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Effect of Potassium and Foliar Nutrition on Yield and Economics of Kodo Millet under Irrigated condition

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ABSTRACT: The field experiment was conducted during *summer* 2021-22 at Eastern block, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore. The field experiment was laid out in Randomized Block Design (RBD) which consists of eight treatments which are replicated thrice to study the effect of nutrient management techniques on yield, yield attributes and economics of kodo millet under irrigated condition. The results showed that maximum number of productive tillers, number of grains per panicle, length of earhead were obtained with the application of 33 kg K ha^{-1} + foliar application of $FeSO_4$ @1% and $ZnSO_4$ @0.5% compared to all other treatments. The higher grain yield (2028 kg ha^{-1}) and straw yield (6822 kg ha^{-1}), net return (Rs.52559) and B:C ratio (2.43) were recorded with the application of 33 kg K ha^{-1} + foliar application of $FeSO_4$ @1% and $ZnSO_4$ @0.5% over the other treatments.

Keywords: Foliar application, Iron, Kodo millet, MN mixture, Potassium, Zinc.

INTRODUCTION

Kodo millet (*Paspalum scrobiculatum* L.) is one of the important nutri cereal crop, which is mainly cultivated in India. Millets are mainly cultivated in low fertile soils of India for the purpose of food and fodder. The kodo millet is also known as ditch millet, rice grass, cowgrass, varagu, and Kodra. It is highly drought tolerant crop and suitable for low rainfall regions (Dubey, 1991). Millets are mainly used as an alternative to cereals because they have a good nutritional profile and we can cultivate with low input levels (Shahidi & Chandrasekara 2013). In our country, the minor millets are cultivated over 4.58 lakh hectares and the production of small millets was 3.70 lakh tonners with the average productivity of 809kg ha^{-1}. The important small millet cultivating states are Madhya Pradesh, Chhattisgarh, Uttarakhand, Karnataka, Maharashtra and Tamilnadu.

The millet cultivation was gradually decreased due to green revolution; lower the productivity and less preference among the farming community. The consumption pattern of food is continuously changing due to the high cultivation and production of cereals and pulses over the millets. In recent days, the consumer preference is changing towards the millets because of diabetic prevalence in world. The continuous intake of kodo millet prevents from cardiovascular diseases and reducing the blood pressure and high cholesterol (Bunkar *et al*., 2021). The productivity of millets was very low due to improper nutrient management, cultivation under dry land conditions and less number of improved varieties. So the foliar fertilization of micro nutrients and adequate supply of macro nutrients are the important nutrient management practices followed to encourage the productivity in millets. The potassium application was not recommended for most of the minor millets in India. But the application of enough quantity of potassium recorded positive results in yield and productivity of millets (Sundaresh & Basavaraja 2017). In this regard, the experiment was conducted with

different nutrient sources to check the yield and economics of kodo millet under irrigated condition.

MATERIALS AND METHODS

The field experiment was conducted at Eastern block, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore during summer2021-22. The experimental farm was located in western agro climatic zone of Tamil Nadu at 11°08′N latitude, 76°97′E longitude with an altitude of 426 m above MSL. The experiment was laid out in a Randomized Block Design with three replication and eight treatments. The treatment consists of: T_1 : RDF + MN Mixture @ 12.5 kg ha^{-1}, T_2 : RDF + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI, T_3 : RDF + 22 kg K ha^{-1} + MN Mixture @ 12.5 kg ha^{-1}, T_4 : RDF + 22 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI, T_5 : RDF + 33 kg K ha^{-1} + MN Mixture @ 12.5 kg ha^{-1}, T_6 : RDF + 33 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI, T_7 : RDF (44:22:0 kg NPK ha^{-1}), T_8 : Absolute Control. The sowing was taken at the first week of January and it was harvested at third week of May. The sources for N, P and K are urea, single super phosphate (SSP) and muriate of potash (MOP). In fertilizer application 50% of N, 100% P and K were applied as a basal dose with micro nutrient mixture (MN mixture). The micro nutrient mixture for small millets was purchased from Central Control Laboratory, Kudumiyanmalai. The foliar application of $FeSO_4$ @1%, $ZnSO_4$ @0.5% was given at active tillering and flower initiation stage. The observations on yield attributes, grain yield, straw yield and harvest index were recorded and analysed through ANOVA for Randomized Block Design (RBD) as per the procedure given by Gomez and Gomez (1984). The significant difference values were computed for 5% probability of error. When the variance ratio (F value) was found significant, critical difference (CD) values were computed for the comparison.

RESULTS AND DISCUSSION

Yield attributes. Data illustrated in Table 1 reveal that the yield contributing characters *viz*., number of productive tillers, number of grains per panicle, earhead length (cm), and test weight (g) were significantly influenced by the different nutrient management practices. The highest number of productive tillers (13.7), number of grains per panicle (209) and earhead length (14.5) were recorded by the application of RDF + 33 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at active tillering and flower initiation stages of kodo millet which is due to enhanced nutrition of crop. The application of zinc and iron plays major role in vigorous growth due to cellular growth, differentiation and metabolic changes in plants and it was attributed with high yield attributes and grain yield in pearl millet (Ram *et al.,* 2021). Sundaresh and Basavaraja (2017) reported similar results with the application of 125% K recorded higher productive tillers (4.47) in finger millet. The other yield attributes like earhead length (14.5 cm), number of grains per panicle (209) and 1000 grains weight (4.58 g) were recorded similar trend with RDF + 33 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI. Similar results were observed by(Patel *et al.,* 2019) for pearl millet where maximum number of productive tillers and earhead length were recorded with foliar application of water soluble fertilizer (19:19:19) and $ZnSO_4$ @ 0.5%. Similarly Sundaresh and Basavaraja (2017)reported application of potassium enhanced the root growth, translocation of photosynthates and increased photosynthetic activity in finger millet.

Table 1: Yield attributes of kodo millet as influenced by different nutrient management techniques.

Treatments	Number of productive tillers	Number of grains per panicle	Length of earhead (cm)	Test weight (g)
T_1 : RDF + MN Mixture @ 12.5 kg ha^{-1}	12.3	181.6	12.8	4.31
T_2 : RDF + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI	12.7	188.3	13.6	4.73
T_3 : RDF + 22 kg K/ha + MN Mixture @ 12.5 kg ha^{-1}	12.4	183.3	13.0	4.48
T_4 : RDF + 22 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI	12.8	192.0	14.0	4.32
T_5 : RDF + 33 kg K/ha + MN Mixture @ 12.5 kg ha^{-1}	13.0	184.6	13.5	4.53
T_6 : RDF + 33 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI	13.7	209.0	14.5	4.62
T_7 : RDF (44:22:0 kg NPK ha^{-1})	11.4	174.3	12.7	4.57
T_8 : Absolute Control	10.8	165.3	12.6	4.33
S. Ed. ±	0.71	9.78	0.28	0.19
CD at 5 %	1.53	20.99	0.60	NS

Yield of kodo millet. The grain and straw yields of kodo millet as influenced by different nutrient management techniques are presented in Table 2. The maximum grain yield (2028 kg ha^{-1}), straw yield (6822 kg ha^{-1}) and harvest index (0.30) were recorded with the application of RDF + 33 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at active tillering and flower initiation stage. T_6 has recorded significantly higher yields over all other treatments and the lowest yield was recorded in absolute control (1379 kg ha^{-1}) and it was on par with RDF + 33 kg K ha^{-1} + MN Mixture @ 12.5 kg ha^{-1}. The increased grain and straw yields with RDF + 33 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI stage was mainly due to the enhanced fertilization which improves vegetative growth and yield attributing characters in kodo millet.

The results confirm the findings of Srinivasa *et al.* (2019) has recorded higher grain yield (2266 kg ha^{-1}) and straw yield (3814 kg ha^{-1}) with the application of recommended dose of N, P_2O_5 + 40 kg K_2O. Fulpagare *et al.* (2018) recorded similar results of higher grain yield (40 q ha^{-1}) and stover yield (72.6 q ha^{-1}) in pearl millet with RDF (60:30:25 NPK kg ha^{-1} + FYM @ 5t ha^{-1}) + Foliar application of 0.1% chelated iron + 0.1 % chelated zinc.

The application of potassium improved meristematic activity like cell enlargement elongation and it involves in root development, translocation of photosynthates and grain filling process (Charate *et al.*, 2018). Application of zinc as a foliar spray was involved in IAA synthesis and metabolic process of plants (Ram *et al.*, 2021) and iron promoting the early vigour and growth through enhancing the uptake of nutrients resulting in higher photosynthesis rate, metabolic and physiological process in plants (Babar *et al*., 2021).

Economics. Highest gross (Rs. 89313) and net returns (Rs. 52559) and B:C ratio (2.43) were recorded with application of RDF + 33 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at active tillering and flower initiation stage. The maximum cost of cultivation (Rs. 37174/ha) was recorded in T_5 (RDF + 33 kg K ha^{-1} + MN Mixture @ 12.5 kg ha^{-1}). This was mainly due to sufficient application of potassium and foliar nutrition of $FeSO_4$ and $ZnSO_4$ at active tillering and flowering initiation. The basal application of potassium produced higher grain and straw yield over other treatments.

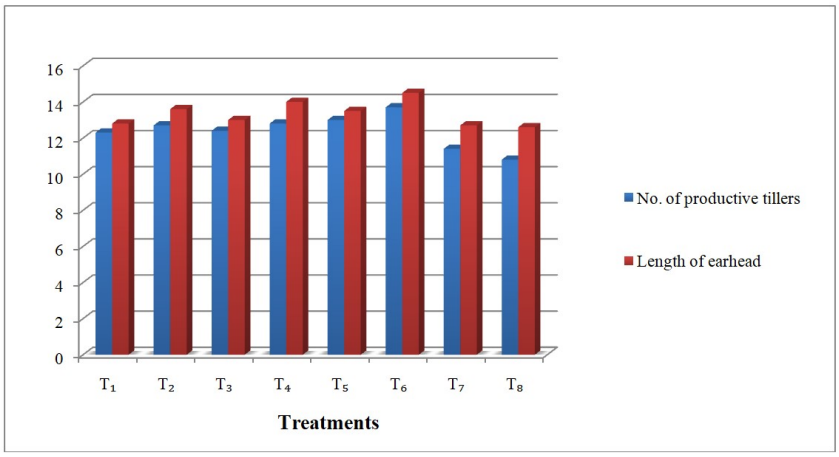

Fig. 1. Effect of different nutrient management techniques on number of productive tillers and length of earhead.

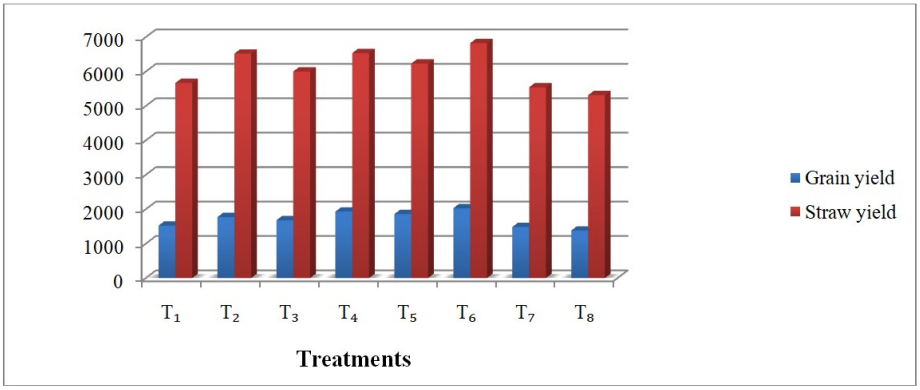

Fig. 2. Effect of different nutrient management techniques on grain yield and straw yield.

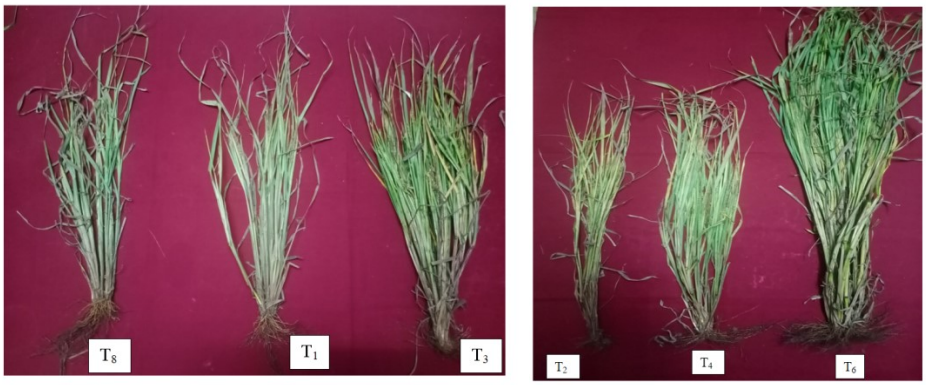

Fig. 3. Comparison of productive tillers of kodo millet at harvesting stage.

Table 2: Yield of kodo millet as influenced by different nutrient management techniques.

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index
T_1 : RDF + MN Mixture @ 12.5 kg ha^{-1}	1521	5667	0.27
T_2 : RDF + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI	1772	6519	0.27
T_3 : RDF + 22 kg K/ha + MN Mixture @ 12.5 kg ha^{-1}	1679	6000	0.28
T_4 : RDF + 22 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI	1930	6533	0.30
T_5 : RDF + 33 kg K/ha + MN Mixture @ 12.5 kg ha^{-1}	1856	6230	0.30
T_6 : RDF + 33 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI	2028	6822	0.30
T_7 : RDF (44:22:0 kg NPK ha^{-1})	1483	5541	0.27
T_8 : Absolute Control	1380	5311	0.26
S. Ed. ±	85.05	182.44	-
CD at 5 %	182.42	826.45	-

Table: 3 Economics of kodo millet as influenced by different nutrient management techniques.

Treatments	Cost of cultivation	Gross return	Net return	B:C ratio
T_1 : RDF + MN Mixture @ 12.5 kg ha^{-1}	36290	67659	31369	1.86
T_2 : RDF + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI	35870	78696	42826	2.19
T_3 : RDF + 22 kg K/ha + MN Mixture @ 12.5 kg ha^{-1}	36879	74370	37491	2.02
T_4 : RDF + 22 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI	36459	85055	48596	2.33
T_5 : RDF + 33 kg K/ha + MN Mixture @ 12.5 kg ha^{-1}	37174	81727	44553	2.20
T_6 : RDF + 33 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at AT & FI	36754	89313	52559	2.43
T_7 : RDF (44:22:0 kg NPK ha^{-1})	35665	65967	30302	1.85
T_8 : Absolute Control	34110	61544	27434	1.80

CONCLUSION

From the above research, it could be concluded that recommended dose of fertilizers (RDF) + 33 kg K ha^{-1} + Foliar spray of $ZnSO_4$ @ 0.5% and $FeSO_4$ @ 1% at active tillering and flower initiation stage was recommended to obtain higher yield in kodo millet under irrigated condition.

FUTURE SCOPE

The potassium application and foliar nutrition were not recommended for most of the minor millet in India. But the application of potassium with foliar nutrition of micro nutrients will enhance the yield and productivity in kodo millet under irrigated condition.

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Conflict of Interest. None.

REFERENCES

Babar, S. R., Athoni, B., & Basamma, K. (2021). Influence of nutrient levels on pearl millet (*Pennisetum glaucum* L.) growth, yield and economics under dryland condition of Northern Karnataka. *Journal of Pharmacognosy and Phytochemistry*, *10*(1): 333-336.

Bunkar, D. S., Goyal, S., Meena, K. K., & Kamalvanshi, V. (2021). Nutritional, Functional Role of Kodo Millet and its Processing: A Review. *Int. J. Curr. Microbiol. App. Sci*, *10*(01): 1972-1985.

Charate, S., Thimmegowda, M., Rao, G. E., Ramachandrappa, B., & Sathish, A. (2018). Effect of nitrogen and potassium levels on growth and yield of little millet (*Panicum sumatrense*) under Dryland Alfisols of southern Karnataka. *Int J Pure Appl Biosci*, *6*(6): 918-923.

Dubey, O. (1991). Response of kodo millet (*Paspalum scrobiculatum*) gentypes to nitrogen under skeletal soils. *Ind. J. Agronomy*, 36(4): 598-599

Fulpagare, D., Patil, T., & Thakare, R. (2018). Effect of application of iron and zinc on nutrient availability and pearl millet yield in vertisols. *International Journal of Chemical Studies*, *6*(6): 2647-2650.

Patel, N., Patel, B., Patel, C., & Foram Patel, B. (2019). Effect of foliar spray of nutrients at different growth stages on pearl millet under Dryland condition. *International Journal of Chemical Studies*, *7*(5): 5-9.

Ram, M., Meena, R., Parewa, H., & Meena, D. (2021). Productivity and Profitability of Pearl Millet as Affected by Zinc and Iron Application in Arid and Semi-arid Region. *International Journal of Agriculture, Environment and Biotechnology*, *14*(3): 375-380.

Shahidi, F., & Chandrasekara, A. (2013). Millet grain phenolics and their role in disease risk reduction and health promotion: A review. *Journal of Functional Foods*, *5*(2): 570-581.

Srinivasa, D., Chikkaramappa, T., Basavaraja, P., Sukanya, T., Murali, K., & Chamegowda, T. (2019). Status of different forms of potassium under foxtail millet crop as influenced by graded levels of potassium in Alfisols of Chikkaballapura region, Karnataka. *International Journal of Chemical Studies*, *7*(3): 3435-3441.

Sundaresh, R., & Basavaraja, P. (2017). Influence of different levels of phosphorus and potassium on growth, yield attributes and economics of finger millet in low phosphorus and potassium soils of eastern dry zone of Karnataka, India. *Int. J. Curr. Microbiol. App. Sci*, *6*(11), 3559-3566.

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