THE EFFECT OF SEPARATE INFECTIONS BY POTATO VIRUSES X AND S ON NETTED GEM POTATO[1]

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Abstract

Numbers and specific gravity of Netted Gem potato tubers were unaffected by mottle and latent strains of potato virus X (PVX) and by potato virus S (PVS). Neither latent PVX nor PVS affected yield but mottle PVX alone and latent PVX combined with PVS reduced tuber size and yield ($P = 0.05$).

Resumen

La gravedad específica y el número de tubérculos de la variedad "Netted Gem" no fueron afectados por los strains moteado y latente del Virus X (PVX) ni por el virus S (PVS) de la papa. La producción no fue afectada por el strain latente del PVX ni por el PVS, pero el strain moteado del PVX sólo y el strain latente combinado con el PVS redujeron el tamaño y producción de tubérculos. ($P = 0.05$)

Introduction

A previous paper (4) reported the yield of a clone of Netted Gem potato before and after eradication of a latent strain of potato virus X (PVX) and potato virus S (PVS). The virus-free plants produced more tubers and a greater yield than the infected ones. The object of the present study was to determine the effect of separate infections by PVX and PVS. Two strains of PVX, a latent and a mottle, were included. In addition, the latent strain of PVX was combined with PVS.

Materials and Methods

Netted Gem (Russet Burbank) potato was obtained from the collection of virus-free cultivars and seedlings maintained by the Vancouver Research Station (5). The viruses were local isolates from potato. The strains of PVX were designated latent and mottle on the basis of their symptoms on potato, the former causing no symptoms and the latter a faint mottle apparent when examined with transmitted light. The PVS isolate caused no visible symptoms. Separate plants in pots were inoculated with each virus and one was inoculated simultaneously with latent PVX and PVS. Virus-free material was derived from a non-inoculated plant. Six weeks after inoculation four or five stem cuttings were taken from each

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plant to provide plants for a field plot of each treatment. Subsequent propagation by tubers in isolated plots for two years produced the seed tubers for a yield trial. The virus content was checked each year by tube precipitin serology for PVS and by inoculation of *Gomphrena globosa* for PVX.

The experimental design was a randomized block containing six replicates. Uniform seed pieces weighing 42 to 50 g were planted 30 cm apart in 9 m rows. Treatment rows were separated by two rows of a virus-free red-skinned cultivar and a single plant of the same red-skinned cultivar was grown on the ends of each treatment row. Standard cultural and pest control practices were followed. About 60 days after planting the virus content of each treatment was checked. Plots were defoliated 112 days after planting and dug 15 days later. Tubers from each treatment were graded and then counted and weighed in bulk according to grade. Well-shaped tubers having a diameter of 5 cm or more were classed as marketable, all others as culls. Specific gravity was determined on samples of 10 marketable tubers from each of the six replicates of each treatment.

Results

There were no symptoms on plants infected with latent PVX, PVS, or latent PVX with PVS. Those infected with mottle PVX showed characteristic mottle symptoms which could be seen on dull days or when a leaf was examined in the shade with the aid of transmitted light. The effects of these viruses on Netted Gem potato are given in Table 1. The total number of tubers and specific gravity were unaffected but tuber size was reduced by mottle PVX and by latent PVX combined with PVS. The reduction in tuber size lowered total and marketable yield.

TABLE 1. —*Effect of potato viruses X and S on the productivity of Netted Gem potato.*

Virus content	Tubers/plant		Yield (metric ton/ha*)		Tuber specific gravity
	Total	Marketable**	Total	Marketable	
Latent PVX + PVS	11.1a	4.9c	36.1b	24.2c	1.100a
Mottle PVX	10.5a	5.5bc	35.7b	27.1bc	1.099a
PVS	11.1a	5.9ab	39.8a	30.1ab	1.098a
Latent PVX + PVS	11.1a	4.9c	36.1b	24.2c	1.096a
Virus-free	10.6a	6.3a	40.6a	32.6a	1.100a

* 1 metric ton/ha = 8.93 cwt/ac.

** Min. diam. 5 cm and not more than 5% misshapen tubers.

Discussion

PVS, discovered in 1952, has world-wide distribution (2) and until recently occurred along with PVX in Netted Gem and most other North

American cultivars. It is likely that a portion of the yield losses attributed to PVX in reports prior to 1952 was due to PVS but the relative importance of the two viruses could not be measured until virus-free stocks became available (3). In Europe, yield losses of 20% have been caused by PVS (2) but the isolate used in this study had no significant effect, except in combination with PVX. Other cultivars may prove to be less tolerant than Netted Gem and more virulent strains may be found.

The reduction in tuber numbers previously reported (4) for virus-infected potato was not confirmed in the present experiment and yield losses were therefore smaller. Possibly the method of propagating seed tubers affects tuberization. In the previous experiments, where tuberization differences were found, the virus-free material was developed from stem cuttings but the infected material had been tuber-propagated for many years. In the present tests both infected and control materials were developed from stem cuttings three years before the trial. Propagation by stem cuttings controls *Erwinia carotovora* var. *atroseptica, Phoma exigua* var. *foveata* and *Helminthosporium atrovirens* (1), the causes of blackleg, gangrene and silver scurf, respectively. These and possibly other tuber-borne pathogens may restrict tuberization and thus add to the losses caused by viruses in tuber-propagated stocks.

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