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Studies on effect of organic and inorganic fertilizers in gherkin (*Cucumis anguria* L.) production

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Abstract
An investigation on effect of organic and inorganic fertilizers in Gherkin (*Cucumis anguria* L.) production was carried out at farmer's field, in Hirekerur Taluk of Haveri District Karnataka during 2019 to study on Impact of vermicompost, chemical and bio-fertilizers in Gherkin (C*ucumis anguria* L.) Production. The results of the experiment data revealed that the application of 75% RDF + *Trichoderma viridae*+ Vermicompost treatments recorded significantly highest plant height (148.37cm), a greater number of leaves per plant (40.50), a greater number of branches per plant (3.72), lowest days to flowering (33.62) and highest fruit yield (12.37 t/ha).

Keywords: Bio-fertilizers, gherkin, *Cucumis anguria*, vermicompost and *Trichoderma*

Introduction
The gherkin (*Cucumis anguria* L.) is a pickle vegetable crop belonging to the family Cucurbitaceae in horticultural crop community mainly cultivated and consumed in Africa, Brazil, Cuba, India, United States and Zimbabwe. It is a monoecious, annual trailing or climbing vine. The unripe fruits are used for processing as pickles, eaten as a cooked vegetable and are used in curries (Purseglove, 1969) [17]. The fruits of gherkin are consumed as boiled, fried, and fresh in salads. The gherkin is also known for traditional importance in medicinal to treat stomach ache, jaundice, hemorrhoids and preventing stone formation in kidney (Baird and Thierest, 1988) [5].

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 gherkin producing soils of Karnataka.

Gherkin 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 Gherkin 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 vermicompost, chemical and bio-fertilizers in Gherkin (C*ucumis anguria* L.) production at farmer's field, in Hirekeru Taluk of Haveri District Karnataka.

Materials and Methods
The experiment was conducted in the farmer's field, in Hirekerur Taluk of Haveri District Karnataka, during 2019 and laid out in Randomized Completely Block Design with seven treatments and replicated thrice. The treatment details are as below.

T_1 – Control
T_2 – 50% RDF+ Vermicompost
T_3 – 75% RDF + Bio-fertilizers (*Trichoderma viridae* -PSF)
T_4 – 100% RDF
T_5 – 25% RDF + *Trichoderma viridae* + vermicompost
T_6 – 50% RDF + *Trichoderma viridae* + vermicompost
T_7 – 75% RDF + *Trichoderma viridae* + vermicompost

The seeds of gherkin var. Ajaxa were sown at a spacing of 100cm x 30cm. The soil of the experimental plot was red sandy loam having 5.8 to 7.12 pH. Before leveling of the individual plots for sowing gherkin, 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 (260: 175: 260 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 vermicompost, 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 vermicompost, chemical and 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_7) 75% RDF + *Trichoderma viridae*+ Vermicompost recorded significantly highest plant height (148.37cm) and was on par with treatment (T_4) 100% RDF and (T_6) 50% RDF ++ *Trichoderma viridae*+ Vermicompost respectively. The lowest plant height (90.43 cm) was recorded in control. Vermicompost bio-fertilizers produced the growth promoting substances *viz*., auxin, gibberellins and cytokinin which contributes towards vigorous growth of the plant in cucumber reported by Nagaraja kusgur *et al.* (2022) [4], Gurmehakdeep Singh (2020) [9], Nirmala and Vadivel (1999) [15], in Gherkin Chandru Patil and J Narayana (2017) [6] and Wange and Kale (2004) [22] 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) [21] in muskmelon.

The influence of vermicompost chemical and bio fertilizers with different levels of NPK also had significance influence with respect to number of leaves per plant. The treatment (T_7) 75% RDF + *Trichoderma viridae*+ Vermicompost recorded significantly more number of leaves per plant (40.50) and was on par with all others treatments except control. 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 Nagarajakusgur *et al.* (2022) [4] in cucumber, Kumaraswamy and Madalageri (1990) [11] in tomato, Randhawa *et al.* (1981) [18] and Muruganandam (2000) [13] in watermelon. The minimum numbers of leaves per plant (22.00) 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 (03.72) was recorded in treatment (T_7) 75% RDF + *Trichoderma viridae*+ Vermicompost. 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) [8]. Similar results were reported by Bindiya *et al.* (2012) [4] in gherkin and Singh and Chhonkar (1986) [21] in musk melon. Similar results were reported by Chandru Patil (2017) [6] in gherkin. The lowest branches (01.25) are recorded in control.

The results of the mean data of the experiment as influenced by vermicompost chemical and bio fertilizers with different level of NPK on yield parameters *viz*., days to first flowering and yield (t\ha) are presented in Table 1.

Early flowering is an important character in gherkin. 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 75% RDF + *Trichoderma viridae*+ Vermicompost (T_7) showed earliness in flowering of 33.62 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 Nagarajakusgur *et al.* (2022) [4], Nirmala *et al.* (1999) [15] and Patil *et al.* (1998) [16].

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 (12.37 t/ha) was recorded with 75% RDF + *Trichoderma viridae*+ Vermicompost (T_7) which was on par with treatment (T_4) 100% RDF and (T_6) 50% RDF + *Trichoderma viridae* + vermicompost respectively. This may be due the application of vermicompost and 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 (04.57t/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) [10], Muniz *et al.* (1992) [12], Choudhari and More (2002) [7], Yingjajawal and Marukmoon

(1993) [23], Shivashankarmurthy *et al*. (2007) [2], Resende and Pessoa (1996) [19], Abhinav Singh *et al.* (2021) [1] and Nagarajakusgur *et al.* (2022) [4] in cucumber and Chandru Patil (2017) [6] in gherkin.

Table 1: Effect of fertilizers on growth and yield parameters in Gherkin (*Cucumis anguria* L.) Production

Treatments	Plant height (cm)	Number of leaves per plant	Number of branches per plant	Days to first flowering	Yield t\ha
T_1 – Control	90.43	22.00	1.25	37.25	04.57
T_2 – 50% RDF+ Vermicompost	120.00	34.00	2.00	36.52	08.63
T_3 – 75% RDF + Bio-fertilizers (*Trichoderma viridae* -PSF)	121.12	35.00	2.70	35.52	08.86
T_4 - 100% RDF	144.72	39.00	3.50	34.13	11.45
T_5 - 25% RDF + *Trichoderma viridae* + *vermicompost*	125.37	37.00	2.95	33.45	08.85
T_6- 50% RDF + *Trichoderma viridae* + *vermicompost*	144.52	39.25	350	34.00	11.43
T_7 -75% RDF + *Trichoderma viridae* + *vermicompost*	148.37	40.50	3.72	33.62	12.37
F Test	*	*	NS	NS	*
S.Em+	3.06	2.12	1.12	3.16	1.19
C.D. @ 5%	10.21	7.61	4.12	9.48	3.45
C.V. %	9.37	10.72	11.23	12.82	13.73

Notations: DAS =Days after sowing, NS: Non significant, PSF = Phosphate Solubilizing Fungi (*Trichoderma viridae*)
RDF- N.P.K. = Nitrogen, Phosphorus, Potassium

Conclusion

According to this study using vermicompost bio-fertilizers and chemical fertilizers has increased growth and yield of gherkin significantly. In other words, the presences of bacteria have increased gherkin growth factors. Result from the present study indicated that growth and yield of gherkin have been affected by the application of chemical, vermicompost and bio-fertilizers in soil. Seeds inoculated with bio-fertilizers 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 Havri District. The results compare means indicated that combination of chemical, vermicopost and bio fertilizer treatments maximize fruit yield.

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