Technological Gap in Adoption of Recommended Practices of Maize Cultivation among the Farmers of Buldana district in Vidarbha

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Abstract

This study was conducted in Buldana district of Vidarbha region. The data was collected, from 120 maize growers with the help of a pretested and structured interview schedule, regarding the actual adoption of recommended practices of maize cultivation and constraints faced by them in adoption. On analysis of data, the major technological gap was found in adoption of recommended varieties of maize, use of bio-fungicide, fungicides, bio-fertilizers and their proper rate in seed treatment, intercropping, use of weedicides and its doses, intercropping and plant protection. Overall 42.51 per cent technological gap index in maize cultivation was recorded in the study area. The major constraints in adoption of recommended practices were lack of knowledge, non availability of recommended varieties, high cost of seed and fertilizers, uncertainty in rain, unavailability of labour, non availability of FYM, irrigation facilities etc.

Introduction

Maize occupies a pride of place among coarse cereal crops in India. It is cultivated in India on an average of 8.6 million hectares with a production of 22.3 million tonnes. Maharashtra is one of the important cereal crop growing states in India occupying an area of 8.22 lakh hectares with the production of 18.24 lakh tonnes, (Anonymous, 2012). In Maharashtra, maize cultivation is getting importance as it is being considered a crop for replacing cereals like *kharif* sorghum, pearl millet and ragi. Similarly there is an increased demand from industries for processing maize, and as a result farmers are getting increased price than the previous years.

In Vidarbha, out of 11 districts the larger area under maize cultivation is observed in Buldana district, covering 74400 hectare area under maize crop. The average yield of maize in Buldana district is comparatively lower than other districts of Maharashtra State. (Anonymous, 2013). This may be due to partial adoption of recommended production technologies by the farmers, which has resulted in reduction in Maize yield as compared to its potential yield. Hence, the existing gap between the available techniques and their actual application by farmers which is

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reflected in poor yield in the farmers' field needs to be studied. There is tremendous opportunity for increasing the production of maize by adopting improved technologies. In view of the above, the present study was planned with specific objectives viz., (1) To ascertain the technological gap in adoption of recommended maize cultivation practices among the maize growers and (2) To study the constraints encountered by the farmers in adoption of recommended technology of maize cultivation.

Methodology

The study was conducted in purposively selected Buldana district of Vidarbha Region in Maharashtra State, having the maximum area under maize crop cultivation among the eleven districts of Vidarbha region. The purposive selection of four Panchayat Samities was made on the basis of the largest area under maize cultivation in the district. Three villages were purposively selected from each selected Panchayat Samiti with similar criteria. A list of maize growers from the selected villages was obtained from the respective Taluka Agriculture Officer. From the list of maize growers 10 farmers were selected who were having a minimum of one acre land under maize cultivation. Thus, a total of 120 maize growers were selected as respondents and interviewed personally using a pretested and well structured interview schedule.

Technological gap had been conceived as the "difference between adoption of the package of practices of maize cultivation recommended by Dr. PDKV, Akola and the extent of adoption of these practices by farmers". The recommended package of practices of maize cultivation was finalized, by using the University literature available and contacting the Subject Matter Specialists of the University. Responses of respondents were collected on a three point continuum i.e. fully adopted, partially adopted and not adopted by assigning scores of 2, 1 and 0, respectively. The technological gap of every major practice was calculated by the following formula:

Total number of sub-practices recommended by the University minus Total number of recommended sub-practices adopted by maize growers. Using this calculation, technological gap index of maize cultivation was worked out using the following formula:

$$\text{Technological Gap Index} = \frac{\text{No.of recommended practices -No.of adopted practices}}{\text{No.of recommended practices}}$$

Constraints faced by farmers in adoption of recommended practices of maize cultivation were recorded under every major practice. Frequency and percentage of each constraint were worked out to find out the intensity of the constraints faced by maize growers.

Results and Discussion

Technological Gap

Distribution of the respondents based on the level of existing technological gap about recommended practices of maize cultivation is presented in Table 1.

Table 1. Distribution of respondents according to their practice-wise technological gap in recommended maize cultivation practices

Sl. No.	Recommended cultivation practices of maize	Technological gap (n=120)			TGI
		Full	Partial	No	
A	**Land preparation**				**18.75**
i	Type of soil (all types of soil)	00 (00.00)	00 (00.00)	120 (100.00)	
ii	Operation for land preparation	01 (00.83)	08 (06.66)	111 (92.50)	
iii	Ploughing (1) & Harrowing (2-3)	00 (00.00)	12 (10.00)	108 (90.00)	
iv	FYM application (15-20 bullock cart per ha)	60 (50.00)	19 (15.83)	41 (34.16)	
B	**Period of sowing**				**04.58**
i	Period of sowing- (Kharif- 20 June-7July; Rabi-upto 15 Oct; Summer- 15-30 Jan.)	03 (02.50)	08 (06.66)	109 (90.83)	
C	**Sowing method**				**05.93**
i	Sowing method (drilling/ dibbling)	00 (00.00)	01 (00.83)	119 (99.16)	
ii	Sowing depth (4-5 cm)	00 (00.00)	25 (20.83)	95 (79.16)	
D	**Variety**				**95.00**
i	Variety (PKVM-Shatak, Sweet Corn, Ambar pop-corn and African Tall)	115 (95.83)	02 (01.66)	03 (02.50)	
E	**Seed rate**				**01.66**
i	Seed rate (15-20 kg. per/ha)	00 (00.00)	03 (02.50)	117 (97.50)	
F	**Seed treatment**				**94.09**
i	Fungicide (Thirum, captan, etc.)	111 (92.50)	02 (01.66)	07 (05.83)	
ii	Bio-fertilizers (azospirillum, azotobacteretc.)	107 (89.16)	04 (03.33)	09 (07.50)	
iii	Dose of fungicide (3 gm/kg of seed)	112 (93.33)	03 (02.50)	05 (04.16)	

Sl. No.	Recommended cultivation practices of maize	Technological gap (n=120)			TGI
		Full	Partial	No	
iv	Rate of biofertilizer (250 gm / 10 kg of seed)	105 (87.50)	02 (01.66)	13 (10.83)	
v	Bio-fungicide (Trichoderma virride)	120 (100.00)	00 (00.00)	00 (00.00)	
vi	Rate of bio-fungicide (3-5 gm / kg of seed)	120 (100.00)	00 (00.00)	00 (00.00)	
G	**Spacing**				**24.69**
i	Spacing of sowing (15 – 20 cm plant - plant)	01 (00.83)	04 (03.33)	115 (95.83)	
ii	Optimum plant population (80000-1 lakh)	15 (12.50)	38 (31.66)	67 (55.83)	
iii	Thinning (15 DAS)	48 (40.00)	19 (15.83)	53 (44.16)	
H	**Intercultivation**				**46.14**
i	Intercultural practices (hoeing, weeding, etc.)	02 (01.66)	12 (10.00)	106 (88.33)	
ii	Time of hoeing (Upto 40 days 2 or 3 hoeing)	00 (00.00)	08 (06.66)	112 (93.33)	
iii	Weedicide (Atrazine pre-emergence)	100 (83.33)	04 (03.33)	16 (13.33)	
iv	Dose of weedicide (0.5 – 1.0 kg/ 700 lit. water/ha.)	105 (87.50)	03 (02.50)	12 (10.00)	
I	**Water management**				**70.20**
i	Water requirement (1or 2 for kharif if necessary, 4-5 for rabi & 6-7 for summer)	79 (65.83)	18 (15.00)	23 (19.16)	
ii	Growth stages for irrigation (Silking and tasling, milking and grain filling stage.)	71 (59.16)	18 (15.00)	31 (25.83)	
J	**Intercropping**				**78.33**
i	Intercrop (Cowpea, mung, udad, tur etc.)	86 (71.66)	13 (10.83)	21 (17.50)	
ii	Row proportion of intercrop (6:2, 8:2, etc.)	87 (72.50)	13 (10.83)	20 (16.66)	
K	**Fertilizer application**				**06.66**
i	Fertilizers dose (120:60:30)	00 (00.00)	23 (19.16)	97 (80.83)	
ii	How the fertilizers (split doses 40 kg N and whole PK at the time of sowing 40 kg N 30-35 DAS & 40 kg N 50-55DAS)	00 (00.00)	08 (06.66)	112 (93.33)	
L	**Plant protection**				**91.52**
i	Control measure for pests (Cultural, Mechanical and Biological)	63 (52.50)	52 (43.33)	05 (04.16)	

Sl. No.	Recommended cultivation practices of maize	Technological gap (n=120)			TGI
		Full	Partial	No	
ii	Chemicals for control of pests (dimithoate 30% or monochrotophos 36%)	115 (95.83)	03 (02.50)	02 (01.66)	
iii	Quantity of chemical (3 ml/10lit.)	116 (96.66)	02 (01.66)	02 (01.66)	
iv	Control measure for disease	119 (99.16)	01 (00.83)	00 (00.00)	
M	**Harvesting and threshing**				**01.25**
i	Proper period for harvesting (after yellowing of crop and hardness of grain)	00 (00.00)	00 (00.00)	120 (100.00)	
ii	Period for threshing (3– 4 days after harvesting)	01 (00.83)	03 (02.50)	116 (96.66)	
	Overall technological gap				**42.51**

TGI – Technological Gap Index Figures in parentheses indicate percentage

It can be seen from Table 1 that, under "land preparation practices", 100.00 per cent respondents had no technological gap about soil type required for maize cultivation. It was followed by 92.50 and 90.00 per cent respondents who always followed the operation for land preparation and number of ploughing, harrowing etc. required by the maize crop, respectively hence no technological gap was found in these practices. With reference to FYM application half of the respondents (50.00%) are unable to use FYM as recommended by the University in maize crop. Full adoption of recommended dose of FYM was found in case of 34.16 per cent of respondents and only 15.83 per cent had partial gap in adoption of recommended dose of FYM. Land preparation is a traditionally shaded practice, hence its technological gap index was only 18.75 per cent.

With reference to "period of sowing", a large number of respondents (90.83%) reported no technological gap. Hence, the index was found to be only 04.58 per cent. Sufficient period has been recommended in all three seasons, which was properly followed by the farmers to maintain the cropping pattern.

As regards the "sowing method" such as drilling/ dibbling for maize, almost all respondents (99.16%) had no gap and about 79.16 per cent respondents were also having no gap in maintaining the depth of sowing of maize seed. The two practices under sowing method were commonly adopted by the maximum number of respondents, hence its TGI was found to be 5.93 per cent only.

In case of "recommended varieties" of maize, it was observed that a higher percentage of respondents (95.83%) were observed in full technological gap because

most of the respondents were using varieties of private companies. This indicates the failure of extension agencies in persuading the farmers to adopt University recommended varieties.

As regards the technological gap about recommended "seed rate" of maize, it is heartening to note that 97.50 per cent respondents had no technological gap in respect of seed rate adoption, where as only 02.50 per cent of respondents reported partial technological gap regarding seed rate for maize.

While, studying the technological gap about "seed treatment" the index was found high (94.09%) because majority of the respondents (92.50%, 93.33%, 89.16%, 87.50%, 100.00% and 100.00%) reported full technological gap in respect of fungicide used, dose of fungicide, bio-fertilizers used, rate of bio fertilizer used, bio-fungicides and rate of bio-fungicide used for seed treatment, respectively. Only few respondents (05.83%, 04.16%, 10.83% and 07.50%) reported no gap in respect of fungicide used, dose of fungicide, rate of bio-fertilizers used, bio fertilizer used, respectively. The reason may be that the maize seed available in the market is mostly treated which is mentioned on their packing. More over majority of the farmers did not have knowledge of seed treatment by fungicides and bio-fertilizers.

With respect to "spacing" recommended for maize cultivation, TGI noted was 24.69 per cent because 95.83 per cent respondents had no technological gap in following the recommended spacing, over half of the respondents (55.83%) had no technological gap in maintaining recommended plant population while 31.66 per cent had partial technological gap. Thinning in 15 days was also properly followed by 44.16 per cent respondents, hence they have no technological gap. However 40.00 per cent of the respondents were found to be in full technological gap. It is inferred that recommended spacing in maize was properly followed by the farmers that could have helped in maintaining the plant population, but thinning was not followed by around half of the respondents. This might be due to lack of awareness among the farmers about the logic behind the thinning in maize.

While studying the technological gap about "intercultivation" it was seen that 93.33 per cent and 88.33 per cent respondents reported no technological gap about following the proper time of hoeing and intercultural operations of maize cultivation, respectively. However, 87.5 per cent and 83.33 per cent respondents were observed in full technological gap about dose of weedicide application in maize and use of proper weedicide, respectively. The technological gap index of intercultivation was seen to be 46.14 per cent. It is clearly indicated that most of maize growers are properly following the intercultural operations like hoeing and weeding on time, but weedicide

was not adopted by the farmers in maize due to lack of knowledge and non availability of labour especially for pre emergence application.

Regarding "water management" in maize TGI was 70.20 per cent because majority of respondents (65.83% and 59.16%) had full technological gap about water requirement and irrigation at proper growth stages, respectively. Only 25.83 per cent and 19.16 per cent of the respondents were properly following (no technological gap) the growth stages of irrigation and water requirements in maize, respectively. Most of the farmers could not have sufficient irrigation sources; they were cultivating maize in kharif only. Farmers who had irrigation facilities, preferably cultivated wheat or gram in rabi.

Technological gap index of "intercropping" in maize was quite high (78.33%) because nearly three fourth of the respondents (71.66% and 72.50%) had full technological gap regarding the use of crops for intercropping in maize and also their row proportion in maize, respectively. This was only due to the lack of knowledge about intercropping in maize.

In "fertilizer application", maximum percentage of the respondents (93.33% and 80.83%) had no technological gap in split doses of Nitrogen and recommended dose of fertilizer. Hence, the technological gap index (06.66%) of fertilizer application in maize was very low. It was the common perception of farmers that the fertilizers have high contribution in the yield of any crop. Hence, maximum farmers were found to adopt the recommendations of fertilizers.

The data on technological gap in respect of practices recommended for "plant protection" indicated that maximum respondents (99.16%, 96.66% 95.83% and 52.50%) had full technological gap. It includes control measure for diseases in maize, quantity of chemicals used, chemicals for control measure for pests and control measures for pests, respectively. Behind this 43.33 per cent of the respondents were observed in partial gap about control measure for pest in maize. This may be due to less attack of pests and diseases in maize, therefore farmers did not pay much attention to its management and hence the technological gap was more (TGI 91.52%).

All of the respondents (100.00%) had no technological gap in respect of "harvesting" maize crop at physiological maturity i.e. after yellowing of leaves and hardness of grain in maize and similarly most of the respondents (96.66%) had no technological gap in respect of threshing technology for maize i.e. 2-3 days after harvesting. Only a small percentage of respondents (02.50% and 00.83%) were observed in partial and full technological gap in the threshing of maize, respectively.

This was due to some situational constraints such as non availability of labour and threshing machine, unseasonal rainfall etc. faced by the respondents.

Overall, 42.51 per cent technological gap was recorded for recommended cultivation practices of maize. In this gap, recommended varieties, seed treatment, plant protection, intercropping and water management practices contributed more. Hence, it is necessary that extension agencies pay more attention to these practices for increasing the yield of maize in Buldana district.

Table 2. Distribution of respondents according to the extent of technological gap

Sl. No.	Technological gap levels and index range	Respondents (n=120)	
		Number	Percentage
1.	Low (up to 33.33)	08	06.66
2.	Medium (33.34 to 66.66)	100	83.33
3.	High (Above 66.66)	12	10.00
	Total	**120**	**100.00**

Mean = 50.82

It is evident from the data in Table 2, that over four fifth of the respondents (83.33%) were observed in medium category of technological gap of maize cultivation, followed by only 10.00 per cent of the respondents who were observed in high technological gap category. A very few respondents (06.66%) were observed in low category of technological gap. The findings are in line with the findings of Kadam *et al.* (2010) and Maraddi *et al.* (2012).

Thus, the above findings lead to the conclusion that majority of the maize growers were found in medium category of technological gap about recommended maize cultivation practices, showing existence of technological gap in that area.

Relational analysis

In order to find out the correlates of technological gap, the coefficient of correlation and for relative contribution, regression coefficient analysis were worked out and have been presented below.

It can be seen from Table 3 that among the selected variables, social participation and knowledge were found to be highly but negatively significant with technological gap. It indicates that with increase in the level of social participation and knowledge of respondents, the technological gap could be decreased. In the correlates of

Table 3. Correlates of technological gap and knowledge of respondents with their selected characteristics

Sl. No.	Characteristics	Technological gap (`r' value)	Knowledge (`r' value)
1	Age	-0.1558	0.0452
2	Education	0.2101*	-0.0762
3	Land holding	-0.1677	0.1590
4	Area under maize crop	-0.1433	0.0983
5	Annual income	-0.1801	0.1618
6	Social participation	-0.4468**	0.2414*
7	Sources of information	-0.1880	0.0903
8	Economic motivation	-0.0390	-0.0091
9	Risk preference	-0.0867	-0.0611
10	Scientific orientation	-0.1253	-0.0553
11	Knowledge	-0.6438**	1.0000

** Significant at 0.01 level of probability
* Significant at 0.05 level of probability

knowledge, social participation was significantly correlated with knowledge of respondents at 0.05 level of probability. Here it is clear that participation of farmers in formal and informal organizations helps to increase their knowledge about recommended cultivation practices of maize. It has been proved in a number of research studies that knowledge of technology is the prerequisite function for its adoption and increase in adoption subsequently decreases the technological gap. Similar findings were reported by Singh (2003).

Education is one of the important variables which was found to be positively and significantly correlated with the technological gap at 0.05 level of probability. This was plausibly because, relatively estimable education of farmers in the study area encouraged them to shift towards maize crop for more economic gain as influenced by the private companies. It was therefore, previously found that the technological gap index of recommended practices like varieties, seed treatment, intercropping, plant protection, etc. was quite high. Those practices were concerned with the products of private companies.

Constraints faced by the maize growers

An attempt has been made to find out actual reasons behind existence of practice wise gap in maize cultivation practices and same has been depicted in Table 4.

Table 4. Distribution of respondents according to the constraints faced during use of maize cultivation practices

Sl. No.	Constraints	Respondents (n= 120)	
		Freq.	%
i	**Land preparation**		
1	Cost of land preparation required very high	77	64.16
2	Unavailability of labour for field operation	98	81.66
3	Non availability of FYM	95	79.16
ii	**Varieties, Seed and seed treatment**		
1	Lack of knowledge about recommended varieties	109	90.83
2	Non availability of certified seed/ quality seed of recommended varieties at proper time and place	118	98.33
3	High cost of certified seed/ quality seed	113	94.16
4	Lack of knowledge about seed treatment	117	97.50
iii	**Intercultivation**		
1	Non availability of bullock pair for field operations	33	27.50
2	Lack of knowledge about selection and application of weedicide	78	65.00
3	Unavailability of effective weedicide at reasonable price	60	50.00
4	Unavailability of labour for pre emergence application of weedicide	55	45.83
5	Uncertainty of rainfall	105	87.50
iv	**Water management, intercropping and fertilizer application**		
1	Non availability of irrigation facilities	65	54.16
2	Lack of knowledge about intercropping in maize	88	73.33
3	Cost of fertilizers was very high	110	91.66
4	Non availability of irrigation sources	45	37.50
v	**Plant protection**		
1	Lack of knowledge about control measure for pest	79	65.83
2	Lack of knowledge about identification of diseases and its control measures	115	95.83
3	High cost of insecticide and pesticide	70	58.33

Variety and good quality seed are the prerequisite for good yield of maize, but it is evident from Table 4 that the non availability of certified seed or quality seed of recommended varieties at the proper time and place and lack of knowledge about seed treatment were the major constraints, reported by 98.33 per cent and 97.50 per cent of the respondents, which were responsible for technological gap in adoption of recommended cultivation practices of maize, respectively. It was followed by high cost of seed (94.16%) and lack of knowledge of maize growers about the recommended varieties (90.83%). Similar findings were reported by Kharat (2012).

Lack of knowledge about identification of diseases and their control, high cost of fertilizers were other constraints expressed by 95.83 per cent and 91.66 per cent of the respondents, respectively. In the study area respondents used to cultivate maize in kharif season which was totally dependent on rain water, due to lack of irrigation facilities. In the situation of climate change uncertainty in rainfall was the constraint noted by 87.50 per cent of the respondents.

In the initial operations, non availability of labour and non availability of FYM were the major constraints for land preparation which were reported by 81.66 per cent and 79.16 per cent of maize growers.

Lack of knowledge about intercropping (73.33%), lack of knowledge about control measures of pests (65.83%), lack of knowledge about selection and application of weedicide (65.00%) are also the associated constraints with the above major constraints given by the maize growers. Lack of knowledge was the common constraint in most of the practices of maize cultivation, which needs special attention of extension agencies working in the area. Adequate knowledge about recommended package of practices is the pre-requisite for their use in cultivation of the crop. It is a fact that recommended practices are major contributing factors to yield. So, no knowledge or inadequate knowledge about recommended practices leads to their non-adoption or improper adoption of the technology. Hence, focus should be given to transfer proper knowledge of recommended practices of maize cultivation to the farmers of the study area.

In order to increase the area and production of maize crop in the study area, the constraints expressed by the respondents are of vital importance. By and large it could be concluded that analysis of these constraints emphasize the need for concentrated efforts to overcome these constraints so as to maximize adoption of recommended practices of maize cultivation and the production of maize and ultimate benefit the farming community in the study area.

Conclusion

It is concluded from the findings that major technological gap was observed in maize cultivation practices like recommended varieties, seed treatment, plant protection, use of weedicides, intercropping and water management. Hence, majority of maize growers were observed in medium category of extent of technological gap. The major constraints recorded behind this, were lack of knowledge of most of the recommended cultivation practices of maize, non availability of quality seed and high cost of inputs like seed and fertilizers. This needs special attention of extension agencies working in the area.

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