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Research Article

EFFECT OF SOWING METHOD, VARIETY AND WEED MANAGEMENT PRACTICES ON YIELD AND ECONOMICS OF PEARLMILLET (*Pennisetum glaucum* L) CROP

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Abstract: The productivity of any crop is the complex phenomenon governed by number of factors viz., use of improved varieties, appropriate sowing method, timely sowing, spacing, judicious use of water as well as nutrients and weeds, pests and disease management. Planting pattern is an agronomic practice that sustains the availability of resources. Present investigation was conducted during *kharif* 2016 and *Kharif* 2017 at Instructional farm of Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Krishi Vigyan Kendra Datia Madhya Pradesh. Total 04 number f sowing method (S1-Broad casting, S2- Line sowing, S3- Ridge and furrow and S4- Transplanting), with two varieties (V1- 86M86 (hybrid) and JBV-2 (composite)) and three weed management practices (W1- Hand hoeing at 20-25 DAS, W2- Pre emergence application of Atrazine @ 40gm a.i./ha and W3- Post Emergence Application of 2,4-D @0.5kg a.i./ha) were tested during the experiment. The findings of studies clearly visualized that the transplanting (15-20 days seedlings) sowing method, 86M86 variety and one hand hoeing at 20-25 DAS/DAT as well as their interaction recorded significantly superior values of all weed parameters and crop parameters in comparison to others. However, in labourer scarcity areas and economical basis; ridge and furrow sowing, 86M86 variety and one hand hoeing at 20-25 DAS/DAT as well as their interaction recorded significantly profitable values of all weed parameters and crop parameters in comparison to others.

Keywords: Sowing method, Weed Management Practices, Variety, Pearlmillet and economics

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Introduction

Planting pattern is an agronomic practice that sustains the availability of resources. Pearl millet is generally a quantitative short day plant Billiard and Pernes, [2] in which long photoperiod delays floral initiation. The productivity of any crop is the complex phenomenon governed by number of factors *viz*., use of improved varieties, appropriate sowing method, timely sowing, spacing, judicious use of water as well as nutrients and weeds, pests and disease management. Among all these, appropriate sowing method or proper land configuration is the most critical factor for realizing desired yield potential. The genotypes can express their full potential only when grown under optimum conditions and at optimum plant base. Water logging during heavy rains and water stress during dry spells are the important factors for low productivity of pearl millet in Northern Madhya Pradesh. Under these conditions land configuration can play a vital role to overcome these problems by providing easy and uniform germination as well as good growth and development of plants. Land configuration increases water use efficiency and also increases availability of nutrients to crops. yield potential as number of grains in (m^{-2}) of short-duration crops may be limited by low radiation interception particularly if the plant population is low. The effect of planting patterns on crop development is improved by the adjustment of row space and density. Spacing (45 cm × 10 cm) among plants is generally considered as an important aspect in the planting system, which influences natural resource utilization. Several methods for enhancing rainwater utilization can support in-situ water conservation allowing higher amount of infiltration and water use by crops Rockstorm *et. al*. [6]. Hence present investigation was carried out to evaluate the effect of sowing method, varieties and weed management practices in pearlmillet.

Methodology

Present investigation was conducted during *kharif* 2016 and *Kharif* 2017 at Instructional farm of RVSKVV, Krishi Vigyan Kendra Datia (M.P). The total rainfall received during the crop season from June 2016 to November, 2016 and June, 2017 to November, 2017 was 497.8 mm and 448.4 mm, respectively. The topography of the field was uniform with proper drainage. The soil of the experimental field was medium in potash content, but low in organic carbon, available nitrogen and medium in available phosphorus contents. It is slightly alkaline in reaction and had moderate cation exchange capacity. Total 04 number f sowing method (S_1-Broad casting, S_2- Line sowing, S_3- Ridge and furrow and S_4- Transplanting), with two varieties (V_1- 86M86 (hybrid) and V_2-JBV-2 (composite)) and three weed management practices (W_1- Hand hoeing at 20-25 DAS, W_2- Pre emergence application of Atrazine @ 40gm a.i./ha and W_3- Post Emergence Application of 2,4-D @0.5kg a.i./ha) were tested during the experiment. The experiment was laid out in spilt plot design.

Result and Discussion

Methods of sowing (S)

Transplanting (15-20 days seedlings) recorded significantly better computed parameters *viz*. grain yield/ha, stover yield/ha, biological yield/ha, harvest index and weed index (1872 kg, 3830 kg, 5701 kg, 32.77% &17.20%; respectively) followed by ridge and furrow sowing(1859 kg, 3817 kg, 5676 kg, 32.70% & 17.76%; respectively) with respect to rest of the treatments. Transplanting (15-20 days seedlings) recorded significantly maximum gross return (Rs.34841/ha); while net return and B:C ratio was registered under ridge and furrow sowing (Rs.16367/ha &1.896; respectively) with respect to rest of the treatments.

Table-1 Grain yield/ha (kg), Stover yield/ha (kg) and Biological yield/ha (kg) as affected by different sowing method, Variety and Weed management practice

Treatment	Yield								
	Grain yield/ha (kg)			Stover yield/ha (kg)			Biological yield/ha (kg)		
	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled
Methods of sowing									
S1	1311	1287	1299	2840	2793	2817	4151	4080	4116
S2	1856	1833	1845	3831	3787	3809	5688	5620	5654
S3	1872	1846	1859	3840	3794	3817	5711	5640	5676
S4	1883	1860	1872	3852	3808	3830	5735	5667	5701
SE(m) ±	21	9	396	44	19	709	64	28	1104
CD (P=0.05)	51	21	862	107	47	1544	158	68	2406
Varieties									
V1	1906	1885	1896	3894	3855	3874	5800	5740	5770
V2	1555	1528	1541	3288	3236	3262	4842	4764	4803
SE(m) ±	13	12	354	26	27	613	39	39	967
CD (P=0.05)	30	28	751	59	62	1299	89	89	2050
Weed management practices									
W1	1845	1818	1831	3784	3735	3760	5629	5553	5591
W2	1730	1707	1719	3591	3549	3570	5321	5257	5289
W3	1617	1594	1606	3397	3352	3375	5014	4947	4980
SE(m) ±	16	16	159	34	32	272	50	48	432
CD (P=0.05)	33	33	319	69	65	544	102	98	863
Interaction									
S*V	S	S	S	S	S	S	S	S	S
S*W	S	S	S	S	S	S	S	S	S
V*W	NS	NS	NS	NS	NS	NS	NS	NS	NS
S*V*W	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table-1.1 Interaction (SXV) effect of different sowing method, Variety and Weed management practice on of Grain yield/ha (kg)

	S1	S2	S3	S4	Mean
V1	1371.95	2057.93	2069.78	2083.33	1895.75
V2	1226.29	1631.10	1648.04	1659.89	1541.33
mean	1299.12	1844.51	1858.91	1871.61	
	S	V	(S*V)1	(S*V)2	
SEm(d)	395.74	354.42	708.84	638.62	
CD(AT 5%)	862.32	751.37	1502.74	1368.35	

Table-1.2 Interaction (SXW) effect of different sowing method, Variety and Weed management practice on Grain yield/ha (kg)

	S1	S2	S3	S4	MEAN
W1	1313.52	1989.33	2002.03	2019.82	1831.17
W2	1298.27	1847.05	1859.76	1869.92	1718.75
W3	1285.57	1697.15	1714.94	1725.10	1605.69
MEAN	1299.12	1844.51	1858.91	1871.61	
	S	W	(S*W)1	(S*W)2	
SEm(d)		159.44	318.88	473.71	
CD(AT 5%)		318.88	637.76	1006.60	

Table-1.3 Interaction (SXV) effect of different sowing method, Variety and Weed management practice on of Stover yield/ha (kg)

	S1	S2	S3	S4	Mean
V1	2957.32	4173.44	4178.52	4188.69	3874.49
V2	2676.15	3445.12	3455.28	3470.53	3261.77
mean	2816.73	3809.28	3816.90	3829.61	
	S	V	(S*V)1	(S*V)2	
SEm(d)	708.52	612.72	1225.44	1119.31	
CD(AT 5%)	1543.87	1298.97	2597.93	2399.40	

Table-1.4 Interaction (SXW) effect of different sowing method, Variety and Weed management practice on Stover yield/ha (kg)

	S1	S2	S3	S4	MEAN
W1	2835.37	4057.42	4059.96	4085.37	3759.53
W2	2815.04	3816.06	3821.14	3828.76	3570.25
W3	2799.80	3554.37	3569.61	3574.70	3374.62
MEAN	2816.73	3809.28	3816.90	3829.61	
	S	W	(S*W)1	(S*W)2	
SEm(d)		272.18	544.37	836.40	
CD(AT 5%)		544.37	1088.74	1780.23	

Table-5 Interaction (SXV) effect of different sowing method, Variety and Weed management practice on Biological yield/ha (kg)

	S1	S2	S3	S4	Mean
V1	4329.27	6231.37	6248.31	6272.02	5770.24
V2	3902.44	5076.22	5103.32	5130.42	4803.10
mean	4115.85	5653.79	5675.81	5701.22	
	S	V	(S*V)1	(S*V)2	
SEm(d)	1104.20	967.14	1934.28	1757.83	
CD(AT 5%)	2406.04	2050.34	4100.68	3767.53	

Table-1.6 Interaction (SXW) effect of different sowing method, Variety and Weed management practice on Biological yield/ha (kg)

	S1	S2	S3	S4	MEAN
W1	4148.88	6046.75	6061.99	6105.18	5590.70
W2	4113.31	5663.11	5680.89	5698.68	5289.00
W3	4085.37	5251.52	5284.55	5299.80	4980.31
MEAN	4115.85	5653.79	5675.81	5701.22	
	S	W	(S*W)1	(S*W)2	
SEm(d)		431.62	863.24	1309.98	
CD(AT 5%)		863.24	1726.48	2786.56	

Table-2 Economics (Rs./ha) as affected by different sowing method, Variety and Weed management practice

Treatment	Economics								
	Gross return (Rs./ha)			Net return (Rs./ha)			B:C ratio		
	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled
Methods of sowing									
S1	24799	24361	24580	7082	6287	6684	1.400	1.348	1.374
S2	34639	34209	34424	16172	16135	16153	1.875	1.893	1.884
S3	34866	34409	34638	16399	16335	16367	1.887	1.904	1.896
S4	35056	34626	34841	11339	16552	13945	1.478	1.916	1.697
SE(m) ±	388	164	7113	388	164	6415	0.020	0.009	0.344
CD (P=0.05)	950	401	15500	950	401	13979	0.048	0.022	0.750
Varieties									
V1	35470	35087	35279	15878	17013	16446	1.819	1.941	1.880
V2	29210	28715	28962	9618	10641	10129	1.501	1.589	1.545
SE(m) ±	239	228	6316	239	228	6316	0.012	0.013	0.335
CD (P=0.05)	552	526	13391	552	526	13391	0.028	0.029	0.711
Weed management practices									
W1	34362	33878	34120	14623	15804	15213	1.749	1.874	1.812
W2	32335	31922	32129	12786	13848	13317	1.664	1.766	1.715
W3	30323	29903	30113	10834	11829	11332	1.567	1.655	1.611
SE(m) ±	305	296	2833	305	296	2745	0.016	0.016	0.142
CD (P=0.05)	621	603	5666	621	603	5489	0.033	0.033	0.284
Interaction									
S*V	S	S	S	S	S	S	S	S	S
S*W	S	S	S	S	S	S	S	S	S
V*W	NS	NS	NS	NS	NS	NS	NS	NS	NS
S*V*W	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table-2.1 Interaction (SXV) effect of different sowing method, Variety and Weed management practice on of Gross Return (Rs./ha)

	S1	S2	S3	S4	mean
V1	25915	38216	38388	38597	35279
V2	23245	30633	30887	31085	28962
mean	24580	34424	34638	34841	
	S	V	(S*V)1	(S*V)2	
SEm(d)	7113	6316	12633	11419	
CD(AT 5%)	15500	13391	26782	24470	

Table-2.2 Interaction (SXW) effect of different sowing method, Variety and Weed management practice on Gross Return (Rs./ha)

	S1	S2	S3	S4	MEAN
W1	24821	36999	37177	37481	34119.66
W2	24564	34475	34660	34816	32128.75
W3	24355	31798	32076	32226	30113.38
MEAN	24580	34424	34638	34841	
	S	W	(S*W)1	(S*W)2	
SEm(d)		2833	5666	8485	
CD(AT 5%)		5666	11332	18038	

Table-2.3 Interaction (SXV) effect of different sowing method, Variety and Weed management practice on of Net Return (Rs./ha)

	S1	S2	S3	S4	mean
V1	8019	19945	20118	17701	16446
V2	5350	12362	12616	10189	10129
mean	6684	16153	16367	13945	
	S	V	(S*V)1	(S*V)2	
SEm(d)	6415	6316	12633	10998	
CD(AT 5%)	13979	13391	26782	23536	

Table-2.4 Interaction (SXW) effect of different sowing method, Variety and Weed management practice on Net Return (Rs./ha)

	S1	S2	S3	S4	MEAN
W1	6852	18655	18833	16512	15213
W2	6690	16226	16411	13942	13317
W3	6511	13579	13857	11382	11332
MEAN	6684	16153	16367	13945	
	S	W	(S*W)1	(S*W)2	
SEm(d)		2745	5489	7826	
CD(AT 5%)		5489	10979	16593	

Table-2.5 Interaction (SXV) effect of different sowing method, Variety and Weed management practice on B:C Ratio

	S1	S2	S3	S4	mean
V1	1.45	2.09	2.10	1.88	1.88
V2	1.30	1.68	1.69	1.51	1.54
mean	1.37	1.88	1.90	1.70	
	S	V	(S*V)1	(S*V)2	
SEm(d)	0.34	0.34	0.67	0.59	
CD(AT 5%)	0.75	0.71	1.42	1.25	

Table-2.6 Interaction (SXW) effect of different sowing method, Variety and Weed management practice on B:C Ratio

	S1	S2	S3	S4	MEAN
W1	1.38	2.02	2.03	1.82	1.81
W2	1.37	1.89	1.90	1.70	1.72
W3	1.37	1.75	1.76	1.57	1.61
MEAN	1.37	1.88	1.90	1.70	
	S	W	(S*W)1	(S*W)2	
SEm(d)		0.14	0.28	0.42	
CD(AT 5%)		0.28	0.57	0.88	

This may be explained due to the fact that under proper spacing between crop plant efficient use of allavailable natural resources and better harnessing solar radiation, absorption and utilization of radiation energy resulted leading to higher photosynthetic rate and finally more accumulation of dry matter by the plants. Our results confirm with the findings of Jan *et al.* (2015) [4] and Kanwar *et al.* (2017) [5].

Varieties (V)

Variety 86M86 was registered significantly superior value computed parameters *viz.* grain yield/ha, stover yield/ha, biological yield/ha, harvest index and weed index (1896 kg, 3874 kg, 5770 kg, 32.76&16.12%; respectively) in comparable to JBV-2 (1541 kg, 3262 kg, 4803 kg, 32.04&31.81%; respectively). 86M86 was recorded significantly higher economic parameters *viz.* gross return, net return and B:C ratio (Rs.35279/ha, Rs.16446/ha &1.880; respectively) in comparable to JBV-2 (`28962/ha, `10129/ha &1.545; respectively). The differential behavior of pearlmillet varieties with respect to these characters could be explained solely by the variation in their genetic makeup and adaptability to soil and climatic conditions. These results are in accordance with the results reported by Ahmad, *et al.* (2012) [1].

Weed management practices (W)

The one hand hoeing at 20-25 DAS/DAT registered significantly expressive computed parameters *viz.* grain yield/ha, stover yield/ha, biological yield/ha, harvest index and weed index (1831 kg, 3760 kg, 5591 kg, 32.63% &18.99%; respectively) over rest of the treatments; while losable was observed under 2, 4-D treated plot (1606 kg, 3375 kg, 4980 kg, 32.16% &28.95%; respectively).One hand hoeing at 20-25 DAS/DAT registered significantly higher economic parameters *viz.* gross return,net return and B:C ratio(Rs.34120/ha,Rs.15213/ha and 1.812; respectively); while lowest was observed under 2, 4-D treated plot(Rs.30113/ha, Rs.11332/ha and 1.611; respectively). Due to favourable conditions created by weed management practices; which resulted higher total dry matter accumulation and optimum translocation of food materials to the cob as well as better uptake of nutrient and moisture. This might be due to better control of weeds and thus resulted in lower accumulation of dry matter of weeds and lower crop weed competition associated with better availability of moisture and nutrients to pearlmillet crop. Photosynthetic food material synthesized in the plant gets deposited in the different plant parts leading to enlargement and development of plant tissues; which cause gradual increment in dry matter. This was also due to the result of luxuriant crop growth as indicated by higher plant height; which resulted in higher dry matter production and its accumulation in different plant parts *viz.* stem, leaves and cobs. This could be attributed to better control of weeds in early growth stages of crop which provided the crop plants optimum environment to utilize growth resources efficiently resulting in better growth of crop. The improvement in crop growth and yield components was the consequence of lower crop weed competition, which shifted the balance in favour of crop in the utilization of nutrients, moisture, light and space. It can be attributed to better translocation of metabolites for grain development. It was in turn due to reduced weed competition in these treatments. These results are in line with the work of Girase *et al.* (2017) [3].

Interaction

S x V

The computed parameters *viz.* grain yield/ha, stover yield/ha, biological yield/ha, harvest index and weed index was significantly superior in interaction of transplanting (15-20 days seedlings) with 86M86 (2083.33 kg, 4188.69 kg, 6272.02 kg, 33.20&7.82%; respectively) over rest of the interactions; while the inferior was recorded under interaction of broadcasting with JBV-2 (1226.29 kg, 2676.15 kg, 3902.44 kg, 31.42&45.77%; respectively).

The economic parameters *viz*. gross returnwasnoticed significantly higher in interaction of transplanting (15-20 days seedlings) with 86M86 (Rs.38597/ha); while net return and B:C ratiowas recorded under interaction of ridge and furrow sowing with 86M86 (Rs.20118/ha &2.10; respectively) over rest of the interactions. These results agree with those of Sarawale *et al*. (2017) [7].

S x W

The interaction of transplanting (15-20 days seedlings) with one hand hoeing at 20-25 DAS/DAT registered significantly effective value ofcomputed parameters *viz*. grain yield/ha, stover yield/ha, biological yield/ha, harvest index and weed index (2019.82 kg, 4085.37 kg, 6105.18 kg, 33.04&10.66%; respectively); while the ineffective value was recorded under interaction of broadcastingwith 2, 4-D treated plot (1285.57 kg, 2799.80 kg, 4085.37 kg, 31.46&43.14%; respectively)over rest of the interactions. The interaction of transplanting (15-20 days seedlings) with one hand hoeing at 20-25 DAS/DAT registered higher value of gross return (Rs.37481/ha); while net return and B:C ratio was recorded underinteraction of ridge and furrow sowing with one hand hoeing at 20-25 DAS/DAT (Rs.18833/ha &2.03; respectively)over rest of the interactions.

Conclusion

The findings of studies clearly visualized that the transplanting (15-20 days seedlings) sowing method, 86M86 variety and one hand hoeing at 20-25 DAS/DAT as well as their interaction recorded significantly superior values of all weed parameters and crop parameters in comparison to others. However, in labourer scarcity areas and economical basis; ridge and furrow sowing, 86M86 variety and one hand hoeing at 20-25 DAS/DAT as well as their interaction recorded significantly profitable values of all weed parameters and crop parameters in comparison to others.

Application of research: Research is applicable in pearlmillet growing areas of gird zone to improve the productivity and profitability of pearl millet crop.

Research Category Sowing Methods, Weed Management Practices

Abbreviations

DAS : Days After Sowing
DAT : Days After Transplanting
B:C ratio: Benefit cost Ratio

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