

AN ANALYTICAL STUDY OF POTATO SEED PRODUCTION IN JALANDHAR DISTRICT OF PUNJAB

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ABSTRACT: Seed is an essential input for the potato crop. Much of the efforts and investment would be infructuous if the farmers did not get the quality seeds. Only the seed with assured purity-genetic and physical can be expected to respond to fertilizers and other inputs in a respected manner. The present study attempted to analyze the source, SRR of potato seed and assess the effect on potato crop yield by using certified seed in the Jalandhar district of Punjab. The current study was conducted on primary data collected from 120 farmers during the 2020-21 agricultural year. The data were analyzed using simple tabular analysis and other suitable statistical techniques. The study found that the most preferred source of seed was the self-retained seed which came out to be 48 per cent, the second most preferred source was private seed dealers, as 17 per cent procured seed from these dealers. The high use of self-retained seed was due to the high cost of purchased seed, and the other reason was that farmers had more confidence in the self-retained seed. The study found that large farmers' Seed Replacement Rate (SRR) was higher. It was 11.2 per cent for small farmers, 19.5 per cent for medium farmers and 27.5 per cent for large farmers. The yield of potato crop using certified seed was higher than non-certified seed. The per cent difference in yield of potato grown by certified and non-certified seed among small and medium farmers was 17 per cent, 11 per cent among large farmers and 15 per cent overall in the Jalandhar district of Punjab. The study highlighted that the primary constraint faced by potato seed growers were high prices of certified seed (69.1 per cent), high cost of pesticides and insecticides (65.8 per cent), fluctuations in the price of potato seed (55 per cent), lack of public procurement at MSP (53.3 per cent), covid related restrictions (52.5 per cent) and lack of extension facilities (48.3 per cent). The study suggested that the government should provide certified seed to the farmers at the lowest cost to increase the seed replacement rate. Awareness regarding the use of certified seed should be given to farmers through extension services. Government institutes like Central Potato Research Station (CPRS) (ICAR), the Centre of Excellence (Dogri) and the Department of Horticulture should expand the production of certified seeds as only 18 per cent of potato growers purchased seeds from these agencies in the study area. The minimum support price of potatoes should be fixed to promote the production of potatoes in the state.

KEYWORDS: Potato, seed replacement rate, source, certified, non-certified

INTRODUCTION

Vegetable production is one of the potential alternatives due to the short cultivation period, small investment (unlike fruits), and growing demand. Potato is the principal vegetable crop of Punjab. During 2019-20, the area under vegetables was about 2.73 lakh hectares in Punjab. Out of this 73.79, per cent area was under potato crop. It may be stated that the area under vegetables was 1.46 of the total cropped area of Punjab during the year 2019-20. The figure was 1.06 per cent in the case of Potato. The potato production was about 2870 thousand

metric tonnes in 2019-20 (Government of Punjab 2020). Punjab's share in India's potato production is about five per cent. (Government of India, 2019; Anantia, 2008; Jairath, 2008; Dastagiri *et al.*, 2009). Seed is an essential input for the potato crop. Much of the efforts and investment will be fructuous if the farmer does not get quality seeds. Only the seed with assured purity-genetic and physical, can be expected to respond to fertilizers and other agricultural inputs. The farmer's returns from the other costly inputs like machinery, irrigation, chemical fertilizers, pesticides, etc., from his land and

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labour, depends upon the seed. Even in an agriculturally developed state like Punjab, it was 3.48 per cent for certified seeds and 4.43 per cent for quality seeds, seed should be replaced every year for hybrid varieties and every four years or sooner for open-pollinated crops like wheat and paddy (Sidhu, 1995). The low replacement of certified seeds could be due to the high price and non-availability at the proper times (Sidhu *et al.*, 1997). Production of good quality seed will be of no value if it does not reach the farmers in time and at an affordable price. The production of certified seeds is far below the actual requirements for different crops in the country. In Punjab, the farmers used 90.51 per cent of self-retained seed from the previous autumn crop of potato. Due to the high cost of purchased seed, the farmers used the self-retained seed, which is usually inferior. Moreover, the general farm produce retained for seed cannot be substituted for quality seed, and it generally lacks genetic vigour and has a poor germination rate (Singh *et al.*, 1990). To increase productivity and production of potatoes, certified/quality seeds can also play an essential role in the state. One major constraint resulting in lower productivity in the country (21.1t/ha) is the use of poor-quality seeds (NHB, 2015). Successive multiplication of seed tubers in the field magnifies the risk of infection and build-up of several bacterial, fungal, nematode and viral pathogens. Degenerated seed lowers the productivity to the extent of about 40 per cent (Salazar, 1996). Keeping in view the importance of potato seed, the

present study was undertaken to identify the different sources of potato seed, determine the difference in yield of potato crop raised with certified and non-certified, and determine the seed replacement rate (SSR) in Jalandhar district of Punjab.

MATERIALS AND METHODS

The study was conducted in Jalandhar district as the area under potato was maximum in this district, i.e., 23 per cent. The four-stage stratified random cum purposive sampling technique was used with the district as the first stage unit, development block as the second, village as the third and the farmers as the fourth and the ultimate unit of the study. One major potato-growing district was purposively selected for the study in the first stage. In the second stage, two potato growing development blocks were selected. In the third stage, three villages were selected randomly from each selected block. In the fourth stage, 60 potato seed growers were chosen randomly from the cluster of villages chosen from each block. In this way, the total sample comprised 120 farmers. The detail in this regard is given in (Table 1).

The farmers were categorised into small, medium and large categories based on the area under potato by using the cube root frequency method. To make the sample design self-weighting, the number of farmers selected from each size category was proportion to their number in that category. Primary data was collected from selected farmers to achieve the study's objectives. Information was collected from

Table 1: Selected district, blocks, villages and number of farmers in the study area

Selected Districts	Selected blocks	Selected villages	No. of Farmers
Jalandhar	Jalandhar east	Qadianwali, Sansarpur and DhanalKalan	60
	Bhogpur	Bhullowal, Kurala and Jamalpur	60
Grand Total			120

Source: Field survey

respondents chosen regarding variety-wise areas, the production yield of potato for certified and non-certified potato seed users, sources of potato seed, seed rate, etc. The secondary data were obtained from the reputed published and unpublished sources, keeping the study's objectives. The Primary and secondary data were analysed using the appropriate statistical tools such as frequency distribution, averages, percentages, etc.

The Seed replacement rate (SRR) of potato crop with the sample farmers for certified seeds during 2019-20 was calculated by taking a percentage of the certified seed to the total seed used for the potato crop.

$$SRR = \frac{C \times 100}{A \times K}$$

Where,

SRR = seed replacement rate for a particular crop

C = certified seeds used by the farmers

A = area under the crop

K = seed rate per unit of area.

To test the significance of the difference between the yield of the crop raised with certified and non-certified seeds, t-test was applied as under:

$$t = \frac{m_1 - m_2}{s \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = \frac{m_1 - m_2}{s} \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

$$S = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

RESULTS AND DISCUSSIONS

Variety-wise area distribution

The varieties of potato can be divided into three categories depending on the duration of the crop, i.e., a) early varieties, b) medium varieties, and c) late varieties (Vashisht and Lal, 2005c). Kufri Pukhraj yields 130 qtl. Per acre in 70-90 days. The maturity period for Kufri Jyoti is about 90-110 days and yields about 80-120 per acre Kufri Badshah is a late variety, and its expected yield is 130 qtl. Per acre within the maturity period of

100-110 days, whereas these figures for Kufri Ashoka are 110 qtl. Per acre and 75-80 days, respectively. Overall, 43 per cent of selected farmers preferred Kufri Pukhraj, 36 per cent of farmers preferred Kufri Jyoti, and 14.2 per cent of the selected cultivate Kufri Badshah in the Jalandhar district of Punjab (Table 2). Most of the farmers cultivate the Kufri Pukhraj variety due to its resistance to early blight and moderately resistant to late blight disease. Moreover, it is easy to cook variety with a waxy texture and mild flavour and also it is free from discolouration after cooking.

Sources of Potato seed

Seed is an essential input for different crops. Healthy seeds in vegetatively propagated crops like potato are critical (Vashisht and Lal, 2005). In developing countries, farmers often have three significant sources of seed: seed purchased from the seed industry or cold stores, seed obtained from the other farmers and seed retained from the previous year's crop. The farmer himself produced more than 85 per cent of the seed consumed in India. Moreover, the Punjab state has established itself as a seed-producing state of potato (Vashisht *et al.*, 2005). The share of the organised seed sector is meagre because of the high price of certified seeds and their non-availability in terms of proper place and time (Verma and Sidhu, 2009). It is essential to mention

Table 2: Variety-wise area of potato cultivated by the selected farmers in Jalandhar district

Variety	Small	Medium	Large	Overall
Kufri Pukhraj	20 (50)	17 (42.5)	15 (37.5)	52 (43.3)
Kufri Jyoti	15 (37.5)	15 (37.5)	13 (32.5)	43 (35.8)
Kufri Badshah	3 (7.5)	6 (15)	8 (20)	17 (14.2)
Any other	2 (5)	2 (5)	4 (10)	8 (6.7)
Total	40 (100)	40 (100)	40 (100)	120 (100)

Source: Field survey

here that the seed consumption is higher in the case of the potato because of its higher seed rate. As a result, seeds alone accounted for 38-40 per cent of the total cost of potato production (Dahiya and Singh, 1992; Sah *et al.*, 2010).

The source of potato seed by selected farmers is shown in Table 3. The results revealed that most of the sampled small, about 38 per cent used self-retained seed, followed by seed from private seed dealers, about 25 per cent, 8 per cent from relatives/friends and cold storage and 5 per cent from CPRS, Centre of Excellence and fellow farmers. Among the medium farmers, 45 per cent of farmers used self-retained seed, followed by seed from private seed dealers, about 15 per cent, 13 per cent of farmers used cold storage seed, 8 per cent of farmers used seed from fellow farmers and the Department of Horticulture (Pb), about 5 per cent of farmers from CPRS and Centre of Excellence and only 3 per cent of farmers used seed from relatives/friends. Among large farmers, 63 per cent of farmers used self-retained seed, followed by 13 per cent from CPRS, 10 per cent from Centre of Excellence, Dhogri (Jalandhar), 8 per cent from cold storage, 5 per cent from the Department of Horticulture, PAU

(Ludhiana) and only 3 per cent of farmers followed private seed dealer. Overall, about 48 per cent used self-retained seed, followed by seed from private seed dealers (about 17 per cent) and cold storage it's (about 9 per cent), 8 per cent from CPRS, 7 per cent followed by Centre of Excellence Dhogri (Jalandhar), about 4 per cent of farmers went by Fellow farmers and Dept. of Horticulture PAU (Ludhiana), Only 3 per cent of farmers used seed from relatives/friends. The high use of self-retained seed may be due to the high cost of the purchased seed. Moreover, the farmers had more confidence in the self-retained seed. The potato seed from friends or relatives was either free or exchanged in barter. The potato farmers were very much conscious of the quality of the potato seed.

Seed Rate is the quantity of seed of a crop required to sow a unit area of land for optimum crop production. Using the recommended seed rate is necessary for maintaining the optimum plant population in the field for a higher yield harvest. It is also required to prevent seed wastage from excess sowing, which reduces the initial cost of production. It is also necessary to know the quantity of seed needed for sowing in advance and ensure quality crop production. The recommended seed rate by PAU for

Table 3: Sources for the seed of potato crop of selected farmers in Jalandhar district

Source of potato seed	Small	Medium	Large	Overall
Self-retained seed	15 (37.5)	18 (45)	25 (62.5)	58 (48.3)
Fellow farmers	2 (5)	3 (7.5)	0 (0)	5 (4.1)
Relatives/friends	3 (7.5)	1 (2.5)	0 (0)	4 (3.3)
Centre of excellence (Dogri)	2 (5)	2 (5)	4 (10)	8 (6.6)
Cold storage	3 (7.5)	5 (12.5)	3 (7.5)	11 (9.1)
CPRS (ICAR)	2 (5)	2 (5)	5 (12.5)	9 (7.5)
Dept. of Horticulture, Punjab	0 (0)	3 (7.5)	2 (5)	5 (4.1)
Private seed dealer	13 (25)	6 (15)	1 (2.5)	20 (16.6)
Total	40 (100)	40 (100)	40 (100)	120(100)

Source: Field Survey

Potato crops is 13-18 Qtl/acre for all varieties. The seed rate adopted was highest among large farmers (15.4 Qtl/acre), followed by selected medium farmers (15.2 Qtl/acre) and 14.3 Qtl/acre by small farmers in the study area (Table 4).

The seed replacement rate of sample farmers

The number of generations up to which the seed could be used from the previous crop season without resorting to renewal is another crucial aspect and vital for the maintenance of the productivity of crops. The deterioration in the quality of seed may result from physical admixtures and loss of genetic vigour and germination power. The admixture may occur in the field, at the threshing yard or even in storage when seeds of other varieties and other crops get mixed with the variety. The deterioration in the quality of seed results in a loss of productivity per unit of area. The seed renewal period recommended by the International Potato Centre; in Lima (Peru) is four years for the potato crop. It is generally assumed that high SRR holds the key to higher production. But in Punjab, as per official figures, the SRRs were low, but productivity continued to be the highest in the country because the actual SRRs of quality seeds were high. The progressive farmers of Punjab exchanged quality seeds among themselves. In this way, farmer to farmer exchange of seeds is very common in Punjab.

Table 4: Potato seed rate in Jalandhar district

Farm Category	Seed rate (q/acre)	Recommended Seed Rate by PAU (Qtl/acre)
Small	14.3	13-18
Medium	15.2	13-18
Large	15.4	13-18
Average	14.9	13-18

Source: - Field Survey

The barter system of seeds among the farmers was an ancient form of transaction of seeds and formed the most popular source of seeds (Reddy, 1989). The economically poor and traditionally conservative farmers preferred to procure seeds locally from the farmers who had already grown good crops. Besides practising the barter system of sources, the farmers also made cash payments to their fellow farmers. The seeds were also given free by fellow farmers and relatives in some cases. The farmers preferred this source because of its reliability (Sidhu, 1995). In Punjab, the lateral spread of seed among the farmers was high. Moreover, the yield of a crop was also affected by many other inputs. The SRRs in the case of sample farmers for certified seeds for potato crops have been worked out separately and discussed in Table 5. The sample farmers took the certified seeds from the Centre of Excellence Dhogri (Jalandhar), Central Potato Research Station (Jalandhar) and Departments of Horticulture. The study showed that the SRR of selected farmers was 19.5 per cent for the potato crop. Due to this factor, the SRR was low for the potato crop.

The seed Replacement Rate was found to be 19.5 per cent in the Jalandhar district of Punjab. It was highest for large farmers, i.e., 27.5 per cent, 19.8 per cent for medium farmers and 11.2 per cent for small farmers in the study area. Seed replacement rate was higher among large farmers due to the better economic condition of large farmers

Table 5: Seed Replacement Rate of Certified Seed of Potato crop in Jalandhar district

Farm Category	Seed Replacement Rate (%)
Small	11.2
Medium	19.8
Large	27.5
Average	19.5

Source: Field Survey

to buy seed from institutional sources and their more heightened awareness about the quality of seed.

The Yield difference was found by taking into account the sample farmers who used both certified and non-certified seeds. There was 10 per cent of small farmers, 18 per cent of medium and 28 per cent of large farmers who used both certified and non-certified seed in the study area (Table 6). The yield of potato crops using certified seed was higher than non-certified seed. The percentage difference among small and medium farmers was 17 per cent, 11 per cent among large farmers and 15 per cent overall in the Jalandhar district. The yield of the crop planted was statistically high at a five per cent level of significance among all farm size categories in the study area.

Farmers faced many constraints in potato seed production. An opinion survey was carried out in the study area to determine the constraints/problems faced by various farmers. Among small farmers, the main problem was high prices of insecticides and pesticides (70 per cent), followed by high costs of certified seed (63 per cent), covid-related restrictions (48 per cent), fluctuation in prices of potato seed (45 per cent), pest and disease attack (38 per cent), lack of access to extension services (35 per cent), no public procurement at the MSP (30 per

cent), non-availability of labour during peak period (25 per cent), certified seed availability not at the appropriate time (23 per cent) (Table 7). Among medium farmers, the primary constraint was high prices of certified seed (68 per cent), followed by the high cost of insecticides and pesticides (65 per cent), the problem faced by farmers due to fluctuation of prices and no public procurement at the MSP was (58 per cent) each, covid related restriction (53 per cent), lack of access to extension services (50 per cent), and each pest and disease attack (48 per cent), no availability of labour during peak period (43 per cent) and certified seed availability not at the appropriate time was (30 per cent). Among large farmers, the major constraint was high prices of certified seed (78 per cent), no public procurement at the MSP (73 per cent), no availability of labour during peak period (70 per cent), pest and disease attack (68 per cent), the problem faced by farmers due to fluctuation in prices and high prices of insecticides and pesticides was (63 per cent) each, lack of access to extension services (60 per cent), covid related restriction (58 per cent), certified seed availability not at the appropriate time was (45 per cent). The result are also in confirmity with the study of Layek and Mula (2021). Overall, the major constraint in the Jalandhar district was high prices of certified seed (69 per cent), followed

Table 6: Difference in yield among potato crops raised with certified and non-certified seeds in Jalandhar district

Particulars	Small	Medium	Large	Overall
Total no. of farmers	40 (100)	40 (100)	40 (100)	120 (100)
No. of farmers using both certified and non-certified seed	4 (10)	7 (17.5)	11 (27.5)	22 (18.3)
Yield-Certified Seed (qtl/acre)	110.5	118.5	122	117
Yield-Non-Certified Seed (qtl/acre)	99.02	101.4	110.4	103.6
Difference in yield	16.9	17.1	11.6	15.2
Per cent Difference	17.0	16.8	10.5	14.7
t-value	1.73**	2.28**	0.67**	1.94**

Source: Field Survey

Table 7: Constraints faced by farmers of Potato seed Production in Jalandhar district (Multiple responses)

Constraints	Small (40)	Medium (40)	Large (40)	Overall (120)
Non-availability of labour during peak period	10 (25)	17 (42.5)	28 (70)	55 (45.8)
Fluctuation in Price of potato seed	18 (45)	23 (57.5)	25 (62.5)	66 (55)
Lack of Public Procurement at the MSP	12 (30)	23 (57.5)	29 (72.5)	64 (53.3)
The high price of certified seed	25 (62.5)	27 (67.5)	31 (77.5)	83 (69.1)
Certified seed availability is not at the appropriate time	9 (22.5)	12 (30)	18 (45)	39 (32.5)
Lack of access to extension services	14 (35)	20 (50)	24 (60)	58 (48.3)
High cost of insecticides and pesticides	28 (70)	26 (65)	25 (62.5)	79 (65.8)
Pest and Disease attack	15 (37.5)	19 (47.5)	27 (67.5)	61 (50.8)
Covid related restrictions	19 (47.5)	21 (52.5)	23 (57.5)	63 (52.5)

Source: Field survey

by the high cost of insecticides and pesticides (66 per cent), fluctuation in price (55 per cent), no public procurement at the MSP (53 per cent), covid related restriction (52 per cent), pest and disease attack (51 per cent), lack of access to extension services (48 per cent), non-availability of labour during peak period (46 per cent) and certified seed availability not at the appropriate time (33 per cent). The results of the study are in close conformity with Kaur *et al* (2020) who also reported that major production constraints in seed potato crop were the high cost of insecticides, pesticides and fungicides, the high price of certified seed availability not at the appropriate time.

CONCLUSION

The study found that only 18 per cent of selected respondents procured seeds from government agencies like CPRS (ICAR), the Centre of excellence (Dogri) and the Department of Horticulture Punjab. To reduce the dependence of potato seed growers on private agencies for seed procurement, the centre and state government should make joint efforts to increase seed production in these institutions. The overall seed replacement rate was 19.5 per cent for the potato crop, which is low. The main reason for the low seed replacement rate for potato

crops was the high cost of certified seeds. The government should spend on research and development of potato seed to increase the seed replacement rate through ICAR, PAU, and other important research institutes. The union and state governments may provide the required funds in this regard. The study further revealed that the yield of potato crops by using certified seed was higher than non-certified seed. The per cent difference in yield of potato crops grown by certified and non-certified seed among small and medium farmers was 17 per cent, 11 per cent among large farmers and 15 per cent overall in the Jalandhar district of Punjab. Extension services should be strengthened in the study area to educate the potato growers on more use of certified seeds. The study highlighted that the primary constraint faced by potato seed growers were high prices of certified sources (69.1 per cent), high cost of pesticides and insecticides (65.8 per cent), fluctuations in the price of potato seed (55 per cent), lack of public procurement at MSP (53.3 per cent), covid related restrictions (52.5 per cent) and lack of extension facilities (48.3 per cent). To combat the above-stated problems government should fix MSP for the potato crop. This ensured price of potato crop will also lead to the diversification in the state and save the state from the problems arising

from wheat paddy monoculture. Government should also provide the inputs at a subsidised rate to potato seed growers, and extension services should also be provided to the farmers for judicious use of these inputs.

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