IDAHO POTATO COMMISSION

Control of Early Blight, Rhizoctonia, White Mold and Pink Rot in Russet Burbank Potatoes -2005

O5P-PotCom-3
2005

Additional sponsors
BASF Corporation, Cerexagri Inc., Heads-Up Plant Protectants,
Syngenta Crop Protection Inc.
Helena Chemical Co.

MILLER RESEARCH, INC.
RUPERT, IDAHO
and
UNIVERSITY OF IDAHO
ABERDEEN, IDAHO

Miller Research
Experimental Plot Data

05P-PotCom-3

Planting Date: 02 May 2005

Pesticides: Sencor, Outlook

Soil Type: Portneuf Silt Loam

Row Spacing: 36 inches

Plant Spacing: 14 inches

Variety: Russet Burbank

Plot Size: 12' X 35" + 5" border

Plot Design: Random Complete Block

Replications: Four

Irrigation Type: Solid set sprinkler

Irrigation Schedule: 65% field capacity

Location: Rupert, ID

Application Data: Amistar-Tee-Jet 8001E in-furrow @ planting.
HeadsUp was misted onto the mixing tubers at 500 mls/100 lbs just before planting. Foliar Ground applications at 20.5 GPA

Application Dates: 02 May 2005 - seed treatments
06 July 2005 - treatment 9
08 July 2005 - treatments 2, 3, 4, 5, 7 & 8
21 July 2005 - treatments 2, 3, 4, 5, 7 & 8

Initial flower drop from primary inflorescence: 15 July 2005

P-Day alarm: 09 July 2005

Frost on June 9th and 11th 2005 slowed row closure because of canopy injury.

SEED TREATMENTS

All seed was cut on an automatic seed cutter. The cut seed is weighed into 50-lb boxes and divided 100 lbs./treatment. The seed from each 50-lb. box is loaded into a modified cement mixer for treatment. Seed treatment products are added as the mixer starts to turn. Total mixing time is 90 seconds. If a dry product is being applied a misting bottle is used to moisten the seed with about 30 mls of water to ensure that all dust adheres to the seed piece.

IN-FURROW LIQUID AT PLANTING APPLICATIONS: Amistar

A single nozzle, Tee Jet 8001 E, sprayed the soil falling into the furrow. The flow from each nozzle is checked using red ball flow monitors. Products used for spraying are placed in three-gallon stainless steel tanks. The mixer unit holds eight tanks. The products are mixed by turning a Teflon coated laboratory magnet inside the tank, with another magnet rotating under the tank. The magnets under the tanks are driven with a hydraulic motor. The hydraulic motor allows the speed of the turning magnets to be controlled. The spray tanks are pressurized with CO_2. Each tank is individually pressurized and protected with one-way valves to prevent intermixing of tank products. Because it is difficult to see the nozzles located behind the planter opener shoe, a Red Ball flow indicator monitors each row to ensure accuracy.

FOLIAR APPLICATIONS

Test products are applied with the Miller Research plot sprayer. This sprayer has been developed on the research farm through many years of testing. A small self-propelled tractor with a hydrostatic drive is used as the power source. The hydrostatic drive allows almost instant calibrated starting and stopping. Products used for spraying are placed in three-gallon stainless steel tanks. The sprayer holds twelve tanks. The products are mixed by placing a Teflon coated laboratory magnet inside the tank; with another magnet under the tank. The magnets under the tanks are driven with a hydraulic motor, which allows the speed of the turning magnets to be controlled.

The spray tanks are pressurized with compressed air. Each tank is individually pressurized and protected with one-way valves to prevent intermixing of tank products. All spray mixtures are prepared before entering the plot. Only one trip is made over each replication in the experiment to complete the spraying. This minimizes crop damage and helps avoid mistakes in application. The unused product in the lines is blown out the ends of the boom in the border area between each plot.

RHIZOCTONIA SOLANI

The first Rhizoctonia evaluations were taken in early July. The entire plant is used for evaluations (all stems on the plant). This disease continues through the season, so readings

taken later will have a higher index number. Three readings were taken to follow the disease development. Data is recorded as outlined below. Stem tissue is evaluated from the point of attachment to the seed piece to the soil surface. Early evaluations are critical since young tubers are forming and Rhizoctonia infections often girdle the stolons and cause a reduced tuber number. Subsequent evaluations are spaced throughout the season with the last reading near the end of August. Tubers can also be evaluated for Rhizoctonia by assessing the amount of sclerotia on the skin of the tubers.

Stem Disease: 10 plants/plot

0 = no disease on stem or stolons
1 = less the 10% of stem with lesions
2 = 10-20% of stem with lesions
3 = 20% or greater covered with lesions, but most not girdled
4 = most stems girdled
5 = almost the entire underground portion is infected

disease index = $\frac{(nx1) + (nx2) + (nx3) + (nx4)}{Yx4} \times 100$

or

Y= total number of stems

The disease severity on the first evaluation generally does not merit a 5 rating. The last two evaluations may use all five categories.

WHITE MOLD ASSESSMENT

The impact of this disease is measured using four parameters:

1 - **Percent of the plants that are infected**. This reading is irrespective of the severity of infection.

2 - **Percent of the stems infected**. In most cases, not all of the stems will be infected on the plant. Infections can be near the base of the plant, or often out on the stems where they are laying in the furrow in contact with the soil.

3 - **Percent of the entire plant tissue that is "affected" by the disease**. This data reflects the impact of the disease more than the above two readings because it considers all dying tissue caused by the disease.

4 **- White Mold Severity Index.** This evaluation is perhaps the best indication of disease severity. It is calculated by multiplying the percent of plants infected by the percent of the tissue "affected".

The evaluation is accomplished by uprooting 10 random plants from the center of each plot. Each stem is separated and rotated by hand to view all portions of the whole stem for *Sclerotinia* infections. Plots receive additional nitrogen to promote vegetative growth.

EARLY BLIGHT ASSESSMENT

We often use two methods to evaluate early blight. The first is a very quick rating from 1-5, five being the most severe. The second much more accurate and sensitive method is outlined below. This was the only method used for early blight assessment for this study.

This method generates data by counting the actual blight infection lesions on individual plant leaves. I have found this, rather than a general rating of severity, to be a much more accurate measure of the efficacy of a product. If the disease pressure is heavy enough, the general defoliation is accelerated, and the date for counting is set when there are still enough green leaves left in the check plots for an accurate evaluation to be made.

Selecting the plants to be counted is the most difficult part of this procedure. Plants with Early Die (Verticillium) are much more susceptible to Early Blight. Plants in which there appear to be an absence of any Early Die symptoms are gathered for counting. Giant hill plants are also avoided because they are not as susceptible to early blight. Only main stem vines without inflorescence are chosen for counting.

Alternaria infection progresses from the older lower leaves to the younger upper leaves. The lesion counts on older leaves often becomes so high that overall differences can be obscured. However, since such plants also produce an abundance of symptoms on the younger leaves, we have found that by counting the lesions on a given number of these upper leaves (usually six to eight) on each plant, it is possible to detect smaller control differences. These lesions, (on the younger leaves) can be more accurately distinguished than those on senescing leaves. Senescing leaves lose their natural resistance to Alternaria infection.

Ten plants are selected from each plot. Each leaf from each plant is spread out so lesions can be counted. I have found no other method that provides as accurate an assessment of product effectiveness. This greater accuracy is worth the difficulty involved with this procedure, and the extra time and effort it takes to count each spot on every green leaf.
One person collects all the plants for the four individuals that will do the lesion counts. Each individual is assigned to one of the four replications. A sixth person records the readings.

PINK ROT EVALUATION

Pink rot infections were determined by removing all decayed tubers from the harvester as each plot was harvested. The decayed tubers were evaluated for pink rot. The number recorded is the number of tubers expressing pink rot at harvest from 66 rft.

POTATO YIELD EVALUATION

Yield data is gathered using a specially modified two-row Champion harvester. Two rows of the four-row plot are dug and cleaned by the harvester and crew riding on the machine. The potatoes are run into a basket hanging on the end of the boom that normally delivers the potatoes into a truck. If a grading sample is required, it is collected in a cardboard box as the weigh basket fills. The basket is suspended by an electronic load cell scale, which is used to weigh the potatoes. The weight is recorded, the sample collected for grading is removed, and the doors on the bottom of the basket are opened to allow the remaining tubers to drop.

GRADING THE POTATO QUALITY

A 40 to 50 pound sample is collected during harvest for grading. USDA standards are used in grading the samples. The samples are separated into the categories listed in the ARM data of this study and weighed. The weights are converted into a percent of the total for statistical analysis. The percents are listed in the grade table.

BARTLETT'S TEST FOR HOMOGENEITY

If the treatment variances are not homogeneous, the assessment fails Bartlett's test for homogeneity, thus violating the analysis of variance assumption of homogeneity of variance. This is typically solved by either applying a data transformation, or by excluding from analysis the problem treatment(s). The following tools can be used: transform to apply a Log, Square Root, or Arcsine Square Root Percent transformation. If this is done there will be a second column of data indicating which transformation was used. The LSD letter indications for significant difference in the transform column should be applied to the values in the original data column. Data columns that should be transformed will have an asterisk by the value in the P (Bartlett's

STATISTICAL ANALYSIS

Least Significant Difference is used as the mean comparison test. The initial analysis of variance is performed at the 90% confidence level, if there are significant differences at this level; the analysis is repeated at 95%. If there are differences at 95%, then another test is calculated at the 99% confidence level.

DISCUSSION AND CONCLUSONS - Conclusions from analysis of P=.10 unless otherwise stated.

RHIZOCTONIA

1- July 6th – Not all treatments were evaluated for Rhizoctonia since some had not received any applications at this date. Four treatments (6–9) had HeadsUp seed

applications at this evaluation but only in three of these produced a significant reduction in Rhizoctonia (#6, 7and 9). If this reduction was real there probably should have also been a reduction in treatment # 8 or, alternately, there is some control in all four but only three achieved significance at the 90% confidence level. Amistar in-furrow was the best Rhizoctonia treatment in the study, significantly reducing Rhizoctonia, even at the 99% confidence level.

2- July 26th – Endura and Amistar significantly reduced Rhizoctonia compared to the untreated check. HeadsUp was not different from the untreated check treatments.

3**-** August 16th – Only Amistar reduced the damage of Rhizoctonia, as in prior evaluations. This was true even at the 99% confidence level.

EARLY BLIGHT

Disease pressure was low. Only Endura and Amistar provided significant control.

PINK ROT

Significant control was provided by treatments # 7 and 9. Both of these treatments had HeadsUp seed treatment and either two applications of HM-0201-A or a single treatment of HeadsUp foliar. This is encouraging because other tests that included phosphate products are also showing control. Perhaps HeadsUp applied as a foliar can also control pink rot commercially.

WHITE MOLD

1- White Mold disease pressure was very low in this study

2-- Percent of the plants that are infected. This category is the least reliable measure for assessing white mold control. Applications of Endura (#3) and the fertilizer check treatment (#2) were the only treatments to reduce disease in this category. Endura totally stopped white mold infections.

3 - Percent of the stems infected. Three treatments significantly reduced the percent of stems infected: Endura, Amistar and the fertilizer check treatment.

4 - **Percent of the entire plant tissue that is "affected" by the disease**. This is the best evaluation to determine white mold control in this test. Only Endura significantly reduced the effects of white mold on the plants.

5 - White Mold Disease Severity Index- The White Mold disease severity index was not useful in this study because the disease pressure was too low.

6- Perhaps there is some protection offered by Amistar and foliar applications of Phosphate and Potassium. The fertilizer products were supplied by Gene Miller of Baicor, L.C. This treatment was a check for the HM-0201-A treatment.

YEILD

Yield was low in this study, possibly because of all the disease evaluations and because this is area has been in continuous potato production for 8-10 years. Treatment # 7, the HeadsUp + HM-0201-A treatment, produced a significant yield increase.

USDA GRADE

The most obvious grade improvement was with the Amistar treatment. Several grade improvements were significant in this treatment. This is most likely tied to significant Rhizoctonia control. There are some other grade differences, but none as consistent as the Amistar treatment.

Late blight did not develop in this study this year.