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Evaluation of Farmer's vs Improved Pearl Millet Production Technologies for Enhanced Productivity and Profitability under Rainfed Conditions

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Abstract

Studies were undertaken to know the performance of different agronomic traits under farmer's vs improved pearl millet production technologies for enhanced productivity and net economic return. Significant differences were found between treatments as well as varieties for days to flowering, plant height, disease score, grain and stover yields. Flowering was delayed by two days when improved method of production was used. Where farmer's method was applied, flowering delayed by four days in comparison with improved technology. These results indicate that with application of inputs, flowering was enhanced. Plant height of both local and improved varieties was increased significantly with application of fertilizer and other inputs. The improved variety was found more resistant (1.13) to foliar diseases than the local variety (2.28). Where either farmer's variety or improved variety was used with farmer's practice, the plots were heavily infested with weeds right from the germination stage of the crop. When the same varieties were subjected to primextra herbicide at 0.50 kg ha^{-1} (a.i) the weeds remained controlled as compared to the ones with no herbicide. The higher grain and stover yields are attributed to the application of primextra herbicide. Where complete improved package of production technology (improved variety + recommended doses of fertilizers, herbicides and optimum plant density) was adopted, it gave significantly higher grain (1569 kg ha^{-1}) and stover (21.30 t ha^{-1}) yields. When farmer's traditional method of production was practiced, it produced lowest grain yield of 722 kg ha^{-1} and stover yield of 7.2 t ha^{-1}. The higher grain and stover yields, are thus due to the use of improved variety coupled with the recommended doses of inputs. The improved variety PARC MS-1 yielded significantly higher grain yield of 1089 kg ha^{-1} and stover yield of 12.7 t ha^{-1} in comparison with local variety which yielded grain yield of 722 kg ha^{-1} and stover yield of 5.7 t ha^{-1}, indicating that with the use of only improved variety the grain as well as stover yields are increased more than double of the local variety. The economic analysis showed that by adoption of improved production technology highest net income of Rs.13810 ha^{-1} was obtained when compared to the farmer's traditional production technology.

Introduction

The present national yield of pearl millet is 459 kg ha^{-1}, level which is far below than the potential yield ranging from 2000 to 2500 kg ha^{-1}. This gap can only be reduced with the use of improved varieties coupled with improved package of production technology accessible and acceptable to the farmers for each ecological zone of the country.

Gautam and Kaushik (1988) reported that when an improved and a local variety sown by broadcast method and without weed control, gave average grain yields of 1.41 and 1.13 t ha^{-1}, respectively. While De and Gautam (1987) reported that with scientific management practices crop yield can be increased at least 3-fold. He found that yield of improved variety was increased to 1.94 t ha^{-1} by sowing in rows, gap filling and thinning, two hand weedings and inter-row cultivation. Yields were further increased to 2.37 t ha^{-1} with application of 40 kg N ha^{-1}. Accordingly he suggested application of nitrogen fertilizer at the rate of 137 kg ha^{-1} with an optimum plant population at 1.3 X 10^b plants ha^{-1} in rows spaced 50 cm apart and chemical weed control with triazine compounds.

Escasinas *et al*. (1977) from their study on effect of different population densities and nitrogen levels on the yield components have reported that application of nitrogen fertilizer increased plant height, leaf area index, panicle length, number of grains per panicle, weight of grains per panicle, stover and grain yields in sorghum.

Lagoke and Adeleke (1989) reported that pre-emergence application of atrazine + terbuthylazine at 0.8 kg ha^{-1} (Gardoprim A) resulted in highest grain yield (1850 kg ha^{-1}). Hoe weeding at 21 and 42 days after sowing resulted in higher yields (1796 kg ha^{-1}) followed by atrazine + terbuthylazine at 0.75 + 0.75 kg or at 1.0 + 1.0 kg in combination with hoe weeding (1705 kg ha^{-1}), Post-emergence application of dimethametryn at 1 kg was toxic to the crop. Uncontrolled weeds reduced yields by 56 percent compared to the hoe-weeded control. Gardoprim A was found to be useful for large scale production and weed control at early crop growth. However, hoe weeding proved to be the most economical method of controlling weeds.

Bhargava *et al*. (1991) reported that when a local variety and an improved variety were grown under (I) local management practices i.e. no weeding no population maintenance and no fertilizer application. (ii) 45 cm row spacing and 150,000 plants ha and weeding up to 30 days after sowing and (iii) 45 cm row spacing and 150,000 plants ha^{-1} and weeding up to 30 days after sowing with application of 40 kg N + 20 kg $P_2 0_5$ ha^{-1} at sowing; mean grain yields of the local cultivar from the 3 management systems were obtained 1.30, 1.67 and 2.20 t ha^{-1} respectively compared with 1.50, 2.09 and 2.57 t ha^{-1} from the improved variety with improved management. Rangaswamy (1982) reported that grain and fodder yields were significantly affected by use of improved variety and application of fertilizer. Improved variety gave 200 percent increase in grain yield but 56 percent less fodder yield than local variety. Low fodder yield of improved variety was due to its short height. Application of fertilizer to local variety seed increased grain yield by 250 percent and fodder yield

by 97 percent. In case of improved variety, application of fertilizer increased grain yield by 58 percent and fodder yield 79 percent, when compared to the ones with no fertilizer. Improved management yielded 38 percent and 43 percent increase in grain and fodder yields respectively in case of local varieties.

Materials and Methods

In this study one local variety (local land race) and one improved variety of pearl millet (PARC MS-1), were used for their comparative yield performance when subjected to farmer's method of production and improved production technology. The improved variety is late maturing (80-85 days) with high grain yield potential (2000-2500 kg ha^{-1}) developed at NARC Islamabad. The local variety is farmer's traditional variety which is mixed land-race with low yield potential ranging from 500 to 700 kg ha^{-1}. These two varieties were planted at NARC Islamabad during kharif seasons of 1997 and 1998 in a randomized complete block design with three replications. The plot size for each plot consisted of 7.5 m X 5 m. The treatments were:

T1. Farmer's variety + Farmers practice.
T2. Farmer's variety + Improved practice.
T3. Improved variety +Farmer's practice.
T4. Improved variety + Improved practice.

All cultural operations were carried out according to the treatment schedule and data on the following parameters were recorded.

1. Germination%
2. Plant stand/plot
3. Days to 50% flowering
4. Plant Height (cm)
5. Disease score (1-5)
6. Lodging %
7. Grain yield/plot
8. Stover yield/plot

Central eight rows were harvested from each treatment plot, and the heads were dried in the sun. These were then threshed and data recorded. The data so recorded were analyzed statistically and LSD and CV were calculated. Economic analysis were also made to know the profitability of each treatment.

Results and Discussion

Results of comparative performance on grain yield, stover yield and other agronomic traits under farmer's vs improved pearl millet production technology are presented in Table 1-5, which are discussed as below.

Days to 50% flowering: Significant differences were found between treatments as well as varieties. In case of farmer's method, flowering was delayed by two days w compared with improved method of production technology. Similarly in case of farmer method, flowering delayed for five days when compared with improved technology (Table 1). These results indicate that with application of input flowering was enhanced. Escasinas *et al*. (1977) have reported earliness in maturity with nitrogen application Narkhede *et al*. (1982) have reported enhanced flowers by 5-8 days when compared to the ones without fertilizer. While comparing varieties, the local variety was earlier the improved variety PARC-MS-1.

Plant Height: Significant differences were observed among the treatments as well as varieties. Plant height of local and improved varieties was increased significantly with application of fertilizer and other inputs (Table 1). These results are in agreement with Escasinas *et al*. (1977) who reported increased plant height with application fertilizers.

Insect and Disease Score: No insect damage was observe in both local as well as improved pearl millet varience however while comparing the local variety with improved variety, significant difference were observed foliar diseases. The improved variety was found resistant to foliar diseases than the local variety. However, there was no significant difference between the local variety and improved variety when both the varieties were subjected to improved technology (Table 1).

Weeds biomass: Weeds biomass data presented in Table 2 show that where either farmer's variety or improved variety was used with farmer's practice, the plots were here infested with weeds right from the germination stage of crop. While in case of farmers variety + improved practice and improved variety + improved practice when the varieties were subjected to primextra herbicide at 0.50 ha^{-1} (a-I) the weeds remained controlled (176-483 biomass ha^{-1}) as compared to the ones with no her (1206-901 kg ha^{-1}), The higher grain and stover yield attributed to the application of primextra herbicide. The results are also in line with Lagoke and Adeleke (1989), who they from their study on weed cover in millet have reported that the use of herbicides along-good cultural practice would help control weeds and the crop production profitable.

Grain and stover yields: Statistical analysis of grain stover yields data showed significant differences a treatments as well as varieties (Table-4). In case of complete improved package of production tech (improved variety+ recommended doses of fertilizers insecticides, herbicides and optimum plant significantly higher grain yield as well as stover yield obtained in comparison with farmer's traditional method cultivation. Where lowest grain yield of 722 kg ha^{-1} stover yield of 5.65 t ha^{-1} was obtained. The higher

Shakoor and Naeem: Pennisetum typhoideum; chemical control; yield components; economic analysis.

Table 1: Mean Performance of Different Agronomic Traits under Farmers vs Improved Pearl Millet Production Technology Valuated at NARC, Islamabad During 1997 and 1998.

Treatments	Variety used	Practice applied flower	Days to 50% (cm)	Plant Height (1-5)	Disease Score (kg/ha)	Weeds biomass
FV X FP	Local	Farmer's Practice	40.5	139.0	2.88	1206
FV X IP	Local	Improved Practice	39.0	147.0	2.38	483
IV X FP	PARC-MS-1	Farmer's Practice	44.5	150.0	1.75	901
IV X IP	PARC-MS-1	Improved Practice	41.0	157.5	1.13	176
C.V.			3.64	1.01	-	-
L.S.D at 5% level			N.S	4.76	-	-

Table 2: Cost of Production of Millet Grain per Hectare Based on Prevailing Prices Kharif-1997 (Farmer's Technology).

Parameters	Units	Rate (Rs)	Total Amount
Ploughing	2	160	320
Swing	1 man day	35	75
Millet seed	20 kg	15	300
Harvesting	5 man days	75	375
Threshing	5 man days	75	375
Widowing	4 man days	75	300
Misa, Expenditure	-	-	200
		Total	1945

Table 3: Cost of Production of Millet Grain per Hectare Based on Prevailing Prices Kharif-1997 (Improved Technology).

Cost	Unit	Rate(Rs)	Amount(Rs)
Plaughing	2	160	320
Showing (by hand drill)	4 man days	75	300
Millet seed	10 kg	15	150
Fertilizer (Urea)	2 bags	360	720
(Tiger DAP)	1-1/2 bags	520	780
Fertilizer application	1 man days	75	75
Rimextra (Herbicide)	0.5 Litre	312/kg	312
Rimextra application	2 man days	75	150
Hinning	4 man days	75	300
lids Scaring	15 man days	75	1125
Harvesting	5 man days	75	375
Threshing (Thresher)	10 litres fuel	25	250
Vinnowing	2 man days	75	150
	2 man days	75	150
		Total cost (Rs/ha)	5157

Table 4: Performance of Different Agronomic Traits under Farmers vs Improved Pearl Millet Production Technology Evaluated at NARC, Islamabad During 1997 and 1998.

Treatments	Variety Used	Practice Applied	Grain Yield (kg/ha)			Fodder Yield (kg/ha)			Gross Income (Rs/ha)		
			1997	1998	Mean	1997	1998	Mean	1997	1998	Mean
X FP	Local	Farmer's Practice	844	600	722	5.7	5.6	5.65	14085	10400	12243
X IP	Local	Improved Practice	1074	1170	992	5.9	6.6	6.25	17585	19200	18393
X FP	PARC-MS-1	Farmer's Practice	1119	1258	1089	11.6	13.8	12.70	19685	22320	21003
K IP	PARC-MS-1	Improved Practice	1437	1700	1569	18.2	24.4	21.30	2.6105	31600	28853
%			12.06	5.28	-	11.67	13.32	-	-	-	-
L.S.D. at 5% level			390.84	208.52	-	3.84	8.94	-	-	-	-

Table 5: Economic Analysis of Farmers vs Improved Pearl Millet Production Technology Evaluated at NARC, Islamab During 1997 and 1998.

Treatments	Variety used	Practice applied	Gross Income (Rs/ha)	Variables Cost (Rs/ha)	Net Income (Rs/ha)	Increase over farmer's Technology due to:		
						IV	IP	IV + IP
FV X FP	Local	Farmer's Practice	12243	1945	10298	-	-	-
PV X IP	Local	Improved Practice	18393	5157	13236	-	2938	-
IV X FP	PARC-MS-1	Farmer's Practice	21003	2620	18383	- 8085	-	-
IV X IP	PARC-MS-1	Improved Practice	28853	5045	23808	-	-	1350

as well as stover yields of improved variety + improved practice, are attributed to the use of improved variety coupled with the recommended doses of inputs. These results are in agreement with the results reported by Singh and Mathur (1982); Umrani *et al*. (1982) and Rangaswamy, (1982) who they also reported significant grain and stover yields with fertilizers and herbicides.

While comparing the local and improved varieties, when subjected to farmer's practice, the improved variety PARC MS-1 yielded significantly higher grain yield of 1089 kg ha^{-1} and stover yield of 12.70 t ha^{-1} in comparison with local variety which yielded grain yield of 722 kg ha^{-1} and stover yield of 5.65 t ha^{-1}, which shows that with the use of only improved variety one can get more than double of grain as well as stover yields. Rafiq and Afzal (1981) have also reported significantly higher grain and stover yield from the improved varieties than the local ones. These results are also in line with the findings of Bhosale *et al*. (1984) who also got significant grain yields from improved varieties. While comparing the farmer's practice with that of improved technology (where farmer's variety is used) grain yield of 992 kg ha^{-1} and stover yield of 6.25 t ha^{-1} was obtained with the improved method of practice in comparison with grain yield of 722 kg ha^{-1} and stover yield of 5.65 t ha^{-1} obtained by the farmer's practice. It shows that with the use of only recommend improved practice of cultivation using the farmer's variety, one can get at least double yields. The higher yields thus obtained were due to the application of improved technology.

The economic analysis presented in Table 5, showed that by adoption of improved production technology highest net income of Rs.13510 ha^{-1} was obtained when compared to the farmer's traditional production technology. The highest net benefit/return is due to the improved variety coupled with improved/recommended production technology.

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