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Impact of different planting dates on the incidence of viral diseases caused by aphid and white fly on potato

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ABSTRACT

The present field study was conducted to find out the effect of different planting dates during rabi season from November to February in 2012-13 and 2013-14, respectively on the infection of various viral diseases caused by Aphids, *Myzus persicae* (Sulzer) and *Aphis gossypii* Glover and white fly, *Bemisia tabaci* Genn on potato at Adisaptagram Block Seed Farm, Hooghly, West Bengal. The four types of viral diseases, viz. mild mosaic, severe mosaic, leaf roll and apical leaf curl diseases were found to infect the potato crop in this locality. The incidence of viral diseases on potato crop was observed in between first and third week of January and then their infection was gradually increased up to full maturity of the crop. The percentage of viral disease infection was higher in late planted and harvested crop compared to those planted and harvested early. Per cent viral disease incidence was found maximum in P_5 (26.25-35.50%), followed by P_4 (28.00-30.75%), P_3 (26.00-29.00%), P_2 (24.00-25.50%) and P_1 (17.75-18.00%) respectively. The per cent leaf roll disease incidence (9.00-20.75%) outnumbered the other viral diseases and maximum percentage of PLRV (Potato leaf roll virus) infection was found during later stage of the crop grown in all the five planting dates. The incidence of mild mosaic was slightly higher (4.00-8.00%) than the incidence of severe mosaic (2.50-5.50%) and it was mainly confined in early to middle phase of crop growth. The incidence of apical leaf curl disease was least and its infection was always higher in later planted crops. The maximum yield of potato tuber was found in P_2, followed by P_1, P_3 and P_5 respectively.

1. Introduction

Potato, *Solanum tuberosum* L. is a world food crop and can be compared only with rice, wheat and maize for its contribution towards securing food and nutrition and avoiding the poverty and hunger especially in the developing world. In India, potato is grown in almost all the states and under very diverse conditions. At present, India is in a position to export substantial quantities of table and seed potatoes and earn a good amount of foreign exchange. Among the states, Uttar Pradesh, West Bengal and Bihar accounted for nearly 71% area and 76% production of the country (Chadha, 2002). In West Bengal, potato is the most important food crop, next to cereals and the states ranks second position in area and production but first in productivity in the country (Rai, 2003). Like other crops, potato too is vulnerable to attack of pest both in the field as well as in godowns. Butani and Verma (1976) and Mishra and Agarwal (1988) gave a comprehensive list of insect and non-insect pests damaging this crop in India. Among these pests, aphids, *Myzus persicae* (Sulzer) and *Aphis* **1.** *gossypii* Glover (Aphididae: Hemiptera) and whitefly, *Bemisia tabaci* (Gennadius) (Aleyrodidae: Hemiptera) are most important sucking pests of potato, which not only cause damage by sucking plant sap, but also transmitting different potato viruses. Among various viral diseases, mild mosaic, normally caused by potato virus X (PVX) and potato virus S (PVS); severe mosaic, generally produced by potato virus Y, F, G (X+Y) and (X+A); leaf roll caused by potato leaf roll virus (PLRV) and apical leaf curl disease, occurred by potato apical leaf curl virus (Biswas *et al*., 2004). Out of these four viral diseases, severe mosaic and leaf roll diseases were readily transmitted by aphids, while mild mosaic was partially transmitted by aphid (Khurana, 1999) ans apical leaf curl virus was spread by whitefly (Gary *et al*., 2001). Thus two sucking pest may act as one of the limiting factor for the production of viral disease free potato seed tubers in the state. Thus to reduce the incidence of viral diseases caused by aphids and whitefly, various types longer persistent synthetic pesticides are applied randomly to decrease the incidence of viral diseases as well as pest population. These pesticides are responsible to pollute the total ecosystem. Thus a field experiment was conducted to find out the impact of different planting dates against viral disease incidence caused by aphid and whitefly on potato.

2. Methods and Materials

The present field investigation was carried out to find out the role of different planting dates on the incidence of various viral diseases caused by aphids, *Myzus persicae* (Sulzer) and *Aphis gossypii* Glover (Aphididae: Hemiptera) and whitefly, *Bemisia tabaci* (Gennadius) (Aleyrodidae: Hemiptera) on potato during rabi season of two crop growing season in

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2012-2013 and 2013-2014 from November to March at Adisaptagram Block Seed Farm, Hooghly, West Bengal. Potato cv. kufri chandramukhi was planted by having five dates of planting (P_1-P_5) starting from third week of November with one week interval upto third week of December (P_1= 15-11-2012 and 15-11-2013; P_2= 23-11-2012 and 23-11-2013; P_3=01-12-2012 and 01-12-2013; P_4= 08-12-2012 and 08-12-2013 and P_5= 15-12-2012 and 15-12-2013, respectively) in 6m X 2m plots along with a spacing of 60cm X 20cm row to row and plant to plant distance, respectively. The field trial was undertaken in a randomized block design (RBD) with four replications. All standard agronomic practices recommended for this region was strictly followed during growing the crop, except application of any insecticides to manage the disease incidence by aphids and whitefly. The crop was allowed to grow up to full maturity of 80 days for respective dates of planting, followed by dehaulming of the crop and finally ten days after dehaulming, the potato tubers was harvested from the field.

During the crop season, weekly observation on the incidence of different viral diseases caused by aphid and whitefly on potato were recorded in each plot. The incidence of different viral diseases along with per cent infestation was noted during the period of field study. The number and weight of healthy and damaged tubers from each plot were observed during harvesting. Thereafter, the incidence of different viral diseases, percent damage extent and yield losses were worked out following standard method of statistical analysis.

3. Results

During the period of study, four types of viral diseases were found to infect the potato crop in this region. These were mild mosaic, severe mosaic, potato leaf roll virus and apical leaf curl disease. During 2012-13, the infection of viral diseases on potato crop initiated in between first and third week of January (Table 1) in all planting dates. These diseases were found first during first week of January in P_1 and P_2 while it was observed during third week of January in P_3 and P_5 and second week of January in P_4. Then the incidence of viral diseases was slowly increased till the dehaulming of the crop in all the five cases. Per cent viral disease was found maximum in P_4 (28.00) and next in the order were P_5 (26.25), P_3 (26.00), P_2 (24.00) and P_1 (18.00), respectively. There was no significant difference in maximum percentage of viral diseases incidence among different planting, except P_1 (first one). Among four viral diseases, the leaf roll disease was most dominant by showing 10.50–16.50% infection in different planting dates, while mild mosaic infection (4.00–6.50%) was slightly higher than severe mosaic infection (3.50-5.50%). But the incidence pattern of apical leaf curl disease was sporadic and its infection was noticed only in P_2, P_4 and P_5 planting dates, ranging from 1.00-2.00%. Mosaics were appeared during early stage of crop growth and in later stage, their infection become static, while the leaf roll infection was started slightly later in the season and then gradually increased upto dehaulming of the crop.

During 2013-2014, the viral disease infection was first appeared in first week of January in first two planting dates (P_1 and P_2), whereas it was second week of January in P_3 and P_4 and third week of January in P_5 (Table 2). Thereafter their infection was gradually increased up to full maturity of 80 days for respective dates of planting. The highest percentage (%) of viral disease infection was recorded in P_5 (35.50%), followed by P_4 (30.75%), P_3 (29.00%), P_2 (25.50%) and P_1 (17.75%), respectively. The crops planted on December were at par among themselves when the maximum percentage of viral disease incidence was concerned. The mild mosaic and severe mosaic diseases were observed to infect the crop slightly earlier than leaf roll disease, though the percentage of infection of mild mosaic (5.00-8.00) was higher than severe mosaic (2.50-5.00). The infection of both the mosaic diseases was gradually increased up to full maturity of the crop in all the planting dates. The incidence of leaf roll disease was recorded slightly later than the mosaics and the disease exhibited highest infection rate of 9.00-20.75% irrespective of all planting dates. The apical leaf curl disease was found in all the five dates of planting and its infection was varied from 0.75-1.75% and this disease was recorded during full vegetative phase of the crop.

4. Discussion

It is evident from both years of present study that the incidence of viral diseases on potato crop was found in between first and third week of January and the their infection was gradually increased up to full maturity of the crop. The percentage of infection was always higher in the late planted and harvested crop compared to those planted and harvested early.

Table 1. Per cent viral disease incidence on potato caused by aphid and white fly under different planting dates during 2012-2013 at Adisaptagram Block Seed Farm, Hooghly, West Bengal.
(Mean of four replications)

Different Planting dates	Percen viral disease incidence on potato caused by aphid and whitefly on different dates of observation										Mean Population	Yield (t/ha)
	January 2013				February 2013				March 2013			
	I WK	II WK	III WK	IV WK	I WK	II WK	III WK	IV WK	I WK	II WK		
P_1	1.00 (3.93)	5.50 (13.32)	10.00 (18.19)	12.50 (20.42)	13.75 (21.44)	18.00 (24.90)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	5.52	29.37
P_2	3.00 (9.65)	6.00 (13.92)	9.00 (17.16)	13.00 (20.82)	16.75 (23.98)	21.00 (27.18)	24.00 (29.28)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	8.43	29.59
P_3	0.00 (0.00)	0.00 (0.00)	7.75 (15.98)	11.25 (19.51)	15.50 (23.12)	18.50 (25.38)	22.75 (28.39)	26.00 (30.58)	0.00 (0.00)	0.00 (0.00)	9.25	27.72
P_4	0.00 (0.00)	1.25 (4.52)	1.50 (5.96)	6.50 (14.44)	10.75 (18.87)	16.00 (23.44)	21.25 (27.31)	24.25 (29.39)	28.00 (31.88)	0.00 (0.00)	9.95	27.57
P_5	0.00 (0.00)	0.00 (0.00)	4.25 (11.69)	7.50 (15.78)	10.25 (18.50)	13.75 (21.62)	18.00 (24.25)	22.00 (27.13)	26.25 (30.04)	27.25 (30.72)	11.38	25.93

Source of variation

	Dates of observation	Planting	Date of observation X Planting
SE (m)±	0.34	0.57	1.27
C.D.- 0.05	0.79	1.32	2.95

*Figures in Parenthesis are logarithmic transformed value.

Table 2. Per cent viral disease incidence on potato caused by aphid and white fly under different planting dates during 2013-2014 at Adisaptagram Block Seed Farm, Hooghly, West Bengal.
(Mean of four replications)

Different Planting dates	Percen viral disease incidence on potato caused by aphid and whitefly on different dates of observation										Mean Population	Yield (t/ha)
	January 2014				February 2014				March 2014			
	I WK	II WK	III WK	IV WK	I WK	II WK	III WK	IV WK	I WK	II WK		
P_1	3.75 (10.75)	6.50 (14.51)	9.25 (17.32)	11.75 (19.76	15.50 (23.01)	17.75 (24.81)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	5.86	28.02
P_2	1.50 (4.91)	4.75 (12.29)	7.50 (15.72)	11.50 (19.69)	16.00 (23.43)	21.25 (27.32)	25.50 (30.22)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	8.00	28.57
P_3	0.00 (0.00)	2.25 (7.41)	6.50 (14.53)	11.25 (19.34)	15.75 (23.10)	19.75 (26.18)	24.50 (29.48)	29.00 (33.83)	0.00 (0.00)	0.00 (0.00)	9.91	26.92
P_4	0.00 (0.00)	1.25 (4.52)	3.75 (10.70)	9.75 (17.75)	15.50 (22.92)	21.25 (27.27)	24.25 (28.97)	27.50 (31.21)	30.75 (33.61)	0.00 (0.00)	12.09	25.62
P_5	0.00 (0.00)	0.00 (0.00)	2.50 (7.75)	5.50 (13.28)	13.50 (21.59)	20.50 (26.78)	24.75 (29.73)	30.00 (33.11)	33.00 (35.01)	35.50 (36.51)	15.02	25.60

Source of variation

	Dates of observation	Planting	Date of observation X Planting
SE (m)±	0.40	0.67	1.49
C.D.- 0.05	0.92	1.54	3.45

*Figures in Parenthesis are logarithmic transformed value.

The percent leaf roll disease incidence (9.00-20.75) outnumbered the other viral diseases and maximum percentage of PLRV (Potato leaf roll virus) infection was found during later part of the crop growth (Konar and Basu, 1999) and there was a significant positive correlation between PLRV infection and aphid population (Biswas *et. al*., 1999). The incidence of mild mosaic was slightly higher (4.00-8.00%) than the infection of severe mosaic (2.50-5.50%) and the incidence of mild mosaic was mainly confined during early to mid phase of crop growth as the principle mode of transmission of this disease is contact, (Khurana, 1999), while the incidence of severe mosaic was gradually increased till the haul cutting of the crop, since its casual organisms was transmitted by aphids (Khurana, 1999 and Lakra, 2005). The incidence of apical leaf curl disease was least but its infection was always higher in late planted crops, because late planted crops harboured a large number of whitefly, the vector of virus (Garg *et al*., 2001).

5.Conclusion

It may be concluded that November planted crop was always better than December planted crop regarding the incidence of viral diseases on potato and yield of healthy potato tubers. The findings of Konar *et al*. (2001) and Paul and Konar (2003) regarding the incidence pattern of different viral diseases on potato were also in the line of present investigator.

The highest yield (t/ha) of potato tuber was obtained in P_2 (28.57-29.59), which was closely followed by P_1 (28.02-29.37) and then P_3 (26.92-27.72), P_4 (25.62-27.57) and P_5 (25.60-25.93), respectively, i.e. higher yield of potato tubers was observed during November planted crop was compared to December planted crop. The rise in temperature from the beginning of February and extending to the entire maturity period of the crop was mainly responsible for lower yield of potato tubers in late planting crops.

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7. References

1. Biswas, M. K., De, B.K., Nath, P.S. & Mohasin, Md., (2004). Influence of different weather factors on the population build up of vectors of potato virus. Annals of Plant Protection Sciences, 12(2):352-355.
2. Butani, D.K. and Verma, S., (1976). Pests of vegetables and their control. 3: Potato, Pesticides, 10(4): 46-51.
3. Chadha, K.L., (ed.) (2002): In: Handbook of Horticulture, ICAR, New-Delhi, pp. 8-10.
4. Garg, I.D., Khurana, S.M.P., Kumar, S. and Lakra, B.S., (2001). Association of a geminivirus with potato apical leaf curl in India and its immuno-electron microscopic detection. J. Indian Potato Association, 28: 227-232.
5. Khurana, S.M.P., (1999). In: Potato Viruses and Viral Diseases, CPRI, Shimla, HP., Tech. Bull. No. 35, pp. 2-5.
6. Konar, A. and Basu, A., (1999). Build up of aphids on potato in Hooghly district of West Bengal. Proceedings of the global conference on 'Potato, Global Research and Development, CPRI, Shimla, HP, Volume- I, pp. 477-479.
7. Konar, A., Basu, A., Mukhopadhyay, S.K. and Chettri, M., (2001). Population buildup of aphids on potato in Burdwan district of West Bengal. J. Indian Potato Association, 28(1):123-124.
8. Lakra, B.S., (2005). Monitoring of foliar diseases and insect-pests of potato at different dates of sowing and their impact on tuber yield in Hariyana. Potato Journal, 32 (3-4): 189-190.
9. Misra, S.S. and Agrawal, H.O., (1988). Potato pests in India and their control. Tropical Pest Management, 34:199-209.
10. Paul, S. And Konar, A., (2003). Incidence of viral diseases and insect vectors on potato in indo gangetic plains of West Bengal. J. Indian Potato Association, 30(1/2): 127-128.
11. Rai, M., (2003). Role of potato in food and Nutritional security in developing countries with special reference to India. Proceeding of National Symp, "Potato Research Towards National Food and Nutritional Security", CPRI, Shimla, H.P., pp. 28-30.