IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed ( Group -I) Journal Volume 12, Iss 07, 2023

# IMPACT OF INTEGRATED NUTRIENT MANAGEMENT ON PLANT GROWTH, PRODUCTION, AND QUALITY PARAMETERS ON STRAWBERRY (FRAGARIA X ANANASSA DUCH.) VAR. CHANDLAR

**Jitendra Kumar[1], Vinay Joseph Silas[2], Raghvendra Singh[3]**

[1,2,3]Assistant Professor (Horticulture), Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur

**Corresponding Author** jitendrakumar.fas@ramauniversity.ac.in

## Abstract

The experiment was carried out at Horticulture Research Farm of Rama University, Mandhana, Kanpur, U.P, India, during October 2023-2024 to Impact of Integrated Nutrient Management on Plant Growth, Production, and Quality Parameters on Strawberry (fragaria x ananassa duch.) Var. Chandlar eight treatments viz., $T_1$ (Control), $T_2$ (100% RDF N: P: K @ 5:18:5 g/plant), $T_3$ (100% RDF + Azotobacter @ 1g/plant), $T_4$ (100% RDF + Azospirillum @ 1g/plant), $T_5$ (50% RDF + Azotobacter @ 1g/plant + topdressing of 50% each of P and K), $T_6$ (50% RDF + Azospirillum @ 1g/plant + topdressing of 50% each of P and K), $T_7$ (50% RDF + Azotobacter @ 1g/plant + PSB @1g/plant + topdressing of 50% K) and $T_8$ (50% RDF + Azospirillum @ 1g/plant + PSB @2g/plant + topdressing of 50% K) in a Randomized Block Design, and their combinations, three times. By boosting the growth, productivity, and quality of strawberries, the use of fertilizer containing biofertilizers such as Azotobacter and Azospirillum accelerates early flowering and extends the time for harvesting. Total soluble solids, ascorbic acid (mg/100g), total sugars (%), plant height (cm), number of leaves per plant, plant area (cm2), number of runners per plant, number of flowers per plant, number of berries per plant, fruit weight (g), fruit length (mm), fruit diameter (mm), fruit yield/plot (kg), and the number of days until first flower and titratable acidity (%) were all maximized by the integrated nutrient management.

**Keywords:** Azotobacter, Azospirillum,. biofertilizers

## Introduction

The strawberry (Fragaria × ananassa Duch.) is a low-volume, high-value crop that belongs to the Rosaceae family. Its cultivated varieties are octaploid (2n=8x=56) and were derived from North American species, Fragaria chiloensis and Fragaria verginiana, in France in the 17th century. One of the most important temperate fruits, strawberries can grow in sub-tropical and tropical climates (Sharma and Badiyala, 1980). They have been successfully grown up to 3000 meters above mean sea level in both humid and arid climates, and because they grow quickly, they are good for kitchen gardens. Haryana is the largest state in India in terms of both area and production (93.28), followed by Maharastra (3.28).

 

The least growing states in India are Punjab, Uttar Pradesh, Jammu and Kashmir, Uttarakhand, and the lower Himachal Pradesh hills, with a combined area of 0.21 thousand hectares and a production of 1.61 thousand metric tons (Anon. 2021). Strawberry fruits are visually appealing and include proteins, minerals, such as P, K, Ca, and Fe, as well as a unique perfume and a pleasing flavor (Joolka, 1983). Although strawberries are low in calories and carbohydrates, they are high in vitamin A (60 IU/100g of edible portion), vitamin C (30–120 mg/100g of edible portion), fiber (1.1%), and pectin (0.55%), which is accessible as calcium pectate.

Water is a major constituent (90%) of strawberry fruit. Elegiac acid is a naturally occurring plant phenol. It has been found to inhibit the cancer disease and asthma by the regular consumption of its fruits. It is also rich source of Thiamine (0.03 mg/100g), Riboflavin (0.01 mg/100g) and Nicotinic acid (0.2 mg/100g). The beneficial microorganisms present in the biofertilizers not only able to improve the plant growth but also maintained the environmental health and productivity of the soil. Among the various factors which contribute towards the growth, yield and quality of strawberry, nutrition is the most important and it has direct effect on bearing and production **(Umar et al., 2009)**. The basic principle behind this concept is to supply both the chemical fertilizers with bio-fertilizers for a sustainable crop production in most efficient manner. Adoption of integrated nutrient management practices in strawberry is more essential to realize higher yield, quality and returns.

## Materials and Methods

The present investigation on the Horticulture Research Farm of Rama University, Mandhana, Kanpur, U.P, India, during October 2023-2024 to Impact of Integrated Nutrient Management on Plant Growth, Production, and Quality Parameters on Strawberry (fragaria x ananassa duch.) which is located in the alluvial belt of Gangetic plains of central Uttar Pradesh. For this an experiment was planned using eight treatments viz., $T_1$ (Control), $T_2$ (100% RDF N: P: K @ 5:10:5 g/plant), $T_3$ (100% RDF + Azotobacter @ 1g/plant), $T_4$ (100% RDF + Azospirillum @ 1g/plant), $T_5$ (50% RDF + Azotobacter @ 1g/plant + topdressing of 50% each of P and K), $T_6$ (50% RDF + Azospirillum @ 1g/plant + topdressing of 50% each of P and K), $T_7$ (50% RDF + Azotobacter @ 1g/plant + PSB @1g/plant + topdressing of 50% K) and $T_8$ (50% RDF + Azospirillum @ 1g/plant + PSB @1g/plant + topdressing of 50% K) along with their combinations, replicated thrice in a Randomized Block Design. The healthy, uniform and disease-free runners of "chandler" and transplanted at 30×30cm spacing on October 6$^{th}$ during 2023. Other cultural practices including irrigation, insect-pests and disease management were common in all treatments. The observations were recorded from each treatment of all three replication. Five plants of strawberry were selected randomly and tagged under each treatment for recording different vegetative attributes viz., plant height (cm), number of leaves per plant, plant area (cm$^2$), days taken to first flower, number of runners per plant, number of flowers per plant, number of berries per plant, fruit weight (g), fruit length (mm), fruit diameter (mm), fruit

yield/plot (kg), total soluble solids, ascorbic acid (mg/100g), titratable acidity (%) and total sugars (%).

## Results and Discussion

How integrated nutrient management affects the winter dawn characteristics of strawberry (Fragaria x ananassa Duch.) plant growth, yield, and quality parameters, specifically vegetative growth, yield, and quality parameters.

## Vegetative Growth Parameter

The data on effect of integrated nutrient management on vegetative growth parameter viz., plant height (cm), number of leaves per plant, leaf area ($cm^2$), days taken to first flower, number of runners per plant, number of flowers per plant are presented in Table-1.

The plant height and number of leaves was significant differences among the treatments at 30, 60 and 90 DAT. The maximum plant height (5.82, 9.58 and 15.80cm) and number of leaves (4.35, 12.69 and 18.20) at 30, 60 and 90 DAT per plant were obtained in $T_6$ (50% RDF + Azospirillum @ 1g/plant + topdressing of 50% each of P and K) treated plants. The minimum plant height (3.88, 6.52 and 11.17cm) and number of leaves (2.42, 10.16 and 14.67) were recorded with $T_1$ (control). These findings are in agreement with the reports of **Marathe and Bharambe (2005)** in sweet orange, **Nowsheen et al. (2006)** and **Tripathi et al. (2010)** in strawberry.

The effect of integrated nutrient management on maximum leaf area (121.11 $cm^2$), number of flower (27.24), number of runners per plant (4.84) and minimum days taken to first flower (27.70) were recorded in $T_6$ (50% RDF + Azospirillum @ 1g/plant + topdressing of 50% each of P and K). These traits were minimum under $T_1$ (control) leaf area (102.08 $cm^2$), number of flowers (18.61), number of runners per plant (1.33) and maximum days taken to flowering (40.11). These findings are in complete agreement with **Nowsheen et al., (2006)** and **Umar et al., (2009)** in strawberry working with strawberry noted similar results. The increase in vegetative growth and other parameters might be due to the production of more chlorophyll content with inoculation of nitrogen fixers. The other reason for increased vegetative growth may be the production of plant growth regulators by microorganism in rhizosphere, which are absorbed by the roots. Therefore, increased vegetative growth may be attributed to the increased biological nitrogen fixation. Better development of root system and the possibly synthesis of plant growth hormones like IAA, GA and Cytokinins and direct influence of bio-fertilizers might have caused increase in vegetative growth parameters.

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed ( Group -I) Journal Volume 12, Iss 07, 2023

**Table 1: Impact of Integrated Nutrient Management on Plant Growth, Production, and Quality Parameters on Strawberry (fragaria x ananassa duch.) Var. Chandlar**

| Treatments | Plant Height (cm) | | | Number of leaves | | | Leaf area ($cm^2$) | Days taken to first flower | Number of runners /plants | Number of flower / plants |
|---|---|---|---|---|---|---|---|---|---|---|
| | 30DAP | 60DAP | 90DAP | 30DAP | 60DAP | 90DAP | | | | |
| $T_1$ | 3.88 | 6.52 | 11.17 | 2.42 | 10.16 | 14.67 | 102.08 | 40.11 | 1.33 | 18.61 |
| $T_2$ | 4.10 | 8.46 | 12.68 | 3.68 | 11.79 | 15.08 | 105.15 | 36.68 | 2.71 | 24.33 |
| $T_3$ | 4.99 | 8.62 | 13.57 | 3.87 | 11.98 | 15.44 | 110.18 | 35.01 | 3.09 | 25.88 |
| $T_4$ | 5.46 | 9.02 | 14.86 | 4.13 | 12.24 | 16.69 | 112.03 | 35.18 | 3.16 | 25.90 |
| $T_5$ | 5.72 | 9.24 | 14.88 | 4.24 | 12.10 | 17.65 | 119.12 | 28.22 | 4.66 | 26.33 |
| $T_6$ | 5.82 | 9.58 | 15.80 | 4.35 | 12.69 | 18.20 | 121.11 | 27.24 | 4.84 | 27.70 |
| $T_7$ | 4.73 | 8.79 | 13.73 | 3.94 | 12.01 | 18.04 | 112.15 | 34.64 | 3.26 | 23.54 |
| $T_8$ | 5.20 | 9.43 | 14.97 | 4.13 | 12.33 | 17.88 | 113.04 | 35.87 | 3.73 | 34.97 |
| **SEm(±)** | **0.053** | **0.124** | **0.134** | **0.081** | **0.162** | **0.264** | **1.420** | **0.523** | **0.050** | **0.408** |
| **C.D. (P=0.05)** | **0.165** | **0.381** | **0.412** | **0.247** | **0.498** | **0.804** | **4.352** | **1.603** | **0.154** | **1.252** |

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed ( Group -I) Journal Volume 12, Iss 07, 2023

**Yield Parameter**

The data on effect of integrated nutrient management on yield parameter viz., number of berries per plant, fruit weight (g), fruit length (mm), fruit diameter (mm) and fruit yield per plot (kg) are presented in Table-2.

The effect of integrated nutrient management on maximum number of berries per plant (22.10) were recorded in $T_6$ (50% RDF + Azospirillum @ 1g/plant + topdressing of 50% each of P and K). These traits were minimum under $T_1$ (control) number of berries per plant (12.77). These findings are in line with the **Gajbhiye et al., (2003)** and **Shukla et al., (2009)** in tomato.

The maximum fruit weight (21.66g) and fruit yield per plot (2.96kg) were recorded in $T_6$ (50% RDF + Azospirillum @ 1g/plant + topdressing of 50% each of P and K). These traits were minimum under $T_1$ (control) fruit weight (16.53g) and fruit yield per plot (1.95kg). These findings are in line with the **Wange et al., (1998)** in strawberry, **Kadlag et al., (2007)** in tomato and **Tripathi et al., (2010)** in strawberry.

The increase in fruit size (length 6.93mm and diameter 4.70mm) during the present investigation might be due to the increased photosynthetic ability of plants fertilized with $T_6$ (50% RDF + Azospirillum @ 1g/plant + topdressing of 50% each of P and K). These traits were minimum under $T_1$ (control) fruit length 3.55 mm diameter 2.24 mm. Fruit size highly correlated with dry matter content and balance level of hormone and nitrogen fixers are known for accumulation of dry matter and their translocation **(Kachot et al., 2001)** as well as synthesis of different growth regulators.

**Table 2: Impact of Integrated Nutrient Management on Plant Growth, Production, and Quality Parameters on Strawberry (fragaria x ananassa duch.) Var. Chandlar**

| Treatments | Number of berries per plant | Fruit weight (g) | Fruit yield/plot (kg) | Fruit length (mm) | Fruit diameter (mm) |
|---|---|---|---|---|---|
| **$T_1$** | 12.77 | 16.53 | 1.95 | 3.55 | 2.23 |
| **$T_2$** | 18.54 | 18.87 | 2.11 | 4.22 | 2.89 |
| **$T_3$** | 19.07 | 19.04 | 2.15 | 5.67 | 3.65 |
| **$T_4$** | 19.78 | 19.45 | 2.88 | 5.42 | 3.34 |

| | | | | | |
|---|---|---|---|---|---|
| **$T_5$** | 21.34 | 20.84 | 2.91 | 6.43 | 4.32 |
| **$T_6$** | 22.10 | 21.66 | 2.96 | 6.93 | 4.70 |
| **$T_7$** | 20.13 | 20.34 | 2.21 | 5.80 | 3.92 |
| **$T_8$** | 19.98 | 21.00 | 2.25 | 6.04 | 3.90 |
| **SEm(±)** | **0.217** | **0.267** | **0.053** | **0.111** | **0.054** |
| **C.D. (P=0.05)** | **0.666** | **0.818** | **0.158** | **0.338** | **0.168** |

## CONCLUSION

Based on the results obtained from the present investigation, it is conducted that the highest vegetative growth, yield and quality parameters viz., plant height at 30, 60 and 90 DAT (5.82, 9.58 and 15.80cm), number of leaves per plant at 30, 60 and 90 DAT (4.35, 12.69 and 18.20), leaf area (121.11 $cm^2$), minimum days taken to flowering (27.70), number of runners per plant found (4.84), number of flower (27.70), number of berries per plants (22.10), fruit weight (21.66g), fruit length (6.91mm), Fruit diameter (4.68mm), fruit yield/plot (2.96kg),. From this study it can be recommend that the application of INM at 50% RDF + Azospirillum @ 1g/plant + topdressing of 50% each of P and K a can be applied to obtain maximum vegetative growth, yield and quality of Strawberry.

## REFRENCES

**Attia, M. M., & Shawky, S. M. (2021).** Banana fiber reinforced concrete: A review. NY Sci. J, 14, 48-55.

**Baksh, H., Yadav, R., & Dwivedi, R. (2008).** Effect of INM on Growth, Yield, Yield Attributing Characters and Quality of Guava (P. guajava L.) Cv. Sardar. Progressive Agriculture, 8(2), 141-144.

**Gajbhiye, R. P., Sharmar, R. R., & Tewari, R. N. (2003).** Effect of biofertilizers on growth and yield parameters of tomato. Indian Journal of Horticulture, 60(4), 368-371.

**Joolka, N. K., & Badiyala, S. D. (1983).** Studies on the comparative performance of strawberry cultivars. Haryana journal of horticultural sciences.

**Karlıdag, H., Esitken, A., Turan, M., Sahin, F. (2007).** Effects of root inoculation of plant growth promoting rhizobacteria (PGPR) on yield, growth and nutrient element contents of leaves of apple. Scientia Horticulturae, 114, 16–20

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed ( Group -I) Journal Volume 12, Iss 07, 2023

**Kachot, N. A., Malavia, D. D., Solanki, R. M., & Sagarka, B. K. (2001).** Integrated nutrient management in rainy-season groundnut (Arachis hypogaea). Indian Journal of Agronomy, 46(3), 516-522.

**Marathe, R.A. and Bharambe, P.R. (2007).** Micrological population in rizosphere as affected by organic, inorganic and biofertilizer and their influence on soil and leaf nutrient status of sweet orange. PKV Research J., **29**(1): 20-23.

**Nowsheen, N., Singh, S.R., Aroosa, K., Masarat, J., and Shabeena, M. (2006).** Yield and growth of strawberry cv. Senga sengana as influenced by integrated organic nutrient management system. Environment and Ecology, **24 S** (3): 651-654.