Effect of Sowing Methods, Nutrient Management and Seed Priming on Seed Yield and Yield Attributes of Finger Millet (*Eleusine coracana* G.)

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Abstract

The field experiment was conducted at Central Experiment Station, Wakawali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, District Ratnagiri (Maharashtra) during Kharif season of the year 2015-16 to study the effect of sowing methods, nutrient management and seed priming on seed yield and yield attributes of Finger millet (*Eleusine coracaca* G.). The experiment was laid out in a split plot design. The main plot treatment comprised methods of planting and sub-plot treatments consisted of four nutrient management practices and sub-sub plot treatment consisted of priming treatments. The transplanting method recorded higher plant height tillers and seed yield than direct seeding. The nutrient management with organic (Neem+vermicompost) and inorganic (recommended NPK) recorded higher seed yield than other nutrient treatments. The seed priming with KH_2PO_4 (2 %) also produced higher seed yield than other priming treatments. Thus finger millet transplanted with application of organic plus inorganic nutrients and seed priming with KH_2PO_4 recorded higher seed yield.

Key words : Planting methods, nutrients, priming, yield per acre, finger millet.

Introduction

Finger millet (*Eleusine coracaca* G.) is an important food grain crop of semiarid 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, fertilize responsive varieties should be adapted with proper nutrient management practices. The productivity is low due to faulty methods of cultivation and little or no use of fertilizers. The secret of boosting its yield mainly lies with suitable planting method and properly fertilizing the crop. Also seed priming plays an important role for rapid and uniform field emergence to achieve high yield. Constraints to good crop establishment include improper seedbed preparation, low quality seed, untimely sowing (Van Osterom *et al.* 1996), poor sowing techniques (Radford 1983), inadequate seed moisture (Harris 1996) and adverse soil condition. Seed priming has been found a double technology to enhance rapid and uniform emergence and to achieve high vigour and better yield. Priming allows some of the metabolic processes necessary for germination to occur without germination to take place. In priming, seeds are soaked in different solutions with high osmotic potential. This prevents the seeds from absorbing in enough water for radicle protrusion, thus suspending the seeds in the lag phase (Taylor *et al.* 1998). Seed priming has been commonly used to reduce the time between seed sowing and seedling emergence and to synchronize emergence. Keeping these points in view, the present investigation was undertaken to estimate the integrated approach for enhancing the production potential in finger millet.

Material and Methods

A field experiment was conducted at Central Experiment

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Station, Wakawali during Kharif 2015 to study the integrated approach for enhancing seed yield and quality of finger millet. Finger millet variety Dapoli Nagli-1 was used for the study. There were two main plot treatments i.e. method of planting while nutrient management was taken as subplot and seed priming was sub-sub plot treatments. The experiment was laid out in split plot design with two replications. The treatment details are as under-

Main plot treatments (sowing methods) : 2

S_1 : Sowing (30 x 10 cm)

S_2 : Transplanting (30 x 10 cm)

Sub plot treatments (Nutrient management) : 4

N_1 : No fertilizers

N_2 : 125 kg Neem + 1250 kg Vermicompost ha^{-1}

N_3 : 50 kg Urea + 50 kg SSP + 50 kg MOP ha^{-1} + Top dressing Urea at 3 to 4 weeks after transplanting + 2% Borax spray at flowering

N_4 : N_2 + N_3

Sub-sub plot treatment (priming) : 4

P_1 : Control-No priming

P_2 : Hydropriming

P_3 : Seed priming with 2% KH_2PO_4

P_4 : Seed priming with 20% liquid pseudomonas fluorescence

The observations on plant height, total chlorophyll content, number of tillers, panicle weight plot^{-1}, seed yield plant^{-1}, seed recovery (%), seed germination (%) and seed vigour index were recorded and subjected to statistical analysis as per Panse and Sukhatme (1985).

Results and Discussion

There was a significant difference in main plot in case of direct sowing and transplanting methods for most of the characters except chlorophyll content (Table 1).

Effect of Planting Method

The sowing method transplanting (S_2) recorded

Table 1. Effect of sowing methods, nutrient management, priming and their interactions in finger-millet variety Dapoli Nagli-1

Treatments	Plant height at harvest (cm)	Total chlorophyll content (mg g^{-1})	No. of tillers	Panicle weight (kg plot^{-1})	Seed yield (g plant^{-1})	Seed yield (kg acre^{-1})	Seed recovery (%)	Germination (%)	Vigour index
S_1	76.54	8.04	3.03	1.434	16.60	682.77	77.27 (61.77)	75.11 (60.12)	805.77
S_2	85.79	8.74	3.63	1.853	19.96	922.68	82.61 (65.55)	81.78 (64.84)	917.19
SE (m)	0.14	0.18	0.03	0.013	0.026	10.09	0.12	0.08	4.53
CD (0.05)	2.58	NS	0.59	0.242	0.462	181.27	2.19	1.44	81.39
N_1	76.13	7.01	2.91	1.329	15.98	642.83	75.22 (60.25)	75.81 (60.61)	790.36
N_2	79.09	7.74	3.38	1.411	17.38	697.00	78.89 (63.08)	77.28 (61.62)	828.89
N_3	84.48	8.27	3.50	1.821	18.72	889.58	82.50 (65.43)	80.41 (63.88)	909.35
N_4	84.96	10.53	3.55	2.013	21.04	981.48	83.15 (65.87)	80.28 (63.80)	917.32
SE (m)	0.57	0.19	0.10	0.040	0.281	13.98	1.1	0.60	15.58
CD (0.05)	1.96	0.65	0.33	0.137	0.969	48.26	3.81	2.08	53.77
P_1	78.08	7.75	2.86	1.490	14.95	631.17	76.92 (61.42)	76.25 (60.98)	809.93
P_2	81.11	8.37	3.47	1.783	18.21	839.17	80.26 (63.86)	78.04 (62.15)	856.81
P_3	83.31	8.87	3.28	1.743	20.67	963.71	82.57 (65.71)	80.53 (63.96)	888.43
P_4	82.16	8.57	3.73	1.558	19.28	776.85	80.00 (63.65)	78.97 (62.83)	890.75
SE (m)	0.71	0.21	0.08	0.045	0.232	23.64	0.96	0.47	22.57
CD (0.05)	2.08	0.62	0.22	0.131	0.678	69.03	2.80	1.37	NS

(Figures in parentheses are arcsin values)

significantly higher plant height, no. of tillers, panicle weight, seed yield, seed recovery, seed germination and vigour index than direct sowing method (S_1).

Effect of nutrient management grain yield

S_2 treatment (transplanting) stress significantly higher seed yield 922.36 kg acre^{-1} than S_1 direct sowing (682.77 kg acre^{-1}). This increase in yield was due to increase in plant height, number of tillers and panicle weight similar results were recoreded by Newase *et al.* (1995) and Ravi (1984) in fingermillet. In case of sub-plot different levels of nutrient treatment there was significant difference for all the traits. The nutrient management N_4 recorded significantly higher plant height, total chlorophyll content, Number of tillers, panicle weight plot^{-1}, seed yield, seed recovery and vigour index over N_1.

Effect of priming

N_4 (combine use of organic + inorganic nutrient) showed significants higher seed yield (981.48 kg acre^{-1}) over N_3 (889.59 kg acre^{-1}), N_2 (697 kg acre^{-1}) and N_1 (642.83 kg acre^{-1}). Similar results were recorded by Newase

Table 2. Effect of Nutrient (S) X Fertilizer (N) interaction on seed yield and its attributes on finger millet.

Treatments	Plant height at harvest (cm)	Total chlorophyll content (mg g^{-1})	No. of tillers	Panicle weight (kg plot^{-1})	Seed yield (g plant^{-1})	Seed yield (kg acre^{-1})	Seed recovery (%)	Germination (%)	Vigour index
S_1N_1	73.75	6.27	2.70	1.070	14.83	504.00	72.01 (58.13)	72.88 (58.64)	761.37
S_1N_2	74.13	6.94	3.09	1.065	15.84	531.50	75.54 (60.85)	74.50 (59.70)	791.37
S_1N_3	79.08	8.10	3.25	1.704	16.58	803.33	80.13 (63.62)	77.00 (61.43)	857.25
S_1N_4	79.23	10.87	3.10	1.899	19.16	892.25	81.40 (64.47)	76.06 (60.73)	813.24
S_2N_1	78.51	7.76	3.11	1.589	17.14	781.67	78.42 (62.37)	78.75 (62.58)	819.50
S_2N_2	84.06	8.54	3.66	1.589	17.14	781.67	78.42 (62.37)	78.75 (62.58)	866.37
S_2N_3	89.87	8.45	3.75	1.758	18.91	862.50	82.25 (65.31)	80.06 (63.55)	961.37
S_2N_4	90.70	10.20	4.00	2.126	22.91	1070.71	84.90 (67.27)	84.50 (66.88)	1021.37
SE (m)	0.80	0.27	0.14	0.056	0.397	19.77	1.56	0.85	22.03
CD (0.05)	2.77	0.92	NS	0.193	1.188	68.24	NS	NS	NS

(Figures in parentheses are arcsin values)

Table 3. Effect of Sowing (S) X Priming (P) interaction on seed yield and its attributes on finger millet.

Treatments	Plant height at harvest (cm)	Total chlorophyll content (mg g^{-1})	No. of tillers	Panicle weight (kg plot^{-1})	Seed yield (g plant^{-1})	Seed yield (kg acre^{-1})	Seed recovery (%)	Germination (%)	Vigour index
S_1P_1	73.98	15.21	2.81	1.204	14.50	518.17	76.10 (60.88)	72.38 (58.32)	759.37
S_1P_2	76.58	16.10	3.13	1.553	16.68	744.17	77.64 (62.03)	75.00 (60.03)	787.38
S_1P_3	78.81	16.42	2.83	1.566	18.14	828.33	79.06 (63.20)	77.44 (61.68)	820.34
S_1P_4	76.81	16.62	3.38	1.415	17.09	640.42	76.27 (60.96)	75.63 (60.46)	856.12
S_2P_1	82.19	15.80	2.90	1.776	15.40	744.17	77.74 (61.96)	80.13 (63.64)	860.50
S_2P_2	85.65	17.36	3.81	2.013	19.75	934.17	82.88 (65.69)	81.08 (64.27)	926.25
S_2P_3	87.80	19.08	3.73	1.920	23.20	1099.08	86.09 (68.21)	83.63 (66.25)	956.50
S_2P_4	87.51	17.66	4.09	1.702	21.48	913.29	83.73 (66.34)	82.31 (65.19)	925.37
SE (m)	1.01	0.30	0.11	0.063	0.328	33.44	1.36	0.66	31.92
CD (0.05)	NS	NS	0.31	NS	0.959	NS	NS	NS	NS

(Figures in parentheses are arcsin values)

et al. 1995 in fingermilet and Ahiwale *et al.* 2013 in fingermillet. In sub-sub plot priming was found to be significant for all the characters except vigour index. Priming P_3 recorded significantly higher plant height, chlorophyll content, seed yield, seed recovery and germination over P_1. P_3 (seed priming with 2% KH_2PO_4) showed significantly higher seed yield (963.71 kg acre^{-1}) over P_2, P_4 and P_1 treatment (631.17 kg acre^{-1}). Similar results were obtained by Yari *et al*. (2010) in Bread wheat and Sathish *et al*. (2011) in maize crop.

Two way interaction

Among the two way interactions, sowing methods (S) and nutrient management (N) interaction was found to be significant for plant height, chlorophyll content, panicle weight and seed yield (Table 2). In this interaction S_2N_4 recorded significantly higher plant height (90.70 cm), panicle weight (2.12 kg), seed yield plant^{-1} (22.91 g plant^{-1}) over other treatments. Significantly higher seed yield was recoreded by S_2N_4 (1070.71 kg acre^{-1}) over other treatments. The increase in seed yield was increase in plant height and panicle weight by this treatment. The present results are in agreement with those Ravi (1984) and Newase *et al.* (1995), Ahiwale *et al*. (2013) in finger millet and Tippanagoudar (2009) in proso millet, respectively. In sowing method (S) and priming (P) interaction was found to be significant for number of tillers and seed yield (Table 3). In this interaction S_2P_4 recorded significantly higher tillers plant^{-1} which was at par with S_2P_2 over other treatments. S_2P_3 recorded significantly higher seed yield (23.20 g plant^{-1}) over other treatments. Among nutrient (N) and priming (P) interaction panicle weight and seed yield was found to be significant (Table 4). In this N_4P_3 recorded significantly higher panicle weight (2.22 kg plot^{-1}) over other treatments. Similarly, N_4P_3 recorded significantly

Table 4. Effect of Nutrient (N) X Priming (P) interaction on seed yield and its attributes on finger millet.

Treatments	Plant height at harvest (cm)	Total chlorophyll content (mg g^{-1})	No. of tillers	Panicle weight (kg plot^{-1})	Seed yield (g plant^{-1})	Seed yield (kg acre^{-1})	Seed recovery (%)	Germination (%)	Vigour index
N_1P_1	72.75	6.35	2.40	1.293	13.05	454.67	71.13 (57.54)	72.75 (58.58)	731.00
N_1P_2	76.48	7.47	3.13	1.613	15.95	693.33	75.18 (60.22)	75.75 (60.55)	809.75
N_1P_3	78.58	7.13	2.65	1.305	18.45	800.00	78.97 (62.74)	78.00 (62.09)	813.25
N_1P_4	76.73	7.11	3.45	1.108	16.48	623.33	75.58 (60.51)	76.75 (61.23)	807.75
N_2P_1	75.85	7.71	2.90	1.303	15.25	518.33	78.56 (62.58)	75.50 (60.37)	735.00
N_2P_2	78.00	7.44	3.30	1.393	16.23	756.67	77.55 (61.97)	76.25 (60.88)	831.25
N_2P_3	80.08	7.99	3.25	1.373	20.50	906.67	80.64 (64.90)	79.00 (62.80)	903.75
N_2P_4	82.45	7.84	4.05	1.578	17.53	606.33	78.83 (62.87)	78.38 (62.44)	845.50
N_3P_1	82.65	7.53	2.98	1.688	14.78	721.67	77.85 (61.98)	77.25 (61.70)	833.00
N_3P_2	85.40	8.62	3.85	1.963	19.03	991.67	83.52 (66.13)	80.40 (63.81)	914.00
N_3P_3	85.53	8.43	3.65	2.075	20.60	963.33	86.25 (68.35)	83.50 (66.17)	910.25
N_3P_4	84.33	8.52	3.53	1.559	20.48	881.67	82.36 (65.28)	80.50 (63.85)	980.00
N_4P_1	81.08	9.43	3.15	1.678	16.73	829.99	80.14 (63.59)	79.50 (63.26)	940.75
N_4P_2	84.58	9.94	3.60	2.163	21.65	915.00	84.81 (67.12)	79.75 (63.37)	872.25
N_4P_3	89.05	11.95	3.55	2.220	23.13	1184.84	84.43 (66.84)	81.63 (64.80)	926.50
N_4P_4	85.15	10.82	3.90	1.990	22.65	996.08	83.23 (65.93)	80.25 (63.79)	929.75
SE (m)	1.42	0.42	0.15	0.090	0.465	47.29	0.92	0.94	45.14
CD (0.05)	NS	NS	NS	0.262	1.356	142.38	NS	NS	NS

(Figures in parenthesis are arcsin values)

Table 5. Effect of Sowing (S) X Nutrient (N) X Priming (P) interaction on seed yield and its attributes on finger millet.

Treatments	Plant height at harvest (cm)	Total chloro-phyll content (mg g^{-1})	No. of tillers	Panicle weight (kg $plot^{-1}$)	Seed yield (g $plant^{-1}$)	Seed yield (kg $acre^{-1}$)	Seed recovery (%)	Germination (%)	Vigour index
$S_1N_1P_1$	68.90	4.89	2.60	0.900	12.40	326.00	68.14 (55.64)	69.50 (56.48)	692.50
$S_1N_1P_2$	74.50	6.83	2.90	1.310	14.00	566.67	70.76 (57.29)	73.00 (58.71)	769.50
$S_1N_1P_3$	77.15	6.86	2.20	1.100	17.50	700.00	76.93 (61.30)	75.00 (60.02)	783.00
$S_1N_1P_4$	74.45	6.49	3.10	0.970	15.40	390.00	72.19 (58.30)	74.00 (59.36)	800.50
$S_1N_2P_1$	72.60	7.13	2.85	0.930	15.25	346.67	80.12 (63.68)	73.00 (58.70)	676.00
$S_1N_2P_2$	74.00	7.02	2.90	0.950	15.75	600.00	75.75 (60.95)	73.50 (59.03)	787.50
$S_1N_2P_3$	75.40	7.07	2.50	1.155	16.10	726.67	73.29 (60.09)	77.50 (61.72)	859.50
$S_1N_2P_4$	74.50	6.55	4.10	1.225	16.25	486.00	72.98 (58.68)	74.00 (59.36)	842.50
$S_1N_3P_1$	76.50	7.44	3.10	1.450	14.00	636.67	76.62 (61.11)	71.50 (57.74)	783.60
$S_1N_3P_2$	79.40	8.17	3.70	1.910	16.45	956.67	81.00 (64.18)	77.50 (61.72)	844.38
$S_1N_3P_3$	81.40	7.66	3.30	1.870	18.50	850.00	84.15 (66.62)	80.00 (63.46)	841.50
$S_1N_3P_4$	79.00	9.15	2.90	1.585	17.35	770.00	78.75 (62.56)	79.00 (62.78)	959.68
$S_1N_4P_1$	77.90	10.96	2.70	1.535	16.35	763.33	79.51 (63.09)	75.50 (60.36)	885.76
$S_1N_4P_2$	78.40	10.19	3.00	2.040	20.50	853.34	83.06 (65.71)	76.00 (60.69)	748.00
$S_1N_4P_3$	81.30	11.26	3.30	2.140	20.45	1036.67	81.88 (64.81)	77.25 (61.52)	797.50
$S_1N_4P_4$	79.30	11.07	3.40	1.880	19.35	915.67	81.15 (64.28)	75.50 (60.36)	822.00
$S_2N_1P_1$	76.60	7.81	2.20	1.685	13.70	583.34	74.11 (59.43)	76.00 (60.69)	769.50
$S_2N_1P_2$	78.45	8.10	3.35	1.915	17.90	786.67	79.59 (63.14)	78.50 (62.39)	850.00
$S_2N_1P_3$	80.00	7.39	3.10	1.510	19.40	900.00	81.02 (64.18)	81.00 (64.17)	843.50
$S_2N_1P_4$	79.00	7.73	3.80	1.245	17.55	856.67	78.98 (62.72)	79.50 (63.09)	815.00
$S_2N_2P_1$	79.10	8.28	2.95	1.675	15.25	690.00	76.99 (61.48)	78.00 (62.05)	794.00
$S_2N_2P_2$	82.00	7.86	3.70	1.835	16.70	946.67	79.35 (62.98)	79.00 (62.73)	875.00
$S_2N_2P_3$	84.75	8.91	4.00	1.590	24.90	1086.67	87.99 (69.72)	80.50 (63.88)	948.00
$S_2N_2P_4$	90.40	9.13	4.00	1.930	18.80	726.67	84.67 (67.06)	82.75 (65.53)	848.50
$S_2N_3P_1$	88.80	7.62	2.85	1.925	15.55	806.67	79.09 (62.85)	83.00 (65.66)	882.50
$S_2N_3P_2$	91.40	9.07	4.00	2.015	21.60	1026.67	86.04 (68.08)	83.30 (65.90)	983.63
$S_2N_3P_3$	89.87	9.21	4.00	2.280	22.70	1076.67	88.36 (70.08)	87.00 (68.88)	979.00
$S_2N_3P_4$	89.65	7.89	4.15	1.532	23.60	993.34	85.96 (68.00)	82.00 (64.93)	1000.50
$S_2N_4P_1$	84.25	7.91	3.60	1.820	17.10	896.67	80.78 (64.08)	83.50 (66.15)	996.00
$S_2N_4P_2$	90.75	9.70	4.20	2.285	22.80	976.67	86.55 (68.54)	83.50 (66.05)	996.50
$S_2N_4P_3$	96.80	12.64	3.80	2.300	25.80	1333.00	86.98 (68.86)	86.00 (68.08)	1055.50
$S_2N_4P_4$	91.00	10.57	4.40	2.100	25.95	1076.50	85.31 (67.59)	85.00 (67.22)	1037.50
SE (m)	2.01	0.60	0.21	0.127	0.657	66.87	2.72	1.33	63.84
CD (0.05)	NS	1.74	0.63	NS	1.918	201.65	NS	NS	NS

(Figures in parentheses are arcsin values)

higher seed yield (23.13 g plant^{-1}) over other treatments and control N_1P_1 (13.05 g plant^{-1}).

In three way interaction

Treatment combination $S_2N_4P_3$ recorded significantly higher chlorophyll content (12.64 mg g^{-1}) over all other treatments (Table 5). Significantly higher seed yield (1333.0 kg acre^{-1}) was recorded by $S_2N_4P_3$ over all other treatments and control $S_1N_1P_1$ (326.0 kg acre^{-1}). These results are in agreement with those recorded by Ravi (1984), Newase *et al.* (1995), Ahiwale *et al.* (2013).

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