E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; 8(9): 540-543
Received: 05-06-2025
Accepted: 07-07-2025

Abdul Fahim Khan
M.Sc. Student, Department of Agronomy, FASAI, Rama University Kanpur, Uttar Pradesh, India

Mandeep Kumar
Assistant Professor, Department of Agronomy, FASAI, Rama University Kanpur, Uttar Pradesh, India

Ravikesh Kumar Pal,
Assistant Professor, Department of Agronomy, FASAI, Rama University Kanpur, Uttar Pradesh, India

Raghvendra Singh
Assistant Professor, Department of Soil Science, FASAI, Rama University Kanpur, Uttar Pradesh, India

Savita Singh
Ph.D. Scholar, Department of Agronomy, FASAI, Rama University Kanpur, Uttar Pradesh, India

Corresponding Author:
Abdul Fahim Khan
M.Sc. Student, Department of Agronomy, FASAI, Rama University Kanpur, Uttar Pradesh, India

Effect of fertility levels and weed management practices on weed dynamics and yield of maize (*Zea mays* L.) grown in Kharif season

Abdul Fahim Khan, Mandeep Kumar, Ravikesh Kumar Pal and Raghvendra Singh and Savita Singh

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i9h.3811

Abstract
The present study was conducted during the kharif season of 2024-25 at Rama University, Mandhana (U.P.),to evaluate Effect of fertility levels and weed management practices on weed dynamics and yield of Maize (*Zea mays* L.) grown in Kharif season. The experiment followed a factorial randomized block design with 12 treatment combinations. The growth parameters—plant height, leaf area index, and Dry Matter Production (DMP)were highest in F3 and W3, followed by F2 and W2.

Keywords: Maize, *Zea mays* L., fertility levels, weed management

Introduction
One of the most significant crops in the world is maize (*Zea mays* L.), of which India produces the third most after wheat and rice. Because of its high genetic potential and greater flexibility, maize can be grown wherever in the world. In addition to being a significant crop for food and feed, maize is also used in industry. About 47 percent of India's total maize output is utilised for chicken feed, followed by 14 percent for starch production, 13 percent for food and livestock feed, 7 percent for food processing, and the remaining 6 percent for export and other uses (IIMR, 2024). Around 197.2 m hectares of maize are grown worldwide, yielding 1137.8 mt of grain and 5.82 t ha-1 of productivity (FAOSTAT, 2024) [9]. Among the major nations that grow maize are the USA, China, Brazil, Mexico, India, Romania, the Philippines, and Indonesia. According to Rao *et al*. (2014), India ranks third in terms of cereal crop productivity and production, and fifth in terms of acre age. In India, 10.04 m hectares of maize are grown, yielding 33.62 mt of grainand3.35tha^{-1} Maize is a tall, monoecious, annual, determinate plant. Along the length of the stem, it bears big, opposing, thin leaves alternately. During flowering, it needs 12-14 hours of light, making it a C4 and day-neutral plant. Spadix is the name of the inflorescence. The female blossom is called silk, while the male is called tassel. Pollen lifespan is enhanced by cool temperatures and high humidity. A higher agricultural yield can be achieved by either expanding the area under cultivation or by raising productivity per unit area. As the area is limited, yield level per unit area has to be increased. Maize has been widely cultivated as a rainfed crop in India.

Nitrogen is a major fertilizer which is constituent of protein and protoplasm of chlorophyll and enzymes (Kaur *et al.*, 2020) [12]. Higher nitrogen levels are reported to increase plant height, stem thickness, leaf area, leaf area index, dry matter accumulation; net assimilates ratio and yield per hectares (Cheema *et al.*, 2010) [7]. In maize, the number of maize grains produced per unit of fertilizer nitrogen applied depends upon the uptake from fertilizer and soil nitrogen and its utilization in producing grains. Phosphorus is a macronutrient that is essential for plant growth and crop production. Plants need phosphorus for growth throughout their life cycle, especially during the early stages of growth and development. The rate of replenishment, which determines the availability of phosphorus, is related to soil pH, phosphorus level in the soil, its fixation by the soil, and placement of added phosphorus (Brady and Weil, 1999). Potassium is considered as most ambient macronutrients required for proper growth, development and

sustainable crop yield. It is a vital element for increasing yield of maize (Bukhsh *et al.*, 2012) [5]. Therefore, due to the importance and role of potassium in improving both chemical and physical properties of soil, and increasing growth, development and crop yield an experiment was planned to examine the role of different levels of potassium on maize growth, yield and quality. Zinc is one of The essential micronutrient elements and is required by crop plants in very small amounts. It play as significant role in various enzymatic and physiological activities and performs many catalytic functions in plant system besides transformation of carbohydrates, chlorophyll and protein synthesis (Singh, 2021) [22]. In India, maize is mainly grown in kharif season which is accompanied by heavy rainfall and higher relative humidity. These conditions favour weeds to proliferate vigorously and compete with crops in respect of nutrients, light, moisture and space etc. Weed competition with maize causes severe reduction in the productivity to a tune of 47.6-49.6% (Lavanya *et al*., 2021) [14] especially in North-western India. Moreover, Indo-gangatic plains region of North-west India have medium to high fertile soil, high rainfall and intensive cropping system which lead to complex weed flora and severe weed problem. Maize is infested with a variety of weed flora including annual and perennial grasses, sedges and broadleaf weeds. Among broadleaf weeds, *Commelina benghalensis, Trianthema portulacastrum, Euphorbia geniculata, Amaranthus viridis* and *Digera arvensis* are dominant. In grasses, main weeds are *Digitaria* spp., *Cynodon dactylon, Echinochloa* spp., *Dactyloctenium aegyptium* and *Rottboellia exaltata*. In the category of sedges, *Cyperus rotundus* and *Cyprus iria* is common (Swetha *et al*., 2018) [23]. Manual weeding in maize is costly and labour-intensive method. Moreover, due to inclement weather conditions, it is not possible to go for manual hoeing. Most of the presently available herbicides provide only narrow spectrum of weed control in maize. So, there is a need to test new herbicides alone or in combinations, which are effective against complex weed flora in kharif maize. Atrazine is commonly used by the farmers for weed control in this crop worldwide. Being a pre-emergence herbicide, it is not effective against some of the weeds, both grass, and broadleaf weeds as well as the sedge *Cyprus rotundus*. Due to a shortage of labor; sometimes farmers skip the application of pre-emergent herbicides, they are left with no other alternative to control the weeds emerging during later stages. Atrazine as the pre-emergence application was the primary weapon to control weeds in maize, but for complex weed flora, it needs to be applied in herbicide mixtures (Walia *et al*., 2007) [24].

Methods and Materials

A field experiment was conducted during kharif season of 2024-25 on loamy sand of in the rural area of Kanpur district of Mandhana, located 10 km from Kanpur in Uttar Pradesh to Effect of fertility levels and weed management practices on weed dynamics and yield of maize grown in kharif season. The soil was normal in pH of 7.65, electrical conductivity (EC) of 0.27 dS m^{-1}, organic carbon content of 0.41%, and available nutrients including nitrogen (N), phosphorus (P), and potassium (K) at levels of 217.0, 19.5, and 149.50 kg ha^{-1}, respectively. The experiment followed a factorial randomized block design with 12 treatment combinations involving three fertility levels—F1 (75% RDF + Zn @ 20 kg/ha), F2 (100% RDF + Zn @ 15 kg/ha), and F3 (125% RDF + Zn @ 10 kg/ha)—and four weed control methods: W1 (Atrazine, PE), W2 (Tembotrione, POE), W3 (manual weeding at 20 and 40 DAS), and W4 (weedy check). Data were gathered on five plants chosen from each plot.

Results

Growth Characters

1. Plant height(cm)

The result shown in table no 1 in which fertility levels recorded at 40, 60, and harvest, significantly greater plant heights (134.51, 211.61, and218.78 cm) were seen in 125% RDF + Zn @ 10 kg ha^{-1} (F_3), which was comparable to the application of 100% RDF (120:60:40) + Zn @ 15 kg ha^{-1} (F_2) at all crop development stages. At a minimum plant height of 124.97, 192.13, and 197.82 cm, 75% RDF + Zn @ 20 kg $ha^{-1}$was applied. Fertility levels were shown to have no discernible impact on maize plant height at 20 DAS. Similar result reported by Ashoka *et al.* (2024) [4] & Chattopadhyay *et al.* (2019) [6].

The impact of weed control on maize plant height was not observed to be significant at 20 DAS. Hand weeding at 20 and 40 DAS resulted in noticeably increased plant heights at 40, 60, and harvest, which were comparable to Tembotrione @ 125 g a.i. ha^{-1} POE (W2) at all crop development stages. Similar result reported by Ali *et al*. (2020) [1] & Deshmukh *et al*. (2022) [8].

2. Dry matter accumulation

The result shown in table no 2 in which fertility levels recorded had no discernible impact on maize's dry matter accumulation at 20 DAS. In comparison to 100% RDF (120:60:40) + Zn at 15 kg ha^{-1} (F_2) treatment at all crop development stages, a significantly larger dry matter accumulation was seen in the 125% RDF + Zn @ 10 kg ha^{-1} (F_3) treatment at 40, 60, and harvest. Similar result reported by Gul *et al*. (2015) [10] & Alias *et al.* (2023) [2].

Weed control had no discernible impact on maize's dry matter buildup at 20 DAS. Hand weeding at 20 and 40 DAS (W_3), 40 DAS, 60 DAS, and harvest stage resulted in noticeably increased plant heights, which were comparable to Tembotrione @125g a.i. ha^{-1} POE (W_2) at every stage of crop development. Similar result reported by Jena *et al*. (2021) [11] & Kumar *et al.* (2015) [13].

3. Leaf Area Index

Fertility levels had no discernible impact on the maize leaf area index at 20 DAS. Plant height in the F_3 (125% RDF + Zn at 10 kg ha^{-1}) treatment was significantly higher at 40, 60, and harvest than in the F_2 (100%RDF (120:60:40) + Zn @ 15 kg ha^{-1}) treatment at all crop growth stages. Similar result reported by Massey *et al.* (2014) [15] &Parashar *et al.* (2020) [19].

Weed control had no discernible impact on the maize leaf area index at 20 DAS. Hand weeding at 20 and 40 DAS (W3), 40 DAS, 60 DAS, and harvest stage resulted in noticeably increased plant heights, which were comparable to Tembotrione @ 125 g a.i. ha^{-1} POE (W2) at all crop growth stages. Similar result reported by Sayad (2016) & Sharma *et al*. (2018) [21].

Table 1: Plant height (cm) of maize as influenced by different fertility levels and weed management practices in maize grown in kharif season

Symbols	Treatments	Plant height (cm)			
		20 DAS	40 DAS	60 DAS	At harvest
	A. Fertility levels				
F1	75%RDF+Zn@20 kgha^{-1}	31.82	124.97	192.13	197.82
F2	100%RDF(120:60:40)+Zn@ 15kg ha-1	32.57	129.95	203.45	212.36
F3	125%RDF+Zn@10 kgha^{-1}	32.67	134.50	211.60	218.77
	S.Em±	0.49	2.38	4.02	4.38
	C.D.at 5%	NS	6.99	11.78	12.85
	B. Weed management				
W1	Atrazine@1kga.i.ha^{-1}(PE)	33.31	130.36	205.23	210.88
W2	Tembotrione@125ga.i. ha^{-1}(POE)	32.03	135.22	214.49	225.58
W3	Handweedingat20&40 DAS	32.28	137.29	223.34	230.24
W4	Weedycheck	31.81	115.69	165.87	169.93
	S.Em±	0.56	2.75	4.64	5.06
	C.D.at 5%	NS	8.07	13.60	14.83

Table 2: Dry matter accumulation (g m-2) at successive stages of maize crop as influenced by different fertility levels and weed management practices grown in *kharif* season

Symbols	Treatments	Dry matter accumulation(gm^{-2})			
		20 DAS	40 DAS	60 DAS	At harvest
	A. Fertility levels				
F1	75%RDF+Zn@20 kgha^{-1}	155.62	472.44	1027.22	1369.63
F2	100%RDF(120:60:40)+Zn @15kg ha-1	158.06	554.92	1186.21	1575.83
F3	125%RDF+Zn@10 kgha^{-1}	163.20	580.45	1248.65	1664.20
	S.Em±	2.88	9.74	22.43	31.74
	C.D.at 5%	8.44	28.55	65.78	93.08
	B. Weed management				
W1	Atrazine@1kga.i.ha^{-1}(PE)	164.25	536.41	1157.44	1541.37
W2	Tembotrione@125ga.i. ha^{-1}(POE)	158.88	580.31	1264.87	1676.27
W3	Handweedingat20&40 DAS	157.71	609.02	1323.62	1748.57
W4	Weedycheck	154.17	418.33	868.51	1178.34
	S.Em±	3.32	11.24	25.90	36.65
	C.D.at 5%	9.74	32.97	75.95	107.48

Table 3: Leaf area index at successive stages of maize crop as influenced by different fertility levels and weed management practices grown in kharif season

Symbols	Treatments	Leaf area index			
		20 DAS	40 DAS	60 DAS	At harvest
	A. Fertility levels				
F1	75%RDF+Zn@20 kgha^{-1}	0.54	2.22	3.43	2.71
F2	100%RDF(120:60:40)+Zn @15 kgha^{-1}	0.56	2.36	3.64	2.91
F3	125%RDF+Zn@10 kgha^{-1}	0.60	2.46	3.74	3.03
	S.Em±	0.02	0.05	0.06	0.05
	C.D.at 5%	NS	0.14	0.19	0.14
	B. Weed management				
W1	Atrazine@1kga.i.ha^{-1}(PE)	0.60	2.30	3.55	2.89
W2	Tembotrione @125g a.i.ha^{-1}(POE)	0.57	2.51	3.73	3.05
W3	Handweedingat20&40 DAS	0.55	2.57	3.83	3.17
W4	Weedy check	0.54	2.02	3.29	2.42
	S.Em±	0.02	0.05	0.07	0.06
	C.D.at 5%	NS	0.16	0.22	0.16

Conclusion

The study revealed that fertility levels and weed management significantly influenced maize growth parameters beyond 20 DAS. The highest plant height, dry matter accumulation, and leaf area index at 40, 60 DAS, and harvest were recorded under 125% RDF+Zn@10kgha^{-1}(F3), comparable to 100% RDF + Zn @ 15 kg ha^{-1} (F2). Minimum values were observed under 75% RDF + Zn @ 20 kg ha^{-1}. Hand weeding at 20 and 40 DAS showed results similar to Tembotrione @ 125 g a.i. ha^{-1} POE. No significant differences were observed at 20 DAS across treatments Similar result reported by Pal *et al* 2023 and 2024 [17, 18].

References

1. Ali AM, Gao C, El-Sawah DFI, Alhaj Hamoud Y, Shaghaleh H, Sheteiwy MS. The integration of bio and organic fertilizers improve plant growth, grain yield, quality and metabolism of hybrid maize (*Zea mays* L.). Agronomy. 2020;10(3):319.
2. Alias A, Usman M, Ullah E, Warraich EA. Effects of different phosphorus levels on the growth and yield of two cultivars of maize (*Zea mays* L.). Int J Agric Biol. 2005;4:632-634.
3. Anonymous. Agricultural statistics. Department of Agriculture and Farmer Welfare; 2024.

4. Ashoka S, Chithaiah P, Chandrappa GT. Studies on the synthesis of CdCO3 nanowires and porous CdO powder. Mater Lett. 2024;64(2):173-176.
5. Bukhsh MA, Ahmad R, Iqbal J, Maqbool M, Ali A, Ishaque M, Hussain S. Nutritional and physiological significance of potassium application in maize hybrid crop production. Pak J Nutr. 2012;11:187-202.
6. Chattopadhyay A, Singh A, Patra A. Assessment of phosphorus bioavailability and yield potential of baby corn (*Zea mays* L.) through the combined use of biochar, phosphorus and mycorrhiza in an Inceptisol. Ann Plant Soil Res. 2019;21(3):245-249.
7. Cheema MA, Farhad MF, Saleem HZ, Khan A, Munir MA, Wahid F, Rahul HM. Nitrogen management strategies for sustainable maize production. Crop Environ. 2010;1:49-52.
8. Deshmukh JP, Shid D, Kadu PR, Konde NM, Jadhvar PR. Effect of fertigation levels and weed management on yield and nutrient uptake by maize in Inceptisols. J Pharmacogn Phytochem. 2022;11(1):179-184.
9. FAOSTAT. Crop and livestock products. 2024. https://www.fao.org/faostat/en/#data/QCL
10. Gul S, Khan MH, Khanday BA, Nabi S. Effect of sowing methods and NPK levels on growth and yield of rainfed maize (*Zea mays* L.). Scientifica. 2015;2015:1-6.
11. Jena PR, DeGroote H, Nayak BP, Hittmeyer A. Evolution of fertiliser use and its impact on maize productivity in Kenya: Evidence from multiple surveys. Food Secur. 2021;13:95-111.
12. Kaur P, Singh SK, Kaur R, Sidhu MK. Response of different levels of nitrogen and spacing on growth and yield of cauliflower grown under central region of Punjab. Int J Bio-resource Stress Manag. 2020;11(4):320-326.
13. Kumar RM, Hiremath SM, Nadagouda BT. Effect of single-cross hybrids, plant population and fertility levels on productivity and economics of maize (*Zea mays*). Indian J Agron. 2015;60(3):431-435.
14. Lavanya Y, Srinivasan K, Chinnamuthu CR, Arthanari MP, Shanmugasundaram S, Chandrasekhar CN. Study on effect of weed management practices on weed dynamics and productivity of kharif maize. Pharma Innov. 2021;10(1):662-665.
15. Massey E, Biesbroek R, Huitema D, Jordan A. Climate policy innovation: The adoption and diffusion of adaptation policies across Europe. Glob Environ Change. 2014;29:434-443.
16. Maurya DK, Pal RK, Singh R, Kumar S, Yadav M, Kumar M, *et al*. Effects of planting method and a combination of organic and inorganic nitrogen on maize (*Zea mays*) growth. Int J Environ Climate Change. 2023;13(12):730-734.
17. Pal RK, Maurya DK, Kumar S, Singh R. Assessing the influence of nano urea on the growth and yield of irrigated wheat (*Triticum aestivum* L.) crop. Int J Environ Climate Change. 2023;13(12):843-851.
18. Pal RK, Singh AK, Kumar A, Kumar P, Om H. Effect of sowing direction and wheat cultivars on growth and yield in Indo-Gangetic Plains of India. Environ Ecol. 2024;42(2A):681-686.
19. Parashar A, Tripathi L. Effect of phosphorus and sulphur on the growth and yield of black gram (*Vigna mungo* L.). J Pharmacogn Phytochem. 2020;9(5):2585-2588.
20. Sayed D. Maize yield and quality as influenced by different levels of phosphorus and sulphur. J Soil Sci Agric Eng. 2016;7(9):651-657.
21. Sharma P, Duary B, Singh R. Tank mix application of tembotrione and atrazine to reduce weed growth and increase productivity of maize. Indian J Weed Sci. 2018;50(3):305-308.
22. Singh J, Partap R, Singh A. Effect of nitrogen and zinc on growth and yield of maize (*Zea mays* L.). Int J Bio-resource Stress Manag. 2021;12(3):179-185.
23. Swetha K, Madhavi M, Pratibha G, Ramprakash T. Impact of topramezone and tembotrione tank mix application with atrazine on growth and yield of maize. Res. 2018;7(5):112-118.
24. Walia US, Singh S, Singh B. Integrated control of hardy weeds in maize (*Zea mays* L.). Indian J Weed Sci. 2007;39(1-2):17-20.