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Effect of different strains of Mycorrhizae on growth of Chilli (*Capsicum annuum* L.)

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Abstract
Experiments were carried out to study the effect of Mycorrhizae on growth of chilli (*Capsicum annum* L.) cv. Bhagya Laxmi. The maximum plant height (92.40cm), maximum number of primary branches per plant (10.00), minimum internodal length (3.40 cm) and minimum days to 50% flowering (56.33 days) was observed in treatment T_2 - Soil application with Myc100 @ 250 g/ha × 1 application at 20 DAT. The Myc 100 is the best product for increasing all growth parameters at its application at 250 g for soil application at 20 DAT.

Keywords: Strains, Mycorrhizae, Chilli, *Capsicum annuum* L.

Introduction
Chilli (*Capsicum annuum* L.) has medicinal value, besides its richness in vitamin C due to the fact that an alkaloid capsaicin can be extracted from it. Its per capita consumption in India ranges from 50gms-60gms per day (Prabhavathi *et al*., 2013) [6]. Fungi gets photosynthates from plants for survival in turn mycorrhiza provide plant an easy asses to nutrients from soil even the nutrients that are not readily available to plant in the soil. Mycorrhiza helps plant to with stand various types of biotic and abiotic stresses. Study indicated that antimicrobial compounds are produced only by the mycorrhizal plants and these compounds are involved in the reduction of root fungal pathogen infection, thereby enhancing the growth and yield of crop plants (Srimeena and Kumari, 2014) [10]. Guruhurthy *et al.* (2014) observed increase plant height, total number of green fruits, fruit weight, plant dry weight per plant and shoot phosphorus concentration on performance of local isolates of Arbuscular mycorrhizal (AM) fungi on growth and yield of chilli (*Capsicum annuum* L.) grown in black clayey soil. Double inoculated chilli plant with AM fungi and Trichoderma species showed significant increase in plant growth parameters like number of shoot length, root length dry weight of shoot and root, number of leaves, number of branching and number of Spores as compared to control (Bhuvaneshwari *et al.*, 2014). Mycorrhizal colonization improves host plant mineral concentration and thereby alters fruit production and quality of fruits under salinity stress in chilli plants (Selvakumar and Thamizhiniyan, 2011) [9].

Material and Method
Experiment was conducted at Vegetable Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during Rabi season 2016-17 with chilli (*Capsicum annuum* L.) cv. Bhagya Laxmi in a Completely randomized Block Design (CRBD) with nine treatments combination given in (Table 1) and replicated thrice. Temperature ranged from16.5 to 29 ℃ during the trial period. The Bulk density, Soil pH, Organic carbon, Electrical conductivity, Available Nitrogen, Available P2O5 and Available K2O of the soil samples taken from the experimental field were 1.36 g cm-3, 7.12, 0.495%, 0.45 dSm-1, 282.4 kg ha-1, 20.16 kg ha-1 and 168.0 kg ha-1 respectively. The seeds of chilli variety Bhagya Laxmi were raised on nursery beds and 30 days old seedlings were transplanted at a spacing of 60 × 50 cm in a plot size 3 × 5 m. The usual agronomic practices were followed as per the endorsed package of practices. To ease the experiment, some plants were randomly selected (five plants were selected for the present investigation) and tagged for recording of observations. Several growth parameters like plant height, number of primary branches per plant, number of internodes, intermodal length, days to 50% flowering and days to 50% flowering were observed and analyzed by using the statistical analysis as described by

Panse and Sukhatme (1985). Analysis of variance for all treatment in Complete Randomized Block Design (CRBD) was carried out and ANOVA table was used to test the hypothesis.

Results and Discussions

Plant height represents growth and vigour. The treatment T_2 - Soil application with Myc100 @ 250 g/ha × 1 application at DAT recorded maximum plant height 92.40 cm. The increased plant height may be due to the increased nutrient uptake due to mycorrhiza which made normally unavailable nutrients into available form to the plants. Apart from this mycorrhiza also made available sufficient water quantity to the plant by absorbing it through root from soil. This increased supply of nutrients mainly resulted in proper cell division and cell elongation, leading to increased height as compared to control. These results are in conformity with the findings of Alfonso and Galan (2006) [1] and Sajan *et al*. (2002) [8]

Increased number of branches could apparently related with number of flowers and consequently number of fruits. The treatment T_2 *i.e.* soil application with Myc100 @ 250 g/ha × 1 application at 20 DAT recorded maximum number of primary branches per plant (10.00). The mycorrhiza generally increased the uptake of soil nutrients in the plants as well as converts the unavailable nutrients into available form to the plants. Thus, the increased in number of branches with the application of Mycorrhizal formulation might be due to increased absorption of nutrients such as Phosphorus, Copper, Iron and zinc. Similar findings are reported Hadad *et al*. in 2012 [4], Bhuvaneshwari *et al.* in 2014 and Raveesha *et al*. in 2010 [7].

Table 1: Effect of various mycorrhizal products on plant height and number of primary branches per plant.

Treatment		Plant height (cm)	Number of primary branches per plant
T_1-	Untreated control	82.73	7.33
T_2-	Soil application with Myc100 @ 250 g/ha × 1 application at 20 DAT	92.40	10.00
T_3-	Soil application with RhizoMyco 100 @ 250 g/ha × 1 application at 20 DAT	85.77	8.33
T_4-	Soil application with RhizoMyxo 100 @ 250 g/ha × 1 application at 20 DAT	85.09	7.67
T_5-	Soil application with Bolt Gr. @ 10 kg/ha ×1 application at 20 DAT	87.37	8.33
T_6-	Foliar application with Ratchet @ 300 ml /ha ×1 application at 30 DAT	87.30	8.00
T_7-	Foliar application with Ratchet @ 300 ml/ha ×2 application at 30 and 60 DAT	92.20	9.00
T_8-	Foliar application with Ratchet @ 450 ml/ha × 1 application at 30 DAT	84.90	7.67
T_9-	Foliar application with Ratchet @ 450 ml/ha × 2 application at 30 and 60 DAT	85.77	7.33
SE(d)		1.44	0.70
CD at 5%		3.05	1.49

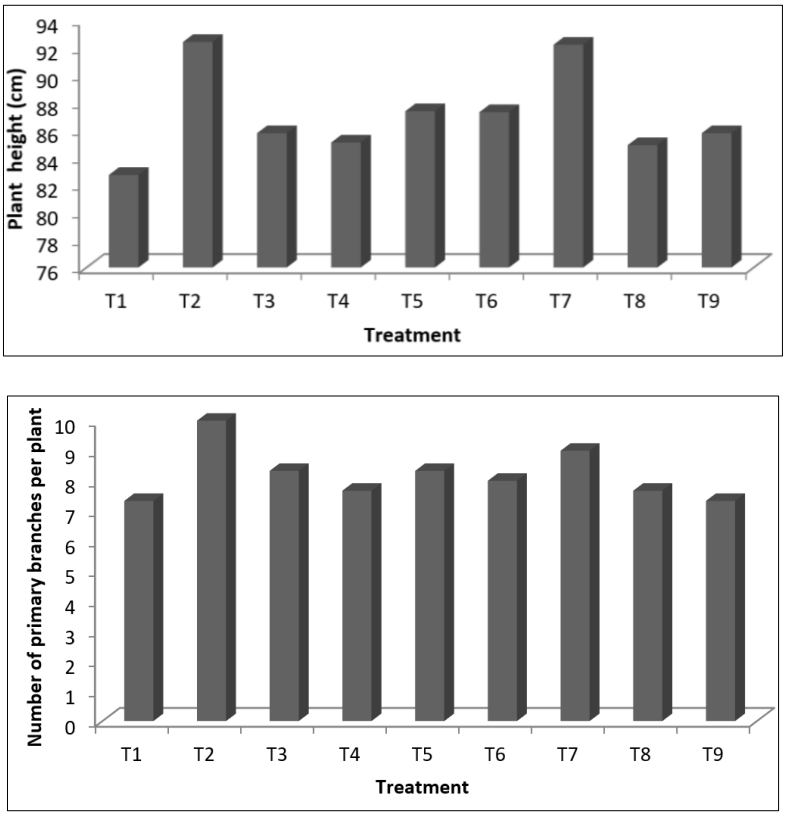

Fig 1: Effect of various mycorrhizal products on plant height and number of primary branches per plant

The minimum internodal length which is desirable was recorded in treatment T_2 - Soil application with Myc100 @ 250 g/ha × 1 application at 20 DAT (3.40 cm). The less internodal length in treatment T_2 - Soil application with Myc100 @ 250 g/ha × 1 application at 20 DAT denoted more sturdy growth habit as compared to other treatments as well as

to control because more number of internodes were observed in the plants which supplied with Myc100 @ 250 g/ha × 1 application at 20 DAT as compared to other treatments.

Minimum days to 50% flowering indicate plant vigorous growth, early flowering and consequently early fruiting. The treatmentT_3 *i.e* (soil application with Rhizo Myco 100 @ 250 g/ha × 1 application at 20 DAT) exhibited minimum days to 50% flowering (56.33 days) Both the applications like soil and foliar of various products were equally good for minimizing the 50% flowering days. The application of mycorrhiza to the plants is responsible for better nutritional status of plant due to proper nutrient supply from the soil, particularly phosphorus and zinc absorption and thus, resulting induction of early flowering. This result was similar with the finding of Ortas *et al*. (2013) [5].

Table 2: Effect of various mycorrhizal products on internodal length and 50% flowering

Treatment		Internodal length (cm)	Days to 50% flowering
T_1 -	Untreated control	4.87	58.67
T_2 -	Soil application with Myc100 @ 250 g/ha × 1 application at 20 DAT	3.40	56.67
T_3 -	Soil application with RhizoMyco 100 @ 250 g/ha × 1 application at 20 DAT	3.73	56.33
T_4-	Soil application with RhizoMyxo 100 @ 250 g/ha × 1 application at 20 DAT	3.77	57.33
T_5-	Soil application with Bolt Gr. @ 10 kg/ha ×1 application at 20 DAT	3.70	57.00
T_6-	Foliar application with Ratchet @ 300 ml /ha ×1 application at 30 DAT	4.83	58.33
T_7-	Foliar application with Ratchet @ 300 ml/ha ×2 application at 30 and 60 DAT	3.60	56.67
T_8-	Foliar application with Ratchet @ 450 ml/ha × 1 application at 30 DAT	3.77	57.00
T_9-	Foliar application with Ratchet @ 450 ml/ha × 2 application at 30 and 60 DAT	3.63	58.33
SE(d)		0.17	0.81
CD at 5%		0.36	1.71

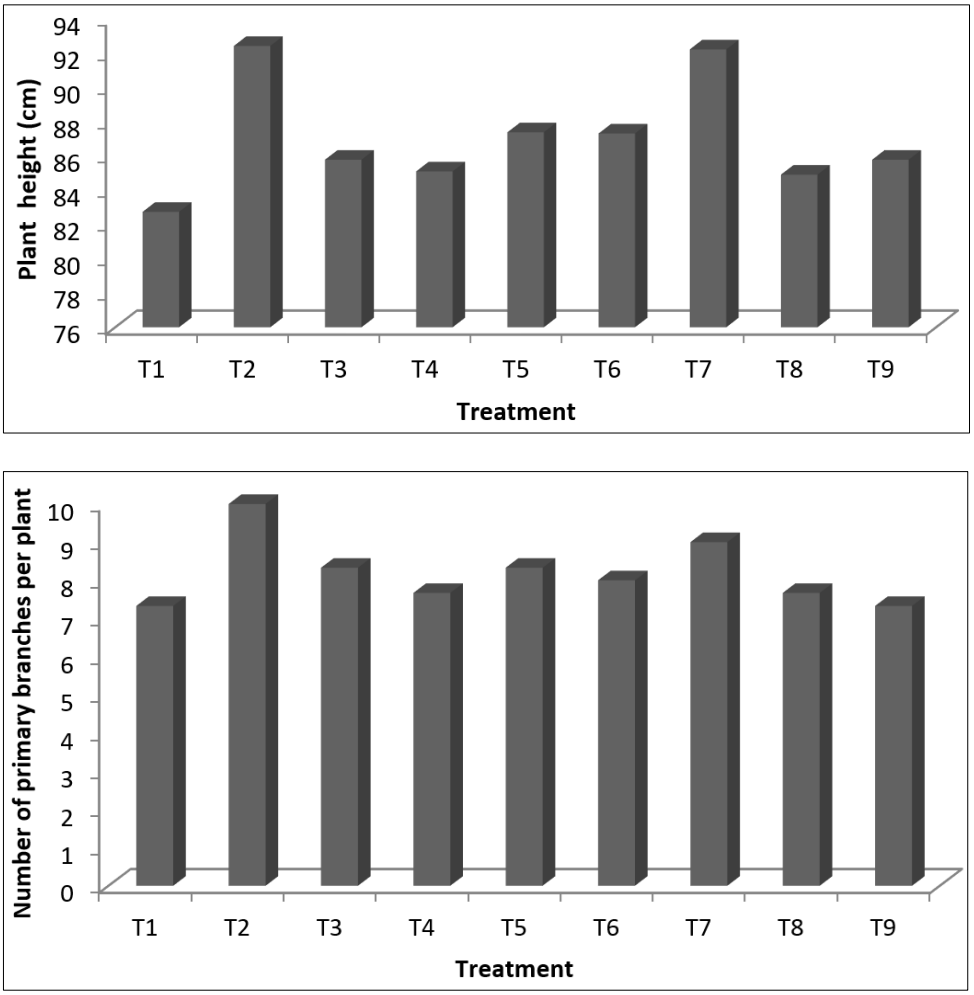

Fig 2: Effect of various mycorrhizal products on internodal length and 50% flowering

Conclusion

From present investigation it can be inferred that the best product for increasing all the growth parameters was Myc100 and the optimum concentration for its application is 250 g/ha as soil application at 20 DAT. In most of the cases, foliar application with Ratchet @ 300 ml/ha application at 30 and 60 DAT was statistically at par with Soil application with Myc100 @ 250 g/ha 20 DAT. Mycorrhiza can be used as a supplement for increasing yield and quality along with commonly used fertilizers. The optimum concentration of mycorrhiza can be used for increasing production of chilli and other solanaceous vegetables.

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