**Impact of integrated nutrient management on growth and yield of capsicum (*Capsicum annuum* L. var. *grossum*)**

**ABSTRACT**

The present investigation during autumn winter season 2024-2025 with the goal of the effect of integrated use of organic manures, inorganic fertilizers and plant growth promoting rhizobacteria (PGPR) on growth, yield and quality of sweet pepper. The experiment was laid out in RBD considering nine treatments with three replications.Different combination of treatment T1Control, T2RDF + FYM 20 t/ha +PGPR, T375% RDF + VC @ 2.5 t/ha, T450% RDF + VC @ 2.5 t/ha, T575% RDF + PGPR, T650% RDF + PGPR, T775% RDF + VC @ 2.5 t/ha +PGPR, T850% RDF + VC @ 2.5 t/ha +PGPR. The results showed that application plant height 68, number of branches 4.56, days to 50 % flowering 27.46, days to Ist harvest 58.1, fruit length 6.58, fruit breadth 4.88, pericarp thickness 5.24, number of fruits/plants 22.56, fruit weight 52.64, yield per plot 22.14, maximum yield per hectare 291.54, TSS 4.78, benefit cost ratio (1.90) was observed with the treatment T2 RDF + FYM 20 t/ha +PGPR. So, we can suggest to farmers for use of Integrated Nutrient Management in production of capsicum.

***Keywords:*** Capsicum, nutrient management, Growth and Yield parameters.

**INTRODUCTION**

Bell pepper (Capsicum annuum var. grossum) is a popular Solanaceous vegetable crop worldwide, with enormous medicinal and export potential. The genus capsicum has diploid chromosome number 2n=2x=24 and *C. annuum*glabriusculum is tetraploid species (2n=2x=48), which is wild form of cultivated pepper (Carrizo *et al.,* 2016).They differ from conventional hot peppers because of fruit size and shape, capsaicin level, and usage. It has three to four lobed, large, blocky fruits with thick flesh and a basal depression, available in a range of colours. Capsicum is gaining popularity not just for its economic relevance, but also for its nutritional worth, which includes high levels of vitamin C, carotene, and calcium (Pariari and Khan 2013).The concept that pepper originated in tropical South America, specifically Brazil, is largely accepted. It is now widely grown in Central and South America, Peru, Bolivia, Costa Rica, Mexico, practically all of Europe, Hong Kong, and India. The winter season is more ideal for its growth, but due to its high demand throughout the year, it is grown under protected cultivation and greenhouse settings year-round (Wani et al., 2011). It is known for its distinct flavour and numerous health advantages. It contains Vitamin A (8493 IU), Vitamin C (283 mg), and minerals such as calcium (13.4 mg), magnesium (14.9 mg), phosphorus (28.3 mg), and potassium (263.7 mg) per 100 g fresh weight. ntegrated nutrient management (INM) is a holistic approach to nutrient management which aims at the efficient and judicious use of all major sources of plant nutrients, i.e., organic, inorganic, and biological components, in an integrated manner to achieve maximum economic yield while having no negative impact on the soil's physicochemical and biological properties. Aside from fertilisers, there are other sources of plant nutrients, such as organic manures and Plant Growth Promoting Rhizobacteria (PGPR). Use of organic manures in Integrated Nutrient Management (INM) helps in mitigating multiple nutrient deficiencies.Generally, PGPR facilitate the plant growth directly by a symbiotic fixation of atmospheric nitrogen, releasing plant growth regulators such as auxins, cytokinin’s, and gibberellins, lowering ethylene in plants, solubilizing inorganic phosphate, mineralizing organic phosphate, producing organic matter, including amino acids, releasing enzymes and stimulating disease-resistance mechanisms (systemic acquired or induced resistance)or indirectly by preventing phyto pathogens (bio-control) through production of antibiotics, siderophores and hydrogen cyanide and thus promotes plant growth and development (Glick *et al.,*2007).

**MATERIALS AND METHODS**

The current investigation entitled “Impact of integrated nutrient management on growth and yield of capsicum (*Capsicum annuum* L var. grossum).”was conducted in the Agriculture Research Farm of Rama University, Mandhana, Kanpur.The experiment was laid out in RBD considering eight treatments with three replications. Different combination of treatmentT1 Control, T2 RDF + FYM 20 t/ha +PGPR, T3 75% RDF + VC @ 2.5 t/ha, T4 50% RDF + VC @ 2.5 t/ha, T5 75% RDF + PGPR, T6 50% RDF + PGPR, T7 75% RDF + VC @ 2.5 t/ha +PGPR, T8 50% RDF + VC @ 2.5 t/ha +PGPR.The seeds of cultivar ‘Solan Bharpur’ were sown at experimental farm under special care in 1.5 x 1 x 0.15 m seed beds distance between row to row is 45cm and plant to plant 30cm distance with the help of khurpi on 9th Aug on 2024-2025 for investigation.Observations were recorded on twelve characters *viz.,*height of plant (cm), number of branches, days to 50 % flowering, days to Ist harvest, fruit length (cm), fruit breadth (cm), pericarp thickness (mm), number of fruits/plants, fruit weight (g), yield per plot (kg), yield per hectare (q), TSS (0Brix).

**RESULT AND DISCUSSION**

The maximum Plant height 68 was recorded in T2 (RDF + FYM 20 t/ha +PGPR), followed by 65 were recorded T7 (75% RDF + VC @ 2.5 t/ha +PGPR), 62 T8 (50% RDF + VC @ 2.5 t/ha +PGPR) and 60 T3 (75% RDF + VC @ 2.5 t/ha), whereas the minimum plant height 54 were recorded with control.This result is corroborated with the findings of Kanchana *et al.* (2014), Rani *et al.* (2015).

The maximum number of branches was noted from T2 having RDF + FYM 20 t/ha +PGPR. At maturity stage 4.56. This was followed by T7 (75% RDF + VC @ 2.5 t/ha +PGPR), the number of branches being 4.14 at maturity stages respectively. The minimum number of branches 2.54 were recorded with control. This result is corroborated with the findings of Kanchana *et al.* (2014), Rani *et al.* (2015).

The minimum days to 50 % flowering 27.46 were recorded in T2 (RDF + FYM 20 t/ha +PGPR), followed by 29.52 were recorded T7 (75% RDF + VC @ 2.5 t/ha +PGPR) and 30.58 in T8 50% RDF + VC @ 2.5 t/ha +PGPR, whereas the maximum days to 50 % flowering 35.64 were recorded with control. This result is corroborated with the findings of Kanchana *et al*. (2014), Rani *et al.* (2015) Jamir *et al.* (2017).

The minimum days to Ist harvest 58.1 were recorded in T2 (RDF + FYM 20 t/ha +PGPR), followed by 59.32 were recorded T7 (75% RDF + VC @ 2.5 t/ha +PGPR) and 60.14 were recorded T8 50% RDF + VC @ 2.5 t/ha +PGPR, whereas the maximum days to Ist harvest 65.42 were recorded with control. This result is corroborated with the findings of Kanchana *et al.* (2014), Rani *et al*. (2015).

The maximum fruit length was noted from T2 having RDF + FYM 20 t/ha +PGPR. At maturity stage 6.58 cm. This was followed by T7 (75% RDF + VC @ 2.5 t/ha +PGPR), the Fruit length being 6.28 at maturity stages respectively., whereas the minimum fruit length 4.45 were recorded with control. This result is corroborated with the findings of Kanchana *et al.* (2014), Rani *et al.* (2015).

The maximum fruit breadth 4.88 were recorded in T2 (RDF + FYM 20 t/ha +PGPR), followed by 4.66 were recorded T7 (75% RDF + VC @ 2.5 t/ha +PGPR) and 4.60 were recorded T8 50% RDF + VC @ 2.5 t/ha +PGPR, whereas the minimum fruit breadth 4.02 were recorded with control. This result is corroborated with the findings of Kanchana *et al.* (2014), Rani *et al.* (2015).

The maximum pericarp thickness 5.24 were recorded in T2 (RDF + FYM 20 t/ha +PGPR), followed by 4.96 were recorded T7 (75% RDF + VC @ 2.5 t/ha +PGPR) and 4.88 were recorded T8 50% RDF + VC @ 2.5 t/ha +PGPR, whereas the minimum pericarp thickness 4.32 were recorded with control. This result is corroborated with the findings of Kanchana *et al.* (2014), Rani *et al.* (2015) and Shilpa *et al.* (2018).

The maximum number of fruits/plants 22.56 were recorded in T2 (RDF + FYM 20 t/ha +PGPR), followed by 21.88 were recorded T7 (75% RDF + VC @ 2.5 t/ha +PGPR) and 21.26 were recorded T8 50% RDF + VC @ 2.5 t/ha +PGPR, whereas the minimum number of fruits/plants 16.24 were recorded with control. This result is corroborated with the findings of Kanchana *et al.* (2014), Rani *et al*. (2015).

The maximum fruit weight 52.64 were recorded in T2 (RDF + FYM 20 t/ha +PGPR), followed by 50.28 were recorded T7 (75% RDF + VC @ 2.5 t/ha +PGPR) and 49.92 were recorded T8 50% RDF + VC @ 2.5 t/ha +PGPR, whereas the minimum fruit weight 43.12 were recorded with control. This result is corroborated with the findings of Kanchana *et al*. (2014), Rani e*t al*. (2015) and Shilpa *et al*. (2018).

The maximum yield per plot 22.14 were recorded in T2 (RDF + FYM 20 t/ha +PGPR), followed by 20.94 were recorded T7 (75% RDF + VC @ 2.5 t/ha +PGPR), whereas the minimum yield per plot (kg) 15.34 were recorded with control. This result is corroborated with the findings of Kanchana *et al.* (2014), Rani *et al.* (2015).

The maximum yield per hectare 291.54 were recorded in T2 (RDF + FYM 20 t/ha +PGPR), followed by 278.54 were recorded T7 (75% RDF + VC @ 2.5 t/ha +PGPR), whereas the minimum yield per hectare (q) 240.26 were recorded with control. This result is corroborated with the findings of Kanchana *et al.* (2014), Rani *et al.* (2015) and Shilpa *et al.* (2018).

The maximum TSS 4.78 were recorded in T2 (RDF + FYM 20 t/ha +PGPR), followed by 4.71 were recorded T7 (75% RDF + VC @ 2.5 t/ha +PGPR) and 4.67 were recorded T8 50% RDF + VC @ 2.5 t/ha +PGPR, whereas the minimum TSS 4.32 were recorded with control. This result is corroborated with the findings of Kanchana *et al.* (2014), Rani *et al.* (2015).

The benefit cast ratio recorded significant result with the application different treatment. The highest amount of benefit cast ratio was fetched from the treatment T7 (1.90) which was significantly superior over all other treatments except treatment T2 (1.78). The lowest amount of benefit cost ratio was fetched from the treatment T1 (0.80). This result is corroborated with the findings of Rani *et al.* (2015).

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| **S. No.** | **Plant height (cm)** | **Number of branches** | **Days to 50 % flowering** | **Days to Ist harvest** | **Fruit length (cm)** | **Fruit breadth (cm)** | **Pericarp thickness** | **Number of fruits/plants** | **Fruit weight (g)** | **Yield per plot (kg)** | **Yield per hectare (q)** | **TSS** | **Cost benefit ratio** |
| **T1** | 54 | 2.54 | 35.64 | 65.42 | 4.45 | 4.02 | 4.32 | 16.24 | 43.12 | 15.34 | 240.26 | 4.32 | 0.8 |
| **T2** | 68 | 4.56 | 27.46 | 58.1 | 6.58 | 4.88 | 5.24 | 22.56 | 52.64 | 22.14 | 291.54 | 4.78 | 1.78 |
| **T3** | 60 | 3.7 | 31.74 | 60.92 | 5.88 | 4.54 | 4.81 | 20.96 | 49.44 | 19.88 | 266.64 | 4.62 | 1.48 |
| **T4** | 59 | 3.58 | 32.46 | 61.48 | 5.67 | 4.48 | 4.74 | 20.68 | 48.62 | 19.46 | 260.46 | 4.6 | 1.34 |
| **T5** | 57 | 3.32 | 33.12 | 62.12 | 5.11 | 4.32 | 4.66 | 20.44 | 46.58 | 18.32 | 254.62 | 4.56 | 1.24 |
| **T6** | 56 | 2.98 | 33.88 | 63.8 | 4.78 | 4.24 | 4.58 | 19.68 | 45.32 | 17.54 | 250.54 | 4.44 | 0.92 |
| **T7** | 65 | 4.14 | 29.52 | 59.32 | 6.28 | 4.66 | 4.96 | 21.88 | 50.28 | 20.94 | 278.54 | 4.71 | 1.9 |
| **T8** | 62 | 3.96 | 30.58 | 60.14 | 6.2 | 4.6 | 4.88 | 21.26 | 49.92 | 20.12 | 271.42 | 4.67 | 1.64 |
| **C.D.** | 2.347 | 0.188 | 1.253 | 2.662 | 0.253 | 0.179 | 0.170 | 0.762 | 2.391 | 0.957 | 7.690 | 0.227 | 0.072 |
| **SEm (±)** | 0.766 | 0.061 | 0.409 | 0.869 | 0.083 | 0.058 | 0.055 | 0.249 | 0.781 | 0.313 | 2.511 | 0.105 | 0.024 |

**Table 1 Impact of integrated nutrient management on Capsicum**

**CONCLUSION**

Based on the results obtained from the present investigation, it is conducted that the highest growth and yield parameters *viz.,* plant height 68, number of branches 4.56, days to 50 % flowering 27.46, days to Ist harvest 58.1, fruit length 6.58, fruit breadth 4.88, pericarp thickness 5.24, number of fruits/plants 22.56, fruit weight 52.64, yield per plot 22.14, maximum yield per hectare 291.54, TSS 4.78, benefit cost ratio (1.90) was observed with the treatment T2 RDF + FYM 20 t/ha +PGPR. So, we can suggest to farmers for use of Integrated Nutrient Management in production of capsicum.

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