. of Plants / Sq. M*		No. of Pods*	
	Control	Treat	Control	Treat	Control	Treat	Control	Treat
KVK Raipur *rabi*-2018								
Average	53.63	62.39	3.4	4.66	12.2	16.4	64.9	80.12
%increase over control	16.33		37.06		34.43		23.45	
KVK Raipur *rabi*-2019								
Average	57.16	73.79	3.58	4.78	12.2	17	58.46	77.4
%increase over control	29.09		33.52		39.34		32.4	

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