Original Research Article

Effect of organic manures and chemical fertilizers on growth, yield and quality traits of summer squash (*Cucurbita pepo* L.)" cv. Punjab Chappan Kaddu

Abstract

The present investigation was conducted during 2019 at DAV University, Jalandhar, to find out the effect of organic manures and chemical fertilizers on growth and yield of summer squash (*Cucurbita pepo* L.) cv. Punjab Chappan Kaddu. The experiment consisted of eleven treatments and three replications. Out of these, an application of 25% of recommended dose of chemical fertilizer + vermicompost @ 15t/ha had a beneficial effect on minimum days to first female flower (74.67 days), minimum days to first fruit set (76.33), minimum days to first fruit harvest (78.33). The maximum plant height (122.85cm) was recorded in 25% recommended dose of chemical fertilizer + FYM @ 25t/ha. 75% of recommended dose of chemical fertilizer + EM Bokashi @ 2.5q/ha) resulted in minimum days to male flower appearance. The maximum sex ratio (0.38), was obtained with the application of 50% recommended dose of chemical fertilizer + EM Bokashi @ 3q/ha. Enhanced growth parameters due to application of organic and inorganic fertilizers in combination could be due to the supply of nitrogen, phosphorous and potassium through the organic and inorganic sources of nutrients at optimum level. The maximum number of picking (26) and maximum number of fruit per plant (9.85) were obtained with the application of 50% recommended dose of chemical fertilizer + EM Bokashi @ 3q/ha. The maximum fruit yield per plant (2.20 kg), fruit yield per plot (26.26 kg), fruit yield per ha (405.57q) were recorded with the application of 50% recommended dose of chemical fertilizer + vermicompost @ 15t/ha. The maximum TSS (2.40B°) were recorded with the application of 75% of recommended dose of chemical fertilizer + FYM @ 20t/ha while, the ascorbic acid was maximum (52.50mg/100g) when 25% of recommended dose of chemical fertilizer + vermicompost 15t/ha were applied. The highest net returns were obtained when 50% of recommended dose of chemical fertilizer + FYM @ 25t/ha was applied which was followed by the application of 25% of recommended dose of chemical fertilizer + FYM @ 25t/ha. The highest benefit: cost (4.5) was obtained with the same treatment.

Keywords: Summer squash, FYM, Vermicompost, EM Bokashi.

Introduction

Summer squash (*Cucurbita pepo* L.), is an important crop of the family Cucurbitaceae. It is grown during summer in tropical and subtropical conditions throughout the world. Its immature fruits are harvested for consumption as cooked vegetable and curries. It also possesses medicinal value and thus used as medicinal plant (Majeed and Mahmoud 1988). The total global area under pumpkin, squash and gourd is 204.29 MH and global production is 2764.39 MT (Anonymous, 2018). India produces about 556.98 MT of pumpkin, squash and gourd from an area of 58.02 MH (Anonymous, 2018). In Punjab, Cucurbits occupy 5th rank in area (17.01 thousand ha) and production (270.45 thousand tonnes) among different vegetable crops (Anonymous, 2019).Summer squash is a rich source of fiber, potassium, calcium, vitamin A, B and C, carotene and carbohydrates. Per 100g edible portion contains 94.8g moisture, 3.5g carbohydrates, 0.5g protein, 0.1g fat, 0.02mg thiamin, 18g vitamin C, 1mg calcium and 0.6mg iron (Dhaliwal, 2018). It also helps in preventing cancer, heart disease and asthma (Sood *et al.*, 2008).

Like human beings and animals plants also require food for their growth and development. To meet the increasing population we need to increase the agricultural production through various types of cultivations and practices, including type and method of fertilization. With the indiscreet use fertilizers the productivity of land has been compensated. Therefore, there is need of only safe/effective fertilization method which is low cost and environmental friendly. Equilibrium of nutrients in plant roots environment plays vital role in plant growth and high yield crop. Organic manures sustain cropping systems through better nutrient recycling and improve the physical, chemical and biological properties of soil. Commonly used organic manures are FYM, vermicompost, poultry manure, biogas slurry, urine and liquid manure etc (Kumar et al., 2018). Though single nutrient source may not supply the rest of required nutrients for the plant but integrated use of all sources is required for balanced plant nutrition and it is necessary to make the

judicious use of fertilizers in right proportion for harvesting better yield. Thus it has been realized that chemical fertilizers must be integrated through more economic and eco-friendly organic manure to achieve sustainable productivity with high quality and minimum deterioration of the environment. Keeping in view the above mentioned facts and figures the present investigation was planned to find out the effect of organic manures and chemical fertilizers on growth, yield and quality traits on summer squash (*Cucurbita pepo* L.).

Materials and Methods

The present study was carried out at the experimental farm of Faculty of Agricultural Sciences, DAV University, Jalandhar in 2019 to study the effect of organic manures and chemical fertilizers on yield and yield contributing traits of summer squash (*Cucurbita pepo* L.). The experiment was laid out in Randomized Block Design and three replications. The variety grown for the investigation was Punjab Chappan Kaddu. Total eleven treatments viz, T_1 (Absolute control), T_2 (100% of recommended dose of fertilizer (NPK100:50:40kg/ha), T_3 (75% of recommended dose of chemical fertilizer + FYM @ 20t/ha), T_4 (50% of recommended dose of chemical fertilizer + FYM @ 25t/ha), T_5 (25% of recommended dose of chemical fertilizer +FYM @ 25t/ha), T_6 (75% of recommended dose of chemical fertilizer + Vermicompost@10t/ha), T_7 (50% of recommended dose of chemical fertilizer + Vermicompost @15t/ha), T_8 (25% of recommended dose of chemical fertilizer + Vermicompost @15t/ha), T_9 (75% of recommended dose of chemical fertilizer + EM Bokashi @ 2.5q/ha), T_{10} (50% of recommended dose of chemical fertilizer + EM Bokashi @3q/ha), T_{11} (25% of recommended dose of chemical fertilizer + EM Bokashi @3q/ha). The soil of the experimental field was sandy in texture

having pH of 7.6 with available nitrogen (195.70kg/ha). The organic manure (FYM, Vermicompost and EM Bokashi) and inorganic fertilizers (Urea, DAP and MOP) was applied in experimental field as per the treatments wise and all the cultural practices were done at regular interval. The data on growth, yield and quality traits were obtained and analyzed statistically.

Results and discussion

Analysis of Variance (ANOVA) revealed that the treatments significantly influenced all the characters under study except harvest duration.

Plant height (cm): Plant height was reported to be significantly influenced by different combination doses of organic and inorganic nutrient sources in terms of integrated nutrient management as compared to control. Plant height was maximum (122.85 cm) when plants were supplied with 25% of recommended dose of chemical fertilizer +FYM@25t/ha and minimum (69.85 cm) in control where no fertilizer was applied to plants. This may be due to the fact that combined application of FYM and inorganic fertilizers increased the absorption of nutrients especially nitrogen which enhanced the cell division and cell elongation resulting in increased plant height. These findings corroborate the finding of Vishwakarma *et al.* (2007), Mahmoud *et al*. (2009) and Das *et al*. (2015). The finding are also in line with finding of earlier researcher *viz.,* Martinetti and Paganini (2006), Pradhu *et al*. (2006), Mulani *et al*. (2007), Azarmi *et al*. (2009), Eifediyi and Remison (2010), Thriveni *et al*., (2015), Singh *et al.* (2017), Geethu *et al*. (2018), Dash *et al*. (2018) and Baghel *et al*. (2018) who also reported increased plant height with use of Integrated Nutrient Management in other cucurbits.

Days to first male flower appearance: T_9 (75% of recommended dose of chemical fertilizer + EM Bokashi @ 2.5q/ha) resulted in minimum days to male flower appearance (65.00) and maximum days (74.33) were observed in T1 (absolute control). The earliness in flowering may be due to better translocation of nutrients to the aerial parts of the plants and enhancement of reproductive phase due to combined effect of organic and inorganic fertilizers as compared to exclusive inorganic fertilizers. The results are in line with the findings of Martinetti and Paganini (2006), Ezzo *et al*. (2012), Thriveni *et al*. (2015), Vishwakarma *et al*. (2007), Anjanappa *et al*. (2012) and Singh et al. (2017) who observed earliness with Integrated Nutrient Management.

Days to first female flower appearance:

Significant effect of different treatments was observed for days to first female flower appearance. Minimum days to first female flower (74.67) was observed in T_8 (25% recommended dose of chemical fertilizer +vermicompost @ 15t/ha) which was significantly at par with all other treatments except T_1 (Absolute control) which produce first female flower after 83 days. Maximum number of days to first female flower was observed in T_1 (Absolute control) which was significantly highest among all.

Earliness is an important character in summer squash. Though earliness is considered as a genetically controlled trait, other factors like environmental, cultural practices and nutrition of plants can also influence it to an appreciable extent. Among the major nutrients, P plays a vital role in imparting earliness. The results clearly indicate better translocation of nutrients to aerial parts of the plants when fertilizers were applied in the integrated forms i.e. combination of organic and inorganic fertilizers which resulted in earlier female

flower appearance in all the treatment combinations than the absolute control in which no fertilizers were applied. This might be due to better nutritional status of the plants which was favoured by the treatments. 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). The results are in line with the findings of Martinetti and Paganini (2006), Ezzo *et al*. (2012), Kumar et al. (2012), Thriveni *et al*. (2015), Vishwakarma *et al*. (2007), Anjanappa *et al*. (2012) and Singh et al. (2017).

Sex ratio:

Sex ratio which is expression of ratio of female flowers to male flowers was maximum (0.38) when 75% of recommended dose of chemical fertilizer +FYM @ 20t/ha or 50% of recommended dose of chemical fertilizer +Vermicompost@15t/ha was applied to the plants. Lowest sex ratio (0.19) was observed in T8 (25% recommended dose of chemical fertilizer + vermicompost @ 15t/ha). The reason behind the more number of female flowers may be due to the supply of nitrogen, phosphorous and potassium through the organic and inorganic sources of nutrients at optimum level. It was minimum when no fertilizers were applied. The lowest sex ratio

may be due to the production of almost same number of pistillate flowers as that of staminate flowers. The results are in conformity with the finding of Anjanappa et al. (2012), Gill *et al*. (2012) and Singh *et al*. (2017).

Days to first fruit set:

Minimum days to first fruit set (76.33) was observed when plants were supplied with 25% of recommended dose of chemical fertilizer + vermicompost @ 15t/ha and 50% of recommended dose of chemical fertilizer + EM Bokashi @3q/ha. The earliness might be also due to the enhanced production of growth promoting substances like gibberellic acid, IAA by application of vermicompost which induce the earliness of female flower production. Sreenivas *et al.* (2000) and Kameswari *et al.* (2010). Bokashi is an organic fertilizer produced by fermentation of organic material such as rice bran. It contains both decomposed and undecomposed organic matter, microbial biomass and intermediate and ultimate substances produced by microbes produced during fermentation (Yamada et al., 2003). The earliness in fruit setting in the plants supplied with 50% of recommended dose of chemical fertilizer + EM Bokashi @3q/ha could be due to the presence of microbes which could have enhanced the production of growth promoting substances like gibberellic acid, IAA as observed with the application of vermicompost. The integrated approach of nutrient application has improved earliness fruiting as compared to unfertilized plot. These findings are in line with the finding of Arshad *et al*. (2014) and Moharana *et al*. (2017). The results of present finding revealing earliness included application of organic and inorganic fertilizers in optimum level corroborate with the finding of earlier researcher Martinetti and Paganini (2006), Ezzo *et al*. (2012), Kumar et al. (2012), Thriveni *et al*. (2015), Vishwakarma *et al*. (2007), Anjanappa *et al*. (2012) and Singh et al. (2017).

Days to first fruit harvest:

The result revealed that the minimum days to first fruit harvest (78.33) were recorded with treatment T_8 (25% of recommended dose of chemical fertilizer + vermicompost @ 15t/ha). Maximum days to first fruit harvest 87.00 was observed in T_1 (Absolute control) which was significantly highest among all. Least number of days to fruiting in most of the treatment combinations except T1 where no fertilizer was applied may be attributed to the fact that the judicious integration of organic manures with inorganic fertilizers are capable of supplying optimum level of nutrient along with favourable growing media efficient in inducing early flowering in the very treatment. These results are in close conformity with the experimental findings of Vishwakarma *et al.,* (2007) in spine gourd, Mohan *et al.,* (2016) and Singh *et al.,* (2018) in cucumber.

Harvest Duration

The effect of organic and inorganic fertilizer was non-significant for harvest duration. It was maximum (54.33 days) in T5 (25% of recommended dose of chemical fertilizer +FYM@25t/ha) and T8 (25% of recommended dose of chemical fertilizer +Vermicompost@15t/ha) while it was minimum (47.67 days) in T1 (Absolute control). Non-significant effect of organic and

inorganic fertilizer for harvest duration in the current study indicated that plants were provided with enough nutrients to continue fruit production irrespective of the components of different fertilizer treatments as per the potential of the cultivar.

Number of picking

It was noticed that T_{10} (50% of recommended dose of chemical fertilizer + EM Bokashi@3q/ha) showed maximum (26) number of picking. This was statistically at par with all the treatments except T_4 (50% of recommended dose of chemical fertilizer + FYM@25t/ha) showing 17.67 picking and T_1 (Absolute control) resulting 15.67 picking. Minimum number of picking (11.00) was observed in T_3 (75% recommended dose of chemical fertilizer + FYM @ 20t/ha) which was significantly lowest among all the treatments.

More number of picking is related to earliness and more number of female flowers in a particular treatment. The reason behind the more number of female flowers in almost all the treatments may be attributed to the supply of nitrogen, phosphorous and potassium through the organic and inorganic sources of nutrients at optimum level.

Number of fruit per plant

Data revealed maximum number of fruit per plant (9.85) in T_{10} (50% of recommended dose of chemical fertilizer + EM Bokashi@3q/ha). The minimum number of fruits per plant (3.97) was observed in T_1 (Absolute control). It was observed that number of fruits per plant was higher in plants which were supplied with integrated use of organic manures and chemical fertilizers than in cases where only inorganic fertilizes T_2 were supplied and when no fertilizers were supplied T_1. This could be due to the fact that integrated use of organic manures and chemical fertilizers increased major elements like nitrogen, phosphorous and potassium through organic manures application which might have accelerated the synthesis of chlorophyll and amino acids leading to more translocation of photosynthates from leaves to fruits resulting in increased number of fruits per plant. Similar findings were also recorded by Martinetti and Paganini (2006), Multani *et al*. (2007), Azarmi *et al*. (2009), Eifediyi and Remison (2010), Mohan *et al*. (2016) and Mohrana et al. (2017).

Fruit yield per plant

Aggrandized yield in T_7 (50% of recommended dose of chemical fertilizer +Vermicompost@15t/ha) (2.20 kg) may be caused due to an ample concentration of endogenous plant growth regulators like auxin, vitamins and mineral in vermicompost which may have contributed to superior fruit characteristics encouraging more number of fruits per plant resulting in increased fruit yield per plant. Endogenous auxins are known to stimulate more number of female flowers in the plant as revealed from higher sex ratio in T_7, could be the reason of maximum fruit yield per plant. The results are in close conformity with the findings of Kameswari et al., (2010). Similar findings were quoted from the experimental trial conducted by Shreeniwas et al., (2000) in ridge gourd, Prabhu et al., (2006)

and Narayanamma et al., (2010) in cucumber. Likewise, the possible reason behind higher number of fruits resulting in highest fruit yield in T_7 may be attributed to the earliness in female flower emergence, allowing maximum number of female flowers throughout the life span leading to more number of fruits which has ultimately contributed to the highest yield in T_7. These findings are in congruence with the findings of Anjanappa et al., (2012) in cucumber, Thriveni et al., (2017) in bitter gourd and Singh et al., (2018) in cucumber.

Fruit yield per plot (kg)

Maximum fruit yield per plot (26.26 kg) was observed in T_7 (50% of recommended dose of chemical fertilizer +Vermicompost@15t/ha) which was significantly higher than all other treatments. Higher yield due to integrated nutrient management was reported earlier in pumpkin by Ghayal *et al*. (2018) in cucumber, Bindiya *et al*. (2006), in sponge gourd and ridge gourd by Nair and Nair (2006), in bitter gourd by Mulani *et al*. (2007) and Sood and Vidya Sagar (2008). The results are in confirmatory with the finding of earlier researchers *viz.*, Sreeniwas *et al*. (2008), Prabhu et al. (2006), Azarmi *et al*. (2009), Sunaryo (2010), Narayanamma *et al*. (2010), Bindiya (2014), Das *et al*. (2015), Threveni *et al*. (2015), Mohan *et al*. (2016), Nayak *et al*. (2016), Nager *et al*. (2017), Kumar *et al*. (2017) and Kharga *et al*. 2019 who observed increased yield with the application of vermicompost as organic source of fertilizers.

Fruit yield per hectare (q/ha)

As observed in fruit yield per plant and fruit yield per plot, fruit yield per hectare was maximum in plants supplied with 50% of recommended dose of chemical fertilizer +Vermicompost@15t/ha (405.57q). It might be due to balanced nutrition, better uptake of nutrients by the plants which helped for better fruit set and fruit yield. More number of fruits per plant and fruit yield per plant, fruit yield per plot ultimately resulted in highest fruit yield per ha. Maximum yield of summer squash in present study could be due to the influence of vermi-compost in combination with NPK enhanced the synthesis of photosynthate by increasing the growth hormones and amino acids. These findings are in close conformity with earlier results obtained by Sreeniwas *et al*. (2008), Prabhu et al. (2006), Azarmi *et al*. (2009), Sunaryo (2010), Narayanamma *et al*. (2010), Kumar *et al*. (2012), Bindiya (2014), Tavali *et al*. (2014), Das *et al*. (2015), Threveni *et al*. (2015), Mohan *et al*. (2016), Kanaiyia and Daniel (2016), Fawaz *et al*. (2016) Nayak *et al*. (2016), Nager *et al*. (2017), Kumar *et al*. (2017) and Kharga *et al*. 2019 who observed increased yield with the application of vermicompost as organic source of fertilizers.

TSS

Among the treatment the quality as influenced by various INM treatment in huge conduct when contrasted with control. The maximum TSS of edible fruit was observed in T_3 -75% of recommended dose of chemical fertilizer + FYM@ 20t/ha (2.40°B) followed by T_8 (25% of recommended dose of chemical fertilizer +Vermicompost@15t/ha) and T_{11} (25% of recommended dose of chemical fertilizer + EM Bokashi@3q/ha) which resulted in TSS to the tune of 2.23 and 2.20, respectively. Minimum TSS (0.73) was found in T_4 (50% of recommended dose of chemical fertilizer + FYM @ 25t/ha) which was statistically at par with T_1 (Absolute

control) and T_5 (25% of recommended dose of chemical fertilizer +FYM@25t/ha) showing TSS to the tune of 1.23 and 0.93, respectively.

Quality characters like total soluble solids (TSS) in summer squash fruit were enhanced in a favorable way due to application of inorganic fertilizer and organic manure in an integrated manner. Treatment combinations consisting of FYM and vermicompost have resulted in higher TSS content. It might be due to the fact that combined application of FYM, vermicompost and inorganic fertilizers might have led to balance C: N ratio which resulted in satisfactory nutrient availability and increased plant metabolism, which ultimately lead to increased carbohydrate accumulation in fruits resulting in higher total soluble solids (TSS). Similar findings were reported by Thriveni et al. (2015), Singh et al. (2017) and Shree et al. (2018). Positive influences of substitution of inorganic fertilizer with different organic manures on TSS content have been reported by Vishwakarma et al. (2007). Kameswari and Narayanamma (2011) stated that application of poultry manure along with recommended dose of nitrogenous fertilizers and vermicompost improved the quality characters like TSS content in ridge gourd. According to Azarmi et al. (2009),Kanaijia and Daniel (2016) vermicompost had positive influences on growth, yield and quality of cucumber. From these reports, it is evident that the results of the present investigation are well supported by the findings of the earlier workers.

Ascorbic acid

It was observed that influence of organic manures and chemical fertilizers were significant for ascorbic acid. The maximum ascorbic acid (52.50 mg/100g) was observed in T_8 (25% of recommended dose of chemical fertilizer +Vermicompost@15t/ha). The minimum ascorbic acid (15.67) was observed in treatment T_1 (Absolute control). This might be due to the more availability of micronutrient like B, Cu, Mn, Zn etc. with the application of vermicompost in integrated nutrient management which might have increased ascorbic acid content of fruit. These results are in accordance with the findings of Triveni *et al*. (2015) in bitter gourd, Das *et al*. (2015) in bottle gourd and Kameswari and Narayanamma (2011) in ridge gourd.

Relative economic

Relative economic in summer squash was calculated and presented in Table 2. Perusal of data on relative economics based on yield revealed that treatment T_7 (50% of recommended dose of chemical fertilizer + vermicompost @ 15t/ha) recorded maximum gross returns (368700) followed by T_4 (50% recommended dose of fertilizer + FYM @ 20t/ha) and T_5 (25% recommended dose of chemical fertilizers + FYM @ 25t/ha). Maximum Benefit cost ratio was revealed in treatment with maximum (4.5) in T_4 (50% of recommended dose of chemical fertilizer + FYM @25t/ha) and T_5 (25% of recommended dose of chemical fertilizer + FYM @25t/ha). Minimum benefit cost ratio (0.9) was observed in T_{11} (25% of recommended dose of chemical fertilizer + EM Bokashi @3q/ha) followed by T_3

(75% of recommended dose of chemical fertilizer + FYM @ 20t/ha) and T_1 (Absolute control). These results are also in conformity with finding of Patle et al., 2018.

Conclusion

It may be concluded that with the application of T_7 (50% of recommended dose of chemical fertilizer + vermicompost @ 15t/ha) highest gross return was observed due to maximum yield per plant, yield per plot, yield per ha. However, with the application of 50% of recommended dose of chemical fertilizers + FYM @ 25t/ha and 25% of recommended dose chemical fertilizer + FYM @ 25t/ha has been found highest net returns and Benefit:cost was observed. This was due to the lower cost of cultivation with the application of FYM.

References

1. Amrithalingam S and Balakrishnan R. 1988. Studies on the effect of Azospirillum, nitrogen and NAA on growth and yield of chilli. *South Indian J. Hort*., **36**: 218.
2. Anjanappa M, Venkatesh J, and Kumara BS. 2012. Influence of organic, inorganic and bio fertilizers on flowering, yield and yield attributes of cucumber (cv. Hassan Local) in open field condition. *Karnataka Journal of Agricultural Sciences*, ***25*(4):** 493-497.
3. Anonymous 2018. FAO Stat. 2018
4. Anonymous 2019. Package of practices of vegetable crops. Punjab Agricultural University Ludhiana, pp-1.
5. Arshad I, Ali W and Khan ZA. 2014. Effect of different levels of NPK fertilizers on the growth and yield of greenhouse cucumber (Cucumis sativus L.) by using drip irrigation technology. International Journal of Research, **1(8):** 650-60**.**
6. Ayuso MS, Pascal JA, Garcia C and Hernandez T. 1996. Evaluation of urban wastes for urban agricultural use. *Soil Science Plant Nutr*., **42**:105-111.
7. Azarmi R, Giglou MT and Hajieghrari B. 2009. The effect of sheep manure vermicompost on quantitative and qualitative properties of cucumber (*Cucumis sativus* L.) grown in the greenhouse. *African Journal of Biotechnology*, **8(19):**4953-4957.
8. Baghel SS, Bose US and Singh SS. 2018. Impact of Different Organic and Inorganic Fertilizers on Sustainable Production of Bottle Gourd [*Lagenaria siceraria* L.]. *Int. J Pure App. Biosci*, ***5*(2):**1089-1094.
9. Belay A, Classens AS, Wehner FC and De Beer JM. 2001. Influence of residual manure on selected nutrient elements and microbial composition of soil under long term crop rotation. *S. Afr. J. Plant Soil*, **18**:1-16.
10. Bindiya Y, Reddy IP, SrihariD, Reddy RS and Marayanamma M. 2006. Effect of different sources of nutrition on soil health, bacterial population and yield of cucumber. *Journal of Research A.N.G.R.A.U* **34**:12-20.
11. Das R, Mandal AR, Priya A, Das SP and Kabiraj J. 2015. Evaluation of integrated nutrient management on the performance of bottle gourd [*Lagenaria siceraria* (Molina) Standl.]. *Journal of Applied and Natural Science*, ***7*(1):**18-25.
12. Dash SK, Sahu GS, Das S, Sarkar S, Tripathy L, Pradhan S.R and Patnaik A. 2018. Yield improvement in cucumber through integrated nutrient management practices in Coastal Plain zone of Odisha, India. *International Journal of Current Microbiology and Applied Science*, ***7*(2):** 2480-2488.
13. Dhaliwal MS. 2018. Hand book of Vegetable.
14. Eifediyi EK and Remison SU. 2010. Growth and yield of cucumber (Cucumis sativus L.) as influenced by farmyard manure and inorganic fertilizer. *Journal of Plant Breeding and Crop Science*, ***2*(7):** 216-220.
15. Ezzo MI, Glala AA, Saleh SA and Omar NM. 2012. Improving squash plant growth and yieldling ability under organic fertilization condition. *Australian Journal of Basic and Applied Sciences*, **6**:572-578.

16. Geethu BL, Saravanan S, Prasad VM, Gokul P and Baby R. 2018. Effect of organic and inorganic fertlizers on the plant growth and fruit yield of bittergourd (*Momordica charantia*) variety: Preethi. *The Pharma Innovation Journal*, **7(7):**75-78
17. Ghayal RG, Vaidya KP and Dademal AA. (2018). Effect of different organic and inorganic fertilizers on growth and yield of cucumber (*Cucumis sativus* L.) in lateritic soil of Konkan (MS). *International Journal Chemical Stud*ies ***6*(2),** 3452-3454.
18. Gill J, Dhillon WS, Gill PPS and Singh N. 2012. Fruit set and quality improvement studies on bitter gourd. *Indian journal of Horticulture,* **69(1)**:39-44.
19. Higa T and Parr JF. 1994. Beneficial and effective microorganisms for a sustainable agriculture and environment (**Vol. 1**). *Atami: International Nature Farming Research Center.*
20. Kameswari PL, Narayanamma M, AhmedSR and Chaturvedi A. 2010. Influence of integrated nutrient management in ridge gourd (*Luffa acutangula* (roxb.) L.). *Vegetable Science* **37(2**)203-204
21. Kanaujia SP, Daniel ML. 2016. Integrated nutrient management for quality production and economics of cucumber on acid alfisol of Nagaland. *Annals of Plant and Soil Research 18*(4):375-380.
22. Kharga S, Sarma P, Warade SD, Debnath P, Wangchu L, Singh AK and Simray AG. 2019. Effect of Integrated Nutrient Management on Growth and Yield Attributing Parameters of Cucumber (*Cucumis sativus* L.) under Protected Condition. *Int. J. Curr. Microbiol. App. Sci*. ***8*(8):**1862-1871.
23. Kumar KM, Somasundaram E, Marimuthu S and Meenambigai, C. 2017. Growth, Yield and Quality of Snake Gourd (*Trichosanthes anguina* L.) as Influenced by Organic Nutrient Management Practices. *Int. J. Curr. Microbiol. App. Sci*. ***6*(11):**918-924.
24. Kumar M, Chaudhary V, Naresh RK, Maurya OP and Pal SL. 2018. Dose integrated sources of nutrients enhance growth, yield quality and soil fertility of vegetable crops. *International journal of current microbiology applied science*, **7(6):** 125-155.
25. Kumar V, Singh VK, Rani T. 2012. Effect of integrated nutrient management on economics in bottle gourd (Lagenaria siceraria). *Environment & Ecology*, 30(4A):1410- 1412
26. Kyan T, Shintani M, Kanda S, Sakurai M, Ohashi H, Fujisawa A and Pongdit S. 1999. Kyusei nature farming and the technology of effective microorganisms. *Atami (Japan), Asian Pacific Natural Agricultural Network.*
27. Majeed, S.H. and Mahmoud, M.J. (1988) Iraqi Herbs and plants in Popular Medical and Scientific Research.First publication. Drug and Drug Education Department. Biological Research Centre. Scientific Research Council. Iraq
28. Martinetti L and Paganini F. 2006. Effect of organic and mineral fertilisation on yield and quality of zucchini. In *International Symposium Towards Ecologically Sound Fertilisation Strategies for Field Vegetable Production, **700*** (pp. 125-128) doi: 10.17660/ActaHortic.2006.700.18

29. Mohan L, Singh BK, Singh AK, Moharana DR and Kumar H. 2016. Effect of integrated nutrient managrment on growth and yield attributes of cucumber (*Cucumis sativus* L.) cv. Swarna Ageti under polyhouse conditions. The Bioscan **12(1)**: 305-308.
30. Moharana DP, Mohan L, Singh BK, Singh AK, Kumar H and Mahapatra AS. 2017. Effect of integrated nutrirnt management on growth and yield attribites of cucumber (*Cucumber sativus* L.) cv. Swarna Ageti under polyhouse conditions. *The Bioscane,* **12(1):**305-308.
31. Mukesh Kumar , Veena Chaudhary , R.K. Naresh , O.P. Maurya and S.L. Pal. 2018. Does Integrated Sources of Nutrients Enhance Growth, Yield, Quality and Soil Fertility of Vegetable Crops?. International Journal of Current Microbiology and Applied Sciences. 7(6): 125-155
32. Mulani TG, Musmade AM, Kadu PP and Mangave KK. 2007. Effect of organic manures and biofertilizers on growth, yield and quality of bitter gourd (*Momordica charantia* L.) cv. Phule Green Gold. *Journal of Soils and Crops*, ***17*****(2),** 258-261.
33. Nager M, Soni A.K and Sarolia D.K. 2017. Effect of organic manures and different levels of NPK on growth and yield of bottle gourd (*Lagenaria siceraria (*Mol.) standl.). International journal of current Microbiology and Applied Science **6(5):**1776-1780.
34. Nair AK and Nair SA. 2006. Influence of FYM and nutrient on ridge and sponge gourd yield intercropped with coconut palm in South Andaman. *International Journal of on Agriculturl Science* **2**:284-285
35. Narayanamma M, Chiranjeevis CH, Ahmed R and Chaturvedi A. 2010. Influence of integrated nutrient management on the yield, nutrient status and quality of cucumber (*Cucumis sativus* L.). *Vegetable Science **37*****(1),** 61-63.
36. Nayak DA, Pradhan M, Mohanty S, Parida AK and Mahapatra P. (2016). Effect of integrated nutrient management on productivity and profitability of pointed gourd (Trichosanthes dioica Roxb.). *Journal of Crop and Weed **12*****(1):** 25-31.
37. Patle BJ, Wagh AP, Umbarkar PS, and Bondre SV. 2018. Integrated nutrient management studies in bottle gourd. *Journal of Pharmacognosy and Phytochemistry*, ***7*****(5),** 1383-1385.
38. Prabhu M, Natarajan S, Srinivasan K, and Pugalendhi L. 2006. Integrated nutrient management in cucumber. *Indian Journal of Agricultural Research*, ***40*****(2)**, 123-126.
39. Reddy BG and Reddy MS. 1999. Effect of integrated management on soil available micronutrient in maize-soybean cropping system. *Journal of Research ANGRAU,* **27**: 24-27.
40. Shree S, Regar CL, Ahmad F, Singh VK, Kumari R and Kumari A. 2018. Effect of organic and inorganic fertilizers on growth, yield and quality attributes of hybrid bitter gourd (*Momordica charanita* L.). *International Journal of Current Microbiology and Applied Sciences,* **7(4):**2256-2266.
41. Singh J, Singh MK, Kumar M, Kumar V, Singh KP and Omid AQ. 2018. Effect of integrated nutrient management on growth, flowering and yield attributes of cucumber (*Cucumis sativus* L.). *Intl. J. Chem. Studies **6*****(4):**567-572.
42. Singh KP and Kalloo G. 2000. Nutrient management in vegetable crops. *Fertilizer News* **45**:77-81.

43. Singh V, Prasad VM, Kasera S, Singh BP and Mishra S. 2017. Influence of different organic and inorganic fertilizer combinations on growth, yield and quality of cucumber (Cucumis sativus L.) under protected cultivation. *Journal of Pharmacognosy and Phytochemistry* **6(4)**:1079-1082
44. Sood R and Vidyasagar. 2008. Nitrogen economy through the use of biofertilizers on yield of summer squash (*Cucurbita pepo* L.). *Crop Research* **36(1, 2 &3):**201-207.

45. Sood R, Gupta S and Rana MK.2018. Zucchini. *Vegetable Crop Science*: 573-582.

46. Sreenivas, Ch & S.Muralidhar, & Rao, M.Singa. (2000). Yield and quality of Ridge gourd fruits as influenced by different levels of inorganic fertilizers and vermicompost. Annals of Agricultural Research. 21. 262-266.

47. Sunaryo Y. 2010. Effect of vermicompost and bokashi on nutrient content of mustard green and lettuce. In *International Seminar on Horticulture to Support Food Security* (pp. 22-23).
48. Suresh KD, Goyal S, Kapoor K and Mundra M. 2004. Microbial biomass carbon and microbial activities of soil receiving chemical fertilizers and organic amendedments. *Archives of Agronomy and Soil Science*, **50**:41-47.
49. Thriveni V, Mishra HN, Pattanayak SK, Sahoo GS and ThomsonT. 2015. Effect of inorganic, organic fertilizers and biofertilizers on growth, flowering, yield and quality attributes of bitter gourd (*Momordica charantia* L.). International Journal of Farm Sciences, **5(1):**24-29.
50. Thriveni V, Mishra HN, Pattanayak SK, Sahoo GS and ThomsonT. 2015. Effect of inorganic, organic fertilizers and biofertilizers on growth, flowering, yield and quality attributes of bitter gourd (*Momordica charantia* L.). International Journal of Farm Sciences, **5(1):**24-29.
51. Vishwakarma SK, Gautam DS, Yadav NS and Gautam SS. 2007. Effect of different levels of nitrogen and phosphorus on growth, yield and quality of spine gourd (*Momordica dioica* Roxb.). Technoframe-*A Journal of Multidisciplinary Advance Research* 119-23.

Table 1: Effect of organic manures and chemical fertilizers on growth, yield and quality of Summer squash (*Cucurbita pepo* L.)

Treatments	Plant Height (cm)	Days to first male flower appearance	Days to first female flower appearance	Sex ratio	Days to first fruit set	Days to first fruit harvest	Harvest Duration	Number of picking	Number of fruit per plant	Fruit yield per plant(kg)	Harvest Duration	Number of picking	Fruit yield per plot(kg)	Fruit yield/ha(q)	TSS	Ascorbic acid
T1	69.85	74.33	83.00	0.23	84.00	87.00	48.67	15.67	3.97	0.39	48.67	15.67	4.86	75.13	1.23	15.67
T2	101.18	71.00	75.67	0.34	76.67	79.00	53.00	23.00	5.67	0.65	53.00	23.00	17.07	263.51	1.73	38.33
T3	91.97	68.67	75.67	0.29	77.00	79.00	53.67	24.33	8.60	0.50	53.67	24.33	6.13	94.86	2.40	41.67
T4	90.65	71.33	75.33	0.29	76.67	79.00	53.67	17.67	9.33	1.87	53.67	17.67	22.48	346.98	0.73	36.67
T5	122.85	71.00	76.00	0.25	77.00	79.67	53.00	24.67	6.97	1.82	53.00	24.67	21.97	339.15	0.93	31.67
T6	100.87	70.33	77.33	0.33	78.33	81.00	52.33	22.67	8.23	1.49	52.33	22.67	17.88	276.05	1.93	25.00
T7	72.45	71.00	75.67	0.38	76.67	79.00	49.00	11.00	9.22	2.20	49.00	11.00	26.26	405.57	1.80	28.33
T8	114.13	67.33	74.67	0.19	76.33	78.33	53.00	25.67	5.75	1.62	53.00	25.67	19.47	298.29	2.23	52.50
T9	109.43	65.00	76.00	0.34	78.00	80.00	54.33	24.33	5.13	1.45	54.33	24.33	17.38	268.40	1.70	36.23
T10	71.00	67.33	75.00	0.38	76.33	78.67	54.33	26.00	9.85	0.90	54.33	26.00	10.71	163.39	1.73	26.23
T11	101.45	72.67	77.00	0.30	78.33	80.00	51.33	25.00	5.06	1.67	51.33	25.00	20.08	310.00	2.20	40.83
SEm±	**11.2**	**2.34**	**1.34**	**0.05**	**1.05**	**0.77**	**1.86**	**1.88**	**1.05**	**0.07**	**1.86**	**1.88**	**0.94**	**14.45**	**0.271**	**6.78**
CD 5%	**23.52**	**4.91**	**2.83**	**0.04**	**0.74**	**1.09**	**N/A**	**3.96**	**2.20**	**0.16**	**N/A**	**3.96**	**1.98**	**30.37**	**0.569**	**14.25**

Table 2: Economics of Summer squash cultivation as influenced by various nutrient combinations

Treatments	Total cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net return (Rs/ha)	B:C ratio
T1	53335	68300	14965	1.2
T2	62335	239560	177225	3.8
T3	70835	86240	15405	1.2
T4	69845	315440	245595	4.5
T5	68325	308320	239995	4.5
T6	130835	250960	120125	1.9
T7	164345	368700	204355	2.2
T8	162825	273180	110355	1.6
T9	150835	244000	93165	1.6
T10	167345	148540	-18805	0.8
T11	165825	281820	115995	1.6