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STUDIES ON PLANTING GEOMETRY TO AUGMENT THE YIELD OF KODOMILLET (*Paspalum scrobiculatum*)

G. Muthu[1], B. Prakash[2] and C. Vigneshwaran[3]

[1&2] Department of Agronomy, Don Bosco College of Agriculture,

[3]Department of Horticulture, Don Bosco College of Agriculture

Sagayathottam – 631 151 (T.N), India.

ABSTRACT

The experiment were conducted during during summer season (April-July) 2023 and Rabi season (Oct-Jan) 2024 at sagayathottam village, Arakkonam Taluk, Ranipet District, Tamil Nadu Field investigation were carried out "to study the planting geometry to augment the yield of kodomillet". The experiment was laid out in Randomized Block Design (RBD) and replicated thrice. The treatments comprised of seven planting geometry viz., Broadcasting - T_1, line sowing – T_2, 25cm x 15cm – T_3, 25cm x 25cm – T_4, 15cm x 15cm – T_5, 30cm x 10cm – T_6, 45cm x 15cm – T_7. Among the different planting geometry, T_4 (25 x 25 cm) recorded higher growth attributes *viz.*, plant height, number of tillers hill^{-1}, leaf area index, dry matter production and yield attributes *viz.*, number of panicles hill^{-1}, number of grains panicle^{-1}, test weight, which in turn accelerated the higher grain and straw yield respectively. The result of the present investigation clearly indicated the positive response of kodo millet due to planting geometry. Among the treatment combination, T_4 (25cm x 25cm) had a spectacular effect on growth and yield components, ultimately leading to the higher grain yield of 2502 kg ha^{-1} in kodo millet. In economic returns, the highest net return of Rs, 43997 and return rupee^{-1} invested of 2.25 was recorded under T_4 (25cm × 25cm). Therefore, it can be concluded that treatment T_4 (25cm × 25cm) holds immense potentiality to uplift the productivity and profitability of kodo millet.

KEYWORDS: Kodo millet, crop geometry, sowing methods, growth parameters and yield parameters.

INRODUCTION

Kodo millet is an indigenous cereal of India . it is considered as one of the important "NUTRI-CEREALS" It is estimated to have been domesticated in southern Rajasthan and Maharashtra dating back 3000 years back (Joshi.,2020). Nowadays it is grown in UP in the north and Kerala, Karnataka, and TN in the south.Kodo millet is a highly drought-resistant crop. Kodo millet have high nutritional benefits such as low glycemic index - which means that Kodo millet releases glucose slowly, over a longer period, and thus helps in sugar control. Among the small millets Kodo millet (*Paspalum srcobiculetum*) has the highest level of free radical activity followed by sorghum and finger millet (Deshpande *et al*., 2015). Due to, elevated antioxidant content it protects against oxidative stress and retains glucose concentrations in type-2 diabetes. Kodo millet occupies an area of 9.08 lakh ha with 3.11 lakh tones of annual production and 342 kg/ha of average productivity. The productivity per unit area is highest in kodo millet when compared to other small millets (Ahamed and Yadava, 1996). It matures in 3-4 months with yields varying from 250 to 1000 kg/ha (Hulse et al., 1980) and a potential yield of 2000kg/ha (Harinarayana, 1989). Plant growth, development, and yield depend on plant spacing. Optimum plant density ensures plants grow properly making better utilization of sunlight and soil nutrients. Crop geometry greatly affects the yield through proper utilization of resources and in turn higher production of photosynthates. An ideal crop geometry assure proper and uniform stand, healthy plant and ensure high productivity (Janani., 2021). If the plant density is higher than optimum plant density. It led to competition among plants for sunlight and nutrients which in turn slowed down. The plant grows and decreases the grain yield. If the plant density is lower than optimum plant density. If the plant density is lower yield and leaves soil moisture unutilized. Maximum yield per unit area can be obtained when the plant density is optimum (satybhan sigh et al., 2019).

MATERIALS AND METHODS

Field experiment were conducted during April-July 2023 and Oct- Jan 2024 in farmer field at sagayathottam village, Arakkonam Taluk, Ranipet District, Tamil Nadu, India to study the planting geometry to augment the yield of kodomillet. The soil of the experimental field is sandy clay loam with 0.6% of organic matter and pH of 8.1. The field soil contained 216, 11.49, 270 kgs of NPK ha^{-1}. The experiments were laid in Randomized Block Design (RBD) with seven treatments and three replications to study about the impact of the crop geometry in kodomillet. The fertilizers were applied to the experimental field as per the treatment schedule. The popular kodomillet variety of ATL 1 was taken for the study. The plant sample collected for estimation of dry matter production at harvest stage also used for chemical analysis to estimate the uptake of nutrients. The data regarding the various parameters in the investigation were analyzed statistically with five percent probability level.

RESULTS AND DISCUSSION

Growth attributes

The growth attributes such as plant height, number of tillers $hill^{-1}$, LAI and DMP were significantly influenced with different planting geometry. Among the different planting geometry, 25 × 25 cm (square planting) recorded higher values for growth attributes of kodo millet. The increase in plant height is always advantageous from point of light interception. More light interception thereby resulted in increased dry matter production per unit area. This was in conformity with Kalaraju (2007) and Hebbal *et al. (*2018). The lesser competition between plants due to wider space allowed the individual plants to develop better root system and better aeration resulted in healthy plant growth with more number of tillers. These results are in conformity with the findings of Narasimhamurthy and Hedge (1981). The higher LAI could be due to more number of leaves and tillers $hill^{-1}$ and also increased rate of photosynthesis (Jawahar *et al*, 2018).The higher total dry matter production was attributed to higher growth attributes in wider spaced crop which resulted in higher dry matter accumulation at the early stages and better translocation of photosynthates to earheads during later stages. These results are in conformity with the findings of Kalaraju *et al*. (2007) and Mishra *et al.(*1973).

Yield attributes and Yield

Planting geometry significantly influenced the yield attributes and yield of kodo millet. Among the different planting geometry, T_4 - 25 × 25 cm (square planting) recorded higher number of earheads $hill^{-1}$, length of earhead, number of grains $earhead^{-1}$ and weight of earhead, test weight, grain and straw yield of kodo millet which was closely followed by T_3 (20 × 20 cm). This could be due to vigorous growth, higher fertility of panicles and proper development of grains due to environmental factors such as nutrients, moisture and light (Jashim *et al.*, 2011 and Jawahar *et al*., 2018. The higher grain yield might be due to efficient translocation of photosynthates to the sink was noticed under optimum planting pattern with transplanting of

Table 1. Effect of planting geometry in Growth parameters of kodomillet

Treatments		Plant height (cm)			Number of tillers hill^{-1}	LAI		Dry Matter Production (Kg ha^{-1})		
		Tillering	Flowering	Harvest		Tillering	Flowering	Tillering	Flowering	Harvest
T_1	Broadcasting (Control)	28.42	57.47	5.79	5.79	0.37	1.1	1556	1908	2511
T_2	Line sowing	42.22	76.42	8.91	8.91	3.34	4.82	2861	3701	4903
T_3	25 cm × 15 cm Spacing	45.18	79.21	9.52	9.52	3.78	5.37	3034	3976	5232
T_4	25 cm × 25 cm Spacing	48.05	83	10.08	10.08	4.3	6.02	3580	4691	6173
T_5	15 cm × 15 cm Spacing	38.88	72.2	7.64	7.64	2.17	3.88	2623	3198	4429
T_6	30 cm × 10 cm Spacing	41.07	75	8.79	8.79	3.63	4.43	2781	3584	4845
T_7	45 cm × 15 cm Spacing	36.66	68	8.21	8.21	1.78	3.21	2255	2843	3907
SEm±		0.7	0.93	0.7	0.19	0.11	0.15	40	83	97
CD (p=0.05)		2.09	2.76	2.09	0.56	0.32	0.43	119	251	290

Table 2. Effect of planting geometry in Yield parameters and Economics of kodomillet

Treatments		Yield Parameters			Grain Yield (Kg Ha^{-1})	Economics			
		Number of Panicles Hill^{-1}	Number of Grains Panicle^{-1}	1000 grain weight (g)		Total cost of cultivation (Rs. ha^{-1})	Gross income (Rs. ha^{-1})	Net income (Rs. ha^{-1})	Benefit cost ratio
T_1	Broadcasting (Control)	14.28	56.12	6.31	1310	32019	40633	8614	1.26
T_2	Line sowing	35.21	78.27	6.49	2021	35033	63592	28559	1.81
T_3	25 cm × 15 cm Spacing	39.02	81.8	6.5	2138	35033	67509	32476	1.92
T_4	25 cm × 25 cm Spacing	44.21	85.33	6.55	2502	35058	79056	43997	2.25
T_5	15 cm × 15 cm Spacing	30.22	73.83	6.44	1823	33247	57195	23947	1.72
T_6	30 cm × 10 cm Spacing	33.56	77.36	6.47	1950	33273	61352	28079	1.84
T_7	45 cm × 15 cm Spacing	26.78	70.02	6.41	1710	33221	53555	20333	1.61
SEm±		0.85	1.17	0.03	24.69				
CD (p=0.05)		2.54	3.52	NS	73.43				

medium aged seedlings. Optimum planting pattern is the prerequisite for proper utilization of growth resources and ultimately to exploit the potential productivity of any crop. The results are in accordance with the findings of Prakasha *et al.* (2018) and Kumar *et al.*(2019).

Economics

The ultimate aim of any agricultural technology/practice is to realize maximum returns per rupee invested.. The net return and return rupee^{-1} invested of kodo millet was greatly influenced by different planting geometry. The highest net return and return rupee^{-1} invested of Rs. 43997 and Rs. 2.25 was associated in the treatment of T_4 (25 × 25 cm). This might be due to optimum plant population maintained in a unit area and increased application of fertilizer leads to higher grain yield resulted in higher net return and benefit cost ratio resulted in more profit.. These results are in line with the earlier findings by Bhomte *et al*. (2013) and Jawahar *et al.* (2018).

Conclusion

The experimental results revealed that there was noticeable variation on the productivity of kodo millet due to adoption of different planting geometry. Sowing of seeds at 25 × 25 cm (T_4) produced better yield characters and yield. However, the treatment T_3 (25 cm × 15 cm) was fallowed with T_4 and it was economically viable.

References

Kalaraju, K. 2007. Response of finger millet genotypes to methods of planting under organic farming. M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Bengaluru, Karnataka, India.

Mishra, A., S. S. Patra and R. N. Patnaik. 1973. Response of ragi to spacing and nitrogen. Ind. J. Agron., 18: 264-268.

Joshi R. P., A.K.Jain, Nikil malhotra and Madhulata kumari. 2020.Millet and Pseudo cereals:genetic resource and breeding advancement, pp 33-38.

Despande S. S., D. Mohapatra, M.K. Tripathi and R. H. Sadvatha. 2015. Kodo millet-nutritional value and utilization in Indian foods. Journal of grain processing and storage., 2(2) :16-23.

Ahamed, M.S. and H.S.Yadava.1996. Assessment of productivity and economics of small millets in Madhya Pradesh. Crop Res., 12(3). 12 – 15.

Hulse, J.M., E.M.Laing and O.E. Pearson.1980. Sorghum and the Millets: their composition and nutritive value. Academic Press, New York.

Harinarayana, G., 1989. Breeding and varietal improvement of Small Millets in India. In. Small millets in global agriculture. Proc. First Int. Small millets workshop. Bangalore. (Eds.) Seetharama .A, Riley, K.W and Harinarayana, G. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.pp 59-70.

Janani.2021. Effect of Planting geometry and NPK levels on productivity of barnyard millet under transplanted condition. M.Sc. (Agri) Thesis, Faculty of agriculture, Annamalai university.

Satybhan Singh, Virendra Singh, Rabish Datt Shukla and Brajesh Yadav. 2019. Effect pf planting geometry and phosphorus levels on pearl millet(*Pennisetum glaucum*). Progressive research – An International Journal.14(1):18-22.

Hebbal, N., B. K. Ramachandrappa and M. N. Thimmegouda. 2018. Yield and economics of finger millet with establishment methods under different Planting geometry and nutrient Source. Ind. J. of Dryland Res. and Develop., 33(1): 54-58.

Narasimhamurthy, S. N. and B. R. Hegde. 1981. Tillering in relation to intra-row competition in ragi under rainfed condition. Ind. J. Agron., 26(3): 337-338.

Jawahar, S., K. Suseendran, C. Kalaiyarasan, S. Ramesh and S. Elankavi. 2018. Optimization of age of seedlings and spacing to enhance the productivity and profitability of kodo millet under transplanted condition. J. of Emerging Technologies and Innovative Res., 5(9): 930- 937.

Jashim Uddin, Md., Sultan Ahmed, Md. Harun-or-Rashid, Md. Mahmudul Hasan and Md. Asaduzzaman. 2011. Effect of spacings on the yield and yield attributes of transplanted aman rice cultivars in medium lowland ecosystem of Bangladesh.J. Agric. Res., 49(4).

Prakasha, G., K. N. Kalyana Murthy, A. S. Prathima and R. N. Meti. 2018. Effect of spacing and nutrient levels on growth attributes and yield of finger millet (*Eleusine coracana* L. Gaertn.) cultivated under Guni planting method in red sandy loamy soil of Karnataka, India. Intl. J. of Curr. Microbio. and Applied Sciences, 7(05): 1337-1343.

Kumar, D. P., S. Maitra, T. Shankar and P. Ganesh. 2019. Effect of crop geometry and age of seedlings on productivity and nutrient uptake of finger millet (*Eleusine coracana L. Gaertn*). Intl. J. of Agric. Environ. and Biotech., 12(3): 267-272.