Int.J.Curr.Microbiol.App.Sci (2019) *8*(6): 1877-1885

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 06 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.806.225

Use of Different Types of Fertilizers in Cucurbitaceae Family

Jyoti, Lovpreet Singh and Jatinder Singh*

Department of Horticulture, SAGR, Lovely Professional University, Punjab, India

**Corresponding author*

Keywords

Cucurbits, Organic fertilizers, Quality and Yield

Article Info

Accepted:
15 May 2019
Available Online:
10 June 2019

A B S T R A C T

Acceptable fertilization of cucurbits has several advantages in terms of uniform growth, and seedling vigor, in literature there is lot of evidence that these plants have proficient processes to repair various kinds of nutritional stresses. Yet it is most significant and foremost decisions that which source (fertilizer) is to be used, when to apply fertilizer and what should the quantity of the fertilizer. Requirement of fertilizer is variable according to type of cultivation i.e. field and protected cultivation. Application of fertilizer under open field conditions involves of a basic dose and it is before sowing and during cultivation 1-3 side dressings are required, whereas continuous application of fertilizers should be there under protected cultivation system. Recently a new tendency has been noted, is the increasing attention in environmental preservation and an extending programme toward organic and sustainable agriculture. Application of organic fertilizer alone or in combination with bio fertilizer + inorganic fertilizers, are studies in organic ecosystems are normally long-term and consequently our present understanding is still in its infancy.

Introduction

Vegetables are the main part of human nutrition. Now a day's people have more awareness about their health. Organically produced vegetables preferable by the consumer in the market. So, the use of organic, bio-fertilizers and various fertilizer combinations helps us to give good and safe quality products. On the other point of view, the price of inorganic fertilizers is more and it would increase the cost of cultivation of the farmer. Thus, combined use of organic and inorganic fertilizers is considered to be the best option for crop production, improve quality, sustainability and safe for environmental use. Application of vermicompost and bio-fertilizers together influences the plant metabolism by increasing the availability of applied nutrients and moisture retention capacity (Akbar *et al.*, 2009).

Cucurbits belong to family cucurbitaceae. This family comprises about 118 genera and 825 species which are of consumed by humans. Though the maximum is originated from Old World, yet several species belong to the New World and at least about seven genera in linked with both hemispheres. There is remarkable diversity (genetic) within same family, and the range of adaptation for

tropical and subtropical areas, temperate regions and arid deserts (Rai *et al.,* 2008). Despite their agronomic, culinary and cultural significance, these crops lack consideration from researchers. Due to this reason these crops are often classified as orphan crops (IPGRI, 2002). Mostly plants of cucurbits species are grown in the summer season and rainy season in tropical and sub-tropical regions (Sanjur *et al.,* 2002). In temperate countries these are grown under protected conditions where temperature, RH, light, CO_2 etc., are maintained automatically in controlled conditions according to the crop requirements. River bed cultivation also used for cucurbits during winter season. Cucurbits are also cultivated for seed consumption as they are considered to be rich in nutrients (De Mello *et al.,* 2000).They are cultivated in different parts of the world for their nutritional value as these are rich in vitamins, phosphorus, calcium, protein, carbohydrates etc. Most of cucurbits have been domesticated and grown as produced vegetables forming basic ingredients for human diet (Thoenissen *et al.,* 2009).

Cucurbitaceae family have tremendous medicinal properties such as anti-HIV, anxiolytic, antipyretic, anti-diarrhoeal, carminative, antioxidant, antidiabetic, antibacterial, laxative, anthelmintic, antitubercular, purgative and hepatoprotective. It is also employed as an abortificient, diuretic, and cardio tonic agent. They also show strong anti-inflammatory, antitussive, cytotoxic, and expectorant properties (Rajasree *et al.,* 2016). Different parts of cucurbits fruit or their seeds are supposed to contain anthelmintic, laxative, and emetic qualities due to the secondary metabolite like cucurbitacin content etc. Some cucurbits crops like bitter gourd and other are well known for their distinctive medicinal properties. Fruits of cucerbitceae are consumed in many forms like salad (long melon, gherkins and cucumber), famous sweets (ash gourd and pointed gourd), deserts (melons), pickles (gherkins) and above all they are used for gastronomic purpose *(Rai et al., 2008*).

During 2017-18 total sowing area in Punjab was 16.23 thousand hectare and total production was 258.56 thousand tonnes with average productivity of 159.28 tonne per hectare. Under Indian conditions 5.6% share is contributed by cucurbits. According to estimation of FAO, the area under these crops were 4,290,000 ha while productivity was 10.52 t/ha. It is estimated that cucurbits provide better potential to incline production for national food security (Rai *et al.,* 2008).For the successful and good quality crop production proper, adequate amount of fertilizers are the prime need. At present, due to the overuse of inorganic fertilizers, the product quality has declined. It also diminishes soil health and is harmful to the environment. According to Indian input survey reported in Table 1 was given by (Anonymous, 2017a).

Effect of inorganic fertilizers

Umamaheswarappa *et al.,* (2005) reported that nitrogen application showed a significant effect on number of days required for initiation of earliness in flowering, number of days required for first fruit set whereas phosphorus application also exhibiteda positive effect on flower initiation, development whereas potassium application had no substantial effect on flowering, fruit set of cucumber in cv. Poinsette. Song *et al.,* (2006) concluded that nitrogen, phosphorus and potassium nutrients uptake by cucumber increased with advanced fertilizer rate. Jilani *et al.,* (2009) stated that application of NPK fertilizer (100-50-50) in cucumber induced earliness in flowering and fruiting, least days for flowering, fruit setting, maturity,

maximum fruit per plant, fruit length, fruit weight and yield. Eifediyi and Remison (2009) stated that the growth and yield attributes of cucumber including the vine length, number of leaves per plant, number of branches, leaf area, number of fruits per plant, fruit length, fruit girth, fruit weight per plant, fruit number per plant and total yield per hectare had increased significantly with increase in inorganic fertilizer application up to the maximum level.

Oga and Umekwe (2013) suggested that NPK fertilizer significantly affected the vine length, flowering, fruiting and marketable yield in watermelon. Arshad *et al.,* (2014) concluded that the application of NPK as fertigation resulted in early flowering, fruiting with maximum number of fruits per plant, more weight, length of fruit and higher yield in cucumber.

Effect of organic fertilizers

Jianming *et al.,* (2008) reported that the highest vitamin C content, lower nitrate content in cantaloupe fruits and increased P and K mineralization was obtained by using chicken and pigeon manure composts. Clementina (2013) stated that organic manure is the best to be used as an alternative to the inorganic manure (NPK) for the production of cucurbita. Ghorbani *et al.,* (2013) specified that the application of 20 t ha^{-1} cattle manure with no-chemical fertilizer is an appropriate approach for organic production of summer squash which produces greater yield with high seed oil contents.

Ojo *et al.,* (2014) stated that the use of organic fertilizer in cultivation of watermelon could be applied as an alternative to mineral fertilizer, although it was cost effective but difficult to procure and cannot substantially amends the physical delicateness of the soil. According to results of Ghasem *et al.,* (2014) application of 14 t/h vermicompost or 50 t/h cow manure was advisable to produce more cucumber yield compared with chemical fertilizer and other treatments. Natsheh and Mousa (2014) showed that the application of compost improved the soil characteristics; increased soil productivity, organic matter content and reduced water requirements for cultivation of cucumber. Hong-mei *et al.,* (2014) reported that application of organic fertilizer increase total production, vitamin C, protein, sugar content of cucumber fruit. Arfan-ul-Haq *et al.,* (2015) revealed in bitter gourd that when the effect of organic materials was compared; it was evident that poultry manure produced the highest yield.

Okoli and Nweke (2015) revealed that poultry manure as organic manure and its combination is a good source of soil amendment since it influenced the growth and yield components of cucumber. Shafeek *et al.,* (2015) described highly substantial results that organic manure at a higher level (3.2 ton/fed.) improved plant growth, fruit yield, physical and chemical characters of fruit quality of cantaloupe plants. Eifediyi *et al.,* (2017) reported that the organic amendments were as environmentally friendly fertilizers and resulted in higher production in watermelon as compared to the inorganic amendment (NPK fertilizer) in terms of positive effects on soil structural properties. Kumar *et al.,* (2017) reported that long term sustainability of organic nutrition in vegetable crops (tropical) depended on the quantity and quality of organic manures applied, crop yield, quality and price of the tinda produce.

Effect of biofertilizers

Isfahani and Besharati (2012) indicated that the use of biological fertilizers increased yield and yield contributing of cucumber. Qun *et al.,* (2015) reported that biological organic fertilizers could improve soil enzyme

activities, adjust soil microbial community structure, improve the soil quality and fertility conditions, and hence decrease the incidence of the wax gourd wilt disease.

Effect of organic+ inorganic fertilizers

Mahmoud *et al.,* (2009) investigated that the combination of organic and inorganic fertilizers could increase plant growth, yield, and quality of cucumber and also increased soil fertility. It also established that composted organic wastes can be used to substitute for around 25% of chemical nitrogen fertilizers. Singh *et al.,* (2012) revealed results of three years experiment that bottle gourd responded to the application of vermicompost @ 2.5 t+50 percent RDF, which registered higher fruits yield over other nutrients combination. Audi *et al.,* (2013) indicated that application of 6.0 ton ha-1 cattle manure + 405 kg ha-1 CAN, in all cases, either in combination or alone, resulted in a significant increase in qualitative and quantitative parameters which led to higher yield in watermelon.

Table.1 Indian input survey report for cucurbit crops

Crop	Crop Area (ha)	Fertilizers used area (ha)				
		Chemical fertilizers (ha)	F.Y.M (ha)	Oil cakes (ha)	Other organics (ha)	Green manure (ha)
Cucumber	5296	3967	1917	104	189	187
Pumpkin	1818	768	700	57	36	30
Bottle gourd	356	124	51	21	25	5
Bitter gourd	1287	354	1013	1	42	3
Ridge gourd	89	39	53	0	0	0
Round gourd	798	591	96	0	0	0
Other gourds	785	706	373	0	2	5

Source: (Anonymous, 2017a)

Anonymous (2013) concluded that in terms of the economic aspect that the application of inorganic fertilizer and organic fertilizer in watermelon gave the more convincing results. Massri and Labban (2014) showed that cows manure was proved to be superior to other types of fertilizers (organic and inorganic) in many traits of watermelon and can reduce the harmful effects of chemical fertilizers on the environment and human health.

Nagar *et al.,* (2017) indicated that application of NPK + vermicompost resulted in significant improvement in yield on account of vermicompost along with nutrients from soil particularly at later stage of crop growth might as it might have increased the rate of photosynthesis with further increased vegetative growth activities and provided more sites for translocation of photosynthesizes with ultimately increased the yield in bottle gourd.

Baghel *et al.,* (2017) clearly indicated that organic manures alone or in combination with inorganic fertilizer significantly enhanced vegetative growth of bottle gourd plants and substantially improve the fruit yield of the bottle gourd cultivars. Baghel *et al.,* (2018) revealed that the plants received 100% RDF of NPK + FYM @ 10 t ha^{-1} + Vermicompost @ 5 t ha^{-1} + poultry manure @ 2.5 t ha^{-1} had a beneficial effect on growth of bottle gourd and yield contributing characters.

Effect of organic + biofertilizers

Kumar *et al.,* (2017) studied that combined application of bio-fertilizers and fertilizers had a positive effect on yield, growth and quality parameter due to addition of nutrients and saving of at least 50% of water in cucumber. Waleed *et al.,* (2017) investigated that the organic fertilizer combined with bio-fertilizer had the best effect on plant growth parameters and availability of nutrients in the soil which was 36.3, 16.1 and 36.3 mg kg-1 in N, P and K, respectively in cucumber.

Effect of biofertilizer+ inorganic fertilizers

Prasad *et al.,* (2009) concluded that the application of inorganic nitrogen but in combination with the azotobacter+ PSB bio-fertilizers resulted in healthy and maximum yield in bitter gourd.

Saeed *et al.,* (2015) stated that a combined application of bio-fertilizer and chemical fertilizer had significant effect in increasing yield and growth characters of cucumber.

Effect of organic + biofertilizer + inorganic fertilizers

Anjanappa *et al.,* (2012) revealed that the plants applied with 75% RDF + 75% FYM + Azotobacter + Phospobacteria + Trichoderma resulted in earliness and higher productivity of cucumber crop.

Habibi *et al.,* (2014) concluded that application of bio- fertilizers in combination with 50% chemical and organic fertilizers, reduced the use of chemical fertilizers and produced higher seed and fruit yield in pumpkin. Das *et al.,* (2015) concluded that equal amount of N+ Organic sources + Azotobacter and PSB gave maximum primary branch count, fruit count, average fruit weight and fruit size in bottle gourd.

Das *et al.,* (2015) concluded that yield and quality characters namely, total soluble solids (TSS) and ascorbic acid in bottle gourd fruit were enhanced positively due to the application of 75% N from inorganic source and 25% N from the organic source along with application of bio- fertilizer (PSB). Mohan *et al.,* (2016) described that 60 per cent each of RDF and vermicompost along with *Azotobacter*, *Trichoderma* and PSB were found to be superior among all the combinations of organic, inorganic and bio-fertilizer sources of nutrients for characters, namely minimum number of days to 50 per cent flowering, average fruit length, fruit weight, edible fruit count and maximum edible fruit yield in cucumber. Nayak *et al.,* (2016) stated that recommended dose of chemical fertilizer which was applied to pointed gourd in conjunction with bio-fertilizer and vermicompost in presence of lime, resulted in improvement the quality of the produce (fruits) without hampering the yield potential of the crop.

Natchathra *et al.,* (2016) reported that application of these integrated nutrients found to have a beneficial effect on the yield of tinda in the presence of *azospirillum* and phosphobacteria bio- fertilizers which secreted growth promoting substances, increased soil fertility in terms of nitrogen, phosphorus and potassium elements. Natchathra *et al.,* (2017) revealed that 75 percent of NPK along with vermicompost @ 2.5 t ha-1 combined with azospirillum and phosphobacteria @ 2 kg ha^{-1}in tinda had good potential to promote and improve growth parameters due to an effective and alternative source of macro and micronutrients in crop of tinda.

From the cited literature we may conclude that use of organic fertilizer has a great scope for increasing growth and yield of cucurbit crops. There are several crops in

cucurbitaceae family but there is no to the point conclusion about particular fertilizer on particular crop. In other words we may state that for higher and better quality there is no single fertilizer for all cucurbitaceous crops. So, it is suggested that specific experiment regarding this study should be designed for a particular crop for concrete results or for future the recommendation.

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How to cite this article:

Jyoti, Lovpreet Singh and Jatinder Singh. 2019. Use of Different Types of Fertilizers in Cucurbitaceae Family. *Int.J.Curr.Microbiol.App.Sci.* 8(06): 1877-1885.
doi: https://doi.org/10.20546/ijcmas.2019.806.225