INTERNATIONAL JOURNAL OF PLANT PROTECTION
VOLUME 13 | ISSUE 2 | OCTOBER, 2020 | 143-147

● ISSN-0974-2670 | Visit us : *www.researchjournal.co.in*

IJPP

RESEARCH PAPER

DOI : 10.15740/HAS/IJPP/13.2/143-147

Assessment of technological gap and performance of management of common scab of potato

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ARITCLE INFO

Received : 21.07.2020
Revised : 02.09.2020
Accepted : 17.09.2020

KEY WORDS :
Common scab, Management, Potato, *Streptomyces scabies,* Technological gap, Disease incidence

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ABSTRACT

Common scab (*Streptomyces scabies*) disease of potato is becoming prominent in many potato-growing districts of Rajasthan resulting in economic losses, since a decade. The experiment was executed out to assess the technological gap and performance of management approaches. Potato tubers of cultivar *Kufri Bahar* was treated with 3.0 per cent boric acid before planting (spray) for the duration of time 30 min and evaluated against the pathogen. This experiment was conducted as on farm trials (OFT) at different villages likewise Phoospura, Naurangabad, Moosalpur, Saktpur and Sarkankhera in Dholpur district for two years (2017-18 to 2018-19). As a result of this experiment treated tuber plants registered the lowest disease incidence (10.6%) and disease control (75.05) as compared to existing farmer practices (FP). The adoption of demonstrated technology was improved potato production and plant protection measures. The OFT was effective in changing the attitude, skill and knowledge of plant protection approach. Potato yield also increased upto 10.37 per cent as compared to the existing FP. Results indicates that plant protection approach increased the net income by Rs. 80580/- ha over the existing FP. It is suggested to organize demonstrations at farmers field on technology assessed through OFT by agriculture department for minimizing the technological gap and increased yield of quality potato.

How to view point the article : Balai, Laxman Prasad, Sharma, D.R., Singh, Navab and Meena, S.M. (2020). Assessment of technological gap and performance of management of common scab of potato. *Internat. J. Plant Protec.*, **13**(2) : 143-147, **DOI : 10.15740/HAS/IJPP/13.2/143-147,**

INTRODUCTION

Potato (*Solanum tuberosum* L.) is a widely grown vegetable cash crop in eastern –Rajasthan and western Uttar Pradesh. Globally, it occupies the fourth place among food crops after rice, wheat and maize. The total area under potato cultivation in Rajasthan is about 13.82 thousand hectares with the total production of 278.52 million tonnes and an average yield of 20.15 t/ha during the year 2017-18 (NHB, 2018). The crop is suffers from large number of soil and tuber borne diseases among, which common scab caused by *Streptomyces scabies*

(Thaxter) Waksman and Henriciis predominant in many potato-growing regions of the country. Common scab is economically important disease of potato in many parts of the world (Lambert and Loria, 1989). It causes 5-60 per cent of economic losses depending on the disease severity (Singh and Shekhawat, 1994 and Singh *et al.,* 1997). While, the disease does not affect the yield quantitatively but, deteriorate of the market quality and acceptability tubers are unsightly and have poor customer appeal, for seed adversely affecting the market price of the potato. The disease mainly affects the young tubers and its infection stops with the ripening of tubers. The disease earliest symptoms are tubers appear small, circular to irregular lesions around the lenticels, periderm brown and rough. Infected tubers and soil sieve are the main source of inoculum. The pathogen is carried through the infected seed tubers to the soil spreads and infects the crop under favourable condition. Effective tuber treatment can reduce the risk of common scab infection spreading from the mother tuber to the progeny and virgin soil. Shekhawat (1990) suggested treating seed tubers by dipping in 3.0 per cent boric acid for 30 minutes to reduce incidence of common scab as well as other seed borne inoculum. It has been identified as a safe chemical, which can replace hazardous organomercurials for controlling common scab, dry rots (*Fusarium* spp.) and soft rots (*Erwinia* spp.) of potato (Arora, 2005).

Factors responsible for development and spread of the disease:

Periodic surveys of different potato fields were conducted to find out the various factors involved in high incidence of the common scab and data on response from farmers for following factors were found associated with high disease incidence:

– Most of the potato grown fields have alkaline soil (pH >7).

– At the time of tuber formation conditions are warm and dry soil severe infection.

– No use of fungicides is tuber seed treatment. It was found that initially, none of the farmer goes for tuber seed treatment and on the appearance of the disease, they use fungicides indiscriminately.

– Majority of farmers have poor economic condition.

– Lack of awareness is about role of seed, soil treatment and less social participation activities.

– Most of the farmers are not doing summer ploughing and weed management.

– In Dholpur district, farmers are mainly cultivating potato crop. Due to mono culturing of this crop, inoculum of soil borne diseases has been increased tremendously. Once the inoculums establish itself in the field, it becomes very difficult to eradicate it.

– Most of the farmers are using local tuber seed (cold storage tuber).

In absence of resistant varieties, farmers are obliged to grow the varieties, which succumb to the disease very easily. Keeping in view the devastating magnitude of the disease, Krishi Vigyan Kendra, Dholpur has designed an intervention on common scab of potato management and the technology was spread to the farmers by conducting the OFT and front-line demonstration.

MATERIAL AND METHODS

Assessment and impact of management practices in potato crop was carried out through OFT, conducted during the winter (*Rabi*) season for two years (2017-18 and 2018-19) at the potato growers fields at different locations of the villages like Phoospura, Naurangabad, Moosalpur, Saktpur and Sarkankhera in Dholpur district. OFT was conducted at Krishi Vigyan Kendra, Dholpur (SKN Agriculture University, Jobner), to validate the efficacy of common scab of potato management recommended technology was taken from Central Potato Research Institute, Shimla (H.P.) and intervention on this technology was done according to the location specific problem. For conducting the OFT, five innovative and receptive farmers were selected and area under each trial was 0.20 ha. The seed tubers were treated with 3.0 per cent boric acid (spray), the formulation was sprinkled equally over the seed tubers. The tubers surface was made wet with water and tubers were rolled to cover them with the chemical equally. The treatment was applied immediately before planting the seed tubers in the field, after the treatment tubers were planted at 60 x 25 cm spacing in 3 x 2 m plots (5 rows with 10 tubers each). The applicable management practices were used for potato variety *i.e.,* Kufri Bahar. Planting was done in the afternoon hrs in the first week of November in both the years under the supervision of KVK scientists. The OFT farmers were facilitated by KVK scientists for performing field operations likewise FYM, fertilizer, preparing bed for planting, irrigation, spraying, weeding,

harvesting and marketing of potato etc. during the experiment of farmers were training and field visits as per requirement. Keeping in view the above-mentioned factors, following treatments were given either alone or in combination and was compared with the FP.

T_1-Farmer's practice

T_2- Tuber treatment with boric acid @ 3.0% before planting.

Training to the farmers was important with respect to envisaged technological intervention. Plot-wise data was recorded from demonstrated practice and FP. To know the avoidable losses due to pathogen, ten plants were selected from each replication in demonstrated technology and FP set of plots and observations were taken on scab infested potato have 100 per cent disease incidence (I), with average disease index (DI) 1.0-2.0 and 1.5 -2.5, respectively.

Each treatment was replicate five times in selective farmer fields. All other demonstrated practices were required for cultivation of the crop. The potato crop was harvested 100 to 120 days after sowing (DAS). After washing the tubers, common scab disease incidence was recorded separately. Disease incidence and index were recorded after harvest on 100 tubers selected at randomly from each replication. Observations on per cent disease incidence were recorded as per the formula given by Singh and Tyagi (1996). Disease incidence was measured on a scale of 0 to 5. Disease index (DI) was calculated by using formula described by Jeswani and Sharma (1990). Per cent reduction over control using following formula:

$$\text{Disease reduction (\%)} = \frac{\text{Disease incidence in control} - \text{Disease incidence in treatment}}{\text{Disease incidences in control}} \times 100$$

Field visits during to OFT plots and FP plot and finally extension gap, technology gap and technology index were calculated as given as formula suggested by Samui *et al.* (2000) and Dayanand and Mehta (2012) as given below.

$$\text{Per cent increase in yield} = \frac{\text{Demonstration yield} - \text{Farmers practice yield}}{\text{Farmers practice yield}} \times 100$$

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield - Yield under existing farmer practice

$$\text{Technology index} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}} \times 100$$

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

Disease incidence and index of common scab:

Average percent potato scab disease incidence, yield performance and economics of OFT of FP and demonstrated technology was assessed. The perusal of the data (Table 1) revealed that there was a remarkable decrease in disease incidence where treatment was done as compared to the untreated one. During 2017-18, it was found that 12.3 per cent disease incidence and 69.90 per cent disease control was achieved in demonstrated technology. The crop yield was found 264.50 q/ha in demonstrated technology and as compared to FP 246.20 q/ha. There was a net return of Rs. 62,700 rupees /ha and B:C ratio of 1.65 was achieved from demonstrated technology, respectively as compared to FP Rs. 52,720 rupees /ha and B:C ratio of 1.55 only. During 2018-19, 10.6 per cent disease incidence and 75.05 per cent disease control, 274.30 q/ha yield and Rs. 80,580 net return was achieved from demonstrated technology, respectively as compared to 42.5 per cent disease incidence and 242.1 q/ha yield and Rs. 67,660 net return were found in FP and B:C ratio of 1.96 observed as compared to 1.84 in FP.

Table 1 : Assessment disease incidence and management, yield and economics in potato crop

Technology	No. of trials	Disease incidence Scab (%)		Per cent disease control		Yield (q/ha)		Net returns (Rs./ha)		B:C ratio	
		2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
T_1 -Farmer practice	5	40.4	42.5	0	0	246.20	242.10	52720	67660	1.55	1.84
T_2- Tuber treatment with boric acid @ 3.0% before planting		12.3	10.6	69.90	75.05	264.50	274.30	62700	80580	1.65	1.96

Table 2 : Analysis of extension, technology gap with yield on farm trials in potato crop

Year	Area	Potential yield (qt/ha)	Demonstration yield (qt/ha)	Farmer yield (qt/ha)	Yield increase over FP (%)	Ext Gap (qt/ha)	Tech Gap (qt/ha)	Tech index (%)
2017-18	1.0	300	264.50	246.20	7.43	18.3	35.5	11.33
2018-19	1.0	300	274.30	242.10	13.30	32.2	25.7	8.56
Over all	1.0	300	269.40	244.15	10.37	25.25	30.60	9.95

Data (Table 2) revealed that an extension gap of 18.3-32.2 q ha^{-1} was found between demonstrated technology and FP and on average basis, the extension gap was 25.25 q ha^{-1}. The lowest extension gap (18.3 q ha^{-1}) was recorded in the year 2017-18. Such gap might be attributed to adoption of improved technology especially high yielding varieties sown with the help of seed tuber planter cum fertilizer drill with the balanced nutrition and appropriate plant protection measures in demonstration, which resulted in higher tuber yield than the traditional FP under on-farm condition. The new technology will eventually motivate the farmer to adopt the promising technology with the use of proper management practices for increasing the profitability. These results are in agreement with the findings of Singh and Chaudhari (2012), Uikey *et al.* (2018) and Singh *et al.* (2020) that there is a wide technology gap among the years. It was highest (35.5 t ha^{-1}) in the year 2017-18 while lowest (25.7 t ha^{-1}) in the year 2018-19. The average technology gap was recorded (30.60 t ha^{-1}). The difference in technology gap in different fields is due to better performance of recommended varieties with demonstrated practices, more feasibility of demonstrated technologies are during the course of investigation with the other factors like monitoring by farmers, soil type and fertility status of the fields. Similarly, the technology index for the years in the study was in relevance with technology gap. Higher technology index reflects the inadequate proven technology for transferring to farmers and insufficient extension services for transfer of technology. The technology index shows the feasibility of the evolved technology at the FP. In this study overall 9.95 per cent technology index was recorded, which varied from 8.56 per cent (2018-19) to 11.33 per cent (2017-18).

Assessed over FP (these is no seed treatment fungicides as well as bio agents and soil treatment, no crop rotation, therefore, soil borne pathogen year after build up population and ultimately pathogen reduction crop yield). This study indicates that the boric acid was found effective in reducing common scab incidence and increasing the yield in potato. Boric acid in our studies has shown measurable control of 69.90 and 75.05 per cent of common scab over FP, which is confirmation with the results of Somani (2009). Outcome of the OFT organized clearly brings out that the dissemination of assessed technology is feasible, economically viable and environmentally safe for containing common scab in potato. The assessment could convince because of its obvious advantages and effective management of common scab in potato. These innovative practices showed solving the farmer's problem, decision-making and ability to modify their FP. Many root pathogens have been control by ploughing organic materials in the soil (Ghaffar, 1993). Based on outcome from OFT, assessment of management practices, FLD were organized and their yield performance and economics of demonstrated technology and FP were analyzed and presented in Table 1 and 2. Thus, favourable cost benefit ratio and higher net returns proved the economic viability of the demonstrated technology and convinced the farmers on the utility of technology provided at real farming situation.

Conclusion:

Boric acid tuber treatment approach for development and adaptation of disease resistant/ tolerant high yielding crop variety plays a critical role. It is a well-established technology to reduce the disease pressure on a crop. It is not only reduced the cost of cultivation by curtailment in expenditure on pesticide purchase and labor, but also increased the farm income through quality improvement in crop yield.

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