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Influence of integrated nutrient management on growth parameters of strawberry (*Fragaria x ananassa* Duch.) *cv*. sweet Charlie under Assam condition

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Abstract
The present investigation was carried out at the Experimental farm, Department of Horticulture, Assam Agricultural University, Jorhat during 2020-21. The objective of the experiment was to study the effect of integrated nutrient management on growth parameters of strawberry under Assam condition. The experiment was laid out in Randomized Block Design (RBD) with three replications and sixteen treatments. The results of the investigation revealed that integrated nutrient management in strawberry had a significant influence on growth of strawberry. The data revealed that the growth characters *viz*., plant height**,** plant spread, number of leaves, leaf area were recorded maximum in the treatment T_{10} (100% RDF + Vermicompost @ 2.5 t/ha + 0.5% $ZnSO_4$ + 0.4% Boron spray + Lime + Microbial consortium). The results obtained during the present experiment showed that application of 100% RDF + Vermicompost @ 2.5 t/ha + 0.5% $ZnSO_4$ + 0.4% Boron spray + Lime + Microbial consortium (T_{10}) resulted better of strawberry under Assam condition. However, treatment T_{11} (100% RDF + FYM @ 10 t/ha + 0.5% $ZnSO_4$ + 0.4% Boron spray + Lime + Microbial consortium) showed at par results with treatment T_{10}. The present investigation revealed that integrated nutrient management has the great potential in improving the growth and yield of strawberry fruits under Assam condition.

Keywords: Strawberry, integrated nutrient management, vermicompost, FYM, microbial consortium

Introduction
Strawberry (*Fragaria* × *ananassa* Duchense) is one of the most popular fruits in the world grown in temperate and sub-tropical zones all over the world, covering an area of 9.2 million hectares and producing 45.9 million tonnes each year (Asrey and Singh 2004) [2]. India has 1 lakh hectare under strawberry cultivation with annual production of about 5000 million tonnes (NHB 2017) [7]. In India, it is being commercially cultivated in the states of Maharashtra, as a leading state, including Uttrakhand, hills of Darjeeling (West Bengal), Himachal Pradesh, and Jammu and Kashmir. These fruits are packed with essential nutrients and vitamins, making them ideal for consumption as part of a healthy diet. Additionally, they're commonly used in various industrial processes, such as canning and manufacturing candies, jams, jellies, pickles and chocolates. Thus, it is having very high market demand and industrial requirements, particularly in the processing and confectionary industries. Strawberries can be grown in many types of soil, from light sand to heavy clay. However, it grows best in humus-rich, slightly porous soils (Sharma, 2002) [10]. Strawberries are highly sensitive to nutrient fluctuations (Yadav *et al*., 2010) [17] and proper nutritional management is essential as it affects vegetative growth and yield. Nutrient management that maintains soil fertility is essential for improving strawberry yield and fruit quality. Appropriate application of organic and inorganic nutrients together with biofertilizers can improve plant growth, yield, and strawberry quality (Subraya *et al*., 2017) [14] and keep the soil healthy (Meena *et al*., 2019) [5]. Therefore, considering economy, environmental friendliness, and maintenance of better soil health, plant nutrients should be effectively used by adopting integrated nutrient management practices. Integrated nutrient management involves judicious use of organic, inorganic, and microbial sources in ways that maintain optimal yields and improve and preserve the physical, chemical, and biological properties of the soil. The rationale behind this concept is to provide both chemical and organic fertilizers together with biofertilizers in the most efficient way for sustainable crop production.

In view of above facts, the present experiment was carried out to study the effect of integrated nutrient management on growth and yield of strawberry under Assam condition.

Materials and Methods

The present investigation was conducted in the Experimental Farm, Department of Horticulture, College of Agriculture, Assam Agricultural University, Jorhat during 2020-21 and 2021-22. The location of the experimental site was situated at $26^0$47'N latitude, $94^0$12'E longitude at an altitude of 86.6 meters above mean sea level. The experimental site is located at sub-tropical humid region and hence humidity is generally high, *i.e.*, above 80%. The maximum temperature range is 34^0C- 37^0C during summer and minimum temperature range falls between 8^0C-10^0 C during winter. The experiment was laid out in Randomized Block Design (RBD) with three replications and sixteen treatments *viz.*, T_0: Control (no manures and fertilizers), T_1: 100% RDF (NPK @ 80:40:40 kg/ha), T_2: 100% RDF + Vermicompost @ 2.5 t/ha, T_3: 100% RDF + FYM @ 10 t/ha, T_4: 100% RDF + Vermicompost @ 2.5 t/ha + 0.5% $ZnSO_4$ + 0.4% Boron spray + Lime, T_5: 100% RDF + FYM @ 10 t/ha + 0.5% $ZnSO_4$ + 0.4% Boron spray + Lime, T_6: 75% RDF + 25% N through Vermicompost + 0.5% $ZnSO_4$ + 0.4% Boron spray + Lime, T_7: 75% RDF + 25% N through FYM + 0.5% $ZnSO_4$ + 0.4% Boron spray + Lime, T_8: 50% RDF + 50% N through Vermicompost + 0.5% $ZnSO_4$ + 0.4% Boron spray + Lime, T_9: 50% RDF + 50% N through FYM + 0.5% $ZnSO_4$ + 0.4% Boron spray + Lime, T_{10}: T_4 + Microbial consortium, T_{11}: T_5 + Microbial consortium, T_{12}: T_6 + Microbial consortium, T_{13}: T_7 + Microbial consortium, T_{14}: T_8 + Microbial consortium and T_{15}: T_9+ Microbial consortium. The healthy tissue cultured planting materials having uniform crown and well developed root system was planted in Hill row system in 15-20 cm raised beds with spacing of 30 cm x 60 cm.

The various growth parameters like plant height, plant spread, number of leaves, etc. were recorded using different standard methods.

Results and Discussion

Effect on growth parameters

The data presented in the table (Table 1 and 2) showed the influence of integrated nutrient management on different growth parameters of strawberry. The improvement in growth parameters might be due to balanced application of nutrients and better uptake of nutrients like nitrogen which has a major role in increasing cell division and improving plant growth. Nitrogen also plays important role in synthesis of chlorophyll, enzymes and proteins which in turn increases the vegetative growth. The results are in conformity with Nazir *et al*. (2005) [6], Singh *et al*. (2010) [12] and Umar *et al*. (2009) [16] where, they observed that the integrated nutrient management was better than the application of single nutrients. The results might also be due to the increased photosynthetic rate and carbohydrate accumulation as a result of application of organic manures which allow most favourable conditions of soil with increased availability of plant nutrients responsible for better plant growth. The other reason may be due to the production of plant growth regulators by biofertilizers in the rhizosphere which are absorbed by the roots.

Table 1: Effect of integrated nutrient management on Plant height, Plant spread and number of leaves at 45, 90 and 135 DAP

Treatments	Plant height (cm)			Plant spread (cm)			Number of leaves		
	45 DAP	90 DAP	135 DAP	45 DAP	90 DAP	135 DAP	45 DAP	90 DAP	135 DAP
T_0	5.43	9.35	11.37	10.40	14.80	17.55	9.11	12.11	14.80
T_1	6.17	12.13	14.18	11.23	15.81	17.80	9.56	14.36	15.20
T_2	6.81	13.24	15.14	11.85	16.58	19.05	9.90	15.40	16.65
T_3	6.42	12.83	14.50	11.49	16.18	18.66	9.86	15.04	16.38
T_4	9.75	15.16	17.67	14.51	19.35	22.57	11.22	19.02	20.04
T_5	9.41	14.82	17.62	13.97	18.71	22.27	10.96	18.33	19.80
T_6	8.85	14.38	17.22	13.22	18.46	21.50	10.30	17.89	19.33
T_7	8.17	14.10	16.53	12.67	17.98	21.05	10.17	17.11	18.49
T_8	7.88	14.00	16.11	12.51	17.55	20.31	10.10	16.09	17.67
T_9	7.29	13.42	15.88	12.18	17.17	19.78	10.01	15.51	16.91
T_{10}	10.76	17.10	20.03	17.27	22.70	25.74	14.92	20.60	22.22
T_{11}	10.73	16.97	19.96	16.94	22.50	25.40	14.87	20.57	22.06
T_{12}	10.61	16.52	19.78	16.02	21.93	25.05	14.10	20.22	21.71
T_{13}	10.57	16.32	19.11	15.50	21.61	24.24	13.43	20.04	21.47
T_{14}	10.23	15.55	18.69	15.10	20.85	23.58	12.09	19.60	20.40
T_{15}	10.05	15.34	18.18	14.84	19.86	23.17	11.34	19.36	20.20
SEd(±)	0.14	0.09	0.15	0.09	0.18	0.20	0.15	0.09	0.14
CD (P=0.05)	0.29	0.19	0.30	0.18	0.36	0.41	0.30	0.18	0.29

Increase in number of runners and shoots per plant might be due to the increase in growth of plant height, number of leaves and leaf area which accumulated more photosynthates and thereby increased numbers of runners per plant. The secretion of growth promoting substances by Azotobacter especially cytokinin might have increased the runners per plant as it helps in branching and development of side buds. Similar results were also reported by Rana and Chandel (2003) [9].

Table 2: Effect of integrated nutrient management on Number of runners per plant and Leaf area (cm^2)

Treatments	Leaf area (cm^2)	Number of runners per plant	Number of shoots per plant
T_0	104.70	1.93	1.87
T_1	110.30	2.47	2.07
T_2	113.21	2.67	2.33
T_3	109.54	2.47	2.27
T_4	118.23	3.80	3.33
T_5	117.09	3.53	3.27
T_6	115.49	3.33	3.00
T_7	114.63	3.07	2.87
T_8	113.45	2.87	2.53
T_9	112.86	2.73	2.50
T_{10}	126.05	4.73	4.73
T_{11}	125.34	4.80	4.67
T_{12}	122.42	4.33	4.43
T_{13}	121.82	4.20	4.30
T_{14}	120.89	3.87	3.80
T_{15}	118.71	3.73	3.67
SEd (±)	0.64	0.16	0.12
CD (P=0.05)	1.30	0.34	0.24

Effect on Root length and diameter

The observations regarding root characters of strawberry as influenced by INM showed that application of nutrients in integrated manner improved the root length and diameter (Table 3). Better development of root system possibly due to the synthesis of plant growth hormones like IAA, GA and Cytokinins (Martinez *et al.*, 1993) [4] and direct influence of biofertilizers (Gajbhiye *et al.*, 2003) [3] which might have caused increased root length and diameter in strawberry.

Table 3: Effect of integrated nutrient management on root characters

Treatments	Root length (cm)	Root diameter (cm)
T_0	8.23	12.06
T_1	8.70	14.65
T_2	9.06	16.14
T_3	9.13	15.86
T_4	10.15	24.30
T_5	9.99	22.44
T_6	9.74	21.63
T_7	9.60	19.92
T_8	9.49	18.08
T_9	9.30	17.51
T_{10}	12.01	30.87
T_{11}	11.78	30.24
T_{12}	11.21	29.44
T_{13}	10.93	28.22
T_{14}	10.53	26.72
T_{15}	10.35	25.41
SEd (±)	0.12	0.23
CD (P=0.05)	0.25	0.47

Conclusion

Fertilizers are the major production input which improves production and quality of fruits. Balanced application of fertilizer is a pre-requisite for higher yield and also for maintaining proper soil health. Integrated Nutrient Management is a certain answer to sustain the soil fertility, maintenance of appropriate status of microflora, to make safe the produce and for realizing the additional yields. The present investigation revealed that integrated nutrient management has the great potential in improving the growth and yield of strawberry fruits under Assam condition.

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Conflict of interest

There is no conflict of interest.

References

1. Ahmadi E, Honnabyraiah MK, Alur AS, Adiga JD, Rao V. Impact of Integrated Nutrient Management on Yield and Quality Parameters of Strawberry (*Fragaria* × *ananassa* Duch.) cv. 'Sabrina' under Polyhouse. Int. J Curr Microbiol App Sci. 2017;6(9):3481-3487.
2. Asrey R, Singh R. Evaluation of strawberry varieties under semi-arid irrigated region of Punjab. Indian J Hort. 2004;61(2):122-124.
3. Gajbhiye RP, Sharma RR, Tewari RN. Effect of bio-fertilizers on growth and yield parameters of tomato. Indian J Hortic. 2003;60(4):368-371.
4. Martinez R, Dibut B, Casanova I, Ortega M. Stimulatory action in *Azotobacter chrooccum* on tomato crop on a red fenallitic soil. Agrotechniade-Cuba. 1993;27(1):23-26.
5. Meena HR, Somasundaram J, Kaushik RA, Sarolia DK, Kala S, Meena GL, *et al*. Integrated Nutrient Management Affects Fruit Yield of Sapota (*Achras zapota* L.) and Nutrient Availability in a Vertisol. Commun Soil Sci Plant Anal. 2019, 50(22).
6. Nazir N, Singh SR, Aroosa K, Masarat J, Shabeena M. Yield and growth of strawberry cultivar *Senga Sengana* as influenced by integrated organic nutrient management system. Environ Ecol. 2005;24(3):651-654.
7. NHB. Statistical database national horticulture board, Gurgaon; c2017. Available from: http:/nhb.gov.in/area_production.html
8. Patil VK, Shinde BN. Studies on integrated nutrient management on growth and yield of banana cv. Ardhapuri (Musa AAA). J Hortic For. 2013;5(9):130-138.

9. Rana RK, Chandel JS. Effect of bio-fertilizer and nitrogen on growth, yield and fruit quality of strawberry. Prog Hort. 2003;35(1):23-30.
10. Sharma RR. Growing Strawberry. International Book Distributing Co Lucknow; c2002.
11. Singh BK. Impact of integrated nutrient management on growth, yield and quality attributes in strawberry (*Fragaria* × *ananassa* Duch.) cv. Chandler. Environ Ecol. 2016;35(1A):363-367.
12. Singh R, Sharma RR, Singh DB. Effect of vermicompost on plant growth, fruit yield and quality of strawberries in irrigated arid region of northern plains. Indian J Hort. 2010;67(3):318-321.
13. 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.
14. Subraya BK, Madaiah D, Kumar MD. Effect of integrated nutrient management on growth and physiological parameters of strawberry (*Fragaria* x ananassa Duch) under naturally-ventilated polyhouse. Int J Farm Sci. 2017;7(3):72-75.
15. Tripathi VK, Kumar N, Shukla HS, Mishra AN. Influence of *Azotobacter*, *Azospirillum* and PSB on growth, yield and quality of strawberry cv. Chandler, paper presented in National Symposium on Conservation Hort., March, 21-23, 2010 at Deharadoon; c2010. p. 198-199.
16. 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.
17. Yadav SK, Khokhar UU, Yadav RP. Integrated nutrient management for strawberry cultivation. Indian J Hort. 2010;67(4):445-449.