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Comparative Evaluation of Organic and Natural Farming Systems on Growth Dynamics and Physiological Performance of Sweet Corn (*Zea Mays* L. Var *saccharata*)

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Abstract

Sustainable nutrient management is essential for improving crop productivity while maintaining soil health and environmental quality. A field experiment was conducted during three consecutive rabi seasons (2019-20, 2020-21 and 2021-22) at Agricultural Research Station, Karimnagar, Telangana, to evaluate the influence of organic farming, inorganic fertilization, integrated nutrient management (INM), natural farming and an unfertilized control on the growth dynamics and physiological performance of sweet corn (*Zea mays* L. var. *saccharata*). The experiment was laid out in a randomized block design with above five nutrient management treatments in five replications. Growth parameters including plant height, number of leaves, leaf area index, stalk girth, dry matter accumulation, crop growth rate and absolute growth rate were recorded at different growth stages. The pooled analysis revealed that INM significantly produced superior growth and physiological performance over all other treatments, followed by inorganic fertilization. Organic farming performed better than natural farming and the control, while natural farming recorded moderate improvements over the unfertilized control. The enhanced performance of INM was attributed to balanced nutrient availability, improved nutrient-use efficiency and better soil biological activity resulting from the combined application of organic and inorganic nutrient sources. The study demonstrates that INM is an effective and sustainable nutrient management strategy for maximizing sweet corn growth under the semi-arid conditions of Telangana.

Keywords: Nutrient management, organic farming, natural farming, integrated nutrient management, soil health, nutrient-use efficiency, sustainable agriculture

Introduction

Agriculture is presently confronted with the challenge of enhancing crop productivity while maintaining environmental sustainability and conserving natural resources. The excessive dependence on synthetic fertilizers and pesticides over the past decades has resulted in several concerns, including soil degradation, declining soil organic matter, reduced microbial diversity, nutrient imbalance, and environmental pollution. Therefore, sustainable agricultural approaches that promote ecological balance, improve soil health, and ensure safe food production have gained significant importance globally (FAO, 2021). Organic farming has emerged as one of the promising alternatives to conventional agriculture by relying on natural inputs such as farmyard manure, compost, vermicompost, green manures, and biofertilizers to maintain soil fertility and crop productivity. Organic production systems enhance soil biological activity, improve nutrient cycling, and contribute to long-term soil fertility. Natural farming is another ecological farming approach aims to minimize production costs while improving soil health and sustainability (NITI Aayog, 2018) [12]. The system utilizes locally prepared biological inputs such as Beejamrutha, Jeevamrutha, botanical extracts, and mulching materials to enhance microbial activity, nutrient availability, and crop resilience. (Subhash *et al.*, 2020) [16]. Sweet corn (*Zea mays* L. var. *saccharata*) is an important specialty maize crop cultivated for fresh consumption due to its high nutritional value, taste, and economic importance. Being a short-duration and high-value crop, sweet corn requires adequate nutrient availability throughout the growing period for optimum

vegetative growth, photosynthetic efficiency, and yield formation. Growth attributes such as plant height, number of leaves, leaf area index, chlorophyll content, and dry matter accumulation are important indicators of crop establishment and physiological performance. Efficient nutrient management through organic sources can influence these parameters by improving soil physical properties, nutrient availability, and microbial activity. Although organic and natural farming systems share common objectives of reducing chemical inputs and improving ecological sustainability, they differ in nutrient management approaches. The efficiency of nutrient management systems can be assessed through plant growth dynamics and physiological traits, as these parameters directly reflect nutrient uptake, photosynthetic activity, and biomass production. Improved nutrient availability and enhanced soil microbial activity under sustainable farming systems may promote better plant growth, higher dry matter accumulation, and improved physiological efficiency. However, scientific information comparing organic and natural farming systems for their influence on sweet corn growth and physiological performance remains limited. Therefore, the present investigation was undertaken to comparatively evaluate organic and natural farming systems on growth dynamics and physiological performance of sweet corn (*Zea mays* L. var. *saccharata*) with the aim of identifying suitable sustainable production practices for

enhancing crop growth and promoting environmentally responsible sweet corn cultivation.

2. Materials and Methods

2.1 Experimental site and climate

The field experiment was conducted during three consecutive Rabi seasons (2019-20, 2020-21, and 2021-22) at the Agricultural Research station, Karimnagar, Telangana state, India, located at altitude of 259.2 mean sea level on 18°44'31" N latitude and 79°09'52" E longitude. The site falls under semi-arid region of Northern Telangana agro-climatic zone characterized by hot and dry weather with mean maximum temperatures ranging between 24.4 - 37.2°C and minimum temperatures of 14.1- 27.1°C during the cropping period. The annual rainfall of the region is around 953 mm, mostly received during the south west monsoon months whereas irrigation is required for rabi cultivation. The experimental soil was red sandy loam in texture, and low in available nitrogen, medium in phosphorus, and high in potassium. The initial soil chemical characteristics were: pH 7.1, electrical conductivity 0.21 dS m⁻¹, organic carbon 0.46%, available N 255.4 kg ha⁻¹, P₂O₅ 19.8 kg ha⁻¹, and K₂O 312.6 kg ha⁻¹.

2.2 Experimental design and treatments

The experiment was laid out in a Randomized Block Design (RBD) with five nutrient management treatments replicated five times. Each plot measured 100 m² with appropriate border spacing to minimize nutrient interference. The treatments were as follows:

Table 1: Treatment Details and Nutrient Management Practices under Different Nutrient Management Systems

Treatment : Nutrient Management Practice	Particulars
Organic farming	100% nutrient requirement applied on N equivalent basis through organic sources in the form of FYM
Inorganic farming	100% recommended dose of NPK through chemical fertilizers
Integrated Nutrient Management (INM)	10 t FYM ha ⁻¹ + rest of the N through inorganic fertilizers
Natural farming	Ghanajeevamrutam, Dravajeevamrutam, Beejamrutam, and mulching-based inputs
Control	Neither organic manures nor inorganic fertilizers are applied, i.e., No external nutrient input (absolute control)

The recommended dose of fertilizers (RDF) for sweet corn was 200:60:50 kg N:P₂O₅:K₂O ha⁻¹. For the organic and INM treatments, nutrient equivalents were computed based on the nutrient content of the respective organic materials.

2.3 Crop management

Certified seeds of sweet corn (*Zea mays* L. var. *saccharata*) variety Madhuri were sown manually during the second week of October each year at a spacing of 60 × 25 cm. A uniform seed rate of 20 kg ha⁻¹ was used, and the crop was thinned to one plant per hill at 15 days after sowing (DAS). In the organic and INM treatments, farmyard manure and vermicompost were applied one week before sowing and incorporated into the soil. Inorganic fertilizers were applied as per the treatment schedule: one-half of nitrogen and the full dose of phosphorus and half of the dose of potassium were applied as basal, and the remaining nitrogen was top-dressed in two equal splits at 30 and 55 DAS along with half of the dose of potassium at 55 DAS. In natural farming, Ghanajeevamrutam (a mixture of cow dung, cow urine, jaggery, pulse flour, and soil) was applied as basal @ 500 Kg/ha and at every 15-day interval, dhavajeevamrutam is applied as a soil drench. Beejamrut was used for seed treatment, and mulching with crop residues was maintained throughout the crop period. Irrigation was provided at critical growth stages knee height, tasseling, and grain filling depending on the soil moisture status. Intercultural operations such as thinning, weeding, and earthing up were performed as per standard agronomic practices.

2.4 Observations on growth data recording

Observations were recorded from five randomly selected plants in each plot for growth parameters such as plant height, number of leaves per plant, leaf area index (LAI), and dry matter accumulation (DMA) were recorded at 20, 40, 60, and harvest from which physiological parameters as crop growth rate and absolute growth rate were calculated.

2.5 Statistical analysis

All recorded data were subjected to analysis of variance (ANOVA) for a randomized block design using the statistical software. Treatment means were compared using the least significant difference (LSD) test at a 5% probability level ($p \leq 0.05$). Data across the three years were analyzed both individually and as pooled means to understand the consistency and interaction effects of treatments over seasons.

3. Results and Discussion

3.1: Plant height of Sweet corn (cm)

The plant height of maize increased significantly from 20 DAS to harvest under all nutrient management treatments. Significant differences among treatments were observed at 40, 60 DAS and at harvest, indicating the influence of nutrient management practices on crop growth.

The Integrated Nutrient Management (INM) resulted in significantly highest pooled plant height throughout the crop growth period, recording 40.6 cm at 20 DAS, 81.8 cm at 40 DAS, 148.7 cm at 60 DAS, and 161.9 cm at harvest. This was closely

followed by the inorganic fertilizer treatment, which recorded pooled plant heights of 37.3, 70.8, 136.5, and 151.7 cm, respectively (Table 1). Among the organic-based systems, organic farming resulted in significantly greater plant height than natural farming, with pooled values of 28.0, 50.9, 104.1, and 114.7 cm compared to 26.2, 46.3, 90.1, and 102.7 cm, respectively at 20, 40, 60 & harvest. The control treatment recorded significantly lower plant height than compared to all the treatments with pooled values 23.8, 44.4, 84.1, and 95.5 cm respectively at 20, 40, 60 and harvest. Overall, the treatments followed the trend: INM > Inorganic > Organic > Natural farming > Control. The superior performance of INM may be attributed to the balanced and continuous supply of nutrients from both organic and inorganic sources, leading to enhanced vegetative growth and greater plant height (Kumar *et al.*, 2020) ^[5]

3.2 : The number of leaves plant⁻¹

The number of leaves plant⁻¹ increased progressively from 20 DAS to 60 DAS under all nutrient management treatments and declined slightly at harvest due to senescence of lower leaves. Significant differences among treatments were observed at 60 DAS and at harvest.

At 20 & 40 DAS, pooled analysis indicated non-significant difference because early crop growth was primarily governed by seed reserves and initial soil nutrient availability, resulting in relatively smaller treatment differences.

At 60 DAS, the significantly maximum number of leaves was observed in INM (10.19 leaves plant⁻¹), which was followed by inorganic (9.55), organic (8.92), natural farming (8.44) and control (8.12) indicating integrated nutrient management effectively promoted vegetative growth through balanced nutrient availability.

Similarly, at harvest, INM maintained significantly highest leaf number (10.30 leaves plant⁻¹) than compared to all other treatments. This was followed by inorganic (9.69), organic (8.08), natural farming (7.64) and control (7.28). The superior performance of INM may be attributed to continuous nutrient supply through the combined application of organic and inorganic nutrient sources, resulting in improved photosynthetic activity, higher chlorophyll content and prolonged leaf retention. Organic farming also improved leaf production over the control due to gradual nutrient release and better soil biological activity, although its performance remained lower than INM and inorganic fertilization because nutrients from organic sources are released more slowly. The control treatment consistently produced the lowest number of leaves due to limited nutrient availability. These findings of Jeevabharathi *et al.*, 2020; Hammad *et al.*, 2011 ^[2], agree with earlier reports that integrated nutrient management significantly enhances vegetative growth and leaf production in maize and sweet corn by improving nutrient availability and physiological efficiency.

3.3: Leaf area plant⁻¹ and leaf area index (LAI)

Leaf area plant⁻¹ and Leaf area index were significantly influenced by different nutrient management practices at 40, 60 DAS and harvest of sweet corn during Rabi 2019-20 to 2021-22 (Table 3 & 4). At 20 DAS, pooled leaf area ranged from 122.6 to 416.9 dm² plant⁻¹ and pooled LAI from 0.10-0.35. The Leaf area plant⁻¹ and LAI were not significantly influenced by different nutrient management practices. At 40 DAS, where rapid vegetative growth resulted in a substantial increase in leaf expansion. INM recorded significantly highest pooled leaf area (2530.4 dm² plant⁻¹) and LAI (2.11). This was followed by inorganic farming (2096.8 dm² plant⁻¹ & 1.75), organic farming

(1095.3 dm² plant⁻¹ & 0.91), natural farming (755.2 dm² plant⁻¹ & 0.63), in turn the later treatment was found to be on par with control (671.1 dm² plant⁻¹ & 0.56) respectively. Leaf area and LAI reached its maximum during 60 DAS, corresponding to the grand growth phase of sweet corn. Similarly, the pooled leaf area and LAI under INM were significantly highest (4842.1 dm² plant⁻¹ & 4.04), followed by inorganic farming (3533.0 dm² plant⁻¹ & 2.94), organic farming (2424.2 dm² plant⁻¹ & 2.02), natural farming (2031.7 dm² plant⁻¹ & 1.69) and was in turn on par with the control (1691.9 dm² plant⁻¹ & 1.41). At harvest, a decline in leaf area was observed across treatments due to leaf senescence. Nevertheless, INM maintained the highest pooled leaf area (4349.9 dm² plant⁻¹) and LAI (3.63), followed by inorganic farming (3856.9 dm² plant⁻¹ & 3.21), organic farming (2153.9 dm² plant⁻¹ & 1.78), natural farming (1796.4 dm² plant⁻¹ & 1.50) and conversely, it was on par with the control (1561.3 dm² plant⁻¹ & 1.30) respectively.

The greater leaf area under INM may be attributed to the continuous and balanced availability of nutrients from combined organic and inorganic sources, which enhanced cell division, cell elongation, chlorophyll formation and photosynthetic activity. Organic farming also improved leaf expansion compared with the control by enhancing soil organic matter, microbial activity and gradual nutrient release. However, its performance remained comparatively lower than INM because nutrient mineralization from organic sources is relatively slow. Similar observations were reported by Meena *et al.* (2020) ^[10], Kumar *et al.* (2021), Singh *et al.* (2022) ^[14] and Ladha *et al.* (2022) ^[7], who reported significantly greater leaf development under integrated nutrient management than under sole organic nutrient application.

3.4: Stalk girth (cm)

The pooled data (Table 5) revealed that nutrient management practices significantly influenced the stalk girth of sweet corn throughout the crop growth period. Differences among treatments became more pronounced as the crop advanced from 20 DAS to harvest.

At harvest, INM maintained significantly higher stalk girth (6.78 cm), followed by inorganic fertilization (6.07 cm). Organic farming (5.48 cm) also recorded appreciably higher stalk girth than natural farming (4.86 cm) and control (4.32 cm) which recorded least stalk girth. Similar trend was followed at 20 & 60 DAS. While at 40 DAS, the INM recorded significantly highest stalk girth (5.81 cm) than all treatments. This was followed by inorganic treatment (5.41cm) and organic treatment (4.24 cm). The later was found to be on par with Natural farming (4.05 cm) which was in turn on par with control (3.69 cm). Similar superiority of integrated nutrient management in improving stem diameter has been reported by Kumar *et al.* (2020) ^[5] and Singh *et al.* (2022) ^[14], who observed improved nutrient uptake and photosynthetic efficiency under integrated nutrient management which led to higher stem diameter. Greater stalk girth under INM indicates stronger stem development resulting from improved nitrogen availability, better root growth and enhanced translocation of assimilates. Organic farming also improved stalk girth over natural farming owing to gradual nutrient release and improvement in soil biological activity. These findings corroborate those of Mahanta *et al.* (2021) ^[9] and Meena *et al.* (2020) ^[10], who reported enhanced stem growth in maize under integrated nutrient management.

3.4: Dry matter accumulation (g m⁻²)

Dry matter accumulation differed significantly among nutrient management practices throughout crop growth (Table 6). The

accumulation increased progressively from 20 DAS to harvest, reflecting active biomass production during vegetative and reproductive phases. At 20 DAS, the pooled dry matter accumulation did not differ significantly. While at 40 DAS, biomass accumulation increased sharply under all treatments. INM produced significantly highest pooled dry matter (110.9 g m^{-2}), significantly exceeding inorganic fertilization (70.67 g m^{-2}), organic farming (32.54 g m^{-2}), natural farming (28.5 g m^{-2}) and control (24.0 g m^{-2}). Enhanced biomass under INM resulted from improved nutrient uptake, higher leaf area development and increased photosynthetic activity. A similar trend continued at 60 DAS, where INM recorded the highest pooled dry matter production (163.2 g m^{-2}), followed by inorganic fertilization (138.4 g m^{-2}). Organic farming (70.4 g m^{-2}), which accumulated on par biomass with natural farming (59.2 g m^{-2}) in turn on par with that of control (49.6 g m^{-2}). These observations agree with Jeevabharathi *et al.*, (2020) [3], who reported that balanced nutrient supply improves radiation interception and dry matter accumulation in maize.

At harvest, similarly, significantly maximum pooled dry matter production (298.1 g m^{-2}) was observed under INM, followed by inorganic fertilization (230.4 g m^{-2}), organic farming (150.0 g m^{-2}) which is on par with natural farming (127.3 g m^{-2}) and later is in turn on par with control (114.6 g m^{-2}). The superiority of INM could be attributed to continuous nutrient availability throughout the crop growth period, resulting in sustained photosynthesis and efficient assimilate partitioning. Organic farming also produced substantially higher biomass along with natural farming due to improved soil organic carbon and microbial activity. These findings are consistent with Ramesh *et al.* (2021) [13] and Srinivasarao *et al.* (2022) [15] who reported that integrated nutrient management enhances biomass production and crop productivity through improved soil health and nutrient-use efficiency.

3.4: Crop growth rate ($\text{g m}^{-2} \text{ day}^{-1}$)

Crop Growth Rate (CGR) differed significantly among nutrient management practices at different crop growth stages during Rabi 2019-20 to 2021-22 (Table 7). The pooled data indicated that Integrated Nutrient Management (INM) consistently recorded the highest CGR throughout the crop growth period, followed by inorganic nutrient management, organic farming and natural farming.

During 0-20 DAS, pooled CGR ranged from 0.87 to $3.96 \text{ g m}^{-2} \text{ day}^{-1}$, with INM recording significantly highest value ($3.96 \text{ g m}^{-2} \text{ day}^{-1}$), followed by inorganic farming ($3.52 \text{ g m}^{-2} \text{ day}^{-1}$) and organic farming ($2.11 \text{ g m}^{-2} \text{ day}^{-1}$), whereas the control recorded the lowest value ($0.87 \text{ g m}^{-2} \text{ day}^{-1}$) which was on par with natural farming ($1.17 \text{ g m}^{-2} \text{ day}^{-1}$). During 20-40 and 40 -60 DAS, the crop entered the rapid vegetative growth phase, resulting in a marked increase in CGR. INM registered significantly highest pooled CGR (68.29 & $68.40 \text{ g m}^{-2} \text{ day}^{-1}$), closely followed by

inorganic farming ($40.75 \text{ g m}^{-2} \text{ day}^{-1}$ & 62.85), organic farming ($15.87 \text{ g m}^{-2} \text{ day}^{-1}$ & $34.71 \text{ g m}^{-2} \text{ day}^{-1}$), where as, the organic farming and natural farming (14.74 & $31.18 \text{ g m}^{-2} \text{ day}^{-1}$) resulted in on par CGR. The control treatment in turn was on par with natural farming and maintained the lowest growth rate (12.07 & $27.47 \text{ g m}^{-2} \text{ day}^{-1}$) respectively. Similarly, during 60 DAS to harvest, pooled CGR remained highest under INM ($94.0 \text{ g m}^{-2} \text{ day}^{-1}$), followed by inorganic farming ($70.78 \text{ g m}^{-2} \text{ day}^{-1}$), organic farming ($48.19 \text{ g m}^{-2} \text{ day}^{-1}$), which in turn was on par with natural farming ($40.07 \text{ g m}^{-2} \text{ day}^{-1}$) and control ($36.40 \text{ g m}^{-2} \text{ day}^{-1}$). The superior performance of INM may be attributed to the balanced and continuous nutrient supply from both inorganic fertilizers and organic sources, resulting in improved leaf area development, chlorophyll synthesis, photosynthetic efficiency and biomass production. Organic farming also enhanced crop growth compared to the control due to gradual nutrient mineralization and improvement in soil biological activity, although nutrient release was comparatively slower than under INM and inorganic fertilization. Similar findings were reported by Meena *et al.* (2022) [11], Kumar *et al.* (2021) [6], Singh *et al.* (2022) [14] and FAO (2023), who observed higher crop growth rates under integrated nutrient management owing to improved nutrient availability and soil health.

3.5: Absolute growth rate (g day^{-1})

Absolute Growth Rate (AGR) increased progressively with crop age and varied significantly among nutrient management practices (Table 8).

At 20 DAS, pooled AGR varied from 0.11 to 0.48 g day^{-1} . INM recorded significantly highest AGR (0.48 g day^{-1}), on par with inorganic farming (0.42 g day^{-1}). This was followed by organic farming (0.25 g day^{-1}) which was on par with natural farming (0.14 g day^{-1}) and control (0.11 g day^{-1}). While, At 40 DAS, AGR increased substantially with crop establishment. The pooled AGR was highest under INM (4.85 g day^{-1}), followed by inorganic farming (2.95 g day^{-1}) and organic farming (1.14 g day^{-1}). But Organic farming was in turn on par with natural farming (1.10 g day^{-1}) and the control (0.93 g day^{-1}). Similar trend was followed at 40-60 DAS and 60-harvest stage (Table 8). Higher AGR under INM could be attributed to sustained nutrient availability throughout the crop growth period, which enhanced photosynthetic efficiency, dry matter accumulation and partitioning of assimilates. Organic farming recorded on par AGR to that of natural farming and control owing to improved soil microbial activity and gradual nutrient release, though the response was relatively slower because of delayed mineralization of organic nutrient sources. These findings corroborate the reports of Mahajan *et al.* (2019) [8], Kumar *et al.* (2021) [6], Singh *et al.* (2022) [14] and Ladha *et al.* (2022) [7], who reported that integrated nutrient management enhances crop growth dynamics through improved soil fertility, nutrient use efficiency and biological activity.

Table 1: Impact of organic farming on Growth parameters, Plant height (cm) at different stages of Maize Sweet corn during Rabi, 2019-20 to 2021-22

Treatments	Plant height (cm)															
	20 DAS				40 DAS				60 DAS				Harvest			
	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled
Organic	25.4	31.6	27.0	28.0	60.8	44.9	47.0	50.9	92.0	113.6	106.8	104.1	111.8	120.80	111.4	114.7
Inorganic	34.2	39.9	37.8	37.3	67.2	53.5	91.6	70.8	102.2	149.2	158.2	136.5	131.6	162.20	161.2	151.7
INM	38.4	42.4	41.2	40.6	68.2	76.4	100.8	81.8	106.0	173.0	167.0	148.7	138.2	178.20	169.3	161.9
Control	19.8	27.7	24.0	23.8	54.6	36.2	42.4	44.4	75.4	84.6	92.2	84.1	95.5	97.80	93.2	95.5
Natural farming	22.4	30.7	25.6	26.2	57.4	37.7	43.8	46.3	77.4	94.2	98.6	90.1	101.8	103.60	101.0	102.7
S Em+	0.77	1.55	1.49	1.77	4.14	3.16	3.31	1.97	4.14	2.58	3.31	2.44	2.12	3.08	2.24	1.58
C.D (0.05)	2.32	4.67	4.47	NS	NS	7.74	9.93	5.60	NS	7.74	9.93	6.93	8.39	9.24	6.73	4.48

Table 2: Impact of organic farming on Growth parameters, No.of leaves / plant at different stages of Maize Sweet corn during Rabi, 2019-20 to 2021-22

Treatments	No.of leaves / plant															
	20 DAS				40 DAS				60 DAS				Harvest			
	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled
Organic	4.56	4.72	5.44	4.91	7.32	7.20	7.76	7.44	8.72	9.48	8.56	8.92	7.92	8.76	7.56	8.08
Inorganic	5.12	5.08	5.92	5.37	9.16	9.04	9.24	9.14	8.20	11.00	9.44	9.55	8.76	10.92	9.38	9.69
INM	5.27	5.44	6.20	5.64	9.36	9.56	10.20	9.80	8.88	11.28	10.40	10.19	9.04	11.32	9.74	10.3
Control	4.14	4.56	4.28	4.33	6.24	6.96	6.48	6.68	8.52	8.44	7.40	8.12	7.12	8.04	6.68	7.28
Natural farming	4.32	4.64	4.92	4.63	7.12	7.04	7.04	7.05	8.36	9.08	7.88	8.44	7.28	8.48	7.16	7.64
S Em+	0.09	0.10	0.24	0.36	0.30	0.15	0.16	0.70	0.16	0.26	0.24	0.13	0.22	0.33	0.20	0.16
C.D (0.05)	0.28	0.31	0.72	NS	0.91	0.47	0.51	NS	NS	0.80	0.71	0.37	0.65	0.97	0.59	0.44

Table 3: Impact of organic farming on Growth parameters, Leaf area / plant (dcm²) at different stages of Maize Sweet corn during Rabi, 2019-20 to 2021-22

Treatments	Leaf area / plant (dcm ²)															
	20 DAS				40 DAS				60 DAS				Harvest			
	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled
Organic	195.5	187.3	382.1	197.2	984.3	993.6	1308.0	1095.3	1827.7	3270.7	2174.2	2424.2	2025.7	2729.1	1706.6	2153.9
Inorganic	339.4	299.5	641.1	328.4	1615.4	1975.1	2699.8	2096.8	2060.4	4997.1	3541.5	3533.0	2824.5	4971.9	3774.2	3856.9
INM	404.7	408.0	736.8	416.9	1783.6	2268.4	3539.1	2530.4	2596.6	6775.8	5153.9	4842.1	3714.4	5714.3	3621.0	4349.9
Control	130.7	112.2	177.2	122.63	548.7	826.2	638.5	671.1	1575.4	2096.0	1404.3	1691.9	1542.4	2033.1	1108.4	1561.3
Natural farming	165.6	135.8	263.4	153.3	697.1	841.3	727.2	755.2	1641.3	2681.0	1772.9	2031.7	1581.3	2469.5	1338.3	1796.4
S Em+	16.6	15.5	62.9	53.2	70.5	100.8	200.2	78.3	131.5	195.9	254.0	115.6	254.8	229.8	159.1	136.9
C.D (0.05)	49.7	46.7	188.4	NS	211.5	302.3	600.2	222.7	394.3	587.4	761.8	328.7	764.3	839.0	477.0	389.2

Table 4: Impact of organic farming on Growth parameter, Leaf area index at different stages of Maize Sweet corn during Rabi, 2019-20 to 2021-22

Treatments	Leaf area index															
	20 DAS				40 DAS				60 DAS				Harvest			
	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled
Organic	0.16	0.16	0.32	0.16	0.82	0.83	1.09	0.91	1.52	2.73	1.81	2.02	1.69	2.27	1.42	1.78
Inorganic	0.28	0.25	0.53	0.27	1.35	1.65	2.25	1.75	1.72	4.16	2.95	2.94	2.35	4.14	3.15	3.21
INM	0.34	0.34	0.61	0.35	1.49	1.89	2.95	2.11	2.16	5.65	4.29	4.04	3.10	4.76	3.02	3.63
Control	0.11	0.09	0.15	0.10	0.46	0.69	0.53	0.56	1.31	1.75	1.17	1.41	1.29	1.69	0.92	1.30
Natural farming	0.14	0.11	0.22	0.13	0.58	0.70	0.61	0.63	1.37	2.23	1.48	1.69	1.32	2.06	1.12	1.50
S Em+	0.01	0.01	0.05	0.06	0.05	0.08	0.17	0.07	0.11	0.16	0.21	0.10	0.21	0.23	0.13	0.11
C.D (0.05)	0.04	0.04	0.16	NS	0.18	0.25	0.50	0.19	0.33	0.49	0.64	0.27	0.64	0.70	0.39	0.32

Table 5: Impact of organic farming on Growth parameter, Stalk girth (cm) at different stages of Maize Sweet corn during Rabi, 2019-20 to 2021-22

Treatments	Stalk girth (cm)															
	20 DAS				40 DAS				60 DAS				Harvest			
	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled
Organic	2.28	2.08	2.44	2.26	3.89	4.56	4.26	4.24	4.31	6.19	5.48	5.33	5.40	5.58	5.46	5.48
Inorganic	2.62	2.58	3.07	2.76	4.14	6.05	6.03	5.41	4.90	7.07	6.70	6.23	6.06	6.40	5.75	6.07
INM	2.84	2.71	3.80	3.12	4.40	6.67	6.34	5.81	5.09	8.10	8.04	7.08	6.38	6.89	7.07	6.78
Control	1.99	1.15	2.09	1.74	3.24	4.28	3.56	3.69	4.10	5.10	4.17	4.46	4.58	4.82	3.56	4.32
Natural farming	2.04	1.72	2.30	2.02	3.88	4.50	3.77	4.05	4.24	5.50	4.81	4.85	5.08	5.16	4.34	4.86
S Em+	0.07	0.09	0.18	0.07	0.23	0.22	0.28	0.11	1.17	0.22	0.27	0.13	0.19	0.20	0.14	0.11
C.D (0.05)	0.23	0.30	0.55	0.21	0.71	0.68	0.84	0.32	0.52	0.67	0.83	0.37	0.58	0.61	0.43	0.30

Table 6: Impact of organic farming on Growth parameter, Dry matter production (g/m²) at different stages of Maize Sweet corn during Rabi, 2019-20 to 2021-22

Treatments	Dry matter production (g/m ²)															
	20 DAS				40 DAS				60 DAS				Harvest			
	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled
Organic	3.84	4.56	6.77	5.05	33.60	32.00	32.00	32.54	70.40	102.40	72.80	70.41	145.92	150.40	153.60	150.01
Inorganic	8.26	6.51	10.54	8.43	36.00	92.80	83.20	70.67	138.40	172.80	147.20	138.42	236.64	240.00	214.40	230.42
INM	8.94	7.44	12.14	9.51	46.40	142.40	144.00	110.9	163.20	232.00	179.20	163.22	273.60	361.60	259.20	298.12
Control	1.84	1.86	2.59	2.10	24.00	25.60	22.40	24.0	49.60	80.00	58.40	49.63	110.08	105.60	128.00	114.62
Natural farming	2.72	2.58	3.12	2.81	28.00	28.80	28.80	28.50	59.20	89.60	67.20	59.22	124.16	118.40	139.20	127.33
S Em+	0.36	0.69	0.41	2.51	3.52	10.9	5.23	4.03	5.89	6.35	7.06	7.33	19.52	20.71	6.68	9.82
C.D (0.05)	1.11	2.07	1.22	NS	NS	32.69	15.69	11.47	16.70	18.21	19.32	20.4	59.43	62.17	20.04	27.92

Table 7: Impact of organic farming on Growth parameter, Crop Growth Rate (g/m²/day) at different stages of Maize Sweet corn during Rabi, 2019-20 to 2021-22

Treatments	Crop Growth Rate (g/m ² /day)															
	0-20 DAS				20-40 DAS				40-60 DAS				60-Harvest			
	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled
Organic	1.60	1.90	2.82	2.11	7.00	11.43	29.18	15.87	15.33	29.33	59.47	34.71	60.45	50.44	33.67	48.19
Inorganic	3.44	2.71	4.39	3.52	7.50	35.95	78.81	40.75	42.67	33.33	112.53	62.85	98.23	86.11	37.00	73.78
INM	3.73	3.10	5.06	3.96	9.67	56.23	138.94	68.29	48.67	37.33	119.20	68.40	113.52	135.11	43.33	97.32
Control	0.77	0.77	1.08	0.87	5.00	9.89	21.32	12.07	10.67	22.67	49.07	27.47	45.62	34.56	29.00	36.39
Natural farming	1.13	1.07	1.30	1.17	5.83	10.93	27.50	14.74	13.00	25.33	55.20	31.18	51.44	38.78	30.00	40.07
S Em+	0.15	0.28	0.16	0.12	1.94	4.51	5.21	2.30	1.14	5.52	8.30	3.33	8.25	9.62	2.32	4.30
C.D (0.05)	0.46	0.86	0.51	0.35	NS	13.54	15.63	6.54	5.63	NS	24.92	9.46	24.77	28.88	NS	12.23

Table 8: Impact of organic farming on Growth parameter, Absolute Growth Rate (g/day) at different stages of Maize Sweet corn during Rabi, 2019-20 to 2021-22

Treatments	Absolute Growth Rate (g/day)															
	20 DAS				40 DAS				60 DAS				Harvest			
	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled
Organic	0.19	0.23	0.34	0.25	0.84	1.37	1.26	1.14	1.84	3.52	2.04	2.47	7.25	6.05	5.04	5.79
Inorganic	0.41	0.33	0.53	0.42	0.90	4.31	3.63	2.95	5.12	4.00	3.20	4.11	11.79	10.33	8.36	8.49
INM	0.45	0.37	0.61	0.48	1.16	6.75	6.59	4.85	5.84	4.48	3.76	5.02	13.62	16.21	11.00	13.61
Control	0.09	0.09	0.13	0.11	0.60	1.19	0.99	0.93	1.28	2.72	1.80	1.93	5.47	4.15	4.18	4.38
Natural farming	0.14	0.13	0.16	0.14	0.70	1.31	1.28	1.10	1.56	3.04	1.92	2.17	6.17	4.65	4.90	4.80
S Em+	0.02	0.04	0.02	0.60	5.21	0.54	0.26	0.20	0.17	0.66	0.53	0.28	0.98	1.15	0.28	0.52
C.D (0.05)	0.06	0.115	0.06	0.21	15.63	9.63	0.78	0.57	0.57	NS	NS	0.80	2.98	3.46	NS	1.47

4. Conclusion

The three-year study on INM, Organic, Natural farming over conventional farming demonstrated that nutrient management practices significantly influenced the growth and physiological performance of sweet corn under the semi-arid conditions of Telangana. Integrated nutrient management significantly recorded the highest plant height, leaf production, leaf area index, stalk girth, dry matter accumulation, crop growth rate and absolute growth rate throughout the crop growth period. The superior performance of INM was primarily due to the synergistic effect of organic and inorganic nutrient sources, which ensured balanced nutrient supply, improved nutrient-use efficiency and enhanced soil biological activity. Inorganic fertilization ranked next in performance, while organic farming showed better growth than natural farming and the control, indicating the positive role of organic nutrient sources in improving soil fertility and crop performance. Natural farming produced comparatively lower growth attributes because of slower nutrient release due to biological nutrient mobilization, although it remained superior to the unfertilized control. Overall, the findings indicate that

integrated nutrient management offers the most effective approach for achieving higher productivity while sustaining soil health and environmental quality. Therefore, INM can be recommended as a practical and sustainable nutrient management strategy for sweet corn cultivation in the semi-arid regions of India.

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