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Research Paper

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Effect of establishment methods and nutrient management on yield attributes and yield of finger millet (*Eleusine coracana* G.)

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ABSTRACT

The field experiment was conducted at the Central Farm, Central Experiment Station, Wakawali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, dist. Ratnagiri (M.S.) during *Kharif* season of the year 2009 on terraced upland to study the effect of establishment methods and nutrient management on yield attributes and yield of finger millet (*Eleusine coracana* G.). The experiment was laid out in a split plot design. The Main plot treatments comprised four methods of crop establishment and sub plot treatments consisted of five nutrient management practices. Thus, there were 20 treatment combinations replicated three times. On the basis of results obtained from present investigation it was concluded that *Kharif* finger millet grown under south Konkan conditions be established by transplanting and supplied with FYM @ 5 t ha^{-1} plus 75 per cent RDF(60:30:00 kg NPK/ha) plus biofertilizers (*Azospirillum* + PSB), so as to obtain higher yield of finger millet.

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KEY WORDS : Establishment methods, Nutrient management, Yield attributed, Finger millet

Finger millet (*Eleusine coracana* G.) is an important food grain crop of semi arid tropics, particularly of India and East Africa. It is a staple food of tribes and lower income class of most of the villages in Konkan. This crop is generally grown in the Konkan on the moderate hill slopes and uplands which are less fertile and productive where rice cultivation is not possible. To get higher yield of quality finger millet, new high yielding fertilizer responsive varieties should be adapted with proper nutrient management practices. The productivity is low due to late transplanting, faulty methods of cultivation and little or no use of fertilizers. The secret of boosting its yields mainly lies in suitable planting method and properly fertilizing the crop. Keeping these views, the present investigation was undertaken.

RESEARCH PROCEDURE

The field experiment was conducted at the Central Farm, Central Experiment Station, Wakawali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (M.S.) during *Kharif* season of the year 2009 to study the effect of establishment methods and nutrient management on yield attributes and yield of finger millet (*Eleusine coracana* G.). The experiment was conducted on terraced upland which was suitable for the cultivation of finger millet. The field experiment was laid out in a split plot design. The Main plot treatments comprised of four methods of crop establishment (S_1 :Line sowing of seeds at 20 cm spacing at onset of monsoon, S_2 :Line sowing of pre germinated seeds at 20 cm spacing after onset of monsoon, S_3 *:Awatni* (Farmer's practice-throwing of seedlings randomly) and S_4 :Recommended transplanting at 20 x 15 cm spacing (*Thomba* method)), whereas, the sub plot treatments consisted of five nutrient management practices *viz.,* F_1:RDF (80:40:00 kg N + P_2O_5 + K_2O ha^{-1}), F_2: FYM @ 5 t ha^{-1} + RDF , F_3: FYM @ 5 t ha^{-1} + 75% RDF + Biofertilizers(*Azospirillum* + PSB), F_4: FYM @ 10 t ha^{-1} + Biofertilizers (*Azospirillum* + PSB) and F_5: FYM @ 15 t ha^{-1} + Biofertilizers (*Azospirillum* + PSB.)). Thus, there were 20 treatment combinations replicated three times. The variety, Dapoli 1 of finger millet was used in the present investigation. The finger millet nursery area was manured with FYM and it was mixed thoroughly in soil at the time of seedbed preparation. Then, nursery beds of 3 m x 1 m size were prepared in a well tilled plot. Fertilizers *viz.,* urea and rock phosphate @ 1 kg each were applied for 100 sq. m. nursery area at the time of sowing. The fungicide treated seeds were sown on the raised beds in lines at 7.5 cm apart and 2.5 cm depth across the length of the raised beds. A hand weeding of nursery was done and it was top dressed with urea @ 1 kg per 100 sq. m. at 15 DAS.

The line sowing of fungicide treated and as per the treatments biofertilizers (*Azospirillum* @ 25 g kg^{-1} + PSB @ 25 g kg^{-1} seeds) inoculated seeds was done at 20 cm spacing in the experimental field as per the treatments on the same day of the nursery sown for the transplanting and *awatni* establishment methods. Fungicide treated seeds were kept in water for 24 hrs on the same day of nursery sowing and line sowing of seeds. The 24 hrs. water soaked seeds were wrapped in gunny bags for 24 hrs. for sprouting. After 24 hrs. of wrapping, sprouted seeds were treated with biofertilizer inoculants (*Azospirillum* and PSB @ 25 g kg^{-1} each) and sown at 20 cm spacing in the experimental field as per the treatments. In *awatni* and transplanting methods, 30 days old, healthy and vigorous seedlings were uprooted and roots of some of the seedlings were dipped in to biofertilizer inoculants (*Azospirillum* and PSB) for 30 minutes. Thereafter, biofertilizers treated seedlings and untreated seedlings were transplanted by throwing randomly in *awatni* method, whereas, in transplanting two seedlings hill^{-1} were transplanted at 20 x 15 cm^2 spacing as per the treatments in the experimental field.

RESEARCH ANALYSIS AND REASONING

During the course of present study, the yield contributing characters, namely, number of earheads sqm^{-1}, number of fingers earhead^{-1}, earhead weight (g), weight of earheads sqm^{-1} (g), grain weight earhead^{-1} (g), grain weight sqm^{-1} (g), straw weight sqm^{-1} (g), length finger^{-1} (cm) and thousand grain weight (g), grain and straw were recorded (Table 1).

Effect of establishment methods:

The number of earheads sqm^{-1} increased significantly due to transplanting as compared to rest of the establishment methods except *awatni* which was at par with transplanting. The number of fingers earhead^{-1} in transplanting was significantly more than the line sowing of pre germinated seeds and at par with remaining establishment methods. The finger millet crop established by transplanting produced earheads of significantly higher weight over rest of the treatments except the weight obtained under *awatni* method. Glimpse of data presented in Table 1 denoted that establishment method, transplanting was found to be significantly superior over all other treatments except *awatni* in recording the yield of earheads sqm^{-1}. Transplanting recorded significantly the highest grain weight earhead^{-1} (2.19 g) and straw weight sqm^{-1} over all other methods of crop establishment. The length finger^{-1} and weight of thousand grains of finger millet was not influenced significantly due to establishment methods of finger millet. The increased yield attributes might be due to increased growth and development parameters and increased grain yield might be due to increased yield attributes. Inspite of high plant population in *awatni* and direct seed sown plots the yield ha^{-1} was adversely affected. As a matter of fact the yield of unit area basis was higher with lower plant population. In other words lower yield plant^{-1} was not nullified because of high number of plants under *awatni*, line sowing of seeds and pre germinated seeds. Transplanting produced maximum and significantly higher grain yield (22.40 q ha^{-1}) and straw yield (33.16 q ha^{-1}) over rest of the establishment methods. The *awatni* method was next best establishment method which produced significantly higher grain yield (17.92 q ha^{-1}) and straw yield (26.44 q ha^{-1}) as compared to line sowing of seeds and line sowing of pre germinated seeds. However, line sowing of seeds and line sowing of pre germinated seeds were at par with each other in producing the grain yield of finger millet. This might be due to increased morphological characters *viz.,* plant height, number of leaves plant^{-1} and hill^{-1}, number of tillers sqm^{-1} and dry matter production plant^{-1}, hill^{-1} and sqm^{-1} observed under transplanting. The present results are in consonance with those of Ravi (1984) and Newase *et al.* (1995) in finger millet and Tippanagoudar (2009) in proso millet.

Effect of nutrient management:

Application of FYM @ 5 t ha^{-1} plus RDF recorded significantly higher number of earheads and weight of earheads over all other treatments followed by FYM @ 5 t ha^{-1} plus 75 per cent RDF plus biofertilizers. Application of RDF recorded significantly lower and significantly higher fingers earhead^{-1} than FYM @ 5 t ha^{-1} plus RDF and application of 10 t of FYM ha^{-1} alongwith biofertilizers, respectively and remained at par with integration of FYM @ 5 t ha^{-1} plus 75 per cent RDF plus biofertilizers and application of FYM @ 15 t ha^{-1} along with biofertilizers. Application of FYM @ 5 t ha^{-1} plus RDF recorded maximum and significantly higher earhead weight as compared to rest of the treatments except the application of FYM @ 5 t ha^{-1} plus 75 per cent RDF plus biofertilizers. There was significant increase in the grain weight earhead^{-1}, grain weight sqm^{-1}, straw weight sqm^{-1} and finger length

Table 1 : Mean values of the different yield contributing characters of finger millet as influenced by different treatments

Treatments	No. of earheads sqm^{-1}	No. of fingers $earhead^{-1}$	Earhead weight (g)	Wt. of earheads sqm^{-1} (g)	Grain wt. $earhead^{-1}$ (g)	Grain wt. sqm^{-1}	Straw weight sqm^{-1}	Length $finger^{-1}$ (cm)	1000 grain wt. (g)	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})
Effect of establishment methods											
S_1: Line sowing of seeds	88.05	5.29	2.33	206.61	1.77	153.17	226.21	8.05	1.72	15.32	22.62
S_2: Line sowing of pre germinated seeds	87.00	4.92	2.13	186.59	1.70	149.06	218.33	7.99	1.66	14.91	21.83
S_3: *Awatni*	95.39	5.59	2.57	246.41	1.91	179.17	264.36	8.12	1.80	17.92	26.44
S_4: Transplanting	101.11	5.72	2.79	285.14	2.19	224.00	331.57	8.14	1.82	22.40	33.16
S.E. ±	3.02	0.15	0.07	11.22	0.07	7.24	10.59	0.03	0.06	0.72	1.06
C.D. (P=0.05)	10.46	0.52	0.25	38.83	0.25	25.04	36.65	NS	NS	2.50	3.67
Nutrient management											
F_1: RDF	87.87	5.42	2.47	215.96	1.90	164.98	238.29	8.02	1.72	16.50	23.83
F_2: FYM @ 5 t ha^{-1} + RDF	107.13	5.83	2.69	291.20	2.14	222.66	329.01	8.32	1.90	22.27	32.90
F_3: FYM @ 5 t ha^{-1} + 75 % RDF + Bio.	96.22	5.58	2.63	258.16	2.07	204.49	302.92	8.24	1.84	20.45	30.29
F_4: FYM @ 10 t ha^{-1} + Bio.	85.43	4.80	2.18	187.52	1.62	138.90	204.42	7.87	1.55	13.89	20.44
F_5: FYM @ 15 t ha^{-1} + Bio.	87.78	5.27	2.31	203.09	1.74	150.72	225.95	7.94	1.74	15.07	22.59
S.E. ±	2.90	0.11	0.06	9.85	0.08	8.02	11.37	0.05	0.06	0.80	1.14
C.D. (P=0.05)	8.35	0.31	0.18	28.38	0.23	23.10	32.76	0.15	0.18	2.31	3.28
Interaction effect											
S.E. ±	2.41	0.22	0.12	5.32	0.11	4.69	5.51	0.11	0.12	1.48	1.74
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
General mean	92.89	5.38	2.46	231.19	1.89	176.35	260.12	8.08	1.75	17.63	26.01

NS = Non significant

due to application of FYM @ 5 t ha^{-1} plus RDF as compared to other treatments except FYM @ 5 t ha^{-1} plus 75 per cent RDF plus biofertilizers which was at par with the former treatment. The nutrient management indicated significant effect on thousand grain weight. Application of FYM @ 5 t ha^{-1} plus RDF recorded significantly higher thousand grain weight (1.90 g) as compared to all other treatments. This indicated that the application of FYM @ 5 t ha^{-1} plus RDF (integration of organic and inorganic sources of nutrients) was superfluous and application of FYM @ 5 t ha^{-1} plus 75 per cent RDF plus biofertilizers (integration of all sources of nutrients) was equally effective in improving the growth and ultimately yield parameters of finger millet. This is obvious as the role of FYM is multidimentional ranging from building up of soil organic matter, maintaining faourable soil physical and chemical properties and balanced supply of nutrients. Further, the effect being registered with the dual inoculation of both the bioinoculants which might be due to the provision of nitrogen and growth promoting substances (IAA and GA), antifungal substances and proliferative beneficial organisms in rhizosphere which in turn promoted root elongation and root hair development by *Azospirillum* and the possible solubilization of fixed P (as alumina and iron phosphate) as well as applied P besides synthesis of growth promoting substances like auxins and gibberellins and produced vitamins which augment plant growth by *Pseudomonas* phosphorus solubilizing species might have improved vigour and resulted in recording higher values of morphological parameters which increase the photosynthetic capacity of plant thereby increasing the biological yield and ultimately economic yield.

Application of FYM @ 5 t ha^{-1} plus RDF recorded significantly higher grain yield (22.27 q ha^{-1}) and straw yield (32.90 q ha^{-1}) over rest of the treatments except the application of FYM @ 5 t ha^{-1} plus 75 per cent RDF plus biofertilizers which was at par with the former treatment. The increase in grain yield of finger millet due to application of FYM @ 5 t ha^{-1} plus RDF and application of FYM @ 5 t ha-

[1] plus 75 per cent RDF plus biofertilizers may be accounted for significant improvement in yield attributes like number of earheads sqm^{-1}, grain weight earhead^{-1}, grain weight sqm^{-1}, finger length and test weight which finally resulted in increased grain yield. Similar results were reported by Prabakaran *et al.* (1995), Basavaraju and Rao (1997), Jena *et al.* (1997), Singh (1999), Kumar *et al.* (2003), Selvi *et al.* (2005), Deshmukh (2007) and Jagathjothi *et al.* (2008).

Conclusion:

On the basis of present investigation, it can be concluded that *Kharif* finger millet grown under south Konkan conditions be established by transplanting and supplied with FYM @ 5 t ha^{-1} plus 75 per cent RDF plus biofertilizers (*Azospirillum* + PSB), so as to obtain higher yield of finger millet with a saving of 25 per cent (20 kg N + 10 kg P_2O_5 ha^{-1}) fertilizer dose to be applied to finger millet.

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