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

www.agronomyjournals.com
2024; SP-7(10): 01-04
Received: 01-07-2024
Accepted: 06-08-2024

Bimlesh Kumar Prajapati
Research Scholar, Department of Soil Conservation and Water Management, CSAUA&T, Kanpur, Uttar Pradesh, India

Munish Kumar
Professor, Department of Soil Conservation and Water Management, CSAUA&T, Kanpur, Uttar Pradesh, India

Sarvesh Kumar
Professor, Department of Soil Conservation and Water Management, CSAUA&T, Kanpur, Uttar Pradesh, India

Yogesh Kumar
Research Scholar, Department of Soil Conservation and Water Management, CSAUA&T, Kanpur, Uttar Pradesh, India

Deepak Kumar Rawat
Teaching Associate, Department of Crop Physiology, CSAUA&T, Kanpur, Uttar Pradesh, India

Ganesh Kumar
Research Scholar, Department of Soil Science and Agricultural Chemistry, P. G. College, Ghazipur, Uttar Pradesh, India

Pushpendra Kumar
Research Scholar, Department of Soil Science and Agricultural Chemistry, CSAUA&T, Kanpur, Uttar Pradesh, India

Sandeep Kumar
Teaching Associate, Department of Agronomy, CSAUA&T, Kanpur, Uttar Pradesh, India

Corresponding Author:
Bimlesh Kumar Prajapati
Research Scholar, Department of Soil Conservation and Water Management, CSAUA&T, Kanpur, Uttar Pradesh, India

Effect of fertility levels and moisture conservation techniques on growth characters of maize

Bimlesh Kumar Prajapati, Munish Kumar, Sarvesh Kumar, Yogesh Kumar, Deepak Kumar Rawat, Ganesh Kumar, Pushpendra Kumar and Sandeep Kumar

DOI: https://doi.org/10.33545/2618060X.2024.v7.i10Sa.1669

Abstract
A field experimented was conducted at Students Instructional Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh during two consecutive *kharif* seasons of 2022 and 2023 to study the effect of effect of fertility levels and moisture conservation techniques on growth characters of maize. The results reveals that application of 150:70:70:25 kg N: P_2O_5: K_2O: $ZnSO_4$ ha^{-1} registered significantly higher values of growth characters of maize under the agro-climatic condition of Kanpur, Uttar Pradesh.

Keywords: Maize, moisture conservation, raised bed and kaolin

Introduction
India possess about 141.58 million ha net sown area, out of which, 58% (80 million ha) is rain shadow area. It contributes 40% to India's foodgrains production and supports 66% livestock population (GoI, 2016) [7]. Likewise, 40% of the population depends on rainfed agriculture and its performance is critical in enhancing production, achieving and sustaining high agricultural growth in years to come (CRIDA, 2015) [4]. Maize (*Zea mays* L.) is one of the versatile crops having wider adaptability under diverse agro-climatic condition. In addition to essential food for human being and quality feedstuff for animals, it also serves as a basic raw material to different industrial products.

Maize is a heavy feeder of the nutrients and affected by the deficiency of essential plant nutrients to a greater extent than other cereals (Kumari *et al*. 2017, Ghosh *et al*. 2017) [11, 6]. Thus, optimizing of fertility levels for maize is important for higher productivity and resource-use efficiency. Apart from this there is a need for improving maize productivity as well as cropping intensity through effective moisture-conservation measures. *In-situ* application of crop residues and division of field in beds and furrows could be used as low-cost input technology to conserve more rainwater in soil by minimizing runoff from the soil surface under scarcity situations (Ravisankar *et al.*, 2014) [15].

Retention of crop residue adds organic matter which improves the quality of the seedbed, increase the water infiltration and retention capacity of the soil, reduces the evaporation of soil moisture, fixes carbon by capturing carbon dioxide from atmosphere and retains it in the soil (Bhale and Wanjari, 2009) [1]. Crop residues have competing uses like fodder in rainfed areas because of dominance of livestock, further more costs are also incurred in their application. Therefore, it is necessary that a suitable amount should be applied to enhance crop productivity in a cost effective manner. Keeping these actualities in view, the present investigation was carried out to study the effect of fertility levels and moisture-conserving practices on growth characters of maize.

Materials and Methods
An experiment was conducted during two consecutive *kharif* seasons of 2022 and 2023 at Students Instructional Farm of Chandra Shekhar Azad University of Agriculture and Technology,

Kanpur, Uttar Pradesh in split plot design assigning three fertility levels in main plot comprising of (F_1) 100:40:40:15 kg N: P_2O_5: K_2O: $ZnSO_4$ ha^{-1}, (F_2) 120:60:60:20 kg N: P_2O_5: K_2O: $ZnSO_4$ ha^{-1} and (F_3) 150:70:70:25 kg N: P_2O_5: K_2O: $ZnSO_4$ ha^{-1}. Each main plot was further divided into five sub plots to accommodate sub plot treatments *i.e*. moisture conservation techniques [(M_1) Raised bed (Ridge) planting, (M_2) Raised bed (Ridge) planting + Crop residual mulch @ 4 tons ha^{-1}, (M_3) Flat sowing + Crop residual mulch @ 4 tons ha^{-1}, (M_4) Flat sowing + Crop residual mulch @ 4 tons ha^{-1} + Kaolin 5% and (M_5) Weeding hoeing by Khurpi + Crop residual mulch @ 4 tons ha^{-1}]. Thus a total of 15 treatment combinations were tested in the study and were replicated thrice. The soil of the experimental field was sandy loam in texture having slightly alkaline in reaction (pH 7.2 & 7.2), low in organic carbon (0.42 & 0.43%) and available nitrogen (181.40 & 183.16 kg ha^{-1}), but medium in available phosphorus (13.00 & 15.26 kg ha^{-1}), potassium (194.00 & 198.47 kg ha^{-1}), Sulphur (8.41 & 8.80 kg ha^{-1}) and zinc (0.42 & 0.42 g ha^{-1}) during first and second year, respectively. Application of nitrogen, phosphorous, potassium, sulphur and zinc through urea, DAP, MOP and zinc sulphate monohydrate, respectively were applied as basal dose during both the experimental years. Nitrogen was applied 50% as basal and remaining in two equal splits. Moisture conservation techniques were done as per treatment. Malviya Hybrid Makka-2 variety of maize were used as a test crop. Other crop management practices were followed as per the recommendation of the area.

Statistical analysis and interpretation of data: Data recorded on various parameters of maize crop in the experiment was subjected to analysis by using Fisher's method of analysis of variance (ANOVA) and interpreted as outlined by Gomez and Gomez (1984) [8]. The levels of significance used in 'F' and 't' test was p= 0.05. Critical difference values were calculated where F test was found significant.

Results and Discussion

The data on plant stand as affected by fertility levels and moisture conservation techniques at 20 DAS and at harvest have been presented in Table 1. The data reveals that the data on plant stand of maize fail to show any significant effect due to fertility levels and moisture conservation techniques. At 20 DAS, maximum plant stand (83.52 and 83.65) was recorded under application of (F_3) 150:70:70:25 kg N: P_2O_5: K_2O: $ZnSO_4$ ha^{-1} but the difference was found to be non-significant. However, least plant stand (83.32 and 83.45) was recorded under application of (F_1) 100:40:40:15 kg N: P_2O_5: K_2O: $ZnSO_4$ ha^{-1} during both the years.

It is evident from the data presented in Table 4.1 that different moisture conservation techniques also fail to show any significant difference in plant stand of maize during both the years of study. However, maximum plant stand (83.55 and 83.68) was recorded under (M_2) Raised bed (Ridge) planting + Crop residual mulch @ 4 tons ha^{-1} during both the years of experimentation.

Fertility levels and moisture conservation techniques exerted significant effect on growth characters (Table 2 and 3) of maize except for plant stand. Among the fertility levels, application of (F_3) 150:70:70:25 kg N: P_2O_5: K_2O: $ZnSO_4$ ha^{-1} recorded significantly higher plant height (34.73 and 36.51 cm) and number of leaves (6.28 and 7.12 $plant^{-1}$) at 30 DAS over (F_1) 100:40:40:15 kg N: P_2O_5: K_2O: $ZnSO_4$ ha^{-1} but was statistically at par with application of (F_2) 120:60:60:20 kg N: P_2O_5: K_2O: $ZnSO_4$ ha^{-1} during both the experimental years. Similar trend was also recorded at 60 DAS at harvest stage of maize. Increase in growth characters also be due to greats availability of nutrients at higher fertilizer dose. This in turn improved protein synthesis and photosynthesis leading to rapid cell division and cell enlargement, which ultimately resulted in higher vertical plant growth. Similar effects of higher rate of fertilizer have also been realized on growth characters of baby corn by several workers (Panwar and Munda, 2006; Bindhani *et al*., 2007; Ibrahim and Hala, 2007; Bindhani *et al*., 2008 and Kumar and Bohra, 2013) [13, 2, 9, 3, 10].

Moisture conservation techniques also showed significant variation in plant height and number of leaves $plant^{-1}$ at periodic intervals. At 30 DAS, application of (M_2) Raised bed (Ridge) planting + Crop residual mulch @ 4 tons ha^{-1} recorded significantly higher plant height (35.91 and 38.57 cm) and number of leaves (7.04 and 7.29 $plant^{-1}$) over rest of the treatments. However, values of growth characters was recorded under (M_3) Flat sowing + Crop residual mulch @ 4 tons ha^{-1}. Almost a similar trend was observed at 60 DAS and at harvest stages of maize crop during both the years. This might be due to higher nutrient uptake and adequate soil moisture prevailing during the growth period, proper availability of nutrients with favourable soil physicochemical conditions which otherwise may have responsible for loss of moisture through evapotranspiration from the cracked surfaces and weeds if not being mulched. This effect might be reflected in increased plant height, number of functional leaves and leaf area. The observations of the present studies in this regard are in consonance with those reported by Lasisi and Aluko (2009) [12], Uwah and Iwo (2011) [16], Devaranavadgi *et al*. (2012) [5], Parshotamkumar (2016) [14].

Table 1: Effect of fertility levels and moisture conservation techniques on periodic plant stand (000 ha^{-1}) of maize

Treatments	20 DAS		At harvest	
	2022	2023	2022	2023
Fertility levels (Main plot)				
F_1: 100:40:40:15 kg N:P_2O_5:K_2O:$ZnSO_4$ ha^{-1}	83.32	83.45	83.10	83.22
F_2: 120:60:60:20 kg N:P_2O_5:K_2O:$ZnSO_4$ ha^{-1}	83.45	83.56	83.21	83.35
F_3: 150:70:70:25 kg N:P_2O_5:K_2O:$ZnSO_4$ ha^{-1}	83.52	83.65	83.31	83.44
S.Em±	1.25	1.27	1.20	1.21
CD (*p*=0.05)	NS	NS	NS	NS
Moisture conservation techniques (Sub plot)				
M_1: Raised bed (Ridge) planting	83.38	83.50	83.16	83.28
M_2: Raised bed (Ridge) planting + Crop residual mulch @ 4 tons ha^{-1}	83.55	83.68	83.33	83.46
M_3: Flat sowing + Crop residual mulch @ 4 tons ha^{-1}	83.30	83.42	83.07	83.21
M_4: Flat sowing + Crop residual mulch @ 4 tons ha^{-1} + Kaolin 5%	83.49	83.62	83.27	83.40
M_5: Weeding hoeing by Khurpi + Crop residual mulch @ 4 tons ha^{-1}	83.43	83.55	83.20	83.34
S.Em±	0.91	0.93	0.91	0.88
CD (*p*=0.05)	NS	NS	NS	NS
Interaction (F x M)	NS	NS	NS	NS

Table 2: Effect of fertility levels and moisture conservation techniques on periodic plant height (cm) of maize

Treatments	30 DAS		60 DAS		At harvest	
	2022	2023	2022	2023	2022	2023
Fertility levels (Main plot)						
F_1: 100:40:40:15 kg N:P_2O_5:K_2O:$ZnSO_4$ ha^{-1}	29.60	31.15	109.21	112.50	173.96	179.21
F_2: 120:60:60:20 kg N:P_2O_5:K_2O:$ZnSO_4$ ha^{-1}	31.79	33.45	117.30	120.84	188.02	193.70
F_3: 150:70:70:25 kg N:P_2O_5:K_2O:$ZnSO_4$ ha^{-1}	34.73	36.51	128.13	132.00	204.10	210.26
S.Em±	0.94	1.45	3.14	3.25	4.41	4.62
CD (p=0.05)	3.68	4.53	12.34	12.77	17.31	18.13
Moisture conservation techniques (Sub plot)						
M_1: Raised bed (Ridge) planting	30.49	31.88	112.51	115.91	179.61	185.03
M_2: Raised bed (Ridge) planting + Crop residual mulch @ 4 tons ha^{-1}	35.91	38.57	132.51	136.52	211.48	217.86
M_3: Flat sowing + Crop residual mulch @ 4 tons ha^{-1}	28.37	29.66	104.67	107.83	167.13	172.17
M_4: Flat sowing + Crop residual mulch @ 4 tons ha^{-1} + Kaolin 5%	33.27	34.78	122.74	126.45	195.91	201.82
M_5: Weeding hoeing by Khurpi + Crop residual mulch @ 4 tons ha^{-1}	32.15	33.62	118.62	122.20	189.34	195.06
S.Em±	0.71	1.26	2.49	2.63	3.77	4.11
CD (p=0.05)	2.07	3.69	7.26	7.68	11.01	11.98
Interaction (F x M)	NS	NS	NS	NS	NS	NS

Table 3: Effect of fertility levels and moisture conservation techniques on periodic number of leaves plant^{-1} of maize

Treatments	30 DAS		60 DAS	
	2022	2023	2022	2023
Fertility levels (Main plot)				
F_1: 100:40:40:15 kg N:P_2O_5:K_2O:$ZnSO_4$ ha^{-1}	5.47	5.67	9.85	10.20
F_2: 120:60:60:20 kg N:P_2O_5:K_2O:$ZnSO_4$ ha^{-1}	6.24	6.46	11.23	11.62
F_3: 150:70:70:25 kg N:P_2O_5:K_2O:$ZnSO_4$ ha^{-1}	6.88	7.12	12.38	12.81
S.Em±	0.21	0.23	0.37	0.38
CD (p=0.05)	0.81	0.83	1.45	1.49
Moisture conservation techniques (Sub plot)				
M_1: Raised bed (Ridge) planting	5.86	6.06	10.54	10.92
M_2: Raised bed (Ridge) planting + Crop residual mulch @ 4 tons ha^{-1}	7.04	7.29	12.68	13.11
M_3: Flat sowing + Crop residual mulch @ 4 tons ha^{-1}	5.39	5.59	9.71	10.06
M_4: Flat sowing + Crop residual mulch @ 4 tons ha^{-1} + Kaolin 5%	6.46	6.69	11.63	12.04
M_5: Weeding hoeing by Khurpi + Crop residual mulch @ 4 tons ha^{-1}	6.22	6.44	11.20	11.59
S.Em±	0.16	0.16	0.28	0.29
CD (p=0.05)	0.45	0.47	0.82	0.84
Interaction (F x M)	NS	NS	NS	NS

Conclusion

On the basis of two year experiment it may be concluded that application of 150:70:70:25 kg N: P_2O_5: K_2O: $ZnSO_4$ ha^{-1} registered significantly higher values of growth characters of maize under the agro-climatic condition of Kanpur, Uttar Pradesh.

References

1. Bhale VM, Wanjari SS. Conservation agriculture: a new paradigm to increase resource use efficiency. Indian Journal of Agronomy. 2009;54(2):166-177.
2. Bindhani A, Barik K, Garnayak L, Mahapatra P. Nitrogen management in baby corn (*Zea mays*). Indian Journal of Agronomy. 2007;52(2):135-138.
3. Bindhani A, Barik K, Garnayak L, Mahapatra P. Productivity and nitrogen-use efficiency of baby corn (*Zea mays*) at different levels and timing of nitrogen application under rainfed conditions. Indian Journal of Agricultural Sciences. 2008;78(7):629-631.
4. ICAR Central Research Institute for Dryland Agriculture (CRIDA). Vision 2050. Santoshnagar, Hyderabad, India: CRIDA; c2015. p. 1.
5. Devaranavadgi SB, Rathod P, Wali SY, Madiwalar SL. Carbon sequestration potential of tree borne oilseeds for dryland areas of Karnataka. International Journal for Crop Improvement. 2012;3:24-26.
6. Ghosh AP, Dass A, Kaur R, Kumar A. Yield components and nutrient accumulation in maize (*Zea mays*) under variable growing environments and chlorophyll meter guided nitrogen fertilization. Indian Journal of Agronomy. 2016;61(2):252-255.
7. Government of India (GoI). Agricultural Situation in India. New Delhi: Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare; c2016. p. 13-15.
8. Gomez AK, Gomez AA. Statistical Procedures for Agriculture Research. New York: Wiley-Interscience; c1984. p. 680.
9. Ibrahim S, Hala K. Growth, yield and chemical constituents of corn (*Zea mays* L.) as affected by nitrogen and phosphorus fertilization under different irrigation intervals. Journal of Applied Sciences Research. 2007;3(10):1112-1120.
10. Kumar R, Bohra JS. Effect of NPKS and Zn application on growth, yield, economics and quality of baby corn. Archives of Agronomy and Soil Science; c2013. Available from: http://www.tandfonline.com/doi/abs/10.1080/03650340.2013.873122.
11. Kumari K, Dass A, Sudhishri S, Kaur R, Rani A. Effect of irrigation regimes and variable nitrogen rates on yield components and nutrient uptake in maize (*Zea mays* L.) in

north-Indian plains. Indian Journal of Agronomy. 2017;62(1):104-107.
12. Lasisi D, Aluko OB. Effects of tillage methods on soybean growth and yield in a tropical sandy loam soil. International Agrophysics. 2009;23:147-153.
13. Panwar A, Munda G. Response of baby corn (*Zea mays*) to nitrogen and land configuration in mid hills of Meghalaya. Indian Journal of Agricultural Science. 2006;76(5):293-296.
14. Parshotamkumar. Effect of different resource conservation practices on growth, yield and productivity of different cropping systems. PhD thesis, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu; c2016.
15. Ravisankar N, Balakrishnan M, Ambast SK, Srivastava RC, Bommayasamy N, Subramani T. Influence of irrigation and crop residue mulching on yield and water productivity of table purpose groundnut (*Arachis hypogaea*) in humid tropical Island. Legume Research. 2014;37(2):195-200.
16. Uwah DF, Iwo GA. Effectiveness of organic mulch on the productivity of maize (*Zea mays* L.) and weed growth. The Journal of Animal & Plant Sciences. 2011;21(3):525-530.