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Studies on the Effect of Establishment Methods and Foliar Nutrition on Productivity of Transplanted Finger Millet (*Eleusine coracana*) under Irrigated Condition

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A B S T R A C T

A field experiment was conducted during the *kharif* season of 2019 in sandy clay loam soil of Agricultural College And Research Institute, Madurai to evolve the different type of transplanting methods and foliar nutrient management practices in finger millet under irrigated condition. Among the different types of transplanting methods, machine transplanting shows better results in physiological parameters. Among the foliar nutrition practices, humic acid 2% foliar application 25 DAT and 50 DAT was reported that incerased plant height, no of leaves, LAI, CGR and this was followed by foliar application of 40 ppm salicylic acid in 25 DAT and 50 DAT. With regard to interaction machine transplanting along with foliar application of 2% humic acid recorded maximum plant height no. of leaves, LAI, CGR .

Introduction

Finger millet (*Eleusine coracana*) is one of the most important nutri cereals which possessing remarkable ability to survive under severe drought. This crop is cultivated mainly for the nutritious grains and straw. Ragi straw is good fodder for cattle and used for hay making.It occupies maximum area among the small millets. In India, finger millet is cultivated about 1.19 M hectares with total production of 1.98 Mtonnes and productivity of 1662 kg/ha. In Tamil Nadu finger millet is cultivated in an area of 0.086M hectares with total production of 0.32 Mtonnes and productivity of 3714 kg/ha respectively (India stat, 2017-2018). The grains can be stored for 8 – 10 years and thus, it is an important famine food (Michaelraj and Shanmugam, 2013).Finger millet grains are more nutritious than wheat and rice. The nutritional values per 100 g of finger millet are: Protein 7.3 g; Minerals 2.7 g; Carbohydrates 72 g; Fat 1.3 g; Calcium 344 mg and Fibre 3.6 g. It also contains Iron 5 mg and Food energy 323–350 K Cal. The finger millet contains important amino acids viz., isoleucine (4.4 g), leucine (9.5 g), methionine (3.1 g) and phenyl alanine (5.2 g) which are deficient in other starchy meals. Millets also contains B vitamins,

especially niacin, B6 and folic acid calcium, iron, potassium, magnesium and zinc (Vachanth *et al.,* 2010). Finger millet has largely cultivated as a crop under rainfed conditions and which was raised under irrigated condition as transplanting crop. Finger millet productivity and production is extremely lower than the other cereals because of planting pattern, establishment methods, planting of aged seedling, insufficient irrigation and nutrient management practices etc.,

Foliar nutrition is the one of the methods of nutrient application to the plant and foliar application of nutrient is nothing but applying fertilizer in liquid form foliar application of nutrients are increase the maximum nutrient absorption in plants. It will penetrate in the leaf cuticle and cells which was helpful for rapid growth of the plants (Manonmani and Srimathi, 2009). Shortage of labour, time bound availability and scarcity of resources, especially water are the main causes for delayed transplanting in finger millet. In spite of the labor scarcity, uniform population as well as adequate plant spacing cannot be possible in the field this also one of the factor for low productivity of finger millet. To rectify these problems mechanical transplanting is only the possible way to achieve maximum production and productivity (Vasudevan *et al.,* 2014).

Materials and Methods

The field experiment was located in field No. 32 of C block at Agricultural College and Research Institute, Madurai. The experimental site is situated geographically at $9^{o}54'$N latitude and $78^{o}54'$E longitude with an altitude of 147 m above the mean sea level under southern agro-climatic zone of Tamil Nadu. Minimum and Maximum temperature, sunshine hours, relative humidity, wind velocity rainfall and evaporation data were collected from agro meteorological observatory at Agricultural College and Research Institute, Madurai, Tamil Nadu. Experiment field contain available N (245 kg ha^{-1}), available P_2O_5 (16.3 kg ha^{-1}, available K_2O (275 kg ha^{-1}) and organic carbon (0.56 %).

The trial was laid out in split plot design with three replications. The treatments at main plots consisted of different methods of transplanting *viz.,* normal transplanting (30 cm x 10 cm) (M_1), square transplanting (17.5 cm x 17.5 cm) (M_2) and machine transplanting (30 cm x 10 cm) (M_3). In sub plots, different foliar nutrition management practices *viz.*, Panchakavya (3%) (S_1), PPFM (1%) (S_2), Salicylic acid (40 ppm) (S_3), Humic acid (2%) (S_4) these are chemicals are sprayed in the interval of 25 DAT and 50 DAT.

Results and Discussion

Plant height

The total height of the plant was significantly affected by different types of transplanting and foliar nutrition practices. Increased plant height 50.86,64.16,91.68 and 113.81 cm at growth stage of 20,40,60 DAT and harvest was noticed in machine transplanting(M_3) which was followed by manual transplanting 49.83,62.69,92.07 and 109.64 cm and lower plant height was recorded 46.4, 58.54,84.74 and 103.62cm. Mudalagiriyappa *et al.,* (2015) also found similar results in the plant height of the finger millet. with regard to foliar application humic acid 2% spray (S_4) at 25 DAT and 50 DAT was recorded maximum plant height 54.85, 70.32 101.20 and118.46 cm which was followed by salicylic acid at the rate of 40 ppm recorded (49.71 62.67, 91.66 112.98 cm) with regard to interaction different types of establishment pattern along with foliar application shown non significance between each other (Table 1).

Table.1 Effect of different types of transplanting and foliar nutrition management practices on plant height (cm) of Finger millet at 20, 40, 60 DAT and harvest stage

Treatments	20 DAT			Mean	40 DAT			Mean	60 DAT			Mean	Harvest			Mean
	M_1	M_2	M_3		M_1	M_2	M_3		M_1	M_2	M_3		M_1	M_2	M_3	
S_1	43.91	39.04	46.13	**43.03**	53.00	50.63	55.61	**53.08**	80.23	75.16	80.65	**78.68**	94.46	79.93	106.36	**93.58**
S_2	49.87	47.04	48.93	**48.61**	63.08	57.93	62.34	**61.12**	90.32	81.67	87.30	**86.43**	113.28	107.62	112.33	**111.08**
S_3	50.09	47.66	51.36	**49.71**	63.25	58.96	65.80	**62.67**	94.31	85.56	95.12	**91.66**	114.16	109.75	115.02	**112.98**
S_4	55.45	52.10	57.01	**54.85**	71.43	66.63	72.90	**70.32**	103.42	96.55	103.63	**101.20**	116.67	117.17	121.54	**118.46**
Mean	**49.83**	**46.46**	**50.86**		**62.69**	**58.54**	**64.16**		**92.07**	**84.74**	**91.68**		**109.64**	**103.62**	**113.81**	
	M	**S**	**M ×S**	**S × M**	**M**	**S**	**M ×S**	**S × M**	**M**	**S**	**M × S**	**S × M**	**M**	**S**	**M X S**	**S X M**
SE(d)	1.22	1.70	2.41	2.41	1.56	2.91	4.11	4.11	2.20	3.73	5.27	5.27	2.72	5.05	7.14	7.14
CD (P =0.05%)	2.86	3.63	NS	NS	3.67	6.20	NS	NS	5.17	7.95	NS	NS	6.39	10.76	NS	NS

Table.2 Effect of different types of transplanting and foliar nutrition management practices on LAI of finger millet at 20, 60, 40 DAT and at harvest stage

Treatments	20 DAT			Mean	40 DAT			Mean	60 DAT			Mean
	M_1	M_2	M_3		M_1	M_2	M_3		M_1	M_2	M_3	
S_1	1.84	1.65	1.92	**1.80**	2.46	2.23	2.66	**2.45**	3.08	2.85	3.21	**3.05**
S_2	2.20	1.97	2.13	**2.10**	2.32	2.86	3.20	**2.79**	3.96	3.52	3.82	**3.77**
S_3	2.26	2.04	2.40	**2.23**	3.48	3.16	3.64	**3.43**	4.10	3.66	4.20	**3.99**
S_4	2.72	2.53	2.78	**2.68**	3.57	3.72	3.73	**3.67**	4.46	4.38	4.52	**4.45**
Mean	**2.26**	**2.05**	**2.31**		**2.96**	**2.99**	**3.31**		**3.90**	**3.60**	**3.94**	
	M	**S**	**M × S**	**S × M**	**M**	**S**	**M × S**	**S × M**	**M**	**S**	**M × S**	**S × M**
SE(d)	0.06	0.10	0.14	0.14	0.08	0.17	0.24	0.24	0.09	0.17	0.24	0.24
CD (P=0.05%)	0.15	0.21	NS	NS	0.19	0.36	NS	NS	0.22	0.36	NS	NS

Table.3 Effect of different types of transplanting and foliar nutrition management practices on CGR (Kg/ha) of finger millet at 20, 60, 40 DAT and at harvest stage

Treatments	0-20			Mean	20-40			Mean	40-60			Mean	60-Harvest			Mean
	M_1	M_2	M_3		M_1	M_2	M_3		M_1	M_2	M_3		M_1	M_2	M_3	
S_1	30.10	27.82	43.26	**33.73**	49.37	45.50	51.18	**48.68**	66.80	60.26	70.13	**65.73**	86.13	71.22	91.43	**82.93**
S_2	37.02	43.88	33.46	**38.12**	56.87	53.10	55.67	**55.21**	80.60	73.42	78.36	**77.46**	103.80	95.20	101.56	**100.19**
S_3	38.86	35.26	40.06	**38.06**	57.36	54.20	57.36	**56.31**	82.13	76.23	84.65	**81.00**	105.36	98.70	108.43	**104.16**
S_4	43.77	36.25	44.15	**41.39**	60.73	57.59	65.93	**61.42**	86.79	85.10	90.23	**87.37**	111.90	110.12	116.17	**112.73**
Mean	**37.44**	**35.80**	**40.23**		**56.08**	**52.60**	**57.53**		**79.08**	**73.75**	**80.84**		**101.80**	**93.81**	**104.40**	
	M	**S**	**M ×S**	**S × M**	**M**	**S**	**M ×S**	**S × M**	**M**	**S**	**M ×S**	**S ×M**	**M**	**S**	**M X S**	**S X M**
SE(d)	0.94	1.13	1.94	1.96	1.36	2.15	3.51	3.74	1.94	2.38	4.07	4.12	2.64	2.83	5.00	4.91
CD (P=0.05%)	2.63	2.38	NS	NS	3.78	4.53	NS	NS	5.40	5.00	NS	NS	7.34	5.95	NS	NS

Leaf Area Index

The leaf area index (LAI) is determined by the number of tillers, number of green leaves hill^{-1}and average leaf size (Rai and Murty, 1976). Leaf area index was moderately affected by transplanting methods and foliar application practices. machine transplanting shown better variance in its growth stage (2.31,3.31,3.94) which was on par with conventional transplanting (2.26, 2.99, 3.60) which was followed by square transplanting. These results are in close conformity with findings of Anitha *et al.*, (2017) and Amin and Haque (2009) (Table 2).

With regard to foliar application (S_4) humic acid 2% foliar application was recorded maximum leaf area index (2.68, 3.67,4.45) which was followed by salicylic acid 40 ppm on 25 DAT and 50 DAT was recorded (2.23,3.43,3.99) and lower leaf area index was recorded in panchagavya 3 % foliar application (1.80,2.45,3.05) with regard to interaction, there is no significance was recorded in leaf area index parameter.

Crop Growth Rate

CGR was significantly affected by different types of transplanting and foliar application methods. maximum crop growth rate was recorded at 20, 40, 60 DAT and harvest stage (40.23, 57.53, 80.84, 104.40 Kg/ha) in machine transplanting ($M_{3)}$ lower crop growth rate was reported in conventional transplanting ($M_{1)}$ 37.44, 56.08,79.08,101.80 (Kg/ha) with regard to foliar application practices, ($S_{4)}$ humic acid 2 % foliar application in 25 DAT and 50 DAT was recorded that increased CGR (33.73, 61.42, 87.37, 112.73 Kg/ha) which was followed by salicylic acid 40 ppm [($S_{3)}$ (38.06, 56.31, 81, 104.16 Kg/ha] with regard to interaction, there is no significance was recorded in crop growth rate (Table 3).

In conclusion by adopting machine transplanting along with humic acid 2% foliar application on 25 DAT and 45 DAT (vegetative and flowering stage) is registered maximum plant height, LAI, CGR.

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