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Profitability of maize cultivation under rainfed condition for marginal and small farmers

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Abstract
The study was conducted in Chandel district of Manipur state to maximise the productivity of maize cultivation under rainfed condition. Maize is one of the most important crops, next to rice and is mostly grown under rainfed hilly upland conditions. In the region, maize production plays a significant role in ensuring food security and is used both for direct consumption as well as for livestock farming. It is a major source of income especially to the marginal and small farmers in rainfed areas of Manipur. The sample consisted of randomly selected 120 farmers who were growing maize under Front Line Demonstrations. The results revealed that Quality Protein maize var. HQPM-5 along with improved technology recorded an average grain yield of 43.52 q/ha with 43.92 per cent increased in yield over farmers practise. The study also showed that reduction in technology index from 45.91 during 2017-18 to 22.11 during 2019-20 exhibited the feasibility of demonstrated technology. The lower the value of technology index, the more is the feasibility of the technology. Further, it was found that the adoption of improved technologies with HYV not only increased the yield but also yield attributing traits of maize. Hence, there is a need to disseminate the improved technologies amongst the farmers with effective extension methods like training and demonstrations to enhanced crop production and profitability for small and marginal farmers.

Keywords: Technology index**,** maize, productivity, frontline demonstration

Introduction
In North-Eastern region of India, maize is the second most important food grain after rice. The crop has multiple uses as food, feed, fuel, etc. Maize has special significance in the region as ingredient of concentrate feeds for poultry, fish, pig and cattle. Maize is mostly grown under rainfed condition in upland and jhum lands. Cultivation of maize plays an important role in subsistence farming which is being practiced by majority of the small and marginal farmers, especially in the hill districts of Manipur. The state is bestowed with suitable agro-climatic conditions for successful cultivation of maize. In the hilly terrains, maize is cultivated in the jhum land or on foothills/terraces. The state is rich in maize diversity and a wide variation of local varieties are available both in hill and valley areas. Farmers usually cultivated local varieties but presently high yielding varieties have gained popularity. Use of local varieties, lack of suitable varieties for jhum cultivation, negligible use of agro-chemicals especially in hills, low moisture retention capacity of upland soil, lack of irrigation facilities, improper weed management, insect pest and disease infestation along with traditional management practices have resulted into low productivity of maize in the state. Taking the above into consideration, a Front Line demonstration on maize cultivation was conducted at the farmers' field of Chandel district with the objective to increase the production and productivity of the maize crop.
The front line demonstration (FLD) is an important method of transferring the latest package of practices in totality to farmers. Further, these demonstrations are designed carefully where provisions are made for speedy dissemination of demonstrated technology among farming community through organization of other supportive extension activities, such as field days and farmers convention (M L Meena and Aishwarya Dudi, 2018) [3].

Materials and Methods
The study was carried out in the district of Chandel during *Kharif* 2017-18, 2018-19 and 2019-20. A total of 120 FLDs were conducted at farmers' field in 40 hectare area. The package of improved technologies like line sowing, nutrient management, seed treatment and whole package were used in the demonstrations. The maize variety HQPM-5 was demonstrated and local variety chavan chakul was taken as farmers' practices. In general, soils of the area under study were clay loam and medium to low in fertility status. Weeding was done at 30-35 days after sowing to ensure weed free which adversely affects growth and yield of crop.

Sowing was done in the first week of May with a seed rate of 20 kg/ha. The data on plant parameters and economic yield from FLD plots and from fields and local practices adopted by the farmers were collected and evaluated. Technology index can also be calculated as given by (M L Meena and Aishwarya Dudi, 2018) [3]

$$\text{Technology index} = \frac{\text{Potential yield - Demonstration yield}}{\text{Potential yield}} \times 100$$

Results and Discussion

Table 1: Yield attributing characters of maize var. HQPM-5

Sl. No.	Parameters	Demonstrated			Farmers practice		
		2017-18	2018-19	2019-20	2017-18	2018-19	2019-20
1	Plant height (cm)	196.5	202.50	220.10	178.20	182.50	189.55
2	No. of cobs/plant	2	2	2	2	2	2
3	No. of seeds/cobs	553	584	649	489	513	542
4	Length of cobs (cm)	17.40	18.5	20	14.80	15.5	17.34
5	Test weight (g)	284.60	286.4	289.52	280.2	281.10	282.5

Yield attributing traits

The data on different yield characters were recorded from different FLD plots. The numbers of seeds per cobs per plant under demonstrated field were 553, 584 and 649 as against farmers' practise 489, 513 and 542 (Table 1) during the year 2017-18, 2018-19 and 2019-20. There was an increase of 13.08, 13.84 and 19.74 per cent of number of seeds per cobs under demonstration of improved technology using Hybrid Maize var. HQPM-5 over farmers' practice i.e. growing of local maize variety Chavan chakul. The length of cobs under demonstration was also higher than the farmers practice during the three years of demonstration. Grain yield of a crop is the result of combined effect of growth, development and yield attributes. These parameters are governed by the heredity of the particular variety but at the same time these are also modified by the level of management and the environmental to which the crop is exposed.

Table 2: productivity and technology index of rapeseed-mustard under FLD and Farmer practise (FP)

Year	Area (ha)	Demonstration (No.)	Yield (q/ha)		Increase in yield (%)	Potential Yield (kg/ha)	Technology Index (kg/ha)
			Demonstration	Farmers practise			
2017-18	20	55	39.75	27.55	44.28	58	45.91
2018-19	10	35	43.33	30.00	44.43	58	33.86
2019-20	10	30	47.50	33.20	43.07	58	22.11
Average	40	120	43.52	30.25	43.92	58	33.96

Grain yield

The yield of maize under FLDs was recorded to be 39.75, 43.33 and 47.50 q/ha during 2017-18, 2018-19 and 2019-20 with the mean yield of 43.52 q/ha (Table 2). The increase in yield under improved technology was 44.28 %, 44.43% and 43.07% during 2017-18, 2018-19 and 2019-20 respectively against the increase in yield under farmers practise. The increased yield with improved technologies was mainly because of the scientific package of practices and use of Hybrid maize variety HQPM-5 seeds.

Technology index reduction from 45.91 kg/ha 2017-18 to 22.11 kg/ha during 2019-20 exhibited the feasibility of demonstrated technology at farmers field (Table 2). The lower the value of technology index, the more is the feasibility of that technology (Charak *et al*. 2020) [1] (Raj *et al*. 2014) [4], Jeengar *et al*. 2006) [2]. The difference in technology index during the study period might be attributed to the dissimilarity in soil fertility status, weather conditions, non-availability of soil moisture and insect pest attack in the crop. Hence, it can be inferred that the awareness and adoption of improved varieties with recommended scientific package of practices have increased during the advancement of study period.

Conclusion

The results of the three years study revealed that FLD recorded higher yield as compared to farmer's practices. The improved technologies with hybrid maize variety HQPM-5 recorded an average yield of 43.53 q/ha which was 43.92 per cent higher than the average yield obtained from farmer's practices (30.25 q/ha). From the above findings, it can also be concluded that use of scientific methods of cultivation combined with high yielding varieties can reduce the technology index to a considerable extent thus leading to increased productivity in the district.

Thus the cultivation of maize with improved technology has been found more productive and increased the grain yield upto 43.92 per cent. Technology and extension gap extended which can be bridges by popularizing package of practices with emphasis of improved high yielding hybrid variety, use of proper seed rate, balanced nutrient application and proper use of plant protection measures. Hybrid seeds can enhance crop yields and performance compared to existing local variety and also it fits well to the existing farming situation and also appreciated by the farmers.

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