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2010 POTATO VARIETY EVALUATIONS

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INTRODUCTION

Each year, the MSU potato breeding and genetics team conducts a series of variety trials to assess advanced potato selections from the Michigan State University and other potato breeding programs at the Montcalm Research Farm (Entrican). In 2010, we tested 182 varieties and breeding lines in the replicated variety trials, plus single observational plots of 186 lines for the Early Observational Trial and 219 lines in the National Chip Processing Trial. The variety evaluation also includes disease testing in the scab nursery (MSU Soils Farm, E. Lansing and Montcalm Research Farm, Lakeview) and foliar and tuber late blight evaluation (Muck Soils Research Farm, Bath). The objectives of the evaluations are to identify superior varieties for fresh or processing markets. The varieties were compared in groups according to market class, tuber type, skin color, and to the advancement in selection. Each season, total and marketable yields, specific gravity, tuber appearance, incidence of external and internal defects, chip color (from the field, 45°F (7.2°C) and 50°F (10°C) storage), as well as susceptibilities to common scab, late blight (foliar and tuber), and blackspot bruising are determined.

Improving agronomic performance of plots at the Montcalm Research Farm has been an on-going process. In 2010, we saw a significant increase in plot yields as a result of improved trial management. We would like to acknowledge the collaborative effort of Bruce Sackett, Mark Otto (AgriBusiness Consultants), Darryl Warncke, Chris Long, and the Potato Breeding Team.

PROCEDURE

Ten field experiments were conducted at the Montcalm Research Farm in Entrican, MI. They were planted as randomized complete block designs with two to four replications. The plots were 23 feet (7 m) long and spacing between plants was 10 inches (25.4 cm). Inter-row spacing was 34 inches (86.4 cm). Supplemental irrigation was applied as needed. The field experiments were conducted on a sandy loam soil that was in corn the previous year and in potatoes 4 years previously.

The most advanced selections in the breeding program were harvested at two dates to evaluate early and late harvest potential (Early Harvest Trial). These same

clones also harvested at a later standard harvest date, included in the various other variety trials. The Date of Harvest Early and Late Trials were replaced by the Early Trial entries being included in other trials for the second (Late) harvest. The most advanced selections were tested in the Advanced trial, representing selections at a stage after the Adaptation Trial. The other field trials were the North Central, Russet, Adaptation (chip-processors and tablestock), and Preliminary (chip-processors and tablestock). *Note: We also conducted an early harvest observation trial (90 days), to screen newer lines from the breeding program for early performance potential as out of the field chip-processing and tablestock varieties. The early observational trial is discussed in the breeding report.*

2010 was the first year of the National Chip Processing Breeder Trial (NCPT). The purpose of the trial is to evaluate early generation breeding lines from the US public breeding programs for their use in chip-processing. The NCPT has 8 sites (North: NY, MI, WI, ND and South: NC, FL, TX, CA) in addition to a scab trial in MN. A total of 220 lines were tested as 15-hill single observation plots. *The NCPT trial is discussed in the breeding report.*

In each of these trials, the yield was graded into four size classes, incidence of external and internal defects in >3.25 in. (8.25 cm) diameter (or 10 oz. (283.5 g) for Russet types) potatoes were recorded. Samples were taken for specific gravity, chipping, disease tests and bruising tests. Chip quality was assessed on 25-tuber composite sample from four replications, taking two slices from each tuber. Chips were fried at 365°F (185°C). The chip color was measured visually with the SFA 1-5 color chart. Tuber samples were also stored at 45°F (7.2°C) and 50°F (10°C) for chip-processing out of storage in January and March. Advanced selections are also placed in the MPIC B.F. Burt Cargill Commercial Demonstration Storage in Entrican, MI for monthly sampling. The lines in the agronomic trials were assessed for common scab resistance at the nursery at the MSU Soils Farm, and at *a new scab site at the Montcalm Research Farm*. There was very strong scab disease pressure at the new Montcalm Scab Disease Nursery. The 2010 late blight trial was conducted at the Muck Soils Research Farm. Maturity ratings (1 early - 5 late) were taken for all variety trial plots in late August to differentiate early and late maturing lines. The simulated blackspot bruise results for average spots per tuber have also been incorporated into the summary sheets.

RESULTS

A. Early Trial:

Chip-processors and Tablestock (Table 1: Early Harvest)

There were 12 entries that were evaluated at the early harvest trial. The results are summarized in **Table 1**. Atlantic, Snowden, Pike and Onaway were used as check varieties. The plot yields were above average in the early harvest (97 days), and specific gravity values were average to slightly below average. Hollow heart was the most prevalent internal defect in the early harvest this year, although only to a limited degree. Atlantic showed the highest incidence of hollow heart in the late harvest (18%). In the

early harvest trial, the best yielding lines were Onaway, MSL211-3, Michigan Purple Sport III, and Michigan Purple. MSL211-3 is an attractive, smooth-skinned, round to oval tablestock line with foliar late blight resistance. Michigan Purple Sport III is a unique selection with splashes of purple from a sport of Michigan Purple. Michigan Purple continues to demonstrate early bulking potential for the farm market.

B. Advanced Trial (Table 2)

A summary of the 18 entries evaluated in the Advanced trial results is given in **Table 2**. Overall, the yields for the Advanced trial (140 days) were above average. The check varieties for this trial were Snowden, Atlantic, and FL1879. The highest yielding lines were Snowden (439 cwt/a), MSL292-A, Kalkaska, MSH228-6, MSQ279-1, and MSQ086-3 (372 cwt/a), followed by Atlantic, MSP515-2, and Beacon Chipper. Hollow heart and vascular discoloration were the predominant internal defects, with FL1879 and Atlantic having the highest levels of hollow heart (33 and 20%, respectively). There was a higher incidence of internal brown spot than typical, with 13% in MSP515-2 and 8% for Atlantic, MSQ070-1, and Kalkaska. Specific gravity was average with five lines having specific gravities equal to or higher than Snowden (1.079): MSQ070-1 (1.088), Atlantic (1.085), MSJ147-1 (1.083), Kalkaska (1.081), and MSL292-A (1.079). All entries in the trial had excellent chip-processing quality out of the field, with an SFA score of 1.0. Many of the MSU breeding lines have moderate to strong scab resistance. Beacon Chipper continues to be consistently high yielding line with good specific gravity, chip quality, and scab resistance. MSH228-6 also continues to be a top agronomically performing clone with scab resistance. Two newer promising chip-processing lines are MSL292-A (chip quality, high yield, good specific gravity, and shows potential as a long-term storage chipper) and MSQ279-1 (good yield and chip quality and scab resistance). Other lines that continue to show promise are MSL007-B, MSJ126-9Y, MSR061-1, MSP270-1, and MSJ147-1.

Variety and Advanced Breeding Line Characteristics

Beacon Chipper – a chip processing line that has high yield potential and moderate scab tolerance along with excellent chip-processing quality. Yield performance in the USPB/SFA trials was also high.

MSH228-6 – a chip-processing line with moderate scab resistance. It has a good type and has performed well in on-farm trials.

Kalkaska (MSJ036-A) – an MSU chip-processing selection with high yield potential. It also has a high specific gravity and scab resistance. The tuber type of MSJ036-A is round and attractive. We are conducting transformations to lower the reducing sugar in the tubers.

MSJ126-9Y – an earlier season chip-processing line with excellent chip quality and long-term storage potential. This line also has scab resistance and an attractive type.

MSL007-B – an MSU chip-processing selection with strong scab resistance, uniform round type, and a unique netted skin. This newer line produces excellent chips with a good specific gravity and average yield.

MSL211-3 – an attractive round-white tablestock line with strong foliar late blight resistance, moderate scab resistance, and an early maturity.

MSL268-D – is also a round-to-slightly oval white tablestock line with moderate scab resistance, strong foliar late resistance, and PVY resistance. This line has an average yield with mid-early maturity.

MSL292-A – a round-white chip-processing line with high yield, good specific gravity, and excellent chip quality that has demonstrated potential for good long-term chip quality.

MSP270-1 – a new round-white chip-processing line with good scab resistance, average specific gravity, and good type. This line produces clean chips with good specific gravity and an early maturity, and has storage potential.

MSQ279-1 – a round-white chip-processing line with good agronomic performance and excellent chip quality that has good scab tolerance.

MSR061-1 – is also a round-white chip-processing line with good scab resistance, moderate foliar late resistance, and PVY resistance. This line has an average yield with mid-early maturity.

In the past the MPIC has sponsored a booth at the Great Lakes Fruit, Vegetable, and Farm Market Expo in December to market Liberator, Michigan Purple, Jacqueline Lee, and new specialty potato varieties to the farm market/roadside stand market segment. The breeding program sponsored the booth in 2009 and 2010 to continue to promote varieties and promising advanced selections that may be of interest to this market segment. There continues to be a strong interest in specialty potato varieties and a growing demand for new, unique potato varieties. We also showcased some of the newer up-and-coming selections from the breeding program to get a sense of the interest from growers who stopped by the booth.

C. North Central Regional Trial Entries (Tables 3 and 4)

The North Central Trial is conducted in a wide range of environments (11 regional locations) to provide adaptability data for the release of new varieties from Michigan, Minnesota, North Dakota, Wisconsin, and Canada. Twenty-two entries were tested in Michigan in 2010. The clones were from three market classes: Red (5 entries), Russet (5 entries), or Round White (12 entries). The results are presented in **Tables 3**

and 4. The MSU lines MSL211-3, MSL268-D, MSM182-1, and MSQ176-5 were the Michigan representatives included in the 2010 North Central Trial. MSL211-3 is an attractive, bright-skinned round to oval white tablestock with late blight resistance and reduced susceptibility to scab. MSL268-D has dual-purpose characteristics; good chip-processing quality and an attractive freshmarket type, combined with late blight resistance, and some early bulking potential. MSM182-1 is a tablestock line with bright-skin, and round type. MSQ176-5 is a late blight resistant tablestock with very uniform, large, round-white tubers and smooth, bright skin.

D. Russet Trial (Table 4)

We continue to increase our russet breeding efforts to reflect the growing interest in russet types in Michigan. In 2010, 13 lines evaluated after 128 days. The results are summarized in **Table 4**. Russet Burbank, Russet Norkotah, Silverton Russet were the reference varieties used in the trial. The highest yielding lines were Silverton Russet (337 cwt/a), A98134-2RUS, W6234-4RUS, and AC00395-2RUS (289 cwt/a). Overall, the internal quality in the russet trial was above average; however, hollow heart and vascular discoloration continue to be the most prevalent internal defects. The highest hollow heart level was observed in AC00395-2Rus (60%) and A01124-3Rus (60%). Specific gravity measurements were average to below average with Russet Norkotah at 1.064. Off type and cull tubers were found in nearly all lines tested, with the highest being Russet Burbank (33%).

E. Adaptation Trials (Tables 5 and 6)

The Adaptation Trials are conducted as two separate trials based on market class: chip-processing and tablestock trials. The majority of the lines evaluated in the Adaptation Trial were tested in the Preliminary Trial the previous year. Three reference cultivars (Atlantic, Snowden, and Pike), and 18 advanced breeding lines are reported in the chip-processing trial. The trial was harvested after 139 days and the results are summarized in **Table 5**. All entries had good out-of-the-field chip scores. Specific gravity values were average for the Montcalm Research Farm (Atlantic was 1.086 and Snowden was 1.080). The highest specific gravity was Atlantic (1.086), followed by MSK409-1 (1084). The greatest hollow heart was noted in MSR159-02 (40%), followed by Atlantic and MSR036-5 (25%). The overall plot yields for this trial were above average in 2010. MSQ035-3 was the highest yielding line in 2010 (514 cwt/a), followed closely by MSS206-2 (504 cwt/a), Missaukee (491 cwt/a), and then Snowden (476 cwt/a). Multiple new breeding lines combine scab resistance and chip-processing: MSQ035-3, MSR036-5, MSR169-8Y and MSR131-2.

In the tablestock trial, 15 advanced breeding lines were evaluated with Onaway and check variety. The trial was harvested after 126 days and the results are summarized in **Table 6**. In general, the yield was above average in this trial and internal defects were low. The greatest amount of hollow heart was seen in Reba (18%). There were a significant number of oversize potatoes in MSS582-1SPL and Reba. The highest yielding line was MSS582-1SPL (round-white with red splashes) at 510 cwt/a, followed

by Reba, MSQ461-2PP, MSQ341-BY, and Onaway (379 cwt/a). Five of the lines have moderate to strong scab resistance. Eight of the 15 lines also had early maturity, similar to Onaway. Promising lines with an attractive type for the tablestock market are MSS582-1SPL, MSQ461-2PP, MSQ341-BY, and MSM288-2Y. Four specialty lines are being considered for release for 2011: MSQ425-4Y (purple splash skin with yellow flesh), MSN215-2P (purple skin with white flesh), MSR226-1R (red skin and red flesh), and Midnight (purple skin with deep purple flesh).

F. Preliminary Trials (Tables 7 and 8)

The Preliminary trial is the first replicated trial for evaluating new advanced selections from the MSU potato breeding program. The division of the trials was based upon pedigree assessment for chip-processing and tablestock utilization. The chip-processing Preliminary Trial (**Table 7**) had 33 advanced selections and two check varieties (Atlantic and Snowden). The chip-processing trial was harvested after 134 days. Most lines chip-processed well from the field (SFA chip score 1.0 – 1.5). Specific gravity values were average to below average for the trial (Atlantic: 1.090). The MSU lines with the highest specific gravities were MSR127-2, MSU383-1, MSU245-1, and MSU246-1. The yields were above average with Snowden at 423 cwt/a and Atlantic at 417 cwt/a. The highest yielding lines were MSU379-1 (547 cwt/a), MR148-A, MSR127-2, MSU383-1, and MST220-8 (434 cwt/a). Sixteen of the lines (46%) were classified to be resistant or moderately resistant to scab (≤ 1.5 scab disease rating). The greatest internal defects were hollow heart (Atlantic, MSU245-1, and MSQ029-1 at 45%), and 55% internal brown spots in Atlantic. Many of the lines in the Preliminary Trial combine good agronomic performance with chip quality, specific gravity, and scab resistance.

Table 8 summarizes the 35 tablestock lines evaluated in the Preliminary Trial (Onaway was the check variety). This tablestock trial was harvested and evaluated after 126 days. Eight of the selections were scab resistant or moderately resistant (≤ 1.5 scab disease rating). MSU161-1 (490 cwt/a), MSR214-2P, MST386-1P, MST285-2, and Onway (417 cwt/a) were the highest yielding lines. In general, there was a low incidence of internal defects. In addition to traditional round white, red-skinned, and yellow flesh freshmarket categories, there are some unique specialty lines. Zongshu 3 and Jingshu 2 were two lines from the Chinese breeding program that were also evaluated.

G. Potato Scab Evaluation (Table 9)

Each year, a replicated field trial at the MSU Soils Farm (E. Lansing, MI) is conducted to assess resistance to common scab. In 2010, we added two new scab testing locations. A site at the Montcalm Research Farm with high common scab disease pressure was chosen as a second testing location for the early generation observational trial (240 lines), and two replications of the scab variety trial (158 lines). *Additionally, we added a replicated On-Farm scab trial (32 lines), which is summarized in the Research Report.* We use a rating scale of 0-5 based upon a combined score for scab

coverage and lesion severity. Usually examining one year's data does not indicate which varieties are resistant but it should begin to identify ones that can be classified as susceptible to scab. Our goal is to evaluate important advanced selections and varieties in the study at least three years to obtain a valid estimate of the level of resistance in each line. The 2010 scab ratings are based upon the Montcalm Research Farm site. **Table 9** categorizes many of the varieties and advanced selections tested in 2010 along with three-year averages where applicable. The varieties and breeding lines are placed into six categories based upon scab infection level and lesion severity. A rating of 0 indicates zero scab infection. A score of 1.0 indicates a trace amount of infection. A moderate resistance (1.2 – 1.8) correlates with <10% infection. Scores of 4.0 or greater are found on lines with >50% infection and severe pitted lesions.

The check varieties Russet Burbank, Russet Norkotah, GoldRush, Red Norland, Red Pontiac, Onaway, Pike, Atlantic, and Snowden can be used as references (bolded in **Table 9**). The table is sorted in ascending order by 2010 rating. This year's results continue indicate that we have been able to breed numerous lines for the chip-processing and tablestock markets with resistance to scab. A total of 60 lines, of the 158 tested, had a scab rating of 1.5 (better than or equivalent to Pike) or lower in 2010. Most notable scab resistant MSU lines are MSH228-6, Kalkaska, MSJ126-9Y, MSL007-B, MSM037-3, MSN215-2P, MSP270-1, MSR036-5, MSR102-3 and MSR169-8Y; as well as some earlier generation lines MSS297-3, MSS544-1R, MSU383-1, and MSU384-1. The greater number of MSU lines in the resistant and moderately resistant categories indicates we are making progress in breeding more scab resistant lines for the chip-processing and tablestock markets. There are also an increasing number of scab resistant lines that also have late blight resistance and PVY resistance. We also continue to conduct early generation scab screening on selections in the breeding program beginning after one year. Of the 240 early generation selections that were evaluated, 98 were resistant (scab rating of ≤ 1.0). Scab results from the disease nursery are also found in the Trial Summaries (**Tables 2-8**).

H. Late Blight Trial (Table 10)

In 2010, the late blight trial was planted at the Muck Soils Research Farm. As in previous years, 196 entries were planted in replication for evaluation in replicated plots. These include lines tested in the agronomic variety trial (157 lines) and entries in the National Late Blight Variety Trial (39 lines). Block planting full rows of advanced selections provide a better assessment of the late blight resistance of these lines. We also planted 132 early generation breeding lines that have a late blight resistant pedigree. The field was planted on June 7. The trials were inoculated on August 3 with a US-8 genotype of *P. infestans*. Late blight infection was identified in the plots 10 days after inoculation. The plots were evaluated more than seven times over a 45 day period following inoculation. We need to note that the disease reaction in the plots was not typical to the previous years' ratings. All disease lesions tested were identified as US-22, which would explain the higher disease ratings (susceptibility) on lines with late blight resistance to US-8 (Tollocan-based resistance lines Jacqueline Lee, Missaukee, etc.). In

2010, twenty-nine lines had moderate to strong late blight resistance to US-22. These were from various late blight resistance sources (Torridon, Stirling, NY121, B0718-3, etc.). **Table 10** lists select lines in the foliar resistance and susceptibility categories.

I. Blackspot Bruise Susceptibility (Table 11)

Evaluations of advanced seedlings and new varieties for their susceptibility to blackspot bruising are also important in the variety evaluation program. Based upon the results collected over the past years, the non-bruised check sample has been removed from our bruise assessment. A composite bruise sample of each line in the trials consisted of 25 tubers (a composite of 4 replications) from each line, collected at the time of grading. The 25 tuber sample was held in 50°F (10°C) storage overnight and then was placed in a hexagon plywood drum and tumbled 10 times to provide a simulated bruise. The samples were peeled in an abrasive peeler in October and individual tubers were assessed for the number of blackspot bruises on each potato. These data are shown in **Table 11**. The bruise data are represented in two ways: percentage of bruise free potatoes and average number of bruises per tuber. A high percentage of bruise-free potatoes is the desired goal; however, the numbers of blackspot bruises per potato is also important. Cultivars which show blackspot incidence greater than Atlantic are approaching the bruise-susceptible rating. In addition, the data is grouped by trial, since the bruise levels can vary between trials. Conducting the simulated bruise on 50°F (10°C) tubers has helped to standardize the bruise testing. We are observing less variation between trials since we standardized the handling of the bruise sample.

In 2010, the bruise levels were comparable to previous years. The most bruise resistant MSU breeding lines this year from the Advanced trial were MSP270-1, MSQ440-2, MSH228-6, MSQ086-3, MSJ126-9Y, MSR061-1, and MSJ147-1. The most susceptible lines from the Advanced trial were MSP515-2, Snowden, MSP459-5, and Atlantic. The Adaptation Trial lines with the best bruise resistance were MSS108-1, MSQ432-2PP, MSR102-3, MSR159-02, MSM288-2Y, MSS544-1R, MSN105-1, MSR157-1Y, and MSS576-05SPL. Of the earlier generation breeding lines (Preliminary Trial), the most bruise resistant were MSR160-2Y, MST202-5, A00188-3C, MSU384-1, CO00188-4W, MSU379-1, MST437-1, MSQ130-4, MSU202-1P, MSR297-A, 1991-563-18, MSQ405-1PP, MST406-2RR, and MSU613-1. The most bruise resistant russet entries were A01124-3RUS, Silverton Russet, W6234-4RUS, CO99053-3RUS, and A98134-2RUS; the most susceptible were W8946-1RUS-NCR and W2683-2RUS. The most bruise resistant entries in the US Potato Board/Snack Food Association Trial were MSJ126-9Y, NY138, and W2978. While W2310-3, Atlantic, Snowden, and W5015-12 were the most bruise susceptible in this trial.