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Risks Related with Food Grain Crops-A Case Study of Haryana, India

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A B S T R A C T

India is recognized as the world's largest producer of pulses, rice, wheat, spices and spice products. There are many areas in front of India to choose for business such as dairy, meat, poultry, fisheries and food grains etc. India has also emerged as the second largest producer of fruits and vegetables in the world. The dominant crops in all parts of the country are the food grains. About two-third of total cropped area is occupied by these crops in the country. The major food grain crops grown in Haryana are wheat, rice, pearl millet, barley, maize etc. But there are so many risks involved with these crops during sowing to harvesting period. Even there are some kinds of risks which are continuing after the harvesting of the crops. The study has reported the results of a survey of 567 farmers conducted to investigate the risk factors involved in different food crops and also tried to investigate the related risks involved in and how and how much, farmers manage the amount of risk. There was a great difference between the actual losses and bearing capacity of the farmers. The study suggests that the farmers hardly get the reasonable prices for their produce. So, the support prices for all the crops should be determined by the government. The farmers also wanted to cover this risk in their crop insurance policy.

Introduction

In the economy of Haryana, agriculture occupies a dominant place. Geographic conditions of the state are favorable for this sector in terms of water resources and soil potential. More than two-third area is shared by food grains out of the total cropped area. Cash crops such as oilseeds and cotton are also grown in addition. In early eighties the production, productivity and profitability which has reached at raised ground in leading green revolution states. Wheat-paddy monoculture has been creating ecological problems in the long run sustainability of agriculture in the state. After know this reality, farmers should diversify towards other crops by increasing area under pulses, oilseeds, fruits, vegetables and commercial crops. But still, farmers in Haryana prefer to grow wheat and rice despite being aware of problems created by this crop rotation in terms of deteriorating soil health and depleting water level (Dagar, 2015). Some people are directly involved in the farming and some others are involved in doing business with these goods. These people earn their livelihood from agriculture. The basic need of human beings and animals is fulfilled by agriculture sector and the allied activities. The raw material for many agro based industries is also provided by this sector. The unique geographical conditions of the country are also providing a supportive environment

for the farming activities such as plain areas, fertile soil, long growing seasons and wide variation in climatic condition etc. The continuous use of science and technology in India has been increasing the production. India has the greatest capacity to produce the food grains which can make huge difference in Indian economy. Farming risks involved a variety of factors in India such as changes in weather conditions, natural disasters, uncertainties in prices and production, poor infrastructure facilities in rural areas and insufficient financial assistance for farmers etc. Not only the viability and potential of the agriculture sector is challenged by these factors but they also affect the livelihood and the income of the farmers (Reddy, 2015). For diversification and specialization of agricultural production agro-climatic conditions have contributed a lot. To diversify the production in response to risk, a farmer has basically three economic reasons such as biophysical or input constraints and market conditions. It may be inexpensively efficient for a farmer to specialize in the production of a particular crop. The various studies suggest that most regions employed diversified farming systems that concentrated on the production of a few key staples (e.g., rice, wheat, or barley) together with complementary fruit and vegetable crops (Bowman and Zilberman, 2013).

There are several kinds of risks in each and every even it is commercial, horticulture, vegetable or a traditional crop. Risk is inbuilt in farming, the most well-known and significant risk is adverse weather (e.g. drought, flood, frost, temperature, etc.). Risk includes the possibility of losing some or all of the original investment**.** These events can have significant economic, social and environmental impacts. For the sensible management in agriculture, these risks should be appropriately managed by adopting the right alternative that can lessen the financial uncertainties faced by the farmers. Wheat and rice comprise 70 per cent of agricultural produce by area, but less than 25 per cent by value in India. These two traditional crops are low value crops to grow as compare to other options. The cropped area of wheat and rice has not seen a significant decrease till now in the last decade. A few organizations which are working on switching farmers to organic farming are experimenting with providing a financial safety net during the first three years of transition and low yields before the produce can be certified as organic. These kinds of provisions could be well thought-out in this concern as well and would help encourage farmers to move to modern farming (http://www.ifmr.co.in). Farming decisions for all food crops including the choice of crop or variety to seed, the types and amounts of inputs and their management are directly formed by the availability and quality of land. In areas, where land for crop production is in abundant, conversion of forests, grasslands and other non-agricultural land to crops continues to be land constraints and where land is relatively scarce, majority of farmers have responded to land constraints through multiple cropping (Reynolds *et al.*, 2015). Irrigation has an important role in food grains production of India and determines the potential for future growth in the country. Ground water extraction has played a crucial role in the growth of yield in food grains production in the last four decades. Thus, decreasing level of ground water is also a big challenge for the food grain production (Sasmal, 2014). For adopting new technologies or conservation practices or lack of knowledge and information about the costs and benefits of the technology ignorance about how to implement such technologies or practices affects a farmer's inclination to accept them (Chavas *et al.*, 2010, Chavas and Kim 2010). There are some factors that can also impact the decision making process of a farmer for adopting land use practices or

technologies such as geographical, biological and market conditions. Biological and geographical factors that include water availability, fertility of the soil, and risks of floods, droughts, frost, or pest or weed and the importance of each of these factors vary with the types of crops grown. The market conditions include labor and input market constraints, financial and credit constraints, social norms, policy constraints, and constraints to knowledge or skills (Stoorvogel *et al.,* 2004).

Materials and Methods

The present study is totally based on primary data and empirical in nature. To record the data, a well-structured questionnaire was developed and administered on the farmers from all over in Haryana selected randomly. Data obtained through well thought-out questionnaire was analyzed using simple statistical tools frequency and percentage analysis. These calculations were done with the help of statistical software packages. Ranking of risk factors is based on the responses of the respondents. The current paper has reported the results of a survey of 567 farmers conducted to investigate the risk factors involved in different food crops. The study further examined the average past losses experienced by the farmers and loss bearing capacity of the farmers in the main food crops. The study also highlights the difference between the actual average losses experienced by sample population in the past and their loss bearing capacity.

Results and Discussion

To investigate the risk factors affecting the affecting the productivity of the food crops, the sampled data is analyzed. Risk factor is a weather condition or situation which affects the productivity of the crops. There are different kinds of weather risks which affect the production of a crop. Each factor is not affecting every crop uniformly. Different risk factors have an effect on various crops adversely. One factor may be more harmful for a crop at one time and may not be for the other crop on the same time. The possible relevant risk factors includes such as floods, drought, unseasonal/excess rain, hailstorms, windstorm, crust formation, variability in temperature, pests and diseases, etc. All these risks are beyond the control of farmers. The losses made by these factors need to be insured to stabiles the income of the farmers. Initially, we have discussed the crop profile of the sample respondents. In the next coming section, we have described the different risk factors involved in the food crops, rank-wise risk factors in different crops grown, average past losses experienced by the respondents in the variable food crops and their actual loss bearing capacity has been discussed.

Table 1 states the crop wise profile of the respondents. It also gives details about the food crops which were grown by the respondents. Wheat is an important food crop of India. It is a Rabi or winter crop. It is sown in the beginning of winter and harvested in the beginning of summer. Normally (in North-India) the sowing of wheat begins in the month of October-November and harvesting is done in the month of April. This is the staple food of millions of people particularly in the northern and north-western regions of India.

Wheat (90.65%) was the highest grown crop by the sampled farmers in Haryana. Rice is also an important food crop of India. It is predominantly a Kharif crop. It covers about one third of total cultivated area of the country and is staple food of more than half of the Indian population. Maximum population of India is of rice consumers. (54.14%) proportion of the sample population grew rice. Millets are short duration warm weather

crops. These are coarse grain crops and are used for both food and fodder. These are Kharif crops though sometimes grown in rabi seasons too. These are sown in May-August and harvested in October-November. Today millets are mostly consumed by poor people as their staple food. Pearl millet was grown by (9.88%) sample farmers. Maize is a crop which is used both as food and fodder. Use of modern inputs such as HYV seeds, fertilizers and irrigation have contributed to the increasing production of maize. The least grown food crop by the sampled population was maize (1.23). Barley is also a rabi crop and it can also use as food as well as fodder. It was grown by (6.35%) farmers in the sampled area.

The figures given in the table 2 shows that which risk factor was more or less serious for a particular crop. In this table, the percentage is used to know the weight age assigned to risks and their ranking. It can be clearly observed from the table that in case of wheat, which is highly grown crop in rabi season in Haryana, the highly risky factor was unseasonal and excess rain (88.7%) during the cropping period. Variability in the temperature also means a lot for the wheat crop. The farmers (78.8%) were concerned about it as temperature is closely related to the production of wheat. 77.8% farmers were highly worried about wind storms followed by price (66.7%) and pests and diseases/unseasonal/excess rain (61.1%) in case of barley. Rice was the second highest grown crop followed by the cotton. The maximum farmers (above 90%) were highly worried about the losses occurred due to different types of pests and diseases in these crops. Use of chemical fertilizers and pesticides increased the cost of farmers. The second risky factor was price. Farmers hardly get the desirable price for these crops. If we talk about the maize (100.0%) and pearl millet (83.9%), the most bothered risk factor was price, followed by pests and diseases.

Table 3 states different kinds of risks which affect the production of a crop. It can be clearly observed from the table that in case of wheat, the highly risky factor was unseasonal/excess rain during the cropping period. Variability in the temperature also means a lot for the wheat crop.

The farmers were concerned about it because temperature played main role in the productivity of wheat. Farmers were very much worried about wind storm followed by price in case of barley. In case of the maize and pearl millet, price was identified as the most bothered risk factor, followed by pests and diseases. The next risk factor after these two was loss made by animals to the crop. Rice was the second highest grown crop followed by the cotton in kharif season. The maximum farmers bothered about the losses occurred due to different types of pests and diseases in the rice crop. The second risky factor was wind storms. Farmers hardly get the desirable price for these crops.

Table.1 Crop wise profile of respondents

Sr. No.	Crop	Frequency	Percentage
1.	Wheat	514	90.65
2.	Rice	307	54.14
3.	Pearl millet	56	9.88
4.	Barley	36	6.35
5.	Maize	07	1.23

Table.2 Ranking of different risk factors with regard to food crops

Risk	Rank	Wheat	Rice	Pearl Millet	Barley	Maize
Flood	HW	8.8	14.7	1.8	11.1	14.3
	MW	10.0	15.3	12.5	5.6	
	LW	81.2	70.0	85.7	83.3	85.7
Drought	HW	9.1	16.7	51.8	2.8	-
	MW	21.8	27.9	19.6	27.8	28.6
	LW	69.1	55.4	28.6	69.4	71.4
Crust formation	HW	3.7	-	21.4	2.8	14.3
	MW	42.8	-	25.0	22.2	28.6
	LW	53.5	-	53.6	75.0	57.1
Fire	HW	63.0	3.9	8.9	25.0	-
	MW	22.0	12.1	23.2	25.0	28.6
	LW	15.0	84.0	67.9	50.0	71.4
Wind storms	HW	63.5	66.9	32.1	77.8	14.3
	MW	23.5	21.0	30.4	11.1	28.6
	LW	13.0	12.1	37.5	11.1	57.1
Frost	HW	3.9	-	-	2.8	-
	MW	7.8	-	-	47.2	33.3
	LW	88.3	-	-	50.0	66.7
Pest and Diseases	HW	43.6	90.2	57.1	61.1	66.7
	MW	36.8	8.2	39.3	33.3	33.3
	LW	19.6	1.6	3.6	5.6	-
Temperature variability	HW	78.8	8.8	1.8	19.4	33.3
	MW	16.5	31.3	23.2	27.8	50.0
	LW	4.7	59.9	75.0	52.8	16.7
Unseasonal/excess rain	HW	88.7	32.9	14.3	61.1	14.2
	MW	8.9	29.3	37.5	25.0	42.9
	LW	2.4	37.8	48.2	13.9	42.9
Hailstorm	HW	36.8	6.5	1.8	30.6	16.7
	MW	21.2	19.2	16.1	25.0	16.7
	LW	42.0	74.3	82.1	44.4	66.6
Post-harvest losses	HW	13.8	4.9	5.4	22.2	42.8
	MW	26.7	35.2	26.7	30.6	42.9
	LW	59.5	59.9	67.9	47.2	14.3
Price	HW	22.8	53.7	83.9	66.7	100.0
	MW	26.8	38.5	10.7	22.2	-
	LW	50.4	7.8	5.4	11.1	-
Animal losses	HW	41.1	2.3	51.8	36.1	57.1
	MW	40.7	35.5	33.9	44.5	28.6
	LW	18.2	62.2	14.3	19.4	14.3
Weed	HW	14.2	10.1	14.3	19.4	28.6
	MW	30.5	27.0	16.1	41.7	14.3
	LW	55.3	62.9	69.6	38.9	57.1

Table.3 Ranking of risk factors involved in food crops

Sr. No.	Crop	Risks involved		
		R_1	R_2	R_3
1.	Wheat	Unseasonal/excess rain	Temperature variability	Wind storms
2.	Rice	Pest and diseases	Wind storms	Price
3.	Pearl millet	Price	Pest and diseases	Animal losses/ Drought
4.	Barley	Wind storms	Price	Pest and diseases/ Unseasonal / excess rain
5.	Maize	Price	Pest and diseases	Animal losses

Table.4 Average loss experienced by farmers in the past

Sr. No.	Crop	Average Loss (%)	Risks involved		
			R_1	R_2	R_3
1.	Pearl millet	34.82	Price	Pest and diseases	Animal losses / Drought
2.	Rice	29.64	Pest and diseases	Wind storms	Price
3.	Barley	22.50	Wind storms	Price	Pest and diseases/ Unseasonal /excess rain
4.	Maize	20.71	Price	Pest and diseases	Animal losses
5.	Wheat	10.11	Unseasonal/excess rain	Temperature variability	Wind storms

Table.5 Loss bearing capacity of farmers in different crops

Extent of loss	Percentage of Respondents				
	Wheat	Rice	Pearl millet	Barley	Maize
Up to 10%	4.41	0.33	21.78	3.41	-
Up to 9%	5.37	0.99	23.76	-	-
Up to 8%	10.54	5.28	29.70	7.95	-
Up to 7%	15.71	8.91	30.69	10.23	-
Up to 6%	30.27	23.43	36.63	13.64	9.09
Up to 5%	55.75	47.19	69.31	48.86	45.45
Up to 4%	65.90	59.41	73.27	53.41	-
Up to 3%	80.27	80.86	84.16	69.32	72.73
Up to 2%	90.61	91.42	86.14	81.82	81.82
Up to1%	100.00	100.00	100.00	100.00	100.00

Table.6 Average past losses experienced and loss bearing capacity of farmers

Crops	Loss bearing capacity										
	Up to 10%	**Up to 9%**	**Up to 8%**	**Up to 7%**	**Up to 6%**	**Up to 5%**	**Up to 4%**	**Up to 3%**	**Up to 2%**	**Up to 1%**	**Average past losses (%)**
Pearl millet	21.78	23.76	29.70	30.69	36.63	69.31	73.27	84.16	86.14	100.00	34.82
Rice	0.33	0.99	5.28	8.91	23.43	47.19	59.41	80.86	91.42	100.00	29.64
Barley	3.41	-	7.95	10.23	13.64	48.86	53.41	69.32	81.82	100.00	22.50
Maize	-	-	-	-	9.09	45.45		72.73	81.82	100.00	20.71
Wheat	4.41	5.37	10.54	15.71	30.27	55.75	65.90	80.27	90.61	100.00	10.11

The figures given in the table 4 indicate that wheat (10.11%) was less risky crop in all the crops grown by the sampled farmers and the amount of risk was highest in pearl millet (34.82%) followed by rice (29.64%), barley (22.50%) and maize (20.71%). Price was the highly risk factor in pearl millet followed by pests and diseases and losses caused by the animals. Drought is also a threat for the pearl millet. The major risks for the rice crop were pest and disease, windstorms and price. Maize is highly affected by price followed by pests and diseases and animal losses. Unseasonal rain and temperature variability meant a lot in the production of wheat.

Table 5 explains that how much the farmers can afford the risk in a particular crop. If we give a look on the given data in the table, it was found that in wheats, only 4.41% farmers could bear losses up to 10%, 5.37% could afford losses up to 9% and 10.54% could bear up to 8%. 90.61% of total respondents could bear losses only up to the extent of 2% and 80.27% up to 3 %. In case of barley, 3.41% respondents could tolerate the losses up to 10 %, 7.95%, up to 8 % and 10.23% could bear the losses up to 7%. The maximum limit of the respondents of loss bearing in maize was up to 6%. Pearl millet was the crop in which the respondents could bear more losses as compared to other crops, 21.78% respondents could afford the losses up to 10%. On the opposite side in case of rice, only 0.33% farmers could bear the loss up to 10% in the rice crop.

Table 6 compares the maximum limit of average losses experienced by the farmers in the past and the loss bearing capacity of farmers with regard to different food crops. There were only 0.33% farmers could bear the loss up to 10% in the rice crop and the average past losses were 29.64%. The reason may be farming of these traditional crops by farmers for a long time due to legacy and farming by fellow farmers. In case of barley, 3.41% respondents could tolerate the losses up to 10 %, 7.95 % up to 8 % and 10.23% could bear the losses up to 7%. The maximum limit of the respondents of loss bearing in maize was up to 6% and beyond this limit farmers could not afford the losses in their crop. But the average losses experienced by the farmers in the crops of barley and maize were 22.50 and 20.71% respectively. Thus, almost in all the crops maximum average past losses experienced by the sampled farmers were too much than the present bearing capacity.

In India, food grains occupy a significant space in the total cropped area. The same is the case of Haryana. Wheat and rice are the major food crops which are grown in high percentage in the state. But, there are so many risks involved in the whole farming so as in the food crops also such as floods, drought, excess and deficit rains, temperature variability, pests, diseases, windstorms and hailstorms etc. All these risks affect differently to variable crops. In case of wheat, which is highly grown crop in rabi season in Haryana, the highly risky factor was unseasonal and excess rain during the cropping

period. Variability in the temperature also means a lot for the wheat crop. The farmers were concerned about it because temperature played main role in the productivity of wheat. Rice was the second highest grown crop followed by the wheat in the sampled area. The maximum farmers bothered about the losses occurred due to different types of pests and diseases in the rice crop. The second risky factor was windstorms. If we talk about the maize and pearl millet the most bothered risk factor was price, followed by pest and diseases. The next risk factor after these two was loss made by animals to the crop. Wheat was less risky crop in all the crops grown by the sampled farmers. The amount of average past losses were in wheat (10.11%) and in barley (22.50%). There was a great difference between the actual losses and bearing capacity of the farmers. Only 0.33% farmers could bear the loss up to 10% in the rice crop and the average past losses were 29.64%. In case of barley 3.41% respondents could tolerate the losses up to 10 %, 7.95 % up to 8 % and 10.23% could bear the losses up to 7%. The maximum limit of the respondents of loss bearing in maize was up to 6%. After this limit, farmers could not afford the losses in their crops. But the average losses experienced by the farmers in the crops of barley and maize were 22.50 and 20.71%, respectively. It was found that in wheat, only 4.41% farmers could bear losses up to 10%, 5.37% could afford losses up to 9%, 10.54% could bear up to 8%. 90.61% of total respondents could bear losses only up to the extent of 2% and 80.27% up to 3 %. But, the average past losses in wheat were 10.11%. Price for their crops is the main problem for the farmers. On the basis of the findings, the study suggests that the farmers hardly get the reasonable prices for their produce. So, the support prices for all the crops should be determined by the government. The farmers also wanted to cover this risk in their crop insurance policy.

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