Project Report

Effect of MH60 for Size Control in a Chipping Variety

Prepared for:

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I. ACKNOWLEDGEMENTS

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II. BACKGROUND

A significant quantity of chipping potatoes are grown in southern Alberta, but little research has been conducted locally on these varieties. High dry matter (specific gravity) is essential for chip quality. Dry matter tends to increase as tubers become more physiologically mature. Tubers of many of these varieties reach undesirable sizes before the crop reaches physiological maturity. Oversized potatoes tend to develop conditions such as brown center and hollow heart and current processing equipment is not designed to handle large-diameter tubers. The potato chip industry favors uniform tuber size, and growers are docked for oversize tubers and associated internal defects.

The use of maleic hydrazide as a foliar applied sprout inhibitor has been well documented. Weis et al. (1980) studied maleic hydrazide applied to Russet Burbank potatoes in Wisconsin and reported that maleic hydrazide was an effective sprout inhibitor on tubers from treatment dates in July and August. Weis et al. (1980) also reported an increase in yield of U.S. #1 tubers and a reduction in malformed tubers. Yada et al. (1991) applied MH60SG on Kennebec and Norchip potatoes in Ontario and reported that foliar applied MH had no apparent effect on yield, was effective in suppressing sprout growth, and had no effect on sugar content of potatoes newly harvested or after 6 months of storage. They also reported that no consistent difference was found between the color of chips made from potatoes from untreated and MH-treated plants. Crompton Corporation advocates the use of maleic hydrazide (MH60) for controlling tuber size. This product is expected to prevent small tubers from late sets from bulking, allowing the remaining tubers to reach marketable sizes. Anecdotal information from North Dakota indicates that MH60 may allow potatoes to reach physiological maturity (higher specific gravity) without producing an excess of oversized tubers.

Royal MH60 is a plant growth regulator. When applied to healthy growing plants, the active ingredient, maleic hydrazide, is absorbed by the plant and will affect plant growth by stopping cell division, but not cell expansion. Through such action, Royal MH60 controls sprout development in potatoes. In addition to sprout control, Royal MH60 can help reduce storage losses and improve quality through a number of additional effects on the potato. Royal MH may improve grade, reduce the number of late season set potatoes, reduce volunteers and reduce shrinkage. Both the extent and number of these benefits obtained will depend on several factors such as variety and local growing conditions.

The purpose of this project was to compare MH60 applications at several stages of tuber development to determine if the product can effectively alter the size profile of chipping potatoes grown in southern Alberta. Total yield, grade, specific gravity, % defects and chip color were

assessed with the help of a commercial processor. Tubers were stored for eight months after harvest and were periodically assessed for sprout control as well as shrinkage.

III. PROJECT OBJECTIVES

- **To determine the effect of MH60 applications on chipping potatoes in southern Alberta.** Total yield, yield profile, specific gravity, %hollow heart, and internal defects were assessed.

- **To establish the correct stage of tuber development for MH60 application to attain an optimal size profile.** MH60 was instead applied at three different rates to compare with no MH60 application. Size profiles and sprout inhibition were compared for each treatment.

IV. WORK PLAN

A commercial field of chipping potatoes near Rolling Hills, AB was planted and managed by a southern Alberta grower. The field was planted April 22, 2004 with E3 seed potatoes at an in-row spacing of 8.2" and a between row spacing of 36".

Pre-plant broadcast fertilizer (80-70-90-15) was applied in spring of 2004 and potatoes were top-dressed with an additional fertilizer application after hilling (60-0-0-64). Touchdown (1 L/ac) was applied as a pre-emergent May 18. Select (70 mL/ac) was applied May 31; Sencor (12.5 g/ac) and Prisim (24 g/ac) were applied June 17 to control weeds. Fungicides were applied throughout the season as shown in Table 1 to control early blight and late blight. Thimet (20 lbs/ac) was applied at planting for control of Colorado potato beetle. The crop was desiccated August 18 with Reglone (1 L/ac).

Table 1: Foliar fungicides applied to the chipping potato crop to prevent early blight and late blight development.

Date of Application	***Fungicide***	***Rate***
June 26	Bravo	1 L/ac
July 7	Quadris	240 mL/ac
July 26	Bravo	1 L/ac

Treatments were applied with a tractor mounted three-point hitch sprayer to separate 1-acre strips (6 rows x length of the field) in a commercial field of chipping potatoes (FL variety) near Rolling Hills, AB. The first treatment was to be applied when tubers expected to size-up reached 1.5" in diameter. The second treatment was to be applied when the tubers expected to size up reached 2" in diameter (2.29 kg/ac ROYAL MH60 SG in 120 L/acre water). The third application was to be applied two weeks before regular top-killing. When we determined that the potatoes were at the correct stage of development for the first application, we were informed that they would be top-killed in two weeks. Because the time frames for application were overlapping, we discussed the trial with the cooperator and Frito Lay, and altered the treatments to study various rates of ROYAL MH60 instead. All treatments were applied August 5, 2004. One acre was treated with a one-third rate of ROYAL MH60 (0.76 kg/ac ROYAL MH60 SG in 120 L/acre water). Another acre was treated with a two-thirds rate of ROYAL MH60 (1.53

kg/ac ROYAL MH60 SG in 120 L/ac water) and a third acre was treated with the full registered rate (2.29 kg/ac ROYAL MH60 SG in 120 L/ac water). A control treatment, where no ROYAL MH60SG was applied was also evaluated.

Treatments:

1. Check; no MH60
2. 0.76 kg/ac ROYAL MH60 SG in 120 L/acre water applied August 5, 2004
3. 1.53 kg/ac ROYAL MH60 SG in 120 L/acre water applied August 5, 2004
4. 2.29 kg/ac ROYAL MH60 SG in 120 L/acre water applied August 5, 2004

All treatments were harvested mechanically September 1, 2004. Five replicates measuring two rows by 25'were harvested from each treatment strip in the field. The harvested tubers were weighed to obtain total yield estimates and graded to categorize small, oversized and deformed tubers. Marketable tubers (1⅞" to 3½" in diameter) were weighed to obtain estimates of marketable yield. Yield estimates have been presented as a percent of the check. A sample of marketable tubers was submitted to the Food Science lab at CDCS for analysis of chip color after harvest. Five to eight tubers were used to make chip slices. Chips were fried, cooled and color was measured on a Hunter colorimeter. L values (lightness values, scale of 0 to 100, where 100 is lightest) have been presented. Another sample of 25 marketable tubers was washed and used to determine specific gravity by the weight-in-air over weight-in-water method. Each of these tubers was then cut to assess brown center, hollow heart and other internal defects. Also, approximately 20 lb. of marketable tubers were weighed and stored at 46 F for 8 months at CDCS. Sprouting was assessed visually and shrinkage was calculated at the end of the storage period. A sub-sample of the stored tubers was submitted to the Food Science lab at CDCS for analysis of chip color after storage.

A 20 lb. sample of field-run tubers were set aside prior to grading and delivered September 7, 2004 to Frito Lay in Taber for commercial assessment. A second 20 lb sample from each replicate was placed in a commercial storage and was delivered May 5, 2005 to Frito Lay for commercial assessment.

Data were statistically analyzed using ANOVA and Duncan's Multiple Range Test ($p \leq 0.05$; SAS).

V. RESULTS AND DISCUSSION

Average length width and length to width ratio of tubers before and after MH60 applications are reported in Table 2. The length and width of tubers increased in the four weeks between applications and harvest, as the tubers finished bulking. Specifically, the tubers increased in diameter more than in length, resulting in oval shaped tubers. There were, however, no significant differences in length to width ratio of tubers at harvest, regardless of whether MH60 was applied or not.

Table 2: Average length, width and length to width ratio of tubers before MH 60 applications (August 3, 2005) and at harvest (September 1, 2005) following MH60 applications.

Trt.	Date	Royal MH60 rate	Length	Width	L/W Ratio
	Aug 3	None	2.48”	1.82”	1.33
1	Sept 1	None	2.96”	2.63”	1.14
2	Sept 1	33.3%	2.86”	2.81”	1.15
3	Sept 1	66.7%	3.13”	2.72”	1.16
4	Sept 1	100.0%	3.08”	2.62”	1.17

Relative total yield and yield of each size category are shown in Table 3. Application of less than the registered rate of Royal MH60 SG resulted in slightly lower yield. Application of Royal MH60 SG at the full registered rate resulted in an increase in total yield and marketable yield relative to the check. Yada et al. (1991) reported that foliar maleic hydrazide (MH) had no apparent effect of yield of chipping potatoes, Kennebec and Norchip, grown in Ontario. The maleic hydrazide in that trial was applied more than one month prior to top-killing.

No significant differences were observed for deformed tubers from any of the treatments, but this may be related to the variety grown. .

Table 3: Relative yield (% of total yield of check) by size category of chipping potatoes from plants sprayed with ROYAL MH60 SG at different rates two weeks before top-killing. Values within a column with the same letter are not significantly different at the P>0.05 level.

Trt.	Royal MH60 rate	Total Yield	Small (<1⅞”)	Marketable (1⅞ to 3½”)	Large (>3½”)	Deformed
1	None	100.00 b	6.73 a	86.27 b	6.95 a	0.04 a
2	33.3%	94.93 b	6.42 a	85.83 b	2.36 a	0.31 a
3	66.7%	95.86 b	5.75 a	84.85 b	3.21 a	0.00 a
4	100.0%	114.93 a	6.73 a	103.16 a	4.46 a	0.53 a

There was no significant difference in specific gravity in tubers from any of the treatments (Table 4). All specific gravities observed were acceptable for potato chip production (1.080 or greater). There were no statistical differences between chip scores from the various treatments although the chip scores from full rate maleic hydrazide treated plants were slightly better (lighter in color) than from the control (Table 4). In the commercial quality control lab, solids were highest in the control tubers and slightly lower in tubers from plants treated with MH60. The percentage of undesirable color observed in chip samples was much lower in maleic hydrazide treated tubers than in the check. Yada et al. (1991) reported from a three-year study that no consistent difference was found between the color of chips made from potatoes from untreated and MH60 treated plants.

Table 4: Post-harvest specific gravity and chip color scores for chipping potatoes from plants sprayed with ROYAL MH60 SG at different rates two weeks before top-killing. Chip color was measured on a Hunter colorimeter. L values are shown here (0 = black, 100 = white). The higher the chip score, the lighter the color. Values within a column with the same letter are not significantly different at the P>0.05 level. Commercial processing data is also shown here.

Trt.	Royal MH60 rate	Specific Gravity	Chip Score (L value)	Commercial Solids	Commercial % Undesirable Color
1	None	1.0808 a	59.58 a	16.84 a	2.09 a
2	33.3%	1.0818 a	59.10 a	16.52 a	0.09 a
3	66.7%	1.0806 a	58.24 a	16.52 a	0.62 a
4	100.0%	1.0816 a	60.25 a	16.42 a	0.60 a

Shrinkage was assessed after 4 months, 6 months, and again after 8 months (Table 6). Shrinkage was similar in the check and the full rate of Royal MH60, however, cut rates of MH60 resulted in slightly less shrinkage during storage. The chipping variety studied seems to be suited to long-term storage and few sprouts were noted even after 8 months in storage, even in the untreated check. Many commercial chipping potatoes are treated with a sprout inhibitor in storage regardless of dormancy so sprout control is not the primary reason for maleic hydrazide applications to chipping potatoes.

Table 6: Shrinkage of chipping potatoes from plants sprayed with ROYAL MH60 SG at different rates and stored at 46 F for 8 months. Values within a column with the same letter are not significantly different at the P>0.05 level.

Trt.	Royal MH60 rate	Shrinkage After 4 Months (%)	Shrinkage After 6 Months (%)	Shrinkage After 8 Months (%)
1	None	5.53 ab	6.68 a	8.21 a
2	33.3%	5.08 b	5.98 b	7.31 b
3	66.7%	5.08 b	5.91 b	7.48 b
4	100.0%	5.91 a	6.91 a	8.32 a

Table 7: Chip color scores for chipping potatoes from plants sprayed with ROYAL MH60 SG at different rates two weeks before top-killing and stored for 8 months at 46 F. Chip color was measured on a Hunter colorimeter. L values are shown here (0 = black, 100 = white). The higher the chip score, the lighter the color. Values within a column with the same letter are not significantly different at the P>0.05 level. Commercial processing data is also presented here.

Trt.	Royal MH60 rate	Chip Score (L value)	Commercial Solids	Commercial % Undesirable Color
1	None	68.03 a	16.66 a	0.27 a
2	33.3%	68.28 a	16.58 a	0.41 a
3	66.7%	67.33 a	16.58 a	1.21 a
4	100.0%	68.07 a	16.26 a	0.00 a

VI. CONCLUSIONS

Registered rates for Royal MH60 applications to potatoes were likely established to optimize sprout control in storage while maintaining yield and quality. Other benefits, such as improved yield, improved grade, and improved storage quality, may result from well-timed applications of MH60 as well.

In this study, we wanted to know if the other benefits could be realized with rates of Royal MH60 below the rates registered for sprout control. Royal MH60 was applied to a commercial crop of chipping potatoes (FL variety) two weeks before desiccation at the full registered rate and at two cut rates (33% and 67%). Data was collected from the treated areas of the field as well as from a check area to which no MH60 was applied. Yield, grade, specific gravity, chip color and storage quality were assessed for each treatment.

When MH60 was applied at the full registered rate, total and marketable yield were greater than the check. There were no significant differences observed for undersized, oversized or deformed potatoes. When MH60 was applied at cut rates, yield was reduced slightly relative to the check. No significant differences were observed in length to width ratio of tubers or specific gravity of tubers at harvest.

Chip scores were not significantly different between treatments either after harvest or after storage, however, chip colors after storage improved for all treatments compared to chip colors at harvest. During storage, there was slightly less shrinkage observed in the cut-rate treatments than in full rate and control treatments. Commercial assessments indicated that solids were similar for all treatments before and after storage.

This commercial field of chippers was well managed and expertly stored. The crop was of very high quality. As such, few dramatic differences were anticipated between treatments. Application of Royal MH60 at the full registered rate improved total and marketable yield while maintaining crop quality at harvest and during long-term storage.

VII. RECOMMENDATIONS

There was considerable interest in this project from the producers in southern Alberta in 2003 and excellent cooperation from our commercial cooperators in 2003 and 2004. Norvalley was studied in 2003, and a Frito Lay variety was studied in the second year of the trial as Norvalley gives inconsistent quality in southern Alberta. In 2003, we concluded that timing of MH60 applications is critical and the timing may be somewhat variety dependent. In 2004, we determined that registered rates of MH60 improved total and marketable yield relative to the check and maintained or improved chipping quality out of long-term storage. Cut-rates of MH60 probably do not result in sufficient benefits to warrant application of the product.

VIII. REFERENCES

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