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Impact of fertilizer, spacing and genotypes on yield, income and related traits in Finger millet

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Abstract

Finger millet is one of important staple cereal and it is rich in calcium. This gives great solution to bone related problems. The grain yield and fodder yield depends upon genotypes, optimum fertilizer and spacing. Out of three finger millet genotypes, DHFM-78-3 (5066 kg/ha) produced highest grain yield and significantly superior over DHFM-4-9 (4441 kg/ha) and DHRS-1 (3921 kg/ha). These genotypes were recorded maximum yield at 22.5 x 10 cm spacing (4831 kg/ha) which was statistically superior 30 x 10 cm spacing (4122 kg/ha). DHFM-78-3, DHFM-4-9 and DHRS-1 produced higher fodder yield of 9380 kg/ha, 9000 kg/ha and 8530 kg/ha, respectively at 22.50 x10 cm spacing and 200% RDF (60:30:30::N:P:K). The finger millet entry, DHFM-78-3 (Rs. 69800 and Rs. 46350) exhibited maximum gross and net returns in 22.50X10 cm and two hundred per cent RDF. When look in to different combinations, 22.50 X 10 cm spacing with 100% recommended dose of fertilizer gave highest B:C ratio found in DHFM-78-3 (3.12:1) and DHFM-4-9 (2.74:1) and DHRS-1 (2.57:1).

Keywords: Finger millet, spacing, fertilizer and yield

Introduction

Finger millet is a staple cereal food crop for millions of people in semi-arid and other regions of the world, particularly in Africa and India, and especially those who live by subsistence farming. Ethiopia is the centre of diversity for finger millet. It is grown from sea level to about 2400 meters above sea level and in a wide range of soil types and tolerant notably to high rainfall and a certain degree of alkalinity. It is used in many forms for human food and also as fodder for livestock (Wafula, Siambi & Gwei-Onyango, 2016) [12]. Finger millet is widely produced by small scale landholders and consumed locally. Finger-millet is primarily grown today in Eastern and Southern Africa to make beer, as it has been displaced by maize as a staple in many regions (Adunga *et al.* 2011) [13]. It is grown mainly in Karnataka in India a, where it covered maximum area. It is wide spreading in warm temperature regions from Africa to Japan and Australia but can also grow in colder regions as Northern Ireland during summer**.**
Finger millet agronomy plays a great role in increasing and sustaining the crop production and productivity. Soil nutrient application rates, and spacing (planting method) are among the major agronomic practices which requires due attention. Consequently plant growth slows down and the grain yield decreases. However, very low plant density may not enable attainment of the yield plateau (Hay & Walker, 1989) [11]. It is therefore necessary to determine the optimum density of plant population per unit area under appropriate spacing and optimum fertilizer dose to obtain maximum yields. It is also quite important to address plant density with respect to fertilizer dose and variety.

Materials and Method

A field and experiment was conducted on red sandy loamy soil and black soil at ARS Hanumanamatti, respectively in Karnataka, India. The soil type of experimental site was red sandy loam in texture, which is deep and possess good drainage at ARS Hanumanamatti and black shallow soil with good drainage facilities at MARS, Dharwad. The field experiment was laid out in Randomized complete Block Design in factorial concept consisting of 18 treatment combinations of three fertilizer levels (100%, 150% and 200% of RDF). The field was prepared by repeated ploughing and harrowing. The FYM was applied 7.5 t/ha to all treatments on 15 days prior to sowing. The finger millet genotypes *viz.*, DHRS-1 DHFM-4-9 DHFM-78-3 was sown at 22.5 X 10 cm and 30 X 10 cm spacing with seed rate of 5 kg/ha. The full dose of NPK as per recommended to 150% and 200% RDF. All agronomic practiced are followed as per package of practices of UAS Dharwad.

The experimental data was subjected to analysed by using Fischer's method of analysis of variance (ANOVA) as outlined by Gomez and Gomez (1984) [14] and all the date were analysed and the results are presented and discussed at a probability level of 0.05 per cent.

Result and Discussion

Grain yield

The finger millet genotypes *viz*., DHRS-1, DHFM-4-9 and DHFM-78-3 tested in different levels of Nitrogen, phosphorus and potash with different spacing 22.50 x 10 and 30 x 10 cm during 2017-18 at ARS Hanumanamatti and results were presented in table 1 and 2. Among these, DHFM-78-3 (4745 kg/ha) produced highest grain yield and statistically superior than DHFM-4-9 (4341 kg/ha) and DHRS-1(3732 kg/ha). The spacing of 22.5 x 10 cm (4729 kg/ha) produced significantly more grain yield than 30 x 10 cm spacing (3817 kg/ha). Two hundred per cent RDF (4647 kg/ha) recorded statistically superior over 150% RDF (4279 kg/ha) and 100% RDF (3892 kg/ha) for grain yield.

Looking into the factorial combination in the table 2. The finger millet genotypes, DHFM-78-3, DHFM-4-9 and DHRS-1 produced highest grain yield 5641 kg/ha, 5046 kg/ha and 4572 kg/ha, respectively at spacing of 22.50x10 cm with 200% RDF (100:80:50::N:P:K).

Same finger millet experiment was repeated at Hanumanamatti during 2018-19 and results were summarised in Table 3 and 4. Out of three genotypes, DHFM-78-3 (5047 kg/ha) exhibited significantly superior over DHFM-4-9 (4250 kg/ha) and DHRS-1 (3854 kg/ha) for grain yield. When considered spacing, 22.5 x 10 cm (4700 kg/ha) recorded more grain yield as compared to 30 x 10 cm (4067 kg/ha) and 200 per cent RDF (4757.71 kg/ha) noticed significantly superior over 150% RDF (4390 kg/ha) and 100% RDF (2896 kg/ha) for grain yield.

Look into the factorial combination In the situation of 22.50 x 10 cm spacing and 200% RDF, maximum grain yield achieved by DHFM-78-3 (5752 kg/ha), DHRS-1 (4749 kg/ha) and DHFM-4-9 (4700 kg/ha).

The finger millet genotypes *viz*., DHRS-1, DHFM-4-9 and DHFM-78-3 tested in different levels of Nitrogen, phosphorus and potash with different spacing of 22.50 x 10 and 30 x 10 cm during 2018-19 at MARS Dharwad and results were presented in table 5 and 6. Out of these, DHFM-78-3 (5406 kg/ha) recorded significantly higher grain yield than DHFM-4-9 (4733 kg/ha) and DHRS-1 (4178 kg/ha) while, 22.50 x 10 cm spacing (5063 kg/ha) produced significantly more grain yield than 30 x 10 cm spacing (4482 kg/ha). Two hundred per cent RDF (5167 kg/ha) expressed statistically superior over 150% RDF (4799 kg/ha) and 100% RDF (4351 kg/ha) for grain yield.

DHFM-78-3, DHRS-1 and DHFM-4-9 produced highest grain yield of 6057 kg/ha and 5144 kg/ha and 5135 kg/ha, respectively at 22.50 x10 cm spacing and 200 per cent RDF (100:80:50:: N:P:K).

The pooled results of Hanumanamatti 2017-18 and 2018-19 and Dharwad 2018-19 were summarized in table7 and 8. Out of these, DHFM-78-3 (5066 kg/ha) produced highest grain yield and significantly superior over DHFM-4-9 (4441 kg/ha) and DHRS-1 (3921 kg/ha). These genotypes were recorded maximum grain yield at 22.5 x 10 cm spacing (4831 kg/ha) which was statistically superior over 30 x 10 cm spacing (4122 kg/ha). These finger millet genotypes gave highest grain yield when applied two hundred per cent RDF (4857 kg/ha) which was significantly superior to 150 per cent RDF (4489 kg/ha) and 100 per cent RDF (4082 kg/ha).

Looking into factorial combinations, DHFM-78-3, DHFM-4-9 and DHRS-1 produced higher grain yield of 5817 kg/ha,4960 and 4822 kg/ha, respectively at 22.50 x10 cm spacing with 200% RDF (100:80:50:: N:P:K).Similar results were observed by Andrew Kipkurui Korir (2019). M. Roja et el (2020) [8] in their results, finger millet responded to fertilizer application from 90:40:25 to 100: 50:50 kg/ ha N_2 P_2O_5 and K_2O while foxtail millet responded from 30: 15:15 to 50: 30:20 kg/ ha N_2 P_2O_5 and K_2O.M. S. Hasan *et al* (2013) reported that yield and yield contributing characters of foxtail millet were influenced by seed ratesJohn W. Mc Arthur *et al* (2017) [10]. F. Yanoah *et al* (2002) [6] reported application of 30 kg/ha increase grain yield 1.2 t/ha in pearl millet. Danish Ahmed Siddiqui *etal* (2020) differential levels of fertilizer and row spacing affect yield of brown top millet.Nandini and Sridhar (2019) [7] recorded spacing of 20 X 10 cm significantly more grain yield as compared to 30 X 10 cm, 20 X5 cm and 10 X5 cm spacing in foxtail millet. Hassan *et al* (2013) reported more grain yield (1.77 /ha) when applied higher dose of fertilizer $N_{30}P_{24}K_{15}$ as compared to normal (0.86 / ha) in little millet.Charate *et al* (2017) found more grain yield of little millet in 40:20:20 as compared to 20:00:00 N: P: K. Similar results were observed by Andrew Kipkurui Korir (2019) and John W. Mc Arthur *et al* (2017) [10]. Charles F. Yanoah *et al* (2002) [6] reported that application of 30 kg/ha increased grain yield by 1.2 t/ha in pearl millet. Danish Ahmed Siddiqui *et al* (2020) [4] recorded different levels of fertilizer and row spacing affect the yield of brown top millet. Nandini and Sridhar (2019) [7] a spacing of 20 X 10 cm recorded significantly higher grain yield as compared to 30 X 10 cm, 20 X5 cm and 10 X5 cm spacing in foxtail millet. M. Roja *et al*. (2020) [8] reported finger millet responded to fertilizer application from 90:40:25 to 100: 50:50 kg/ ha N_2 P_2O_5 and K_2O while foxtail millet responded from 30: 15:15 to 50: 30:20 kg/ ha N_2 P_2 O_5 and K_2O.

Fodder yield

Finger millet trial was conducted at Hanumanamatti during 2017-18 and results were presented in Table 1 and 2. The highest fodder yield found in DHFM-78-3 (7680 kg/ha kg/ha) which was statistically superior over DHFM-4-9 (7210 kg/ha) and DHRS-1 (6700 kg/ha). When look into spacing, 22.5 X 10 cm (7300 kg/ha) produced numerically more fodder yield than 30 X 10 cm spacing (6150 kg/ha). Two hundred per cent RDF (8120 kg/ha) recorded significantly superior over 100 per cent RDF (6230 kg/ha) and 150 per cent RDF (7240 kg/ha) for fodder yield.

Comparison of eighteen different factorial combinations, DHFM-78-3, DHFM-4-9 and DHRS-1 produced highest fodder yield of 8650 kg/ha, 8650 kg/ha and 7780 kg/ha, respectively at 22.5 X10 cm spacing with 200% RDF (100:80:50:: N:P:K).

Same trial was repeated during 2018-19at Hanumanamatti and results have been summarised in table 3 and 4. Look into fodder yield, DHFM-78-3 (7950 kg/ha) exhibited significantly superior over DHRS-1 (6970 kg/ha) and it was numerically superior over DHFM-4-9 (7490 kg/ha). A spacing of 22.5 x 10 cm (6780 kg/ha) exhibited numerically more fodder yield than 30 x10 cm spacing (7350 kg/ha). Two hundred per cent RDF (8390 kg/ha) recorded significantly superior over 150% RDF (7520 kg/ha) and 100% RDF (6510 kg/ha) for fodder yield.

Look into the factorial combinations, DHFM-78-3, DHFM-4-9 and DHRS-1 produced maximum fodder yield of 8930 kg/ha, 8420 kg/ha and 8050 kg/ha respectively, at 22.50 x10 cm spacing with 200% RDF (100:80:50:: N:P:K).

Finger millet genotypes were evaluated at Dharwad during 2018-19 and results were presented in table 5 & 6. Among finger millet genotypes,DHFM-78-3 (9720 kg/ha) recorded highest fodder yield and it showed significantly superior over DHFM-4-9 (9400 kg/ha) and DHRS-1 (8700 kg/ha) for fodder yield. These genotypes exhibited maximum fodder yield found at 22.50 x 10 cm spacing (9370 kg/ha) which was numerically superior over 30 x 10 cm spacing (9180 kg/ha).Maximum fodder yield found in 200% RDF (1015 kg/ha) which exhibited significantly superior over 150% RDF (9370 kg/ha) and 100% RDF (8300 kg/ha).

DHFM-78-3, DHFM-4-9 and DHRS-1 produced maximum fodder yield of 10740 kg/ha, 10460 kg/ha and 9750 kg/ha, respectively, at 22.50 x10 cm spacing with 200% RDF (100:80:50:: N:P:K) among eighteen different factorial combinations.

Pooled analysis of Hanumanamatti during 2017-18 and 2018-19 and Dharwad 2018-19 and results were depicted in table 7 and 8.Out of eighteen different factorial combinations, finger millet genotype, DHFM-78-3, DHFM-4-9 and DHRS-1 produced maximum fodder yield of 9380 kg/ha, 9000 kg/ha and 8530 kg/ha, respectively, at 22.50 x10 cm spacing with 200 per cent RDF (60:30:30:: N:P:K).

DHFM-78-3 (8450 kg/ha) produced highest fodder yield as well as statistically superior over DHRS-1 (7460 kg/ha) and numerically superior over DHFM-4-9 (8030 kg/ha). Out of two spacing, these finger millet genotypes exhibited maximum fodder yield at 22.5 x 10 cm (8090 kg/ha) and it showed numerically superior over 30 x 10 cm (7870 kg/ha) spacing. Two hundred per cent RDF (8880 kg/ha) recorded significantly superior over 150% RDF (8040 kg/ha) and 100% RDF (7010 kg/ha).

Among different eighteen factorial combinations, DHFM-78-3, DHRS-1 and DHLM-21-2 recorded highest fodder yield of 8360 kg/ha, 8100 kg/ha and 7150 kg/ha, respectively at 22.50 x10 cm spacing and 200% RDF (100:80:50:: N:P:K). Nandini and Sridhar (2019) [7] observed that 20 X 10 cm recorded significantly more straw yield as compared to 30 X 10 cm, 20 X5 cm and 10 X5 cm spacing in foxtail millet.

On comparison with different eighteen factorial combinations, DHFM-78-3, DHFM-4-9 and DHRS-1 produced higher fodder yield of 9380 kg/ha, 9000 kg/ha and 8530 kg/ha, respectively at 22.50 x10 cm spacing and 200% RDF (60:30:30::N:P:K) similar results observed by Danish Ahmed Siddique *et al* (2020) [4] they reported that differential levels of fertilizers and row spacing affects fodder yield in brown top millet (*Brachiaria ramose* L.) in Entisols of Baster Platue zone of chattishgarh. M. Roja *et al* (2020) [8] observed that increased fodder yield by increase in fertilizer levels from 75% to 125% in finger millet (responded and fertilizer level 100:50:50 produced more fodder yield as compared to 90:40:25) and foxtail millet (responded and with 50:30:20 produced more fodder yield as compared to 30:15:15). Danish Ahmed Siddique *et al* (2020) [4] they reported that differential levels of fertilizers and row spacing affects fodder yield in brown top millet (*Brachiaria ramose* L.) in Entisols of Baster Platue zone of chattishgarh. M. Roja *et al* (2020) [8] observed that increase fodder yield by increase fertilizer levels from 75% to 125% in finger millet (responded and fertilizer level 100:50:50 produced more fodder yield as compared to 90:40:25) and foxtail millet (responded and with 50:30:20 produced more fodder yield as compared to 30:15:15).

Gross returns and net returns

The trial was conducted at Hanumanamatti during 2017-18 and results were presented in table 1 and 2. The DHFM-78-3 recorded highest gross and net returns (Rs 56,935 and Rs 36,334) which were statistically superior over DHFM-4-9 (Rs 52,097 and Rs 31,493) and DHRS-1 (Rs 44,787 and Rs 24,185). The spacing, 22.5 X 10 (56,746 and 36,144) exhibited significantly superior over 30 X10 cm (Rs 45,800 Rs 25,197).Two hundred per cent RDF (Rs 55,764 and Rs 32,980) recorded statistically more gross and net returns 150% RDF (Rs 51,346 Rs 30,789) and 100% RDF (Rs 46,710 Rs 28,244).

Looking into different factorial combinations, DHFM-78-3(Rs 67,694 and Rs 44,910) DHFM-4-9 (Rs 60,552 and Rs 37,768) and DHRS-1(Rs 54,862 and Rs 32,078) recorded maximum gross and net returns at 22.50 x10 cm spacing with 200% RDF (100:80:50::N:P:K)

Same experiment repeated at Hanumanamatti during 2018-19 and results were depicted in table 3 and 4. DHFM-78-3 (Rs 60,562 and Rs 39,223) recorded statistically more gross and net returns than DHFM-4-9 (Rs 50,995 and Rs 29,546) and DHRS-1 (Rs 46,250 and Rs 24,801). The spacing 22.5 X 10 (Rs 56,402 and Rs 34,953) also expressed significantly more gross and net returns when compared to 30 X 10 cm spacing (Rs 48,803 and Rs 27,427). Two hundred per cent RDF (Rs 57,092 and Rs 33,420) recorded statistically superior over 150% RDF (Rs 52,675 and Rs 31,335) and 100% RDF (Rs 48,039 and Rs 28,815) for gross and net returns. DHFM-78-3 (Rs 69,022 and Rs 45,239) exhibited maximum gross and net returns at 22.5 X 10 cm and two hundred per cent RDF.

Finger millet genotypes evaluated at Dharwad during 2018-19 and results were summarised in table 5 and 6. The DHFM-78-3 (Rs 64,872 and Rs 43,534) showed statistically more gross and net returns than DHFM-4-9 (Rs 56,797 and Rs 35,384) and DHRS-1 (Rs 50,132 and Rs 28,683). 22.5 X 10 spacing (Rs 60,755 and Rs 39,306) exhibited significantly superior over 30 X 10 cm (Rs 53,780 and Rs 32,404). Two hundred per cent RDF (Rs 62,003 and Rs 38,331) expressed significantly superior over 150% RDF (Rs 57,583, and Rs 36,249) and 100% RDF (Rs 52,209 Rs and 32,985). DHFM-78-3 (Rs 72,684 and Rs 48,901) exhibited maximum gross and net returns in 22.5 X 10 cm and two hundred per cent RDF.

Pooled and analysed During kharif season in 2017-18 and 2018-19 and Dharwad during 2018-19 and results were presented in table 7 and 8. The DHFM-78-3 (Rs 60,790 and Rs 39,697) recorded highest gross and net returns (Rs 65,105 and Rs 49,591) which were significantly superior over DHFM-4-9 (Rs 53,297 and Rs 32,129) and DHRS1 (Rs 40,905 and Rs 25,890). The spacing 22.5 X 30 recorded statistically more gross (Rs 57,968) and net returns (Rs 36801) than 30 X 10 cm (Rs 49461 Rs 28343). Two hundred per cent RDF (Rs 58286 and Rs 34910) exhibited statistically superior over 150% RDF (Rs 53,870 and Rs 32,791) and 100% RDF (Rs 48,986 and Rs 30,015) for gross and net returns. DHFM-78-3 (Rs 69,800 and Rs 46,350) exhibited maximum gross and net returns at 22.5 X 10 cm and two hundred per cent RDF

B:C ratio

Trial was conducted at Hanumanamatti during 2017-18 and summarised results were presented in table 1 and 2. Among three genotypes, DHFM-78-3 (2.77:1) recorded significantly higher B: C ratio as compared to DHFM-4-9 (2.53:1) and DHRS-1 (2.18:1). 22.50 x 10 cm spacing (2.76:1) expressed statistically more B: C ratio than 30 x 10 cm (2.23:1). Hundred per cent RDF (2.53:1) exhibited slightly more B: C ratio when compared to 150% RDF (2.50:1) and 100% RDF (2.45:1).

When looked into different combinations, DHFM-78-3 (3.13:1) and DHFM-4-9 (2.66:1) exhibited maximum B:C ratio at 22.5 X 10 cm spacing with 100% recommended dose of fertilizer gave highest B: C ratio. Another genotype, DHRS-1 produced maximum B: C ratio (2.60:1) at 150% RDF and 22.5 X10 cm spacing.

The B:C ratio of DHFM-78-3 (2.84:1) noticed maximum DHFM-4-9 (2.38:1) and DHRS-1(2.16:1). With 22.50 x 10 cm spacing recorded (2.64:1) more B:C ratio than 30 x 10 cm (2.28:1). The 100% RDF, 150% RDF and 200% RDF recorded 2.5:1, 2.47:1 and 2.41:1 B: C ratio respectively.

Looking into different genotypes spacing and fertilizer combinations, The DHFM-78-3 recorded maximum B: C ratio (3.07:1) at 100 per cent recommended dose of fertilizer and 22.50 x 10 cm spacing.

Same trial was conducted at Hanumanamatti during 2018-19. The B:C ratio of DHFM-78-3 (2.84:1) was statistically superior over DHFM-4-9 (2.38) and DHRS-1(2.16). 22.50 x 10 cm spacing (2.64:1) exhibited statistically more B: C ratio than 30 x 10 cm (2.28:1). Among different fertilizer levels, 100% RDF (2.50:1) recorded maximum B: C ratio and it was slightly superior over 150% RDF (2.47:1) and 200% RDF (2.41:1).

Out of eighteen different factorial combinations, DHFM-78-3 (3.07:1) exhibited highest B: C ratio at 22.50 X 10 cm and 100 per cent RDF.

Same little millet genotypes evaluated in Dharwad during 2018-19. Among three genotypes, DHFM-78-3 (3.04:1) recorded maximum B: C ratio with significantly superior over DHFM-4-9 (2.65:1) and DHRS-1 (2.34:1). At 22.50 x 10 cm spacing (2.84:1) noticed significantly superior over 30 x 10 cm spacing (2.52:1). Hundred per cent RDF exhibited statistically more B: C (2.72:1) ratio when compared to 150% RDF (2.70:1) and 200% RDF (2.62:1).

Among eighteen different factorial combinations, DHFM-78-3 (3.16:1), DHFM-4-9 (2.97:1) and DHRS-1 (2.67:1) recorded highest B: C ratio at 22.50 x 10 cm spacing with 100% RDF.

The pooled data analysis of Hanumanamatti during 2017-18 and 2018-19 and Dharwad during 2018-19 and results were presented in table 7 and 8.Among three genotypes, DHFM-78-3 (2.88:1) recorded significantly more B: C ratio as compared to DHFM-4-9 (2.52:1) and DHRS-1 (2.23:1). 22.50 x 10 cm spacing (2.74:1) expressed statistically more B: C compared to 30 x 10 cm (2.34:1). Hundred per cent RDF (2.58:1) exhibited slightly more B: C ratio when compared to 150% RDF (2.55:1) and 100% RDF (2.49:1).

When looked in to different combinations, DHFM-78-3 (3.12:1) and DHFM-4-9 (2.74:1) and DHRS-1 (2.57:1) exhibited maximum B: C ratio at 22.5 X 10 cm spacing with 100% recommended dose of fertilizer. B.H.Reddy *etal* (2018) reported that RDF along with urea spray 2%, spray 2% DAP + spray 2% (CaNO3) + spray 2% (19:19:19) increase B:C (1.54:1)

Table 1: Response of Finger Millet genotypes to different spacing and fertilizer levels (Hanumanamatti 2017-18)

Treatments	Grain yield (kg/ha)	Fodder yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
Genotypes (G)					
G1 DHRS-1	3732	6700	44787	24185	2.18
G2 DHFM-4-9	4341	7210	52097	31493	2.53
G3 DHFM-78-3	4745	7680	56935	36334	2.77
S.Em±	111.52	0.29	1338.29	1338.29	0.067
CD at 5%	320.52	0.83	3846.29	3846.29	0.193
Spacing (S)					
S1 (22.5 cm)	4729	7300	56746	36144	2.76
S2 (30 cm)	3817	7080	45800	25197	2.23
S.Em±	91.05	0.24	1092.71	1092.71	0.055
CD at 5%	261.7	0.68	3140.48	3140.48	0.157
Fertilizer levels (F)					
F1 (100% RDF)	3892	6230	46710	28244	2.53
F2 (150% RDF)	4279	7240	51346	30789	2.5
F3 (200% RDF)	4647	8120	55764	32980	2.45
S.Em±	111.52	0.29	1338.29	1338.29	0.067
CD at 5%	320.52	0.83	3846.29	3846.29	0.193

Table 2: Response of Finger Millet genotypes to different spacing and fertilizer levels

Treatments	Grain yield (kg/ha)	Fodder yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
G1S1F1 DHRS-1	3914	5830	46965	28501	2.54
G1S1F2	4457	6660	53489	32931	2.6
G1S1F3	4572	7780	54862	32078	2.41
G1S2F1	2997	5460	35966	17502	1.95
G1S2F2	3024	6800	36283	15726	1.76
G1S2F3	3430	7640	41156	18372	1.81
G2S1F1 DHFM-4-9	4100	6540	49203	30739	2.66
G2S1F2	4818	7220	57822	37264	2.81
G2S1F3	5046	8150	60552	37768	2.66
G2S2F1	3487	6290	41839	23361	2.26
G2S2F2	4008	7040	48092	27535	2.34

G2S2F3	4589	8100	55076	32292	2.42
G3S1F1 DHFM-78-3	4811	8240	57734	39270	3.13
G3S1F2	5199	8420	62393	41835	3.04
G3S1F3	5641	8650	67694	44910	2.97
G3S2F1	4046	6710	48552	30088	2.63
G3S2F2	4166	6530	49997	29439	2.43
G3S2F3	4603	7500	55242	32458	2.42
S.Em±	273.17	0.71	3278.13	3278.14	0.16
CD at 5%	785.12	2.12	9421.45	9421.46	0.47

Table 3: Response of Finger Millet genotypes to different spacing and fertilizer levels (Hanumanamatti 2018-19)

Treatments	Grain yield (kg/ha)	Fodder yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
Genotypes (G)					
G1 DHRS-1	3854	6970	46250	24801	2.16
G2 DHFM-4-9	4250	7490	50995	29546	2.38
G3 DHFM-78-3	5047	7950	60562	39223	2.84
S.Em±	112.42	0.21	1349.13	1349.13	0.065
CD at 5%	323.12	0.59	3877.45	3877.45	0.186
Spacing (S)					
S1 (22.5 cm)	4700	7590	56402	34953	2.64
S2 (30 cm)	4067	7350	48803	27427	2.28
S.Em±	91.79	0.17	1101.56	1101.56	0.053
CD at 5%	263.82	0.48	3165.92	3165.92	0.152
Fertilizer levels (F)					
F1 (100% RDF)	4003	6510	48039	28815	2.5
F2 (150% RDF)	4390	7520	52675	31335	2.47
F3 (200% RDF)	4757.71	8390	57092	33420	2.41
S.Em±	112.42	0.21	1349.13	1349.13	0.065
CD at 5%	323.12	0.59	3877.45	3877.45	0.186

Table 4: Response of Finger Millet genotypes to different spacing and fertilizer levels

Treatments	Grain yield (kg/ha)	Fodder yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
G1S1F1 DHRS-1	4025	6110	48295	29071	2.51
G1S1F2	4568	6940	54818	33478	2.57
G1S1F3	4749	8050	56992	33209	2.4
G1S2F1	3108	5740	37296	18072	1.94
G1S2F2	3134	7080	37614	16274	1.76
G1S2F3	3541	7910	42486	18703	1.79
G2S1F1 DHFM-4-9	4157	6820	49882	30658	2.59
G2S1F2	4118	7500	49422	28082	2.32
G2S1F3	4700	8420	56405	32621	2.37
G2S2F1	3597	6570	43168	23944	2.25
G2S2F2	4277	7310	51326	29986	2.41
G2S2F3	4647	8300	55770	31987	2.34
G3S1F1 DHFM-78-3	4922	8520	59063	39839	3.07
G3S1F2	5310	8720	63721	42381	2.99
G3S1F3	5752	8930	69022	45239	2.9
G3S2F1	4211	7000	50533	31309	2.63
G3S2F2	4929	6800	59150	37810	2.77
G3S2F3	5157	7780	61880	38762	2.68
S.Em±	275.39	0.51	3304.69	3304.69	0.159
CD at 5%	791.48	NS	9497.78	9497.78	0.456

Table 5: Response of Finger Millet genotypes to different spacing and fertilizer levels (Dharwad 2018-19)

Treatments	Grain yield (kg/ha)	Fodder yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
Genotypes (G)					
G1 DHRS-1	4178	8700	50132	28683	2.34
G2 DHFM-4-9	4733	9400	56797	35348	2.65
G3 DHFM-78-3	5406	9720	64872	43534	3.04
S.Em±	83.8	0.17	1005.6	1005.6	0.048
CD at 5%	240.84	0.49	2890.14	2890.14	0.138
Spacing (S)					
S1 (22.5 cm)	5063	9370	60755	39306	2.84
S2 (30 cm)	4482	9180	53780	32404	2.52
S.Em±	68.42	0.14	821.07	821.07	0.039
CD at 5%	196.65	0.56	2359.79	2359.79	0.113
Fertilizer levels (F)					

F1 (100% RDF)	4351	8300	52209	32985	2.72
F2 (150% RDF)	4799	9370	57589	36249	2.7
F3 (200% RDF)	5167	10150	62003	38331	2.62
S.Em±	83.8	0.17	1005.6	1005.6	0.048
CD at 5%	240.84	0.49	2890.14	2890.14	0.138

Table 6: Response of Finger Millet genotypes to different spacing and fertilizer levels.

Treatments	Grain yield (kg/ha)	Fodder yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
G1S1F1 DHRS-1	4276	7820	51306	32082	2.67
G1S1F2	4696	8520	56353	35013	2.64
G1S1F3	5144	9750	61733	37950	2.6
G1S2F1	3446	7960	41355	22131	2.15
G1S2F2	3662	8600	43950	22610	2.06
G1S2F3	3841	9560	46093	22309	1.94
G2S1F1 DHFM-4-9	4752	8690	57020	37796	2.97
G2S1F2	4837	9910	58043	36703	2.72
G2S1F3	5135	10460	61614	37831	2.59
G2S2F1	4091	8120	49092	29868	2.55
G2S2F2	4520	9350	54234	32894	2.54
G2S2F3	5065	9850	60781	36998	2.56
G3S1F1 DHFM-78-3	5068	10050	60817	41593	3.16
G3S1F2	5602	10550	67223	45883	3.15
G3S1F3	6057	10740	72684	48901	3.06
G3S2F1	4472	8550	53665	34441	2.79
G3S2F2	5478	8690	65733	44393	3.08
G3S2F3	5759	9770	69113	45995	2.99
S.Em±	205.26	0.42	2463.22	2463.22	0.117
CD at 5%	589.98	1.68	7079.38	7079.38	0.338

Table 7: Response of Finger Millet genotypes to different spacing and fertilizer levels (Pooled for three years)

Treatments	Grain yield (kg/ha)	Fodder yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
Genotypes (G)					
G1 DHRS-1	3921	7460	47056	25890	2.23
G2 DHFM-4-9	4441	8030	53297	32129	2.52
G3 DHFM-78-3	5066	8450	60790	39697	2.88
S.Em±	80.811	0.154	969.73	969.73	0.047
CD at 5%	232.253	0.443	2787.03	2787.03	0.134
Spacing (S)					
S1 (22.5 cm)	4831	8090	57968	36801	2.74
S2 (30 cm)	4122	7870	49461	28343	2.34
S.Em±	65.982	0.126	791.78	791.78	0.038
CD at 5%	189.634	0.362	2275.6	2275.6	0.109
Fertilizer levels (F)					
F1 (100% RDF)	4082	7010	48986	30015	2.58
F2 (150% RDF)	4489	8040	53870	32791	2.55
F3 (200% RDF)	4857	8880	58286	34910	2.49
S.Em±	80.811	0.154	969.73	969.73	0.047
CD at 5%	232.253	0.443	2787.03	2787.03	0.134

Table 8: Response of Finger Millet genotypes to different spacing and fertilizer levels (Pooled).

Treatments	Grain yield (kg/ha)	Fodder yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
G1S1F1 DHRS-1	4071	6590	48855	29885	2.57
G1S1F2	4574	7380	54886	33807	2.6
G1S1F3	4822	8530	57863	34412	2.47
G1S2F1	3184	6390	38206	19235	2.01
G1S2F2	3274	7490	39282	18203	1.86
G1S2F3	3604	8370	43245	19795	1.84
G2S1F1 DHFM-4-9	4336	7350	52035	33064	2.74
G2S1F2	4591	8210	55096	34016	2.62
G2S1F3	4960	9000	59524	36073	2.54
G2S2F1	3725	7010	44700	25725	2.35
G2S2F2	4268	7890	51218	30138	2.43
G2S2F3	4767	8750	57209	33759	2.44
G3S1F1 DHFM-78-3	4934	7340	59205	40234	3.12
G3S1F2	5370	8350	64446	43366	3.06
G3S1F3	5817	9380	69800	46350	2.98
G3S2F1	4243	7420	50917	31946	2.68

G3S2F2	4858	8930	58293	37214	2.76
G3S2F3	5173	9290	62078	39072	2.7
S.Em±	197.94	0.378	2375.347	2375.35	0.114
CD at 5%	568.9	1.086	6826.813	6826.81	0.328

Conclusion

The finger millet genotypes, DHFM-78-3, DHFM-4-9 and DHRS-1 produced highest grain yield of 5641 kg/ha, 5046 kg/ha and 4572 kg/ha, respectively at spacing 22.50 x10 cm and 200% RDF (100:80:50:: N:P:K).

In the factorial combinations, DHFM-78-3 and DHFM-4-9 and DHRS-1 produced higher grain yield of 5817 kg/ha, 4960 and 4822 kg/ha, respectively at 22.50 x10 cm spacing with 200% RDF (100:80:50:: N:P:K). When looked in to fodder yield, DHFM-78-3, DHFM-4-9 and DHRS-1 produced higher fodder yield of 9380 kg/ha, 9000 kg/ha and 8530 kg/ha, respectively at 22.50 x10 cm spacing and 200% RDF (60:30:30::N:P:K). The finger millet variety, DHFM-78-3 (Rs 69800 and Rs 46350) exhibited maximum gross and net returns in 22.5 X 10 cm and two hundred per cent RDF. When compared different combinations for B: C ratio, finger millet genotypes, DHFM-78-3 (3.12:1) and DHFM-4-9 (2.74:1) and DHRS-1 (2.57:1) maximum at 22.5 X 10 cm spacing with 100% recommended dose of fertilizer.

Hence, maximum grain yield, fodder yield, gross and net returns found at 22.50 X 10 cm with 200% RDF but maximum B: C ratio recorded at 22.50 X 10 cm spacing and recommended dose of fertilizer. Where as, based on results RDF and 22.5 cm were optimum for cultivation of finger millet genotypes.

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