Executive Summary: Weed Control and Crop Tolerance Evaluations in Processing Tomatoes

Researcher: D.E. Robinson, A.S. Hamill

Objectives:

1) Determine the effect of weed management programs on tomato establishment and yield.
2) Determine the effect of application timing on tomato tolerance and weed control with rimsulfuron.
3) Determine the effect of application rate on tomato tolerance and weed control with clomazone.
4) Determine the effect of tank mixing rimsulfuron, thifensulfuron-methyl and metribuzin with Kocide or Bravo on tomato tolerance and weed control.
5) Evaluate new herbicides for tolerance and weed control in tomatoes.
6) Determine the tolerance of processing tomato cultivars to thifensulfuron-methyl.
7) Determine the effect of various adjuvants on tolerance of tomatoes to thifensulfuron-methyl.

Methodology: Research studies were completed at the Greenhouse and Processing Vegetable Research Station in Harrow, Ontario and at Ridgetown College, Ridgetown, Ontario. The trials consisted of small plots, which were replicated four times. Herbicide treatments were applied with a CO_2 pressurized sprayer calibrated to deliver 200 L/ha at 200 kpa. The data collected included visual crop tolerance ratings, fresh and dry weight, visual weed control ratings and crop yields.

Summary of results:

Objective 1: One half of each plot in this trial was maintained weed-free to test for tolerance of tomatoes to various weed management programs. Weeds were left in the other half of each plot to determine the level of weed control of each herbicide program.

None of the treatments caused commercially unacceptable visual injury. Some distortion of the lower leaves was evident in the trifluralin+metribuzin (1105+700 g a.i. ha^{-1}), s-metolachlor+metribuzin (1600+700 g a.i. ha^{-1}), and the s-metolachlor+metribuzin (1600+250 g a.i. ha^{-1}) followed by sequential metribuzin (150 g a.i. ha^{-1}) micro-rate treatments at 7 DAT. In all cases, the injury was less than 1% and was no longer measurable by 35 DAT.

The trifluralin+s-metolachlor+metribuzin tank mix provided excellent season long control of redroot pigweed and common lamb's-quarters, but poor control of green foxtail. Season long control of velvetleaf and redroot pigweed was observed following pre-plant incorporation (PPI) s-metolachlor (1600 g a.i. ha^{-1}) plus four sequential postemergence applications of metribuzin (150 g a.i. ha^{-1}). Common ragweed, common lamb's-quarters and green foxtail control were fair. The s-metolachlor+metribuzin (1600+250 g a.i. ha^{-1}) PPI tank mix followed by four sequential postemergence metribuzin (150 g a.i. ha^{-1}) treatments gave excellent control of velvetleaf and common lamb's-quarters, but poor control of green foxtail. This treatment did not reduce marketable or total yields compared with the untreated check, and gave the best yields overall in the weedy half of each treatment. The addition of thifensulfuron-methyl (6 g a.i. ha^{-1}) to this treatment did not increase visual injury of tomatoes, nor did it result in a decrease in marketable or total yield in the weed-free portion of each plot. Excellent control of velvetleaf, common lamb's-quarters and redroot pigweed was obtained, but green foxtail control was still poor.

Objective 2: One half of each plot was maintained weed free to examine the effect of delayed application timing (from cotyledon to 11 leaf stage of common lamb's-quarters) of rimsulfuron (15 g a.i. ha^{-1}) on tomato visual injury, yield and maturity. Weeds were left in the other half of each plot to determine the level of weed control of application timing.

None of the treatments caused commercially significant visual injury to tomatoes. The application made at the cotyledon stage was too early to give good control of velvetleaf and green foxtail, though good control of common lamb's-quarters was obtained. Control of common lamb's-quarters was poor at 56 days after treatment (DAT), when rimsulfuron was applied after the cotyledon stage of this weed. Commercially acceptable control of velvetleaf and green foxtail was obtained when applied to plants at the cotyledon to one leaf stage, but decreased when rimsulfuron was applied to weeds at the 2-leaf stage or greater. Tomato marketable and total yields were not reduced by any application timings in the weed-free portion of each plot.

Objective 3: One half of each plot was maintained weed-free to test for visual injury and yield of tomatoes following pre-plant incorporated treatments of clomazone applied at rates from 0 to 840 g a.i. ha^{-1}. Weeds were left in the other half of each plot to determine the level of weed control as a function of clomazone rate.

None of the treatments caused commercially unacceptable visual injury at 7 days after planting (DAP), however the injury was statistically significant as clomazone rate increased up to 840 g a.i. ha^{-1} by 14 DAP. Tomatoes had outgrown the injury by 28 DAP.

At 42 DAP clomazone gave fair control of redroot and green pigweed, common lamb's-quarters and green foxtail, and poor control of velvetleaf at 840 g a.i. ha^{-1}. By 70 DAP clomazone gave fair control of the two pigweed species at 840 g a.i. ha^{-1}. Control of velvetleaf, common lamb's-quarters and green foxtail was poor at this rate of clomazone. Total and marketable tomato yields were not reduced by application of clomazone at any of the rates tested in the weed-free portion of the trial.

Objective 4: One half of each plot in this study was maintained weed-free to test for visual injury and tolerance of tomatoes to various tank mixes of rimsulfuron, thifensulfuron-methyl, metribuzin, chlorothalonil and chlorothalonil+copper. Weeds were left in the other half of each plot to determine the level of weed control of each treatment.

Visual injury was not significant in any of the treatments. The tank mix of rimsulfuron+metribuzin (15+150 g a.i. ha^{-1}) provided fair control of velvetleaf and green foxtail up to 56 days after planting (DAP) and good to excellent control of redroot pigweed and common lamb's-quarters. This is in contrast to the rimsulfuron (15 g a.i. ha^{-1}) treatment, which gave poor control of velvetleaf and common lamb's-quarters, and the metribuzin (150 g a.i. ha^{-1}) treatment, which gave fair control of velvetleaf and poor control of green foxtail.

The tank mix of thifensulfuron-methyl+metribuzin (6+150 g a.i. ha^{-1}) provided good season long control of redroot pigweed and common lamb's-quarters, but poor control of velvetleaf and green foxtail. This result contrasts with the thifensulfuron-methyl (6 g a.i. ha^{-1}) treatment alone, which gave good to excellent control of redroot pigweed, fair control of common lamb's-quarters and green foxtail, and the metribuzin (150 g a.i. ha^{-1}) treatment, which gave only fair season-long control of redroot pigweed.

The rimsulfuron+thifensulfuron-methyl (15+6 g a.i. ha^{-1}) tank mix gave excellent control of redroot pigweed, good control of velvetleaf and common lamb's-quarters, and fair to good control of green foxtail. In the weedy portion of the trial, total and marketable tomato yields were greater in this treatment than in the rimsulfuron+metribuzin and thifensulfuron-methyl+metribuzin tank mixes.

There was no antagonism in the rimsulfuron+chlorothalonil or thifensulfuron-methyl+chlorothalonil treatments, compared with rimsulfuron or thifensulfuron-methyl alone. The addition of copper however, did reduce velvetleaf and redroot pigweed control in the rimsulfuron+chlorothalonil treatment. During mixing, it was noted that when copper was added, the herbicide did not dissolve as readily as without, which may have reduced spray coverage. The reduction in weed control did not correspond to a yield decrease. In the thifensulfuron-methyl+chlorothalonil treatment, the addition of copper reduced velvetleaf, redroot pigweed and common lamb's-quarters control, and corresponded to reduced yield, possibly due to the high density of common lamb's-quarters.

None of the treatments caused any yield reductions in the weed-free portion of the trial, and there was no increase in the amount of green fruit at harvest, indicating that maturity had not been delayed.

Objective 5: One half of each plot was maintained weed-free to test for tolerance of tomatoes to preemergence applications of flumioxazin (52.5, 70 and 140 g a.i. ha^{-1}) and preemergence and postemergence applications of halosulfuron-methyl (50 and 100 g a.i. ha^{-1}). Weeds were left in the other half of each plot to determine the level of weed control of each herbicide. A standard treatment of s-metolachlor+metribuzin (1600+375 g a.i. ha^{-1}) applied pre-plant incorporated, followed by three 150 g a.i. ha^{-1} micro-rate applications of metribuzin was included for comparison. This study was established in an area infested with eastern black nightshade - mean densities of this weed were 26 plants per m^2 in the untreated check.

None of the treatments resulted in commercially unacceptable visual injury to tomatoes. Visual injury in the preemergence and postemergence applications of halosulfuron-methyl caused less than 1% visual injury up to 14 days after planting or treatment.

Excellent control of redroot pigweed, common lamb's-quarters and fall panicum was observed in the standard treatment. This treatment only provided fair control of eastern black nightshade. Flumioxazin (52.5 and 70 g a.i. ha^{-1}) gave good (89% to excellent (92%) control of eastern black nightshade, respectively. Control of common lamb's-quarters and fall panicum was only fair at either rate, and flumioxazin did not control redroot pigweed. The preemergence treatment of halosulfuron-methyl provided fair control of redroot pigweed and common lamb's-quarters and poor control of eastern black nightshade and fall panicum. The postemergence treatment of halosulfuron-methyl gave good to excellent control of redroot pigweed, but poor control of common lamb's-quarters, eastern black nightshade and fall panicum.

There was no decrease in marketable or total yield in the weed-free portion of any of the treatments compared to the untreated check or the standard treatment, indicating that flumioxazin and halosulfuron-methyl are possible candidates for further analysis in tomatoes. The high level of eastern black nightshade control in the flumioxazin treatment further emphasizes the importance of continued evaluation of this compound for incorporation into current weed management practices.

Objective 6: This trial was maintained weed-free to examine the effect of thifensulfuron-methyl (applied postemergence at 6 and 12 g a.i. ha^{-1}) on visual injury and yield of 13 processing tomato varieties: CC337, H9144, H9314, H9478, H9492, H9553, H9909, N1069, N1082, N1480E, N1480L, N1522 and PETO696.

There was no commercially significant injury and no reduction in plant fresh or dry weight, marketable yield, or total yield in any of the 13 varieties tested. There also was not an increase in green fruit as thifensulfuron-methyl rate increased, indicating that maturity had not been delayed by the herbicide.

Some leaf cupping and distortion in H9909 and N1069, and slight chlorosis of the growing points of H9553, N1480E, PETO696 were observed at 7 days after treatment (DAT). By 14 DAT, H9553, N1480E and PETO 696 had recovered from the discoloration of the growing points. By 28 DAT, N1069 and H9909 had outgrown the visual injury observed earlier in the season.

Objective 7: This trial was maintained weed-free to determine the effect of adjuvant (Agral 90, AgSurf, Citowett, Super Spreader and Activator 90) on visual injury and yield of two tomato varieties (H9478 and H9553) caused by postemergence applications of thifensulfuron-methyl at 6 g a.i. ha^{-1}.

Though more visual injury was noted at 7 days after treatment (DAT) in the Activator 90 treatment than for the other adjuvants tested, the tomatoes outgrew this injury by 28 DAT. Injury appeared as yellowing of the new growth.

There were no significant differences in yield of either tomato variety in any of the treatments, and there were no differences in green fruit among the five treatments, indicating that maturity was not different in any of the treatments.