Review Article

Biofertilizer and Organic Manures in Strawberry Production: A Review

Anupam Singh*, Md Abu Nayyer*, Amrit Kumar Singh, Rizwan Ali and Sarfaraz

Department of Agriculture, Integral Institute of Agricultural Sciences and Technology (IIAST), Integral University, Lucknow

Abstract

Strawberry is a popular, tasty, nutritious, and tiny fruit, but it requires a lot of ingredients to grow well. Though inorganic fertilizers are a major source of nutrients, using exclusively chemical fertilizers in an unbalanced manner can have a bad effect on soil health and the environment. Bio-fertilization is crucial in the development and implementation of sustainable agriculture practices in order to prevent natural and environmental contamination from worsening. Excessive use of inorganic fertilizers and pesticides, especially on fruits that may be consumed without peeling, such as strawberries, is hazardous to human health. Strawberry growth, yield, and quality can all be maintained with organic manures. Biofertilizers are natural fertilizers that contain living microbial inoculants and can provide plants with nutrients that are otherwise unavailable. By preserving long-term soil fertility, integrated nutrient management can help ensure long-term strawberry development, yield, and quality. Different nutrition management in strawberry is studied in light of good nutrient management for better growth, yield, and quality.

Keywords: Strawberry, organic manure, biofertilizer, integrated nutrient management

***Correspondence**

Author: Anupam Singh, Md Abu Nayyer

Email: abunayyer@iul.ac.in, anupams@iul.ac.in

Introduction

The cultivated strawberry (*Fragaria X ananassa* Duchesne) belongs to the Rosaceae family and has chromosomal number (2n=8x=56). Strawberry fruit is one of the world's most appetizing, refreshing, and nutrient-dense mushy fruits. It is a monoecious octoploid hybrid of *Fragaria chiloensis* and *Fragaria virgiana*, two predominantly dioecious octoploid species. Strawberry is prized in both home gardens and commercial fields for its nutrient-dense fruits with a delicious aroma [1]. It is one of the fruit crops that provides quick returns in the shortest time feasible, with very high returns per unit area on capital input. Strawberry is a low calorie carbohydrate fruit with a high nutritional value. Vitamin A (60 IU/100g edible amount), vitamin C (30-120 mg/100g edible portion), fibre, and high pectin content (0.55%) are all present in the form of calcium pectate. The strawberry fruit is mostly made up of water (90 percent). Ellagic acid is a naturally occurring plant phenol that has been shown to help prevent cancer and asthma when consumed regularly [2]. Maharashtra is the most productive strawberry-producing state in India. It's also grown commercially in Haryana, Punjab, Uttar Pradesh, Jammu & Kashmir, Uttrakhand, and Himachal Pradesh's lower hills [3].

Bio-fertilizers are live microorganisms found in nature that have no negative effects on plants, soil health, or the environment [2]. These microorganisms live freely in the soil or in symbiotic relationships with plants, contributing directly or indirectly to plant nitrogen and phosphorus nutrition. Horticultural crops benefit from bio-fertilizers in terms of growth and yield. The usage of bio-fertilizers has been shown to boost crop output by 15 to 30 percent [4]. Hormones, vitamins, and other growth factors are also produced by bio-fertilizers, which are necessary for vegetative growth and development [5].

To take on this task, all microorganisms are the most prolific and efficient. They store and supply nitrogen by fixing free nitrogen in the root system, and in exchange, they exude carbon sources and other chemicals through the plant. Surprisingly, large bacterial concentrations were found in the plant's rhizosphere, or root nodules, which is where high concentrations of nutrients gather, allowing for rapid growth and bacterial metabolism. Beneficial microorganisms, which are employed instead of chemical fertilisers, can increase plant development while simultaneously maintaining the soil's environmental health and productivity. Recent research has confirmed that a variety of bacteria species found mostly in the rhizosphere of plants are helpful to crop development, quality as well as yield. Plant Growth Promoting Rhizobacteria include isolates from the genera Azospirillum and Azotobacter, among others [6]. This type bacteria colonise plant roots, promoting development and, in certain cases, protecting plants from illness. Depending on the bacterial strain, they have a direct or indirect mechanism of action. Bacteria supply plant chemicals generated by themselves and encourage growth through an indirect method of action. Nitrogen, growth hormones, and some minerals from the natural environment, such as iron or phosphorus, are

examples of these molecules. Bacteria defend plants from diseases in an indirect mode of action by protecting them from various phytopathogenic microbes. Azospirillum spp. is a well-studied plant growth-promoting bacteria because of its capacity to colonise the roots of a wide range of plant species, the majority of which are important for agriculture [7]. Organic manures, green manures, bio-fertilizers, and chemical fertilisers are all part of an integrated nutrient management (INM) system. Nutrient supply from both organic and inorganic sources is crucial in terms of crop yield and quality. The INM aids in the restoration and maintenance of soil fertility and agricultural productivity. It may also aid in the prevention of nutritional deficiencies other than N, P, and K. Biofertilizers are made up of microorganisms that assure the right delivery of nutrients to the host plants, as well as their optimal growth and physiology management. The selection of appropriate strains for a given crop is vital for the manufacture of bacterial biofertilizer. Each biofertilizer has a unique biological role in terms of nutrient delivery to crop plants. Biofertilizers are one of the most advanced modern agricultural equipment, and they are used to improve soil fertility and quality. It provides a cost-effective and environmentally friendly way to supplement nutrition supplies. Chemical fertilisers, which are not only in short supply but also expensive and harm the environment, soil, and water, are used extensively in modern intensive crop production. As a result, the present focus is on investigating the possibility of complementing chemical fertilisers with organic fertilisers, particularly microbial-derived biofertilizers. As a result, a well-balanced mix of inorganic and organic fertilisers, as well as bio-fertilizers, may be beneficial in enhancing strawberry fruit yield. Furthermore, such initiatives will aid in the maintenance of long-term productivity and soil health.With this in mind, the current study was designed to determine the impact of FYM and bio fertilisers on strawberry growth and quality.

A. Impact of FYM (farm yard manure) on vegetative growth, quality and yield of strawberry
B. Impact of biofertilizer on vegetative growth, yield and quality of strawberry
C. Combined effect of organic manure (FYM) and biofertilizer on vegetative growth, yield and quality of strawberry.

A. Impact of FYM (farm yard manure) on vegetative growth, quality and yield of Strawberry [8]

This research included two strawberry variety, RU-1 (Festival) and RU-2 (AOG), as well as eight organic manures, including control, cowdung, mustard oilcake (MOC), poultry manure, cowdung+MOC, cowdung+poultry manure, MOC+poultry manure, and cowdung+MOC+poultry manure, and cowdung+MOC+poultry manure. Except for number of runners per plant and TSS content with AOG, Festival produced the best growth, yield, and quality attributes. The highest yield (19.14 t/ha) was achieved by combining cowdung+MOC+poultry manure. [9] This research trail included two strawberry cultivars, RU-1 (Festival) and RU-2 (AOG), as well as eight organic manures: control, cowdung, mustard oilcake (MOC), poultry manure, cowdung+MOC, cowdung+poultry manure, MOC+poultry manure, cowdung+MOC+poultry manure, MOC+poultry manure, and cowdung+MOC+poultry manure, and cowdung+MOC+ Festival had the best growth, yield, and quality qualities, except for the number of runners per plant and TSS content with AOG. Combining cowdung+MOC+poultry manure yielded the maximum output (19.14 t/ha). [10] Among the bulky organic manures, farmyard manure has a prominent place. The FYM appears to increase crop output directly, either by accelerating the respiration process through cell permeability or by hormone growth action. Through biological degradation, it provides plants with accessible forms of N, P, and K. [11] The apply of 40 tonnes of organic fertiliser (FYM) + 60 kg ha-1 NPK fertilisers resulted in a greater strawberry fruit production (27.62 t ha-1), whereas the untreated plot yielded the minimum fruits yield (21.76 t ha-1). [12] Organic manures were studied to see if they had a positive impact on yield characteristics. However, the treatment combination 75 percent Organic Fertilizer FYM + 25 percent Inorganic Fertilizer yielded the highest fruit production per plant (6.58 kg/plot). With 75 percent Organic Manure FYM + 25% Inorganic Fertilizer RDF, the greatest plant spread (67.66 cm) and total number of leaves/plant (35.20) were observed. [13] The plant height of the plant was significantly influenced by the different sources of nutrients, with the lowest plant height recorded under treatment 50 percent vermicompost+50 percent poultry manure with Azotobacter inoculation (15.41cm) and (19.61cm) at 60 and 90 DAT, respectively. The maximum number of leaves was observed under treatment 50 percent vermicompost+50 percent poultry manure with Azotobacter 20.39 leaves per plant and the maximum number of leaves was recorded under treatment 50 percent The maximum strawberry plant spread (24.54 cm) was observed in treatment T8 –50 percent Vermicompost+50 percent Poultry Manure with Azotobacter, and the maximum fruit length (3.65 cm), width 3.10 cm, and fruit weight of 10.59 gm were recorded with the use of 50 percent Poultry Manure+ 50 percent FYM with Azotobacter.

B. Impact of biofertilizer on vegetative growth, yield and quality of strawberry [14]

Beneficial microorganisms that can release nutrients from source materials and plant residues in the soil and make them available commercially when specific strains are utilised as biological fertilisers make up the majority of biofertilizers. By enhancing biological nitrogen fixation, nutrient availability and uptake, and stimulating natural hormones, biofertilizers aid in improving crop output and quality. They are safe for humans, environment and animals, and their use contributes to the reduction of pollution in our environment. [15] After planting at 30, 60, 90, and 120 days, substantial differences in plant height were identified due to the usage of bio-fertilizers. At 120 DAP, treatment T5 (RDF + Azospirillum @ 7 kg/ha + Phosphate Solublizing Bacteria @ 6 kg/ha) was found to have the maximum plant height (31.20 cm) and the total number of leaves per plant (41.90). [16] When comparing the control treatment to the biofertilizer treatment, plant height, number of leaves per plant, crown diameter, leaf area, and dry weight per plant were all significantly changed. [4] Application of *Azotobactor* + AM + PSB +vermicompost gives maximum number of leaves (54.30),plant height (20.26 cm) of Strawberry Fruit, whereas other growth parameters were noted minimum in control. Maximum production of Strawberry fruit (311.26gm/plant) were evaluated with *Azotobactor* + *Arbuscular mycorrhizae* +Vermicompost + PSB while found lowest production (*i.e.*136.59gm/plant) seen under control. [3]. Made a field study with application of *VesicularArbuscular mycorrhizae* (VAM) 12kg/ha + *Azotobactor* 10kg/ha. They found to be beneficial over other treatments andcontrol. This treatment recordedhighest number of fruit yield (37.59t/ha.) or (417.73 g/plant) of strawberry Fruit. [17]. conducted research and they got maximum strawberry Fruit yield (19.87 t/ha) in the variety 'Camarosa' produces maximum yield in the treatment of PSB 2gm/plant +75% RDF + topdressing of 25% K + *Azospirillium* 2gm/plant closely followed by PSB 2gm/plant +75% RDF + topdressing of 25% K + *Azotobactor* 2gm/plant (*i.e.* 17.41t/ha) as against to the control (treated with distilled water) (which was 12.40t/ha). [18] made an experiment and got result the yield (132.75q/ha.) of strawberry fruit was noted maximum with organic manures & Bio-fertilizers (oil cake + wood ash + Poultry manure + PSB + *Azotobactor*) as against to other treatments and control. [19] When compared to other treatments, they observed that using Bio- fertiliser mixed with 50% Mineral fertiliser resulted in the highest values of number of leaves per plant, crown per plant, and leaf area is (28.56, 2.56, and 529.66 cm^2), respectively. [20] When it came to bio-fertilizers and nitrogen, researchers discovered that Azotobacter infected plants had the highest plant height (24.92 cm), number of leaves (26.29), leaf area (96.12 cm), and total number of runners (18.70) per plant when compared to other treatments.[21] On strawberry cv. Chandler, researchers used 5, 6, and 7 kg of Azotobacter, Azospirillum, and PSB, respectively, and found that 7 kg ha-1 Azotobacter significantly enhanced plant height (16.05 cm), total number of leaves (54.75 g), and number of runners (4.39) plant-1. [22] investigated several quantities of biofertilizers, such as Azotobacter and Azospirillum, and discovered that the application of Azotobacter (6 kg ha-1) + Azospirillum (6 kg ha-1) fertilised plants of strawberry cv. Charlie, Charlie, Charlie.

C. Combined effect of organic manure (FYM) and biofertilizer on vegetative growth, yield and quality of strawberry [20]

Bio-fertilizers are naturally occurring materials containing living microorganisms that are derived from the roots or farmed soil and have no negative impact on plant, soil, climate, or environment. Bio-fertilizers have an important part in the fixation of atmospheric nitrogen and phosphorus solubilization, as well as in the stimulation of plant growth hormones. Azotobacter, Phosphate Solubilizing Bacteria (PSB), and Azospirillum are biofertilizers that fix atmospheric nitrogen and solubilize phosphorus to boost soil fertility and biological activity. Strawberry plants inoculated with Azotobacter significantly improve yield. Besides this, inoculated plants increased the fruit size [13] conducted a field study on the effects of organic manure and biofertilizers on strawberry growth, yield, and quality. They used vermicompost (50 percent), poultry manure (50 percent), and Azotobacter in the research trail and obtained the best results, including the maximum plant height (19.61 cm), the total counted of leaves per plant (21.11), the total number of flowers per plant (30.41), and the highest number of flowers per plant [23] conducted the research trial with the application of 25% nitrogen through FYM augmented with Azotobacter, the maximum plant height was recorded as 21.24cm and plant spread was observed 28.16cm, 74.95 cm^2 leaf area, fruit length is 37.62mm, fruit width is 28.01 mm, and maximum fruit weight was observed (15.87g) which was on par with the plant with 100% N in the form of Urea with Azotobacter. [24] They investigated that the vegetative growth parameters were maximum in treatment 50 percent RDF+ Farm Yard Manure + Azotobacter (50g/plant)+ PSB(50g/plant)+ VAM (250g/plant) and maximum plant height in treatment 50 percent RDF+ FYM+ Azotobacter (50g/plant)+ PSB(50g/plant)+ VAM (250g/plant) in Randomized Block Design (18.67 cm) The maximum number of leaves was recorded (18.67). In T2, the maximum yield per plant was reported (173.42g). [25] The maximum yield/plant (304.73 g), non-reducing sugars, total sugars, sugar to acid ratio, TSS, and Vitamin C content were found to be highest under the treatment 100 percent RDF + Azospirillum + PSB, whereas the maximum fruit weight (15.68 g), fruit length (3.61 cm), and reducing sugar

content were found to be lowest. [2] They conducted a study on the effects of organic manure (FYM, vermicompost, and press mud) and biofertilizers (Azotobacter, phosphate solubilizing bacteria, and Azospirillum) on plant height (23.59 cm), maximum leaves plant-1 (12.67), first flowering (61.06 days DAP), flowers plant-1 (15.33), first fruit setting (72.80 days), and fruits plant-1 (72.80 (8.33). Similarly, the treatments of vermicompost and PSB had a substantial impact on Total Soluble Solids (TSS) (10.75° Brix), titrable acidity (0.82), ascorbic acid (57.24 mg/100g fruit), total sugars (5.95%), and juice content (79.50 percent). [26] Using Azotobactor, Azospirillum, FYM, and NPK to perform a strawberry research trial. On their own research field, they discovered that in the treatment T12 - Azotobactor (50 percent) + Azospirillum (50 percent) + NPK (50 percent) + FYM at 105 DAP, the plant's maximum growth (19.25cm), maximum number of leaves per plant (18.80cm), highest length of leaves (8.80cm), and maximum width of leaves (10.94cm) were recorded. [27] The largest number of runners per plant (6.77) and crown per plant (5.16) were found in the Vermicompost + Azotobacter+ PSB treatment, whereas the highest number of flowers/plant (59.91) and fruit set/plant (49.60) were found in the FYM + Vermicompost + Poultry manure + Azotobacter+ PSB treatment. The treatment Vermicompost had the highest fruit set percentage/plant (84.05%). The treatment FYM + Vermicompost+ Poultry manure + Azotobacter + PSB had the shortest days to fruit set (6.47 days). In the Vermicompost + Azotobacter+ PSB treatment, the maximum yield/plant(290.56 g), highest yield per plot (2.90 kg), and maximum yield per ha (145.26 qt) were reported. [28] to investigate the effects of Integrated Nutrient Management on strawberry cv. Winter down growth, yield, and quality characteristics Strawberry var. winter down runners were transplanted at a spacing of 30 x 30 cm during the first week of November. The T7 (50 percent RDF + Vermicompost + Azotobacter) had the highest plant height, number of leaves per plant, leaf area, chlorophyll content, and plant spreading, whereas the control had the lowest. Biochemical measures such as fruit weight, fruit lenth, fruit TSS, ascorbic acid/100 gm pulp, and acidity were all greater in T7, as was yield per plant.

Table 1 Effect of organic manure (FYM) and Biofertilizer on strawberry crop

S. No	Treatment	Yield	Refrences
1.	50% vermicompost+50% poultry manure	7.72 ton/hac	[13]
2.	*Azotobactor*+100% Nitrogen/ha.	372.89 quintal/hac	[23]
3.	50% RDF + Vermicompost + *Azotobacter*	9.66 fruit/plant	[28]
4.	100% RDF+ *Azospirillum*+ PSB	304.73 gm yield/plant	[25]
5.	Vermicompost+PSB	8.33 fruit/ plant	[2]
6.	50%RDF+*Azotobactor*+Vermicompost	9.66 fruit/plant	[28]
7.	Vermicompost+*Azotobacter*+PSB	145.26quntal/hac	[27]

Conclusion

It can be safely concluded from the research with organic manure and bio-fertilizers on strawberry that organic manure and biofertilizers play an important role in enhancing the maximum plant height, plant spread number, leaves per plant, and maximum number of flower per plant in vegetative characters. FYM and biofertilizer were also found to be effective for fruiting characteristics, producing maximum fruit weight, length, volume of fruit per plant, and yield quintal/ha. It also works on TSS, acidity, total sugar, and vitamin C levels in strawberries. After seeing all of this, we can conclude that FYM and Biofertilizer are quite beneficial in the production of strawberry.

References

[1] Kumar, R., Bakshi, M. and Singh, B.D. Influence of plant growth regulators on growth, yield and quality of strawberry (Fragaria × ananassa Duch.) Under U.P. Subtropics. 2012, the Asian journal of Horticulture, 7(2), pp: 434-436.

[2] Kumar N, Singh H. K. and Mishra P K. Impact of Organic Manures and Biofertilizers on Growth and Quality Parameters of Strawberry cv. Chandler Indian. 2015, Journal of Science and Technology, Vol 8(15), ISSN: 0974-5645.

[3] Singh and Saravanan, Effect of bio-fertilizers and micronutrients on yield and quality of strawberry (Fragaria x ananassa Duch) cv. CHANDLER.2012, The Asian Journal of Horticulture Volume 7 pp 533-53.

[4] Singh. A.K, Beer. K and Pal. A.K. Effect of vermicompost and biofertilizer on strawberry: Growth flowering and yield.2015, Annals of Plant and Soil Research 17 (2): 196-199.

[5] Mishra and Triphati. Influence of Different Levels of Azotobacter, PSB Alone and in Combination on Vegetative Growth, Flowering, Yield and Quality of Strawberry cv. Chandler.2011, International Journal of Applied Agricultural Research ISSN 0973-2683 Vol. 6 pp. 203-210.

[6] Esitken A, Hilal E. Yildiz, Sezai Ercisli, M. Figen Donmez, Metin Turan, Adem Gunes. Effects of plant growth promoting bacteria (PGPB) on yield, growth and nutrient contents of organically grown strawberry. 2009, Scientia Horticulturae. 124, p 62–66.
[7] Cassán FD, Garcia de Salamone I. *Azospirillum* sp.: Cell Physiology, Plant Interactions and Agronomic Research. 2008, Argentina. Asociación Argentina de Microbiologia; Argentina: 276 p.
[8] M.H.A. Rashid. Optimisation of Growth, Yield and Quality of Strawberry Cultivars through Organic Farming. 2018, J. Environ. Sci. & Natural Resources,11(1):116-123.
[9] Khalid S. Qureshi KM. Hafiz IA. Khan KS and Qureshi US. Effect of Organic amendments on Vegetative Growth, Fruit Quality and Yield of Strawberry. Pakistan J. Agric. Res. Vol. 26 No. 2, 2013.
[10] Prasad H, Sajwan P, Kumari M and SPS Solanki. Effect of Organic Manures and Biofertilizer on Plant Growth, Yield and Quality of Horticultural Crop: A Review. 2016, P-ISSN: 2349–8528 E-ISSN: 2321–4902, pp 217-221.
[11] Mahadeen, A. Y. Influence of organic and chemical fertilization on fruit yield and quality of plastic-house grown strawberry. 2009, J. Agric. Sci. 5: 167-177.
[12] Sharma K and Negi M. Effect of organic manures and inorganic fertilizers on plant growth of strawberry (Fragaria x ananassa) cv. Shimla delicious under mid-hill conditions of Uttarakhand. 2019, Journal of Pharmacognosy and Phytochemistry Vol. 8.
[13] Soni S, Kanawjia A, Chaurasiya R, Chauhan P.S, Kumar. R and Dubey S. Effect of Organic Manure and Biofertilizers on Growth, Yield and Quality of Strawberry (Fragaria X ananassa Duch) CV. Sweet Charlie National Conference on Conservation Agriculture (ITM University, Gwalior on 22-23 February, 2018) E-ISSN: 2278-4136 P-ISSN: 2349-8234 SP2: 128-132.
[14] Walid Fediala Abd El-Gleel Mosa, Lidia Sas Paszt, Nagwa A. Abd EL Megeed. The Role of Bio-Fertilization in Improving Fruits Productivity-A Review. 2014, Advances in Microbiology 04, 1057-1064.
[15] Bhagat and Panigrahi H. Effect of bio-fertilizers on growth, yield and quality of strawberry (Fragaria x ananassa Duch.) cv. Nabila under net tunnel. The Pharma Innovation Journal. 2020, 9(1): 442-446.
[16] Hassan. A. Hassan. Effect of Nitrogen Fertilizer Levels in the Form of Organic, Inorganic and Bio fertilizer Applications on Growth, Yield and Quality of Strawberry. 2015, Middle East Journal of Applied Sciences ISSN 2077-4613 Pages: 604-617.
[17] Kumar S, Kundu1 M, Rakshit R. Effect of bio-fertilizer on growth, yield and quality of strawberry (Fragaria × ananassaDuch.) cv. Camarosa. 2019, Bulletin of Environment, Pharmacology and Life Sciences Bull. Env. Pharmacol. Life Sci., Vol 8 S99-S107.
[18] Nazir, Nowsheen and Singh. Effect of integrated organic nutrient sources on soil nutrient status and microbial population in field of strawberry (Fragaria x ananassa Duch). 2012,Indian Journal of Horticulture 69(2):177-180.
[19] Khalil N. H. and Agah R.J. Effect of Chemical, Organic and Bio Fertilization on Growth and Yield of Strawberry. 2018, Plant Int'l Journal of Advances in Chemical Engg., & Biological Sciences (IJACEBS) Vol. 4) ISSN 2349-1507 EISSN 2349-1515.
[20] Rana, R.K. and Chandel, J.S. Effect of biofertilizers and nitrogen on growth, yield and fruit quality of strawberry.2003, Progessive Horticulture, 35(1): 25-30.
[21] Tripathi, V.K., Kumar, N., Shukla, H.S. and Mishra, A.N. Influence of Azotobacter, Azospirillum and PSB on growth, yield and quality of strawberry cv. chandler. 2010, Abst: National Symposium on Conservation Hort., Dehradun, pp. 198-199.
[22] Sahoo SK, Singh DB. Effect of different levels of biofertilizers on growth, yield and quality of strawberry (Fragaria ananassa Duch) cv. Sweet Charley. 2005, Orissa Journal of Horticulture.; 33(2):pp 82-85.
[23] Umar I, Kumar V, Wali, Kher R, Jamwal M. Effect of Fym, Urea and Azotobacter on Growth, Yield and Quality of Strawberry Cv. Chandler. 2009, Notulae Botanicae Horti Agrobotanici Cluj-Napoca Not. Bot. Hort. Agrobot. Cluj 37 (1) 2009, 139-143.
[24] Patil VK, Shinde BN. Studies on integrated nutrient management on growth and yield of banana cv. Ardhapuri. 2013, (Musa AAA). J. Hort. Fores. 2013; 5(9):130- 138.
[25] Subraya, B. K., Madaiah, D. and Dinesh Kumar, M. Effect of Integrated Nutrient Management on Yield and Quality of Strawberry (Fragaria x ananassa Duch.) Under Naturally Ventilated Polyhouse Condition. 2017, Int. J. Pure App. Biosci. 5 (6): 1704-1707.
[26] Rubee L., Deepa H., Dwivedi, Ram, R. B., Meena, M. L. and Mukeshbabu, Impact of integrated nutrient management on growth parameters of strawberry cv. Chandler under sub-tropical conditions of Lucknow. 2013, Int. J. Agric. Boi. Res., 3 (3): 418-422.
[27] Srivastav A, Singh R, Baksh H, Singh B.K., Pandey R, Pal V.K and Maurya l.K. Effect of Organic Manures

and Bio-Fertilizers on Floral and Commercial Yield Characters of Strawberry (Fragaria × ananassa Duch.) cv. Chandler. 2019, Int. J. Curr. Microbiol. App. Sci 8(2): 392-397.

[28] Singh L, and Sadawarti R K. Effect of INM (Integrated nutrient management) on plant growth, yield and quality of strawberry (Fragaria x ananassa Duch.) The Pharma Innovation Journal 2021; 10(5): 244-247

Publication History

Received	20.06.2023
Revised	04.08.2023
Accepted	16.08.2023
Online	30.08.2023