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Divya Chouhan
Career Point University, Alaniya,
Kota, Rajasthan, India

Effect of organic nitrogen management practices on growth attributes of wheat (*Triticum aestivum* L.)

Divya Chouhan

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Abstract

A field experiment was conducted to evaluate the effect of different organic nitrogen management practices on growth parameters of wheat (*Triticum aestivum* L.). The experiment comprised eight treatments involving different combinations of Farm Yard Manure (FYM), split nitrogen application through irrigation, Jeevamrit, and Panchagavya under organic nutrient management practices. The experiment was laid out in a Randomized Block Design with appropriate replications during the rabi season. Observations on emergence count, plant height, dry matter accumulation, and number of tillers were recorded at different growth stages. The results revealed that the application of 50% Recommended Dose of Nitrogen (RDN) through FYM as basal along with split nitrogen application through irrigation supplemented with Jeevamrit @ 500 L ha⁻¹ and Panchagavya @ 3% spray (N8) significantly enhanced all growth parameters of wheat. The treatment N8 recorded the highest emergence count (136.00), plant height at harvest (112.07 cm), dry matter accumulation at harvest (46.57 g plant⁻¹), and number of tillers at harvest (107.00). This treatment was found statistically superior over other treatments and closely followed by N7 comprising 75% RDN through FYM as basal + 25% RDN through irrigation along with Jeevamrit and Panchagavya spray. The lowest values for growth parameters were observed under N1, where 100% RDN was applied through FYM as basal application alone.

Keywords: Wheat, organic nitrogen management, farm yard manure (FYM), Jeevamrit, Panchagavya

Introduction

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops and serves as a staple food for a large proportion of the world's population (Choudhary *et al.*, 2017; Sharma *et al.*, 2024; Manohar *et al.*, 2025; Choudhary *et al.*, 2024) [8, 9, 29, 30, 31, 20, 7]. In India, wheat occupies a prominent position among food grain crops and contributes significantly to national food security (Meena *et al.*, 2024; Singh, 2021; Sharma *et al.*, 2024; Manohar *et al.*, 2025; Choudhary *et al.*, 2024) [21, 32, 29, 30, 31, 20, 7]. Increasing demand for wheat production necessitates the adoption of sustainable nutrient management practices that enhance productivity while maintaining soil health and environmental quality (Khatua *et al.*, 2025; Choudhary *et al.*, 2017; Gawdiya *et al.*, 2023; Somdutt *et al.*, 2021; Sheoran *et al.*, 2025; Ahmad *et al.*, 2025; Dhiman *et al.*, 2023) [16, 8, 9, 12, 1, 10]. Nitrogen is one of the most essential nutrients required for the growth and development of wheat, strongly influencing yield, protein content, and biomass production (Singh *et al.*, 2020; Choudhary *et al.*, 2017; Gawdiya *et al.*, 2023; Bhardwaj *et al.*, 2021; Somdutt *et al.*, 2021; Wu *et al.*, 2025; Hu *et al.*, 2021; Sheoran *et al.*, 2025; Ahmad *et al.*, 2025) [33, 8, 9, 12, 4, 40, 13, 1]. It plays a vital role in chlorophyll formation, photosynthesis, protein synthesis, and vegetative growth (Singh *et al.*, 2020; Gawdiya *et al.*, 2023; Bhardwaj *et al.*, 2021; Somdutt *et al.*, 2021; Hu *et al.*, 2021; Sheoran *et al.*, 2025; Ahmad *et al.*, 2025) [12, 4, 13, 1]. Conventional wheat cultivation largely depends on chemical fertilizers for meeting nitrogen requirements; however, continuous and indiscriminate use of inorganic fertilizers has led to deterioration of soil fertility, nutrient imbalance, reduced microbial activity, and environmental pollution (Khatua *et al.*, 2025; Singh *et al.*, 2020; Choudhary *et al.*, 2017; Gawdiya *et al.*, 2023; Bhardwaj *et al.*, 2021; Somdutt *et al.*, 2021; Hu *et al.*, 2021; Sheoran *et al.*, 2025; Ahmad *et al.*, 2025; Dhiman *et al.*, 2023). Therefore, there is growing interest in organic nutrient management approaches that can sustain crop productivity while preserving soil health (Khatua *et al.*, 2025; Choudhary *et al.*, 2017; Gawdiya *et al.*, 2023; Somdutt *et al.*, 2021; Hu *et al.*, 2021; Sheoran *et al.*, 2025; Ahmad *et al.*, 2025; Dhiman *et al.*, 2023) [16, 8, 9, 12, 13, 1, 10].

Corresponding Author:
Divya Chouhan
Career Point University, Alaniya,
Kota, Rajasthan, India

Organic sources such as Farm Yard Manure (FYM), Jeevamrit/Jeevamrut, and Panchagavya have gained considerable attention in sustainable agriculture due to their beneficial effects on soil physical, chemical, and biological properties (Khatua *et al.*, 2025; Choudhary *et al.*, 2017; Gawdiya *et al.*, 2023; Game *et al.*, 2020; Somdutt *et al.*, 2021; Hu *et al.*, 2021; Sheoran *et al.*, 2025; Dhiman *et al.*, 2023) [16, 8, 9, 12, 11, 13, 10]. FYM improves soil structure, water-holding capacity, and nutrient availability (Khatua *et al.*, 2025; Choudhary *et al.*, 2017; Gawdiya *et al.*, 2023; Somdutt *et al.*, 2021; Hu *et al.*, 2021; Sheoran *et al.*, 2025; Ahmad *et al.*, 2025; Dhiman *et al.*, 2023) [16, 8, 9, 12, 13, 1, 10], while Jeevamrit and Panchagavya act as bio-enhancers containing beneficial microorganisms, enzymes, plant growth regulators, and micronutrients (Khatua *et al.*, 2025; Choudhary *et al.*, 2017; Game *et al.*, 2020; Hu *et al.*, 2021; Sheoran *et al.*, 2025) [16, 8, 9, 11, 13].

These organic formulations stimulate microbial activity and improve nutrient mineralization, thereby enhancing plant growth and development (Khatua *et al.*, 2025; Choudhary *et al.*, 2017; Gawdiya *et al.*, 2023; Somdutt *et al.*, 2021; Hu *et al.*, 2021; Sheoran *et al.*, 2025) [16, 8, 9, 12, 11, 13]. Split application of nitrogen at critical growth stages such as crown root initiation and tillering ensures synchronized nutrient availability with crop demand, improving nitrogen use efficiency and yield (Singh *et al.*, 2020; Choudhary *et al.*, 2017; Gawdiya *et al.*, 2023; Bhardwaj *et al.*, 2021; Somdutt *et al.*, 2021; Wu *et al.*, 2025; Ahmad *et al.*, 2025) [33, 8, 9, 12, 4, 40, 1]. Integration of organic nutrient sources with liquid organic formulations may therefore provide a balanced and sustained nutrient supply to wheat plants and improve crop performance, especially under organic or integrated systems (Khatua *et al.*, 2025; Choudhary *et al.*, 2017; Gawdiya *et al.*, 2023; Somdutt *et al.*, 2021; Hu *et al.*, 2021; Sheoran *et al.*, 2025; Ahmad *et al.*, 2025; Dhiman *et al.*, 2023) [16, 8, 9, 12, 13, 1, 10].

Keeping these facts in view, the present investigation was undertaken to study the effect of different organic nitrogen management practices on emergence count, plant height, dry matter accumulation, and number of tillers of wheat under organic production systems (Khatua *et al.*, 2025; Choudhary *et al.*, 2017; Gawdiya *et al.*, 2023; Somdutt *et al.*, 2021; Hu *et al.*, 2021; Sheoran *et al.*, 2025; Dhiman *et al.*, 2023) [16, 8, 9, 12, 13, 10].

Materials and methods

Experimental site

The present investigation entitled “Effect of Organic Nitrogen Management Practices on Growth Attributes of Wheat (*Triticum aestivum* L.)” was conducted during the Rabi season of 2025-26 at the Agriculture Research Farm of Career Point University. The experimental farm is situated in the south-eastern region of Rajasthan and falls under the semi-arid agro-climatic zone characterized by hot summers and cool winters. The region receives moderate rainfall, most of which occurs during the monsoon season.

The experimental field was nearly levelled, well drained, and suitable for wheat cultivation. The soil of the experimental site represented the typical wheat-growing soils of south-eastern Rajasthan. Before sowing, composite soil samples were collected randomly from different locations of the field at 0-15 cm depth and analyzed for physico-chemical properties such as soil pH, electrical conductivity, organic carbon, and available nitrogen, phosphorus, and potassium using standard analytical procedures.

Climatic Conditions

The climate of the Kota region is semi-arid with distinct winter and summer seasons. During the crop growth period, the prevailing weather conditions remained favorable for wheat cultivation. The average temperature during the Rabi season ranged between 8 °C and 30 °C. The crop received congenial environmental conditions during vegetative as well as reproductive growth stages. Irrigation water was applied according to treatment requirements to avoid moisture stress during crop growth.

Experimental Material

The wheat variety Raj 4037 was used for the present investigation. The variety is suitable for cultivation under Rajasthan conditions and possesses good yield potential and adaptability under irrigated conditions.

Experimental Details

The experiment was laid out in a Randomized Block Design (RBD) comprising eight treatments with three replications.

Experimental Details

Particulars	Details
Experimental design	Randomized Block Design (RBD)
Number of treatments	8
Number of replications	3
Total number of plots	24
Plot size (gross)	5.0 m × 3.6 m
Crop	Wheat
Variety	Raj 4037
Season	Rabi, 2025-26
Row spacing	22.5 cm
Location	Agriculture Research Farm, Career Point University, Kota

Treatment Details

The experiment consisted of eight organic nitrogen management treatments involving Farm Yard Manure (FYM), Jeevamrit, and Panchagavya.

Treatment Details

Treatment	Details
N1	100% RDN through FYM as basal application
N2	50% RDN through FYM as basal + 50% RDN at first irrigation
N3	75% RDN through FYM as basal + 25% RDN at first irrigation
N4	50% RDN through FYM as basal + 25% RDN at first irrigation + 25% RDN at second irrigation
N5	N ₁ +Jeevamrit @ 500Lha ⁻¹ atsowingandfirstirrigation+Panchagavya @ 3% sprayatpre-floweringstage
N6	N ₂ +Jeevamrit @ 500Lha ⁻¹ atsowingandfirstirrigation+Panchagavya @ 3% sprayatpre-floweringstage
N7	N ₃ +Jeevamrit @ 500Lha ⁻¹ atsowingandfirstirrigation+Panchagavya @ 3% sprayatpre-floweringstage
N8	N ₄ +Jeevamrit @ 500Lha ⁻¹ atsowingandfirstirrigation+Panchagavya @ 3% sprayatpre-floweringstage

Land Preparation

The experimental field was prepared thoroughly to obtain fine tilth for proper germination and establishment of the crop. Initially, the field was ploughed with a tractor-drawn mould board plough followed by two cross harrowings. Planking was done after each tillage operation to conserve soil moisture and pulverize the soil properly. Well-decomposed FYM was incorporated into the soil before sowing according to treatment requirements.

Preparation and application of organic inputs

Farm Yard Manure (FYM)

Well-decomposed FYM was used as the major organic source of nitrogen. The quantity of FYM required for each treatment was calculated on the basis of the recommended dose of nitrogen (RDN) and nitrogen content present in FYM. FYM was applied either as basal or in split doses according to treatment combinations.

Jeevamrit

Jeevamrit is a fermented liquid organic formulation prepared using indigenous cow products and organic ingredients. The formulation was prepared using the following ingredients:

- Fresh cow dung - 10 kg
- Cow urine - 10 L
- Jaggery - 2 kg
- Pulse flour (Besan) - 2 kg
- Rhizospheric soil - 1 kg
- Water - 200 L

All ingredients were mixed thoroughly in a plastic drum and allowed to ferment for 5-7 days with regular stirring twice daily. Jeevamrit was applied @ 500 L ha⁻¹ at sowing and at first irrigation according to the treatment schedule.

Panchagavya

Panchagavya is an organic growth stimulant prepared from cow-based products including cow dung, cow urine, milk, curd, and ghee along with jaggery and banana. The prepared Panchagavya solution was diluted to 3% concentration for foliar spray. Foliar application of Panchagavya @ 3% was carried out at pre-flowering stage using a knapsack sprayer during morning hours.

Sowing of Crop

The crop was sown during the Rabi season of 2025-26 using the recommended seed rate. Sowing was carried out manually in rows spaced 22.5 cm apart. Uniform seed placement and adequate soil moisture were maintained to ensure proper germination and crop establishment.

Irrigation Management

Irrigation was applied uniformly to all plots except treatment variations involving split application of organic nitrogen. The first irrigation was applied at Crown Root Initiation (CRI) stage followed by subsequent irrigations at tillering, booting, flowering, and grain filling stages according to crop requirement.

Intercultural Operations

Necessary intercultural operations such as weeding and hoeing were carried out periodically to keep the experimental field free from weeds. Plant protection measures were adopted whenever necessary to protect the crop from insect pests and diseases.

Emergence count

Emergence count was recorded at 15 days after sowing (DAS) to assess germination percentage and establishment of wheat seedlings under different organic nitrogen management treatments. One meter row length was selected randomly from two locations in each experimental plot excluding border rows. The number of healthy emerged seedlings was counted manually and the average value was expressed as number of emerged plants per meter row length.

The data presented in Table 1 revealed that different organic nitrogen management practices exerted significant influence on emergence count of wheat. Among all treatments, the highest emergence count (136.00 plants m⁻¹ row length) was recorded under treatment N8 comprising 50% RDN through FYM as basal application along with split nitrogen application and supplementation of Jeevamrit and Panchagavya spray. This treatment was found significantly superior over all other treatments. The second-best treatment was Nu₇ (131.00 plants m⁻¹ row length), which remained statistically at par with Nu₈ in some cases. The lowest emergence count (110.00 plants m⁻¹ row length) was observed under Nu₁ where 100% RDN was supplied through FYM as basal application alone. The improvement in emergence count under integrated organic nutrient treatments might be attributed to better soil physical conditions, enhanced microbial activity, improved nutrient availability, and growth-promoting effects of Jeevamrit and Panchagavya (Sharma *et al.*, 2024; Meena *et al.*, 2024; Khatua *et al.*, 2025; Bhardwaj *et al.*, 2021; Game *et al.*, 2020) [29, 30, 31, 21, 16, 4, 11]. Similar findings regarding enhanced germination and crop establishment due to integrated organic nutrient management have also been reported by several researchers in wheat and cereal/forage crops (Somdutt *et al.*, 2021; Mol *et al.*, 2024; Onte *et al.*, 2025; Sharma *et al.*, 2024; Khatua *et al.*, 2025; Nautiyal & Bankoti, 2025; Bhardwaj *et al.*, 2021; Singh *et al.*, 2020; Choudhary *et al.*, 2017; Gawdiya *et al.*, 2023; Game *et al.*, 2020) [18, 23, 33, 29, 30, 31, 16, 4, 8].

Table 1: Effect of organic nitrogen on emergence count and plant height on wheat.

Treatment Details	Emergence count	30 DAS	60 DAS	90 DAS	At Harvest
N1: 100% Recommended Dose of Nitrogen (RDN) through Farm Yard Manure (FYM) as basal application	110.00	24.15	51.32	73.44	85.07
N2: 50% RDN through FYM as basal application + 50% RDN through irrigation at Crown Root Initiation (CRI) stage	114.00	26.42	54.76	77.28	88.80
N3: 75% RDN through FYM as basal application + 25% RDN through irrigation at Crown Root Initiation (CRI) stage	117.00	28.37	57.91	80.65	91.93
N4: 50% RDN through FYM as basal application + 25% RDN through irrigation at CRI stage + 25% RDN through irrigation at tillering stage	120.00	30.84	61.58	84.12	95.73
N5: 100% RDN through FYM as basal application + Jeevamrit @ 500 L ha ⁻¹ + Panchagavya @ 3% spray	123.00	33.15	64.42	87.86	99.03
N6: 50% RDN through FYM as basal + 50% RDN through irrigation + Jeevamrit + Panchagavya spray	127.00	35.68	68.94	92.40	103.10
N7: 75% RDN through FYM as basal + 25% RDN through irrigation + Jeevamrit + Panchagavya spray	131.00	38.41	72.88	96.85	107.07
N8: 50% RDN through FYM as basal + split nitrogen application + Jeevamrit + Panchagavya spray	136.00	41.76	77.32	101.64	112.07
SEm (±)	1.21	0.82	1.24	1.38	1.45
CD (P=0.05)	3.67	2.48	3.76	4.18	4.39

Plant height

Plant height was recorded periodically at different growth stages and at harvest to evaluate the influence of different organic nitrogen management practices on crop growth. Five healthy and representative plants were selected randomly from each plot and tagged properly. Plant height was measured from the ground surface to the tip of the spike excluding awns using a meter scale. The average height was expressed in centimeters (cm). Plant height increased progressively with advancement of crop growth stages under all treatments. The data indicated significant differences among treatments at 30, 60, 90 DAS and at harvest. At harvest, the maximum plant height (112.07 cm) was recorded under treatment N₈, which was significantly superior over all other treatments. The treatments Nu₇ (107.07 cm) and N₆ (103.10 cm) also recorded higher plant height compared to other treatments. The minimum plant height at harvest (85.07 cm) was recorded under N₁. The increased plant height under N₈ may be due to continuous and balanced supply of nutrients through split application of FYM combined with Jeevamrit and Panchagavya (Sharma *et al.*, 2024; Sunil, 2020; Meena *et al.*, 2024; Prakash *et al.*, 2022; Sharma *et al.*, 2024) [29, 30, 31, 34, 21, 24]. Jeevamrit enhances microbial population and nutrient mineralization, improving nutrient availability to wheat plants and sustaining growth during critical stages (Sharma *et al.*, 2024; Sunil, 2020; Meena *et al.*, 2024; Bhardwaj *et al.*, 2021; Verma *et al.*, 2023) [29, 30, 31, 34, 21, 4, 37]. Panchagavya contains nutrients, beneficial microorganisms and growth promoting substances (including plant hormones) that stimulate vegetative growth and biomass accumulation in several field crops (Sharma *et al.*, 2024; Chongre *et al.*, 2020; Bagri & Bhadauria, 2023; Sunil, 2020; Vinutha *et al.*, 2023; Chandana *et al.*, 2024; Verma *et al.*, 2023; Saini *et al.*, 2025) [29, 30, 31, 6, 2, 34, 38, 5, 37]. Improved nitrogen availability during critical crop growth stages such as tillering and stem elongation has been shown to enhance N supply to wheat and other cereals, supporting greater growth and N use efficiency (Bagri & Bhadauria, 2023; Sunil, 2020; Bhardwaj *et al.*, 2021) [2, 34, 4]. This synchronized nutrient supply and improved soil biological activity likely enhanced cell division and elongation in meristematic tissues, resulting in increased plant height under integrated organic nutrient management like N₈ (Chongre *et al.*, 2020; Sunil, 2020; Meena *et al.*, 2024; Bhardwaj *et al.*, 2021; Prakash *et al.*, 2024; Verma *et al.*, 2023) [6, 34, 21, 4, 37].

Dry matter accumulation

Dry matter accumulation was recorded at 30-day intervals during crop growth. Five representative plants were uprooted carefully

from each plot and washed thoroughly with clean water to remove adhered soil particles. The plant samples were initially shade dried and subsequently oven dried at 65±5 °C until constant weight was obtained. The dried samples were weighed using an electronic digital balance and dry matter accumulation was expressed as g plant⁻¹. Dry matter accumulation increased continuously with crop age under all treatments. Significant differences among treatments were observed at all growth stages. The highest dry matter accumulation at harvest (46.57 g plant⁻¹) was recorded under treatment N₈, followed by Nu₇ (42.77 g plant⁻¹) and N₆ (39.23 g plant⁻¹). The lowest dry matter accumulation (24.80 g plant⁻¹) was recorded under Nu₁. Higher dry matter accumulation under integrated organic nitrogen management treatments may be attributed to improved nutrient uptake, enhanced photosynthetic efficiency, and better root development (Bhardwaj *et al.*, 2021; Khan *et al.*, 2023; Bakhtiar, 2017; Kavinder *et al.*, 2019) [4, 15, 3]. The combined application of FYM, Jeevamrit, and Panchagavya likely improved soil biological activity and nutrient availability throughout the crop growth period, thereby increasing biomass production (Sharma *et al.*, 2024; Singh *et al.*, 2024; Walia *et al.*, 2024; Ranjan *et al.*, 2023; Choudhary *et al.*, 2024) [29, 30, 31, 32, 39, 25, 7]. Split application of nitrogen also ensured synchronized nutrient availability with crop demand, resulting in better vegetative growth and dry matter production (Sharma *et al.*, 2024; Bhardwaj *et al.*, 2021; Tanwar *et al.*, 2021; Kavinder *et al.*, 2019; Bakhtiar, 2017) [29, 30, 31, 4, 36, 3].

Number of tillers per meter row length

The number of tillers was recorded at 30-day intervals during crop growth. One meter row length was selected randomly at two different places in each plot and all tillers present within the selected row length were counted manually. The average number of tillers was calculated and expressed as tillers per meter row length.

Statistical Analysis

The experimental data recorded for various observations were statistically analyzed using the analysis of variance (ANOVA) technique appropriate for Randomized Block Design as described by Gomez and Gomez (1984). The significance of treatment effects was tested using the F-test at 5% level of significance. Standard error of mean [SEm (±)] and critical difference (CD) at P=0.05 were calculated for comparing treatment means wherever treatment effects were found significant.

Results and Discussion

Table 2: Effect of organic nitrogen on dry matter accumulation.

Treatment Details	Dry matter accumulation g plant ⁻¹			
	30 DAS	60 DAS	90 DAS	At Harvest
N ₁ : 100% Recommended Dose of Nitrogen (RDN) through Farm Yard Manure (FYM) as basal application	4.82	12.44	19.86	24.80
N ₂ : 50% RDN through FYM as basal application + 50% RDN through irrigation at Crown Root Initiation (CRI) stage	5.38	13.95	21.92	27.50
N ₃ : 75% RDN through FYM as basal application + 25% RDN through irrigation at Crown Root Initiation (CRI) stage	5.94	15.42	23.74	29.80
N ₄ : 50% RDN through FYM as basal application + 25% RDN through irrigation at CRI stage + 25% RDN through irrigation at tillering stage	6.68	17.36	26.48	32.87
N ₅ : 100% RDN through FYM as basal application + Jeevamrit @ 500 L ha ⁻¹ + Panchagavya @ 3% spray	7.44	19.12	28.96	35.77
N ₆ : 50% RDN through FYM as basal + 50% RDN through irrigation + Jeevamrit + Panchagavya spray	8.36	21.45	31.84	39.23
N ₇ : 75% RDN through FYM as basal + 25% RDN through irrigation + Jeevamrit + Panchagavya spray	9.28	23.84	35.62	42.77
N ₈ : 50% RDN through FYM as basal + split nitrogen application + Jeevamrit + Panchagavya spray	10.44	26.86	39.18	46.57
SEm (±)	0.28	0.54	0.72	0.88
CD (P=0.05)	0.84	1.64	2.18	2.67

Table 3: Effect of organic nitrogen on number of tillers.

Treatment Details	Number of tillers			
	30 DAS	60 DAS	90 DAS	At Harvest
N1: 100% Recommended Dose of Nitrogen (RDN) through Farm Yard Manure (FYM) as basal application	24.00	48.00	66.00	72.00
N2: 50% RDN through FYM as basal application + 50% RDN through irrigation at Crown Root Initiation (CRI) stage	26.00	52.00	71.00	77.00
N3: 75% RDN through FYM as basal application + 25% RDN through irrigation at Crown Root Initiation (CRI) stage	28.00	56.00	75.00	81.33
N4: 50% RDN through FYM as basal application + 25% RDN through irrigation at CRI stage + 25% RDN through irrigation at tillering stage	31.00	60.00	80.00	86.00
N5: 100% RDN through FYM as basal application + Jeevamrit @ 500 L ha ⁻¹ + Panchagavya @ 3% spray	34.00	64.00	85.00	91.00
N6: 50% RDN through FYM as basal + 50% RDN through irrigation + Jeevamrit + Panchagavya spray	37.00	69.00	90.00	96.00
N7: 75% RDN through FYM as basal + 25% RDN through irrigation + Jeevamrit + Panchagavya spray	40.00	73.00	95.00	101.33
N8: 50% RDN through FYM as basal + split nitrogen application + Jeevamrit + Panchagavya spray	44.00	78.00	101.00	107.00
SEm (±)	0.96	1.18	1.42	1.54
CD (P=0.05)	2.91	3.58	4.30	4.66

Number of tillers

The number of tillers per meter row length differed significantly among treatments at all growth stages. The treatment N₈ recorded the maximum number of tillers at harvest (107.00), which was significantly superior over other treatments. This was followed by N₇ (101.33) and N₆ (96.00). The lowest number of tillers at harvest (72.00) was recorded under N₁. The increase in tiller production under integrated organic nitrogen management practices may be attributed to better nitrogen availability during active vegetative growth stages and improved soil health conditions, as split FYM plus liquid organics enhanced nutrient availability, soil organic carbon, and microbial activity in organic wheat systems (Sharma *et al.*, 2024; Saharan *et al.*, 2023; Mahapatra *et al.*, 2020) [29, 30, 31, 27, 19]. Adequate nutrient supply through split nitrogen application enhanced meristematic activity and tiller formation, with studies reporting higher effective tillers and yield where N was applied in splits rather than a single basal dose (Sharma *et al.*, 2024; Mhango *et al.*, 2024; Choudhary *et al.*, 2024; Kumar *et al.*, 2025; Saady *et al.*, 2020) [29, 30, 31, 22, 7, 18, 28].

In addition, the bio enhancing effects of Jeevamrit and Panchagavya might have stimulated physiological activities and root growth, resulting in increased tillering capacity, since these liquid organics and related formulations increased microbial populations, nutrient mineralization, growth promoting substances, and effective tillers or tillers per plant in wheat and other cereals (Sharma *et al.*, 2024; Zulfiqar *et al.*, 2023; Kumar *et al.*, 2024; Mahapatra *et al.*, 2020; Ote *et al.*, 2025; Singh *et al.*, 2023; Tahir *et al.*, 2024; Yang *et al.*, 2019) [29, 30, 31, 42, 17, 19, 18, 33, 35, 41].

Conclusion

Based on the results of the present investigation, it can be concluded that organic nitrogen management practices significantly influenced the growth attributes of wheat (*Triticum aestivum* L.). Among the different treatments, application of 50% RDN through FYM as basal along with split nitrogen application through irrigation supplemented with Jeevamrit @ 500 L ha⁻¹ and Panchagavya @ 3% spray (N₈) proved most effective in improving emergence count, plant height, dry matter accumulation, and number of tillers. The superior performance of treatment N₈ may be attributed to balanced and continuous nutrient availability, enhanced microbial activity, improved soil health, and growth-promoting effects of Jeevamrit and Panchagavya. Integrated use of FYM with liquid organic formulations and split nitrogen application ensured better nutrient synchronization with crop demand, resulting in enhanced vegetative growth and biomass production. Therefore, integrated organic nitrogen management involving FYM, Jeevamrit, and Panchagavya can be recommended as a sustainable and eco-friendly nutrient management strategy for improving growth

performance of wheat under the south-eastern region of Rajasthan.

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