



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(9): 206-210
Received: 19-06-2026
Accepted: 23-07-2026

Devyani S Ilhe
PG Scholar, Agronomy Section,
College of Agriculture, Nagpur,
Maharashtra, India

Dr. DD Mankar
Professor of Agronomy (CAS),
Agronomy Section, College of
Agriculture, Nagpur, Maharashtra,
India

Pradheepa S
PG Scholar, Agronomy Section,
College of Agriculture, Nagpur,
Maharashtra, India

Prachi J Gabhane
PG Scholar, Agronomy Section,
College of Agriculture, Nagpur,
Maharashtra, India

Shilpa J Ambatkar
PG Scholar, Agronomy Section,
College of Agriculture, Nagpur,
Maharashtra, India

Nikita M Rajput
PG Scholar, Agronomy Section,
College of Agriculture, Nagpur,
Maharashtra, India

Corresponding Author:
Devyani S Ilhe
PG Scholar, Agronomy Section,
College of Agriculture, Nagpur,
Maharashtra, India

Effect of spacing and fertilizer dose on growth, yield, quality and economics of fodder maize (*Zea Mays*)

Devyani S Ilhe, DD Mankar, Pradheepa S, Prachi J Gabhane Shilpa J Ambatkar and Nikita M Rajput

DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i9c.6498>

Abstract

A field experiment was conducted during *kharif* season of 2025-26 at Agronomy Farm, College of Agriculture, Nagpur, to study the “Effect of spacing and fertilizer dose on growth, yield, quality and economics of fodder maize (*Zea mays*)”. Result revealed that closer spacing 30 cm x 10 cm recorded higher plant height, leaf area plant⁻¹, leaf area index, green fodder yield t ha⁻¹, crude fiber, GMR, NMR and B : C ratio while wider spacing recorded maximum stem girth, dry matter accumulation, CGR and RGR of dry matter, TDN and crude protein content.

Among all fertilizer dose F₃ 150% RDF (120:45:30 kg NPK ha⁻¹) recorded maximum and significantly higher plant height, stem girth, fresh leaf weight (g) plant⁻¹, fresh weight of stem (g) plant⁻¹ recorded at 40 DAS and at harvest as compare to all other fertilizer treatments and was at par with fertilizer dose F₁, F₂ and F₆. The maximum and significantly higher leaf area index recorded with application of higher fertilizer dose treatment F₃ 150% RDF (120:45:30 kg NPK ha⁻¹) at 40 DAS and was at par with fertilizer dose F₁, F₂, F₅ and F₆. The green fodder yield (t) ha⁻¹ also recorded maximum and significantly higher due to application of higher fertilizer dose treatment F₃ 150% RDF (120:45:30 kg NPK ha⁻¹) as compare to all other fertilizer treatments and was at par with F₁ and F₂. Total digestible nutrients (TDN %) and crude protein (%) content recorded maximum and significantly higher at 45 DAS and at harvest due to application of higher fertilizer dose treatment F₃ 150% RDF (120:45:30 kg NPK ha⁻¹) however TDN % was at par with F₂, F₄ and F₆ while the application of F₄ 75% RDF (60:22.5:15 kg NPK ha⁻¹) + 2% DAP spray at 20 DAS recorded maximum and significantly higher crude fiber (%) content at harvest and was at par with F₆. However, fertilizer dose F₃ 150% RDF (120:45:30 kg NPK ha⁻¹) recorded maximum and significantly higher gross monetary return and net monetary return and was at par with F₂ and F₁ along with higher benefit-cost (B:C) ratio of fodder maize.

Keywords: Fodder maize, spacing, fertilizer dose, growth, yield, quality, economics

Introduction

Maize (*Zea mays* L.), being one of the most popular dual crops grown widely in *kharif* season for grain as well as for fodder in India (Subrahmanya *et al.*, 2017) [8]. India holds the seventh position in global maize production, contributing a modest 2.7 percent to the total global output of maize ((Anonymous, 2024). India has largest animal population of the world and first position in milk production. However, milk productivity is less compared to developed countries due to shortage of green, succulent and nutritious fodder. Among fodder crops, maize (*Zea mays* L.) is the most important silage plants in the world because of its high yield, high energy forage produced with lower labour and machinery requirements than other forage crops (Kumar *et al.*, 2016).

Forage maize responds differently to spacing and fertilizer dose under different environmental and cultural factors which influence maize forage yield and quality. However, plant spacing and nitrogenous fertilizer application is considered most important factors which can increase fodder production significantly. Competition associated with different spacing alters plant morphology in various ways. As such there is a considerable scope for increasing yield by adjusting optimum plant spacing. An adequate supply of nutrients at each growth stage is highly essential for good yield and quality of fodder maize (Paul *et al.*, 2019) [5]. NPK fertilization of maize influences DM yield by influencing leaf area index, leaf area duration and photosynthetic efficiency (Kumar *et al.*, 2016) [4].

Material and Methods

A field experiment was carried out at the Agronomy Research Farm, College of Agriculture, Nagpur, during the 2025-2026 *kharif* season. The investigation was conducted to determine the "Growth, yield and quality of fodder maize (*Zea mays*) as influenced by spacing and fertilizer dose". The experiment was laid out in Split Plot Design with three replications and twelve treatments. *viz.*, two spacing 30 cm x 10 cm (S₁) and 45 cm x 7 cm (S₂) in main plot and six fertility levels in subplots (F₁) 100% RDF (80:30:20 kg NPK ha⁻¹), (F₂) 125% RDF (100:37.5:25 kg NPK ha⁻¹), (F₃) 150% RDF (120:45:30 kg NPK ha⁻¹), (F₄) 75% RDF (60 :22.5 :15 kg NPK ha⁻¹) + 2% DAP spray at 20 DAS, (F₅) 75% RDF (60 :22.5 :15 kg NPK ha⁻¹) + 2% urea spray at 20 DAS and (F₆) 75% RDF (60 :22.5 :15 kg NPK ha⁻¹) + 2% DAP spray at 20 DAS + 2% urea at 40 DAS of recommended dose of fertilizer (RDF 80 :30 :20 kg NPK ha⁻¹).

The soil of the experimental site was clay in texture, low in available nitrogen, phosphorous and sulphur and rich in available potash. Organic carbon content was medium and soil reaction was slightly alkaline. Fodder maize PDKV- Aarambh (BMH 18-2) was sown on June 29, 2025 and harvested on August 26, 2025.

Results and Discussion

Effect of spacing

Growth attributes

Spacing 30 cm x 10 cm recorded maximum and significantly higher plant height as compared to spacing 45 cm x 7 cm at 40 DAS and at harvest, fresh weight of leaves plant⁻¹ (g) recorded maximum and significantly higher due to spacing 30 cm x 10 cm at 40 DAS. These results might be due to increased competition for light often causes plants to grow taller as they try to overtop neighbouring plants. These findings are accordance with the findings of Satpal *et al.* (2024) [6]. Leaf area plant⁻¹ (dm²) was recorded maximum and significantly influenced by spacing 30 cm x 10 cm at 40 DAS and at harvest but leaf area index was found maximum and significantly higher at all growth stages.

While spacing 45 cm x 7 cm recorded maximum and significantly higher stem girth at 40 DAS and at harvest, leaf: stem ratio at 15 DAS, dry matter accumulation (g) plant⁻¹ at 30 DAS. RGR of dry matter found maximum and significantly higher for 15 - 30 DAS interval due to spacing 45 cm x 7 cm which was at par with spacing 30 cm x 10 cm and CGR of dry matter recorded maximum and significantly higher for 0 - 15 DAS interval due to spacing 45 cm x 7 cm. These results might be due to the more space available under spacing 45 cm x 7 cm, reduced competition between rows, usually allows each plant more access to resources like sunlight, nutrients etc. resulting in maximum stem girth of plants. Shivakumar *et al.* (2022) [7]. also reported similar findings.

Yield and yield attributes

Spacing 30 cm x 10 cm recorded maximum and significantly higher total fresh weight (g) plant⁻¹ at 40 DAS and at harvest respectively, moisture percent on fresh weight basis and green fodder yield (g) plant⁻¹ at harvest. Highest green fodder yield (t) ha⁻¹ was recorded due to spacing 30 cm x 10 cm and was at par with spacing 45 cm x 7 cm. The higher fodder yield under closer spacing (30 cm x 10 cm) might be the cumulative effect of more fresh weight, more leaf area, more plant population, higher plant height, higher fodder yield plant⁻¹. Wani *et al.* (2024) [10]. reported the highest green fodder yield due to 30 cm x 10 cm spacing than other two planting spacing.

Quality parameters

Wider spacing of 45 cm x 7 cm recorded numerically higher total

digestible nutrients and crude protein (%) content while closer spacing of 30 cm x 10 cm recorded maximum and significantly higher crude fiber content at both 45 DAS and at harvest. Wider plant spacing improved forage quality due to reduced inter-plant competition, resulting in better nutrient accumulation and digestibility characteristics which enhance nitrogen accumulation in plant tissues and ultimately increases crude protein content and TDN. A similar trend was reported by Kumar *et al.* (2017) [3]. in fodder maize, where planting density significantly influenced quality parameters.

Economics

Closer spacing of 30 cm x 10 cm recorded maximum and significantly higher gross monetary return and net monetary return as compare to wider spacing of 45 cm x 7 cm. The higher benefit-cost (B:C) ratio of fodder maize was recorded under spacing of 30 cm x 10 cm as compare to wider spacing of 45 cm x 7 cm. The higher GMR and NMR under closer spacing (30 cm x 10 cm) might be due to higher plant population per unit area, which resulted in more green fodder yield per hectare. Bharti *et al.* (2019) [2]. also found highest and significantly superior gross return under the spacing of 30 cm x 20 cm over all plant spacing.

Effect of fertilizer dose

Growth parameters

Higher fertilizer dose F₃ 150% RDF (120:45:30 kg NPK ha⁻¹) recorded maximum and significantly higher plant height, stem girth, fresh leaf weight (g) plant⁻¹, fresh weight of stem (g) plant⁻¹ recorded at 40 DAS and at harvest as compare to all other fertilizer treatments and was at par with fertilizer dose F₁ 100% RDF (80:30:20 kg NPK ha⁻¹), F₂ 125% RDF (100:37.5:25 kg NPK ha⁻¹) and F₆ 75% RDF (60 :22.5 :15 kg NPK ha⁻¹) + 2% DAP spray at 20 DAS + 2% urea at 40 DAS. The maximum and significantly higher leaf area index recorded with application of higher fertilizer dose treatment F₃ 150% RDF (120:45:30 kg NPK ha⁻¹) at 40 DAS and was at par with fertilizer dose F₁ 100% RDF (80:30:20 kg NPK ha⁻¹), F₂ 125% RDF (100:37.5:25 kg NPK ha⁻¹), F₅ 75% RDF (60 :22.5 :15 kg NPK ha⁻¹) + 2% urea spray at 20 DAS and F₆ 75% RDF (60 :22.5 :15 kg NPK ha⁻¹) + 2% DAP spray at 20 DAS + 2% urea at 40 DAS.

While leaf area plant⁻¹, number of leaves plant⁻¹ and dry matter accumulation plant⁻¹ was not significantly influenced by fertilizer dose at any crop growth stages but numerically maximum values recorded due to application of higher fertilizer dose treatment F₃ 150% RDF (120:45:30 kg NPK ha⁻¹). Leaf stem ratio not significantly influenced by fertilizer dose at harvest. RGR and CGR of dry matter recorded numerically highest due to application of higher fertilizer dose treatment F₃ 150% RDF (120:45:30 kg NPK ha⁻¹) for 40 DAS - harvest interval.

Higher fertilizer dose leading to higher vegetative growth, especially nitrogen play an important role on vegetative growth of plant which improved leaf size, chlorophyll content and photosynthetic efficiency. Varma *et al.* (2022) [9]. also reported significantly higher growth attributes like plant height due to 150% RDF than other treatments.

Yield and yield attributes

F₃ 150% RDF (120:45:30 kg NPK ha⁻¹) recorded maximum and significantly higher total fresh weight plant and fodder yield (g) plant⁻¹ at harvest among all other fertilizer treatments and was at par with F₁ 100% RDF (80:30:20 kg NPK ha⁻¹), F₂ 125% RDF (100:37.5:25 kg NPK ha⁻¹) and F₆ 75% RDF (60 :22.5 :15 kg NPK ha⁻¹) + 2% DAP spray at 20 DAS + 2% urea at 40 DAS. The green fodder yield (t) ha⁻¹ also recorded maximum and significantly

higher due to application of higher fertilizer dose treatment F₃ 150% RDF (120:45:30 kg NPK ha⁻¹) as compare to all other fertilizer treatments and was at par with F₁ 100% RDF (80:30:20 kg NPK ha⁻¹) and F₂ 125% RDF (100:37.5:25 kg NPK ha⁻¹).

While maximum moisture percent on fresh weight basis recorded numerically higher at harvest due to fertilizer dose treatment F₁ 100% RDF (80:30:20 kg NPK ha⁻¹). Application of higher fertilizer doses increased the availability of essential nutrients, particularly nitrogen, phosphorus, and potassium, which enhanced chlorophyll formation, photosynthetic efficiency, leaf area development, stem elongation, and dry matter accumulation. Wani *et al.* (2024) [10], also reported among nitrogen levels, the highest green fodder yield (538.89 q ha⁻¹) with application of 150% RDN.

Quality parameters

Total digestible nutrients (TDN %) and crude protein (%) content recorded maximum and significantly higher at 45 DAS and at harvest due to application of higher fertilizer dose treatment F₃ 150% RDF (120:45:30 kg NPK ha⁻¹) however TDN % was at par with F₂ 125% RDF (100:37.5:25 kg NPK ha⁻¹), F₄ 75% RDF (60:22.5:15 kg NPK ha⁻¹) + 2% DAP spray at 20 DAS and F₆ 75% RDF (60:22.5:15 kg NPK ha⁻¹) + 2% DAP spray at 20 DAS + 2% urea at 40 DAS while the application of F₄ 75% RDF (60:22.5:15 kg NPK ha⁻¹) + 2% DAP spray at 20 DAS recorded maximum and significantly higher crude fiber (%) content at harvest and was at par with F₆ 75% RDF (60:22.5:15 kg NPK ha⁻¹) + 2% DAP spray at 20 DAS + 2% urea at 40 DAS.

The increase in TDN might be due to higher nutrient uptake and higher available nutrients. These findings are in agreement with Kumar *et al.* (2017) [3], who reported that increasing fertility levels significantly improved fodder quality parameters. Adequate nutrient supply promotes better growth and accumulation of plant constituents, resulting in higher values of the parameter studied. Wani *et al.* (2024) [10], also recorded significantly highest protein content (9.75%) due to 150% RDN than 125% RDN and 100% RDN. The present result 150% RDN are in conformity with the above result.

Economics

Application of higher fertilizer dose F₃ 150% RDF (120:45:30 kg NPK ha⁻¹) recorded maximum and significantly higher gross monetary return and net monetary return and was at par with application of F₂ 125% RDF (100:37.5:25 kg NPK ha⁻¹) and F₁ 100% RDF (80:30:20 kg NPK ha⁻¹). The higher benefit-cost (B:C) ratio of fodder maize was recorded under application of 150% RDF (120:45:30 kg NPK ha⁻¹).

The higher GMR under 150% RDF might be due to increased fodder yield due to balanced nutrient supply. Adequate nitrogen, phosphorus and potassium improved vegetative growth, biomass

production and fodder yield, resulting in greater income. Bharti *et al.* (2019) [2], also found highest and significantly superior gross return with the application of 150% N kg ha⁻¹ as compare to other fertilizer levels.

Interaction effect

Growth parameters

Growth parameters like stem girth, leaf : stem ratio, fresh leaf weight (g) plant⁻¹, Fresh weight of stem (g) plant⁻¹, leaf area plant⁻¹ leaf area index, number of leaves plant⁻¹, dry matter accumulation plant⁻¹, RGR and CGR of dry matter found non-significantly influenced by interaction of spacing and fertilizer treatments at all observation stages, while interaction of spacing 30 cm x 10 cm with 75% RDF (60:22.5:15 kg NPK ha⁻¹) + 2% DAP spray at 20 DAS (S₁ x F₄) fertilizer treatments recorded significantly influenced for plant height at 40 DAS and at harvest and was at par with the all the fertilizer management practices with 30 cm x 10 cm.

Yield and yield attributes

At harvest, total fresh weight (g) plant⁻¹ was maximum and significantly higher due to interaction of spacing 30 cm x 10 cm with 100% RDF 80:30:20 kg NPK ha⁻¹ (S₁ x F₁) and was at par with S₁ x F₂, S₁ x F₃, S₁ x F₄, S₁ x F₅ and S₁ x F₆. At harvest, the moisture content (%) in plant on fresh weight basis was maximum and significantly higher due to interaction of spacing 30 cm x 10 cm with 75% RDF 60:22.5:15 kg NPK ha⁻¹ + 2% urea spray at 20 DAS (S₁ x F₅) and was at par with S₁ x F₁, S₁ x F₂, S₁ x F₃, S₁ x F₄ and S₁ x F₆.

At 40 DAS, green fodder yield (g) plant⁻¹ was maximum and significantly higher due to interaction of spacing 30 cm x 10 cm with 75% RDF 60:22.5:15 kg NPK ha⁻¹ + 2% DAP Spray at 20 DAS (S₁ x F₄) and was at par with all the interactions except S₂ x F₄, S₂ x F₅ and S₂ x F₆. At harvest, green fodder yield (g) plant⁻¹ was maximum and significantly higher due to interaction of spacing 45 cm x 7 cm with 120% RDF 100:37.5:25 kg NPK ha⁻¹ (S₂ x F₂) and was at par with all other interactions except S₂ x F₁, and S₂ x F₃. While, interaction effect between spacing and fertilizer levels on green fodder yield (t) ha⁻¹ was found to be non-significant.

Quality parameters

The interaction effect between spacing and fertilizer levels on TDN content, crude protein (%) content and crude fiber (%) was found to be not significant at 45 DAS and at harvest.

Economics

GMR and NMR was not significantly influenced by interaction effect of spacing and fertilizer dose.

Table 1: Growth attributes of fodder maize at harvest as influenced by spacing and fertilizer dose

Treatments	Plant height (cm)	Stem girth (cm)	Leaf : stem ratio	Fresh weight of leaves (g)	Fresh weight of stem (g)	No. of leaves plant ⁻¹	Leaf area plant ⁻¹ (dm ²)	Leaf area index	Dry matter accumulation (g plant ⁻¹)	RGR (g g ⁻¹ day ⁻¹)	CGR (g m ² day ⁻¹)
Main Plot- Spacing											
S ₁	188.8	3.97	0.365	63.03	173	10.79	3.75	1.249	66.14	3.96	96.77
S ₂	163.9	4.08	0.433	63.17	156.9	11.05	3.18	1.01	68.57	4.01	91.57
SE(m) ₊	2.5	0.01	0.029	2.24	2.2	0.07	0.03	0.007	0.6	0.02	2.23
CD (0.05)	15.4	0.04	NS	NS	13.3	NS	0.16	0.045	NS	NS	NS
Sub Plot -Fertilizer											
F ₁	180.1	4.06	0.357	62.61	177.1	11	3.5	1.138	69.59	4.02	98.82
F ₂	179.2	4.09	0.366	66.86	183.3	11	3.5	1.141	70.26	4.03	102.21
F ₃	182.3	4.15	0.377	69.21	182.9	11.16	3.61	1.176	73.23	4.06	104.56
F ₄	167.4	3.89	0.466	63.04	148.7	10.89	3.3	1.079	66.3	3.98	91.89
F ₅	169.2	3.88	0.384	51.19	138.1	10.33	3.37	1.101	57.21	3.8	71.12
F ₆	179.8	4.09	0.443	65.68	159.6	11.16	3.5	1.142	67.52	3.99	96.43
SE(m) ₊	3.4	0.07	0.06	4.07	10.9	0.29	0.17	0.056	3.91	0.06	8.4
CD (0.05)	10.2	0.19	NS	NS	32.2	NS	NS	NS	NS	NS	NS
Interaction (Spacing x Fertilizer)											
SE(m) ₊	4.8	0.09	0.085	5.76	15.4	0.41	0.25	0.08	5.53	0.08	11.88
CD (0.05)	14	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
GM	176	4.03	0.399	63.1	165	10.92	3.46	1.13	67.35	3.98	94.17

Table 2: Yield and yield attributes of fodder maize at harvest as influenced by spacing and fertilizer dose

Treatment s	Total fresh weight (g) plant ⁻¹	Moisture content (%) in plant on fresh weight basis	Green fodder yield (g) plant ⁻¹	Green fodder yield (t) ha ⁻¹
Main Plot- Spacing				
S ₁	236.0	72.06	236.0	31.03
S ₂	220.1	66.71	220.1	25.39
SE(m) ₊	1.0	0.59	1.0	0.80
CD (0.05)	6.2	3.61	6.2	4.85
Sub Plot -Fertilizer				
F ₁	239.7	70.96	239.7	31.35
F ₂	250.1	71.51	250.1	33.11
F ₃	252.1	70.89	252.1	35.08
F ₄	211.8	67.72	211.8	24.30
F ₅	189.3	65.80	189.3	20.22
F ₆	225.3	69.43	225.3	25.20
SE(m) ₊	10.9	2.22	10.9	2.81
CD (0.05)	32.0	NS	32.0	8.28
Interaction (Spacing x Fertilizer)				
SE(m) ₊	15.4	3.13	15.4	3.97
CD (0.05)	45.3	9.24	45.3	NS
GM	228.1	69.39	228.1	28.21

Table 3: Quality of fodder maize at harvest as influenced by spacing and fertilizer dose

Treatments	TDN (%)	Crude protein (%)	Crude fiber (%)
Main Plot- Spacing			
S ₁	50.77	7.03	24.926
S ₂	50.60	7.00	24.670
SE(m) ₊	0.03	0.01	0.039
CD (0.05)	NS	NS	0.239
Sub Plot -Fertilizer			
F ₁	50.44	6.98	24.820
F ₂	51.20	7.35	24.620
F ₃	52.11	7.73	24.020
F ₄	50.06	6.68	25.225
F ₅	49.91	6.52	25.015
F ₆	50.30	6.77	25.087
SE(m) ₊	0.05	0.02	0.068
CD (0.05)	0.14	0.06	0.201
Interaction (Spacing x Fertilizer)			
SE(m) ₊	0.07	0.03	0.096
CD (0.05)	NS	NS	NS
GM	50.67	7.02	24.798

Table 4: Economics of fodder maize as influenced by spacing and fertilizer dose

Treatments	COC (Rs ha ⁻¹)	GMR (Rs ha ⁻¹)	NMR (Rs ha ⁻¹)	B : C Ratio
Main Plot- Spacing				
S ₁	31282	124133	92851	3.94
S ₂	29988	101544	71557	3.34
SE(m) _±	-	3189	3189	-
CD (0.05)	-	19402	19402	-
Sub Plot -Fertilizer				
F ₁	31467	125400	93933	3.98
F ₂	33052	132433	99381	4.00
F ₃	34704	140333	105630	4.04
F ₄	28564	97200	68636	3.40
F ₅	27128	80867	53738	2.96
F ₆	28893	100800	71907	3.45
SE(m) _±	-	11226	11226	-
CD (0.05)	-	33112	33112	-
Interaction (Spacing x Fertilizer)				
SE(m) _±	-	15876	15876	-
CD (0.05)	-	NS	NS	-
GM	30635	112839	82204	3.64

Conclusion

The present study evident that spacing 30 cm x 10 cm and among fertilizer treatments 100% RDF found best for the growth, yield, quality and economics of fodder maize as compare to all other treatments.

Acknowledgement

I am sincerely thankful to Dr. D. D. Mankar, Chairman of advisory committee and Professor of Agronomy (CAS), Agronomy Section, College of Agriculture Nagpur, Dr. V. S. Khawale, Professor of Agronomy, Agronomy Section, College of Agriculture Nagpur Agronomy Farm, College of Agriculture, Nagpur, Dr. P. D. K. V. Akola, (MH) for providing research farm for my experimental trail.

Reference

1. Anonymous. ANGRAU crop outlook reports of Andhra Pradesh maize, June to May 2024. Andhra Pradesh: Acharya N. G. Ranga Agricultural University; 2024.
2. Bharti R, Gupta SK, Singh MK, Choudhary SR, Kohli A. Effect of plant population and varied nitrogen levels on quality and economics of fodder maize (*Zea mays* L.). Int J Chem Stud. 2019;7(6):325-328.
3. Kumar R, Singh M, Meena BS, Kumar S, Yadav MR, Parihar CM, *et al.* Quality characteristics and nutrient yield of fodder maize (*Zea mays*) as influenced by seeding density and nutrient levels in Indo-Gangetic Plains. Indian J Agric Sci. 2017;87(9):1203-1208.
4. Kumar R, Singh M, Tomar SK, Meena BS, Rathore DK. Productivity and nutritive parameters of fodder maize under varying plant density and fertility levels for improved animal productivity. Indian J Anim Res. 2016;50(2):199-202.
5. Paul NC, Paul U, Paul SC, Paul SK. Effects of plant spacing and nitrogen level on the green fodder yield of maize (*Zea mays* L.). Arch Agric Environ Sci. 2019;4(3):307-312.
6. Satpal S, Kumar S, Neelam, Bharadwaj KK, Kumar A. Sowing date, crop geometry and fertilizer levels influenced yield, productivity and economics of fodder maize. Forage Res. 2024;50(3):278-283.
7. Shivakumar SD, Karthikeyan R, Babu C. Effect of spacing and fertilizer levels on growth, yield and economics of fodder maize pre-release culture TNFM 131-9. J Curr Crop Sci Technol. 2022;109(7-9):25-30.
8. Subrahmanya DJ, Kumar R, Tyagi N, Ram H, Singh M,

Meena RK, *et al.* Yield of fodder maize (*Zea mays*) and its chemical composition under varying plant densities and nutrient management. Indian J Anim Nutr. 2017;34(4):425-429.

9. Varma MN, Palai JB, Mahapatra A, Bera M. Growth, yield and economics of hybrid maize (*Zea mays* L.) as affected by plant density and fertilizer levels. Crop Res. 2022;57(3):151-155.
10. Wani AA, Rasool FU, Ahmad L, Bhat MI, Qayoom K, Mir AH, *et al.* Effect of planting density and nitrogen levels on the yield attributing characters of fodder maize (Shalimar Fodder Maize-1). Asian J Soil Sci Plant Nutr. 2024;10(2):483-488.