

Original Research Article

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Effect of Biofertilizers and Inorganic Fertilizers on Growth and Yield of Chilli (*Capsicum annuum* L.)

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ABSTRACT

The present study has been carried out at HRS. Mondouri, BCKV Mohanpur, West Bengal, during *rabi* seasons of both the year (2012-2013), to find out the effect of biofertilizers with graded level of inorganic fertilizers on growth and yield of chilli cv. Beldanga. The experiment was laid out in RBD with 3 replications. Two nitrogen fixing biofertilizers (*Azospirillum lipoferum* and *Azotobacter chroococcum*), two phosphatic biofertilizers [VAM (*Glomus fasciculatum*) and PSB (*Bacillus polymixa*)] and one potassic mobilizer (*Fraturia aurantea*) were included. Biofertilizers were applied @ 6 g per plot with 250 g well rotten FYM. Three levels of recommended dose (RD) of NPK *i.e.*, 100%, 75% and 50% were included. The RD is 150:80:80 NPK Kg/ha. Among different treatments, number of both primary (4.54), and secondary (16.70) branches/plant, earliest flower initiation (38.26 days), number of fruits per plant (101.73), yield/plant (169.46 g) and projected yield (6.35 t/ha) were observed in plants raised under NPK (100%) + *Azospirillum* + VAM + KM. But the maximum plant height (55.50 cm) were recorded in NPK (75%) + *Azotobacter* + PSB + KM. Plant spread in both East-West (35.93cm) and North-South (34.26cm) direction were recorded in NPK (75%) + *Azospirillum* + PSB + KM. For yield maximization point of view the best treatment is NPK (100%) + *Azospirillum* + VAM + KM.

Keywords

Inorganic and biofertilizers, growth, yield, chilli.

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Introduction

Chilli (*Capsicum annuum* L.) is the universal spice and widely cultivated throughout temperate, tropical and subtropical countries. It is an indispensable spice due to its pungency, spice, taste, appealing odour and flavour. The dried fruit are extensively used as spices. The ground powder and oleoresin are utilized in pharmaceutical preparations (Warrier, 1989). Nutrient management is one of the most important factor to improve the productivity of chilli. The continuous sole and erratic use of chemical fertilizers in imbalance form leads to decline in soil fertility as well as

nutrient uptake efficiency of plants, resulting in either yield stagnation or decrease consequently. In last four decades many microorganisms have been used in the form of biofertilizers. 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). Biofertilizers are the preparations containing living or latent cells of efficient strains of micro organisms capable of fixing atmospheric nitrogen, solubilizing phosphorous and potassium, mobilizing

nutrients and absorptions of water, decomposing cellulolytic and lignolytic water materials. These micro organisms also produce the growth promoting substances which greatly influences the seed germination, root growth and proliferation.

The *Azotobacter* and *Azospirillum* apart from its role in nitrogen fixation from the atmosphere is also involved in production of bioactive substances. Application of phosphate solubilizing microorganisms has given promising response in improving yield of various crops. Mycorrhizal fungi are the distinct symbiotic association between plant roots and soil fungi. Potassium solubilizing biofertilizers are able to solubilize potassium minerals through production and excretion of organic acids (Friedrich *et al.*, 1991). To maintain long term soil health and productivity there is a need for integrated nutrient management through manures and biofertilizers (Mondal *et al.*, 2003). Therefore, the current trend is to explore the possibility of supplementing chemical fertilizers with the biofertilizers. Keeping in this view the present investigation was undertaken to find out the effect of biofertilizers with graded levels of inorganic fertilizers on growth and yield of chilli.

Materials and Methods

The experiment was undertaken during the *rabi* season of two consecutive years *i.e.*, 2012-13 and 2013-14, for studying the effect of inorganic and biofertilizers on growth and yield of chilli cv. Beldanga at Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal. The research station was located at 23.5⁰ N latitude and 89⁰ E longitude, with an altitude of 9.75m above the mean sea level. It comes under sub-tropical sub humid climatic conditions and Gangetic alluvial soil with sandy clay loam texture and Soil pH 6.9,

Organic carbon (%) 0.41, Total nitrogen (%) 0.05, Available phosphorus (kg ha⁻¹) 21.11 and Available potassium (kg ha⁻¹) 78.80. The experiment was laid out in randomized block design with 3 replications and 13 treatments (Table 1). Seeds were sown during middle of September in well pulverized raised seed bed. Healthy seedlings were transplanted during middle of November in 2.0 m x 1.6 m plots at 50 x 40 cm spacing, accommodating 16 plants per plot during both the years. Biofertilizers were applied @ 6 g per plot with 250 g well rotten FYM. Three levels of recommended dose (150:80:80 NPK Kg/ha) of NPK *i.e.*, 100%, 75% and 50% were included. Two-third of NPK and whole amount of FYM was applied irrespective of treatments during field preparation. All intercultural operations, such as weeding, irrigation, and Pest and disease management were done as and when required.

The observations were recorded on five randomly selected plants from each plot on different growth and yield parameters. The observation regarding the plant height and plant spread in both direction were recorded at 75 days after transplanting (DAP), number of primary and secondary branches were also counted at 75 DAP. Harvesting was done through 6-8 picking at weekly interval. After completion of harvesting the projected yield per hectare was calculated on the basis of yield per plot considering 75 % area occupied by chilli in the present experiment and rest was utilized for channels, ridges etc. Data recorded for both years were pooled together and analysed statistically to express the result.

Results and Discussion

The experimental results (Table 1) revealed a number of interesting features of growth, yield attributing parameters and yield of chilli.

Table.1 Effect of biofertilizers with graded levels of inorganic fertilizers on growth and yield of chilli (two years pooled data)

Treatment	Plant height (cm) 75 DAP	Plant spread (75 DAP)		Branches		Days to first flowering	Number of fruits/pla nt	Yield/ Plant (g)	Projected yield/ha (t)	
		East-West (cm)	North- South (cm)	Primary	secondary					
T ₁	NPK (100%) + Azot.+ VAM + KM	48.16	33.70	31.80	4.10	13.34	46.25	81.76	160.66	5.76
T ₂	NPK (100%) + Azot. + PSB + KM	51.27	32.33	31.37	3.97	14.37	39.82	92.63	164.42	6.04
T ₃	NPK (100%) + Azos. + VAM + KM	54.70	35.37	32.53	4.54	16.70	38.26	101.73	169.46	6.35
T ₄	NPK (100%) + Azos. + PSB + KM	52.83	33.23	32.63	4.07	14.86	42.53	94.87	163.00	5.91
T ₅	NPK (75%) + Azot. + VAM + KM	51.00	31.17	30.57	3.60	15.44	39.28	82.17	150.76	5.58
T ₆	NPK (75%) + Azot. + PSB + KM	55.50	34.10	32.47	3.64	14.04	47.56	84.88	146.36	5.41
T ₇	NPK (75%) + Azos. + VAM + KM	46.07	31.90	32.27	3.94	13.48	43.14	88.97	152.76	5.69
T ₈	NPK (75%) + Azos. + PSB + KM	53.30	35.93	34.26	3.80	12.30	41.38	86.25	151.68	5.56
T ₉	NPK (50%) + Azot. + VAM + KM	51.77	29.50	30.24	3.50	14.30	38.72	79.48	135.20	4.36
T ₁₀	NPK (50%) + Azot. + PSB + KM	49.50	32.33	31.77	3.04	12.27	40.13	77.54	127.64	4.50
T ₁₁	NPK (50%) + Azos. + VAM + KM	43.73	31.10	31.24	4.01	13.68	41.28	81.40	132.60	4.83
T ₁₂	NPK (50%) + Azos. + PSB + KM	51.03	30.47	29.27	3.13	13.90	46.75	73.08	134.84	4.64
T ₁₃	NPK (100%)	45.90	31.67	30.64	3.20	12.60	43.76	74.84	133.02	4.78
S. Em (±)		2.041	1.760	2.067	0.235	0.654	1.425	2.640	0.213	0.014
C.D. (P=0.05)		5.423	4.893	4.513	1.002	2.011	4.532	7.621	0.954	0.124

Azot.= *Azotobacter*, Azos.= *Azospirillum*, VAM= Vesicular arbuscular mycorrhiza, PSB= Phosphorus solubilising bacteria, KM=Potassium mobilize
DAP=Day after planting

Among different treatments, the maximum plant height (55.55 cm) was reported in NPK (75%) + *Azotobactor* + PSB + KM and Plant spread in both East-West (35.93cm) and North-South (34.26cm) direction were recorded in NPK (75%) + *Azospirillum* + PSB + KM. The number of both primary (4.54), and secondary (16.70) branches/plant, earliest flower initiation (38.26 days), number of fruits per plant (101.73), yield/plant (169.46g) and projected yield (6.35 t/ha) were observed in plants raised under NPK (100%) + *Azospirillum* + VAM + KM.

The treatment combination of NPK (100%) + *Azospirillum* + VAM + KM recorded maximum yield (6.35 t/ha) followed by NPK (100%) + *Azotobactor* + PSB + KM (6.04 t/ha) and NPK (100%) + *Azospirillum* + PSB + KM (5.91 t/ha) as compared to 4.98t/ha under NPK (100%). For yield maximization point of view, the most effective treatment was NPK (100%) + *Azospirillum* + VAM + KM followed by NPK (100%) + *Azotobactor* + PSB + KM and NPK (100%) + *Azospirillum* + PSB + KM under alluvial plans of west Bengal for production of chilli.

The increase in yield was largely as a consequence of the cumulative effect of plant growth characters. Similar growth and yield increase were recorded earlier with combined inoculation of biofertilizers in chilli (Sable *et al.*, 2007; Khan and Chattopadhyay, 2009 and Wange and Kale, 2004), The increase in growth attributes due to increase fertilizers may be ascertained due to increase amount of nutrients such as nitrogen, phosphorus and potassium in plants leading to increase formation of plant metabolites that help to build up the plant tissues (Childer, 1996).

The experimental results indicated that combination *Azospirillum* and VAM was superior as compared to other combinations. The better efficiency of *Azospirillum* in chilli

was also reported by Paramaguru and Natarajan (1993) and Jeevansab (2000). Other than enhancing P availability, uptake of miner elements like Zn, Cu and Mn and hormonal production have also been attributed to VAM inoculated plants in increasing plant growth. (Sukhada, 1987), Bagyaraj and Sreeramulu (1982) are reported that mycorrhizal inoculation enhanced significantly the yield of green chilli and reduced the application of phosphatic fertilizers by 50 per cent. The yield under treatment combination NP (100%) + biofertilizers were more or at par with NPK (100%) alone, indicating there is a chance of saving of 25% inorganic NP through biofertilizers. These results are in conformity with the findings of Gowda *et al.*, (2002) and Khan and Chattopadhyay (2009) they also recorded the saving of 25% inorganic fertilizers through biofertilizers.

For yield maximization point of view, the most effective treatment was NPK (100%) + *Azospirillum* + VAM + KM followed by NPK (100%) + *Azotobactor* + PSB + KM and NPK (100%) + *Azospirillum* + PSB + KM under alluvial plans of west Bengal.

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