LATE BLIGHT MANAGEMENT PLAN FOR ALASKA
2005

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INTRODUCTION

Development of this Action Plan

The Late Blight Management Plan for Alaska was developed utilizing the Idaho Action Plan 1998 as a template. The Idaho Action Plan was prepared by personnel from the University of Idaho's College of Agriculture in cooperation with numerous experts through out the United States. The Alaska Management Plan was developed to provide Alaskan potato growers with information for managing this "new to Alaska" disease. Sound management practices will reduce the potential for yield and quality losses that can be caused by late blight. Decisions concerning preventive measures and fungicide spray programs can only be made from a sound knowledge base. You are encouraged to ask questions and seek other sources of information. Web searches for late blight will provide current information and color photographs. The web site from Oregon State University, http://oregonstate.edu/potatoes is a good place to start. Links from this site can take you to North Dakota State University (NDSU) and to many other university sites. A good site is with the Global Initiative on Late blight and can be found at http://gilb.cip.cgiar.org/index.php, the more you know the better you are.

Occurrence of Late Blight

Late blight is the most important disease of potatoes on a world-wide basis. In 1989 and 1990 outbreaks of late blight were reported in northwestern Washington in commercial potato fields that had received 2 to 4 late season applications of metalaxyl. Since it's introduction in the late 70's metalaxyl , trade name Ridomil , was very effective in controlling foliage and tuber blight, however, the late blight found in Washington proved to be resistant to Ridomil. Workers across the U.S. and Canada soon found several new strains of late blight that until then, were not known to occur in the United States. Many of the new genotypes were shown to be resistant to metalaxyl and caused several serious outbreaks in the U.S. As more information was gathered and new strains were identified it became obvious that these new genotypes were more aggressive and better fit than the old U.S. 1. The development of control methods for the new strains became an immediate priority for the U.S. potato industry.

Occurrence of Late Blight in Alaska

Late blight was found in a field in the Matanuska Valley in early September 1995. It was determined to be an A2 mating type U.S. 7 strain by Cornell University. The foliage in the field was killed, the tubers harvested and quickly marketed. No late blight was found during the 1996 or 1997 growing seasons, which were relatively dry. Late blight was found in the Matanuska Valley in mid August of 1998 after a wet July. This time it was determined to be an A1 mating type U.S. 11 strain. A1's are usually sensitive to metalaxyl , however, U.S. 11 is not. Late blight was confirmed in fields of seven farms in the central valley and in four storages after harvest. It

was anticipated to reappear during the 1999 growing season, but somehow we escaped and late blight was not found again until August 9th 2005. The initiating source of the 1995 or the 1998 either late blight infection has not been determined

Late Blight Biology

Wind dispersed spores long distance. Community disease, Protectant fungicides need to be on the surface of the plants leaves and stems prior to the spores landing

Late Blight Dispersal

Potatoes may be exposed to late blight during the growing season from inoculum produced by infected potatoes in cull piles, volunteer potato plants, or the disease may originate from planting infected seed tubers. Tomato plants and fruit are susceptible to and have also been identified as sources of late blight inoculum. Under the right environmental conditions, spores from infected plants can be carried in moist air for miles. If the appropriate weather conditions exist, these wind borne spores can infect healthy plants and thus continue to spread the disease. There are no chemicals that will effectively kill the metalaxyl resistant strains once they have become established in a plant. As a result it is imperative that everyone develops a "prevention attitude" towards late blight. An effective prevention program includes implementing cultural and chemical management practices that reduce the potential for occurrence, spread, and losses from late blight.

CULTURAL CONTROL METHODS

Prior to Planting

Learn to recognize late blight leaf, stem, and tuber symptoms. Color photographs in extension bulletins, trade magazines, and on web sites are good sources. The ability to recognize tuber, stem and foliar symptoms will help with early detection. Responding quickly with appropriate treatment is important for controlling late blight.

Assess seed quality and grade to a tight standard (consider washing to improve visibility of defects if soft rot will not be a problem). Recent research has shown seed treatments can reduce the potential for late blight spread due to the seed cutting procedure.

Understand the Environmental Conditions Favoring the Development of Late Blight

Late blight is more likely to develop during rainy periods. In the absence of rainfall, sprinkler irrigation provides the water necessary for late blight development. Humidity and temperature greatly affects the fungus's development. Mycelial growth can occur between 35 f to 84 f. The optimum temperature is 70f. Infection can take place over a wide range of temperatures.

Spores are readily spread by splashing rain, overhead irrigation, and wind. Humidity above 90% is essential for long distance transmission. Spore germination will only occur in the presence of free water. Periods of fog, heavy dew, or rain are perfect incubators. Rapidly repeating cycles of spore production and spread give late blight its potential to develop quickly. Spores washed from foliage and stem lesions can infect tubers in the hill before harvest. Spores falling from green vines can infect tubers during harvest.

Fertilizer

Fertility plays a role in late blight management. High nitrogen levels promote rapid vine growth, which will be more difficult to keep protected with fungicides. Also green and vigorous vines are more difficult to kill with desiccants. Green vines may harbor late blight spores that can infect tubers during harvest.

Eliminate Sources of Inoculum

New late blight infections are initiated by fungal spores (inoculum) produced on the surface of **living** infected plant tissue. Sources of inoculum include infected plants or tubers in cull piles, volunteer plants arising from infections from the previous year, infected seed potatoes, tomato plants, and tomato fruits.

A Quarantine to help prevent the importation of infected material was enacted against tomato seedlings and seed potatoes unless they were produced in such a manner that would minimize their potential to carry late blight.

Volunteer potatoes are common in Alaska despite the occurrence of extreme freezing temperatures. Use shallow cultivation and labeled broad leaf herbicides to suppress the growth of volunteers. Planting potatoes back to back will add to the risk of reinfection. Planting certified seed will reduce the potential for disease introduction. The occurrence of late blight in an area does not mean that seed tubers are infected. There is an increased risk, however.

Avoid Conditions that Favor Late Blight

Weather conditions greatly affect the incidence and severity of late blight. Temperatures ranging between 55 and 80*f, rain, irrigation, relative humidity 90% or higher, fog, and heavy dew favor infection. Disease progress and spore production are also enhanced. Although weather is beyond our control, field selection and careful management can help reduce the time periods favorable for disease development.

Select fields with good water drainage and air flow characteristics. Low spots and areas near windbreaks that tend to stay wet for longer periods are typical spots for initial late blight development. Free water on leaves or stems for four hours or longer is required for late blight to get started. Reduce water ponding caused by over irrigation by renozzling or making other modifications to your irrigation system and irrigation practices. Avoid planting in areas of fields where plants are at high risk for infection or where plants cannot be adequately protected with fungicides. In Idaho and other regions with pivot irrigation, it is recommended that potatoes not be planted in the area between the center and the first tower as this area remains constantly wet and is typically where late blight is first found.

Excessive nitrogen fertilization promotes rapid and heavy vine growth. A rapid growth rate exposes more non-fungicide protected tissue to infection during the time interval between

fungicide applications. Heavy vine growth also extends the time period when the relative humidity within the canopy remains above 90%.

Varietal Susceptibility

All currently available potato varieties are susceptible to late blight, some to a greater or lesser degree. Early maturing varieties, such as Russet Norkota, Shepody, and Frontier Russet seem to be more prone to yield losses because defoliation progress rapidly and diseased leaves are not replaced by new growth. Shepody and Ranger Russet also seem to be very susceptible to tuber infection. The table below gives a relative ranking to the foliar stage of late blight for some varieties. It is important to note that susceptibility to foliar infection does not seem to correlate to the level of tuber infection.

Information from Outside growing areas indicate the following:

Susceptible	Moderately Susceptible	Highly Susceptible
Shepody	Ranger Russet	Frontier Russet
Atlantic	Russet Burbank	Russet Norkota
AO82611-7 (Umatilla)	Chipeta	Hilite
	Green Mountain	Gemchip
		Goldrush

The Varieties listed below are being grown in Alaska 1999- 2005

24-3	French Fingerling	Norland (dark red)
AK 114	Frontier	Peanut
AK Frostless	German Butterball	Peanut(BB)
AK Sweetheart	Goldrush	Pimpernel
Alasclear	Green Mountain	Ranger
Alaska Red	Hilat	Red LaSoda
Alaska Redeye	Hilite	Red Pontiac
All Blue	Huckleberry	Red Ruby
Allagash	Idarose	Reda
Andover	Iditared	Redsen
Atlantic	Jemseg	Rote Eerstling
Bake-King	Katahdin	Russet Norkota
Belmont	Kennebec	Sangre
CalWhite	Knik	Sangre 11
Caribe	Krantz	Shepody
Caribe (white)	Kueka Gold	Snowchip
Chaleur	Magic Molly	Superior
Cherry Red	Mainstay	Tundra
Chieftain	Mirton Pearl	Yellow Finn
Denali	NorDonna	Yukon Gold
Eramosa		

PLANTING TIME

Do not mix seed lots during cutting. Keep lots separate to avoid mixing clean seed with potentially infected seed and spreading the problem over a larger area. During cutting, eliminate and save suspicious tubers that show a rust brown, firm decay typical of late blight. Send suspicious tubers to a lab for positive identification.

Recent evidence indicates that late blight may spread readily from infected tubers to freshly-cut surfaces and to the sprouts of healthy seed tubers during cutting. Keep knives sharp and disinfected. Clean and disinfect all equipment between lots.

The application of fungicides to seed pieces is not a common practice in Alaska, however the dusting of seed with a labeled seed piece treatment that contains an EBDC, such as Tops MZ, may help reduce any spread caused by cutting. If possible, store seed at less than 45°F, then warm and treat just before tubers begin to sprout.

EARLY SEASON

Do not let cull potatoes accumulate. Culls should be disposed of in an appropriate manner as a **daily** routine. Eliminating cull potatoes early in the season is critical because these potatoes could be the source of a new epidemic. Potato pieces resulting from seed cutting or culls left after loading or unloading equipment may support the production of late blight spores whether or not the pieces are sprouting. All living potato tissue can potentially harbor the fungus.

The time of year dictates the **proper method of disposing** of cull potatoes. The **daily** burial of culls is the recommended method when live potato plants are in the field. Potatoes may sprout and produce plants even when buried to depths greater than two feet. Feeding potatoes to livestock can be used as a disposal method when unintended spore release will not infect live plants. Feeding to live stock can safely be carried out from October 1st until late March or April when freezing temperatures will help destroy any potatoes not eaten. At a certain point in time, not enough freeze-time will pass to be certain that the tubers will be thoroughly destroyed. Do not allow cull piles to build up at feeding areas because deep layers of potatoes may provide insulation against freezing and create a later volunteer problem within the feeding area. Monitor disposal sites to prevent volunteers.

Cultivate and properly hill fields.

Cultivating and hilling early may promote better water infiltration and reduce weed populations. Form wide and high hills to help minimize exposure of tubers to late blight spores that may be washed from infected plants. The use of a dammer-diker on sloping fields will help increase water infiltration and reduce ponding in low areas.

Control weeds.

Dry leaves are better than wet leaves. Weeds can contribute to conditions favorable to late blight by restricting air movement within the canopy. Reduced air movement will keep the humidity higher and increase the time required for leaves to dry after rain or irrigation. Also tall weeds will intercept fungicides intended to protect the crop.

Scout fields regularly.

Closely monitor the growing crop and submit any suspected late blight samples for identification. WHERE Concentrate scouting in areas of fields that tend to stay wet for long periods, such as against windbreaks or low spots. Areas infected in prior years are also likely places. The windward sides of fields are usually infected first from wind borne spores. Areas that may have escaped a fungicide application are also more susceptible. Look for volunteer potatoes, especially fields that had blight the previous year. Destroy all volunteers.

Forecasting

Forecasting models that predict when late blight outbreaks may occur have been developed for many areas worldwide, some work, some don't. Temperature and relative humidity are closely correlated with late blight outbreaks. The Alaska Division of Agriculture in cooperation with other agencies are trying to put together weather monitoring stations to track conditions that favor late blight development. The data will be collected and correlated to any outbreaks of late blight in Alaska and to help develop a predictive model. Growers will be notified when environmental conditions conducive to late blight have been met.

MIDSEASON

Irrigation Management

Potato leaves need to stay wet for 6 to 10 hours for late blight spores to germinate and infect a plant. The longer leaves remain wet, the greater the risk for infection to occur. With this in mind, irrigation scheduling will affect the potential for late blight to infect the crop. Avoid irrigation during, or immediately after periods of cool, rainy weather. When possible, allow the plant foliage to dry completely between irrigations. Heavy, less frequent water applications may be better than light, frequent ones, but not if soil is being washed from the hills and exposing tubers or if areas of standing water are created.

With solid set or set-and–move systems, consider beginning irrigations after midnight or when leaves would normally be wet from dew. Water for less than 8 hours to prevent leaves from remaining wet for a greater length of time. Keep equipment in good repair to prevent the formation of wet areas caused by leaking gaskets.

Scouting

Continue scouting fields, especially low spots, field borders, weedy areas, and any place where lack of air movement or shading allows leaves to remain wet for prolonged periods. Keep an eye on cull disposal sites and last years potato fields for volunteers so that measures can be taken before they become a source of inoculum.

Sanitation

Although late blight is more likely to be spread by wind it is unwise for industry personnel to take risks. Growers may wish to supply coveralls and boots that remain on the farm for workers or visitors to wear. People entering fields may want to wear high boots that can be disinfected between fields. Dilute household bleach, mixed one part bleach to nine parts water, is an effective disinfectant.

When found destroy hot spots.

Current knowledge indicates that when small infestations are found it is beneficial to destroy all visibly infected plants and all plants within 25 feet. Spore production requires green plant tissue. Disking, rototilling, vine beating, burning with propane flamer, spraying a desiccant or any method that destroys the infected plants, will help reduce this source of inoculum in your field. In Alaska, desiccants can take two or longer to completely destroy the foliage. This allows continued spore production during the time it takes for the herbicide to completely kill the plants. It is therefore advised that a fungicide be applied in combination with the desiccant and that fungicide treatments continue in this area until the infected zone is dead. Mechanical destruction of the vines will stop spore production more quickly than desiccants. The area to be killed should extend at least 25 feet beyond the plants with visible symptoms. While this can be effective, remember that it requires 3 to 5 days after infection has occurred for visible lesions to show up. If conditions were favorable for disease spread during these 3 to 5 days, killing an infected area after symptoms appeared may not have been done soon enough to prevent further spread. Mark infected areas so they can be found later to inspect for tuber infection prior to harvest. Marking the zone with flags or better yet, spray paint, will help in finding these areas later in the season.

Weather

Watch the weather. It will hurt when it pours rain an hour after several hundred dollars of fungicide was just applied. Juggling irrigation, cultivation, hilling, and spraying, rain and wind guessing will be difficult. Remember fungicides need to be applied prior to spore showers, but waiting until after a rain to spray may be too late.

LATE SEASON

Avoid excessive irrigation

Compacting or washing soil from the hills exposes tubers to late blight spores and sunlight. Potato tubers can become infected when spores are washed from infected foliage and contact tubers that are exposed on the surface. Spores may swim short distances through the soil or be carried in the soil water solution via cracks in the soil and infect underground tubers. Excessive rain, as we saw in 2005, can wash spores through the soil to contact tubers.

Scout fields.

Continue scouting on a weekly basis to locate any hot spots that may develop. Infected areas should be flagged so they can be thoroughly examined prior to harvest. These areas are extremely important because even small levels of foliar infection can lead to a significant amount of tuber infection if green vines are present during harvest. Hot spots should be evaluated for tuber rot prior to harvest.

Prevent volunteers.

Preharvest sprout suppressants must be applied at least two weeks prior to vine kill while vines are green and actively growing and. Malic hydrazide (Royal MH030, Super Sprout Stop) has been reported to provide 70 to 80% control of next years volunteers when applied at the full label rate. **Malic hydrazide should not be applied to seed potatoes**. Malic hydrazide can cause some foliar and tuber injury if overlapping occurs or if applications are made to stressed crops.

Kill vines completely.

Late blight cannot survive and produce spores without green foliage or stem tissue. During harvest of fields where late blight was found, any green vines mixed with tubers, may lead to tuber infections that become evident only later in storage. Kill vines 2 to 3 weeks prior to the anticipated harvest date. Continue fungicide applications until all vines are completely dead. This will minimize the chances for infections to occur during harvest, and may allow infected tubers to rot in the field. Mechanical or chemical vine destruction methods may be used. No data are available that suggests that one method is better than another as long as vines are completely dead. Vine rolling may help to get the desiccant to the lower portion of the stem and expose the soil and lower canopy to drying if vines are very large. Rolling seals soil cracks and may reduce the potential for tuber infection. Vine kill chemicals (Diquat, EnQuik) work best in warm, sunny weather. Our cool, cloudy weather at harvest typically slows down the action of chemical desiccants. Green vines have been observed in fields where desiccants have been applied three weeks after application. Perhaps the addition of acidifiers would help, but without local trials one can only speculate.

Frost usually does not completely kill all the vines, unless the temperature stays down for several days. Growers should not rely on frost for adequate vine kill.

Mechanical vine destruction with a flail or vine beater can eliminate green tissue within a few days.

HARVEST AND STORAGE

Harvest carefully.

Avoid harvesting during wet conditions and before skins are set to minimize skinning, cuts, and bruises. These types of harvest damage provide ideal entry sites for late blight as well as other pathogens. Although late blight does not need a wound to gain entry to tubers, cut, skinned, and shatter-bruised tubers are more likely to become infected. Damaged areas on tubers that remain wet for an extended time period provide pathogens a better opportunity to become established. Remember, late blight is a water mold and needs 6 to 10 hours of continuous moisture to infect a plant or tuber.

Hot spots that were identified during the growing season are now very important. A thorough inspection of these areas will help identify harvest priority. A value judgement will need to be made to determine if, in fact, harvesting should occur. It is strongly suggested that tubers from hot spots be harvested and stored separately. Mixing infected tubers into the whole pile is not a good idea because of the potential for creating numerous infection sites. Tubers from heavily infected areas, if harvested, should be stored where they can be closely monitored and moved out if breakdown occurs.

Identify the level of tuber infection. Sort tubers coming into the storage during harvest, removing as many infected tubers as possible and disposing of culls properly. Remove vines, loose soil, and anything else that may interfere with air distribution in the pile. Identifying infected tubers can be difficult, especially if they are covered with soil. Periodically, take samples. Wash the tubers and examine them closely.

Decision time.

Potato lots with more than 5% late blight infection are considered difficult if not impossible to store even in cellars with good ventilation systems. Lots with up to 2% late blight are considered manageable at least for the short run. Storage under normal chip-stock conditions, 50-55*f and 90-95% RH, will not work as these are also ideal conditions for further disease development. The ability to provide high volumes of air through the pile is critical during the early storage period. Diseased tubers should be cooled to as low a temperature as is practical, preferably 38-40*f, as soon as possible after harvest. High volumes of air pushed through the pile must be maintained until the pile is dry. Keep the relative humidity below 85% to dry out the infection spots. Problems should become apparent within 4 to 6 weeks. Be alert for an ammonia-like odor and wet spots. The shrinkage loss and energy cost caused by pushing large volumes of low humidity air should be considered.

Minimize volunteers.

Tubers left in the field are potential volunteers, and if infected, may contribute to next year's problems. The number of small tubers left in the field can be reduced by using narrower pitch chain on the harvester. This may also increase the soil load in the harvester, and the soil must be removed before placing the potatoes in storage. Use a collector bin on the trash chain to gather discarded tubers so that they do not drop back in the field. If fall field work is required use shallow tillage practices that tend to leave tubers near the surface where they are more likely to freeze.

CHEMICAL CONTROL

Types of Fungicides

Understand the mode of action of fungicides.

Fungicides are classified as either "protectant" or "systemic". A **protectant** fungicide provides protection when a coating of fungicide is applied to the plant surface **before** the plant is exposed to the pathogen. Protectants do not enter the plant. Examples of protectant fungicides include chlorothalonil (Bravo, Terranil), EBDC compounds (Maneb, Dithane, Polyram, Penncozeb, Manzate) and Copper (Kocide, Nu Cop). **Systemic** fungicides penetrate and move within the plant. This mode of action provides protection to plant cells that are some distance from the initial site of contact with the fungicide. Metalaxyl (Ridomil), a chemical that is effective against some races of late blight, moves downward in the plant and confers protection to plant cells below the site of deposition. The new systemic chemicals, Curzate, Acrobat, and Tatto, are more limited in their movement. They move laterally or upwards only short distances. Chemicals with this limited type of movement are referred to as "local systemics" with "translaminar" movement.

Selecting Fungicides

Included in this bulletin is a list of fungicides labeled for use on potatoes for controlling late blight. The fungicides are listed by a chemical name, then by their trade name. The fungicide selected is not as important as proper timing and accurate placement of the fungicide on the crop. **Remember there is a maximum seasonal total amount of chemical that can be applied for compounds that have the same active ingrediant.**

Protectant fungicides

Protectant fungicides **must** be applied with a frequency that ensures coverage of new growth **before** it is attacked. Potato plants can produce 6 to 10 inches of new vine growth a week during early July. Keeping this new growth protected will be a challenge.

Carefully read and follow label directions. **Several of the fungicides labeled for use have maximum amounts that can be applied per year**. Alternating fungicide classes is a good practice and may be necessary if these maximum limits are being approached.

Factors to consider

To ensure thorough and complete coverage, a necessity for controlling late blight, fungicides may need to be applied up to two weeks prior to potatoes being exposed to late blight spores.

The irrigation method, application frequency, and amount of water applied all influence fungicide redistribution within the canopy. Timing fungicide application and irrigation schedules will require planning

Fungicides can be applied by ground rigs, irrigation systems (chemigation), or airplanes. Air application requires a permit in Alaska. The permit will require a minimum of 120 days to obtain.

Field location, size, shape, and contour will affect application efficiency. The distance to water for refilling and keeping the spray boom out of the dirt when traveling through swales are only a few of the troubles encountered.

The availability of equipment needs to be evaluated. A successful late blight management program, and this cannot be overemphasized, **must** include having the fungicide applied to the crop **before** late blight is seen in the field. We are a long way from replacement parts. What type of sprayer, how many nozzles and inline screens, what personal protective equipment is required? The list will be long.

Application methods

There has been considerable discussion about the superiority of ground application compared to air or sprinkler application in providing fungicide coverage of the entire canopy. Each method has its advantages and disadvantages. Regardless of the method used, planning and management are required to ensure the best results. Using the best sprayer will allow late blight to develop if nozzles are plugged or strips are skipped between applications.

Ground application is a very effective because the water volumes and pressures used provide good leaf coverage and penetration of the fungicide into the canopy. Research at the University of Wisconsin found that hollow cone and extended range flat fan nozzles were superior to flood jet nozzles.

Recalibrate the sprayer often, and replace nozzles that are under or over applying by more than 10%. Raise the boom height as the crop grows to maintain the proper overlap in the spray pattern.

The main disadvantage of ground application is the amount of time required to apply the sprays. Moving irrigation equipment out of the way is another. Multiple trips through the field with a ground sprayer will increase soil compaction, especially on heavy soils. The University of Idaho documented a 1to 3% reduction in yield due to sprayer traffic in two fields in the Treasure Valley

Sprinkler application uses existing equipment to apply fungicides. The addition of an injector pump and a back flow preventer to the irrigation system and you are ready to go. The down side is that this method tends to deposit lower levels of fungicide within the canopy. The uniformity of fungicide application depends on the uniformity of water distribution. A thorough understanding of the system is important. Fungicides should be used at their highest labeled rates to ensure an effective concentration remains on the leaves. For solid set or wheel move systems the fungicide should be injected during the last 15 minutes of the irrigation set. Make sure the fungicide has been flushed out of the end nozzles before shutting the system down. The main disadvantage of center pivots is the huge volume of water applied with the chemical. Some systems allow a fast rate of travel that will decrease the amount of water.

WHEN TO APPLY FUNGICIDES

Initial applications

The central Matanuska Valley was exposed to late blight during the 1998 growing season. It is believed that a single source was responsible for initiating the outbreak that infected at least seven farms in the central valley. Tubers infected with late blight have been found in four commercial storages in the Matanuska Valley during the fall of 1998. Growers will make a concerted effort to prevent infected tubers from reinitiating another disease outbreak in 1999, but it is practical to assume that not all inoculum sources will be eradicated and steps to protect subsequent crops are required. If multiple sites produce inoculum in 1999, the potential exists for an earlier and more severe outbreak than that which occurred in 1998. Applying protectant fungicides before the first spores are released is required for good control.

It is vital to stay ahead of the fungus with a protectant spray program. Protectant fungicides must be applied at intervals that maintain coverage on new leaves, especially when the environmental conditions are conducive for late blight. Potato vines grow rapidly during the early part of the season. The vines of the variety Green Mountain were observed to grow 10 inches during a one week period of early July.

Suggestions for when to begin spraying vary according to the late blight potential. When blight pressure is expected to be high and occur early, protecting the crop should also begin early when the plants are 6 to 8 inches tall. These early applications help protect the stem and lower canopy after the vines close. Once vines close, conditions within the canopy become favorable for infection to occur. Early applications are recommended, especially for 1999, since the potential exists for multiple sources of late blight. Irrigated fields are more prone to late blight because growth is more rapid and leaves stay wet for longer periods. All areas in the Matanuska Valley must be considered at risk any time the environmental conditions become favorable for late blight. In any event the first spray should be made before the rows close to insure that some protectant is on the lower canopy. Preventive measures are very important when dealing with late blight.

If late blight is, or has been found, in a lot being used as planting stock, spraying should begin early to protect the crop. Rigorously scout for late blight. Early detection is critical to maintain control. Wind borne innoculum will require the correct weather conditions to travel and become established in a distant field. Dry weather will help contain blight pockets.

Pay extra attention if the weather is rainy or if the humidity has been high because of irrigation, fog, or dew. Problems will start sooner if the weather is rainy. Preventing blight from becoming established in a field is very important because rescuing a field can be very hard. There are no curative fungicides that will effectively stop a late blight epidemic. If blight is found, every effort should be made to eradicate it immediately. The sooner the infected plants are destroyed fewer spores are released. Infected plants in a small area can be rogued and placed in plastic bags for removal from the field. Plants within a ten foot area of the infected plant should also be destroyed as it can take four or five days after infection has occurred for symptoms to appear. Burn or bury these plants. If hand pulling and bagging is impractical then other means to destroy plants in the infected area should be taken. Other means include flaming, spraying a desiccant or disking. Remember that live plant tissue is required for late blight to produce spores, so the quicker the plants are dead the better.

Low risk conditions

Under low risk conditions, effective control can be maintained by spraying at 7 to 10 day intervals. If blight is reported in your area, spraying should continue at no more than 7 day intervals. Some of the EBDC compounds (Dithane, Penncozeb, Maneb) can be applied on 5 day intervals. Consult product label.

Should heavy late blight pressure occur, spraying a different chemical at intervals between applications of the first chemical may be desirable. Alternating two chemicals in overlapping spray programs, each based on a 5 to 7 day interval, will provide fields with a protective fungicide every 3 or 4 days. Care must be taken **not to exceed the seasonal maximum** application rates for a chemical group.

The choice of chemicals to use will change if blight pressure is high. Sprays with combinations of fungicides such as, Curzate plus Super Tin or Bravo plus Super Tin have been show to be effective.

If late blight becomes established in your field, taking measures to prevent tuber infection will help avoid storage losses. Destroy affected vines. Because the late blight fungus does not remain alive after the foliage dies, it is essential that the vines be completely dead before harvest. Harvesting with green vines in the field increases the possibility of contaminating tubers with spores. Since most vine desiccants require a minimum of 2 to 3 weeks of warm sunny weather to achieve this goal protectant fungicides should be applied to the dying vines to mimimize spore spread and tuber infection. **Fungicides should not be mixed with vine killers**. Remember the pre-harvest interval on the label must be followed.

Avoid harvesting hot spots

Tubers in these areas are more likely to be infected and mixing them throughout the storage can lead to problems. If you cannot be convinced that leaving these areas in the field is a good idea, then harvest and store them separately. A 5% infection level is considered a “do not store” guideline. Infected tubers have a high decay potential. Continuous monitoring for hot or wet spots is necessary. High air movement rates will dry the tubers and will help reduce decay. Temperature near 38*f will retard decay whereas 48*f and above will likely result in extensive decay.