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Vegetable Crops: Risks and losses faced by farmers

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Abstract

Farming activities take place in a highly variable biophysical and economic environment which 4 5 poses numerous types of risks. Risk perception plays a key role in the production and investment behavior of farmers. But, limited attention has been paid to understand its nature in cash-crop 6 farming such as fruits and vegetables. To get a deeper understanding of the major factors 7 constraining production of vegetables, an analysis of the farmers' perception on various risks in 8 9 vegetables was carried out. There are different types of the risks and uncertainties are involved in different vegetable crops. The present study describes some of the factors constituting 10 uncertainties that limit farm production and productivity. The study was focused on the various 11 risk factors involved in different vegetable crops that are most worried by the sample population 12 13 and highlights the losses caused by these factors and was conducted in Haryana state. The study also highlights the loss bearing capacity of the respondents and concluded that there was a great 14 difference between the actual average losses experienced by the farmers and loss bearing 15 capacity of the farmers. The study also gives suggestion to make stronger the economy of the 16 farmers, all types of risks and crops should be covered under the insurance policies formulated 17 by the government at present or in the future. Effective measures should be taken to properly 18 manage the risks faced by the farmers. 19

20 Key Words: Vegetable Crops, Risk, Average Losses, Loss Bearing Capacity

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Introduction

Haryana is a major agricultural state of the country. The dominant economic activity of 22 23 the state is agriculture. In the process of economic development, the state has experienced rapid structural changes such as improving infrastructures, inflated land values and crop prices, a trend 24 25 which has converted agriculture into a potentially highly profitable business. Due to globalization of the market, adoption of advanced technology and supportive government 26 27 policies change in agriculture has take place. Agricultural diversification in the state is highly intensified towards vegetables production. Cultivation of vegetables crops has made rapid strides 28 29 due to favorable agro-climatic conditions suitable for cultivation of a wide range of vegetables (Ali and Kapoor, 2008). The farming business is naturally risky. Disparity in weather, insect 30 infestations and plant diseases can harm the quality of the crop and reduce production. Slight 31 changes in aggregate supply and demand for agricultural products can lead quickly to large 32 changes in prices and changes in regulations can alter farmers' production practices and costs. In 33

addition to production and price risks, farm businesses are also affected by financial risk 34 associated with borrowing capital and farm operators and farm workers face personal health risks 35 associated with the farm environment and working conditions (www.cdc.gov). Horticultural crop 36 farming is associated with negative outcomes affected from imperfect expected climatic, 37 biological and price variables. These variables include natural adversities e.g. pest and diseases, 38 weather factors and adverse fluctuations in both input and output prices which are not within the 39 control of farmers (Fakayode et al. 2012). Vegetable production in outdoor environments is 40 affected by weather conditions whereas outdoor weather conditions have a slight impact on 41 greenhouse environments (Jones and Harrison, 2004). 42

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Literature Review

44 Vegetables are so important for human diet that a meal without a vegetable is supposed to be incomplete in any part of the world. India is the second largest producer of vegetables in the 45 46 world, next to China. A good number of vegetables in India are an introduction from foreign countries. Therefore, the developments in the field of vegetable production will not only improve 47 48 the nutritional requirement for masses but also will meet the challenge of adequate food supply to the growing population in India. The limited cultivable area can be best utilized for growing 49 50 vegetables which are known to give higher yields. Our country has wide range of agro-climatic conditions which make possible the production of vegetables throughout the year in one part of 51 52 the country or the other and then maintaining a continuous supply of fresh vegetables. These off season vegetables are in great demand in home market as well as in the neighbouring Gulf 53 54 countries (Kumar, 2012). Risk is considered as a strong behavior force that affects decision making in the production of high value commercial crops. The majority of vegetable growers 55 experienced high variability in price than yield. It means stabilizing price, would be a more 56 effective strategy to reduce income risk in the cultivation of vegetables (Mehta, 2012). The 57 actual returns of the farmers are forced to below due to the risk factors in farming. Probability of 58 occurrence of risks results in increased cost of production, decline in farm outputs and farm 59 efficiency. In the processing, distribution and marketing of farm products risk is also a prominent 60 61 factor (Ehirim et al. 2006). Government has provided a range of risk management strategies for farmers such as crop insurance, price stabilization, and emergency relief. But these strategies 62 63 have been failed to effectively manage risk faced by farmers due to the poor implementation of these strategies (Miller et al., 2004 & Boehije and Lins, 2010). In tropical areas, crop protection 64

is an important element of fruit and vegetable production. To control pests and diseases, various 65 methods have been developed both in temperate and tropical countries as like resistant cultivars, 66 biological control, chemical control, cultural practices and integrated pest management (IPM). 67 But instead of these existing alternative practices, the use of chemical pesticides has grown 68 radically since the 1970s all over the world (Abate et al. 2000). The demand for vegetables 69 especially for export is increasing. Vegetables can make high income for the farmers because of 70 71 high market value and profitability. They also have high nutritive value compared to cereals (EARO, 2000). Vegetables are highly perishable; they start to lose their quality right after 72 harvest and continued throughout the process until it is consumed. So, vegetables productions are 73 risky investment activities. High risk involved in vegetable production may be attributed to 74 several factors that are beyond the control of producers. The crops are subjected to high price 75 and quantity risks with changing consumer demands and production conditions. Unusual 76 production or harvesting weather or a major crop disease can influence badly the marketing 77 system (Alamerie et al. 2014). 78

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Research Methodology

80 The present study is empirical in nature and based on primary data. To record the data, a well structured questionnaire was developed and administered on the farmers from all over in 81 Haryana selected randomly. Data obtained through well designed questionnaire was analyzed by 82 using simple statistical tools percentage analysis and frequency. All the calculations were done 83 with the help of statistical software packages. Ranking of risk factors is based on the responses 84 of the respondents. The current paper has reported the results of a survey of 567 farmers 85 86 conducted to investigate the risk factors involved in vegetable crops grown by the sampled 87 population. The study also 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 88 89 between the loss bearing capacity and actual average losses experienced by sample population in the past. 90

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Results and Discussion

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93 To investigate the risk factors affecting the productivity of the vegetable crops, the sampled data is analyzed. There are different kinds of natural risks which affect the production of 94 95 a crop. Every risk factor does not affect all crops uniformly. Various risk factors have an effect on the crops adversely and differently. The possible relevant risk factors includes such as 96 variability in temperature, floods, drought, unseasonal/excess rain, hailstorms, wind storms, crust 97 formation, etc. All these risks are away from the control of farmers. The losses made by these 98 99 factors need to be managed to stabiles the income of the farmers. Initially, we have discussed the crop profile of the sample respondents. The different risk factors involved in the vegetable crops, 100 rank-wise risk factors in different crops grown, average past losses experienced by the 101 respondents in the vegetable crops and their actual loss bearing capacity has been discussed. 102

Sr.No.	Сгор	Frequency	Percentage
1.	Potato	36	6.35
2.	Tomato	24	4.23
3.	Onion	22	3.88
4.	Bhindi	13	2.29
5.	Carrot	07	1.23
6.	Cauliflower	06	1.06
7.	Pea	03	0.53

103 Table 1: Crop wise profile of respondents

104

The data states the crop wise profile of the respondents. It also gives details about the 105 vegetable crops which were grown by the respondents. Among the vegetable crops, potato 106 (6.35%) was the highest grown crop by the sampled population followed by tomato (4.23%), 107 onion (3.88%), and bhindi (2.29%). A proportion of 0.53% of the population grew pea. It was the 108 109 least grown crop by the respondents. Carrot was grown by 1.23% respondents while, 1.06 farmers has grown cauliflower. Thus, we can say that potato, tomato and onion were the major 110 vegetable crops grown by the sampled farmers and these crops can grown in both the seasons in 111 112 Haryana.

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115 **Table 2: Ranking of different risk factors with regard to different crops**

Risk	Rank	Potato	Tomato	Onion	Bhindi	Carrot	Cauliflower	Pea
Flood	HW	-	-	18.2	-	-	-	-
	MW	2.9	-	-	-	-	-	-
	LW	97.1	100.0	81.8	100.0	100.0	100.0	100.0
Drought	HW	-	-	-	-	-	-	-
_	MW	5.6	4.2	22.7	7.7	-	-	-
	LW	94.4	95.8	77.3	92.3	100.0	100.0	100.0
Crust	HW	-	-	-	-	-	-	-
formation	MW	-	-	-	50.0	-	-	33.3
	LW	100.0	-	100.0	50.0	100.0	-	66.7
Fire	HW	-	-	-	-	-	-	-
	MW	-	-	-	-	-	-	-
	LW	-	-	-	-	-	-	-
Wind	HW	20.0	66.7	13.6	66.7	28.6	-	-
storms	MW	8.6	25.0	9.1	16.7	14.3	-	33.3
	LW	71.4	8.3	77.3	16.6	57.1	100.0	66.7
Frost	HW	43.3	36.4	47.1	-	28.6	16.7	33.3
	MW	43.3	63.6	11.8	-	71.4	66.7	66.7
	LW	13.4	-	41.1	-	-	16.6	-
Pest &	HW	88.9	87.5	94.4	92.3	57.1	83.3	100.0
Diseases	MW	11.1	12.5	5.6	-	28.6	16.7	-
	LW	-	-	-	7.7	14.3	-	-
Temperatur	HW	22.2	29.2	40.9	15.4	28.6	50.0	-
e variability	MW	55.6	41.7	50.0	61.5	71.4	50.0	100.0
	LW	22.2	29.1	9.1	23.1	-	-	-
Unseasona/	HW	75.0	54.2	50.0	30.8	28.6	50.0	66.7
excess rain	MW	22.2	33.3	22.7	46.1	57.1	50.0	33.3
	LW	2.8	12.5	27.3	23.1	14.3	-	-
Hailstorm	HW	8.3	29.2	22.7	-	28.6	16.7	-
	MW	16.7	16.7	13.6	46.2	14.3	66.7	33.3
	LW	75.0	54.1	63.7	53.8	57.1	16.6	66.7
Post harvest	HW	61.1	62.5	54.5	46.2	57.1	50.0	66.7
losses	MW	22.2	12.5	27.3	38.5	42.9	33.3	33.3
	LW	16.7	25.0	18.2	15.4	-	16.7	
Price	HW	83.3	79.2	86.4	84.6	57.1	100.0	100.0
	MW	16.7	20.8	13.6	15.4	28.6	-	-
	LW	-	-	-	-	14.3	-	-
Animal	HW	11.1	29.2	27.3	76.9	14.3	66.7	66.7
losses	MW	44.4	58.3	27.3	15.4	57.1	16.7	33.3
	LW	44.5	12.5	45.4	7.7	28.6	16.6	-
Weed	HW	-	8.3	4.5	23.1	-	-	-
	MW	16.7	12.5	36.4	7.7	-	16.7	33.3
	LW	83.3	79.2	59.1	69.2	100.0	83.3	66.7

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117 With regard to onion crop price was that risk factor about which farmers were highly 118 worried and concerned. Almost all the farmers bothered about it. Thus, we can say that the price

119 for their crops is the major problem for the farmers. The farmers did not get right prices for their produce. Pests and diseases affected a lot the productivity potato (88.9%). In case of potato, the 120 121 second bothered risk factor was price. The production of potato was also affected by the unseasonal/excess rain (75.0%) during the crop season. The figures explain that the respondents 122 were highly worried about pests and diseases in the crop of tomato (87.5%). The second 123 concerned risk factor was price in tomato. Post-harvest losses like rain, theft and fire in crops 124 125 after harvesting but before selling were also an important risk factor in case of tomato. If we give a look to the crop carrot, farmers were highly anxious for the prices of carrot. They wanted high 126 prices for their crop but they did not get. Bhindi is a vegetable crop and it was grown by very 127 small number of farmers. Pests and diseases were the main hurdle in high productivity of this 128 crop. If a farmer produces bhindi in good quantity, then the second concern is for its price. 129 Bhindi was also affected by the losses due to animals in the crop. The data also describe the risks 130 involved in cauliflower and pea. It was clearly observed from the data that highly risky factor in 131 cauliflower and pea was the price of the crops that a farmer got. All the farmers (100.0%) were 132 highly worried about it. The next risk factor concerned was pest and diseases. There are some 133 134 risks that can be controlled by treatment in crops on time after observation of these risks like pests and diseases, irrigation in case of drought, but some risks are there which can't be 135 controlled. 136

Sr.No.	Crop	Risks involved							
		R ₁	\mathbf{R}_2	\mathbf{R}_3					
1.	Potato	Pest & diseases	Price	Unseasonal/excess					
				rain					
2.	Tomato	Pest & diseases	Price	Wind storms					
3.	Onion	Pest & diseases	Price	Post- harvest losses					
4.	Bhindi	Pest & diseases	Price	Animal losses					
5.	Carrot	Price/Post- harvest losses	Wind storms/Frost/	Animal losses					
		/Pest & diseases	Temperature variability/						
			Unseasonal/excess						
			rain/Hail storms						
6.	Cauliflower	Price	Pest & diseases	Animal losses					
7.	Pea	Price/Pest & diseases	Unseasonal/excess	Frost					
			rain/Post- harvest						
			losses/Animal losses						

Table 3: Ranking of risk factors involved in different crops

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139 The figures state different kinds of risks which affect the production of a crop. Pests and 140 diseases affected a lot the productivity of all the vegetable crops. In case of potato, tomato, onion 141 and bhindi the second bothered risk factor was price. The production of potato was also exaggerated by the unseasonal and excess rain during the crop season. The main risk factor was 142 143 pests and diseases in the crop of tomato followed by price. A post-harvest loss like rain, theft and fire in crops after harvesting but before selling was also an important risk factor. If we give a 144 look to carrot, farmers were highly anxious for the prices of this crop. They wanted high prices 145 for their crops but they did not get. So, the farmers wanted to cover this risk in their crop 146 insurance policy. Bhindi is a vegetable crop and it is grown by very small number of farmers. 147 Pests and diseases were the main hurdle in high productivity of this crop. If a farmer produces 148 bhindi in good quantity, then the second concern was for its price. Carrot, bhindi and cauliflower 149 were also affected by the losses due to animals in the crop. It was clearly observed from the data 150 151 that highly risky factor in carrot, cauliflower and pea was the price of the crop that a farmer got.

152 Table 4: Average loss experienced by farmers in the past

Sr.No.	Crop	Average	Risks involved							
		Loss (%)	R ₁	\mathbf{R}_2	\mathbf{R}_3					
1.	Potato	37.26	Pest & diseases	Price	Unseasonal/excess rain					
2.	Bhindi	37.00	Pest & diseases	Price	Animal losses					
3.	Tomato	34.55	Pest & diseases	Price	Wind storms					
4.	Caulifl		Price	Pests& diseases	Animal losses					
	ower	30.00								
5.	Onion	30.05	Pest & diseases	Price	Post- harvest losses					
6.	Carrot		Price/Post harvest	Wind storms/Frost/	Animal losses					
			losses/Pest &	Temperature						
			diseases	variability/						
				Unseasonal/						
				excess rain/Hail						
		28.13		storms						
7.	Pea		Price/Pest & diseases	Unseasonal/	Frost					
				excess rain/Post-						
				harvest losses/Animal						
		20.00		losses						

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The data given in table depict that the vegetable crops such as potato, bhindi and tomato, losses in potato (37.26%) were more than the bhindi (37.00%) and tomato (34.55%). The largest risk factor was pests and diseases in potato, bhindi, tomato, onion, carrot and pea. The farmers used pesticides and chemicals to protect their crops from different pests and diseases which increased their cost on one side along with ill side effects on the quality of product and soil. So, in this way, the farmer suffered double loss on the same time. In case of pea, cauliflower and carrot price assigned the main risk factor. However, in India, to cover the risk of price in agriculture there is a provision of MSP (Minimum Support Price) but it does not cover all the crops and in some cases it also in synchronized with the farmers. Further, the risk in agriculture is vulnerable to non price such as wind storms, crust formation, post-harvest losses, frost, fire, etc. involved in different crops at different times which were beyond the control of the farmers.

Extent of		Percentage of Respondents									
Loss	Potato	Tomato	Onion	Bhindi	Carrot	Cauliflower	Pea				
Up to 10%	5.66	21.21	-	-	-	-	-				
Up to 9%	15.09	30.30	2.17	10.00	-	-	-				
Up to 8%	35.85	42.42	8.70	20.00	-	-	25.00				
Up to 7%	39.62	48.48	15.22	30.00	25.00	-	50.00				
Up to 6%	75.47	63.64	26.09	40.00	75.00	-	-				
Up to 5%	77.36	90.91	60.87	80.00	100.00	50.00	100.00				
Up to 4%	84.91	93.94	65.22	-	-	-	-				
Up to 3%	90.57	96.97	84.78	90.00	-	100.00	-				
Up to 2%	96.23	100.00	100.00	-	-	-	_				
Up to 1%	100.00	-	-	100.00	-	-	-				

Table 5: Loss bearing capacity of farmers in different crops

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The data given the table compares the maximum limit of average losses experienced by 167 the farmers in the past and the loss bearing capacity of farmers with regard to different crops. 168 169 There are 5.66% farmers were there in the sampled population who could afford the losses of up 170 to 10% in potato which is the main vegetable crop. All the farmers could afford the loss up to 5% in carrot. In bhindi, 90.00% farmers could afford the losses up to 3% in relation to 10.00% 171 172 farmers could bear up to 9% losses. In carrot, the loss limit was up to 7% (25.00%) and in cauliflower it was just 5% (50.00%). Onion which is the major vegetable crop, the highest limit 173 174 of bearing losses by respondents was up to 9% and only 2.17% of sampled population could manage this limit, 8.7% could bear up to 8%, 15.22% could up to 7%. All the farmers could bear 175 176 the losses up to 2% in onion. The percentage of farmers in loss bearing capacity up to 10% in tomato was 21.21%. 177

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

Crops	Loss bearing capacity										
	Up	Up	Up	Up	Up	Up	Up	Up	Up	Up	Average
	to	to	to	to	to	to	to	to	to	to	past

	10%	9%	8%	7%	6%	5%	4%	3%	2%	1%	losses
											(%)
Potato	5 66	15.09	35.85	20.62	75.47	77.36	84.91		96.23	100.0	
	5.00			39.02				90.57		0	37.26
Bhindi		10.00	20.00	20.00	40.00	80.00	-		-	100.0	
	-			50.00				90.00		0	37.00
Tomato	21.21	30.30	42.42	48.48	63.64	90.91	93.94	96.97	100.00	-	34.55
Onion	-	2.17	8.70	15.22	26.09	60.87	65.22	84.78	100.00		30.05
Cauliflower	-	-	-	-	-	50.00	-	100.00	-	-	30.00
Carrot	-	-	-	25.00	75.00	100.00	-	-	-	-	28.13
Pea	-	-	25.00	50.00	-	100.00	-	-	-	-	20.00

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Table-6 compares the maximum limit of average losses experienced by the farmers in the 183 184 past and the loss bearing capacity of farmers with regard to vegetable crops. There are 5.66% farmers were there in the sampled population who could afford the losses of up to 10% in potato 185 which is the main vegetable crop. The past experienced loss for potato was 37.26%. All the 186 farmers could afford the loss up to 5% in pea and carrot. In bhindi, 90.00% farmers could afford 187 188 the losses up to 3% and only 10.00% farmers could bear up to 9% losses. In carrot, the loss limit was up to 7% (25.00%) and in cauliflower it was just 5% (50.00%). The average loss in the past 189 was 28.13% in carrot and 30.00% in cauliflower. Onion which is the major vegetable crop, the 190 highest limit of bearing losses by respondents was up to 9% and only 2.17% of sampled 191 192 population could manage this limit, 8.7% could bear up to 8%, 15.22% could up to 7%. All the farmers could bear the losses up to 2% in onion but the average losses experienced by the 193 farmers in the past in onion crop were 30.05%. Thus, almost in all the crops maximum average 194 past losses experienced by the sampled farmers were too much than the present bearing capacity. 195

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Conclusions

197 A proportion of 6.35% of respondents were involved in growing potato. Pests and diseases affect a lot to the productivity of potato (88.9%). In case of potato and onion, the second 198 bothered risk factor was price after the pests and diseases attacks. The production of potato was 199 200 also exaggerated by the unseasonal and excess rain during the crop season. The main risk factor 201 was pests and diseases in the crop of tomato. The second concerned risk was price in tomato. Bhindi is a vegetable crop and it was grown by very small number of farmers. Pests and diseases 202 203 were the main hurdle in high productivity of this crop. If a farmer produces bhindi in good quantity, then the second concern was for its price. Carrot and bhindi were also affected by the 204 205 losses due to animals in the crop. The highly risky factor in cauliflower and pea was the price of 206 the crop that farmers got. But cost of cultivation was also high. Market risks were also there in 207 the vegetable crops. Average past losses in potato (37.26%) were more than the bhindi (37.00%) 208 and tomato (34.55%). The largest risk factor was pests and diseases followed by price. Only 5.66% farmers were there in the sampled population who could afford the losses up to 10% in 209 210 potato which is the main vegetable crop. The past experienced loss was 37.26%. In carrot the loss limit was up to 7% (25.00%) and in cauliflower it was just 5% (50.00%). The average loss 211 212 in the past was 28.13% in carrot and 30.00% in cauliflower. In onion, which is the major vegetable crop, the highest limit of bearing losses by respondents was up to 9% and only 2.17% 213 of the sampled population could manage this limit, 8.7% could bear up to 8%, 15.22% up to 7% 214 but the average losses experienced by the farmers in the past in the onion crop were 30.05%. 215 The study suggests that the proper measures have to be taken by the government to strengthen 216 the economy and wealth of the farmers and their crop losses should be managed effectively, so 217 that they could be able and prepare for the next cropping season on crop failure. 218

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