

**EFFECT OF BIOFERTILIZERS AND BIOCONTROL AGENTS ON GROWTH AND YIELD IN OFF
SEASON BRINJAL UNDER LOW COST POLYHOUSE**

ABSTRACT

An experiment was conducted to determine the combined effect of biofertilizers and biocontrol agents on growth and yield of brinjal *Solanum melongena* L. under low cost polyhouse during off season in the experimental polyhouse of the College of Agricultural Engineering and Post Harvest Technology (CAEPHT), Central Agricultural University (CAU), Ranipool, Sikkim, India. The experiment was planned with 3 treatments and six replications viz. T₁- Farm Yard Manure 5 kg/m², T₂- FYM 5 kg/m² + biofertilizer (a mixture of *Azotobacter* + PSB at the rate 10 g/kg FYM each), T₃- FYM 5 kg/m² + biofertilizer + biocontrol agent (a mixture of *Pseudomonas fluorescens* + *Trichoderma* at the rate 5 g/kg FYM each). There was a significant variation in vegetative growth and yield among all the treatments. The maximum plant height (45.62 cm), the number of branches/ plant (11.17) and the number of leaves/ plant (50.05), the number of fruits/ plant (38.9) and fruit yield/ plant (810 g) were observed with treatment T₃ which was at par with the treatment T₂ and were significantly higher than the treatment T₁ receiving FYM singly. Organic manure (FYM) inoculated with biofertilizers may therefore, be recommended for organic brinjal production for cultivation under low cost polyhouses in Sikkim (India) and application of biocontrol agents may be limited to areas having some history of occurrence of diseases because it involves an extra production cost in the application of biocontrol agents.

Key words: *Brinjal, biofertilizers, biocontrol agents and low cost polyhouse.*

1. INTRODUCTION

Brinjal or eggplant (*Solanum melongena* L.) is an important solanaceous vegetable crop widely grown in the subtropical and tropical regions of the world. It is of much importance as a warm weather vegetable crop of far East being grown extensively in India, Bangladesh, Pakistan, China and the Philippines. In India, it is one of the most common, popular and principal vegetable crops grown throughout the country. Brinjal occupies 669 thousand ha of total area and produces 12400 thousand

28 MT2) [1]. In the southern states with mild climatic conditions, its harvest period is prolonged whereas in
29 the northern parts it is shortened. It is a versatile crop adapted to different agro-climatic regions and can
30 be grown throughout the year in South India whereas in the hilly regions, it is cultivated only in the
31 summer season.

32 On the other hand, biofertilizer is a substance which contains living microorganisms when applied
33 to seed, plant root, or soil, colonizes the rhizosphere of the plant and promotes the growth by providing
34 essential nutrients or makes available primary nutrients to the host plant [2]. The use of biofertilizers is
35 beneficial in regenerating the soil health by enriching fertility and fulfilling plant nutrient requirements by
36 supplying the organic nutrients through microorganism and their byproducts [3]. Microorganism in
37 biofertilizer provides three primary nutrients N, P and K through atmospheric nitrogen fixation,
38 phosphorous solubilization, and potash mobilization which have potential to reduce the use of chemical
39 fertilizers to the tune of 50% and increase productivity up to 20% [4][5] [6] [7] [8].

40 The major constraint in the production of brinjal is the bacterial wilt disease caused by *Ralstonia*
41 *solanacearum* which constitutes a serious obstacle to the cultivation of the economically important brinjal
42 among other crops, causing total damage of plantations before as well as after bearing fruits [9].
43 Biological control could have an important role in the management of bacterial wilt [10]. Effective
44 management of bacterial wilt of brinjal by *Pseudomonas fluorescens* in field experiment signifies its
45 potentiality and scope as a plant growth promoting rhizobacteria (PGPR) when formulated using effective
46 substrate carrier and adhesive[9]. But reports on the use of a combination of biocontrol agents and
47 biofertilizers in the quality and quantity production of brinjal are very scanty. *Trichoderma* and
48 *P. fluorescens* are effective against damping off, collar rot and seedling blight diseases of
49 vegetables [11][12][13][14].

50 Sikkim being an organic state, the demand for organic vegetables is very high. Therefore, there is a
51 need to produce vegetables with high quality and yield through an organic mode of farming. Organic
52 farming through the use of a combination of biofertilizers and biocontrol agents along with locally
53 available farm manures (FYM, vermicompost, etc.), not only gives the quality organic produce but also
54 sustains the soil health and environment friendly practices for brinjal cultivation in the terrace farm lands
55 of Sikkim. Keeping above points in view, present investigation has been undertaken to investigate the

56 effect of biofertilizers and biocontrol agents in enhancing growth and yield of brinjal under low
57 costpolyhouse during the winter season.

58 2. METHODS AND MATERIALS

59 The experiment was conducted during October, 2012 to March, 2013 at the all India Coordinated
60 Research Project on Plasticulture Engineering and Technologies (AICRP on PET) experimental field of
61 College of Agricultural Engineering and Post-Harvest Technology, CAU, Ranipool, Sikkim of India to
62 evaluate the effect of biofertilizers and biocontrol agents in enhancing growth and yield of brinjal as an off
63 season crop under low cost polyhouse. Brinjal being a cross-pollinated crop, bee-hive with bee colony
64 was installed in the polyhouse to enhance pollination. The soil of the experimental site was sandy loam
65 (sand: 62%, silt: 23%, clay: 15%) with pH of 6.2).

66 Organic equivalent dose of recommended NPK (125:100:50 kg/ha) for brinjal as suggested by [15]
67 was considered and manuring doses were calculated based on recommended doses of nitrogen (125
68 kg/ha) for FYM. The recommended NPK dosage was found to be equivalent to 5 kg FYM per m². The
69 experiment was laid out in randomized block design (RBD) with 3 treatments and six replications viz.
70 T₁: FYM 5kg/m², T₂: FYM 5kg/m² + biofertilizer (a mixture of *Azotobacter* + PSB @ 10g/kg FYM each), T₃:
71 FYM 5kg/m² + biofertilizer (a mixture of *Azotobacter* + PSB @ 10g/kg FYM each) + biocontrol agent (a
72 mixture of *P. fluorescens* + *Trichoderma* @ 5g/kg FYM each).

73 The biological resources [*Trichoderma* (Strain UBT-18), *P. fluorescens*(Strain VPF-1), *Azotobacter*
74 (Strain UBAZ-1) and Phosphate solubilizing bacteria (Strain UBPS-9)] used in the experiment were
75 provided from Department of Plant Pathology, Faculty of Agriculture, UBKV.

76 The seedlings of brinjal were transplanted on raised beds of 15 cm height with row spacing of 50
77 cm and seedling spacing of 45 cm in the low cost polyhouse on October 10, 2012. Irrigation was given at
78 two-three days interval depending on weather condition through hand / surface irrigation method. The
79 data were recorded on various growths and yield parameters viz. plant height, number of branches,
80 number of leaves, number of fruits/plant and fruit yield/plant. The data collected for various parameters
81 were subjected to statistical analysis using RBD One Factor SPSS-16 software.

82

83 3. Result and Discussion

84 3.1. Effect of Biofertilizers and Biocontrol Agents on Vegetative Growth of Brinjal

85 At the early stages of plant growth, the variation in vegetative growth among the treatments was
86 insignificant. During the later stages (60 and 90 DAT), the treatments inoculated with biofertilizers alone
87 (T_2) and combination of biofertilizers + biocontrol agents (T_3) were observed to be varying significantly on
88 vegetative growth of brinjal than the treatment (T_1) receiving only FYM equivalent dose of recommended
89 NPK.

90 **Table 1: Effect of biofertilizers and biocontrol agents on the growth of brinjal**

| Treatments | 60 DAT* | | | 90 DAT* | | | No. of fruits/ plant | Fruit yield/ plant (g) |
|------------|----------------------|---------------------------|-------------------------|----------------------|---------------------------|-------------------------|-------------------------|---------------------------|
| | Plant height (cm) | No. of branches/ plant | No. of leaves/ plant | Plant height (cm) | No. of branches/ plant | No. of leaves/ plant | | |
| T_1 | 15.96 | 6.00 | 10.26 | 32.76 | 8.74 | 28.94 | 30.80 | 709.20 |
| T_2 | 22.23 | 7.10 | 17.45 | 39.87 | 10.26 | 37.56 | 34.00 | 796.70 |
| T_3 | 25.92 | 7.73 | 18.67 | 45.62 | 11.17 | 50.05 | 38.90 | 810.00 |
| LSD at 5% | 3.74 | NS | 3.24 | 5.92 | 1.10 | 7.74 | 5.33 | 79.95 |

91 *DAT: Days after transplanting

92 The maximum plant height (25.92 cm) and the number of leaves (18.67) were recorded in
93 treatment T_3 at 60 DAT which showed performance at par with the treatment T_2 and were significantly
94 higher than the treatment T_1 receiving FYM alone. At 90 DAT, the maximum plant height (45.62 cm), the
95 number of branches (11.17) and number of leaves (50.05) was observed in treatment T_3 which showed
96 performance at par with the treatment T_2 and were significantly higher than the treatment T_1 receiving
97 FYM alone. Biofertilizers and biocontrol agents were found to be effective in increasing vegetative growth
98 parameters for organic brinjal. Higher vegetative growth in plants treated with biofertilizers and biocontrol
99 agents may be attributed to improvement in plant mineral concentration through better nitrogen fixation
100 caused by biofertilizer application[16], increase in phosphorus uptake by plant caused by phosphate
101 solubilising bacteria[17] and disease protection as well as plant growth-promoting rhizobacteria effects

102 caused by biocontrol agents[18]. Increase in plant height, the number of branches/ plant and number of
103 leaves/ plant due to the application of biofertilizers have also been reported by [19]in tomato, [20]in
104 gherkin. The application of biocontrol agents may have protected the plant from disease incidence by
105 colonizing the rhizosphere of the plant preceding to the occurrence of any harmful disease causing
106 pathogens as beneficial plant growth-promoting rhizobacteria and so enhanced the growth(plant height,
107 number of branches and number of leaves)[21]. Similar findings were also reported by [22]and [15] for
108 brinjal.

109 **3.2. Effect of Biofertilizers and Bio-control Agents on Yield of Brinjal**

110 The maximum number of fruits/ plant (38.90) and fruit yield/ plant (810 g) was recorded in the treatment
111 T₃ which showed performance at par with the treatment T₂ and were significantly higher than the
112 treatment T₁ receiving FYM alone. Azotobacter may have enhanced the available nitrogen in the soil [18]
113 and the inoculation of phosphate solubilizing microorganisms may have increased plant N and P
114 uptake[23], which led to increasing in yield of brinjal. Increase in the number of fruits/ plant and fruit yield/
115 plant due to the application of biofertilizers have also been reported by [18] 18 in tomato, [24]in safflower,
116 [19] in gherkin and [25]in brinjal. Application of biocontrol agents increases the number of fruits/ plant and
117 fruit yield/ plant probably due to its major role as antagonistic endophytic bacteria as well as plant growth-
118 promoting rhizobacteria. Similar findings were also reported by [21] [15] for brinjal.

119

120 **4. CONCLUSION**

121 The findings revealed that plant growth and yield of brinjal (local var.) cultivated within the low-cost
122 polyhouse in the mid-hill region of Sikkim have been affected significantly by combined inoculation of
123 biofertilizers (*Azotobacter* + PSB) and bio-control agents (*P.fluorescens* + *Trichoderma*). Yield in plots
124 with inoculated with biofertilizer alone (without bio control agent) was also found to be at par with the
125 corresponding yield in plots with combined inoculation of biofertilizer and biocontrol agents. Thus, it may
126 be concluded that for obtaining optimum plant growth and yield from brinjal, the treatment receiving
127 organic manure (FYM) inoculated with biofertilizers may be recommended as there is no significant
128 difference between the treatment of combined inoculation of biofertilizers + bio-control agents and that of

129 biofertilizers singly. It may be economically viable as because biofertilizer is considered as safer and
130 cheaper fertilizers which have potential to reduce the use of chemical fertilizers, increase productivity and
131 also regenerate the soil health in the long run. Moreover, it may be considered as cost-effective
132 treatment, where there is no chance for the occurrence of diseases as compared to combined treatments
133 because it involves an extra cost in the application of biocontrol agents. However, in places with some
134 history of bacterial wilt or related infestation, biocontrol agents may be suggested along with biofertilizers.

135 Effect: NA

136 Consent: NA

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