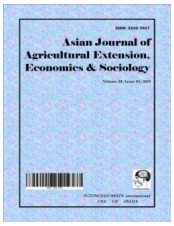

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Effect of Technological Intervention on Yield of Summer Pearl Millet

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Front line demonstrations (FLDs) were conducted by pearl millet Research Station, JAU, Jamnagar on 313 farmers' field in 125 hectares of different 98 villages of Gujarat state during summer season of 2015 to 2019. Prevailing farm practices were treated as control for comparison with recommended package *i.e.* improved variety (GHB 558, GHB 538, GHB 732), seed rate 4 kg/ha, timely sowing (15 Feb to 15 March), line sowing with spacing of 60 cm (R-R) and 10-12 cm (P-P), balanced use of fertilizers (NPK @120:60:0 kg/ha, thinning 15 days after sowing, weed management (pre emergence spray of Atrazin @ 0.5 kg/ha and one hand weeding), proper critical stage apply 8-10 irrigation, two foliar spray of profenophos 0.05 % at 20 and 40 days after germination to control shoot fly and stem borer pests infesting pearl millet, timely harvesting and threshing. The cumulative effect of technological intervention over five years, revealed average grain yield 4362 kg/ha and dry fodder yield 7365 kg/ha which is 6.17% and 12.76% higher over the farmers' practices. The economics and cost benefit ratio of both farmers' and improved practices was worked out. On an average net profit was obtained 6837 ₹/ha due to adoption of improved package of practices. The average cost benefit ratio was 2.23 under improved demonstration practices, while it was 2.43 under farmers' practices. By conducting the Front line

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demonstrations of proven technologies, yield potential and net income from pearl millet cultivation can be enhanced to a great extent with increase in the income level of the farming community.

Keywords: FLDs; front line demonstration; net profit; pearl millet.

1. INTRODUCTION

Pearl millet is a cereal crop that thrives in the arid and semi-arid tropical regions of Asia and Africa. It is an important food crop in areas with low rainfall and shallow soils. It is not only a quick growing short duration crop, but also found drought as well as heat tolerant and well adapted to different soil types. Because of its propensity for high dry matter production at high temperature, it has made a mark in tropics and sub-tropics. Pearl millet is grown over in 8.0 m ha mainly as a rainfed crop in north and northwestern parts of India comprising states of Gujarat, Rajasthan, Maharashtra and Haryana [1].

In Gujarat it is an important food and fodder crop as it is second in terms of area after wheat and third after wheat and rice in terms of production. It is an important staple food for the people of arid and semi-arid regions of the state, North Gujarat, Kutch and Saurashtra. It is cultivated by Gujarat farmers in 3 different seasons viz., rainy (kharif) season (June-September), post-rainy (rabi) season (November-February) and summer season (February-May).

In Gujarat it is grown in 26 out of 33 districts covering an area of 1.63 lakh ha in Kharif with an average productivity 1272 kg/ha and around 2.4 lakh ha area under summer cultivation with an average productivity of 2628 kg/ha [2]. The total area of Pearl Millet in the state is 3.97 lakh ha with an average productivity 2430 kg/ha [2]. The area of summer cultivation is increasing gradually due to short period of time available to farmer after rabi crops, acute demand of fodder and suitable climatic situation in the state.

Pearl millet is considered as whole crop utilization. Its grain has high nutritive value for human consumption and livestock also relish its straw, both in fresh and dried forms [3]. Pearl millet is an important coarse grain crop and serves as stable diet for millions of people living in poverty.

Available improved agricultural technology does not serve its purpose till it reaches and be adopted by its ultimate users, the farmers. The technology transfer refers to the spread of new ideas from originating sources to ultimate users. Looking to the existing gap in state average yield, farmers' practices yield and improved technology yield, there is ample scope for further improvement of production and productivity of pearl millet for increase the income level of the farming community of the Gujarat State. The demonstration of varietal components under FLDs plays important role in the maximization of pearl millet production [4]. Considering these facts the varietal components under FLDs were tested in summer pearl millet cultivation situation in Gujarat state.

2. MATERIALS AND METHODS

Front line demonstrations were organized and conducted by Pearl Millet Research Station, JAU, Jamnagar on 313 farmers' field in 125 hectares of different 98 villages of Gujarat state during summer season under real farming situations during 2015 to 2019. The demonstration area was 0.40 ha. and all demonstrations on various locations were under direct supervision of the scientists. To manage the assessed problem, improved variety (GHB 558, GHB 538, GHB 732), seed rate 4 kg/ha, timely sowing, line sowing with spacing of 60 cm (R-R) and 10-12 cm (P-P), balanced use of fertilizers (NPK @120:60:0 kg/ha, thinning 15 days after sowing, weed management (pre emergence spray of Atrazin @ 0.5 kg/ha and one hand weeding), proper critical stage apply 8-10 irrigation, two foliar spray of profenophos 0.05 % at 20 and 40 days after germination to control shoot fly and stem borer pests infesting pearl millet, timely harvesting and threshing were followed as intervention during the course of front line demonstration scheme. Before the conduct of demonstrations, training to the farmers of respective villages was imparted with respect to proven technological interventions. All other steps like site and farmer selection, lay out of demonstrations, farmers' participation were followed as suggested by Chaudhary (1999) [5].

Visits of farmers and extension functionaries were organized at demonstration plots to disseminate the message at large scale. The yield data were collected from both the demonstration and control (Farmers' practices) plots by random crop cutting method. The cost of cultivation, net income and cost benefit ratio were computed and analyzed. The extension gap, technology gap, technological index [6,7] and state average yield gap [8] were calculated by using the following formula:

Percentage increase yield = (Improved practices yield - farmers' practices yield/ farmers' practices yield) × 100

Technology gap = Potential yield - Improved practices yield

Extension gap = Improved practices yield - farmers' practices yield

Technology index = (Potential yield - Improved practices yield/ Potential yield) × 100

State average yield gap = (Improved practices yield - Average state yield/Average state yield) × 100

3. RESULTS AND DISCUSSION

The gap between the farmers' practices and improved technologies of pearl millet in different district of Gujarat is presented in Table 1. The gap observed was due to in use of improved variety (GHB 558, GHB 538, GHB 732), seed rate 4 kg/ha, timely sowing, line sowing with spacing of 60 cm (R-R) and 10-12 cm (P-P), balanced use of fertilizers (NPK @120:60:0 kg/ha, thinning 15 days after sowing, weed management (pre emergence spray of Atrazin @ 0.5 kg/ha and one hand weeding), proper critical stage apply 8-10 irrigation, two foliar spray of profenophos 0.05% at 20 and 40 days after germination to control shoot fly and stem borer pests infesting pearl millet, timely harvesting and threshing.

The yield performances are presented in Table 2. The results indicated that under improved practices, the grain yield of pearl millet was found to be substantially higher than under farmers' (local) practices during all the years (2015-2019). The grain yields of pearl millet under improved practices recorded were; 3967, 4000, 4515, 4589 and 4739 kg/ha during summer of 2015, 2016, 2017, 2018 and 2019, respectively. The yield improvement due to technological interventions was to the tune of 4.61, 6.10, 8.87, 5.79 and 5.45 % over farmers' practices. The cumulative effect of technological interventions over five years, revealed an average yield 4362 kg/ha, which was 6.17% higher over farmers' practices. The results revealed that the average dry fodder yield of 2015 to 2019 was 7365 kg/ha in the improved practices which was 12.76% higher than the farmers' practices 6551 kg/ha. The highest dry fodder yield of 7612 kg/ha was recorded with improved practices during summer of 2018. The results indicated that higher yields were obtained under improved demonstration practices compared to farmers' practices.

Table 1. Difference between improved and farmers' practices under front line demonstration on pearl mille

Sr. no.	Components	Improved practices	Farmers' practices
1	Land preparation	Two Ploughing	Two Ploughing
2	Variety	Improved Hybrid GHB 558, GHB 538 and GHB 732	Local available variety
3	Sowing method	Line sowing	Broadcasting & Line sowing
4	Seed rate	3.75 kg/ha	6-8 kg/ha
5	Spacing of row to row and plant to plant	60 cm & 10-15cm	45 cm & 10 cm
6	Plant population	Optimum	Uneven
7	Weed management	Pre emergence spray of Atrazin @ 0.5 kg/ha + one hand weeding	Weeding in not common
8	Doses of NPK fertilizers	120-60-0 kg/ha	Imbalance and inadequate
9	Irrigation at critical stage	8-10	Unequal
10	Plant protection	Application of recommended dose of insecticide as per requirement	Use of incorrect dose and plant protection is not common

Table 2. Yield performance of FLD on pearl millet crop

Season	No. of Demon-strations	Variety	Grain yield (kg/ha)		% Increase in yield over farmers' practices	Dry fodder yield (kg/ha)		% Increase in dry fodder yield over farmers' practices
			Improved practices	Farmers' practices		Improved practices	Farmers' practices	
Summer 2015	76	GHB-558, GHB-732	3967	3792	4.61	6943	5689	22.04
Summer 2016	75	GHB-538, GHB-732	4000	3770	6.10	7188	6569	9.42
Summer 2017	62	GHB-558, GHB-538, GHB-732	4515	4147	8.87	7492	6607	13.39
Summer 2018	50	GHB-732	4589	4338	5.79	7612	6982	9.02
Summer 2019	50	GHB-538, GHB-732	4739	4494	5.45	7591	6906	9.92
Sum/Mean	313	-	4362	4108	6.17	7365	6551	12.76

Table 3. Extension gap, technology gap, technology index and state average gap (%) of pearl millet under FLD and existing package of practices

Season	Grain yield (kg/ha)		Extension gap (kg/ha)	Technology gap (kg/ha)	Technology Index	State average yield gap (%)
	Potential	State average				
Summer 2015	6718	2658	175	2751	40.95	49.25
Summer 2016	6718	2750	230	2718	40.46	45.45
Summer 2017	6718	2726	368	2203	32.79	65.63
Summer 2018	6718	2919	251	2129	31.69	57.21
Summer 2019	6718	2642	245	1979	29.46	79.37
Mean	6718	2739	254	2356	35.07	59.38

Table 4. Economics of FLD on pearl millet crop

Year	Gross expenditure (₹/ha)		Gross return (₹/ha)		Net return (₹/ha)		C:B ratio	
	Improved practices	Farmers' practices	Improved practices	Farmers' practices	Improved practices	Farmers' practices	Improved practices	Farmers' practices
Summer 2015	30656	31920	68512	63594	37856	31674	1:2.23	1:1.99
Summer 2016	30875	32173	86816	81413	55941	49240	1:2.81	1:2.53
Summer 2017	30387	31610	72821	66337	42435	34727	1:2.40	1:2.10
Summer 2018	30268	31470	78690	73959	48422	42489	1:2.60	1:2.35
Summer 2019	31247	32600	110720	104411	79473	71812	1:3.54	1:3.20
Mean	30687	31954	83512	77943	52825	45988	1:2.72	1:2.43

Selling price of pearl millet grain was 13.77, 18.11, 12.81, 13.83 and 20.16 ₹/kg in June month of 2015, 2016, 2017, 2018 and 2019, respectively. Dry fodder yield 2.00 ₹/kg

The extension gap of 175, 230, 368, 251 and 245 kg/ha was observed during summer of 2015, 2016, 2017, 2018 and 2019, respectively (Table 3). On an average extension gap was observed 254 kg/ha. The technology gap ranged between 1979 to 2751 kg/ha and on an average technology gap in the five years of the FLD programmes was 2356 kg/ha. The technology gap observed may be attributed to dissimilarity in the soil fertility status, agricultural practices and local climatic situation. The technology index varied from 29.46 to 40.95 per cent. On an average technology index observed was 35.07 per cent, which shows the efficacy of good performance of technical interventions. The gap between state average yield and improved practices was to the tune of 49.25%, 45.45%, 65.63%, 57.21% and 79.37% during the summer of 2015, 2016, 2017, 2018 and 2019, respectively. On average, state average gap in the five years of FLD programmes was 59.38%. It indicates that the pearl millet growers with low yield were identified by low knowledge of scientific technology of pearl millet cultivation. It is a point of concern for research and extension workers to disseminate improved pearl millet production technology for raising its production.

The economic viability of improved technologies over farmers' practices was calculated depending on prevailing prices of inputs and outputs costs (Table 4). It was found that cost of cultivation of pearl millet varied from 30268 to 31247 ₹/ha with an average of 30687 ₹ /ha in improved practices as against the variation in cost of cultivation from 31470 to 32600 ₹/ha with an average of 31954 ₹/ha in farmers' practices. The cultivation of pearl millet in the improved practices gave higher net return ranged from 37856 to 79473 ₹/ha with a mean value of 52825 ₹ /ha as compared to farmers' practices which recorded 31674 to 71812 ₹ /ha with a mean of 45988 ₹ /ha. Higher benefit cost ratios of 2.23, 2.81, 2.40, 2.60 and 3.54 were found under improved practices compared to 1.99, 2.53, 2.10, 2.35 and 3.20 under farmers' practices in the corresponding seasons. On average, a net profit of 6837 ₹/ha was obtained due to adoption of improved package of practices. Hence, there is a wide scope to increase the production of pearl millet crop by providing need based training and demonstration on improved production technology to the farmers. The above findings are in confirmation with similarly to those of Parmar et al. (2016) for pearl millet [8], Zala et al. (2013) for finger millet [9] and Thakur et al. *(*2019) for chick pea [7].

4. CONCLUSIONS

The FLD produces a significant positive result and provided the researcher an opportunity to demonstrate the productivity potential and profitability of the latest technology (Intervention) under real farming situation. In demonstration plot improved production technology of pearl millet performs better 6.17 % in grain yield and 12.76 % in dry fodder yield over the farmers' (control) practices. The productivity gain under FLD over existing practices of pearl millet cultivation created greater awareness and motivated the other farmers to adopt suitable production technology of pearl millet.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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