Lettuce Disease Survey in New Brunswick, 1986

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Field lettuce (*Lactucasativa* L.) is produced on approximately 12 ha in the southeast of New Brunswick. The most important varieties are Ithica, Queen Crown and Calmar (heading types), and Valmaine, Signal and Paris Cos Island (romaine types). Harvest is staggered from July to October through sequential transplanting and direct seeding. Only minimal efforts are made to manage disease and insect problems. The most important diseases in 1986 were grey mould (*Botrytis cinerea* Pers.), bottom rot (*Rhizoctonia solani* Kuhn.), drop or white mould (*Sclerotiniasclerotiorum* (Lib.) de By.), tip burn (a physiological disorder), aster yellows (a mycoplasma vectored by the *Macrosteles fascifrons* Stal. species complex) and downy mildew (*Bremia lactucae* Regel.). Low levels of mosaic virus were also found throughout the survey period. Economic loss from most of these diseases did not warrant control. Aster yellows vector control is already used. Gray-mold control is recommended for early season transplant crops. Downy mildew control is recommended for late season crops with spraying based on monitoring for the presence of the pathogen.

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La laitue des champs (*Lactuca sativa* L.) est cultivée sur approximativement 12 ha dans le sud-est du Nouveau-Brunswick. Les variétés les plus importantes sont: Ithica, Queen Crown et Calmar (Pomme), et Valmaine, Signal et Paris Cos Island (Romaine). La récolte s'étend de juillet a octobre grlce à une transplantation continue et au semis direct des graines. On consacre des efforts minimums pour la gestion des problèmes de maladies et d'insectes. Les maladies les plus importantes en 1986 furent la moisissure grise (*Botrytis cinerea* Pers.), la pourriture basale (*Rhizoctonia solani* Kuhn.), l'affaissement sclérotique (*Sclerotiniasclerotiorum* (Lib.) de By.), la brirlure de la pointe (un désordre physiologique), la jaunisse (un mycoplasme transmis par le complexe des espèces de *Macrosteles fascifrons* Stal.) et le mildiou (*Bremia lactucae* Regal.). On a détecté une faible presence du virus de la mosaïque tout le long de la saison. Les pertes économiques dûes à la plupart de ces maladies ne justifient pas leurs contrôle. On effectue déjà le contrôle du vecteur de la jaunisse. On recommande le contrôle de la moisissure grise pour les transplants des récoltes hâtives. On recommande le contrôle du mildiou pour les récoltes tardives en se basant pour traiter sur la presence du pathogène.

Introduction

Field lettuce (*Lactuca sativa* L.) production in New Brunswick consists of approximately 12 hectares in the southeast part of the province. The total value of the crop is approximately $160,000. This area, with a sandy loam soil, has a frost free period of approximately 130 days, 1600 – 1800 annual degree days above 5°C. and from May to September, 400 mm of precipitation.

Both iceberg or heading type lettuce (vars. Ithica, Queen Crown and Calmar) and romaine lettuce (vars. Valmaine, Signal and Paris Cos Island) are grown, with iceberg being the predominant type. The lettuce harvest is staggered through the use of sequential plantings of direct seeded and transplant crops, providing continuous harvest from July to October. Only minimal efforts are made to manage insect and disease problems occurring in the crop.

Prior to 1986 no studies had been done to determine the extent of yield loss in the crop due to disease. In answer to this a disease survey was conducted throughout the summer of 1986 to determine both the type of disease present and their effect on marketable yield.

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Methods

The survey was conducted by inspecting the majority of commercial lettuce fields in the designated areas when they were 50-70% harvested. In each field three rows were randomly selected and within each row the number of healthy plants was determined. All harvested heads (evident by the remaining stem) were presumed healthy. Diseased heads, usually left standing in the row, but also those cut and discarded between the rows, were diagnosed on the basis of symptoms and when evident, by the signs of the pathogen. Type specimens of each disease, and plants exhibiting unusual symptoms were periodically returned to the lab and examined microscopically to confirm field diagnosis. At the time of rating the average number of plants per row was determined, as well as an estimate of field size. This information was combined with the data from each of the three rows rated to obtain an estimate of the total number of plants exhibiting the symptoms of each disease found in the field. For each sampling date these total numbers of each disease for each field were then added to determine an average percent disease (fig. 1 & 2). For the season disease totals (fig. 3 & 4) estimates of the numbers of diseased plants from each field as well as total plant numbers were summed for the entire season before being converted to percentage thereby accounting for variable production levels on the different sampling dates.

Lettuce drop can be incited by either *Sclerotinia sclerotiorum* (Lib.) de By., or S. *minor* Jagger. According to Purdy (1979) these two species can be differentiated on the basis of sclerotial size. During the course of this survey sclerotia were col-

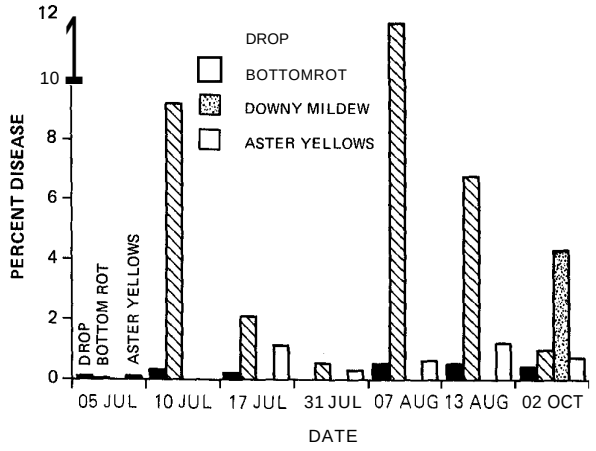


Figure 1. Iceberg lettuce percent disease by survey date.

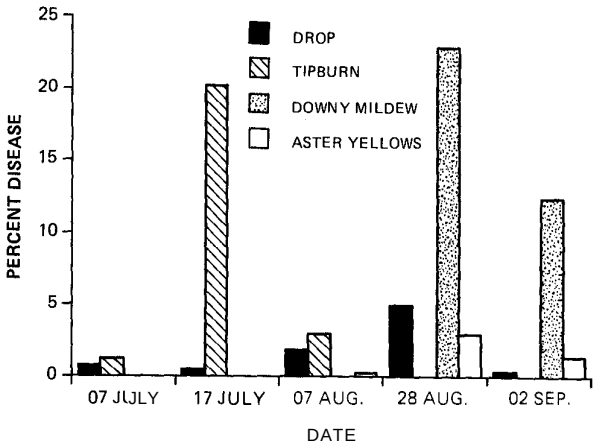


Figure 2. Romaine lettuce percent disease by survey date.

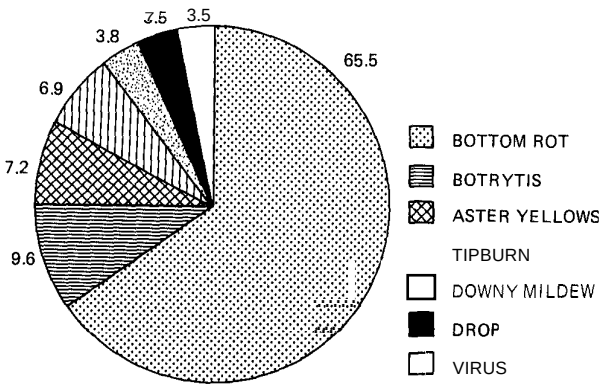


Figure 3. Iceberg lettuce disease type as a percent of total disease.

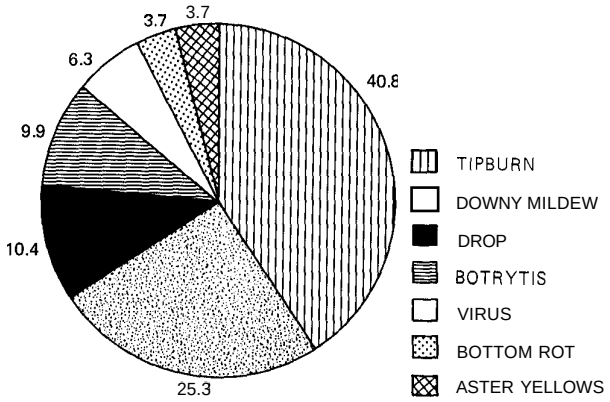


Figure 4. Romaine lettuce disease type as a percent of total disease.

lected off lettuce plants exhibiting drop to determine which species was the causal organism of drop in New Brunswick.

In addition, throughout the survey period the aster leafhopper (*Macrosteles fascifrons* Stal.) population was monitored at six sites surrounding the lettuce fields. Leafhoppers were collected with a sweep net, using a standardized pattern of ten sweeps while walking ten steps through each site. Sampling was done at each site on a weekly basis. Capture values for the six sites were averaged for each date.

Results and discussion

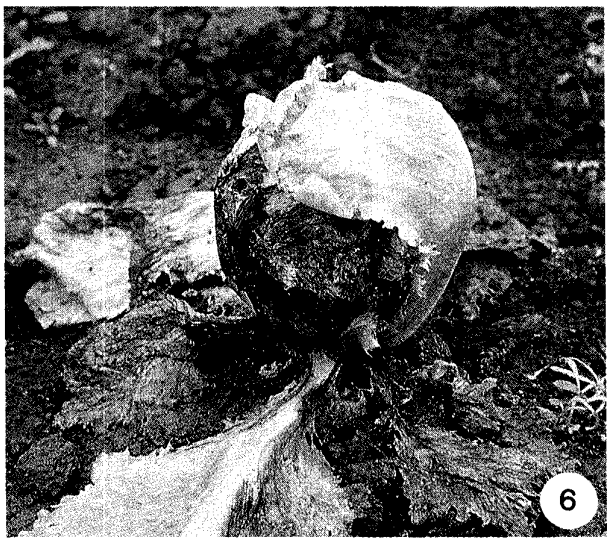
Botrytis cinerea Pers. (*Botryotinia fuckeliana*) (de By.) Whet., a weak parasite attacking dead and damaged plant tissue, was found infecting lettuce plants at all stages of growth.

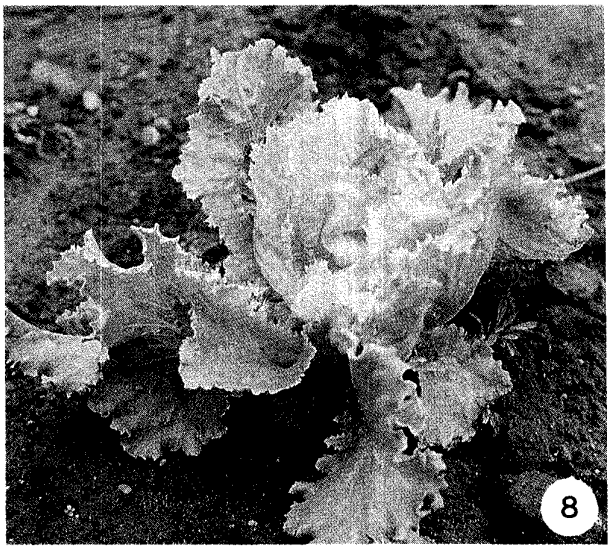
The greatest loss from *Botrytis* sp. occurred on the early season transplants. Greenhouse grown plants which were hardened outside in a cold frame and inadvertently frost damaged and then returned to the greenhouse, were then infected with *Botrytis* sp. Many young plants in the field were also infected with *Botrytis* sp. following frost damage. For two fields rated for early season transplant infection of this type, it was found that this damage resulted in 2 and 11% loss.

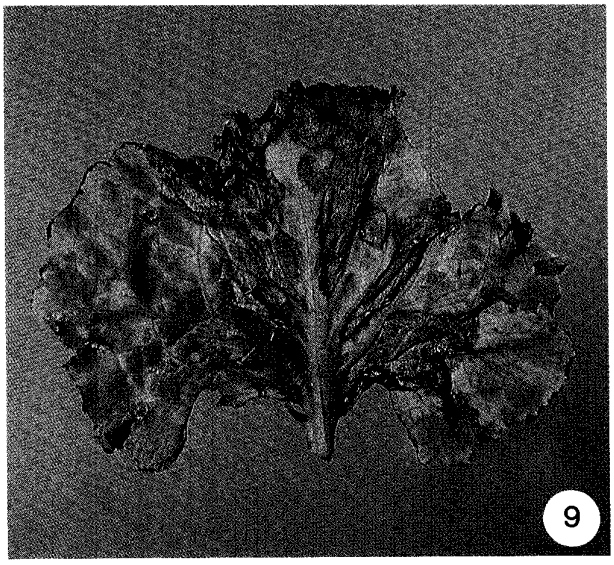
Low levels of this disease were found in fields of mature romaine and head lettuce throughout the growing season, often associated with damage such as tipburn. When these plants were encountered during field rating the damage was attributed to the primary pathogen when possible.

The results presented in figures 1 and 2 represent data from twenty nine lettuce fields and summarize four of the diseases with the highest incidences observed on head and romaine lettuce respectively.

Bottom rot (*Rhizoctonia solani* Kuhn.) was the most destructive disease on head lettuce and resulted in considerable losses. The greatest incidence was found on August 7, following a period of heavy rain. At that time yield losses of 9.7% occurred on surveyed fields and resulted in some fields being abandonned prior to complete harvest. These abandonned fields were not surveyed. Bottom rot is favored by warm and humid or wet conditions (Pieczarka, 1975). The first symptoms are discrete, somewhat depressed lesions on the midribs







5. Lettuce drop – *Sclerotinia sclerotiorum*
6. Bottom rot – *Rhizoctonia solani*
7. Tipburn
8. Aster yellows
9. Downy mildew – *Bremia lactuca*

and petioles of the outer wrapper leaves. Under favorable conditions these lesions expand causing a wet black rot that involves the entire head (fig. 5). In drier conditions the lesions develop but the extensive head decay does not occur (Pieczarka, 1975). As R. solaniis common in soil, this could account for the low levels of the disease in other time periods. Heads with small lesions would possibly have been harvested and the damaged wrapper leaves removed. R. solani losses were negligible on romaine lettuce throughout the summer. It was only noted on two dates; August 7 and August 28, but in both cases the yield loss was found to be less than 1%.

Yield losses attributed to lettuce drop or white mold (*Sclerotinia* sp.) in head lettuce were always found to be below 1%. In romaine, levels reached over 5% loss on August 28.

Sclerotia collected from both head and romaine lettuce ranged in size from 1-22 mm with a mean size of 5.5 mm. This exceeds the size range for *Sclerotinia* minor but falls within the 1 to 30 mm range of S. *sclerotiorum* (Purdy, 1979). Sclerotia produced by S. *minor* were obtained from lettuce in one field within the survey area. This field also had high levels S. *sclerotiorum*. S. minor had not been recorded in Canada prior to 1984 when it was found in Southwestern Ontario (Jarvis, 1985).

Two distinct sets of symptoms caused by Sclerotinia sp. were found. The normal symptoms associated with drop is where the wrapper leaves wilt and lie flat on the ground, followed by collapse of the head (fig. 6). In the second type of drop found, in head lettuce only, the head did not collapse but remained erect. The outer leaves of the head lost turgidity and eventually became dry and papery. Profuse white mycelium characteristic of *Sclerotinia* sp. could be found in the heart region of such heads. Occasionally sclerotia ranging from 1 to 7 mm were found in decayed tissue of plants with these symptoms.

Yield loss due to tipburn (fig. 7) reached 20.2% on romaine lettuce when summer temperatures approached their maximum, but was less than 1% on head lettuce. In fields of romaine lettuce where the topography was uneven, the greatest incidence of tipburn corresponded with areas of greatest slope. A lower incidence was observed in field depressions perhaps reflecting the availability of soil moisture.

The lettuce growers in the survey area periodically sprayed the crop for control of the aster yellows (fig. 8) vector *Macrosteles fascifrons* Stal. Low levels of aster yellows were found in both romaine and head lettuce throughout the survey period. Since the decision to spray was not based on a monitoring system but rather on individual grower observation of M. *fascifrons* in his fields, no statements can be made regarding the effect the spray had on levels of aster yellows found. Levels of aster yellows in unsprayed fields have been reported to range from 78% in Prince Edward Island (Thompson, 1965) to 5.8% of plants infected in Ontario (Stevenson and Knibbe, 1979). In a lettuce variety trial established by the C.D.A. in Southeastern New Brunswick, aster yellows infection ranged from 0 to 3% (Agriculture Canada, 1986).

Leafhoppers were collected in the survey area between June 20 and September 26. M. *fascifrons* was present in all samples, the maximum capture averaged for all sites being 8.6 leafhoppers/10 sweeps on July 7.

Downy mildew (*Bremia lactuca*) (fig. 9) began appearing in late crops coinciding with dropping temperatures. It was first noted an romaine lettuce on August 28 resulting in yield losses of 23%. It also caused considerable damage to the October 2 romaine and head lettuce crop. Downy mildew was found to cause considerable damage on head lettuce (var. Ithica) in Ontario. Damage ranged form 68.5 to 89% of plants with outer leaves infected and 1.8 to 23% of plants with inner leaves infected (Bruin and Edgington, 1978, 1979).

Low levels of a mosaic virus were also found in fields of head and romaine lettuce throughout the survey period.

Conclusions

Most diseases occurring in the New Brunswick lettuce crop in 1986 did not have incidences high enough to warrant the recommendation of control procedures.

Figures 3 and 4 show each disease occurring in the lettuce throughout the survey period as a percent of total disease in head arid romaine lettuce respectively. The most serious disease in head lettuce was bottom rot (fig. 3). This disease can be controlled throught the use of a prbtectant fungicide, but further study is required to determine if this course of action would be economically feasable. The most serious disease on romaine lettuce was tip burn (fig. 4). Possibly this high occurrence resulted from over maturity of the lettuce prior to harvest. It should also be noted that the majority of the loss occurred on one harvest date, July 17, when summer temperatures approached their maximum. Timely harvesting of the romaine lettuce, prior to maturity, during this time period would reduce losses of this type.

Downy mildew was the most prevalent disease on romaine lettuce and was also a significant problem on head lettuce on one sampling date. Head lettuce was not being harvested on the sampling dates when the high losses on romaine occurred. This indicates that head lettuce being harvested during late August and September in subsequent years would have the potential for significant losses to occur. Control is therefore recommended for downy mildew in late summer and fall crops of both types of lettuce, with fungicide spraying based on grower monitoring for disease.

Preventive control of *Botrytis* sp. in the early season transplants is also suggested as the control is inexpensive and the potential for loss at this stage is great.

Acknowledgement

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