



ISSN Print: 2618-060X
 ISSN Online: 2618-0618
 NAAS Rating (2026): 5.20
 IJRA 2026; 9(9): 1264-1271
www.agronomyjournals.com
 Received: 17-07-2026
 Accepted: 20-08-2026
 Published: 28-09-2026

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Growth response of maize and mungbean to integrated nutrient management under a maize–mungbean cropping system

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DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i9q.6684>

ABSTRACT

Integrated nutrient management (INM) is an important approach for improving crop growth through the balanced supply of nutrients from inorganic and organic sources. A two-year field experiment was conducted during Kharif seasons of 2022 and 2023 at the Crop Research Centre, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh, to evaluate the direct and residual effects of INM practices on the growth parameters of maize and mungbean under a maize–mungbean cropping system. The experiment was laid out in a randomized block design with three replications and eleven nutrient management treatments comprising different combinations of recommended dose of fertilizers (RDF), poultry manure, Beejamrit seed treatment and Jeevamrit spray. Growth observations were recorded at different crop growth stages, including plant height, dry matter accumulation and physiologically active leaves in maize, and plant height, branches plant-1 and other vegetative growth parameters in mungbean. In maize, growth increased with integrated nutrient application, with 125% RDF (T_{11}) recording the highest plant height, dry matter accumulation and number of physiologically active leaves, while T_{10} (100% RDF + 25% N through poultry manure + Beejamrit + Jeevamrit) followed closely. In mungbean, T_{10} consistently recorded the highest growth, with pooled plant height of 15.91 cm at 30 DAS and 41.40 cm at harvest, along with 3.54 branches plant-1. The lowest growth values were generally observed under 100% RDF alone (T_1). The improved growth under integrated nutrient management may be associated with a more balanced nutrient supply and the beneficial contribution of organic and biological inputs to crop establishment and vegetative development. The results indicate that appropriate integration of inorganic fertilizers with poultry manure, Beejamrit and Jeevamrit can substantially improve the growth performance of maize and mungbean under the studied cropping system.

Keywords: Integrated nutrient management, Maize, Mungbean, Plant height, Dry matter accumulation, Vegetative growth, Beejamrit, Jeevamrit, Poultry manure, Growth parameters

Introduction

Crop growth is a fundamental determinant of productivity and is strongly influenced by the availability, balance and synchronization of essential plant nutrients. Growth attributes such as plant height, leaf development, branching and dry matter accumulation reflect the physiological response of crops to prevailing nutrient conditions and directly contribute to the development of an effective photosynthetic canopy. In intensive cropping systems, continuous removal of nutrients and inadequate replenishment can result in nutrient imbalance, which ultimately restricts vegetative growth and crop performance. Therefore, balanced nutrient management is essential for maintaining vigorous crop growth and efficient utilization of available resources.

Maize (*Zea mays* L.) is a fast-growing and nutrient-demanding cereal crop with a high requirement for nitrogen and other essential nutrients during its active vegetative and reproductive growth stages. Adequate nitrogen availability promotes leaf development, chlorophyll synthesis, plant height and dry matter production, whereas nutrient deficiency can markedly restrict vegetative development and biomass accumulation (Amanullah *et al.*, 2009; Leghari *et al.*, 2016) [1, 2]. Integrated nutrient management, involving the combined use of inorganic fertilizers and organic nutrient sources, can provide a more balanced nutrient supply and improve nutrient availability throughout crop growth. Previous studies have reported enhanced plant height, leaf area, dry matter accumulation and other growth characteristics of maize under integrated application of fertilizers and organic manures (Balyan *et al.*, 2006; Kumar *et al.*, 2005; Ravi *et al.*, 2012; Shilpashree *et al.*, 2012) [3, 4, 5, 6].

Mungbean (*Vigna radiata* L.) is an important short-duration pulse crop that contributes to diversified and sustainable cropping systems. Its growth and development are influenced by the availability of phosphorus, potassium and other nutrients, particularly during active vegetative and reproductive stages. Plant height,

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number of branches and leaf development are important indicators of mungbean growth and canopy establishment. Integrated application of organic manures and biofertilizers has been reported to improve plant height, dry matter production, branching and other growth characteristics of mungbean (Dhakal *et al.*, 2015; Mishra *et al.*, 2018; Verma *et al.*, 2022) [7, 8, 9].

Organic nutrient sources can complement mineral fertilizers by improving the physical and biological environment of the soil. Poultry manure contributes organic matter and nutrients and can improve soil porosity, aggregation and moisture retention, thereby supporting root growth and nutrient uptake. The combined application of organic and inorganic nutrient sources may also stimulate microbial activity and nutrient mineralization, which can improve nutrient availability to growing plants (Purbajanti *et al.*, 2019; Samuel *et al.*, 2018) [10, 11]. Such complementary effects are particularly relevant under intensive cropping conditions where sustained nutrient availability is required for maintaining crop growth.

Biological inputs such as Beejamrit and Jeevamrit have also gained attention as components of integrated nutrient management. Beejamrit is used as a seed treatment and can support seed germination and early seedling establishment, whereas Jeevamrit is associated with enhanced microbial activity and nutrient transformation in the crop environment. These biological inputs, when integrated with mineral fertilizers and organic manures, may contribute to improved nutrient synchronization and vegetative development (Sreenivasa *et al.*, 2010) [12].

The maize–mungbean cropping system provides an opportunity to evaluate the growth response of both cereal and pulse crops under different nutrient management strategies. Mungbean, as a leguminous crop, also contributes to biological nitrogen fixation and diversification of the cropping sequence. Earlier investigations have demonstrated that diversification with legumes and integrated nutrient management can improve soil biological properties and crop performance (Choudhary *et al.*, 2018; Hazra *et al.*, 2019) [13, 14].

Although the beneficial effects of integrated nutrient management on crop productivity have been widely reported, relatively less emphasis has been placed on the comparative response of specific growth parameters of maize and mungbean under a common nutrient management framework, particularly under the conditions of western Uttar Pradesh. Detailed assessment of growth characteristics can provide useful information on how different combinations of inorganic, organic and biological nutrient sources influence crop establishment and vegetative development.

Therefore, the present investigation was undertaken to evaluate the direct and residual effects of integrated nutrient management practices on the growth parameters of maize and mungbean under a maize–mungbean cropping system. The study specifically focused on plant height, dry matter accumulation, physiologically active leaves and other important vegetative growth attributes to identify nutrient management practices capable of promoting vigorous and balanced crop growth.

2. Review of literature

2.1 Growth response of maize to integrated nutrient management

Maize growth is strongly influenced by the availability and balance of essential nutrients, particularly nitrogen. Integrated application of inorganic fertilizers with organic nutrient sources has been reported to improve vegetative growth, biomass production and nutrient uptake in maize. Balyan *et al.* (2006) [3] reported that integrated nutrient management improved maize plant height and dry matter production compared with individual nutrient sources. Kumar *et al.* (2005) [4] also observed maximum plant height and leaf area index with the combined application of 100% NPK and farmyard manure, indicating the beneficial effect of integrating organic and inorganic nutrient sources on maize growth.

Shilpashree *et al.* (2012) [6] reported that application of 100% N along with FYM significantly increased plant height and leaf area index of maize. The improved growth was associated with better nutrient availability under integrated nutrient management. Similarly, Haque *et al.* (2012) [15] observed higher plant height, dry matter accumulation and leaf area index with the application of 75% NPK combined with FYM. These findings demonstrate that partial substitution or supplementation of mineral fertilizers with organic sources can support vigorous vegetative development.

Ravi *et al.* (2012) [5] reported that the combined application of FYM, recommended fertilizer and zinc significantly increased plant height, leaf area index and total dry matter accumulation in quality protein maize. Sarwar *et al.* (2012) [16] also observed improved maize performance when a portion of nitrogen was substituted through FYM, indicating the potential of integrated nutrient sources to improve crop growth over sole mineral nitrogen application. Nagavani *et al.* (2014) [17] further reported significant improvement in maize growth and yield components under integrated nutrient management involving poultry manure and fertilizers.

The beneficial influence of organic nutrient sources on maize growth has also been demonstrated through vermicompost-based nutrient management. Shah *et al.* (2017) [18] reported improved crop performance with 100% RDF combined with vermicompost, while Meena *et al.* (2015) [19] observed improved growth and productivity of maize under integrated organic and inorganic nutrient application. Kumar *et al.* (2005) [4] and Verma *et al.* (2006) [20] similarly demonstrated that integrated nutrient supply improved growth characteristics of maize under maize-based cropping systems.

2.2 Growth response of mungbean to integrated nutrient management

Mungbean growth is influenced by balanced nutrient availability and the use of organic and biological nutrient sources. Plant height, branching and leaf development are important indicators of vegetative growth and canopy establishment in mungbean. Dhakal *et al.* (2015) [7] reported that integrated application of RDF, vermicompost and biofertilizers significantly improved dry matter accumulation and other growth characteristics of mungbean. Their findings indicated that the combined use of organic and inorganic nutrient sources provided favourable conditions for crop growth and development.

Verma *et al.* (2022) [9] reported significant improvement in plant height and plant dry weight of mungbean with the combined application of Rhizobium, PSB and poultry manure. The integrated treatment also improved branching and other crop attributes, demonstrating the contribution of organic manure and microbial inputs to vegetative development. Meena *et al.* (2015) [21] likewise reported beneficial effects of bioinorganic nutrient combinations on mungbean performance.

Mishra *et al.* (2018) [8] observed improved growth and yield of mungbean under integrated nutrient management, indicating that combined nutrient sources can enhance crop development. Choudhary *et al.* (2020) [22] also reported positive effects of organic and inorganic nutrient sources on mungbean growth and yield attributes. Saini *et al.* (2022) [23] further documented improved growth and yield of green gram under integrated nutrient management.

2.3 Role of organic and biological inputs in crop growth

Organic nutrient sources contribute not only nutrients but also improvements in the soil environment that can support crop growth. Poultry manure can improve soil physical conditions, moisture retention and nutrient availability, thereby favouring root development and nutrient absorption. Purbajanti *et al.* (2019) [10] reported beneficial effects of organic and inorganic fertilizers on crop growth and physiological characteristics. Samuel *et al.* (2018) [11] demonstrated that long-term application of organic and mineral fertilizers influenced soil enzyme activity, indicating their role in nutrient transformation and availability.

Biological inputs such as Beejamrit and Jeevamrit can complement inorganic and organic nutrient sources. Beejamrit is used as a seed treatment and supports early crop establishment, while Jeevamrit is associated with biological activity and nutrient transformation. Sreenivasa *et al.* (2010) [12] reported the beneficial role of Beejamruth as a source of beneficial bacteria. Such biological inputs, when integrated with mineral fertilizers and organic manures, may contribute to improved nutrient availability and crop growth.

3. Materials and Methods

The field experiment was conducted during the Kharif seasons of 2022 and 2023 at the Crop Research Centre, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh, India. The experimental site is located in the Indo-Gangetic alluvial plains at 29.08° N latitude and 77.70° E longitude, with an average elevation of 230 m above mean sea level. The region has a semi-arid, subtropical climate characterized by hot summers and cool winters. During the maize growing seasons, weekly maximum temperature ranged from 27.7 to 39.7 °C, while minimum temperature ranged from 17.9 to 27.4 °C. Total rainfall received during the maize-growing period was 713.1 mm in 2022 and 899.1 mm in 2023.

Before initiation of the experiment, soil samples were collected from the 0–15 cm soil layer and analysed for their physicochemical properties. The soil was clay loam in texture, containing 44.5% sand, 21.8% silt and 33.7% clay. The soil had a bulk density of 1.45 g cm⁻³, pH 7.75, electrical conductivity 0.18 dS m⁻¹ and organic carbon 0.37%. Available nitrogen, phosphorus and potassium were 159, 23.9 and 300 kg ha⁻¹, respectively. The soil was categorized as low in available nitrogen, medium in available phosphorus and high in available potassium. The experimental field had followed a pulse–cereal-based cropping history for five years.

The experiment was laid out in a randomized block design (RBD) with 11 nutrient management treatments and three replications, resulting in 33 experimental units. Each experimental plot had a net size of 24 m² (5.0 m × 4.8 m). Maize was planted at 60 × 20 cm spacing, while mungbean was maintained at 30 × 10 cm spacing.

The nutrient management treatments comprised different combinations of recommended dose of fertilizers (RDF), poultry manure, Beejamrit seed treatment and Jeevamrit spray:

T₁: 100% RDF (Control)

T₂: 100% RDF + Beejamrit

T₃: 100% RDF + Jeevamrit

T₄: 100% RDF + Beejamrit + Jeevamrit

T₅: 75% RDF + 25% N through poultry manure + Jeevamrit

T₆: 75% RDF + 25% N through poultry manure + Beejamrit

T₇: 75% RDF + 25% N through poultry manure + Beejamrit + Jeevamrit

T₈: 100% RDF + 25% N through poultry manure + Beejamrit

T₉: 100% RDF + 25% N through poultry manure + Jeevamrit

T₁₀: 100% RDF + 25% N through poultry manure + Beejamrit + Jeevamrit

T₁₁: 125% RDF

The RDF for maize was 120:60:60 kg N:P₂O₅:K₂O ha⁻¹.

Pre-sowing irrigation (palewa) was applied before field preparation, followed by one disc ploughing, two cultivator operations and leveling through planking. Maize and mungbean were sown manually on 29 June 2022 and 9 June 2023. A seed rate of 25 kg ha⁻¹ was used for both crops. The basal fertilizer application consisted of the full phosphorus and potassium doses along with half of the nitrogen dose through DAP, urea and MOP. The remaining nitrogen was applied in two equal split doses. In treatments receiving poultry manure, poultry manure @ 1 t ha⁻¹ was incorporated at sowing. Beejamrit was applied as a seed treatment @ 6 L ha⁻¹, while Jeevamrit was applied as a 10% solution at sowing and 30 DAS.

Weed management was carried out using Atrazine @ 1.5 kg ha⁻¹ as a pre-emergence application followed by one manual weeding at 38 DAS. Maize fall armyworm was managed using Lambda-cyhalothrin 2.5 EC @ 700 ml ha⁻¹ and Emamectin benzoate 5% SG @ 200 g

ha⁻¹. Irrigation was provided at critical crop growth stages, particularly knee-high, tasseling and silking stages.

Growth observations were recorded at important crop growth stages. For maize, five plants were randomly selected and tagged from each plot. Plant height was recorded at the knee-high, tasseling and harvest stages. At the knee-high stage, height was measured from the ground level to the leaf tip, whereas at tasseling and harvest, height was measured from the ground level to the base of the tassel. The mean value was expressed in centimetres. Physiologically active leaves were counted from the tagged plants and expressed as the mean number of leaves plant⁻¹. For dry matter accumulation, two plants from each plot were uprooted, sun-dried and subsequently oven-dried at 65 °C, and dry weight was expressed as g plant⁻¹.

For mungbean, observations were recorded at 30 DAS and harvest. The growth parameters included plant height, number of branches plant⁻¹ and trifoliate leaves plant⁻¹.

The growth data of maize and mungbean were subjected to analysis of variance (ANOVA) appropriate for the randomized block design. Treatment means were compared using the Critical Difference (CD) at the 5% level of significance following Gomez *et al.* (1984) [24].

4. Results and Discussion

The growth parameters of maize were markedly influenced by the different nutrient management treatments during both experimental seasons. The pooled data (Table 1) showed a progressive improvement in plant height, dry matter accumulation and number of physiologically active leaves with the integration of inorganic fertilizers with poultry manure and biological inputs.

Plant height increased progressively across the nutrient management treatments. The lowest pooled plant height at harvest was recorded under T₁ (100% RDF), with a value of 159.69 cm. Plant height increased with the inclusion of Beejamrit, Jeevamrit and poultry manure in the nutrient management schedule. Treatments T₈ and T₉ recorded pooled plant heights of 201.99 and 205.69 cm, respectively, whereas T₁₀ (100% RDF + 25% N through poultry manure + Beejamrit + Jeevamrit) recorded 207.59 cm.

The maximum pooled plant height was recorded under T₁₁ (125% RDF), reaching 217.33 cm, which was higher than all other treatments. Thus, T₁₁ produced the maximum plant height, while T₁₀ was the next highest treatment. The increase in plant height with higher and integrated nutrient supply indicates the importance of adequate nutrient availability for sustained vegetative growth of maize. Nitrogen availability supports cell division, cell elongation and leaf development, while the incorporation of organic sources can complement mineral nutrient supply and improve the soil environment. Similar improvement in maize growth under integrated nutrient management has been reported by Balyan *et al.* (2006) [3], Kumar *et al.* (2005) [4] and Shilpashree *et al.* (2012) [6].

Dry matter accumulation also responded substantially to nutrient management. The pooled dry matter accumulation ranged from 1310.48 g m⁻² under T₂ to 1692.09 g m⁻² under T₁₁. T₁₀ recorded 1664.13 g m⁻², ranking immediately below T₁₁. T₉ recorded 1552.02 g m⁻², while T₈ recorded 1482.13 g m⁻².

The highest dry matter accumulation under T₁₁ indicates that the additional nutrient supply associated with 125% RDF supported greater biomass production. The comparatively high dry matter accumulation under T₁₀ also demonstrates the contribution of integrated nutrient sources, where poultry manure and biological inputs were combined with the recommended fertilizer dose. The CD values for dry matter accumulation were 58.81 and 86.06 g m⁻², respectively, for the two experimental seasons. The enhanced dry matter accumulation under integrated nutrient management may be attributed to improved nutrient availability and sustained nutrient supply during crop growth. Similar improvements in biomass production under integrated nutrient management have been reported by Haque *et al.* (2012) [15] and Ravi *et al.* (2012) [5].

The number of physiologically active leaves was also influenced by nutrient management. The pooled number of leaves ranged from 9.34

leaves plant⁻¹ under T₂ and T₆ to 11.16 leaves plant⁻¹ under T₁₁. T₁₀ recorded 10.70 leaves plant⁻¹, followed by T₉ with 10.32 leaves plant⁻¹ and T₈ with 10.27 leaves plant⁻¹. The greater number of physiologically active leaves under T₁₁ and T₁₀ suggests improved vegetative development under higher and integrated nutrient availability. A greater number of active leaves can contribute to improved canopy development and photosynthetic activity, thereby supporting greater biomass accumulation. The CD for the number of leaves was 0.48 leaves plant⁻¹ in both seasons, indicating significant treatment effects.

Mungbean growth showed a clear response to the nutrient management treatments applied within the cropping system. Plant height and branching were enhanced by the integration of poultry manure and biological inputs with mineral fertilizers. In contrast to maize, where T₁₁ recorded the maximum values for the reported growth parameters, mungbean showed (table 2) its highest growth under T₁₀.

At 30 DAS, pooled plant height ranged from 10.57 cm under T₁ to 15.91 cm under T₁₀. T₁₁ recorded 13.43 cm, while T₉ recorded 14.89 cm. The progressive increase from T₁ through the integrated treatments indicates a favourable response of early mungbean growth to combined nutrient management. The highest plant height under T₁₀ was substantially greater than that recorded under the control treatment.

The improvement in early plant growth under T₁₀ may be associated with the combined effect of adequate mineral nutrient availability, poultry manure and biological inputs. Beejamrit may support early seedling establishment, while Jeevamrit and organic manure may contribute to nutrient transformation and availability during crop establishment.

A similar trend was observed at harvest. The lowest pooled plant height was recorded under T₁ (28.08 cm), whereas T₁₀ recorded the maximum value of 41.40 cm. T₉ and T₈ recorded pooled plant heights of 40.19 and 38.98 cm, respectively. T₇ recorded 37.29 cm, while T₁₁ recorded 37.59 cm.

The higher plant height under T₁₀ demonstrates the favourable response of mungbean to the combined application of 100% RDF, poultry manure, Beejamrit and Jeevamrit. The result is consistent with the findings of Dhakal *et al.* (2015) [7], Verma *et al.* (2022) [9], Mishra *et al.* (2018) [8] and Saini *et al.* (2022) [23], who reported improved growth of mungbean under integrated nutrient management and combined organic and biological nutrient sources.

Branch development was also improved under integrated nutrient management. The pooled number of branches ranged from 2.65 plant⁻¹ under T₁ to 3.54 plant⁻¹ under T₁₀. T₉ recorded 3.50

branches plant⁻¹, while T₁₁ recorded 3.41 branches plant⁻¹. Treatments incorporating poultry manure along with Beejamrit and/or Jeevamrit generally recorded greater branching than 100% RDF alone.

The greater branching under T₁₀ indicates improved vegetative development under the combined nutrient management treatment. Adequate nutrient availability during the vegetative phase can promote the development of lateral branches and a more extensive canopy. Similar positive effects of integrated nutrient management on mungbean growth have been reported by Verma *et al.* (2022) [9], Mishra *et al.* (2018) [8] and Choudhary *et al.* (2020) [22].

Overall, the two crops exhibited somewhat different responses to nutrient management. In maize, T₁₁ (125% RDF) recorded the maximum plant height, dry matter accumulation and physiologically active leaves, while T₁₀ remained among the highest-performing integrated treatments. In mungbean, T₁₀ (100% RDF + 25% N through poultry manure + Beejamrit + Jeevamrit) consistently recorded the highest values for the reported growth parameters. These findings demonstrate that crop growth responded positively to increased nutrient availability and, particularly in mungbean, to the combined integration of mineral, organic and biological nutrient sources. The contrasting response between maize and mungbean also highlights the importance of crop-specific nutrient requirements when designing integrated nutrient management strategies.

5. Conclusion

The present investigation demonstrated that integrated nutrient management significantly influenced the growth performance of maize and mungbean under the maize-mungbean cropping system. In maize, higher nutrient availability resulted in greater plant height, dry matter accumulation and development of physiologically active leaves, with 125% RDF (T₁₁) recording the highest values for the measured growth parameters. The integrated treatment T₁₀, comprising 100% RDF + 25% N through poultry manure + Beejamrit + Jeevamrit, also produced comparatively higher growth values.

In mungbean, the integrated application of 100% RDF with 25% N through poultry manure, Beejamrit and Jeevamrit (T₁₀) consistently recorded the highest plant height and number of branches plant⁻¹. The results indicate that combining inorganic fertilizers with organic and biological nutrient sources can favourably influence vegetative growth and crop establishment. Overall, the study highlights the importance of balanced and integrated nutrient management for improving growth characteristics of maize and mungbean under the studied agro-climatic conditions.

Table 1. Effect of Direct and Residual INM Practices on Maize (Pooled Analysis)

Treatment	PH harvest 22-23	PH 23-24	PH Pooled	DM 22-23	DM 23-24	DM Pooled	Leaves 22-23	Leaves 23- 24	Leaves Pooled
<i>T</i> ₁ : 100% RDF (Control)	160.00	159.37	159.69	1546.67	1551.76	1549.22	9.90	9.91	9.91
<i>T</i> ₂ : 100% RDF + Beejamrit ST	170.43	169.80	170.12	1288.61	1332.36	1310.48	9.33	9.34	9.34
<i>T</i> ₃ : 100% RDF + Jeevamrit spray	173.00	172.37	172.69	1339.87	1355.62	1347.74	9.43	9.44	9.43
<i>T</i> ₄ : 100% RDF + Beejamrit ST + Jeevamrit spray	181.32	180.69	181.00	1370.65	1386.40	1378.53	9.86	9.87	9.86
<i>T</i> ₅ : 75% RDF + 25% N from PM + Jeevamrit spray	190.09	189.46	189.78	1371.16	1386.91	1379.04	9.66	9.67	9.66
<i>T</i> ₆ : 75% RDF + 25% N from PM + Beejamrit ST	196.84	196.21	196.53	1427.87	1443.62	1435.74	9.33	9.34	9.34
<i>T</i> ₇ : 75% RDF + 25% N from PM + Beejamrit ST + Jeevamrit spray	195.32	194.69	195.00	1450.32	1466.07	1458.19	9.67	9.68	9.68
<i>T</i> ₈ : 100% RDF + 25% N from PM + Beejamrit ST	202.30	201.67	201.99	1474.26	1490.01	1482.13	10.27	10.28	10.27
<i>T</i> ₉ : 100% RDF + 25% N from PM + Jeevamrit spray	206.00	205.37	205.69	1549.47	1554.57	1552.02	10.31	10.32	10.32
<i>T</i> ₁₀ : 100% RDF + 25% N from PM + Beejamrit ST + Jeevamrit spray	207.90	207.27	207.59	1661.59	1666.68	1664.13	10.69	10.70	10.70
<i>T</i> ₁₁ : 125% RDF	217.60	217.06	217.33	1689.54	1694.64	1692.09	11.16	11.17	11.16
SE (m) ±	2.45	2.44		28.89	28.97		0.17	0.16	
C.D. (<i>p</i> = 0.05)	7.28	7.25		58.81	86.06		0.48	0.48	

(continued on next page)

Table 2. Effect of Direct and Residual INM Practices on Mungbean (Pooled Analysis)

Treatment	PH 30DAS 22	PH 30DAS 23	PH30 Pooled	PH Harvest 22	PH Harvest 23	PHH Pooled	Branches 22	Branches 23	Branches Pooled
T ₁ : 100% RDF (Control)	10.00	11.14	10.57	27.00	29.16	28.08	2.67	2.62	2.65
T ₂ : 100% RDF + Beejamrit ST	10.11	11.25	10.68	29.98	32.14	31.06	3.25	3.03	3.14
T ₃ : 100% RDF + Jeevamrit spray	10.23	11.37	10.80	30.00	32.16	31.08	2.97	2.76	2.87
T ₄ : 100% RDF + Beejamrit ST + Jeevamrit spray	11.30	12.44	11.87	30.21	32.37	31.29	3.00	2.78	2.89
T ₅ : 75% RDF + 25% N from PM + Jeevamrit spray	11.90	13.04	12.47	34.76	36.92	35.84	2.83	2.95	2.89
T ₆ : 75% RDF + 25% N from PM + Beejamrit ST	12.00	13.14	12.57	35.39	37.55	36.47	3.10	3.22	3.16
T ₇ : 75% RDF + 25% N from PM + Beejamrit ST + Jeevamrit spray	12.54	13.68	13.11	36.21	38.37	37.29	3.20	3.37	3.29
T ₈ : 100% RDF + 25% N from PM + Beejamrit ST	13.84	14.98	14.41	37.90	40.06	38.98	3.30	3.36	3.33
T ₉ : 100% RDF + 25% N from PM + Jeevamrit spray	14.32	15.46	14.89	39.11	41.27	40.19	3.42	3.58	3.50
T ₁₀ : 100% RDF + 25% N from PM + Beejamrit ST + Jeevamrit spray	15.34	16.48	15.91	40.32	42.48	41.40	3.50	3.59	3.54
T ₁₁ : 125% RDF	12.60	14.26	13.43	36.02	39.16	37.59	3.40	3.42	3.41
SE (m) ±	0.24	0.18		0.63	0.50		0.16	0.18	
C.D. (p = 0.05)	0.72	0.53		1.87	1.48		0.47	0.54	

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How to cite this article: Rajput A, Singh V, Tripathi KM, Jaiswal AK, Singh HS, Chaubey C, et al. Growth response of maize and mungbean to integrated nutrient management under a maize–mungbean cropping system. *International Journal of Research in Agronomy*. 2026;9(9):1264-1271. doi: <https://www.doi.org/10.33545/2618060X.2026.v9.i9q.6684>

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