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Effect of Organic Manures on Growth and Yield of Gherkin (*Cucumis sativus* L.) in Terraced Farmlands of Sikkim

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Abstract An experiment was conducted to find out the effect of organic manure doses on growth and yield of gherkin in terraced farmlands of Sikkim. Effect of increase in organic manure on plant vegetative growth and yield was studied in four treatments (3, 4, 5 and 6 kg farm yard manure (EYM) equivalent per plant). While highest number of leaves per vine (17.94), vine length (141.80 cm) at 42 days after sowing and yield per vine (957 g) was observed for the highest dose of manure (6 kg FYM), the observed values of yield per vine were at par for the dose of 5 kg FYM (955 g). With lesser cost of cultivation (8167 per 100 m^2) and higher net returns (´7727 per 100 m^2), the manure dose of 5 kg FYM equivalent per plant can therefore be recommended for profitable cultivation of organic gherkin on the terraced farms of Sikkim.

Keywords Organic, FYM, Vermicompost,Gherkin, Yield.

Introduction

Gherkin (*Cucumis sativus* L.) is a Cucurbitaceae crop commonly known as pickling cucumber. Its unripe fruits are processed into pickle (Purseglove 1969) and other preserved forms, which have a huge demand in USA, Europe, Russia and other Western countries. It is commonly grown in USA, Australia and Sri Lanka and was introduced in India during late eighties for export oriented production (Bindiya et al. 2012). The existing agro-climatic conditions in India favors round-the-year production of high-quality gherkin unlike Mexico, Hungary and Madagascar, where it is possible to cultivate gherkin only for one season in a year (EXIM 2009). This has led to introduction and expansion of gherkin cultivation in India taking advantage of the global export demand and surplus rural manpower searching for profitable livelihood options.

Organically grown produce fetches higher price in the international market and there is a great demand worldwide for gherkin as it is totally an export oriented crop. Application of organic manures not only increases the crop productivity, but also enhances the quality of the produce, reduces the cost of production, ensures clean environment and thus

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plays a pivotal role in sustainable agriculture. Balanced fertilizer use along with organic manure is considered as promising agro-technique to sustain yield with increased fertilizer-use efficiency and restoration of soil fertility (Verma et al. 2016). The FYM is known to play an important role in improving the fertility and productivity of soils through its positive effects on soil physical, chemical and biological properties and maintaining balance in plant nutrition (Kumar et al 2011).The vermicompost (VC) provides excellent soil structure, porosity, aeration, drainage, water retention capacity and prevents soil degradation (Kumara et al. 2003, Pal et al. 2015). Several researchers have reported the effect of combine and /or alone application of different organic manures in gherkin production e.g. Sareedha et al. (2007) reported that the combination of FYM @ 25 t/ha + recommended doses of fertilizers (RDF) (120:90:50 kg NPK/ ha) + vermiwash (1:5 dilution) results in the highest fruit set percentage (88.57), highest number of fruits (88.35), single fruit weight (4.62 g) and fruit yield (408.17 g). Increased yield parameters of gherkin cv Ajax Hybrid have also been reported by Anburani et al. (2010) with application of FYM @ 25 t/ha along with foliar application of vermiwash (1:5 dilution). Bindiya et al. (2012) reported higher yield per vine (257 g) with application of VC 18 t/ha + biofertilizers (*Azotobacter* and PSB each @ 2 kg/ha). Silva et al. (2010) reported the maximum fruits yield per vine (2.2 kg) in gherkin with increase in levels of compost (500 g per plant).

In Sikkim, the subsidy on chemical fertilizers has been stopped from 2006-07 and in 2016, the tiny Himalayan State has been declared as the first organic State of India. Being in proximity of the international market through the Kolkatta port, Sikkim also has an advantage for export promotion and marketing of organic produce. Thus, in above context, there is a need to find out the optimum doses of organic manures for gherkin cultivation in small narrow terraces of Sikkim on round-the-year basis. Keeping all these aspects in view, an experiment was conducted to study the effect of various kinds of locally available organic manures on growth and yield of gherkin for its profitable cultivation in terraced farms of Sikkim. The economic analysis of organic cultivation of gherkin in terraced farms of Sikkim is also presented.

Table 1. Organic equivalent doses of recommended NPK for gherkin.(*RDF : Recommended doses of fertilizers).

Organic equivalent doses	Values
Recommend inorganic fertilizer (N:P:K)	625: 350:675 kg/ha
Per plant dosage of N:P:K considering plant population of 33333/ha	18.75:10.50:20.25 g/ plant
Nutrient availability (N:P:K) in FYM (Chadha 2003)	0.75:0.2:0.5%
Per plant equivalent dosage of FYM as per RDF*	5 kg FYM/plant
Nutrient availability (N:P:K) in VC (Chadha 2003)	3.0:1.0:1.5%
Per plant equivalent dose of VC as per RDF*	1.35 kg Vc/plant

Materials and Methods

An experiment was conducted for two-consecutive years during June to August, 2012 and 2013 at All India Coordinated Research Project on Plasticulture Engineering and Technologies (AICRP-PET) experimental field of College of Agricultural Engineering and Post-Harvest Technology (CAEPHT), Central Agricultural University (CAU), Ranipool, Sikkim, India to study the effect of various kinds of locally available organic manures viz. FYM and VC on growth and yield of gherkin. Organic equivalent of recommended NPK dose (625:350:675 kg/ha) as suggested by Silva et al. (2010) was considered and manuring doses were calculated based on recommended doses of nitrogen (625 kg/ha) for FYM and VC (Table 1). Similarly, Bindiya et al. (2012),while studying effect of organic manures and biofertilizers on growth, yield and nutrient uptake in gherkin, calculated manure doses for each treatment based on recommended doses of nitrogen.

The recommended NPK dosage was found to be equivalent to 5 kg FYM or 1.35 kg VC per plant. The experiment was laid out in randomized block design (RBD) with four treatments with doses of 3, 4, 5 and 6 kg FYM equivalent (Table 2) and four replications (Gomez and Gomez 1984). Half of the manure dose was applied through FYM as basal dose considering slow nutrient release rate of FYM (Chandra 2005) and the remaining half was applied through VC in two equal splits (one as basal dose and the second at the time of flowering).

Table 2. Experimental treatment details.

Treatments	Dose (FYM equivalent per plant, 50% provided through VC) (kg FYM per plant)	Basal dose FYM* (50%) (kg)	VC** (25%) (g)	First split VC (25%) (g)
T_1	3	1.5	188	188
T_2	4	2.0	250	250
T_3	5	2.5	313	313
T_4	6	3.0	375	375

Gherkin seeds were sown on raised beds of 15 cm height with row spacing of 1 m and seed spacing of 0.3 m. Observations on plant growth parameters such as days to seed germination, number of leaves, vine length (cm), days to first flowering and fruits yield per vine were recorded on randomly selected five plants in each treatment and replication. The data collected for various parameters were subjected to statistical analysis using RBD one factor SPSS_16 software.

Results and Discussion

The experiment indicated significantly enhanced vegetative growth and yield parameters viz.number of leaves per vine, vine length (in cm) and fruit yield per vine (in g) (Table 3) due to the increased application of organic manures (FYM and VC). Increase in the levels of organic manures had a significant effect on vegetative growth parameters. The number of leaves per vine (5.87) and vine length (14.40 cm) at 21 days after sowing (DAS) were observed to be the highest for treatment T_4 (Table 3). The same values were however at par for the treatments T_3 and T_2. Later, at an advanced stage of crop growth, the number of leaves per vine (17.94) and vine length (141.80 cm) at 42 DAS were observed to be the highest for the treatment T_4 which, though at par with the treatment T_3, showed significant increase over the remaining treatments (Table 3). Increased vegetative growth in gherkin may be attributed to the application of organic manures (FYM and VC) that probably supplied the macro and micro-nutrients, enzymes and growth promoting substances thereby causing improved cell elongation and differentiation required for the enhanced vegetative growth. The application of FYM also improves physical, chemical and biological properties of soil leading to improved root growth and thereby uptake of nutrients and water from greater soil volume resulting into better plant growth. These findings are in conformity with those of Kumar et al. (2010) in tomato, Vasanthi and Kumarswamy (1999) in rice, Kokani et al. (2015) in blackgram, Eifediyi and Remison (2010) in cucumber, and Silva et al. (2010) in gherkin.

Further, it was also observed that the increased levels of organic manures showed significant increase in the fruit yield per vine. The maximum fruit yield per vine of 957.28 g was recorded under the treatment T_4 which was also found at par for the treatment T_3. This may be attributed to the enhanced ability of plants through application of FYM and VC which were considered as slow suppliers of nutrients throughout the crop growth, development, flowering and fruiting stages on a continual basis responsible for supply of macro and micro-nutrients and thereby to increase the growth of gherkin. The increase in vegetative growth as evidenced by the increased number of

Table 3. Effect of organic manures on growth and yield of gherkin. (*DAS : Days after sowing).

Treatments	21 DAS*			42 DAS*			Fruits yield per vine (g)
	Days to seed germination	No. of leaves	Vine length (cm)	No. of leaves	Vine length (cm)	Days to first flowering	
T_1	4.34	4.93	9.60	13.34	80.73	32.67	659.17
T_2	4.14	5.67	14.00	14.80	109.07	30.67	768.91
T_3	3.87	5.80	14.14	17.14	126.74	31.33	954.67
T_4	3.87	5.87	14.40	17.94	141.80	31.34	957.28
SEm (±)	0.28	0.24	0.51	0.45	7.40	0.89	1.92
CD (p = 0.05)	NS	0.71	1.54	1.35	22.01	NS	5.70

Table 4. Economic analysis of organic gherkin cultivation in Sikkim (100 m^2 area).

Treatments	Cost of organic fertilizer (`)	Cost of labor (`)	Cost of other inputs (`)	Total cost of cultivation (`)	Total value of returns (`)	Net income (`)	Benefit cost ratio
T_1	2560	3800	205	6565	10973	4408	1.67
T_2	3324	3800	205	7329	12806	5477	1.75
T_3	4162	3800	205	8167	15894	7727	1.95
T_4	4998	3800	205	9003	15941	6938	1.77

leaves per vine and maximum vine length might have resulted in faster and more synthesis and translocation of photosynthates (Sharma and Singh 2007) from source (leaves) to sink (fruit) (Dubey and Misra 2005) resulting in maximum fruits yield per vine. These results are in conformity with Sareedha et al. (2007), Silva et al. (2010), Bindiya et al. (2012) in gherkin and Eifediyi and Remison (2010) in cucumber.

In economic analysis of organic cultivation of gherkin on small terraces of Sikkim, the values of cost of cultivation, total returns and net returns were calculated (Table 4) wherein the costs of FYM and VC were considered to be `2 and `12 per kg respectively and the price of produce was considered to be `50 per kg. With low average land holdings in Sikkim, the unit of cultivation area for calculation of economics was considered as 100 m^2. Labor cost was observed to be the major expenses ranging between 42 to 58% of the total cost of cultivation in the four treatments. The next major component of expenditure was cost of organic manures ranging between 39 to 56% of the total cost of cultivation. The cost of cultivation and total returns were observed to be increasing with increase in organic manure dose and were the highest for the treatment T_4. The highest net returns (`7727) were observed in the treatment T_3 with lesser investment amongst the four treatments, which can therefore be recommended for cultivation of gherkin in Sikkim conditions. Higher prices of gherkin for export oriented processed products are however expected if the crop is introduced and promoted for large scale cultivation. The benefit cost ratio among the treatments was observed to be the highest (1.95) for the treatment T_3. These results are in line with those of Silva et al. (2010) as they found the highest benefit ratio (74.2%) and cost ratio (8.3%) in gherkin after application of 500 g compost. Similarly, Sharma et al. (2003) and Bybordi and Malakouti (2007) reported the highest net returns and benefit cost ratio with the application of FYM and VC in turmeric and onion respectively.

References

Anburani A, Gayathiri M, Arulananth R (2010) Effect of organic manures as soil and foliar application on yield attributes in gherkin (*Cucumis sativus* L.) cv Ajax Hybrid. Adv Pl Sci 23 (1) : 197—199.

Bindiya Y, Srihari D, Babu JD (2012) Effect of organic manures and biofertilizers on growth, yield and nutrient uptake in gherkin (*Cucumi sanguria* L.). J Res ANGRAU 40 (1) : 26—29.

Bybordi A, Malakouti MJ (2007) Effect of different organic fertilizers (animal manure, compost and vermicompost) on the yield and quality of red onion in Khosrowshahr and Bonab. Iran J Soil and Water Sci 21 (1): 33—44.

Chadha KL (2003) Hand book of Horticulture. Published by Directorate of Information and Publications of Agriculture, ICAR, Krishi Anusandhan Bhavan, Pusa, New Delhi, pp 58.

Chandra K (2005) Organic manures. Regional Director, Regional Center of Organic Farming, No. 34, 5th Main Road, Hebbal, Banglaore 24. Releazed on the occasion of 10 days training program on production and quality control of organic inputs Kottayam, Kerala, pp 24.

Dubey RK, Misra RL (2005) Response of chemical and biofertilizers on corm and cormel production in gladiolus. Prog Hort 37 (2) : 412—418.

Eifediyi EK, Remison SU (2010) Growth and yield of cucumber (*Cucumis sativus* L.) as influenced by farm yard manure and inorganic fertilizer. J Pl Breed Crop Sci 2 (7) : 216—220.

EXIM (2009) Sikkim : Export potential and prospects. Occasional paper No. 134 (June 2009), Export-Import Bank of India, Mumbai, pp 103.

Gomez KA, Gomez AA (1984) Statistical procedures for agricultural research. 2nd ed. John Wiley and Sons Incorporation, UK, pp 680.

Kokani JM, Shah KA, Tandel BM, Bhimani GJ (2015) Effect of FYM, phosphorus and sulfur on yield of summer blackgram and post-harvest nutrient status of soil. The

Bioscan 10 (1) : 379—383.

Kumar ABM, Gowda NCN, Shetty GR, Karthik MN (2011) Effect of organic manures and inorganic fertilizers on available NPK, microbial density of the soil and nutrient uptake of brinjal. Res J Agric Sci 2 (2): 304—307.

Kumar V, Malik MF, Singh B (2010) Effect of integrated nutrient management on growth, yield and quality of tomato. Prog Agric 10 (1) : 72—76.

Kumara HGLA, Kuruppuarachchi DSP, Gunathilaka HAWS (2003) Effect of growing environment and cultivation methods on root distribution and moisture extraction of gherkin (*Cucumis sativus* L.). In : Proceedings of 3rd Agricultural Research Symposium, Wayamba University of Sri Lanka, Makandura, Gonawila, Sri Lanka, pp 111—118.

Pal A, Maji S, Govind, Kumawat R, Kumar S, Meena DC (2015) Efficacy of various sources of nutrients on growth, flowering, yield and quality of tomato *(Solanum lycopersicum)* cv Azad T-6. The Bioscan 10 (1) : 473—477.

Purseglove JW (1969) Tropical crops dicotyledons-1. Longmans Green and Co. Ltd, pp 109—110.

Sareedha P, Anburani, Gayathri M (2007) Effect of organic and inorganic nutrients on yield of gherkin (*Cucumis sativus* L.) cv Ajax Hybrid. South Ind Hort 55 (1-6) : 73—77.

Sharma G, Singh P (2007) Response of NPK on vegetative growth, flowering and corm production in gladiolus under mango orchard. J. Ornam Hort 10 (2) : 52—54.

Sharma DP, Sharma TR, Agrawal SB, Rawat A (2003) Differential response of turmeric to organic and inorganic fertilizers. JNKVV Res J 37 (2) : 17—19.

Silva DAMS, Jayasekera SJBA, Banda RMG (2010) Effect of compost on gherkin productivity. In : Proceedings of 10th Agricultural Research Symposium, Wayamba University of Sri Lanka, Makandura,Gonawila, Sri Lanka, pp 1—5.

Vasanthi D, Kumarswamy K (1999) Efficacy of vermicompost to improve soil fertility and rice yield. J Ind Soc Soil Sci 47 (1) : 268—271.

Verma C, Thanki JD, Singh D, Chaudhari SN (2016) Effect of nitrogen, bio-fertilizer and farm yard manure on yield and nutrient uptake in oat (*Avena sativa* L.). The Bioscan 11 (1) : 499—501.