# New Tools for Weed Control in Vegetable Crops

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**Why Was This Project Funded**: This project was conducted in order to develop Ohio evaluation data needed to support registration of new herbicides for use on various vegetable crops of importance in the state. For 2017 we focused on the following projects:

- 1) In cooperation with the manager of the OARDC Muck Crops Research Station we established field day demonstrations of weed control in sweet corn using Anthem and Acuron (Sweet corn herbicide demonstration at Muck Crops Research Station).
- We continued our evaluation of vegetable crop tolerance of glufosinate (Liberty/ Rely) soil residues following application of glufosinate PREPLANT for control of established annuals (horse weed/marestail and others).
- 3) We continued our evaluation of the performance and crop safety of the new herbicide bicyclopyrone for onion.

## What Was Discovered

# 1.Sweet corn herbicide demonstration at Muck Crops Research Station

#### <u>Methods</u>

A demonstration of new sweet corn herbicides was established at the Muck Crops Agricultural Research Station, Willard, OH. Sweet corn variety, 'lochief', was planted. Four days after planting, pre-emergence herbicide treatments were applied to the designated plots with a backpack sprayer. Number of corn plants, number of harvested ears, and total fresh weight of harvested ears were recorded for comparison.

#### Take home message

Plants treated by Anthem had the highest percentage of plant producing ears and highest average ear weight, even though the plants treated by Anthem had the shortest plant height.

| Trt | Herbicide   | Rate |      | Rate |    | Herbicide Rate |  | Average<br>height (in) | % plant<br>producing ears | Average ear<br>weight (g) |
|-----|-------------|------|------|------|----|----------------|--|------------------------|---------------------------|---------------------------|
| 1   | Acuron      | 3    | qt/a | 72.1 | 87 | 206            |  |                        |                           |                           |
| 2   | Anthem      | 10   | oz/a | 68.4 | 91 | 246            |  |                        |                           |                           |
| 3   | Zidua       | 3    | oz/a | 72   | 87 | 220            |  |                        |                           |                           |
| 4   | Atrazine 4L | 1    | qt/a | 73.1 | 88 | 199            |  |                        |                           |                           |
|     | Outlook     | 16   | oz/a |      |    |                |  |                        |                           |                           |

#### Table 1: Crop height and yield

#### Figure 1: Overview of the trial area on 7/27/2017



# 2. Glufosinate (Liberty/ Rely) safety on vegetable crops as burn down herbicide

## Method

Two experiments were established in Willard at the OARDC Muck Crops Agricultural Research Station (muck soil) and at Wiers Farm (clay soil). A split plot arrangement of treatments, with herbicide as the main plot and different crops as the subplot, was arranged in a randomized complete block with four replications. Herbicide treatments were applied to the designated plots with a backpack sprayer. Four different vegetables, kale, lettuce, cucumber and bell pepper, were transplanted the following day. Phytotoxicity and dry matter data were analyzed statistically to detect significant differences.

## Take home message

Glufosinate soil residues did not injure pepper, cucumber, kale or lettuce in either the muck or mineral soils. There were no differences in dry weight per harvested crop plant. The results indicate that glufosinate as burn-down herbicide is safe to crops even when applied as soon as one day before transplanting.

| Bell pepper      |           |              |           |                  |     |  |  |  |
|------------------|-----------|--------------|-----------|------------------|-----|--|--|--|
|                  | F         | Phytotoxicit |           |                  |     |  |  |  |
| Treatment        | 6/08/2017 | 6/15/2017    | 6/26/2017 | Dry weight/plant |     |  |  |  |
|                  |           | %            | G         |                  |     |  |  |  |
| Control          |           | 0            | 0         | 0                | 1.7 |  |  |  |
| Rely             | 2 pt/a    | 0            | 0         | 0                | 1.5 |  |  |  |
| Rely             | 3 pt/a    | 0            | 0         | 0                | 1.5 |  |  |  |
| Roundup PowerMax | 32 oz/a   | 0            | 0         | 0                | 1.4 |  |  |  |

#### Table 2: Phytotoxicity assessment and dry weight of crops in muck soil

| Cucumber         |           |              |           |                  |     |  |  |  |
|------------------|-----------|--------------|-----------|------------------|-----|--|--|--|
|                  | F         | Phytotoxicit |           |                  |     |  |  |  |
| Treatment        | 6/08/2017 | 6/15/2017    | 6/26/2017 | Dry weight/plant |     |  |  |  |
|                  |           | %            | g         |                  |     |  |  |  |
| Control          |           | 0            | 0         | 0                | 3.8 |  |  |  |
| Rely             | 2 pt/a    | 0            | 0         | 0                | 3.7 |  |  |  |
| Rely             | 3 pt/a    | 0            | 0         | 0                | 3.7 |  |  |  |
| Roundup PowerMax | 32 oz/a   | 0            | 0         | 0                | 3.7 |  |  |  |

| Kale             |           |              |           |                  |     |  |  |  |
|------------------|-----------|--------------|-----------|------------------|-----|--|--|--|
|                  | F         | Phytotoxicit |           |                  |     |  |  |  |
| Treatment        | 6/08/2017 | 6/15/2017    | 6/26/2017 | Dry weight/plant |     |  |  |  |
|                  |           | %            | g         |                  |     |  |  |  |
| Control          |           | 0            | 0         | 0                | 4.7 |  |  |  |
| Rely             | 2 pt/a    | 0            | 0         | 0                | 5.5 |  |  |  |
| Rely             | 3 pt/a    | 0            | 0         | 0                | 5.2 |  |  |  |
| Roundup PowerMax | 32 oz/a   | 0            | 0         | 0                | 4.9 |  |  |  |

| Lettuce          |           |              |                  |   |     |  |  |  |
|------------------|-----------|--------------|------------------|---|-----|--|--|--|
|                  | F         | Phytotoxicit |                  |   |     |  |  |  |
| Treatment        | 6/08/2017 | 6/15/2017    | Dry weight/plant |   |     |  |  |  |
|                  |           | %            |                  | g |     |  |  |  |
| Control          |           | 0            | 0                | 0 | 5.9 |  |  |  |
| Rely             | 2 pt/a    | 0            | 0                | 0 | 5.9 |  |  |  |
| Rely             | 3 pt/a    | 0            | 0                | 0 | 6.4 |  |  |  |
| Roundup PowerMax | 32 oz/a   | 0            | 0                | 0 | 6.4 |  |  |  |

# Figure 2: Trial overview of muck soil on 06/08/2017



# Table 3: Phytotoxicity assessment and dry weight of crops in mineral soil

| Bell pepper |         |           |               |           |                  |  |  |  |  |
|-------------|---------|-----------|---------------|-----------|------------------|--|--|--|--|
| Treatment   |         |           | Phytotoxicity |           |                  |  |  |  |  |
|             |         | 6/15/2017 | 6/26/2017     | 7/05/2017 | Dry weight/plant |  |  |  |  |
|             |         |           | %             |           | g                |  |  |  |  |
| Control     |         | 0         | 0             | 0         | 1.9              |  |  |  |  |
| Rely        | 2 pt/a  | 0         | 0             | 0         | 1.7              |  |  |  |  |
| Rely        | 3 pt/a  | 0         | 0             | 0         | 1.7              |  |  |  |  |
| Roundup     | 32 oz/a | 0         | 0             | 0         | 1.6              |  |  |  |  |

| Kale      |         |           |               |                  |     |  |  |  |  |
|-----------|---------|-----------|---------------|------------------|-----|--|--|--|--|
|           |         |           | Phytotoxicity |                  |     |  |  |  |  |
| Treatment |         | 6/15/2017 | 6/26/2017     | Dry weight/plant |     |  |  |  |  |
|           |         |           | %             |                  | g   |  |  |  |  |
| Control   |         | 0         | 0             | 0                | 7.1 |  |  |  |  |
| Rely      | 2 pt/a  | 0         | 0             | 0                | 7.5 |  |  |  |  |
| Rely      | 3 pt/a  | 0         | 0             | 0                | 7.7 |  |  |  |  |
| Roundup   | 32 oz/a | 0         | 0             | 0                | 6.8 |  |  |  |  |

| Lettuce   |         |           |               |           |                  |  |  |  |  |
|-----------|---------|-----------|---------------|-----------|------------------|--|--|--|--|
|           |         |           | Phytotoxicity |           |                  |  |  |  |  |
| Treatment |         | 6/15/2017 | 6/26/2017     | 7/05/2017 | Dry weight/plant |  |  |  |  |
|           |         |           | %             |           | g                |  |  |  |  |
| Control   |         |           | 0             | 0         | 11.2             |  |  |  |  |
| Rely      | 2 pt/a  |           | 0             | 0         | 10.2             |  |  |  |  |
| Rely      | 3 pt/a  |           | 0             | 0         | 10.5             |  |  |  |  |
| Roundup   | 32 oz/a |           | 0             | 0         | 9.4              |  |  |  |  |

#### Figure 3: Trial overview of mineral soil on 6/15/2017



#### 3. Bicyclopyrone: crop tolerance and weed control in onion

#### <u>Method</u>

Experiments were established at OARDC Muck Crops Agricultural Research Station. The experimental design was a randomized complete block with four replications. Green onion cultivar 'Ishikura' was planted on 08/09/17. One day after planting, early pre-emergence treatments of bicyclopyrone were applied to designated plots. On 08/14/2017 late pre-emergence treatments were applied and the whole trial sprayed with glyphosate to kill all emerged weeds. Post-emergence bicyclopyrone treatments were applied to weeds and emerged onions on 09/15/2017 using the same equipment and settings. Weeding either by hand or with a basket weeder was performed to keep the trial uniformly weed free. Data were analyzed statistically to detect treatment differences.

#### Take home message

Bicyclopyrone did not cause crop injury when applied pre-emergence, nor result in stand reduction. However, phytotoxicity was significant with post-emergence treatments. The injury increased as herbicide rate increased. 6.84 oz product per acre, a 2X rate, caused 75% injury on 9/29/2017. Early and Late PRE treatments of bicyclopyrone did not affect onion plant weight; however, POST treatments reduced plant weight compared to the control.

# Table 4: Stand count, crop injury and weight per plant with different bicyclopyrone (BIR)treatments

|     | Treatment |          |           |          | 8/28       | 8/28     | 9/8   | 9/15     | 9/22 | 9/29 | 10/16 | Weight/ |      |          |
|-----|-----------|----------|-----------|----------|------------|----------|-------|----------|------|------|-------|---------|------|----------|
| No. | Early PRE |          | Late PRE  |          | POST       |          | Stand | Injury   | %    |      |       |         |      | Plant(g) |
| 1   | Control   |          |           |          |            |          | 92    | 0        | 0    | 0    | 0     | 0       | 0    | 5.6 a    |
| 2   |           | 2.57oz/A |           |          |            |          | 87    | 0        | 0    | 0    | 0 c   | 0 d     | 0 d  | 5.1 a    |
| 3   | BIR       | 3.42oz/A |           |          |            |          | 92    | 0        | 0    | 0    | 0 c   | 0 d     | 0 d  | 5.4 a    |
| 4   |           | 6.84oz/A |           |          |            |          | 89.5  | 0        | 0    | 0    | 0 c   | 0 d     | 0 d  | 5.2 a    |
| 5   | Prowl H2O | 2pt/A    |           |          |            |          | 85    | 0        | 0    | 0    | 0 c   | 0 d     | 0 d  | 5.4 a    |
| 6   |           |          |           | 2.57oz/A |            |          | 94.5  | 0        | 0    | 0    | 0 c   | 0 d     | 0 d  | 5.5 a    |
| 7   |           |          | BIR       | 3.42oz/A |            |          | 91.25 | 0        | 0    | 0    | 0 c   | 0 d     | 0 d  | 5.3 a    |
| 8   |           |          |           | 6.84oz/A |            |          | 86.5  | 0        | 0    | 0    | 0 c   | 0 d     | 0 d  | 5.1 a    |
| 9   |           |          | Prowl H2O | 2pt/A    |            |          | 93.5  | 0        | 0    | 0    | 0 c   | 0 d     | 0 d  | 5.4 a    |
| 10  |           |          |           |          |            | 2.57oz/A |       |          | •    |      | 15 b  | 41 c    | 33 c | 2.7 b    |
| 11  |           |          | Drawl U20 | 2        | BIR        | 3.42oz/A |       |          |      |      | 19 b  | 64 b    | 53 b | 2.0 b    |
| 12  |           |          | Prowi H20 | 2ρι/Α    |            | 6.84oz/A |       |          |      |      | 28 a  | 75 a    | 65 a | 1.4 b    |
| 13  |           |          |           |          | Goaltender | 3oz/A    |       | <b>.</b> |      |      | 0 c   | 0 d     | 0 d  | 5.5 a    |

Note: Means within a column followed by different letter differ significantly. Letters are not denoted if there is no significant difference among treatments.



# Figure 4: Bicyclopyrone treatment comparison on 09/29/2017, two weeks after post treatment

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