

Potato late blight forecasting in Prince Edward Island in 1978

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Potato late blight reports were issued semi-weekly by means of the public news media in Prince Edward Island during the 1978 season as a trial service to potato growers in the province. Data on temperature, relative humidity and rainfall within potato fields at seven locations across the province were heavily relied upon in formulating spray recommendations for controlling the late blight fungus *Phytophthora infestans*. The time of first appearance of disease symptoms following periods of high humidity in late July was accurately anticipated and alerted growers to a potential epidemic situation. Growers were advised to relax their spraying schedule to 14 day intervals in the last half of August and early September when dry weather caused the disease to die out and further spread was prevented. Results from a mailed survey questionnaire indicated many growers were able to use the service to help them time spray applications and to reduce the number of sprays required.

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Au cours de la campagne de végétation de 1978, des bulletins d'information sur le mildiou ont été transmis, à titre d'essai, deux fois par semaine par les médias à l'intention des planteurs de pomme de terre de l'Île-du-Prince-Édouard. Les données concernant la température, l'humidité relative et la pluviométrie dans des champs répartis à sept endroits de la province ont servi de base à l'établissement de recommandations pour les pulvérisations contre l'organisme pathogène *Phytophthora infestans*. La date de l'apparition des symptômes après une période de forte humidité en fin de juillet a pu être prévue avec exactitude et on a pu alerter les producteurs des risques d'infestation d'envergure épidémique. Par la suite, les producteurs ont été en mesure de ramener leur calendrier de pulvérisation à intervalles de 14 jours dans la seconde moitié d'août et le début de septembre, le temps sec ayant alors entraîné la disparition virtuelle du pathogène et écarté tout nouveau danger de propagation. Les réponses obtenues d'une enquête postale conduite auprès des producteurs ont fait ressortir que ce service leur a permis de prévoir les dates de pulvérisation et aussi de réduire le nombre de traitements de protection.

Introduction

In Prince Edward Island, Canada, potato late blight caused by the fungus *Phytophthora infestans* (Mont.) de Bary, is a disease of economic significance with which growers must contend. In most years, field losses due to late blight can be substantial unless adequate fungicide treatments are employed (1, 2). A survey in 1972 indicated that many growers applied routine sprays irrespective of the presence of blight or prevalence of weather conditions conducive to the development of late blight (5). Studies elsewhere have shown that the efficiency of fungicides can be improved when blight sprays are applied according to forecasting methods based on weather conditions (3, 6). Thus, there is a need to have good weather-based potato late blight forecasts in Prince Edward Island to (1) provide early warnings of blight outbreaks, (2) assist growers in scheduling sprays for blight control and (3) reduce costs by eliminating unnecessary sprays. Blight warnings were issued in the province for many years by L.C. Callbeck, but were discontinued upon his retirement after the 1976 season.

In the 1978 growing season, the Prince Edward Island Department of Agriculture and Forestry and the Charlottetown Weather Office, Environment Canada issued potato blight reports jointly on a trial basis. The purposes of this paper are to (1) describe the forecasting system that was used, (2) report on the recommendations that were made based on this system and (3) give some indications of the response of growers to this service.

Materials and methods

The forecasting system used to predict blight occurrence and recommend spray intervals was patterned after methods developed by Hyre (4) and Wallin (7) as combined and modified later by Krause (6) and also by Hodgson (personal communication, W.A. Hodgson, 1978). Hyre's system used daily rainfall and temperature to predict the onset of blight. Wallin's system based forecasts of initial occurrence and subsequent spread on temperature and relative humidity criteria. Krause's Blitecast system, which was a combination of these two methods, recommended more sprays than necessary when tried under our local conditions and therefore some modifications in Krause's methods were required. These modifications are given in Table 1, which shows the relationship of Wallin's severity values and Hyre's rain-favourable days to a blight weather index (BWI) and a recommended spray schedule.

Air temperature, relative humidity and rainfall were continually monitored in representative potato fields at

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seven locations across the province during the 1978 season. Hygrothermographs and maximum and minimum thermometers were mounted in standard weather shelters situated between the potato rows at ground level. The data were collected each Monday and Thursday and Wallin severity values and Hyre rain-favourable days as described by Krause (6) were calculated. A BWI was then determined for each region using relationships shown in Table 1. The climatic data were also relayed by telephone to W.A. Hodgson, Fredericton Research Station, Agriculture Canada and fed into a computer-based experimental blight forecasting program as an independent check on the data analyses and spray recommendations.

Table 1. Blight Weather Index and general spray recommendations as determined by Wallin severity values and Hyre rain-favourable days.

Number of rain-favourable days during last seven days	Severity Values for the last seven days					
	<3	3	4	5	6	7
≤4	V	V	L	M	M	H
74	V	L	M	M	H	E
Blight Weather Index	General Spray Recommendations					
E - Extreme	5 to 7-day spray					
H - High	7-day spray					
M - Moderate	10-day spray					
L - Low	14-day spray					
V - Very Low	No spray recommended					

Potato late blight reports were prepared every Monday and Thursday afternoon from July 14th to September 15th, and communicated to growers via radio, newspaper and television by noon on the following day. The reports contained the following information: (a) a BWI for each region of the province, indicating the conduciveness of the weather conditions of the past 7-10 days to the development of late blight; (b) a statement of forecast weather conditions and the anticipated effect on the BWI; (c) reports on the location and severity of blight outbreaks in the province; (d) a recommended spray schedule (time interval between sprays) and suggested rates of application of fungicides. The statements of forecast conditions were prepared by staff of the Charlottetown Weather Office, Environment Canada. Reports of blight incidence in the field were routinely received from field inspectors with the Plant Quarantine Division of Agriculture Canada, Charlottetown. Growers were advised of the general spray recommendations in Table 1 at the beginning of the season, but in the blight reports the spray recommendations were sometimes adjusted. These adjustments were based on the Fredericton experimental blight forecasting program because this system also took into consideration the blight severity in the field, the forecast weather conditions and the time of year (personal communication, W.A. Hodgson, 1978). In the general spray recommendation, only antecedent weather conditions were taken into consideration.

Following is a typical example of the type of blight report issued in 1978:

POTATO BLIGHT REPORT

(to be issued on or before Tuesday, August 1 only)

The P.E.I. Department of Agriculture and Forestry and the Charlottetown Weather Office issued the following potato blight report on Monday, July 31:

The Blight Weather Index is low for all regions of the Province.

Except for a few showers late Tuesday and Wednesday, mainly cool and dry conditions should prevail for most of the period. No significant change is predicted in the blight index over the next few days.

Traces of blight have been reported in a number of fields in the central and southeast region of the province, although drier weather during the past week has helped to keep the disease in check. A 10 to 14 day advisory spray schedule is in effect for all areas.

(Next report will be issued on Thursday, August 3).

After the harvesting season, a one-page questionnaire was mailed to 112 growers, being approximately 10% of all potato producers in the province. Names were selected by choosing every tenth grower from an alphabetical listing of all seed and tablestock producers. The questions pertained to the following areas: (1) potato acreage; (2) cultivars grown; (3) incidence of blight; (4) spraying practices, i.e. timing, chemicals used, method of application; (5) frequency with which reports were received; (6) usefulness of the various statements in the blight reports; (7) effect on spraying practices; (8) communication media; (9) advertisement; (10) future requirements for blight forecasts.

Results

At the time of the initial blight report issued on July 14, growers were advised to apply the first blight spray even though the BWI was "low" and no blight outbreaks had yet been reported. The BWI increased to "high" in all regions during the latter part of July, and the first symptoms of blight were observed in various fields a few days after a warning of a threatened blight outbreak had been issued. August was an exceptionally dry month during which old infections were kept in check and no new outbreaks were reported. The BWI dropped to "very low" in all regions for a 24-day period beginning August 14, and growers were advised that a 14-day spray schedule would control the disease adequately at that time. Abnormally cool temperatures kept the BWI low during damp weather in the second week of September, and no new outbreaks of blight were reported. Over the entire season, the blight forecasting system recommended from 4 to 6 sprays for the control of late blight.

A brief evaluation of the forecast statements contained in eighteen blight reports indicated the following: Ten

forecasts predicted the BWI category for the next period accurately (the category being either extreme, high, moderate, low or very low as in Table 1); three forecasts predicted a BWI which was off by one category in at least some areas of the province; two forecasts were off by one category in all areas; one forecast was off by at least one category in all areas and up to two categories in some regions; two forecasts were off by two categories in all regions.

Some of the results of the questionnaires mailed to growers after the season are summarized in Table 2. The percentage of affirmative responses to each item on the questionnaire is indicated. All other respondents either replied in the negative, indicated they did not know or left the question blank. Of the 112 questionnaires sent out, only 26 were returned by growers (23%), and one of these was considered ineligible. Seventy-six percent of the respondents indicated that the reports helped them schedule fungicide sprays and a large majority said they were able to reduce the number of sprays applied. This reduction in sprays apparently did not affect disease incidence adversely, because all respondents reported no problems with late blight in 1978. Ninety-two percent indicated that the blight incidence reports were a useful component of the service. The recommended spray schedules drew the least favourable response and only 52% indicated that these were useful. Almost 50% of the respondents normally use a flexible spray schedule while the remainder usually adhere to a rigid 7-day or 10-day program. Over 90% of the respondents indicated that they thought the service should continue in future years.

Table 2. Results of survey questionnaire as indicated by percentage of affirmative responses. (23% of 112 selected growers responded).

Item	Affirmative responses	
	Percentage of growers	Number of growers
Reports helped to schedule sprays	76%	19
Reports helped to reduce number of sprays	60%	15
Growers who used 4-6 sprays	60%	15
Growers who used >6 sprays	20%	5
Growers normally using flexible spray program	48%	12
Growers normally on rigid 7 or 10 day program	52%	13
Useful items of blight reports:		
(i) blight incidence reports	92%	23
(ii) blight weather forecasts	84%	21
(iii) BWI	80%	20
(iv) recommended spray schedule	52%	13
Blight forecasting service adequately advertised	56%	14
Blight reports should continue in following year	92%	23

Discussion

The 1978 season was very suitable for testing the ability of the blight forecasting system to reduce the number of sprays required, because weather conditions were not very conducive to the development of late blight

epidemics. Due to dry weather, researchers at the Charlottetown Research Station experienced difficulty in establishing late blight symptoms in unsprayed plots that were inoculated with spores of *P. infestans* (personal communication, H.W. Platt, 1978). Therefore we estimate that two or three properly timed sprays would have given adequate blight control in most cases. Many growers sprayed more often as an insurance against risk of disease and were reluctant to extend their spray schedule beyond 10-14 day intervals even though conditions were not conducive to the development of late blight.

In our opinion, the following facts indicate that the blight forecasting system used in 1978 was successful: (1) the time of appearance of initial blight symptoms was accurately anticipated; (2) no increase in blight was reported during periods when growers were advised to relax their spray schedule; (3) in general, growers responded favourably to the service; (4) many growers were able to reduce the number of blight sprays and still maintain good disease control. One year's results, however, cannot be considered as a thorough test of the system. Since we intend to continue blight forecasting as an on-going service to growers in the province, there will likely be opportunity for further evaluation in the future.

The results of the questionnaire probably represent a somewhat biased view of the opinions of potato producers in the province, since only 23% of the growers that were surveyed gave a response. For example, a greater percentage of growers who made use of the service may have responded to the questionnaire than of growers who did not know of the service or did not make use of it. In our opinion, however, the results represent the views of at least 23% of all producers since growers were selected at random from a list of names.

The blight forecasting service is potentially more useful to growers using a flexible schedule than to those on a rigid 7 or 10-day program. We believe, however, that growers on a rigid schedule will be prepared eventually to build some flexibility into their spraying operations once they can be convinced that the blight forecasting system is reliable. Growers' confidence in the blight forecasts can only be increased if the system can demonstrate repeated successes in future years. Additional advertisement and explanation of the service may also increase the level of acceptance by growers, since only 56% of the respondents to the questionnaire indicated that the service was advertised adequately prior to the season.

One of the present concerns of some growers is that the service will encourage fewer sprays and thereby reduce protective coverage in the province and increase the risk of blight epidemics. This concern is understandable because in past years it has been necessary to encourage growers to spray more often for blight control. The forecasting system, however, encourages a "cautious" reduction in the frequency of blight spraying only when

there is little threat of a blight outbreak and thus helps growers save costs from needless sprays. At present costs of about \$5 to \$6 per acre (\$12 to \$15 per ha) per spray, \$280,000 to \$336,000 could have been saved in 1978 in P.E.I. for each spray that was not required on an estimated 56,000 acres (22,660 ha) potatoes grown in the province. In wet years when conditions are very conducive to blight epidemics, no savings on spraying costs would be made since the number of blight sprays would not be reduced. It is expected that under those conditions the service will help growers - especially those who do not spray enough - in maintaining a regular spray program, and thereby reduce crop losses due to late blight disease.

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