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

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Abstract
Proso millet is one of important minor millet grown in India. The crop is able to evade drought by its quick maturity. There is need to evaluate different proso millet genotypes. So, utilized different proso millet genotypes *viz*., DHPM-2769, GPUP-8 and DHPM-2164 to investigate higher grain and fodder yield at different fertilizer level and spacing. DHPM-2769, GPUP-8 and DHPM-2164 produced higher grain yield of 5661 kg/ha, 5381 kg/ha and 4497 kg, respectively at 22.50 x 10 cm spacing with 200% RDF (60:30:30::N:P:K). DHPM-2769 and GPUP-8 produced highest fodder yield of 65730 kg/ha, and 5940 kg/ha, respectively, at 22.50 x10 cm spacing with 200 per cent RDF (60:30:30::N:P:K) while, DHPM-2164 (5070 kg/ha) showed maximum fodder at 30 X10 cm with 200 & RDF. 22.5 X 10 cm spacing with 200% recommended dose of fertilizer gave highest gross and net returns found in DHPM-2769 (Rs 58028 and Rs 44914), DHPM-2164(Rs 45991 and Rs 32878) and GPUP-8 (Rs 55231 and Rs 42117). Among eighteen different factorial combination, DHPM-2769, GPUP-8 and DHPM-2164 recorded maximum (4.14:1), (3.94:1) and (3.28:1) B: C ratio at 200% RDF with 22.50 x 10 cm spacing.

Keywords: proso millet, fertilizer, spacing, foctorial design, B:C ratio

Introduction
Proso millet is one of the oldest grain crops and is grown in many parts of the world known in many parts of the world known by different names such as broom corn millet, hog millet, Hershey millet, proso millet or common millet, etc. probably proso millet originated in India. It spread from India to other proso millet growing parts of the world. It might have originated for *Penicum psilopodium* which is found in its wild state in Burma, India and Malaysia. It is grown extremely in India, Japan, China, Egypt, Arabia and Western Europe. In India proso millet is largely grown in Madhya Pradesh, Eastern Uttar Pradesh, Bihar, Tamil Nadu, Maharashtra, Andhra Pradesh and Karnataka.

Proso millet is important minor millet grown in India. The crop is able to evade drought by its quick maturity. Being a short duration crop (60-90 days) with relatively low water requirement, this escapes drought period and, therefore, offers better prospects for intensive cultivation in dry land areas. Under rainfed conditions, proso millet is generally grown during kharif season but in areas where irrigation facilities are available, this is profitably grown as summer each crop in high intensity rotations. In India it is cultivated over an area of 0.41 lakh ha with total production of about 0.22 lakh tonnes and productivity of 531 kg/ha during the year 2015-16.

Proso millet is free from gluten and has numerous amounts of fatty acid and carbohydrates. It also contains the minerals such as magnesium, manganese, phosphorus etc. It is helpful for the postmenopausal women. It prevents the high blood pressure and provides adequate zinc, vitamin B6 and iron for the daily functioning. It is easily digested as they are non-acid forming. They are rich in fibre which helps to make the stomach full for long period of time and prevents overeating. So, not only nutritional importance but farmer's income, grain and fodder yield is also very important. Present investigation to get higher grain, fodder yield and more farmers' income from suitable variety in optimum fertilizer dose and spacing. Thereby utilized three different proso millet genotypes *viz*., GPUP-8, DHPM-2769 and DHPM-21-2 tasted at 22.5 X10 cm and 30 X10 cm with 100%, 150% and 200% fertilizer doses to maximized grain and fodder yield and income of farmer.

Material and Method
A field and experiment was conducted during Kharif 2017 and 2018 at ARS Hanumanamatti and Kharif 2018 at MARS, UAS Dharwad of zone -8 in Karnataka, India on red sandy loamy soil and black soil, respectively.

The soil type of experimental site was red sandy loam in texture, which is deep and possess good drainage at ARS Hanumanamatti. At Dharwad black shallow soil with good drainage facilities. 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 ploughing and repeated harrowing. The FYM was applied 5 t/ha to all treatments on 15 days prior to sowing. The proso millet genotypes *viz*., DHPM-2769, GPUP-8 and DHPM-2164 was sown at 22.5 X 10 cm and 30 X 10 cm spacing with seed rate of 5 kg/ha on with monsoon rain. 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) 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 proso millet genotypes *viz*., GPUP-8, DHPM-2769 and DHPM-2164 tested in different levels of Nitrogen, phosphorus and potash and 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. Out of these, DHPM-2769 produced highest grain yield (5355 kg/ha) which was statistically superior over GPUP-8 (5059 kg/ha) and DHPM-2164 (4815 kg/ha). Spacing of 22.5 x 10 cm (5371 kg/ha) produced significantly more grain yield than 30 X 10 cm (4781 kg/ha). 200% RDF (5468 kg/ha) recorded statistically superior over 150% RDF (5089 kg/ha) and 100% RDF (4673 kg/ha) for grain yield.

Look into the eighteen different factorial combinations, DHPM-2769, GPUP-8 and DHPM-2164 produced higher grain yield of 6201 kg/ha, 5561 kg/ha and 5238 kg/ha, respectively at 22.50 X10 cm spacing and 200% RDF (40:40:00::N:P:K).

Same proso millet experiment was repeated at Hanumanamatti during 2018-19 and results were summarised in Table 3 and 4. Out of three genotypes, DHPM-2769 (4354 kg/ha) exhibited significantly superior over GPUP-8 (4164 kg/ha) and it was numerically superior over DHPM-2164 (3579 kg/ha). When look into spacing, 22.5 x 10 cm (4274 kg/ha) recorded more grain yield as compared to 30 x 10 cm (3791 kg/ha). 200% RDF (4449 kg/ha) noticed significantly superior over 150% RDF (3922 kg/ha) and 100% RDF (3726 kg/ha) for grain yield. Comparisons of eighteen different factorial combinations for grain yield has been presented in the table.4, DHPM-2769, GPUP-8 and DHPM-2164 produced maximum grain yield of 5322 kg/ha, 4833 kg/ha and 3958 kg/ha respectively, in the spacing of 22.50 x10 cm and 200% RDF (40:40:00:: N:P:K).

Same proso millet experiment was repeated at at MARS Dharwad during 2018-19 and results were presented in table 5 and 6. Out of these, DHPM-2769 (4607 kg/ha) recorded significantly more grain yield than GPUP-8 (4436 kg/ha) and DHPM-2164 (3810 kg/ha) while, these genotypes exhibited significantly more grain yield at 22.5 x 10 cm (4469 kg/ha) when compared to 30 x 10 cm spacing (4103 kg/ha). 200% RDF (4747 kg/ha) expressed statistically superior over 150% RDF (4152 kg/ha) and 100% RDF (3958 kg/ha) for grain yield.

Look into the eighteen different factorial combinations, DHPM-2769, GPUP-8 and DHPM-2164 produced highest grain yield of 5460 kg/ha, 5044 kg/ha and 4293 kg/ha respectively, in the 22.50 x10 cm spacing and 200% RDF (40:40:00::N:P:K).

The pooled analysed results of Hanumanamatti 2017-18 and 2018-19 and Dharwad 2018-19 were summarized in table 7 and 8. Out of these, DHPM-2769 (4772 kg/ha) produced grain yield significantly superior over GPUP-8 (4554 kg/ha) and DHPM-2164 (4068 kg/ha). These genotypes were recorded maximum grain yield at 22.5 x 10 cm spacing (4705 kg/ha) which was statistically superior over 30 x 10 cm spacing (4225 kg/ha). These pros millet genotypes, gave highest grain yield when applied 200% RDF (4888 kg/ha) as compare to 150 per cent RDF (4388 kg/ha) and 100 per cent RDF (4119 kg/ha). Out of eighteen different factorial combinations, DHPM-2769, GPUP-8 and DHPM-2164 produced higher grain yield of 5661 kg/ha, 5381 kg/ha and 4497, respectively at 22.50 x 10 cm spacing with 200% RDF (60:30:30:: N:P:K). Hassan *et al.* (2013) which was they got more grain yield (1.77 /ha) when apply higher dose of fertilizer $N_{30}P_{24}K_{15}$ as compared to normal (0.86 / ha) in little millet. Charate *et al.* (2017) [4] they 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] Application of 30 kg/ha increase grain yield 1.2 t/ha in pearl millet. Danish Ahmed Siddiqui *et al.* (2020) [3] differential levels of fertilizer and row spacing affect yield of brown top millet. Nandini and Sridhar (2019) [7] 20 X 10 cm recorded significantly more 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]. They reported finger millet responded to fertilizer application from 90:40:25 to 100: 50:50 kg/ ha N_2 P_2 O_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.

Table 1: Response of Proso Millet genotypes to different spacing and fertilizer levels (Hanumanamatti 2015-16)

Treatments	Grain yield (kg/ha)	Fodder yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
Genotypes (G)					
G1 GPUP-8	5059	4240	40476	28752	3.11
G2 DHPM-2769	5355	4610	42840	31090	3.31
G3 DHPM-2164	4815	4300	38516	26766	2.94
S.Em±	91	0.06	729	729	0.06
CD at 5%	262	0.18	2095	2095	0.18
Spacing (S)					
S1 (22.5 cm)	5371	4810	42971	31220	3.32
S2 (30 cm)	4781	3960	38251	26500	2.92
S.Em±	74	0.05	595.3	595.3	0.05
CD at 5%	214	0.15	1711	1711	0.15

Fertilizer levels (F)					
F1 (100% RDF) (20:20:00)	4673	3.91	37380	26260	2.95
F2 (150% RDF) (33:30:00)	5089	4.33	40709	29059	2.98
F3 (200% RDF) (40:40:00)	5468	4.91	43743	31263	3.17
S.Em±	91	0.06	729	729	0.06
CD at 5%	262	0.18	2095	2095	0.18

Table 2: Response of Proso 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 GPUP-8	5179	4460	41432	30312	3.39
G1S1F2	5378	4830	43021	31371	3.36
G1S1F3	5561	5140	44442	31964	3.38
G1S2F1	4305	4040	34440	23320	2.76
G1S2F2	4682	4220	37456	25806	2.88
G1S2F3	4920	5450	39360	26880	2.82
G2S1F1 DHPM-2769	5060	3980	40480	29360	3.31
G2S1F2	5557	4680	44478	31878	3.38
G2S1F3	6201	5550	49611	37130	3.64
G2S2F1	4583	3470	36664	25544	2.96
G2S2F2	5059	3890	40472	28822	3.14
G2S2F3	5536	4760	44288	31808	3.22
G3S1F1 DHPM-2164	4841	4280	38728	27608	3.15
G3S1F2	4861	4210	38888	27238	3
G3S1F3	5238	4560	41904	29424	3.02
G3S2F1	4067	3210	32536	21416	2.59
G3S2F2	4861	3620	38888	27238	3
G3S2F3	5019	4310	40152	27672	2.88
S.Em±	223	0.15	1786	1786	0.07
CD at 5%	642	0.44	5132	5134	0.21

Table 3: Response of Proso Millet genotypes to different spacing and fertilizer levels (Hanumanamatti 2016-17)

Treatments	Grain yield (kg/ha)	Fodder yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
Genotypes (G)					
G1 GPUP-8	4164	5130	33215	20615	2.25
G2 DHPM-2769	4354	5020	34831	22131	2.41
G3 DHPM-2164	3579	4850	28632	15932	1.92
S.Em±	70	0.12	556.5	556.5	0.04
CD at 5%	200	0.34	1599	1599	0.12
Spacing (S)					
S1 (22.5 cm)	4274	5110	34195	21495	2.35
S2 (30 cm)	3791	4890	30324	17624	2.05
S.Em±	57	0.1	454.4	454.4	0.04
CD at 5%	163	0.28	1306	1306	0.1
Fertilizer levels (F)					
F1 (100% RDF) (20:20:00)	3726	4260	29810	17740	2.14
F2 (150% RDF) (33:30:00)	3922	4980	31376	18775	2.16
F3 (200% RDF) (40:40:00)	4449	5760	35592	22162	2.32
S.Em±	70	0.12	556.5	556.5	0.04
CD at 5%	200	0.34	1599	1599	0.12

Table 4: Response of Proso 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 GPUP-8	4065	4050	32519	20449	2.36
G1S1F2	4181	4550	33445	20845	2.32
G1S1F3	4833	5400	38659	25228	2.53
G1S2F1	3716	4630	29724	17654	2.13
G1S2F2	3792	5790	30335	17735	2.07
G1S2F3	4212	4940	33698	20268	2.18
G2S1F1 DHPM-2769	4242	5130	33939	21868	2.48
G2S1F2	4606	5900	36845	24245	2.53
G2S1F3	5322	6900	42578	29147	2.84
G2S2F1	3766	3550	30125	18055	2.16
G2S2F2	3849	4050	30792	18191	2.11
G2S2F3	4339	6360	34710	21280	2.25
G3S1F1 DHPM-2164	3302	3900	26417	14346	1.86
G3S1F2	3772	4630	30175	17574	2.06

G3S1F3	3958	5520	31668	18238	2.02
G3S2F1	3267	4300	26139	14069	1.83
G3S2F2	3333	4980	26663	14063	1.78
G3S2F3	3841	5790	30730	17300	1.95
S.Em±	170	0.29	1363	1363	0.11
CD at 5%	490	0.84	3918	3918	0.3

Table 5: Response of Proso Millet genotypes to different spacing and fertilizer levels (Dharwad 2016-17)

Treatments	Grain yield (kg/ha)	Fodder yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
Genotypes (G)					
G1 GPUP-8	4436	5230	66574	53871	5.22
G2 DHPM-2769	4607	6040	69111	56410	5.43
G3 DHPM-2164	3810	4750	57156	44456	4.49
S.Em±	59	0.1	881.7	881.7	0.07
CD at 5%	169	0.29	2534	2534	0.2
Spacing (S)					
S1 (22.5 cm)	4469	5570	67032	54332	5.27
S2 (30 cm)	4103	5100	61542	48842	4.84
S.Em±	48	0.08	719.9	719.9	0.06
CD at 5%	138	0.23	2069	2069	0.16
Fertilizer levels (F)					
F1 (100% RDF) (20:20:00)	3958	4560	59375	47304	4.92
F2 (150% RDF) (33:30:00)	4152	5320	62287	49687	4.94
F3 (200% RDF) (40:40:00)	4747	6140	71199	57769	5.3
S.Em±	59	0.1	881.7	881.7	0.07
CD at 5%	169	0.29	2534	2534	0.2

Table 6: Response of Proso 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 GPUP-8	4256	5350	63846	51776	5.29
G1S1F2	4326	6210	64888	52287	5.15
G1S1F3	5044	6040	75634	62203	5.62
G1S2F1	4071	4880	61070	48999	5.06
G1S2F2	4094	6040	61417	48816	4.87
G1S2F3	4534	6620	68012	54581	5.06
G2S1F1 DHPM-2769	4361	4630	65408	53338	5.42
G2S1F2	4789	5690	71830	59229	5.7
G2S1F3	5460	7140	81896	68465	6.1
G2S2F1	4094	4300	61417	49346	5.09
G2S2F2	4199	4770	62979	50378	5
G2S2F3	4742	5920	71135	57705	5.3
G3S1F1 DHPM-2164	3447	4360	51698	39627	4.28
G3S1F2	3932	4880	58987	46387	4.68
G3S1F3	4293	5980	64402	50971	4.8
G3S2F1	3521	3840	52809	40738	4.38
G3S2F2	3575	4300	53624	41024	4.26
G3S2F3	4094	5110	61417	47986	4.57
S.Em±	144	0.24	2160	2160	0.17
CD at 5%	414	0.94	6207	6207	0.36

Table 7: Response of Proso 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 GPUP-8	4554	4830	46795	34411	3.54
G2 DHPM-2769	4772	5220	48927	36544	3.72
G3 DHPM-2164	4068	4630	41435	29051	3.12
S.Em±	39.57	0.05	397.3	397.3	0.03
CD at 5%	113.7	0.142	1142	1142	0.09
Spacing (S)					
S1 (22.5 cm)	4705	5160	48066	35682	3.65
S2 (30 cm)	4225	4650	43372	30989	3.27
S.Em±	32.31	0.04	324.4	324.4	0.02
CD at 5%	92.87	0.116	932.3	932.3	0.07
Fertilizer levels (F)					
F1 (100% RDF) (20:20:00)	4119	4240	42188	30435	3.36
F2 (150% RDF) (33:30:00)	4388	4880	44797	32507	3.42

F3 (200% RDF) (40:40:00)	4888	5600	50178	37065	3.6
S.Em±	39.57	0.05	397.3	397.3	0.03
CD at 5%	113.7	0.142	1142	1142	0.09

Fodder yield

The proso millet genotypes *viz*., GPUP-8, DHPM-2769 and DHPM-2164 tested in different levels of Nitrogen, phosphorus and potash and 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. The highest fodder yield observed in DHPM-2769 (4610 kg/ha) which was statistically superior over DHPM-2164 (4300 kg/ha) and GPUP-8 (4240 kg/ha). Comparisons in different into spacing, the genotypes showed more fodder yield in spacing of 22.5 X 10 cm (4810 kg/ha) than 30 X 10 cm spacing (3960 kg/ha). These genotypes noticed maximum fodder yield in 200% RDF (4910 kg/ha) as compared to 150 per cent RDF (4330 kg/ha) and 100 per cent RDF (3910 kg/ha).

Comparison of eighteen different factorial combinations, DHPM-2769 and DHPM-2164 gave highest fodder yield of 5550 kg/ha and 4560 kg/ha, respectively at 22.50 X10 cm spacing with 200% RDF but GPUP-8 (5450 kg/ha) recorded highest fodder yield in the spacing of 30 X 10 cm spacing with 200% RDF.

Same trial was repeated at Hanumanamatti during 2018-19 and results have been summarised in table 3 and 4. Look into fodder yield, GPUP-8 (5130 kg/ha) exhibited numerically superior over DHPM-2769 (5020 kg/ha) and DHPM-2164 (4850 kg/ha). Fodder yield of these genotypes maximum found in 22.5 x 10 cm spacing (5110 kg/ha) as compared to 30 x10 cm spacing (4890 kg/ha). Maximum fodder found in 200% RDF (5760 kg/ha) which was numerically superior over 150% RDF (4980 kg/ha) and 100% RDF (4260 kg/ha).

Look into different eighteen factorial combinations, DHPM-2769 (6900 kg/ha), produce highest fodder yield at 22.5 X10 cm with 200% RDF while, GPUP-8 (5790 kg/ha) recoded maximum at 30X 10 with 150% RDF and DHPM-2164 (5790) showed maximum at 30X10 cm with 200% RDF.

Same trail was repeated in Dharwad during 2018-19 the highest fodder yield was observed in table 5 & 6. Among proso millet genotypes, DHPM-2769 recorded highest fodder yield of 6040 kg/ha which was significantly superior over GPUP-8 (5230 kg/ha) and DHPM-2164 (4750 kg/ha). These genotypes exhibited maximum fodder yield in the spacing of 22.50 x 10 (5570 kg/ha) which was statistically superior over 30 x 10 cm (5100 kg/ha). Maximum fodder yield found in 200% RDF (6140 kg/ha) as compared to 150% RDF (5320 kg/ha) and 100% RDF (4560 kg/ha).

Comparison of different eighteen factorial combinations, DHPM-2769 and DHPM-2164 produced higher fodder yield of 7140 kg/ha and 5980 kg/ha, respectively at spacing 22.50 x10 cm with 200% RDF (40::40:0::N:P:K) while, GPUP-8 (6620 kg/ha) recorded maximum fodder yield at 30 X10 cm with 200% RDF. Pooled analysis of Hanumanamatti during 2017-18 and 2018-19 and Dharwad 2018-19 for fodder yield and results were depicted in table 7 and 8. DHPM-36-3 (5220 kg/ha) produced highest fodder yield as well as statistically superior over GPUP-8 (4630kg/ha) and GPUP-8 (4830 kg/ha). Out of two spacing, these proso millet genotypes exhibited maximum fodder yield at 22.5 x 10 cm (5160 kg/ha) and it showed significantly superior over 30 x 10 cm (4650 kg/ha) spacing. Maximum fodder yield found in 200% RDF (5600 kg/ha) which was significantly superior over 150% RDF (4880 kg/ha) and 100% RDF (4240 kg/ha)

Out of eighteen different factorial combinations, proso millet genotype, DHPM-2769 and GPUP-8 produced highest fodder yield of 6530 kg/ha, and 5940 kg/ha, respectively at 22.50 x10 cm spacing with 200 per cent RDF (60:30:30::N:P:K) while, DHPM-2164 (5070 kg/ha) showed maximum fodder at spacing of 30 X10 cm with 200% RDF.

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. Danish Ahmed Siddique *et al.* (2020) [3] they reported that differential levels of fertilizers and row spacing affects fodder yield in brown top millet (*Bracheria ramose* L.) in Entisols of Baster Platue zone of Chhattisgarh. M. Roja *et al.* (2020) [8] observed that increase fodder yield by increase fertilizer levels from 75% to 125% in finger millet (responded and gave 100:50:50 gave more fodder yield as compared 90:40:25) and foxtail millet (responded and gave 50:30:20 gave more fodder yield as compared 30:15:15).

Table 8: Response of Proso 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 GPUP-8	4500	4620	45933	34179	3.68
G1S1F2	4628	5200	47118	34834	3.61
G1S1F3	5381	5940	55231	42117	3.94
G1S2F1	4031	4520	41745	29991	3.32
G1S2F2	4189	5350	43069	30786	3.28
G1S2F3	4555	5850	47023	33910	3.35
G2S1F1 DHPM-2769	4554	4580	46609	34855	3.73
G2S1F2	5028	5430	51401	39117	3.96
G2S1F3	5661	6530	58028	44914	4.19
G2S2F1	4148	3770	42735	30982	3.4
G2S2F2	4369	4230	44747	32464	3.42
G2S2F3	4872	5710	50044	36931	3.59
G3S1F1 DHPM-2164	3863	4180	38947	27194	3.1
G3S1F2	4188	4760	42683	30399	3.25
G3S1F3	4497	4710	45991	32878	3.28
G3S2F1	3618	3790	37161	25407	2.93
G3S2F2	3923	4300	39725	27442	3.01
G3S2F3	4318	5070	44100	30986	3.14
S.Em±	96.94	0.12	973.2	973.2	0.08
CD at 5%	278.6	0.35	2797	2797	0.24

Gross returns and net returns

The data of gross return and net return of proso millet genotypes at Hanumanamatti during 2017-18 were presented table 1 and 2. The DHPM-2769 recorded highest gross and net returns (Rs 42840 and Rs 31090) which were statistically superior over GPUP-8 (Rs 40476 and Rs 28752) and DHPM-2164 (Rs 38516 and Rs 26766). The spacing of 22.5 X 10 (Rs 42971 and Rs 31220) exhibited significantly superior over 30 X10 cm (Rs 38251 Rs 26500). 200% RDF (Rs 43743 and Rs 31263) recorded statistically more gross and net returns 150% RDF (Rs 40709 Rs 29059) and 100% RDF (Rs 37380 Rs 26260).

Out of eighteen different factorial combinations, proso millet genotype, DHPM-2769 (Rs 49611 and Rs 37130), GPUP-8 (Rs 44442 and Rs 31964) and DHPM-2164 (Rs 41904 and Rs 29424) recorded highest gross and net returns at 22.5 X10 cm with 200% RDF.

Same experiment repeated at Hanumanamatti during 2018-19 and results were depicted in table 3 and 4. The DHPM-2769 (Rs 34831 and Rs 22131) recorded statistically more gross and net returns than GPUP-8 (Rs 33215 and Rs 20615) and DHPM-2164 (Rs 28632 and Rs 15932). The spacing 22.5 X 10 (Rs 34195 and Rs 21495) also expressed significantly more gross and net returns when compared to 30 X 10 cm spacing (Rs 30324 and Rs 17624). 200% RDF (Rs 35592 Rs 22162) recorded statistically superior over 150% RDF (Rs 31376 and Rs 18775) and 100% RDF (Rs 29810 and Rs 17740) for gross and net returns.

Among eighteen different factorial combinations, DHPM-2769 (Rs42578 and Rs 29147), GPUP-8 (Rs. 38659 and Rs. 25228) and DHPM-2164 (Rs. 31668 and Rs. 18238) exhibited maximum gross and net returns at 22.5 X 10 cm and two hundred per cent RDF.

Proso millet genotypes evaluated at Dharwad during 2018-19 and results were summarised in table 5 and 6. The DHPM-2769 (Rs 69111 and Rs 56410) showed statistically more gross and net returns than GPUP-8 (Rs 66574 and Rs 53871) and DHPM-2164 (Rs 57156 and Rs 44456). Spacing of 22.5 X 10 (Rs 67032 and 54332) exhibited significantly superior over 30 X 10 cm (Rs 61542 and Rs 48842). Maximum gross and net returns observed in two hundred per cent RDF (Rs 71199 and Rs 57769) expressed significantly superior over 150% RDF (Rs 62287, and Rs 49687) and 100% RDF (Rs 59375 and Rs 47304).

Out of eighteen different factorial combinations, DHPM-2769 (Rs 81896 and Rs 68465), GPUP-8 (Rs. 75634 and Rs. 62203) and DHPM-2164 (Rs. 64402 and Rs. 50971) exhibited maximum gross and net returns in 22.5 X 10 cm and two hundred per cent RDF.

Pooled analysis of Hanumanamatti during 2017-18 and 2018-19 and Dharwad during 2018-19 and results were presented in table 7 and 8. The DHPM-2769 recorded highest gross and net returns (Rs 48927 and Rs 36544) which were significantly superior over GPUP-8 (Rs 46795 and Rs 34411) and DHPM-2164 (Rs 41435 and Rs 29051). The spacing 22.5 X 30 recorded statistically more gross and net returns (Rs 48066 and Rs 35682) when compared to 30 X 10 cm (Rs 43372 and Rs 30989). RDF 200% (Rs 50178 and Rs 37065) exhibited statistically superior over 150% RDF (Rs 44797 and Rs 32507) and 100% RDF (Rs 42188 and Rs 30435) for gross and net returns. Comparison of different combinations, DHPM-2769 (Rs 58028 and Rs 44914), GPUP-8 (Rs 55231 and Rs 42117) and DHPM-2164(Rs 45991and Rs 32878) recorded highest gross and net return at 22.5 X 10 cm spacing with 200% recommended dose of fertilizer.

B:C ratio

The data of B:C ratio at Hanumanamatti during 2017-18 were summarised presented in table 1 and 2. Among three genotypes, DHPM-2769 recorded significantly more B: C (3.31: 1) ratio as compared to GPUP-8 (3.11:1) and DHPM-2164 (2.94:1). Moreover more B:C ratio found at 22.50 x 10 cm spacing (3.32:1) which was statistically superior over 30 x 10 cm spacing (2.92:1). Maximum B: C ratio found in 200% RDF (3.17:1) and it exhibited significantly superior than 150% RDF (2.98:1) and 100% RDF (2.95:1).

When look in to eighteen different combinations, DHPM-2769 (3.64:1) exhibited maximum B:C ratio at 22.5 X 10 cm spacing with 200% recommended dose of fertilizer while, another genotype GPUP-8 (3.39:1) and DHPM-2164 (3.02:1) noticed highest B: C ratio at 22.50 x 10 cm spacing with 100% RDF.

B:C ratio of proso millet at Hanumanamatti during 2018-19 summarised in Table 3 and 4. The B: C ratio of DHPM-2769 (2.41:1) was statistically superior over GPUP-8 (2.25:1) and DHPM-2164 (1.92:1). The maximum B: C ratio observed at 22.50 x 10 cm spacing (2.35:1) and it exhibited statistically superior over 30 x 10 cm (2.05:1). Among different fertilizer levels, 200% RDF (2.32:1) recorded maximum B: C ratio which was statistically superior over 150% RDF (2.16:1) and 100% RDF (2.14:1). Out of eighteen different factorial combinations, DHPM-2769 (2.84:1) and GPUP-8 (2.53:1) exhibited highest B: C ratio at 22.50 X 10 cm with 200% RDF. But DHPM-2164 (2.06:1) exhibited the highest B:C ratio at 22.50 X 10 cm with 150% RDF.

The data of proso millet B: C ratios of proso millet at Dharwad during 2018-19 were presented in table 5 and 6. The B: C ratio of DHPM-2769 (5.43:1) recorded highest among three genotypes which was numerically superior over GPUP-8 (5.22:1) and DHPM-2164 (4.49:1). 22.50 x10 cm spacing exhibited B: C ratio (5.27:1) significantly superior over 30 x 10 cm spacing (4.84:1). Out of these different fertilizer levels, 200% fertilizer level (5.3:1) recorded significantly more B: C ratio than 150% RDF (4.94:1) and 100% RDF (4.92:1).

Among eighteen different factorial combination, DHPM-2769, GPUP-8 and DHPM-2164 produced highest B:C ratio of 6.1:1, 5.62:1 and 4.8:1 respectively at 22.50 x 10 cm spacing with 200% RDF

Pooled analysis of Hanumanamatti data during 2017 -18 and 2018-19 and Dharwad 2018-19 were presented in Table 7 and 8. Out of three genotypes, DHPM-2769 (3.72:1) produced statistically more B:C ratio than GPUP-8 (3.54:1) and DHPM-2164 (3.12:1). 22.50 x 10 cm spacing (3.65:1) recorded significantly more B:C ratio than 30 x 10 cm (3.27:1) and The 200% RDF C (3.6:1) exhibited significantly superior over 150% RDF (3.42:1) and 100% RDF (3.36:1) for B:C ratio. Among eighteen different factorial combinations, DHPM-2769 (4.19:1), GPUP-8 (3.94:1) and DHPM-2164(3.28:1) recorded maximum B:C ratio at 200% RDF with 22.50 x 10 cm spacing.

Conclusion

The maximum fodder yield, grain yield depends upon fertilizer dose, spacing and genotypes. All three genotypes produced highest grain yield *viz*., DHPM-2769 (5661 kg/ha), GPUP-8 (5381 kg/ha) and DHPM-2164 (4497 kg/ha) and fodder yield of DHPM-2769 (6530 kg/ha) and GPUP-8 (5940 kg/ha) at 22.5 X 10 cm spacing with 200 per cent RDF but

maximum fodder yield of DHPM-2164 (5070 kg/ha) found at 30 X 10 cm spacing with 200 per cent. The highest gross return and net return of DHPM-2769 (Rs 58028 and 44914), GPUP-8 (Rs 55231 and Rs 42117) and DHPM-2164 (Rs 45991 and Rs 32878) found at 22.5 X 10cm spacing with 200 per cent. The B:C ratio of DHPM-2769 (4.19:1), GPUP-8 (3.94:1) and DHPM-2164 (3.28: 1) recorded maximum at 22.5 X 10cm spacing with 200 per cent. So, DHPM-2769 exhibited highest grain, fodder, gross return, net return and B:C ratio.

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