



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
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NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(6): 751-754
Received: 11-03-2026
Accepted: 15-04-2026

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Nutrient content in maize as influenced by weed management practices in Central India

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DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i6j.5777>

Abstract

The field experiment was conducted at Agricultural farm of the Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (M.P.) during *kharif* season of 2022-23 and 2023-24 to access the nutrient content in grain and stover of maize for enhancing nutritional value. Results revealed that weed free treatment was recorded significantly higher nitrogen, phosphorus and potassium content in grain and stover of maize crop which had showed statistically at par with Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS and Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS on pooled data basis. Among the weed management treatment, nitrogen content in stover (0.66%) and phosphorus content in grain (0.47%) and stover (0.24%) were estimated significantly superior and same in treatment Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS and Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS on pooled basis. However, nitrogen content in grain (1.57 and 1.56%) and potassium content in grain (0.57 and 0.56%) and stover (1.56 and 1.57%) were calculated significantly higher under Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS followed by Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS, respectively on the pooled data basis.

Keywords: Nutrient content, maize, weed management, grain and stover

Introduction

Maize (*Zea mays* L.) is a prime cereal of India and world. Its productivity and nutritional quality are strongly influenced by weed interference, particularly during the early growth stages when competition for soil nutrients is most intense. Weeds compete directly with maize for nitrogen, phosphorus and potassium, often removing a greater proportion of available nutrients than the crop itself under unmanaged conditions. Efficient weed management practices such as hand weeding, herbicide application, and integrated weed control significantly reduce weed biomass and nutrient depletion, thereby enhancing nutrient availability and uptake by maize. Improved weed control has been consistently associated

With higher accumulation of N, P and K in maize grain and straw compared to weedy check treatments (Chaudhary *et al.*, 2024) [2]. These practices also contribute to better partitioning of nutrients toward economic yield and improved soil plant nutrient balance. Studies have demonstrated that nutrient uptake by weeds during the critical period of crop weed competition may exceed that of maize, resulting in reduced nutrient content in grain and stover and ultimately lowering yield and nutrient use efficiency (Rani *et al.*, 2022; Samrat *et al.*, 2021) [7, 9]. Under the agro - ecological conditions of Central India, characterized by variable rainfall, distinct weed flora and diverse soil types, nutrient losses due to weed competition are particularly pronounced. However, region-specific information on the influence of weed management practices on maize nutrient content remains limited. Understanding nutrient dynamics under different weed management regimes will contribute to the development of sustainable, location-specific maize production systems. Hence, a study was under taken to assess the effect of weed management practices on nitrogen, phosphorus and potassium content in grain and stover of maize.

Materials and Methods

The field study was carried out during the *kharif* season of 2022-23 and 2023-24 at the Agriculture farm of Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna

(M.P.). The farm is located beneath the Kymore Plateau in Northern Madhya Pradesh. It is positioned at 25°10' N latitude, 80°32' E longitude, and has an altitude ranging from 190 to 210 m above mean sea level. The soil of the experimental field was sandy loam in texture having soil pH 7.25 and 7.37 organic carbon 0.430% and 0.390% available nitrogen 192.4 and 165.7 kg/ha available phosphorous 17.5 and 15.5 kg/ha available potassium 185.8 and 182.40 kg/ha in two respective year. The crop experienced rainfall of 454 mm and 597.2 mm during the crop period in two consecutive years. Treatment consisted thirteen weed management practices viz. T₁: weedy check, T₂: Weed free, T₃: Atrazine 50% WP @ 1kg a.i/ha. PE, T₄: Flumioxazin 50 SC @ 250ml/ha PE, T₅: Diclosulam 84% WDG @ 30g/ha PE, T₆: Tembotrione 34.34% @ 120g a.i/ha at 21 DAS, T₇: Topramezone 33.6% @ 25 g/ha at 21 DAS, T₈: Halosulfuron 75% WG @ 90 g/ha at 21 DAS, T₉: Tembotrione @ 120g a.i/ha + Atrazine (750g/ha) at 15 DAS, T₁₀: Topramezone @ 25 g/ha + Atrazine (750g/ha) at 15 DAS, T₁₁: Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS, T₁₂: Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS, T₁₃: farmer practices (HW at 20 – 25 DAS). Thus, thirteen treatments were tried in a three replicated randomized block design (RBD). The maize (cv. LG- 36503) was sown 23 July 2022 and 18 July 2023 at a row spacing of 60 cm in furrows apart with seed rate 20 kg/ha. Twenty day after sowing the plant spacing of maize was maintained at 20 cm apart with thinning operation. The maize crop was fertilized @ 120: 60: 40 kg N: P₂O₅: K₂O/ha. One third quantity of N + full quantity of P₂O₅ and K₂O was basally applied at sowing and remaining two third nitrogen had applied two equal split doses as top dressing at 20 and 50 DAS. The maize crop was harvested on 17 November 2022 and 20 October 2023 during two consecutive year.

The nitrogen, phosphorus and potassium content in grain and stover of maize at harvest was estimated by adopting modified micro Kjeldhal's method for nitrogen, Chlorimetric method for phosphorus as Olsen *et al.*, (1954) ^[5] and Flame photometry method for potassium as described by Jackson (1973) ^[4]. Analysis of variance technique appropriate to randomized block design and valid conclusions were drawn as suggested by Panse and Sukhatme (1957) ^[6]. The treatment differences were tested for significance by 'F' test, the data in which the treatment effects were significant, the appropriate standard error of mean and the critical difference (C.D.) were worked out at 5% level of significance.

Results and Discussion

N content (%) in seed and stover of maize crop

Nitrogen content in grain of maize was significantly improved with the use of all weed control treatment except Diclosulam 84% WDG @ 30g/ha PE and weed free over weedy check plot on the basis of pooled data. It was recorded (Table 1) significantly higher under weed free viz. 1.60% (2022-23) and 1.58% (2023-24) and 1.59% (pooled) followed by Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS viz. 1.59% (2022-23) and 1.57% (pooled) and Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS i.e. 1.57% (2023-24) and 1.56% (pooled). The nitrogen content in stover of maize was significantly enhanced with application of Topramezone 33.6% @ 25 g/ha at 21 DAS, Halosulfuron 75% WG @ 90 g/ha at 21 DAS, Tembotrione @ 120g a.i/ha + Atrazine (750g/ha) at 15 DAS, Topramezone @ 25 g/ha + Atrazine (750g/ha) at 15 DAS, Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS and Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS and weed free as compared with to weedy check on the basis of pooled data. It was found significantly maximum under

weed free i.e. 0.62% (2022-23), 0.71% (2023-24) and 0.67% (pooled) followed by Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS i.e. 0.62% (2023-24), 0.70% (2023-24) and 0.66% (pooled) and Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS viz. 0.61% (2022-23), 0.70% (2023-24) and 0.66% (pooled). The improvement of nitrogen content in grain and stover of maize under weed control treatment might be owing to more availability of nitrogen in soil to the maize plant which was associated to lower weed density in concerning treatment. These results are in agreement with the finding of Chen *et al.* (2010) ^[3].

P content (%) in seed and stover of maize crop

Weed management treatment viz. Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS, Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS, Topramezone @ 25 g/ha + Atrazine (750g/ha) at 15 DAS, Tembotrione @ 120g a.i/ha + Atrazine (750g/ha) at 15 DAS, Halosulfuron 75% WG @ 90 g/ha at 21 DAS, Topramezone 33.6% @ 25 g/ha at 21 DAS and Tembotrione 34.34% @ 120g a.i/ha at 21 DAS as well as weed free obtained significantly enhancement in P-content in seed of maize over weedy check and rest of the weed management treatment on pooled basis. The phosphorus content in grain of maize was found significantly greater under weed free viz. 0.48% (2022-23) and 0.47% (2023-24) and 0.48% (pooled) followed by Halosulfuron (90 g/ha) + Atrazine (750 g/ha) at 15 DAS and Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS viz. 0.47% (2022-23 and 2023-24) and 1.57% (pooled). However, weed management treatment viz. Halosulfuron 75% WG @ 90 g/ha at 21 DAS, Tembotrione @ 120g a.i/ha + Atrazine (750g/ha) at 15 DAS, Topramezone @ 25 g/ha + Atrazine (750g/ha) at 15 DAS, Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS, Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS and weed free registered significantly more and same P-content in maize stover over weedy check and rest of the other weed control treatment. This might be due to better availability of phosphorus because of lower weed density which resulted greater growth and stover yield of maize. These results are in agreement with the finding of Asangi, *et al.* (2018) ^[1].

K content (%) of seed and stover of maize crop

Potassium content in grain of maize was significantly improved due to all weed management treatment and weed free over weedy check and farmer practices on pooled basis. Among the weed management treatment, potassium content in grain of maize was recorded significantly higher under Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS (0.57%) followed by equal in Halosulfuron (90 g/ha) + Atrazine (750 g/ha) at 15 DAS, Topramezone @ 25 g/ha + Atrazine (750 g/ha) at 15 DAS, Tembotrione @ 120g a.i/ha + Atrazine (750g/ha) at 15 DAS and Halosulfuron 75% WG @ 90 g/ha at 21 DAS (0.56%) on pooled basis. Weed free was recorded significantly higher K-content (0.60%) which exhibited statistically at par with by Tembotrione @ 120g a.i/ha + Atrazine (750g/ha) at 15 DAS (0.57%) on pooled basis. The K-content in stover had noted significantly maximum under weed free [1.60% (2022-23), 1.58% (2023-24) and 1.59% (pooled)] which was followed by Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS [1.59% (2022-23) and 1.57% (pooled)] and Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS [1.57% (2023-24)]. The higher K-content in grain and stover of maize might be due to less removal of potassium by weeds from soil because of effective weed control by of weed control practices of most of the treatment. These results are in agreement with the finding of Yadav *et al.* (2020) ^[11] and Rawal *et al.* (2022) ^[8].

Table 1: Effect of weed control treatments on nitrogen content in grain and stover of maize plant

Treatment Symbol	Nitrogen content in grain (%)			Nitrogen content by stover (%)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
T ₁ : Weedy check	1.54	1.47	1.51	0.59	0.61	0.60
T ₂ : Weed free	1.60	1.58	1.59	0.62	0.71	0.67
T ₃ : Atrazine 50% WP @ 1kg a.i/ha. PE	1.52	1.53	1.53	0.56	0.67	0.61
T ₄ : Flumioxazin 50 SC @ 250ml/ha PE	1.55	1.51	1.53	0.60	0.62	0.61
T ₅ : Diclosulam 84% WDG @ 30g/ha PE	1.59	1.45	1.52	0.59	0.63	0.61
T ₆ : Tembotrione 34.34% @ 120g a.i/ha at 21 DAS	1.56	1.50	1.53	0.60	0.65	0.62
T ₇ : Topramezone 33.6% @ 25 g/ha at 21 DAS	1.55	1.53	1.54	0.57	0.69	0.63
T ₈ : Halosulfuron 75% WG @ 90 g/ha at 21 DAS	1.58	1.50	1.54	0.59	0.67	0.63
T ₉ : Tembotrione@ 120g a.i/ha + Atrazine (750g/ha) at 15 DAS	1.57	1.50	1.54	0.59	0.68	0.63
T ₁₀ : Topramezone@ 25 g/ha + Atrazine (750g/ha) at 15 DAS	1.56	1.55	1.55	0.62	0.68	0.65
T ₁₁ : Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS	1.55	1.57	1.56	0.62	0.70	0.66
T ₁₂ : Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS	1.59	1.54	1.57	0.61	0.70	0.66
T ₁₃ : Farmer practices (HW at 20 – 25 DAS)	1.53	1.52	1.52	0.60	0.61	0.60
SEm ±	0.017	0.022	0.014	0.013	0.016	0.010
CD (P = 0.05)	0.049	0.065	0.040	0.038	0.047	0.029

Table 2: Effect of weed control treatments on phosphorus content in grain and stover of maize plant

Treatment Symbol	Phosphorus content in grain (%)			Phosphorus content in stover (%)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
T ₁ : Weedy check	0.46	0.43	0.45	0.23	0.24	0.23
T ₂ : Weed free	0.48	0.47	0.48	0.23	0.25	0.24
T ₃ : Atrazine 50% WP @ 1kg a.i/ha. PE	0.47	0.43	0.45	0.22	0.23	0.23
T ₄ : Flumioxazin 50 SC @ 250ml/ha PE	0.45	0.45	0.45	0.23	0.23	0.23
T ₅ : Diclosulam 84% WDG @ 30g/ha PE	0.47	0.43	0.45	0.23	0.23	0.23
T ₆ : Tembotrione 34.34% @ 120g a.i/ha at 21 DAS	0.46	0.46	0.46	0.23	0.24	0.23
T ₇ : Topramezone 33.6% @ 25 g/ha at 21 DAS	0.47	0.45	0.46	0.21	0.24	0.23
T ₈ : Halosulfuron 75% WG @ 90 g/ha at 21 DAS	0.48	0.44	0.46	0.23	0.24	0.24
T ₉ : Tembotrione@ 120g a.i/ha + Atrazine (750g/ha) at 15 DAS	0.46	0.46	0.46	0.23	0.25	0.24
T ₁₀ : Topramezone@ 25 g/ha + Atrazine (750g/ha) at 15 DAS	0.47	0.45	0.46	0.23	0.24	0.24
T ₁₁ : Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS	0.47	0.47	0.47	0.23	0.24	0.24
T ₁₂ : Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS	0.47	0.47	0.47	0.23	0.24	0.24
T ₁₃ : Farmer practices (HW at 20 – 25 DAS)	0.47	0.42	0.45	0.23	0.24	0.23
SEm ±	0.005	0.012	0.007	0.003	0.004	0.003
CD (P = 0.05)	0.016	0.035	0.019	0.009	0.012	0.008

Table 3: Effect of weed control treatments on potassium content in grain and stover of maize plant (%)

Treatment Symbol	Potassium content in grain (%)			Potassium content in stover (%)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
T ₁ : Weedy check	0.55	0.49	0.52	1.54	1.47	1.51
T ₂ : Weed free	0.57	0.60	0.59	1.60	1.58	1.59
T ₃ : Atrazine 50% WP @ 1kg a.i/ha. PE	0.54	0.55	0.55	1.56	1.50	1.53
T ₄ : Flumioxazin 50 SC @ 250ml/ha PE	0.57	0.50	0.54	1.59	1.45	1.52
T ₅ : Diclosulam 84% WDG @ 30g/ha PE	0.61	0.47	0.54	1.52	1.53	1.53
T ₆ : Tembotrione 34.34% @ 120g a.i/ha at 21 DAS	0.57	0.52	0.55	1.55	1.51	1.53
T ₇ : Topramezone 33.6% @ 25 g/ha at 21 DAS	0.55	0.55	0.55	1.55	1.53	1.54
T ₈ : Halosulfuron 75% WG @ 90 g/ha at 21 DAS	0.59	0.52	0.56	1.57	1.50	1.54
T ₉ : Tembotrione@ 120g a.i/ha + Atrazine (750g/ha) at 15 DAS	0.55	0.57	0.56	1.58	1.50	1.54
T ₁₀ : Topramezone@ 25 g/ha + Atrazine (750g/ha) at 15 DAS	0.56	0.56	0.56	1.56	1.55	1.55
T ₁₁ : Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS	0.57	0.55	0.56	1.55	1.57	1.56
T ₁₂ : Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS	0.62	0.51	0.57	1.59	1.54	1.57
T ₁₃ : Farmer practices (HW at 20 – 25 DAS)	0.49	0.55	0.52	1.53	1.52	1.52
SEm ±	0.020	0.015	0.012	0.017	0.022	0.014
CD (P = 0.05)	0.057	0.045	0.035	0.049	0.065	0.040

Conclusion

Thus can be concluded that application of Mesotrione 2.5% W/V + Atrazine 25% W/V @ 275 g/liter SC at 15 DAS as well as Halosulfuron (90 g/ha) + Atrazine (750g/ha) at 15 DAS applied in maize was found the equally best treatment for higher nutrient content in both seed and stover under the conditions of the Kymore Plateau region of Madhya Pradesh.

References

- Asangi H, Verma A, Purohit HS, Bana RS. Phosphorous concentration and uptake in maize varieties cultivated under organic nutrient management. International Journal of Agricultural and Statistical Sciences. 2019;15(1):311-315.
- Chaudhary V, Patel JN, Alam MS. Effect of weed management practices on nutrient content and their uptake

- by maize crop (*Zea mays* L.). International Journal of Research in Agronomy. 2024;7(7):23-28.
3. Chen X, Zhang F, Cui Z, Li J, Ye Y, Yang Z. Critical grain and stover nitrogen concentrations at harvest for summer maize production in China. Agronomy Journal. 2010;102(1):289-295.
 4. Jackson ML. Soil chemical analysis. New Delhi (India): Prentice Hall of India Pvt. Ltd.; 1973. p. 111-226.
 5. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. USDA Circular No. 939. Washington (DC): United States Department of Agriculture; 1954. p. 1-19.
 6. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. New Delhi (India): Indian Council of Agricultural Research; 1957.
 7. Rani BS, Chandrika V, Prabhakara Reddy G, Sudhakar P, Nagamadhuri KV, Karuna Sagar G. Weed dynamics and nutrient uptake of maize as influenced by different weed management practices. Indian Journal of Agricultural Research. 2022;56(3):283-289.
 8. Rawal N, Singh YV, Das TK, Meena MC. Accumulation of nitrogen, phosphorus, and potassium in various stages of hybrid maize (*Zea mays* L.) as affected by different levels of NPK. Communications in Soil Science and Plant Analysis. 2022;53(10):1176-1195.
 9. Samrat M, Madhavi M, Ram Prakash TP. Influence of tillage and weed management practices on yield and nutrient uptake of maize. International Journal of Plant and Soil Science. 2021;33(17):43-50.
 10. Reddy KKK, Vani KP, Sudhakar C, Surendra Babu P, Triveni S. Effect of tillage and weed management on maize (*Zea mays* L.) yield and nutrient uptake. Journal of Scientific Research and Reports. 2024;30(11):922-934.
 11. Yadav SK, Sharma SK, Choudhary R, Jain RK, Jat G, Choudhary RS. Comparison of nutrient content, uptake and protein content in varieties of different types of maize growing under organic farming. International Journal of Current Microbiology and Applied Sciences. 2020;9(6):3798-3812.