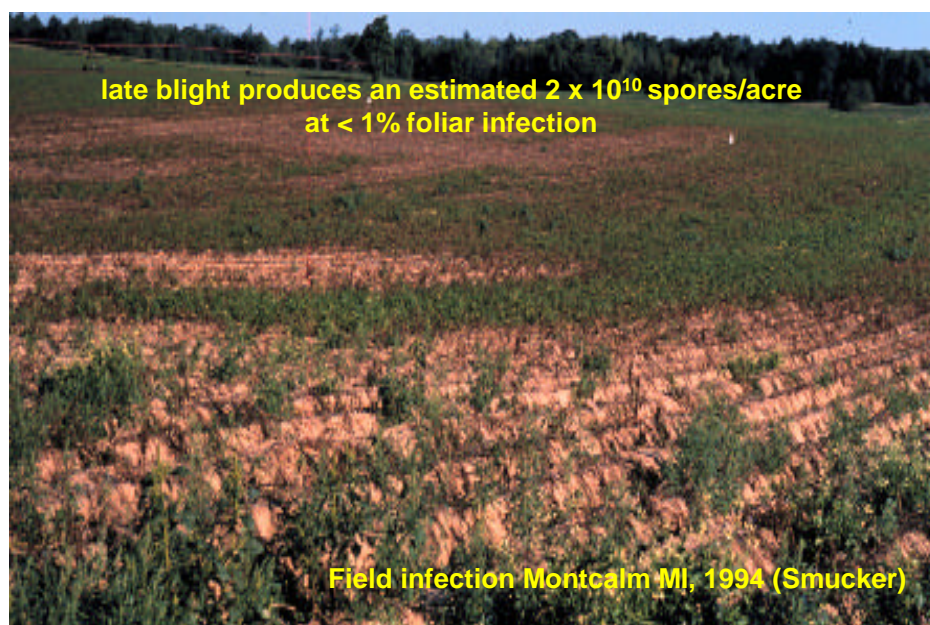
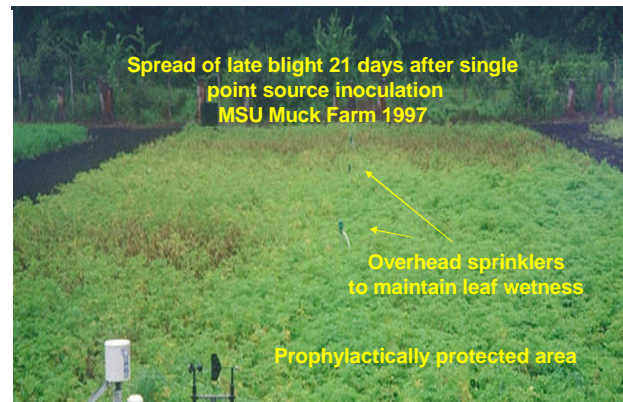


Potato Late Blight Emergency Procedure for Michigan - Late season amendment - 2000.
Dr. Willie Kirk

The recent late blight conducive conditions have resulted in late blight infection in many potato fields in Montcalm County. At this stage in the season it is likely that these conditions will continue as dew points are reached regularly during early evening and result in wet canopies until early afternoon. Over the growing season weather patterns have been very conducive for late blight development and in some areas as many as 120 late blight disease severity values have accumulated. These values can be checked for different areas of Michigan on the late blight web page (<http://potato.msu.edu>). All potato growing areas in Michigan should now be considered at risk with regard to potato late blight. Crops protected with residual surface-active fungicides should be at least risk from the disease. Protectant spray programs at a minimum application frequency of five days (ground) and five-day (air) should continue as long as the vines are green or alive. Although no fungicides currently give perfect control of late blight, the following pictures will confirm what could happen when no fungicides are applied.



Results from the chemical protection trials and the anti-sporulation studies (1995 - 1999) have shown that the section 18 products Acrobat MZ, Curzate M8 and Tattoo C have given good but not perfect control of late blight. In 1996, spores from lesions collected from some treated fields **re-infected** plants under controlled conditions but generally the rate of re-infection was low. Do not use sticking or bonding agents with the fully systemic or semi-systemic fungicides as they can affect the ability of the fungicide to penetrate the leaves and stems. Wetting agents should also be used with caution. There has been little or no detailed work carried out at MSU or in the US additives to the Section 18 materials. Therefore these products should be used as labeled.

Late planted crops: consider these crops in terms of canopy and tuber development rather than as seasonal expectations as to where they would normally be in terms of development. These crops will still be producing axillary shoots and therefore new growth. Tattoo C can still be applied to protect this new growth. The flex-rate should be considered when on a five day schedule using about 1.75 pt/A.

General procedure for late blight infected crops or crops in regions where late blight has been confirmed.

Observe standard procedures for late blight management as per MSU recommendations. The portion of the crop where late blight **has not been observed** should be sprayed immediately with Tattoo C (2.3 pt/acre) or Acrobat 2.25 lb/acre or Curzate 60WP 0.21 lb/acre + EBDC 2.0 lb/acre or + Bravo WS 1.5 pt/acre. The area where late blight **has been observed** should be sprayed with any of the above fungicides plus Supertin (3.75 oz/acre) in the maximum amount of water practical (10 gal/acre by air >25 gal/acre by ground).

If the infection is localized and the leaf/stem area per plant infected is greater than 20%, the infected plants should be desiccated with Diquat (1 pt/acre in 50 gal water/acre ground-rig: 10 gal water/acre air) + a 75% non-ionic spreader 8 - 16 fl oz per 100 gal (e.g. LI700, X77, Kinetic) + Supertin 3.75 oz/acre. The use of a desiccant will limit the spread of inoculum from localized sources. The area to be desiccated should be double that of the outermost infected plant found e.g. 20' circle radius = 40' radius sprayed; 20' square area = 40' square area sprayed.

If applying fungicide by air cover the whole field then apply desiccant.

By ground,

1) Apply fungicide to uninfected crop first then apply fungicide to infected area; take care to minimize re-entry into uninfected portion of the field and apply fungicide during exit from the infected area of the field.

2) Desiccate infected area plus safety margin and re-enter desiccated area with a fungicide 2 days later; e.g. Polyram + Supertin (2 lb/acre + 3.75 oz/acre). Monitor the desiccated area and the immediate surrounding area for regrowth and lesions. If regrowth present - apply Diquat 1 pt/acre + Supertin 3.75 oz/acre again, in water volumes as above.

Fungicide program for infected crop after emergency action.

Please refer to table available from MPIC in Potato Late Blight A Guide to Control for choice of programs. This crop should be treated at five day intervals with e.g. Bravo ZN (2.2 pt/acre) + Super Tin (3.75 oz/acre) or e.g. Polyram (2 lb/acre) + Super Tin (3.75 oz/acre) for 15 days or until the infection is no longer spreading. A seven-day interval between protectant fungicides should then be followed until desiccation. Supertin can be applied up to 7 days pre harvest but cannot be applied after desiccation.

If late blight exceeds > 20% of the leaf area over the whole crop, the crop should be desiccated and treated as above.

All crops, not already treated, should be sprayed immediately with either Tattoo C (2.23 pt/acre) or Acrobat MZ (2.25 lb/acre) or Curzate M8 (1.5 lb/acre) plus Supertin (3.75 oz/acre) in the maximum amount of water practical (10 gal/acre by air >25 gal/acre by ground). Crops not infected with late blight should then be protected with a strict five to seven day application interval with protectant fungicides e.g. Bravo ZN (2.2 pt/acre) or an EBDC (2 lb/acre).

Crops in vicinity of late blight infected fields.

Crops in the vicinity of infected crops should follow applications of Section 18 fungicides with applications of a protectant e.g. Bravo ZN (2.2 pt/acre) or an EBDC (2 lb/acre) plus Supertin (2 oz/acre) after 5 days. Once the infection has been contained, a seven-day schedule should be resumed using a protectant program as described above.

Fungicide applications should continue on a seven-day schedule once the late blight infection is under control.

Copper sulfate: should be used to help dry out canopies. Copper sulfate is mildly phytotoxic to potato canopies and should cause enough desiccation to open up dense canopies to allow them to dry out more readily. The copper may also desiccate some of the active sporulation and the acidic solution may also help reduce the spore population. Application rates should be 5 - 10 lb/A and applied by either air or ground.

Cultural controls

Irrigation: try to irrigate as much as possible in the evening to allow the canopy time to dry out during the day.

Harvest: where tuber infection is confirmed, allow crops as much as 28 days after desiccation before harvest. This will allow time for infected tubers to degrade in the soil and not be introduced into storage.

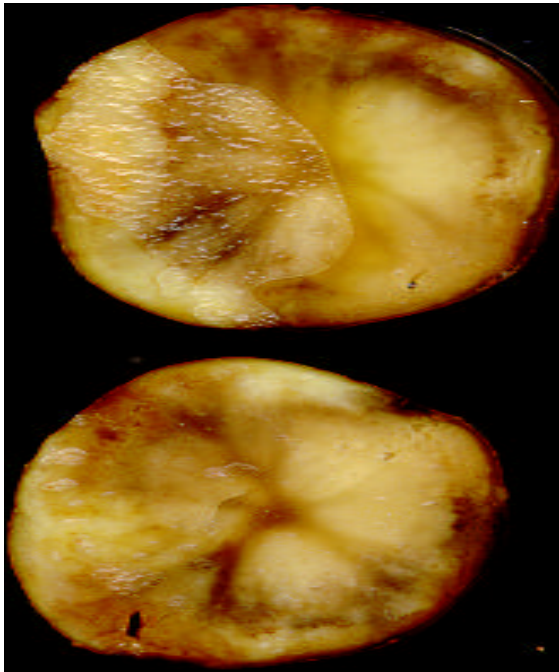
Grading: load bins as slowly as possible to allow graders time to pick out infected tubers. Remove all tubers with signs of any infection of any disease as they may be harboring late blight, pink rot, pythium or soft rot which when in storage will quickly rot tubers.

Disinfection of tubers: a disinfectant may help control pathogens on the surface of tubers however once pathogens have penetrated the skin they are not accessible to disinfectants. Results with Purogene on internal infections have shown poor control however when soft rot bacteria and Fusarium dry rot spores have been treated with Purogene applied directly to artificial cultures we have seen excellent control. This is probably also true for Oxidate and trials will be conducted with

both Oxidate and Purogene in fall - winter 2000. There has been no data generated at MSU for Oxidate to date.

Oxidate recommendations are as follows: pre-storage for control of Fusarium tuber rot, Bacterial soft rot, Silver Scurf, Early Blight, Late Blight: 2.5 - 1.25 fl oz/gal of water, spray diluted solution on tubers to run-off to achieve full and even coverage. An additional surfactant can be added as needed to aid in sticking (Biosafe do not recommend any specific sticker). They also recommend direct injection into humidification water for post-harvest potatoes in storage: same diseases as above 1.25 - 0.5 fl oz/gal of water.

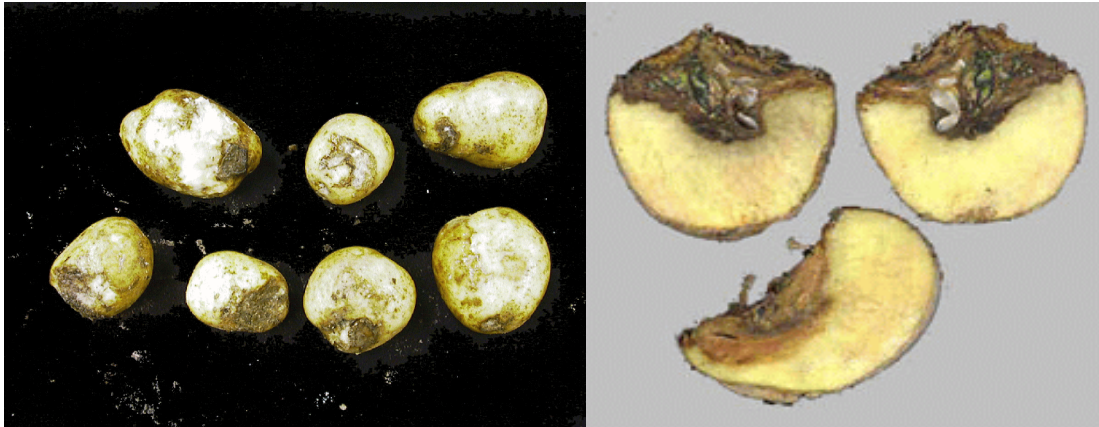
The following pictures show typical late blight disease symptoms.



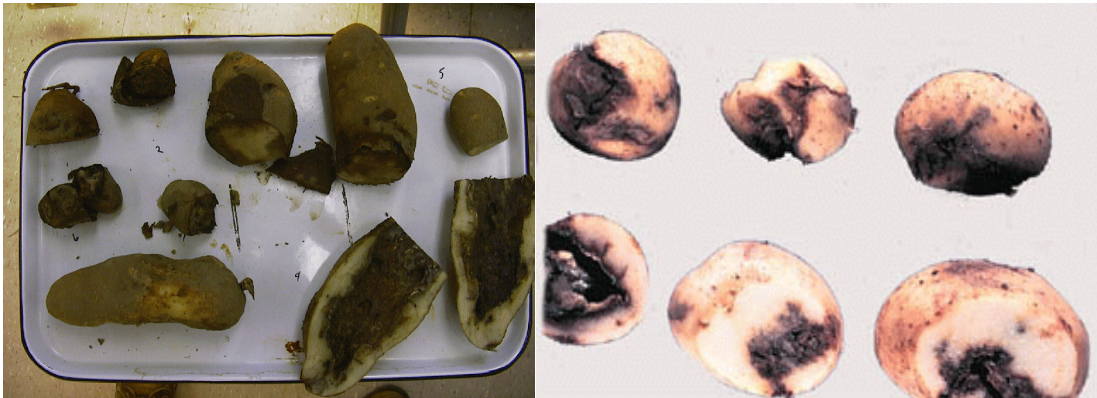
Internal discoloration of tuber tissue due to late blight infection and tuber surface degradation and sporulation



Potato storage into which a low **VISIBLE** percentage of infected tubers were introduced. Storages will become completely infected within 2 months at 49BF.



Fusarium external and internal symptoms



Pythium external and internal symptoms



Pink rot (internal symptoms)

If you need to send samples please follow the sampling procedure for late blight.

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**Phone 517 353 4481 and 517 355 4754
Fax 517 353 1926
Email kirkw@msu.edu**

The MSU Potato Late Blight Clinic is ready to receive samples of leaves and tubers from potato crops suspected to be affected with late blight. ELISA and microscopic confirmation of the disease can be turned around in 6 hours to 2 days depending on the sample condition. We will run electrophoretic assays and mating type analysis at the end of the season. The charge for disease identification, pathogen genotype and metalaxyl sensitivity is a total of \$40 per sample (billing on checks payable to MSU). The following sampling procedure should be followed to enable a timely and efficient turnaround.

1) Sample collection.

Stems and Leaves. Remove suspected foliar tissue or actively sporulating leaf and/or stem lesions and place them in small paper bags. Do not put samples directly into plastic bags, this avoids rapid degradation of the sample. Place paper bags with sample(s) into a plastic bag. The plastic bag should have some ventilation but no large holes.

Tubers. Wrap suspect tubers in newspaper and place the samples in a suitably sized box. Tubers that are well rotted cannot easily be diagnosed and take longer than leaves to ascertain genotype of the pathogen.

2) Sample labeling.

Samples taken from different seed lots or batches of the same seed lot should be clearly identified. Samples of stems or leaves within the same field or from different fields: samples should be clearly labeled detailing field, location within field, date of sampling, fungicide application details and variety of potato. Each sample should be placed in a separate bag. Batches of samples should be placed in plastic bags. The bags should be labeled with the phone/fax number of the grower or consultant with a water resistant marker pen.

3) Sample care.

Samples should be kept in a cool-box until dispatched. Do not add water to the samples or enclose a water-soaked tissue with the samples as this can cause sample degeneration and may interfere with the assay procedure.

4) Sample delivery.

To expedite identification, where possible, samples should be delivered on the day of sampling to the Potato Late Blight Clinic at MSU. Alternatively, next day guaranteed delivery services should be used. If sending samples, samples should be placed in a box with aeration and a chemical cool-pack.