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RESEARCH ARTICLE

EFFECT OF BIOFERTILIZERS AND INORGANIC FERTILIZERS ON GROWTH AND YIELD OF CHILLI (*CAPSICUM ANNUUM* L) VAR- CO 1

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ABSTRACT

The use of synthetic fertilizer is being discouraged. Now a day's synthetic fertilizers are replaced by biofertilizers. In order to evaluate the efficacy of microbial inoculants combined with inorganic fertilizers in improving the performance of plant growth and yield of *capsicum annum* and soil were inoculated with single inoculation, dual and triple inoculation along with inorganic fertilizers. The data was collected in biomass of shoots and yield was collected after every harvest between 30 days interval. Triple inoculation with synthetic fertilizer of NPK100% caused a maximum improvement of growth and yield, while dual and double inoculation with various combinations of inorganic fertilizers comparatively showed inferior. However, the extent of improvement varied with the inoculants. The nitrogen and phosphorus contents in the shoots of plants raised from single, double or triple inoculations were higher than plants raised from untreated (control) plants. The present findings showed that combination of microbial inoculants seems to promote the performance of chillies for higher yield.

Key words: *Capsicum annu,* Growth.

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INTRODUCTION

Biofertilizers are gaining importance in recent years due to increased cost of inorganic fertilizers and reduction in the benefit to cost ratio chillies cultivation. Now a day's, organic farming is the cultivation of crops through organic inputs with intensity to minimize the use of chemical fertilizers and pesticides that is hazardons to the environment. *Azotobacter* and *Azospirillium* are also known to increase growth and yield of vegetable crops (Bashan *et al.,* 1989; Hamedunnisa and Begum 1998). To maintain long term soil health and productivity there is a need for integrated nutrient management through manures and biofertilizers (Mondal *et al.,* 2003). Biofertilizers are eco-friendly, low cost input and not only improve the crop growth and yield but also improve fruit quality and fertilizer use efficiency (Patel *et al.,* 2011). Organic material such as bio-digested slurry, poultry manure, green leaf manure and FYM can substitute for inorganic fertilizer to maintain productivity and environmental quality (Singh *et al.,* 2014). In the present study an attempt has been made to explore the possibility of proving the performance of Co-1 chilly an important spice crop of the country, through an integrated application of microbial inoculants.

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A package of triple inoculants, consisting of nitrogen fixers *Azotobacter*, *Azospirillium* and potential phosphorus solubilizing bacteria *Bacillus megaterium* identified as the basis of preliminary screening and was evaluated for their efficacy.

MATERIALS AND METHODS

In order to evaluate the efficacy of microbial inoculants in improving the performance of chilly the following treatments were set; T_1- control(100% NPK), T_2- 75% NP + 100 % K, T_3- 75% N + 100 % PK + *Azotobacter,* T_4 – 75% N + 100 % PK + *Azospirillum*, T_5 – 75 % N + 100 % PK + *Azotobacter* + *Azospirillum,* T_6 - 75% P + 100% NK + PSB, T_7 – 75% NP + 100% K + *Azotobacter*+ PSB, T_8 – 75% NP + 100 % K + *Azospirillum* + PSB, T_9 – 75% NP + 100% K + *Azotobacter* + *Azospirillum* + PSB, T_{10} – 100% NPK + *Azotobacter* + *Azospirillum* + PSB, T_{11} – *Azotobacter* + *Azospirillum* + PSB. The present experiment was conducted in randomized block design, 11 treatments with 3 replications in pot at pot culture yard, department of microbiology, faculty of agriculture, Annamalai University during rabi, 2016. The seedlings were raised in seedling pots containing sterilized soil without inoculants. After 30 days the seedlings were transplanted to pots are measuring (1' ×2'×2') containing 7 kg of land soil and sand in the ratio of 1:1. The seeds of chillies was surface sterilized with 80 percent ethanol and 0.1 percent mercuric

chloride and washed with sterile distilled water for 3 to 4 times. The seeds were mixed with carrier based bioinoculants as single, dual and consortium of organisms separately having a cell load of 1×10^9 cfu ml^{-1} and shade dried for 30 min. after shade drying, the seeds were sown at 20 seeds per pot and finally two seeds were maintained. A control pot without inoculation was also maintained.

Table 1. The effect of plant height, number of branches, number of fruits, average fruit yield, and protein content on chilly plant for 90 days

Treatment	Plant height (cm)	Number of branches / plant	Number of fruits / plant	Average fruit yield / plant (g)
T_1 – Control	45.08	4.9	59.05	141.06
T_2 – 75% NP +100% K	53.09	6.6	70.9	197.21
T_3 – 75% N + 100% PK + *Azotobacter*	56.83	7.8	72.6	218.03
T_4 – 75% N + 100% PK + *Azospirillum*	58.07	8.9	76.2	225.35
T_5 – 75% N + 100% PK + *Azotobacter*+ *Azospirillum*	70.23	11.2	83.1	233.43
T_6 – 75% P + 100% NK + PSB	60.29	9.7	78.9	229.10
T_7 – 75% NP + 100% K + *Azotobacter* + PSB	67.41	10.3	80.4	230.01
T_8 – 75% NP + 100% K + *Azospirillum* + PSB	75.22	13.6	86.9	240.91
T_9 – 75% NP + 100% K + *Azotobacter* + *Azospirillum* + PSB	73.70	12.9	84.9	237.73
T_{10} – 100% NPK + *Azotobacter* + *Azospirillum* +PSB	77.63	14.7	89.0	245.46
T_{11} – *Azotobacter* + *Azospirillum* + PSB	50.30	6.3	68.7	174.42

Table 2. The effect of single, double or triple inoculations of Azotobacter , Azospirillum and Phosphorus solubilizing bacteria on shoot dry weight, root dry weight, nitrogen and phosphorus uptake on chilly for 90 days

Treatment	Shoot weight / plant	Root dry weight / plant (g)	Nitrogen mg/g of dry shoot	Phosphorus mg/g of dry shoot
T_1 – Control	1.412	0.331	17.3	1.0
T_2 – 75% NP +100% K	1.552	0.532	22.6	1.4
T_3 – 75% N + 100% PK + *Azotobacter*	1.641	0.623	28.9	1.4
T_4 – 75% N + 100% PK + *Azospirillum*	1.875	0.675	31.4	1.6
T_5 – 75% N + 100% PK + *Azotobacter* + *Azospirillum*	2.481	0.844	38.8	2.6
T_6 – 75% P + 100% NK + PSB	2.50	0.746	32.7	1.9
T_7 – 75% NP + 100% K + *Azotobacter* + PSB	1.486	0.811	35.8	2.1
T_8 – 75% NP + 100% K + *Azospirillum* + PSB	2.289	0.946	43.6	3.4
T_9 – 75% NP + 100% K + *Azotobacter* + *Azospirillum* + PSB	2.859	0.908	46.7	3.0
T_{10} – 100% NPK + *Azotobacter*+ *Azospirillum* +PSB	2.971	0.989	50.2	3.8
T_{11} – *Azotobacter* + *Azospirillum* + PSB	2.653	0.388	20.0	1.3

The experiment was conducted in randomized block design (RBD) with three replication. Two plants were maintained in each pot. The plants were harvested 90 days after transplantation. The samples of non-rhizosphere soils were collected at the same time. The population of *Azotobacter, Azospirillum* and PSB in the rhizosphere / non-rhizosphere soils was determined by the dilution plate count method (Timonin, 1940) Nitrogen and Phosphorus content of the plants were estimated (Jackson 1973).

RESULT AND DISCUSSION

The population of Azotobacter, Azospirillum and PSB in the rhizosphere of plants raised from seeds treated with single, double or triple inoculation influenced higher than plants raised from untreated plants. Single, double or triple inoculations caused an improvement in shown in Table 1. Single, double or triple inoculations caused an improvement in plant height, number of branches number of fruits average fruit yield was shown in table 1. However, the extent of improvements was varied with the inoculations. Inoculation with microbial consortium along with 100% NPK caused maximum Improvement while dual and single inoculation combined with various combinations of inorganic fertilizers resulted comparatively inferior. The increased shoot dry weight, root dry weight, nitrogen and phosphorus content in shoots was greater than that of control plants (table 2). Maximum improvement of shoot and root dry matter, number of chillies, nitrogen and phosphorus content in shoots was caused when plants inoculated with *Azotobacter, Azospirillum* and phosphorus soulbilizing bacteria. Similar findings were recorded by early workers (zehura khan *et al.,* 2012; hiremath *et al.,* 2006) in *Capsicum annum* plant. The present finding shows that combinations of microbial inoculations may or may not result in the better performance of plants.

The study highlights that greater benefit due to triple inoculation for chillies without phosphate treatment is recommendable in pot experiments with microbial inoculants. These results are in conformity with the findings of kumbar *et al.,* (2017) they also recored the saving 0f 25% inorganic fertilizers through biofertilizers.

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