

Adoption of improved potato cultivation practices

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Received : February, 2013 / Accepted : May, 2013

Abstract : Cultivation of vegetables and fruits is a viable commercial proposition. With the introduction of liberal trade policies, prospects for export of fruits and vegetables have improved. Vegetables provide a good source of income to the growers and play an important part in human nutrition. Potato is one of the major vegetable crops of the world. It is an important crop and it can supplement the food needs of the country in a substantial way as it produces more dry-matter food. Potato production in India has made tremendous progress only with the development of new technologies in different fields of agriculture. Due to the complexity in different technologies sometimes farmers find it difficult to understand, as a result of which they lag behind in the adoption of recommended package of practices. In this context the need was felt to study the extent of adoption of potato cultivation practices. An interview schedule was prepared to collect the data from 160 vegetable growers from the state Punjab. Recommended seed varieties of potato were adopted by 65.50 per cent of respondents whereas recommended dose of fertilizers were used by 45.00 per cent of respondents. About half of the respondents used recommended insecticides/pesticides, fungicides and storage practices. The data further revealed that majority of the respondents had low extent of adoption of recommended cultivation practices of potato crop. The data generated through this study can form the basis for planning integrated extension strategies to create more knowledge and awareness among the vegetable growers about the recommended cultivation practices of potato crop.

Keywords: Extent, adoption, vegetable growers, potato

Introduction

Vegetable production in India has made tremendous progress with the result of better seed varieties, fungicides, insecticides, irrigation facilities etc. Cropping

intensity has increased up to 300 per cent. Besides, manifold increase in yield levels of almost all vegetable crops has taken place. It has become possible only due to the development of new technologies in different fields of agriculture. Due to the complexity in technologies, sometimes farmers find it difficult to understand and remember all the operations, as a result of which they lag behind in the adoption of recommended package of practices. There may be some other reasons also like lack of knowledge, non-availability of inputs, high cost of inputs, old traditions, lack of skill and attitude towards new technology. No technology is of any use unless it is adopted by the farmers. It has been seen that a large number of techniques and practices do not reach the farmer's fields and those carried to the farmers get considerably distorted or often adopted partially with the result farmer's does not get the potential yield. The problem of technological change is not as simple as it is commonly understood. The past experience has shown that inspite of arranging supplies and credit all through the year, the desired level of change in farm technology could not be accomplished. The reasons for such a state of affairs may be many and varied but the most apparent one seems to be the lack of focus on the farming community. The situational, socio-psychological and communication variables of a farmer play an important role in the process of change from subsistence to commercial farming.

It has been observed that the farmers are not adopting recommended practices and consequently not realizing the potential yield of these vegetable crops. To understand the problems of farmers in the adoption of complete recommended farm practices, researchers as well as extension workers should come out with some concrete findings and suggestions, which can solve these problems. Therefore, it is very essential that the farmers must be aware about recommended farm practices for increasing the vegetable production. The extent of adoption of any innovation will be high only if the farmers are fully motivated to adopt the innovations. For this purpose one has to identify the gap between the

recommended farm practices and actual adoption by the farmers. So that emphasis may be given by the extension workers to educate the farmers to get full potential yield. In this context the need was felt to study the extent of adoption of potato cultivation practices. The focus of the study was to analyze the extent of adoption of recommended cultivation practices of potato crop.

Materials and Methods

Locale and sampling: The investigation was conducted in two districts namely, Jalandhar and Ludhiana one of the most developed states of Punjab, India. A list of vegetable growers was procured from the office of State Department of Horticulture, Jalandhar and Ludhiana. Eighty vegetable growers, who were cultivating potato crop on at least two acres of land, were selected randomly from each of these two districts, making a total of one hundred sixty respondents.

Selection of farm practices: The selected farm practices for the study were improved seeds, fertilizer applications, plant protection measures, storage and marketing.

Data collection: An interview schedule was developed which consisted of questions to elicit response regarding the following aspect.

Extent of adoption: It is a measure of adoption of recommended cultivation practices of potato crop. To measure the extent of the adoption proportion of percentage of farmers, who follow the recommended cultivation practices of potato crop was calculated from each district and then the total proportion of percentage of farmers was also calculated.

Results and Discussion

Recommended seeds and fungicides in potato crop:

The extent of adoption of potato crop was measured with the help of percent adoption scores and “Z” test and presented in Table 1. It was found that about 62.50 per cent of total respondents adopted the recommended seed varieties of potato, such as Kufri Pukhraj, Kufri

Bahar, Kufri Badhshah, Kufri Sindhuri, Kufri Joyti, Kufri Sutlej, Kufri Ashoka, Diamond and Dangri. Nearly 51.00 per cent respondents from Jalandhar and 73.75 per cent of the respondents from Ludhiana used recommended seed varieties of potato crop. Half of the respondents of both districts (50.63%) used recommended fungicides for the seed treatment. They used fungicides like Captan, Thiram and Sevin for the treatment of potato seed. Approximately 47.00 per cent of total respondents followed the recommended methods to apply the fungicides. About 32.50 per cent of respondents were there in Jalandhar who used correct dose of fungicides whereas in Ludhiana 48.75 per cent of respondents used recommended dose of fungicides. Again nearly half of the total respondents (49.38%) used recommended seed rate of potato for sowing. The study further reveal that there was a significant difference in the adoption of improved seed varieties, recommended fungicides, their method of application and their doses with the Z value of 2.94, 2.37, 2.06 and 2.09, respectively between the respondents of Jalandhar and Ludhiana districts. Seed rate for the potato was significantly differentiated in Jalandhar and Ludhiana with Z value of 1.74. Again the study reveal that percent adoption scores of Jalandhar was 41.25, in Ludhiana it was 58.75 and the overall percent adoption score was 50.00.

Recommended fertilizer application on potato crop:

The findings of the study presented in Table 2 reveal that more than half of the total respondents (55.00%) used FarmYard Manure (FYM) in recommended amount. About 61.25 per cent of respondents of Ludhiana and nearly 49.00 per cent of respondents of Jalandhar applied recommended quantity of FYM to the potato crop. There was a non-significant difference between these two districts. The findings are in conformity with Shailbala and Pathak (2008) who reported that a less percentage of farmers applied the recommended dose of FYM to the crops.

About 46.00 per cent of the respondents from each of the districts used recommended dose and method of application of nitrogen. Nearly 29.00 per cent of

Table 1: Distribution of respondents using recommended seeds and fungicides in potato crop (n=160)

Cultivation practices of potato	Jalandhar		Ludhiana		Total		Z-value
	f	%	f	%	f	%	
Seed varieties	41	51.25	59	73.75	100	62.50	2.94***
Seed rate	34	42.50	45	56.25	79	49.38	1.74*
Fungicide used for seed treatment	33	41.25	48	60.00	81	50.63	2.37**
Method of fungicide application	31	38.75	44	55.00	75	46.88	2.06**
Dose of fungicide	26	32.50	39	48.75	65	40.63	2.09**
Overall Score (Out of 5)		2.06		2.94		2.50	
Standard deviation (SD)		0.53		0.42		0.49	
Percent adoption score		41.25		58.75		50.00	

*Significant at 10 per cent level of probability, ** Significant at 5 per cent level of probability, ***Significant at 1 per cent level of probability

Table 2: Distribution of respondents according to recommended fertilizer application on potato (n= 160)

Cultivation practices	Jalandhar		Ludhiana		Total		Z-value
	f	%	f	%	f	%	
Dose of FYM	39	48.75	49	61.25	88	55.00	1.59
N : Dose	34	42.50	41	51.25	75	46.88	1.11
Method	32	40.00	42	52.50	74	46.25	1.59
Time	23	28.75	34	42.50	57	35.63	1.82*
P : Dose	31	38.75	39	48.75	70	43.75	1.28
Method	36	45.00	38	47.50	74	46.25	0.32
Time	28	35.00	31	38.75	59	36.88	0.49
K : Dose	32	40.00	43	53.75	75	46.88	1.74*
Method	39	48.75	40	50.00	79	49.38	0.16
Time	27	33.75	36	45.00	63	39.38	1.46
Overall Score (Out of 10)	4.01		4.91		4.46		
SD	0.43		0.38		0.41		
Percent adoption score	40.13		49.13		44.63		

*Significant at 10 per cent level of probability

respondents of Jalandhar and 42.50 per cent of respondents of Ludhiana applied nitrogen to potato crop at recommended time. There was a significant difference between both of these districts as far as time of application of nitrogen was concerned. Nearly 39.00 per cent of respondents of Jalandhar and 48.75 per cent respondents of Ludhiana used recommended dose of phosphorous, whereas 46.25 per cent of total respondents used recommended method of phosphorous application. As far as the time of application of phosphorous was concerned, 36.88 per cent of respondents of both of the districts followed recommended time of application of phosphorous. It was also found that there was a non-significant difference between both of the districts in relation to the dose, method and time of phosphorous application. The findings further reveal that nearly 47.00 per cent of respondents used recommended dose of potassium. There was a significant difference between these two districts with a Z value of 1.74. Half of the respondents of Ludhiana district followed the recommended method of potassium application. Very near to half i. e. 49.38 per cent of the total respondents followed recommended method of potassium application to potato crop. About 39.00 per cent of respondents used recommended time of application of potassium from both of the districts. There was a non-significant difference between both of the districts as far as method and time of application of potassium were concerned. The study further reveals that the total per cent adoption score of Jalandhar and

Ludhiana were 40.13 and 49.10, respectively. The total percent adoption score was 44.63.

Recommended mechanical weed control in potato crop: Perusals of data in Table 3 reveal that the problem of weeds in potato crop was faced by all vegetable growers. Most of the respondents controlled weeds by both mechanical and chemical methods. In potato crop 57.50 per cent of the total respondents done recommended number of hoeings and very near to half of the respondents i.e.49.38 per cent followed the recommended time interval between hoeings from both of the districts. About 40.00 per cent of the respondents of Jalandhar and nearly 59.00 per cent of respondents of Ludhiana followed the recommended time interval between the hoeings. There was a significant difference between both of these districts with Z value of 2.37.

Recommended chemical control measures on potato crop: The data in Table 4 indicate that nearly 52.00 per cent of total respondents applied recommended weedicides for the control of weeds in potato crop. These were stomp 30 EC and basalin. About 48.13 per cent of total respondents used recommended dose of these weedicides. There was a significant difference between Ludhiana and Jalandhar as far as recommended weedicides and their doses were concerned ($Z=2.37$). Recommended method and time of application of weedicides were followed by 46.25 and 43.75 per cent of total respondents respectively.

The findings further reveal that tobacco caterpillar,

Table 3: Distribution of respondents according to the use recommended mechanical weed control in potato crop (n= 160)

Cultivation practices	Jalandhar		Ludhiana		Total		Z-value
	f	%	f	%	f	%	
No. of hoeings	41	51.25	51	63.75	92	57.50	1.60
Time interval of hoeings	32	40.00	47	58.75	79	49.38	2.37**

***Significant at 1 per cent level of probability

beetle, cutworm, aphid and jassid were the major insect-pest faced by the vegetable growers in the cultivation of potato crop. About 58.00 per cent of the total respondents used recommended insecticides/pesticides such as rogor, thiodan, metasystox, endosulfan and chloropyriphos to control the insect-pests of potato crop. There was a non-significant difference between these districts as recommended insecticide/pesticide was concerned. Fifty per cent of the total respondents from both of the districts with significant difference ($Z=1.90$) applied recommended dose of insecticide/pesticides. Nearly 39.00 per cent of respondents of Jalandhar followed recommended method of application of insecticide/pesticide, while 55.00 per cent of respondents of Ludhiana district followed the recommended method of application. There was a significant difference between the respondents of both of these districts with 2.06 of Z value. About 47.50 per cent of respondents from both districts used insecticide/pesticide at recommended time of application with a non-significant difference.

The data further reveal that (Table 4) 62.00 per cent of respondents from both districts used recommended fungicides like indofil-M45, phorate, emisan, ridomil, copper oxychloride, agalor for the control of diseases (Late blight, early blight, common scab, mosaic and leaf curl) in potato crop. There was a significant difference between Jalandhar and Ludhiana as far as dose of fungicide was concerned with Z value of 1.99, as 35.00 per cent of respondents from both of the districts used recommended dose of fungicide for potato crop. One third of the respondents (33.75%) from the total sample followed the recommended method of fungicide application. Further 26.25 per cent and 37.50 per cent of respondents of Jalandhar and Ludhiana

respectively followed the recommended time of fungicide application. There was a non-significant difference between the respondents of both of these districts as far as method and time of fungicide application were concerned. It can further observe from the Table 5 that the overall percent adoption score was 44.32. Gandhi *et al.* (2008) reported that majority of the tomato growers used high dose of insecticides, whereas the doses of weedicids and fungicides used were according to the recommendation.

Recommended cultural control measures of potato crop: It is evident from the data in Table 5 that 38.75 per cent of the respondents of Jalandhar followed the recommended cultural control measures to control the tobacco caterpillar in potato crop, while 48.75 per cent of respondents of Ludhiana districts used recommended cultural control measures for tobacco caterpillar. About 51.00 and 61.00 per cent of total respondents collected eggs and used strips to control tobacco caterpillar respectively. All of the respondents removed eggs to destroy the beetle. The aphids are controlled by removing affected plants (61.54%) and avoiding spray to ripe fruits (53.85%). All respondents destroyed cut worm by removing affected plants. There was a significant difference among the respondents of both districts as far as the cultural method to control cut worm were concerned with Z value of 1.80. About 30.00 per cent of respondents of Jalandhar used cultural control measures to control the disease of late blight, whereas 38.75 per cent of respondents of Ludhiana used recommended cultural methods to control the disease of late blight. About 34.00 per cent of total respondents used healthy seeds and removed diseased tubers from stores each. Nearly 45.00 per cent of the respondents of both districts removed off type plants from the fields

Table 4: Distribution of respondents according to the recommended chemical control measures on potato crop (n=160)

Cultivation practices	Jalandhar		Ludhiana		Total		Z-value
	f	%	f	%	f	%	
Weedicide	34	42.50	49	61.25	83	51.88	2.37**
Dose	31	38.75	46	57.50	77	48.13	2.37**
Method of application	33	41.25	41	51.25	74	46.25	1.27
Stage/time of application	27	33.75	43	53.75	70	43.75	2.55**
Insecticide/pesticide	42	52.50	51	63.75	93	58.13	1.44
Dose	34	42.50	46	57.50	80	50.00	1.90*
Method of application	31	38.75	44	55.00	75	46.88	2.06**
Stage/time of application	33	41.25	43	53.75	76	47.50	1.58
Fungicide	26	32.50	36	45.00	62	38.75	1.62
Dose	22	27.50	34	42.50	56	35.00	1.99**
Method of application	23	28.75	31	38.75	54	33.75	1.34
Stage/time of application	21	26.25	30	37.50	51	31.88	1.53
Overall Score (Out of 12)	4.46		6.18		5.32		
SD	0.64		0.71		0.68		
Percent adoption score	37.19		51.46		44.32		
Z-value(overall)							18.90***

*Significant at 10 per cent level of probability, ** Significant at 5 per cent level of probability, ***Significant at 1 per cent level of probability

Table 5: Distribution of respondents according to the recommended cultural/biological control measures of potato crop (n= 160)

Cultivation practices	Jalandhar		Ludhiana		Total		Z-value
	f	%	f	%	f	%	
Insect/Pest							
Tobacco Caterpillar	31	38.75	39	48.75	70	43.75	1.28
Collect Eggs	16	51.61	20	51.28	36	51.43	
Use strips	19	61.29	24	61.54	43	61.43	
Beetle	3	3.75	8	10.00	11	6.88	1.56
Remove eggs	3	100.00	8	100.00	11	100.00	
Aphid	4	5.00	9	11.25	13	8.13	1.45
Remove effected plants	2	50.00	6	66.67	8	61.54	
Spray is not given to ripe fruits	3	75.00	4	44.44	7	53.85	
Cut worm	5	6.25	12	15.00	17	10.63	1.80*
Remove effected plants	5	100.00	12	100.00	17	100.00	
Disease							
Late blight	24	30.00	31	38.75	55	34.38	1.17
Use healthy seeds	8	33.33	11	35.48	19	34.55	
Remove diseased tubers from stores	9	37.50	10	32.26	19	34.55	
Remove off type plants	11	45.83	14	45.16	25	45.45	
Mulching	7	29.17	8	25.81	15	27.27	
Early blight	19	23.75	26	32.50	45	28.13	1.23
Use healthy seeds	19	100.00	26	100.00	45	100.00	
Common scab	14	17.50	21	26.25	35	21.88	1.34
Use healthy seeds	8	57.14	10	47.62	18	51.43	
Less irrigation given at maturity	4	28.57	6	28.57	10	28.57	
Use more green manure	7	50.00	8	38.10	15	42.86	
Mosaic	20	25.00	27	33.75	47	29.38	1.22
Use green manure	11	55.00	19	70.37	30	63.83	
Use healthy seeds	13	65.00	11	40.74	24	51.06	
Leaf curl	7	8.75	16	20.00	23	14.38	2.03**
Use healthy seeds	4	57.14	8	50.00	12	52.17	
Remove effected plants	2	28.57	5	31.25	7	30.43	

*Significant at 10 per cent level of probability, ** Significant at 5 per cent level of probability

to manage late blight. Approximately 28.00 per cent of total respondents used healthy seeds to manage early blight. Common scab was controlled by using healthy seeds (51.43%), providing less irrigation at maturity (28.57%) and using green manure (42.86).

About 64.00 and 51.00 per cent of total respondents used green manure and healthy seed to manage mosaic in potato respectively. Leaf curl was control by 52.17 and 30.43 per cent of total respondents by using healthy seeds and removing effected plants. There was a significant difference among the respondents of

Jalandhar and Ludhiana as far as the control of leaf curl was concerned ($Z=2.03$). These findings are similar to those reported by Dhillon and Kumar (2004) that the majority of the vegetable growers collected eggs to destroy the beetles in metha crop. They also used healthy seeds of the crop to reduce the chances of disuse.

Recommended storage practices of potato crop: The data presented in Table 6 reveal that 53.75 per cent of total respondents used recommended chemicals to the potato at the time of storage and half of the respondents of both the districts (50.00%) used recommended dose

Table 6: Distribution of respondents according to the recommended storage practices of potato crop (n= 160)

Cultivation practices	Jalandhar		Ludhiana		Total		Z-value
	f	%	f	%	f	%	
Chemical	34	42.50	52	65.00	86	53.75	2.85***
Dose	30	37.50	50	62.50	80	50.00	3.16***
Treatment before storage	32	40.00	48	60.00	80	50.00	2.53**
Storage place	30	37.50	50	62.50	80	50.00	3.16***
Storage temperature	29	36.25	46	57.50	75	46.88	2.69***
Relative humidity	28	35.00	44	55.00	72	45.00	2.54**
Storage life	28	35.00	40	50.00	68	42.50	1.92*
Overall Score (Out of 7)	2.64		4.13		3.38		
SD	1.16		0.92		1.04		
Percent adoption score	37.68		58.93		48.30		

*Significant at 10 per cent level of probability, ** Significant at 5 per cent level of probability, ***Significant at 1 per cent level of probability

Table 7: Distribution of respondents on the basis of extent of adoption of recommended cultivation practices of potato crop (n=160)

Extent of Adoption	Jalandhar		Ludhiana		Total		Chi-square value
	f	%	f	%	f	%	
Low	38	47.50	25	31.25	63	39.37	11.12**
Medium	26	32.50	22	27.50	48	30.00	
High	16	20.00	33	41.25	49	30.63	

** Significant at 5 per cent level of probability

of those chemicals. There was a significant difference among the respondents of both districts with respect to recommended chemicals and their doses with Z value of 2.85 and 3.16 respectively. Further half of the respondents gave recommended treatment to potato before storage like pre cooling and fumigation and placed potato in recommended storage place such as cold stores with the significant difference 2.53 and 3.16 respectively. Nearly 47.00 per cent of the total respondents stored potato at recommended temperature. Further, 45.00 per cent and 42.50 per cent of respondents of both the districts stored potatoes at recommended relative humidity and at recommended time period. It was further observed that there was a significant difference between Ludhiana and Jalandhar as far as storage temperature, humidity and time were concerned with Z value of 2.69, 2.54 and 1.92, respectively. The overall percent adoption score was 48.30.

Overall extent of adoption of recommended cultivation practices of potato crop: The data presented in Table 7 indicate that more than one third of the respondents of both districts i.e. 39.37 per cent belonged to low extent of adoption in potato crop whereas less than one third of the total respondents i.e. 30.00 and 30.63 per cent belonged to medium and high extent of adoption in potato crop respectively. It had a significant chi square value of 11.12.

Potato is one of the major food crops of the world. It is an important crop and it can supplement the food needs of the country in a substantial way as it produces more dry-matter food, has well balanced protein and produces more calories from unit area of land and time than other major food crops (Pandey, 2007). Among the major potato growing countries of the world, China ranks first followed by India. The present production of potato in India is about 423.39 lakh tones. Potato production in India has made tremendous progress only with the development of new technologies in different fields of agriculture. Due to the complexity in different technologies, sometimes farmers find it difficult to understand and remember all the operations, as a result of which they lag behind in the adoption of

recommended package of practices. The results from the study clearly indicate that majority of the respondents had low extent of adoption of recommended cultivation practices of potato crop. The percent adoption scores of vegetable growers of Ludhiana districts were more as compared to their counterparts of Jalandhar district on all the selected recommended farm practices of potato crop. Recommended seed varieties of potato were adopted by 65.50 per cent of respondents whereas recommended dose of fertilizers (NPK) were used by 45.00 per cent of respondents. About half of the respondents used recommended insecticides/pesticides, fungicides and storage practices. Therefore, it is imperative that the government and non-government research organization may make integrated and coordinated extension efforts to impart the required knowledge about recommended cultivation practices to potato growers. To reduce the technological gap, integrated extension strategies are the need of the hour. The line department in collaboration with State Agricultural Universities should essentially organize extension activities followed by regular field visits and interaction meetings to promote increased adoption of potato cultivation technologies. There is need to have a consortium of progressive potato growers, scientists from different institutes, representatives of grower associations and lead input providers to tackle the genuine problems of potato growers in an organized manner and develop appropriate strategy for potato production. Further, there is need for problem based, result oriented and time bound action research.

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