Successful management of potato spindle tuber viroid in seed potato crop

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An analysis of field inspection data over a period of 15 years (1969-1983) of New Brunswick seed potato crop showed that the incidence of potato spindle tuber viroid (PSTV) had decreased to the point where it could not be detected by visual observation. This eradication of PSTV in the seed potato crop could be attributed to higher standards or stricter regulations in seed certification programs, use of virus-free seed multiplied at Elite seed farms, enactment of provincial disease eradication acts and strict planting requirements by processing companies in the region.

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Une analyse des donnbes d'inspection au champ, couvrant une période de 15 ans (1969-1983) de culture de la pomme de terre de semence au Nouveau-Brunswick, a démontré une diminution de l'incidence du viroïde de la filosité des tubercules (PSTV) au point ou il n'est plus détectable par observation visuelle. Cette bradication du PSTV dans la culture des pommes de terre de semence peut être attribuée à des standards plus élevés ou à des rbglements plus sbvbres dans les programmes de certification des semences. à l'emploie d'une semence exempte de virus multipliée sur les fermes de semence Elite, à la promulgation de lois provinciales sur l'bradication des maladies et a des exigences de plantation sévères de la part des compagnies de transformation de la région.

Introduction

The potato spindle tuber disease was first reported on the North American continent in New Jersey in 1922 by Martin (7). Martin visited Prince Edward Island, Canada in 1930 and found potato spindle tuber in potato crops growing there (6). Although the disease persisted in Eastern Canada, it was not until 1950 that it reached serious proportions (6). This sudden rise in the incidence of the disease coincided with the planting of large acreages of the new potato variety Sebago (6).

In 1969, leaf and tuber samples from potatoes suspected of having potato spindle tuber viroid (PSTV) were collected from tablestock fields in Eastern Canada and the samples were found to be 92% infected with a mild strain and 8% with a severe strain of PSTV (11). Subsequently, an in depth survey of 80 tablestock fields in New Brunswick revealed an average incidence of 3.8% PSTV among the three major varieties, viz., Kennebec (3.3%). Katahdin (2.5%). and Russet Burbank (4.6%) (12).

Since the last PSTV survey in New Brunswick 15 years ago, many changes have been introduced in the seed certification program and it was of interest to analyze the effect of these changes on the PSTV situation. This paper reports that the PSTV incidence has been reduced to the extent that it has not been observed in the last four years in any seed potato field and discusses the impact of various changes in potato seed production.

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Data collection

Field readings collected over the past fifteen years by potato inspectors of the Food Production and Inspection Branch of Agriculture Canada were used to determine the occurrence of PSTV in seed potato stocks. In this procedure, fields were inspected three times during the growing season and a record of PSTV incidence was made on the basis of visual symptoms. The validity of reading PSTV by symptoms was verified by cross-protection tests using host-indicator plants (11), in which only 38 of 355 samples of suspected PSTV material collected by different inspectors in different provinces could not be confirmed as PSTV infected by indicator tests (11). Both mild and severe strains of PSTV were collected by visual symptoms (11). Thus the field inspection readings were considered accurate for large-scale assessment of PSTV incidence. The PSTV readings made by the inspectors were estimates and ranged from traces to 5%. Irrespective of the amount of PSTV, fields with any PSTV were used to calculate the percentage of fields with PSTV infection. Three types of calculations were made; in ona case all cultivars, irrespective of acreage were used, while in the second case only Russet Burbank acreage were used, and in the third case only Kennebec acreage were used to calculate the percentage of fields with PSTV. The selection of Russet Burbank and Kennebec was made to show the differences in symptom expression of the former over the latter, in which PSTV is relatively difficult to visualize (5).

Results

The results (Fig. 1) represent an average of 1988 fields or 10,565.6 hectares per year of seed potato production in New Brunswick. Incidence of PSTV was noted in 5% of the fields containing Russet Burbank in 1969, and decreased steadily until 1975, when it was no longer detectable by visual observation (Fig. 1). However, with the cultivar Kennebec, in which it is relatively difficult to read PSTV, the percentage of infected fields fluctuated from year to year and reached an undetecta-

ble level by 1980. When all cultivars are considered (representing about 30), an intermediate picture between Russet Burbank and Kennebec is visualized (Fig. 1). However, in all cases PSTV detection ceased by 1980 and has not been detected in 1981, 1982, 1983 (Fig. 1) and 1984 (person: communication with potato inspectors).

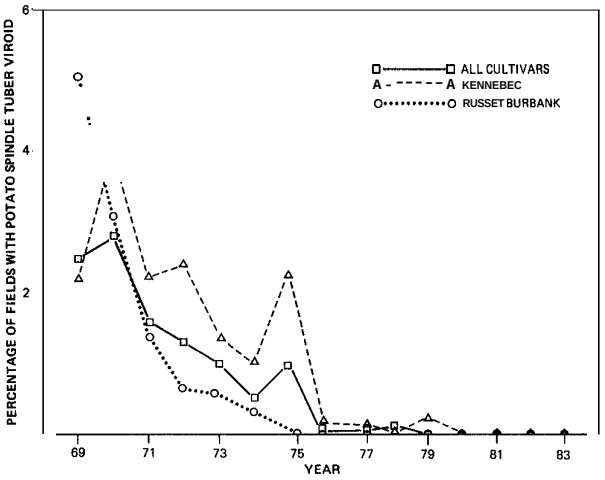

Figure 1. Percentage of fields with potato spindle tuber viroid from 1969 through 1983.

Discussion

From these data it appears that PSTV incidence in New Brunswick seed potatoes has decreased to a level which cannot be detected by visual observation. Because visually-observed samples have been shown to be PSTV infected and represented mild and severe strains (9), this absence of PSTV detection cannot be accounted for by the occurrence of mild strains undetectable by visual observation. Instead, the undetectability of PSTV in seed potatoes in New Brunswick could be attributed to the following changes in seed certification and seed production practices.

Canadian seed improvement programs are constantly striving to upgrade the quality of "elite" seed stocks, which serve as the basis for certified seed production. In an attempt to more effectively control viral, bacterial and viroid diseases, official elite seed farms were established in the mid sixties. These seed farms are staffed with personnel having the expertise to perform technical procedures required for the production of superior disease-free seed.

The second step to improve seed quality was the introduction of seed regulations in the 1970's (1,2), which required that elite seed be grown from virus-free cuttings, plants, or tubers. This regulation further required that all elite I, II, and 10% of the elite III seed, be planted in tuber units and inspected three times during the growing season and that potatoes grown in each category automatically drop a level the following year. These regulations constituting a flush-through system assisted in the reduction of PSTV incidence. In addition to the visual observation, samples of elite I to III were monitored in the laboratory by polyacrylamide gel electrophoresis for PSTV (E.M. Smith - personal communication). Because of the success in the management of PSTV in seed potatoes, the seed regulation was further strengthened in 1980 by allowing "zero tolerance" for PSTV in any seed potato fields at first, second or third inspection (2).

Because of the botanical seed-transmitted nature of PSTV (8), there is a possibility of PSTV introduction to elite seed farms through the introduction of promising and new seedlings or cultivars. This avenue has also been closed to the entry of PSTV by the practice of potato breeders in Canada, who ensure that all cultivars or advanced seedlings are free of PSTV before their multiplication at regional trials or cultivar evaluation at seed farms.

In order to reduce the build-up of virus or viroid diseases, the New Brunswick provincial government passed the Potato Disease Eradication Act (3) which includes PSTV as a prescribed disease. As a prescribed disease, if PSTV is found and confirmed by an inspector, the infected plants must be isolated and disposed of and the farm must undergo thorough disinfection. In addition, this act requires the planting of certified or better grade seed for commercial plantings, which further ensures freedom from PSTV build-up. Besides the provincial government's regulations, the major potato processing company in the region has made it compulsory to plant Foundation class seed for processing purposes (4).

Thus, as stated earlier (9, 10) potato spindle tuber viroid in Canada has become rare compared to the late sixties (12). Although it has been known in various countries (9) for a long time, there has been no report of serious economic losses anywhere in the world in recent years. PSTV should be treated as a minor disease which can be kept under control by proper seed certification and seed production programs.

Acknowledgement

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