Original Research Article

Farmers' Attitude and Preference towards Crop Diversification with Maize in Haryana

ABSTRACT:

The study concluded that the scheme 'Mera Pani Meri Virasat' is proved helpful in crop diversification of paddy with maize'. Farmers showed that armyworm in maize deteriorate the quality of maize' which demote the crop diversification from paddy with maize. 'The govt. assistance of Rs.7000/- per acre is less as compared to economic loss due to fall armyworm in maize'. The farmers preferred replacement of paddy with maize because of 'Maize is fully mechanized as compared to paddy (partially mechanized)' followed by 'leaching of nitrate and pesticides in paddy field resulted groundwater pollution. Farmers also preferred maize because of 'Less water requirement as compared to paddy'. 'Maize crop is more suitable for livestock as being used green fodder for animal, easily decomposable, and can be used for mushroom production also'. The attitude of farmers towards diversification showed that 'MSP of maize crop should be increased and procurement may be ensured by the government'.

Key words: *Attitude, preferences, crop diversification, maize, rice.*

INTRODUCTION

Rice is the major crop in Haryana, its area increased from 1.92 to 14.22 lakh ha, and production increased from 2.23 to 45.23 lakh tonnes during 1966-67 to 2020-21. Since the late sixties, the introduction of high yielding varieties of rice and expansion of irrigation and electricity facilities assured procurement as favourable government policies boosted rice cultivation. At present, rice based cropping systems in agriculture had predominated in Haryana. The traditional maize cultivated site was also occupied by rice cultivation shifting of the area site was accelerated due to the non-availability of high yielding cultivars in maize. However, rice has expanded in the region's with limited water availability and less rainfall that caused the water table to decline at an alarming level as rice is recommended in the areas receiving rainfall more than 800 mm. The rice cultivation was the need of the hour to ensure the nation's food security and helped bring food self-sufficiency and farmers prosperity. The burning of crop residue contributes to atmospheric pollution with severe environmental, soil, and human health and economic implications. It releases large amounts of air pollutants and heat generated soil temperature, causing the death of beneficial soil microbial population. It also reduces the level of nitrogen and carbon in the top 0-15 cm soil profile, which is essential for crop root development.

Burning the crop residue causes phenomenal pollution problems in the atmosphere and substantial nutritional loss and physical health deterioration to the soil. Burning of one ton of paddy straw release 3 kg particulate matter, 1460 kg CO , 199 kg ash, and 2 kg SO . These gases affect human health due to the 2 general degradation in air quality, resulting in aggravation of eye and skin diseases. Fine particles can also aggravate chronic lung diseases. One ton of paddy straw contains approximately 5.5 kg N, 2.3 kg P O , 25 kg K O, 1.2 kg S, 50-70% of micronutrients 2 5 2 absorbed by the rice, and 400 kg of carbon are lost due to the burning of paddy straw. Apart from the loss of nutrients, some soil properties like soil temperature, pH, moisture, available phosphorus, and soil organic matter are greatly affected due to burning. Nonetheless, the time available between rice harvesting and wheat sowing is very narrow (in the range of 20-30 days). However, rice cultivation in similar fields has created some serious problems and environmental threats, viz. The declining water table, enhanced groundwater pollution by nutrient and pesticide leaching, affected soil physical properties and soil biodiversity, enhanced greenhouse gas emissions, rice residue burning to result in environmental pollution etc.

Depletion of groundwater level by 1 m/year since 2013 and underground water level plunged by 20-60 meters in 19 districts out of 22 districts of Haryana due to non-conventional rice; more 'Dark Zones' as ground water dries up rapidly; canal waters and groundwater salinity led to water-logging; groundwater pollution by leaching of nitrate and agrochemical; depletion of soil physical health, environmental pollution; underground water contamination; loss of biodiversity; favoured incidence of pest (weed, disease etc.); human and animal health affected due to excessive use of agrochemicals are some of the major disadvantages in rice growing areas. An urgent need is felt to reduce the area under rice; diversification of rice crop with remunerative, less risky, and eco-friendly crops can provide substantial income and help to address many of these problems.

Maize has the potential to emerge as the most appropriate substitute, which can bring more prosperity to the farming community without adversely affecting natural resources. It has also added the advantage of saving precious resources like water and electricity. Due to increased adverse consequences of rice cultivation and promising innovations in maize research and development, and availability of technical know-how, it is high time to promote maize cultivation in the state to prevent further deterioration in natural resources and to ensure the long-

term sustainability of agricultural development in the state. Therefore, it is crucial to extend the benefit of maize diversification to Haryana farmers considering the progress made by the other states. The salient advantages of diversification through maize cultivation are (i) the saving of water to the tune of 90% by maize cultivation instead of paddy (Maize Summit, 2018).; (ii) The maize cultivation saves 70% power as compared to paddy (Maize Summit, 2018); (iii) The maize cultivation will help in an overall improvement in environmental quality leading to improved quality of life. The biomass of maize is easily degradable compared to rice due to less silicon content and, therefore, improves the soil's organic matter content; (iv) The maize crop optimize cropping system and results in higher system productivity and profitability by following maize-wheat-mungbean (MWMb), maize-mustard-mungbean (MMMb), maize-autumn/ winter/summer vegetable systems in the state.

Maize was a major crop in North Eastern Haryana until the 1970s in the Kharif season, having more than 1.7 lakh ha in Karnal, Ambala, Kurukshetra, Yamunanagar, Panipat etc. Due to raw material availability, the country's first starch industry was established at Yamunanagar in 1937. The establishment of the corn-based agro-industry viz. feed, poultry, specialty corn, silage making, starch etc. will generate more employment and entrepreneurship opportunities state. Keeping the above facts in view, the study was conducted to know about “Farmers’ Attitude and Preference towards Crop Diversification with Maize in Haryana”.

RESEARCH METHODOLOGY

The study was conducted in Haryana State. There are 22 districts in Haryana State out of which two districts namely; Karnal and Yamunanagar were selected randomly because of having major area under rice cultivation. Four villages from each district i.e. Uchana, Kacchawa, Kunjpura and Subri from Karnal block of Karnal district and four villages i.e. Radauri, Kantroli, Silikalan and Kanjnu from Radaur block of Yamunanagar district were selected randomly. Ten (10) farmers from each selected village were also selected randomly to make a total sample of 80 farmers using random sampling technique to study the “Farmers’ Attitude and Preference towards Crop Diversification with Maize in Haryana”. The data collected, tabulated, analyzed and the results were drawn using appropriate statistical measures.

RESULTS AND DISCUSSION

The results of the study are given under following heads and subheads as under:

Personal profile of respondents

The data in table 1 showed that about two-third of respondents (60.00%) belonged to middle age (31 to 50 years) group followed by old (51 and above) to the extent of 30.00 per cent. The remaining 10.00 per cent belonged to young (up to 30 years) age group. The data further reported that 27.50 per cent of the respondents were higher secondary followed by 23.75 per cent, 22.50 per cent, 15.00 per cent, 06.25 per cent, 05.00 per cent and only 02.50 per cent having matriculation, graduate, middle, post graduate, primary and illiterate, respectively. About one-third (32.50%) of the respondents have land holding above 5 acres up to 10.00 acres, followed by above 2.5 acres up to 5.00 acres (27.50%), above 10 acres up to 15 acres (17.50%), less than 2.5 acres (12.50%), and above 15 acres (10.00%), respectively.

Irrigation facilities available:

It was depicted from table 2 that majority of the respondents (90.00%), having both sources of irrigation (canal + tubewell/submersible pump) followed by submersible/tubewell alone (82.50%) and canal only (17.50%), respectively.

Farming System followed:

The data were analyzed and the results given in table 3 revealed that a vast majority (90.00%) were doing livestock with agriculture followed by integrated farming system (15.00%), poly house vegetable production (10.00%), mushroom cultivation (7.50%), beekeeping (5.00%), organic farming (3.75%), poultry as well as fisheries (1.25%), respectively.

Cropping pattern followed

It was observed in table 4 that 67.50 per cent of the respondents practicing sole cropping pattern followed by mixed cropping (13.75%), multiple cropping (10.00%), and intercropping (8.75%), respectively.

Crop rotation followed

The data showed in table 5 that majority of the respondents (82.50%) has cotton –wheat cropping system followed by rice-wheat (40.00%), cotton-other crops (15.00%), rice-other crops (10.00%), bajra/jowar/guar-wheat (8.75%), sugarcane based (6.25%), bajra/jowar/guar-fellow (6.25%), bajra/fellow-mustard (2.50%), fellow-wheat (2.50%) and bajra/fellow-pulses (2.50%), respectively.

Mass Media Exposure

It was depicted from table 6 that newspaper ranked first with weighted mean score of 1.50 followed by television and radio ranked second and third with weighted mean score of 1.48 and 0.43, respectively as mass media.

It was also reported in table 6 that farmers used online solution (32.50%) of respondents followed by farm magazine (27.50%) and Kisan Sewa Kendra (10.00%) to get the information but not in regular use (as and when required).

Extension Contact

The data depicted in table 7 revealed that among the extension contact of the farmers , the most popular were the progressive farmers with weighted mean score of 2.75 followed by ADOs/HDOs, Scientists, NGOs/Coop society, input dealer/sales representatives and SDAO/SMS ranked second, third, fourth, fifth and sixth, respectively.

Social Media for getting information

The data from table 8 reported that 72.50 per cent of respondents got information through WhatsApp followed by Face book (48.75%), YouTube (40.00%), Apps like e-Mausam (35.00%) Websites (17.50%), portal (10.00%) and any other means like Twitter, Telegram (05.00%), respectively.

Attitude of farmers towards crop diversification with maize in Haryana (n=80)

The data presented in table 9 revealed that most of the farmers showed their interest towards crop diversification with maize with the fact that 'MSP of maize crop should be increased and procurement of produce may be ensured by the Govt.' which ranked first, followed by 'crop diversification gives an idea how one crop can replace the other crop in the system', 'The scheme 'Mera Pani Meri Virasat' is proved helpful in crop diversification of paddy with maize', Govt. should provide monitory benefit/support to enhance the crop diversification, 'Knowledge regarding maize production practices promote crop diversification from paddy crop', 'Rice being more remunerative crop, it is difficult to diversify it with maize', 'Crop diversification teaches us to utilize available resources in efficient manner', 'Farmers awareness regarding sustainable use of resources help in promoting the crop diversification', 'Crop diversification with maize increase soil fertility', 'Proper drying and threshing of maize will be helpful in crop diversification' and 'Fall army worm in maize deteriorate the quality of maize which demote the

crop diversification from paddy with maize' thereby which ranked second, third, fourth, fifth, sixth, seventh, eighth, ninth and tenth, respectively.

The table 9 further also reported that ‘Government should give insurance to recommended crop diversification', 'Diversification of paddy with maize is risk for small farmers', Only big farmers can adopt crop diversification with maize crop', 'Risk bearing ability of a farmer decide the crop diversification', 'There is big risk in adoption of maize crop in water lodged areas', ' Govt. assistance of Rs. 7000/- is less as compared to economic loss due to fall armyworm in maize', 'Productivity of maize as compared to rice decide the adoption or rejection in crop diversification' and 'Profit is the prime concern for farmer rather than food and fodder quality through crop diversification with maize', and which ranked XI, XII, XIII, XIV, XV, XVI and XVII, respectively were of the attitude of the farmers towards crop diversification of paddy with maize. The diversification with maize is a need of the time because of depleting water resource in paddy –wheat areas.

Preferences of farmers towards crop diversification with maize in Haryana

The data in table 10 related to preferences of farmers towards crop diversification of paddy with maize crop were collected which revealed that 'Maize is fully mechanized as compared to paddy (partially mechanized)', 'There is leaching of nitrate and pesticides in paddy field which results in groundwater pollution, but in maize there is no such pollution', 'The duration of maize crop is lesser than paddy hence, fit as maize-wheat cropping system', 'Water requirement of maize crop is less as compared to paddy', 'The soil physical health is degrading with paddy where as by maize crop, soil health is restoring/improving', 'Water productivity is higher in maize crop than paddy crop', 'Issue of crop residue burning in paddy results in environmental pollution and degrades biodiversity, but in maize there is no such issues', 'Cost of cultivation of maize is less than paddy', 'Maize is climate resilient crop where as in paddy increased temperature thereby increases green house gases (GHG)', 'The rice produce is surplus, hence, there is no state requirement whereas maize is highly deficit and government requires more', 'Maize crop is more suitable for livestock as its green fodder used for animal fodder, easily decomposable and can be used for mushroom production also', 'Maize crop is more suitable for intercropping due to wider crop spacing whereas, paddy is not suitable for intercropping', 'Less requirement of electricity and power/energy in maize as compared to paddy which require very high electricity/power', 'The handling and post harvest losses of maize is low'

and 'High loss due to attack of fall armyworm in maize which deteriorate quality of maize' with weighted mean scores of 0.938, 0.925, 0.913, 0.900, 0.888, 0.875, 0.863, 0850, 0.838, 0.825, 0.813, 0.800, 0.788, 0.775 and 0.763, respectively which ranked Ist, IInd, IIIrd, IVth, Vth, VIth, VIIth, VIIIth, IXth, Xth, XIth, XIIth, XIIIth, XIVth and XVth, respectively.

CONCLUSION

The study concluded and resulted that the scheme 'Mera Pani Meri Virasat' is/being proved helpful in crop diversification of paddy with maize'. Farmers showed that armyworm in maize deteriorate the quality of maize' which demote the crop diversification from paddy with maize. 'The goverment assistance of Rs. 7000/- is less as compared to economic loss due to fall armyworm in maize'. The farmers preferred replacement of paddy with maize because of 'Maize is fully mechanized as compared to paddy (partially mechanized)' followed by 'leaching of nitrate and pesticides in paddy field resulted groundwater pollution'. Farmers also preferred maize because of 'Less water requirement as compared to paddy'. 'Maize crop is more suitable for livestock as being used green fodder for animal, easily decomposable, and can be used for mushroom production also'. The attitude of farmers towards diversification showed that 'MSP of maize crop should be increased and procurement may be ensured by the government.'

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Table 1: Personal profile of respondents **(n=80)**

S. No	Variable(s)	Category	Frequency	Percentage
1	Age	Young (up to 30)	08	10.00
		Middle (31 to 50)	48	60.00
		Old (51 and above)	24	30.00

2.	Education	Illiterate	02	02.50
		Primary	04	05.00
		Middle	12	15.00
		Matriculation	19	23.75
		Higher Secondary	22	27.50
		Graduate	18	22.50
		Post Graduate	05	06.25
3.	Land holding	Less than 2.5 acre	10	12.50
		Above 2.5 and up to 5 acres	22	27.50
		Above 5 and up to 10 acres	26	32.50
		Above 10 to 15 acres	14	15.00
		Above 15 Acres	08	10.00

Table 2: Irrigation facilities available **(n=80)**

S. No	Source of irrigation	Frequency	Percentage
1.	Submersible pump/tube well	66	82.50
2.	Canal	14	17.50
3.	Both (Canal+ Tube well/submersible pump)	72	90.00

Multiple responses

Table 3: Farming System followed **(n=80)**

S. No	Farming System	Frequency	Percentage
1.	Livestock	72	90.00
2.	Poultry	01	01.25
3.	Fishery	01	01.25
4.	Bee keeping	04	05.00
5.	Organic farming	03	03.75
6.	Mushroom cultivation	06	07.50
7.	Integrated farming system	12	15.00
8.	Polyhouse vegetable production	08	10.00

Multiple responses

Table 4: Cropping pattern followed **(n=80)**

S. No	Cropping pattern	Frequency	Percentage
1.	Sole cropping	54	67.50
2.	Mixed cropping	11	13.75

3.	Inter cropping	07	08.75
4.	Multiple cropping	08	10.00

**Multiple responses*

Table 5: Crop rotation followed **(n=80)**

S. No	Crop rotation	Frequency	Percentage
1.	Rice-Wheat	32	40.00
2.	Cotton-Wheat	66	82.50
3.	Sugarcane Based	05	06.25
4.	Rice-Other crops	08	10.00
5.	Cotton-Other crops	12	15.00
6.	Bajra/Jawar/Guar-Wheat	07	08.75
7.	Bajra/Jawar/Guar-Fallow	05	06.25
8.	Fallow-Wheat	02	02.50
9.	Bajra/Fallow-Mustard	02	02.50
10.	Bajra/Fallow-Pulses	02	02.50

**Multiple responses*

Table 6: Mass Media Exposure **(n=80)**

Sr. No	Mass Media	Used	Extent of utilization			Total Score	Weighted Mean Score	Rank
			Daily (3)	Often (2)	Sometime (1)			
1.	Newspaper	54 (67.50)	23 (69)	20 (40)	11 (11)	120	1.50	I
2.	Television	62 (77.50)	15 (45)	27 (54)	20 (20)	119	1.48	II
3.	Radio	18 (22.50)	05 (15)	07 (14)	06 (6)	035	0.43	III
4.	Farm Magazine	22 (27.50)	-	-	-	-	-	--
5.	Kisan Sewa Kendra	08 (10.00)	-	-	-	-	-	--
6.	Online Solution	26 (32.50)	-	-	-	-	-	--

Figures given in parenthesis indicates percentage

Table 7: Extension Contact **(n=80)**

S.	Extension	Frequency of contact	Total	Weighte	Rank

No	Officials	Weekly (4)	Fortnightly (3)	Monthly (2)	Whenever needed (1)	None (0)	Score	d Mean Score	order
1.	Progressive Farmers	28 (112)	21 (63)	14 (28)	12 (12)	5 (00)	220	2.75	I
2.	ADOs/HDOs	26 (104)	20 (60)	12 (24)	15 (15)	7 (00)	203	2.54	II
3.	Scientists	15 (60)	16 (48)	23 (46)	12 (12)	14 (00)	166	2.07	III
4.	NGO/Coop. Society	12 (48)	11 (33)	16 (32)	26 (26)	15 (00)	139	1.73	IV
5.	Others (Input dealers/Sales rep.)	11 (44)	15 (45)	08 (16)	22 (22)	24 (00)	127	1.58	V
6.	SDAO/SMS	6 (24)	8 (24)	14 (28)	25 (25)	27 (00)	101	1.26	VI

Figures given in parenthesis indicates percentage

Table 8: Social Media for getting information (n=80)

S. No	Social media/ICT tools	Frequency	Percentage
1.	WhatsApp	58	72.50
2.	Face book	39	48.75
3.	YouTube	32	40.00
4.	Websites	14	17.50
5.	Portal	08	10.00
6.	Apps (e-Mausum)	28	35.00
7.	Any others (twitters, telegram etc.)	04	05.00

**Multiple responses*

Table 9: Farmers' Attitude towards Crop Diversification with Maize in Haryana (n=80)

S. No	Statements	Attitude level			Total Score	Weighted Mean Score	Rank Order
		Strongly agree (2)	Agree (1)	Disagree (0)			
1.	MSP of maize crop should be increased and procurement may be ensured by the Govt.	72	8	0	152	1.90	I

2.	Crop diversification gives an idea how one crop can replace the other crop in the system.	70	10	0	150	1.87	II
3.	The scheme Mera Pani Meri Virasat is proved helpful in diversifying paddy with maize.	66	14	0	146	1.82	III
4.	Government should provide monitory support to enhance the crop diversification.	65	15	0	145	1.81	IV
5.	Knowledge regarding maize crop production practices promotes crop diversification from paddy crop.	65	14	11	144	1.80	V
6.	Rice being more remunerative crop, so it is difficult to diversify it with maize.	62	18	0	142	1.77	VI
7.	Crop diversification teaches to utilize available resources in efficient manner.	63	15	2	141	1.76	VII
8.	Farmer's awareness regarding sustainable use of resources help in promoting the crop diversification.	63	14	2	140	1.75	VIII
9.	Crop diversification with maize increase soil fertility.	63	14	03	140	1.75	VIII
10.	Proper drying and threshing of maize will be helpful in CD	61	17	2	139	1.74	IX
11.	Fall armyworm in maize deteriorate the quality of maize which demote the crop diversification from paddy with maize	61	16	3	138	1.72	X
12.	Government should give insurance to recommended crop diversification.	57	23	0	137	1.71	XI
13.	Diversification of Paddy with maize is risk for small farmers.	59	17	4	135	1.69	XII
14.	Only big farmers can adopt crop diversification with maize crop	58	18	4	134	1.67	XIII
15.	Diversification with maize is a need of hour because of depleting water resource in paddy – wheat areas.	57	17	6	131	1.64	XIV
16.	Risk bearing ability of a farmer decides the crop diversification.	59	13	8	131	1.64	XIV
17.	Govt. assistance of Rs. 7000/- is less as compared to economic loss due to fall armyworm in maize.	57	17	4	131	1.64	XIV
18.	There is big risk in adoption of maize crop in water lodged areas.	54	16	10	124	1.55	XV
19.	Productivity of maize as compared to rice decide the adoption or rejection in crop diversification	46	26	8	118	1.48	XVI
20.	Profit is the prime concern for farmer rather than food and fodder quality through crop diversification with maize.	47	23	10	117	1.46	XVII

Table 10: Preferences of farmers towards crop diversification with maize in Haryana (n=80)

Sr. No	Statements	Preferred (1)	Not Preferred (0)	Total Score	Weighted Mean Score	Rank Order
1.	Maize is fully mechanized as compared to paddy (partially mechanized)	75	07	75	0.938	I
2.	There is leaching of nitrate and pesticides in paddy field which results in groundwater	74	06	74	0.925	II

	pollution, but in maize there is no such pollution					
3.	The duration of maize crop is lesser than paddy hence, fit as maize-wheat cropping system.	73	07	73	0.913	III
4.	Water requirement of maize crop is less as compared to paddy	72	08	72	0.900	IV
5.	The soil physical health is degrading with paddy where as by maize crop, soil health is restoring/improving	71	09	71	0.888	V
6.	Water productivity is higher in maize crop than paddy crop.	70	10	70	0.875	VI
7.	Issue of crop residue burning in paddy results in environmental pollution and degrades biodiversity, but in maize there is no such issues	69	11	69	0.863	VII
8.	Cost of cultivation of maize is less than paddy.	68	12	68	0.850	VIII
9.	Maize is climate resilient crop where as in paddy increased temperature increases green house gases (GHG).	67	11	67	0.838	IX
10.	The rice produce is surplus, hence, there is no state requirement where as maize is highly deficit and Govt. requires more	66	15	66	0.825	X
11.	Maize crop is more suitable for livestock as its green fodder used for animal fodder, easily decomposable and can be used for mushroom production also.	65	18	65	0.813	XI
12.	Maize crop is more suitable for intercropping due to wider crop spacing whereas; paddy is not suitable for intercropping.	64	11	64	0.800	XII
13.	Less requirement of electricity and power/energy in maize as compared to paddy which require very high electricity/power	63	13	63	0.788	XIII
14.	The handling and post harvest losses of maize is low.	62	15	62	0.775	XIV
15.	High loss due to attack of fall armyworm in maize which deteriorate quality of maize	61	16	61	0.763	XV