Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2017; 6(5): 1178-1181
Received: 28-07-2017
Accepted: 30-08-2017

Niyati Jain
Department of Vegetable Science, G.B. Pant University of Agriculture & Technology Pantnagar, Uttarakhand, India

Arghya Mani
Department of Post harvest technology of Horticulture Crops, BCKV, Mohanpur, India

Supriya Kumari
Department of Microbiology and Fermentation Technology, Jacob Institute of Biotechnology and Bioengineering, Faculty of Engineering and Technology Shuats, Allahabad, UP, India

Sourabh Kasera
Department of Horticulture, Naini Agricultural Institute, Faculty of Agriculture, Shuats, Allahabad, UP, India

Vijay Bahadur
Department of Horticulture, Naini Agricultural Institute, Faculty of Agriculture, Shuats, Allahabad, UP, India

Correspondence
Niyati Jain
Department of Vegetable Science, G.B. Pant University of Agriculture & Technology Pantnagar, Uttarakhand, India

Influence of INM on yield, quality, shelf life and economics of cultivation of strawberry (*Fragaria* × *ananassa* Duch.) cv. Sweet Charlie

Niyati Jain, Arghya Mani, Supriya Kumari, Sourabh Kasera and Vijay Bahadur

Abstract
The experiment conducted during the year 2013-14 and 2014-15 with 21 treatments included combinations of organic and microbial sources of nutrients (Compost, Poultry manure, Vermicompost, FYM, *Azotobacter* and PSB) replicated thrice with 18 plants per replication in Randomized Block Design. Observations were recorded for fruit yield, quality and shelf life. In different combinations organic manure and biofertilizers the treatment T_{15} (Vermicompost + Poultry manure+ *Azotobacter* + PSB) registered earliest in flowering (40.68 days) and T_{17} (Vermicompost+ FYM + *Azotobacter* + PSB) highest number of flowers plant^{-1} (13.42). The maximum fruit weight (12.86 g), number of fruits plant^{-1} (11.78) and yield (112.63 g plant^{-1}) were recorded with plants treated with T_{15} (vermicompost+ Poultry manure +*Azotobacter* +PSB) and maximum shelf life (5.69 days), TSS (7.05 °B), Ascorbic acid (53.44 mg/100 g of pulp), Acidity (0.64%), and pH (2.66) also found best in T15 (vermicompost+ Poultry manure +*Azotobacter* +PSB) followed by T_{18} (Poultry manure+ compost +*Azotobacter* + PSB) and T_{17} (FYM+ vermicompost + *Azotobator* + PSB) respectively. However, the maximum cost: benefit ratio (1: 3.69) was recorded in the T_{17} (Vermicompost+ FYM+ *Azotobacter* + PSB). The highest yield and best quality fruit were recorded in the combination of T15 (Vermicompost + Poultry manure+ PSB+ *Azotobacter*).

Keywords: strawberry, organic manure, biofertilizers, quality, shelf life and economics.

Introduction
The modern cultivated strawberry (*Fragaria X ananassa* Duchesne) is one of the most delicious, refreshing and nutritious among soft fruits of the world. It is a monoecious octoploid hybrid of two largely dioecious octoploid species *i.e*. *Fragaria chiloensis* and *Fragaria virginiana* (Vaishnav at el., 2017) [7]. The fresh ripe fruits of strawberry are rich source of vitamins and minerals. Among vitamins it is a fairly good source of vitamin-A (60 IU) and vitamin-C (30-120 mg/100g of edible portion). It occupies on area of 2, 43, 907 ha with a total production 43, 66, 662 tones (FAO, 2010) [1]. It is cultivated to a limited extent is plains and sub mountainous areas of Himachal Pradesh, Uttarakhand, Uttar Pradesh, Maharashtra, Karnataka, Punjab, Haryana and Madhya Pradesh, wherever, irrigation facilities are available in India.

Since fertilizers constitute a major costly production input, exploitation of yield potentiality of crops depend on how effectively and efficiently this input is managed. Moreover high fertility levels not only put a heavy financial burden to the basic system of production, on the other hand, the large scale use of only chemical fertilizers as a source of nutrients has less fertilizer use efficiency (Pandey *et al.*, 2017) [8]. Fruit and vegetables have high toxic residues if chemical fertilizers, insecticides are spread on them to save them from pest attack and when human beings eat such fruits and vegetables they have serious health problems (Kumari at el., 2015) [3]. Nitrogen, Phosphorus, Potassium are mobile nutrients, while the others have varying degree of mobility. K and P is costly nutrients and being used in huge quantity in India where few million tones is being imported annually to India (Kumari at el., 2017) [5-6-8-12]. Plants can absorb only 5% of food elements from the chemical fertilizers. The acidic and alkaline elements of the remaining chemical fertilizers react with soil and forms thick layers of rocks in the soil and leaves. This rocky layer makes the land infertile. Many of these fertilizers are acidic hence long term use increases the acidity of the soil which reduces the beneficial soil organisms thus degrades ecosystem and accelerate the process of soil erosion (Kumari *at el*., 2016) [4].

Most of the countries are using bio fertilizers to remove these problems Bio-fertilizers are

micro organisms that enrich the nutrients quality of soil. The main sources of bio fertilizers are bacteria, fungi and cynobacteria (blue green algae). Organic manures such as Farm yard manure and vermicompost is the excreta of earthworms, which is rich in humus and nutrients and provide a lot of advantage in association of microorganisms (*Azotobacter, Azospirillum*, PSB *etc*.) (Singh *at el.,* 2017) [7-8-12]. azotobacter dominant non-symbiotic nitrogen fixing heterotrophic bacterium found in Indian soils which come from the bio fertilizers to solve such problems as increased salinity of soil and chemical run off from the agricultural field (Kumari at el., 2015) [3]. Organic manure supplies food for microbes and makes soil porous, which is very favourable for the microbes. FYM is one of the traditional manure and is mostly readily available to the farmers. Many workers have been reported the integrated nutrient management work on agriculture crops Pandey *et al., (*2017) [8] on Dahlia, Kumari *et al*., (2015;2016;2017) on Paddy, Legumes and cole crops, Yadav *et al*., (2010) [16], Umar *et al*., (2009) [13], Singh *et al*., (2008) **[11]**, Rana and Chandel (2003) [10], Zargar *et al.,* (2008) [17], Umar *et al.,* (2010) [14] Ahmad and Mohammad (2012) and Jitendra and Rao (2013) on strawberry. Yet it needs to combat this problem, use of organic manures and bio fertilizers are probably the best way to maintain a sustained fruit production pattern. Keeping above facts and findings this study aimed at best possible yield, quality, shelf life and economics cultivation of strawberry (*Fragaria* × *ananassa* Duch.) cv. Sweet Charlie.

Materials and Methods

The present investigation was carried out at the research farm of the Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India during year 2013-14 and 2014-15. The strawberry runners of uniform size were transplanted 2-5 cm depth at a spacing of 60×30 cm. in first week of November. Un-inoculated runners were transplanted first then the inoculated runners were planted. FYM, Compost, Vermicompost and Poultry Manure were applied in the concerned plots as per the treatment. NPK were applied in the control treatment. Slurry of 200 ml of the lignite based culture of PSB and *Azotobacter* were prepared in 15 L of water individually and combinations of both 100 ml *Azotobacter* and 100 ml PSB culture were prepared in 15 L of water. Four months old strawberry runners were dipped in the slurry for 30 min and then transplanted. The various combinations of organic manures and biofertilizers were: T0- Recommended dose of nutrients through chemical fertilizers, T1- compost, T2- Poultry Manure, T3- vermicompost, T4- FYM, T5- Vermicopost + Poultry manure, T6- Poultry manure + Compost, T7- FYM + Vermicompost, T8- Poultry manure + FYM, T9- Vermicompost + compost, T10- Compost + FYM, T11- Compost + *Azotobacter* + PSB, T12- Poultry Manure+ *Azotobacter* + PSB, T13- Vermicompost+ *Azotobacter* + PSB, T14- FYM+ *Azotobacter* + PSB, T15- vermicompost+ Poultry manure+ PSB+ *Azotobacter*, T16- Poultry manure + Compost+ *Azotobacter* + PSB, T17- FYM + Vermicompost+ *Azotobacter* + PSB, T18- Poultry manure + FYM+ *Azotobacter* + PSB, T19- Vermicompost + compost+ *Azotobacter* + PSB, T20- Compost + FYM+ *Azotobacter* + PSB. Paddy straw mulch was applied after 60 days of planting. Mulch usually applied on the surface of soil to protect the fruit in the direct contact of soil.

Results and Discussion

Plants receiving T15 (Vermicompost + Poultry manure + *Azotobacter* + PSB) recorded highest average fruit weight of (12.26 g) which was found at par with T17 (FYM + Vermicompost+ *Azotobacter* + PSB) (12.23 g). However, plants treated with T0 (Recommended dose of nutrients through chemical fertilizers) exhibited least fruit weight (7.94 g). Maximum fruit diameter (2.99 cm) was recorded in T15 (Vermicompost + Poultry manure+ *Azotobacter* + PSB) which was significantly higher to other treatments but it was at par with T17 (FYM + Vermicompost +*Azotobacter* + PSB) (2.98 cm) and T18 (Poultry mnaure + FYM +*Azotobacter* + PSB) (2.94 cm). Least fruit diameter (2.42 cm) was obtained in T0 (Recommended dose of nutrients through chemical fertilizers). T15 (Vermicompost + Poultry manure +*Azotobacter* + PSB) recorded highest average fruit length of (5.25 cm) followed by T17 (FYM + Vermicompost + *Azotobacter* + PSB) (4.61 cm). However, plants treated with T0 (Recommended dose of nutrients through chemical fertilizers) exhibited least fruit length (3.06 cm). Maximum number of fruits plant^{-1} (11.78) was found in T15 (Vermicompost + Poultry manure+ *Azotobacter* + PSB) which was significantly higher to other treatments but it was at par with T5 (Vermicompost + Poultry manure) (11.71) and T17 *(*Vermicompost+ FYM +*Azotobacter* +PSB) (11.70). Least number of fruits plant^{-1} (8.34) was obtained in T0 (Recommended dose of nutrients through chemical fertilizers). Application of T15 (Vermicompost + Poultry manure +*Azotobacter* + PSB) gave significantly maximum total yield of fruit plant^{-1} (112.63 g) followed by T17 (FYM + Vermicompost +*Azotobacter* + PSB) (109.5 g) and T18 + (FYM + Poultry manure +*Azotobacter* + PSB) (105.4 g). However, the minimum yield of fruits per plant (51.61 g) was observed in plant receiving T0 (Recommended dose of nutrients through chemical fertilizers). The earliness may be due to optimum supply of plant nutrients and growth hormones in right amount during the entire crop period caused vigorously inducing the vegetative development of plant and ultimately more photosynthesis. Increase in fruit yield and its parameters may be due to increased in the number of leaves which worked as an efficient photosynthesis structure and produced high amount of carbohydrates in the plant system. More number of flowers, which resulted higher fruits per plant and fruit yield and their attributes, under present study due to capability of vermicompost and poultry manure in producing growth hormone, enzymes, antifungal and antibacterial compounds, which in turns enhanced marketable yield over other treatments. Similar findings also reported by (Pandey *et al.,* 2017) [8] on Dahlia, (Kumari *et al*., 2015;2016;2017) [3-4-5-6-8-12] on Paddy, Legumes and cole crops, Yadav *et al*., (2010) [16], Umar *et al*., (2009) [13], Singh *et al*., (2008) [11], Rana and Chandel (2003) [10], Zargar *et al.,* (2008) [17], Umar *et al.,* (2010) [14] Ahmad and Mohammad (2012) and Jitendra and Rao (2013) in strawberry.

The total soluble solids, acidity, ascorbic acid and pH were significantly influenced by the organic nutrient application. The maximum total soluble solids (7.05 °B) and ascorbic acid (53.42 mg/100g of pulp) were recorded with treatment T15 (*Azotobacter* + PSB + VC + PM) followed by total soluble solids (6.51°B) and ascorbic acid (52.86 mg/100g of pulp) with T17 (*Azotobacter* +PSB + VC+ FYM) respectively and while the minimum total soluble solids (5.31°B) and ascorbic acid (49.38 mg/100g of pulp) were observed in T0 (Recommended dose of nutrients through chemical fertilizers) and minimum acidity (0.64 %) and pH (2.63) was found in

T15 (Vermicompost + Poultry manure + *Azotobacter* + PSB) followed by acidity (0.66%) and (0.66%) and pH (2.69) and (2.78) T17 (Vermicompost+ FYM + *Azotobacter* + PSB) and T5 (vermicompost + Poultry manure) and maximum acidity (0.72%) and pH (3.90) in T0 (Recommended dose of nutrients through chemical fertilizers). Increased TSS and Ascorbic acid at higher levels of nitrogen might have resulted due to the fact that absorption of nitrogen may be exerted regulatory role as an important and during ripening of fruits the carbohydrate reserves of the roots and stem are drawn upon heavily by fruits which might have resulted into higher TSS and ascorbic acid in fruits. Increased TSS, Ascorbic acid in fruits and decreased acidity and pH are in agreement with the findings of Hamid *et al.* (2006) who reported that that application of P.S.B. on strawberry resulted increase in T.S.S., total sugar, ascorbic acid and juice percentage and Singh *et al.* (2008) [11] who reported that the effect of vermicompost on strawberry cv. 'chandler' and reported that fruit harvested from plant receiving vermicompost were farmer, TSS and ascorbic acid increases, acidity decreased and color more attractive. Poultry manure contains essential plant nutrients that play significant role in improving quality as reported by Prabakaran and Pichal (2003) [9].

Shelf life was significantly influenced by the integrated nutrient application. The maximum shelf life (5.69 days) was recorded with T15 (Vermicompost + Poultry manure +*Azotobacter* + PSB) followed by (5.28 days) T17 (*Azotobacter* +PSB + VC+ FYM) respectively and minimum with (2.53 days) T0 (Recommended dose of nutrients through chemical fertilizers).

The application of T15 (Vermicompost + Poultry manure + *Azotobacter* + PSB) has resulted in maximum net returns per hectare (Rs.11, 91, 599) followed by (Rs. 11, 60, 349) T17 (Vermicompost+ FYM +*Azotobacter* +PSB) respectively with a cost: benefit ratio of 1:3.62 (T15) and 1: 3.64 (T17) per hectare (Table 2). Cost: benefit ratio is an important and ultimate factor which decides the optimum levels of input to be used for maximization of production and returns of any crop. The maximum cost: benefit ratio was obtained in T17 (Vermicompost+ FYM +*Azotobacter* +PSB) and it was due to higher returns compared to cost of cultivation. The least cost: benefit ratio in treatment T0 (Recommended dose of nutrients through chemical fertilizers) was due to lower returns compared to cost of cultivation of strawberry. Many workers also reported the higher net return and cost: benefit ratio with the application of organic fertilizers and biofertilizers viz. Yadav *et al*. (2010) [16] in strawberry, Javaria and Khan (2011) [2] in tomato.

Table 1: Effect of Integrated Nutrient Management on yield, quality and shelf life parameters of strawberry cv. Sweet Charlie.

Treatment combinations	Number of fruit plant^{-1}	Fruit yield plant^{-1}	Fruit weight (g)	Fruit diameter (cm)	Fruit length (cm)	Specific gravity	TSS (°B)	Acidity (%)	pH	Ascorbic Acid (mg/100 g pulp)	Shelf life (days)
T0	8.34	51.61	7.94	2.42	3.08	1.13	5.31	0.72	3.90	49.38	2.53
T1	8.91	67.70	8.97	2.54	3.58	1.23	5.56	0.71	3.79	49.79	3.14
T2	9.08	70.33	9.18	2.47	3.37	1.48	5.51	0.71	3.69	51.66	3.13
T3	9.17	80.88	10.63	2.75	3.84	1.43	6.08	0.68	3.12	51.28	4.07
T4	9.27	66.25	9.89	2.54	3.57	1.38	5.74	0.69	3.10	51.42	3.18
T5	11.71	100.7	12.11	2.89	4.55	1.81	6.59	0.66	2.78	52.78	5.18
T6	10.70	97.87	11.59	2.76	3.92	1.60	6.06	0.67	3.29	52.16	4.24
T7	11.50	105.38	11.94	2.89	3.89	1.70	6.08	0.70	3.60	52.26	4.78
T8	9.78	92.45	11.28	2.83	4.27	1.66	5.98	0.68	3.41	52.12	4.95
T9	9.69	86.11	11.28	2.73	3.67	1.67	5.58	0.69	3.23	51.95	4.25
T10	9.18	77.52	10.84	2.77	3.35	1.45	5.50	0.69	3.21	52.16	3.89
T11	9.57	77.03	10.38	2.53	3.62	1.54	5.38	0.71	3.49	50.31	3.82
T12	9.22	79.36	10.40	2.76	3.66	1.76	5.35	0.70	3.32	50.22	3.94
T13	9.61	81.24	10.51	2.80	3.73	1.59	5.38	0.70	3.30	51.98	4.10
T14	9.72	81.40	10.50	2.75	3.71	1.59	5.57	0.69	3.21	51.76	4.28
T15	11.78	112.6	12.26	2.99	5.25	1.84	7.05	0.64	2.63	53.42	5.69
T16	11.07	98.65	11.89	2.77	3.72	1.53	6.30	0.69	3.13	52.35	4.88
T17	11.70	109.5	12.23	2.98	4.61	1.86	6.51	0.66	2.69	52.86	5.28
T18	10.36	105.4	11.71	2.94	4.14	1.80	6.84	0.68	2.98	52.58	5.00
T19	10.77	88.29	11.37	2.85	3.83	1.74	6.10	0.69	3.28	52.49	4.96
T20	9.71	87.81	11.67	2.83	3.50	1.75	5.66	0.70	3.37	50.91	4.49
F-test	S	S	S	S	S	S	S	S	S	S	S
SE.d (±)	0.437	1.817	0.076	0.053	0.285	0.220	0.237	0.009	0.107	0.222	0.334
CD t 0.5%	0.883	3.673	0.153	0.107	0.576	0.445	0.479	0.019	0.217	0.449	0.675

Table 2: Economics of Integrated Nutrient Management in strawberry cv. Sweet Charlie.

Treatment	cost of cultivation (Rs./ha)	Yield (q/ha)	sale rate (Rs./kg)	Gross return (Rs./ha)	Net return (Rs./ha)	Cost: benefit ratio
T_0	300,629	46.45	150	696750	396121	1.32
T_1	307,401	60.93	150	913950	606549	1.97
T_2	303,401	63.29	150	949350	645949	2.13
T_3	353,401	72.79	150	1091850	738449	2.09
T_4	313,401	59.62	150	894300	580899	1.85
T_5	328,401	90.67	150	1360050	1031649	3.14
T_6	305,401	88.08	150	1321200	1015799	3.33
T_7	318,401	94.84	150	1422600	1104199	3.47
T_8	308,401	83.2	150	1248000	939599	3.05
T_9	330,401	77.49	150	1162350	831949	2.52

T_{10}	310,401	69.76	150	1046400	735999	2.37
T_{11}	307,801	69.32	150	1039800	731999	2.38
T_{12}	303,801	71.42	150	1071300	767499	2.53
T_{13}	353,801	73.11	150	1096650	742849	2.10
T_{14}	313,801	73.26	150	1098900	785099	2.50
T_{15}	328,801	101.36	150	1520400	1191599	3.62
T_{16}	305,801	88.78	150	1331700	1025899	3.35
T_{17}	318,801	98.61	150	1479150	1160349	3.64
T_{18}	308,801	94.83	150	1422450	1113649	3.61
T_{19}	330,801	79.46	150	1191900	861099	2.60
T_{20}	310,801	79.03	150	1185450	874649	2.81

Conclusion

On the basis of present investigation 2013-14 and 2014-15, it is concluded that the treatment T_{15} (poultry manure + vermicompost + *Azotobacter* + PSB) was found the best in terms of yield (112.63 g plant^{-1}) and quality (TSS 7.05 °B and Ascorbic acid (53.42mg/ 100 g of pulp) parameters of strawberry. The maximum Shelf life (5.69 days) was recorded in T_{15} (poultry manure + vermicompost + PSB+ *Azotobacter*). However, the maximum cost: benefit ratio (1: 3.64) was recorded in the T_{17} (Vermicompost+ FYM + PSB+ *Azotobacter*).

References

1. FAO. Statistical Database of the Food and Agricultural Organization, Rome. wwww.fao.org. Accesses, 2010-2012.
2. Javaria S, Khan MO. Impact of integrated nutrient management on tomato yield quality and soil environment. J. Pl. Nut. 2011; 34:140-149.
3. Kumari S, Singh J, Masih H. Isolation and identification of free living nitrogen fixer and Phosphobacteria from the partial flood affected area of Bihar and its effect on growth and yield of paddy (Oryza sativa L.). Res. Environ. Life Sci. 2015; 8(1):83-86.
4. Kumari Supriya, Masih Harison, Singh Jaykrit, Schchida Nand Pandey, Ravindra kumar. Screening of most efficient *rhizobium* isolate from root nodules of legumes of different agro climatic zones of Bihar. In: Res. Environ. Life Sci. 2016; 9(2):237-240.
5. Kumari S, P Ramteke, V Rajwade, Lawrence R, Masih H. Isolation and Characterization of Phosphorus and Potassium Solubilising Microbes from Rhizosphere of Orchard Field and Its Effect on Seedling Growth of Broccoli (*Brassica Oleracea* Var. Italica L.) Chemical Science Review and Letters. 2017; 6(23):432-1442.
6. Kumari S, Rajwade V, Ramteke P, Lawrence R, Masih H. Isolation and Characterization of Potassium and Phosphorus Solubilising Bacteria and Fungus (KSB, PSB, KSF, PSF) and its Effect on Cauliflower. Int. J. Curr. Microbiol. App. Sci. 2017; 6(4):987-1006.
7. Murli Manohar Vaishnav, Sandeep Singh, Saket Mishra. Studies on Different Levels of NPK with Combination of Fym on Growth, Mortality and Establishment of Kinnow (Citrus Reticulata Blanco) Under Subtropical Condition. Int. J. Curr. Microbiol. App. Sci. doi: https://doi.org/10.20546/ijcmas.2017.607.254. 2017; 6(7):2167-2171.
8. Pandey SK, Kumari S, Singh D, Singh VK, Prasad VM. Effect of Biofertilizers and Organic Manures on Plant Growth, Flowering and Tuber Production of Dahlia (*Dahlia variabilis* L.) Cv. S.P. Kamala, Int. J. Pure App. Biosci. doi: http://dx.doi.org/10.18782/2320-7051.2521. 2017; 5(2):549-555.
9. Prabakaran C, Pichal GJ. Effect of different organic nitrogen sources on pH, total soluble solids, titrable acidity, crude proteinreducing and non-reducing sugars and ascorbic acid content of tomato fruits. J. Soil Crops. 2003; 13(1):172-175.
10. Rana RK, Chandel JS. Effect of biofertilizer and nitrogen on growth, yield and fruit quality of strawberry. Prog. Hort. 2003; 35(1):25-30.
11. Singh R, Sharma RR, Kumar SI, Gupta RK, Patil RT. Vermicompost substitution influence growth, physiological disorders, fruit yield and quality of strawberry. Bio. Res. Tech. 2008; 99:8507-8511.
12. Singh Vivek Kumar, VM Prasad, Supriya Kumari, Preeti Rajoria, Pragati Misra. Identification of the Suitable Hardening Protocol and Hardening Medium in Micropropagation of Gerbera (Gerbera jamesonii Bolus). Int. J. Current Microbiol. App. Sci. doi: https://doi.org /10.20546/ijcmas.2017.607.292. 2017; 6(7):2476-2484.
13. Umar I, Wali VK, Kher R, Jamwal M. Effect of FYM urea and Azotobacter on growth, yield and quality of strawberry cv. Chandler. Notes Bot. Hort. Agrobot. Cluj. 2009; 37(1):139-143.
14. Umar I, Wali VK, Rehman MV, Mir MM, Banday SA, Bisati IA. Effect of subabul (*Leucaena leucocephala*), urea and biofertilizer application on growth, yield and quality of strawberry cv. Chandler. Appl. Bio. Res. 2010a; 12:50-54.
15. Verma J, Rao VK. Impact of INM on Soil Properties, Plant Growth and Yield parameters of Strawberry cv. Chandler. J Hill Agric. 2013; 4(2):61-67.
16. Yadav SK, Khokhar UU, Yadav RP. Integrated nutrient management for strawberry cultivation. Ind. J Hort. 2010; 67(4):445-449.
17. Zargar MY, Baba ZA, Sofi PA. Effect of N, P and biofertilizers on yield and physico-chemical attributes of strawberry. Agro Thesis. 2008; 6(1):3-8.