Integrated Nutrient Management in Muskmelon: A Comprehensive Field Study

Abstract: The present study aims to describe the effects of integrated nutrient management (INM) on Madhumita variety of muskmelon cultivation in terms of plant growth, fruit yield, and quality. The experiment has been carried out inthe crop field located in the North Konkan region of Maharashtra, India.This case study involved seven different treatments (T1 to T7), each with varying nutrient application regimes. Certain observational data, such as vine length, number of leaves per plant, leaf length, days to 50% flowering, number of fruits per plant, fruit length, fruit width, fruit weight, and fruit yield, were recorded for three replications over the course of the experiment.

The results of statistical analysis revealed significant differences, with specific treatments demonstrating T6, which included Vermicompost at 5 tons/ha, 75% of the recommended dose of fertilizers (RDF), and 1% NOVEL prime organic liquid nutrient, consistently outperformed the other treatments groups. The findings highlight the utility of integrated nutrient management. It helps in understanding and optimizing the application of nutrients to boost crop productivity and promote sustainability.

Keywords: Bio compost, Crop Health, Crop Protection Equipment(CPE), Randomized Block Design (RBD), Recommended Dose of Fertilizer (RDF), Vermicompost.

1. Introduction

Muskmelon (Cucumis melo) is a vital seasonalfruit crop in global agriculture known for its excellent nutritional values and economic significance. For each 100 grams of the edible portion, it provides approximately 26 to 41 calories of energy, 0.6 to 1.0 grams of protein, 5 to 10 milligrams of calcium, 0.2 to 0.4 milligrams of iron, 8.17 milligrams of magnesium, and 7.39 milligrams of phosphorus (Howard et al., [5]). Therefore, its significance has increased, particularly in developing countries where the population is rising at an exponential rate, leading to a significant portion of the population suffering from food scarcity. This has led to a mounting demand for such agricultural produce, presenting both opportunities and challenges for modern farming practices. Furthermore, due to unpredictable changes in climatic conditions and the unbalanced application of pesticides and fertilizers, there is an adverse effect on the environment, food quality, and soil fertility. In this context, the adoption of innovative and sustainable agricultural methods is paramount.Among these methods, integrated nutrient management (INM) is emerging as a promising approach to enhance crop production while also preserving the environment.

Keeping in view, the present study embarks on a comprehensive exploration of the effects of integrated nutrient management on muskmelon cultivation, addressing crucial aspects of plant growth, fruit yield, and quality. The importance of this study lies in its contribution to addressing the challenges faced by modern agriculture, notably the optimization of crop productivity and the preservation of ecological balance.In order to substantiate the significance of the present study, it is valuable to briefly discuss noteworthy research endeavours undertaken by various practitioners in a similar manner.

Prabhu et al. [10] applied an INMapproach for cucumber cultivation in winter season in Tamil Nadu, achieving appreciable productivity with a recorded yield of 32.80 tons per hectare (ton/ha) and a Benefit-to-Cost ratio of 2.24. Anjanappa et al. [1] conducted an experiment in Karnataka to investigate the influence of organic, inorganic, and biofertilizers on the yield and economics of cucumber cultivation under protected conditions.Jugraj et al. (2018) observed almost similar effects of the INM approach on the growth, flowering, and yield attributes of cucumber cultivation. Ghosh et al. [3] and Satish et al. [13]assessed the responses of organic and inorganic nutrient sources on growth and yield of watermelon and bottle gourd respectively.

In 2019, Matthew [7] conducted a study in the African country of Nigeria to investigate the effects of sowing dates and nutrients application on the growth and yield of muskmelon. He found that the sowing dates did not significantly influence overall growth, but muskmelons planted in May exhibited a higher number of leaves per plant, increased leaf area, and longer vine length.

Recently, Sankhala et al [12]and Sai et al. [11] carried out similar studieson muskmelon in Indian states of Gujarat and Telangana, respectively. They also observed that integrated nutrient management significantly influenced the quality and yield of muskmelon.

In the subsequent sections, the methodology, analysis of results, findings, and, finally, conclusions will be presented, highlighting valuable insights in the ever-evolving field of agricultural science.

2. Materials and Methods

The experiment was carried out on agricultural land owned by the ASPEE Foundation (ARDF), North Kokan region of Maharashtra during the Rabi season of the year 2022. The climatic conditions of this farming area are typically hot and humid, with a maximum temperature of 40.6°C and a minimum of 8.3°C, and annual rainfall of 2293 mm (Govt. of Maharashtra) [4]. The experiment was set up using a Randomized Block Design (RBD) layout. Farm Yard Manure (FYM) was the primary source of fertilizer.

The muskmelon variety utilized in this study was Madhumita, with a sowing date of 5th Dec. 2022. The spacing between plants was set at 90cm X 45 cm, ensuring adequate room for growth and development. The experimental layout followed a Randomized Block Design (RBD), facilitating systematic and controlled comparisons between treatments. Each plot measured 4.5 meters by 2.7 meters, providing ample space for observation and data collection. To ensure reliability and validity, the experiment included three replications, enhancing the robustness of the findings.

The experimental treatments applied in this study were as follows: T1: FYM at 5 tons/ha + 100% RDF, T2: Bio compost at 5 tons/ha + 100% RDF, T3: Vermicompost at 2 tons/ha + 100% RDF, T4: FYM at 5 t/ha + 75% RDF + 1% NOVEL prime organic liquid nutrient, T5: Bio compost at 5 tons/ha + 75% RDF + 1% NOVEL prime organic liquid nutrient, T6: Vermicompost at 5 tons/ha + 75% RDF + 1% NOVEL prime organic liquid nutrient, T7: Control receiving 100% RDF only.

The material "NOVEL" prime organic liquid nutrient is a specialized organic liquid nutrient formulated to enhance plant growth and productivity. This unique blend contains essential nutrients and compounds beneficial for plant development, aiming to improve overall crop health and yield(Champaneriet. al) [2].

3. Results

Table 3 provides a comprehensive dataset that includes various growth and yield parameters of crops subjected to different treatment conditions, which are denoted as T1 to T7. To analyze the variation in the impact of these treatments on the test plants, a statistical method known as Analysis of Variance (ANOVA) is employed(Panse and Sukhatme) [8]. MATLAB software is used to generate illustrative plots that aid in understanding the effects of the tests on the overall results.

Table1: Comprehensive Nutrients Treatment Results

Treatment	Average Vine length (cm)	Average Number of leaves per plant	Average Leaf length (cm)	Days taken to 50% flowering	Average Number of fruits per plant	Average Fruit length (cm)	Average Fruit width (cm)	Average Fruit weight (kg)	Average Fruit yield kg/plant	Fruit yield q/ha
T1	159.3	85.9	12.3	38.9	2.7	9.5	6.5	0.63	1.11	106.15
T2	165	87.4	13.4	37.8	3.1	10	6.8	0.7	1.16	113.48
T3	173.2	89.7	14.1	36.8	3.5	10.7	7.6	0.77	1.22	117.71
T4	183.9	91.4	15.1	35.7	3.9	11.3	8	0.83	1.27	123.03
T5	195.2	92.7	15.9	34.7	4.5	12.1	8.7	0.88	1.35	127.15
T6	206.4	95.3	16.7	34.1	4.9	12.9	9.3	0.97	1.44	133.37
T7	143.3	80.1	10.7	40.7	2.4	8.5	5.8	0.53	0.92	94.55
S.Em.±	0.28	0.57	0.27	0.21	0.04	0.16	0.11	0.01	0.02	1.1
C.D.	0.87	1.75	0.82	0.65	0.13	0.49	0.34	0.04	0.06	3.39

4. Discussion

This analysis examines the impact of nutrient treatments on various aspects of muskmelon cultivation, providing valuable insights for optimizing crop productivity. The effects of these treatments on plant growth and final yield are critically assessed, forming the basis for developing a successful Integrated Nutrient Management (INM) decision support system.The use the appropriate crop protection equipment (CPE) is also play important role in the success of INM. The key findings are highlighted below:

i.Average Vine Length (cm): The shortest vines, measuring 143.3 cm, were observed in treatment T7, while the longest vines, reaching 206.4 cm, were found in treatment T6. Notably,T6 received a treatment consisting of Vermicompost at a rate of 5 tons/ha, 75% of the recommended dose of fertilizers (RDF), and 1% of the NOVEL

brand of prime organic liquid nutrient. In contrast, T7 received 100% RDF.Similar findings were observed by Ghosh et al. [3], who found that higher vermicompost and inorganic fertilizer levels significantly boosted watermelon vine length. Similarly, Jagraj Singh et al. [6] noted that various integrated nutrient management (INM) doses of organic manure and fertilizers significantly impacted cucumber vine length during crop growth and Thriveni et al. [14] in bitter gourd supported integrated nutrient management including application of optimum organic manures increased vine length.

ii.Average Number of Leaves per Plant: The highest average numbers of leaves per plant, 95.3, was observed in treatment T6, while the lowest, 80.1, was found in T7. The other treatments fell within the range between these two values.Similar findings were also reported by Matthew [7] in muskmelon, where they observed that the application of inorganic fertilizers along with organic manures increased the number of leaves per plant.

iii.Average Leaf Length (cm): Leaf length displays a similar pattern to the number of leaves, with the longest leaves 16.7cm in treatment T6 and the shortest 10.7 in treatment T7.Similar observations were made by Satish et al. [13] in bottle gourd.

iv. Days Taken to 50% Flowering: Treatment T6observed the 34.1 days to reach 50% flowering, while treatment T1 and T7 taken the comparatively few days longer.This result was in conformity with the findings of Prabhu et al. [10] found the application of vermicompost along with inorganic fertilizers induced less number of days taken to first flowering.

v. Average Number of Fruits per Plant: Treatment T6 has the highest average number of fruits per plant, with 4.9, while T7 has the lowest, with 2.4.Similar observations were made by Sankhala et al. [12], who reported that organic manures contain all the essential nutrients. Their application with inorganic fertilizers definitely enhances nutrient availability, which helps the muskmelon crop produce a greater number of fruits per plant.

vi. Average Fruit Length (cm): The pattern repeats, with the longest fruitsmeasuring 12.9 cm in treatment T6, and the shortest, at 8.5 cm in T7.Similar result obtains by Nayak et al. (2016) in pointed gourd who observed maximum fruit length in the treatment which received vermicompost and full recommended dose of NPK. A synergistic interaction between organic manures and inorganic fertilizers resulted in enhanced fruit length.

vii. Average Fruit Width (cm): Similarly, treatment T6 achieved the widest fruits at 9.3 cm, while T7 had the narrowest at 5.8 cm. Maximum fruit width was recorded due to higher dose of nutrients resulted in improving the soil physical, chemical and biological properties resulted in increase in the fruit width. These findings corroborate with the findings of Patel et. al [9] and Sankhala et al. [12] in muskmelon.

viii. Average Fruit Weight (kg): Treatment T6 has the heaviest fruits 0.97 kg, and the fruit weight generally decreases with each treatment, being the lightest0.53 kg in T7.Similar result also found by Sankhala et al. [12] in muskmelon, where they recorded that organic manures application with inorganic fertilizers enhances the nutrient availability which helps the muskmelon crop to produce maximum fruit weight.

ix. Average Fruit Yield kg/plant: Following the previous trends, treatment T6 demonstrates the highest fruit yield per plant at 1.44 kg, while T7 has the lowest yield at 0.92 kg. Sankhala et al. [12]in muskmelon recorded that organic manures application with inorganic fertilizers enhances the nutrient availability which helps the muskmelon to produce maximum fruit yield per plant.

x. Average Fruit Yield q/ha: As treatment T6 is observed as the most productive treatment, the yield per hectare (q/ha) follows a similar trend to the yield per plant, with T6 achieving the highest at 133.37 quintal/hectare, and T7 recording thelowest yield at 94.55 quintal/hectare. Increased fruit yield was also related to balanced nutrition, better uptake of nutrients by plants which helped for better fruit set and fruit yield. The results were in conformation with the findings of Anjanappa et al. [1] in cucumber noticed influence of organic manures in combination with NPK enhanced more yield.

The trends discussed above can also be easily observed in the graphical illustrations presented in Fig. 1.

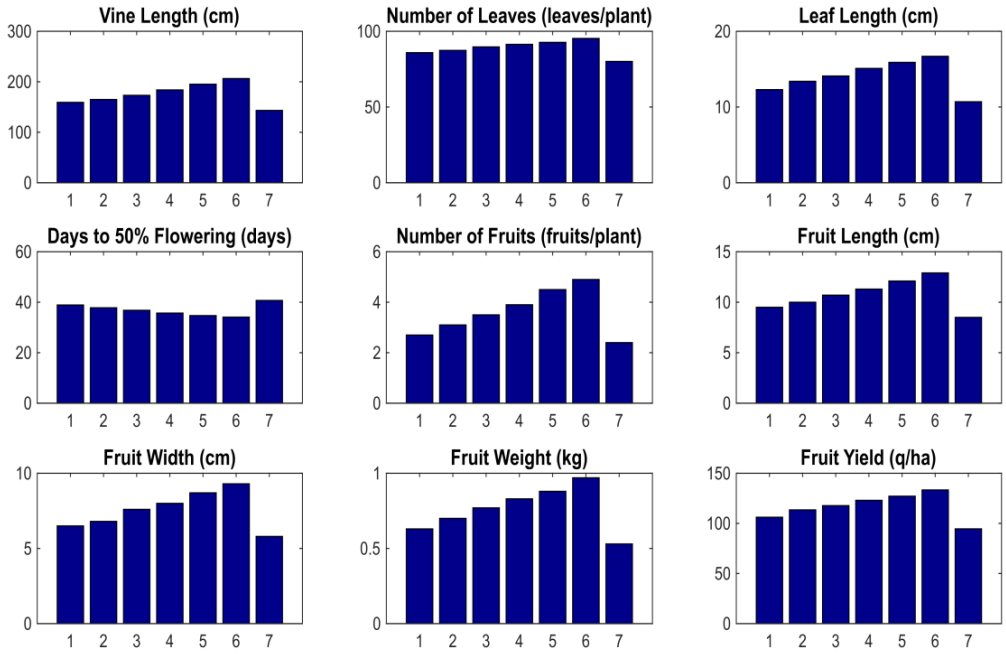

Fig 1.: Illustartive effect of treatments (T1 to T7)

5. Conclusion:

The results of this analytical study clearly indicate the substantial influence of different integrated nutrient management (INM) treatments (T1 to T7) on muskmelon cultivation. Treatment T6, which included Vermicompost at 5 tons/ha, 75% of the recommended dose of fertilizers (RDF), and 1% NOVEL prime organic liquid nutrient, consistently outperformed the other treatments across various parameters.Notably, T6 exhibited the longest vine length (206.4 cm), the highest number of leaves per plant (95.3), the longest leaves (16.7 cm), the shortest time to 50% flowering (34.1 days), the highest number of fruits per plant (4.9), the longest fruits (12.9 cm), the widest fruits (9.3 cm), the heaviest fruits (0.97 kg), the highest fruit yield per plant (1.44 kg), and the highest fruit yield per hectare (133.37 quintal/hectare).

In similar practices Farmers and agricultural practitioners are encouraged to consider the adoption of INM techniques, with a focus on treatments similar to T6, to maximize their crop production. Further research should delve deeper into optimizing specific nutrient management strategies to further improve similar cultivation and promote sustainable agriculture.

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

Statement of Conflict of Interest

Corresponding author declare that there is no conflict of interest between authors on contents of the paper or financial sources if any.

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Author contribution

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by [Swapnil Dekhane], [Narendra Kumar] and [Rahul Pisal]. The first draft of the manuscript was written by [Swapnil Dekhane] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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