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A studies on impact of chemical and bio-fertilizers in cucumber (C*ucumis sativus* L.) production under Zone number 7 of Karnataka

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Abstract
An experiment on Cucumber (*Cucumis sativus* L.) production was carried out at Agricultural and Horticultural Research Station, Kathalagere, Channageri, Taluk of Davangere District, Karnataka during 2021 to study on Impact of Chemical and Bio-Fertilizers in Cucumber (C*ucumis sativus* L.) Production. The results of the experiment data revealed that the application of 100% NPK + *Azotobacter chroococcum* + *Trichoderma viridae*+ *Glomus fasciculatum* treatments recorded significantly highest plant height (145.25cm), a greater number of leaves per plant (42.00), a greater number of branches per plant (4.00), lowest days to flowering (32.00) and highest fruit yield (11.50 t/ha).

Keywords: *Azotobacter*, *Cucumber*, *Cucumis sativus*, *Glomus fasciculatum* and *Trichoderma*

Introduction
The Cucumber (*Cucumis sativus* L.) is an important horticultural vegetable crop belonging to the family Cucurbitaceae, mainly cultivated and consumed in Africa, Brazil, Cuba, India, United States and Zimbabwe. It is a monoecious, annual trailing or climbing vine. The fruits of cucumber are consumed as boiled, fried, and fresh in salads.

Its production continues to gain attention in Indian communities because of their nutritional and economic values. Average yield per/ha is below world average. Factors responsible for the low yield include inappropriate farming systems, climate change, pests and diseases infestation, poor access to credit facilities, inappropriate method of cultivation, distance to market and low availability of land. Important but often neglected is the quality/fertility status of cucumber producing soils of Karnataka.

Cucumber responds well to fertilizers and organic manures. The use of expensive commercial fertilizers as per the requirement of the crop is not much affordable to the average farmers. The application of high input technologies such as chemical fertilizers, pesticides, herbicides improved the production but there is growing concern over the adverse effects of the use of chemicals on soil productivity and environmental quality. The situation thus demands evaluation of proper technology for improving the growth, yield and nutrient uptake in Cucumber without much adverse effect on natural resources.

Fertilizer use is inadequate and application is often based on blanket recommendation. Low soil quality and poor agronomic management have contributed to more than 40 per cent decrease in yield. With good agricultural practices and soil management, optimum yield can be attained.

Modern nutrient management strategy has shifted its focus towards the concept of sustainability. Hence, the present investigation was carried out to study on Impact of Chemical and Bio-Fertilizers in Cucumber (C*ucumis sativus* L.) Production at Agricultural and Horticultural Research Station, Kathalagere, Channageri, Taluk of Davangere District, Karnataka.

Materials and Methods
The experiment was conducted in the Agricultural and Horticultural Research Station, Kathalagere, Channageri, Taluk of Davangere District, during 2021 and laid out in Randomized Completely Block Design with seven treatments and replicated thrice. The treatment details are as below.

T_1 – 50% NPK
T_2 –75% NP and 100% K

T_3 – 100% RDNPK
T_4 – 50% NPK + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum*
T_5 – 75% NP and 100% K + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum*
T_6 –100% NPK + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum*
T_7 – Control

The seeds of Cucumber var. *poinsette* were sown at a spacing of 100cm x 30cm. The soil of the experimental plot was red sandy loam having 6.5 to 7.0 pH. Before leveling of the individual plots for sowing cucumber, Farm yard manure (FYM) was applied @ 25 tonnes per hectare as a basal dose and subsequently mixed well in the soil. At the time of sowing seed, 1/3 of nitrogen and full dose of phosphorus and full dose of potassium (150: 75: 75 NPK kg/ha) were applied as per the treatments. The remaining 2/3of nitrogen was applied 20th and 40th day after sowing. The recommended dose of chemical and bio fertilizers were applied. Regular weeding, irrigation and plant protection were followed. Observations on growth and yield parameters *viz*., plant height (cm), number of leaves, number of branches, days to first flowering and yield (kg/plot) were recorded and analyzed.

Results and Discussion

The results of the mean data of the experiment as influenced by bio fertilizers with different level of NPK on growth parameters *viz*., plant height (cm), number of leaves per plant, and number of branches per plant are presented in Table no.1.

Application of (T_6) 100% NPK + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum* recorded significantly highest plant height (145.25cm) and was on par with treatment (T_3) 100% RDNPK and (T_5) 75% NP and 100% K + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum*, respectively. The lowest plant height (95.75 cm) was recorded in control. Bio-fertilizers produced the growth promoting substances *viz*., auxin, gibberellins and cytokinin which contributes towards vigorous growth of the plant in cucumber reported by Gurmehakdeep Singh (2020) [8], Nirmala and Vadivel (1999) [13], in Gherkin Chandru Patil and J Narayana (2017) [5] and Wange and Kale (2004) [19] reported in brinjal.

The increased vine length might be due to continued vegetative growth enhanced by spilt application of nitrogen. The highest vine length in the best treatment might be due to ready availability of nutrients, their improved absorption and translocation by plants more quickly, which resulted in higher photosynthetic activity than other treatments. Similar results were reported by Singh and Chhonkar (1986) [18] in muskmelon.

The influence of bio fertilizers with different levels of NPK also had significance influence with respect to number of leaves per plant. The treatment (T_6)100% NPK + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum* recorded significantly highest plant height (42.00) and was on par with treatment (T_3) 100% RDNPK and (T_5) 75% NP and 100% K + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum*, respectively. The increased number of leaves due to the application of bio fertilizers would have enhanced nitrogen activity of the plant, which may lead to the increased vegetative growth. These results are in accordance with the findings of Kumaraswamy and Madalageri (1990) [10] in tomato, Randhawa *et al.* (1981) [15] and Muruganandam (2000) [12] in watermelon. The minimum numbers of leaves per plant (27.15) are recorded in control.

The results of mean comparing of number of branches per vine between all treatments non-significant difference exists. The maximum number of branches per plant (04.00) was recorded in treatment (T_6)100% NPK + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum* and lowest branches(01.20) per plant was recorded in control. The increased rate of photosynthetic products entering in to the system might have caused cell elongation and rapid cell division in the growing portion resulting in more number of branches per vine resulting in higher yield in gherkin (Curry and Byrne, 1992) [7]. Similar results were reported by Bindiya *et al*. (2012) [4] in gherkin and Singh and Chhonkar (1986) [18] in musk melon. Similar results were reported by Chandru Patil (2017) [5] in gherkin. The lowest branches (1.43) are recorded in control.

The results of the mean data of the experiment as influenced by bio fertilizers with different level of NPK on yield parameters *viz*., days to first flowering and yield (t\ha) are presented in Table1.

Early flowering is an important character in cucumber. Though earliness is considered as a genetically controlled trait, other factor like environmental, cultural practices and nutrition of the plants can also influence it to an appreciable extent. In the present study the plants treated with 100% NPK + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum* (T_6) showed earliness in flowering of 32 days compare to other treatments. This might be due to better nutritional status of the plants which was favoured by the treatments. Similar findings have been reported in cucumber by Nirmala *et al.* (1999) [13] and Patil *et al*. (1998) [14].

Increased production of leaves might help to elaborate more photosynthates and induce flowering stimulus, thus affecting early initiation of flower bud. Early vigorous growth seen in treatments with organic manures would have helped to synthesize more cytokinin by these plants which might have helped to the translocation of these synthesized cytokinin as well as more quantity of available phosphorus through xylem vessels and accumulation of cytokinin and phosphorus in these axillary buds would have favoured the plants to enter into reproductive phase Amrithalingam and Balakrishnan, (1988) [2].

The highest fruit yield (11.50 t/ha) was recorded with 100% NPK + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum* (T_6) which was on par with treatment (T_3) 100% RD NPK and (T_5) 75% NP and 100% K + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum* respectively. This may be due the application of Azotobacter and Azospirillum bio fertilizers were effective in nitrogen fixation, synthesis of plant growth promoting hormones and enzyme activation reported by Anburani *et al*. (2003) [3] in brinjal. Significantly lowest fruit yield (5.27t/ha) was recorded in control.

More yield of cucumber in present study could be due to the influence of bio-fertilizers in combination with different level of NPK enhanced the synthesis of photosynthates by increasing the synthesis of growth regulators like IAA, GA, amino acids, and vitamins. The vigorous vegetative growth might have accelerated the photosynthetic rate and there by increased the supply of carbohydrates. Better assimilation of

these carbohydrates might have created favourable conditions for auxin synthesis inducing flowering resulting in more number of fruit set which in turn might have increased the yield. Present findings are in conformity with the reports of Hanna and Adams (1991) [9], Muniz *et al.* (1992) [11], Choudhari and More (2002) [6], Yingjajawal and Marukmoon (1993) [20], Shivashankarmurthy *et al.* (2007), Resende and Pessoa (1996), Abhinav Singh *et al.* (2021) [1] in cucumber and Chandru Patil (2017) [5] in gherkin.

Table 1: Impact of chemical and bio-fertilizers combination on plant height (cm), number of leaves per plant, number of branches per plant, days to first flowering and yield in cucumber.

Treatments	Plant height (cm)	Number of leaves per plant	Number of branches per plant	Days to first flowering	Yield t\ha
T1 – 50% NPK	121.45	35.00	1.35	36.00	06.25
T_2 – 75% NP and 100% K	122.30	37.00	1.50	35.00	06.50
T3 – 100% RDNPK	143.00	41.50	3.00	33.00	10.32
T_4 - 50% NPK + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum*	122.45	36.00	2.00	34.00	05.75
T_5 -75% NP and 100% K + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum*	142.05	41.00	3.00	33.45	09.75
T_6-100% NPK + *Azotobacter chroococcum* + *Trichoderma viridae* + *Glomus fasciculatum*	145.25	42.00	4.00	32.00	11.50
T_7 – Control	95.75	27.15	1.20	36.79	04.37
F Test	*	*	NS	NS	*
S.Em+	4.25	1.25	0.80	2.04	1.14
C.D. @ 5%	12.50	4.12	2.86	6.65	3.32
C.V. %	10.56	11.50	12.45	10.20	14.35

Notations: DAS =Days after sowing, NS: Non significant, PSF = Phosphate Solubilizing Fungi (*Trichoderma viridae*)
VAM = Vesicular Arbuscular Mycorrhizae (*Glomus fasciculatum*), N.P.K. = Nitrogen, Phosphorus, Potassium

Conclusion

According to this study using bio-fertilizers has increased growth and yield of cucumber significantly. In other words, the presences of bacteria have increased cucumber growth factors. Result from the present study indicated that growth and yield of cucumber, have been affected by the inoculation with *Azotobacter chroococcum*, because these bio-fertilizers can fix the atmospheric nitrogen in soil. Seeds inoculated with *Azotobacter chroococcum* had beneficiary response on growth and yield of cucumber by 5 - 30%. As a result, biological fertilizers can be recommended for the sake of achieving the higher quality production. The traits fruit weight and fruit size could be used for the selection of better yielding lines under Davangere District. The results compare means indicated that combination of bio fertilizer and chemical fertilizer treatments maximize fruit yield.

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