# Vegetable weed management update

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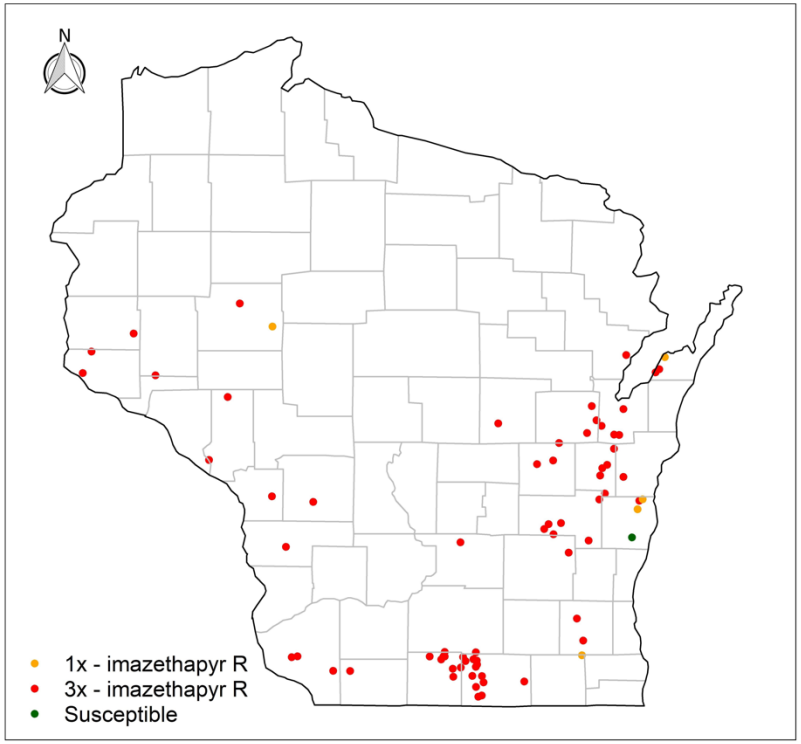
# Let’s cut to the chase…

- Herbicide resistance among weeds is out of control.
- Weed species that are almost always found with herbicide resistance have spread at an amazing pace across Wisconsin.
- We haven’t seen a new herbicide site of action since 1988 and that won’t change soon.

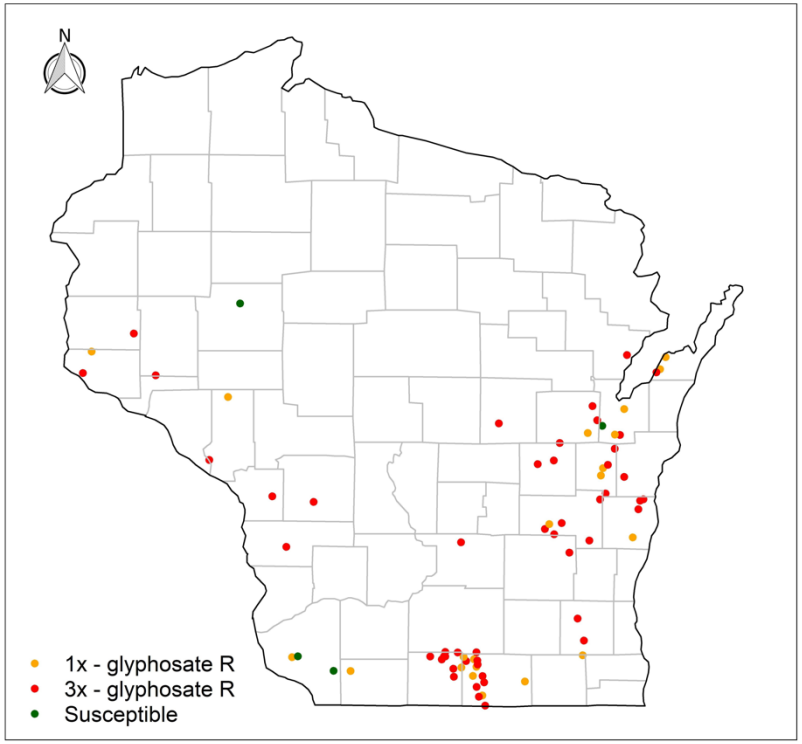
# Weed resistance in Wisconsin

**Imazethapyr** resistance in Wisconsin waterhemp – 2019 update



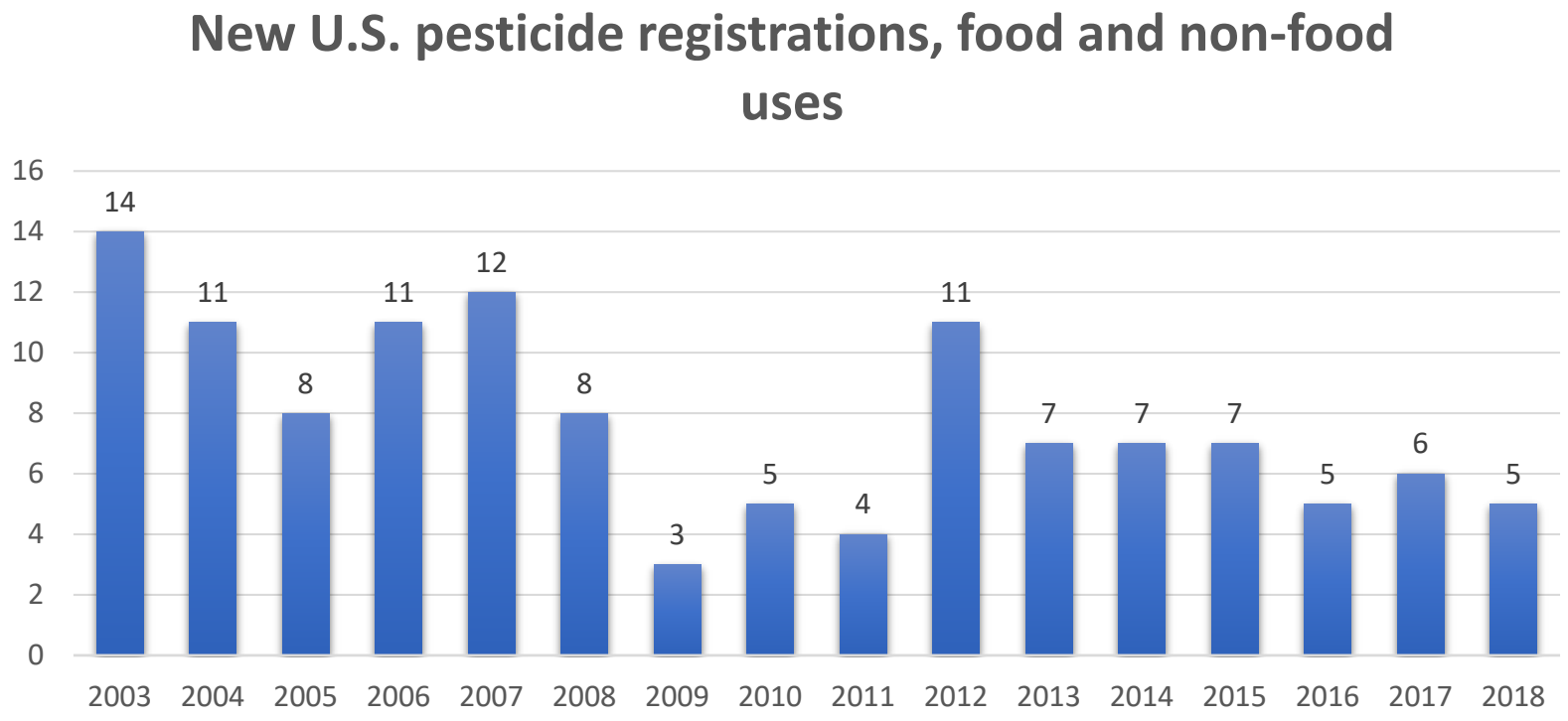

Source: University of Wisconsin - Madison

**Glyphosate** resistance in Wisconsin waterhemp – 2019 update




Source: University of Wisconsin - Madison

# Registration trends



# Herbicide label updates

- Lorox 24c for carrots with specific soil type/organic matter/groundwater depth instructions expired 12/31/2019; registrant intends to request new 24c
- Zidua herbicide now includes supplemental label for celery and potato

| Pyroxasulfone | Group | 15 | Herbicide |
|---|---|---|---|

# Supplemental Label

Zidua®
Herbicide

## For weed control in potato

This supplemental label expires May 31, 2022, and must not be used or distributed after this date.

### Table 1. Residual Rates of Zidua in Potato

| Application Timing | Use Rate by Soil Texture[1] (ozs/A) | | |
|---|---|---|---|
| | Coarse | Medium | Fine |
| Preemergence | 1.5 | 1.5 to 2.0 | 1.5 to 2.0 |

[1] Refer to **Zidua** product container label for definitions of soil texture groups.

# Zidua – potato weed control

- Hill-spray application, prior to potato emergence and when seed is covered by at least 2” soil
- No injury observed
- No effect on tuber size distribution, quality or overall yield
- Evaluated on several soil types and potato varieties
- Control spectrum enhanced when tank-mixed with other potato herbicides allowed at the hill-spray timing

| Weed species | Control ~1 month after treatment (%) |
|---|---|
| Common lambsquarters | 97 |
| Redroot pigweed | 100 |
| Common ragweed | 96 |
| Hairy nightshade | 100 |
| Ladysthumb smartweed | 100 |
| Fall panicum | 100 |

# Potential PPO inhibitor herbicides for potato

Potato PPO Inhibitor Crop Safety Sandy Soil - Hancock, WI - 2019

| Trt No. | Treatment Name | Rate | Rate Unit | Appl Timing | 6/3/2019 % Injury | 6/11/2019 % Injury | % Weed Control 6/11/2019 COLQ | RRPW | CORW | HANS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Dual Magnum | 1 | pt/a | HS | 0 c | 0 d | 100 - | 100 - | 85.2 b | 100 - |
| | Metribuzin | 0.5 | lb/a | HS | | | | | | |
| 2 | Dual Magnum | 1 | pt/a | HS | 10 b | 6.5 b | 99.3 - | 100 - | 99.4 a | 100 - |
| | Chateau | 0.5 | oz/a | HS | | | | | | |
| 3 | Dual Magnum | 1 | pt/a | HS | 15 a | 11.6 a | 100 - | 100 - | 99.8 a | 100 - |
| | Chateau | 1 | oz/a | HS | | | | | | |
| 4 | Dual Magnum | 1 | pt/a | HS | 16.6 a | 15 a | 100 - | 100 - | 100 a | 100 - |
| | Chateau | 1.5 | oz/a | HS | | | | | | |
| 5 | Dual Magnum | 1 | pt/a | HS | 0 c | 0 d | 100 - | 100 - | 84.5 b | 100 - |
| | Spartan | 1 | oz/a | HS | | | | | | |
| 6 | Dual Magnum | 1 | pt/a | HS | 0 c | 0 d | 100 - | 100 - | 78.4 b | 100 - |
| | Spartan | 2 | oz/a | HS | | | | | | |
| 7 | Dual Magnum | 1 | pt/a | HS | 1.1 c | 2.7 c | 100 - | 100 - | 73.8 b | 100 - |
| | Spartan | 3 | oz/a | HS | | | | | | |

Means followed by same letter or symbol do not significantly differ (P=.05, LSD).

- Focused on herbicides that have tolerances established, some of which have registrations in other regions
- Instead of asking how much herbicide the crop will tolerate, we're asking how little herbicide is needed to get weed control
- Overall goal to minimize crop injury risk in cool, wet springs with reduced herbicide rates

# Potential PPO inhibitor herbicides for potato

Potato PPO Inhibitor Crop Safety Sandy Soil - Hancock, WI - 2019

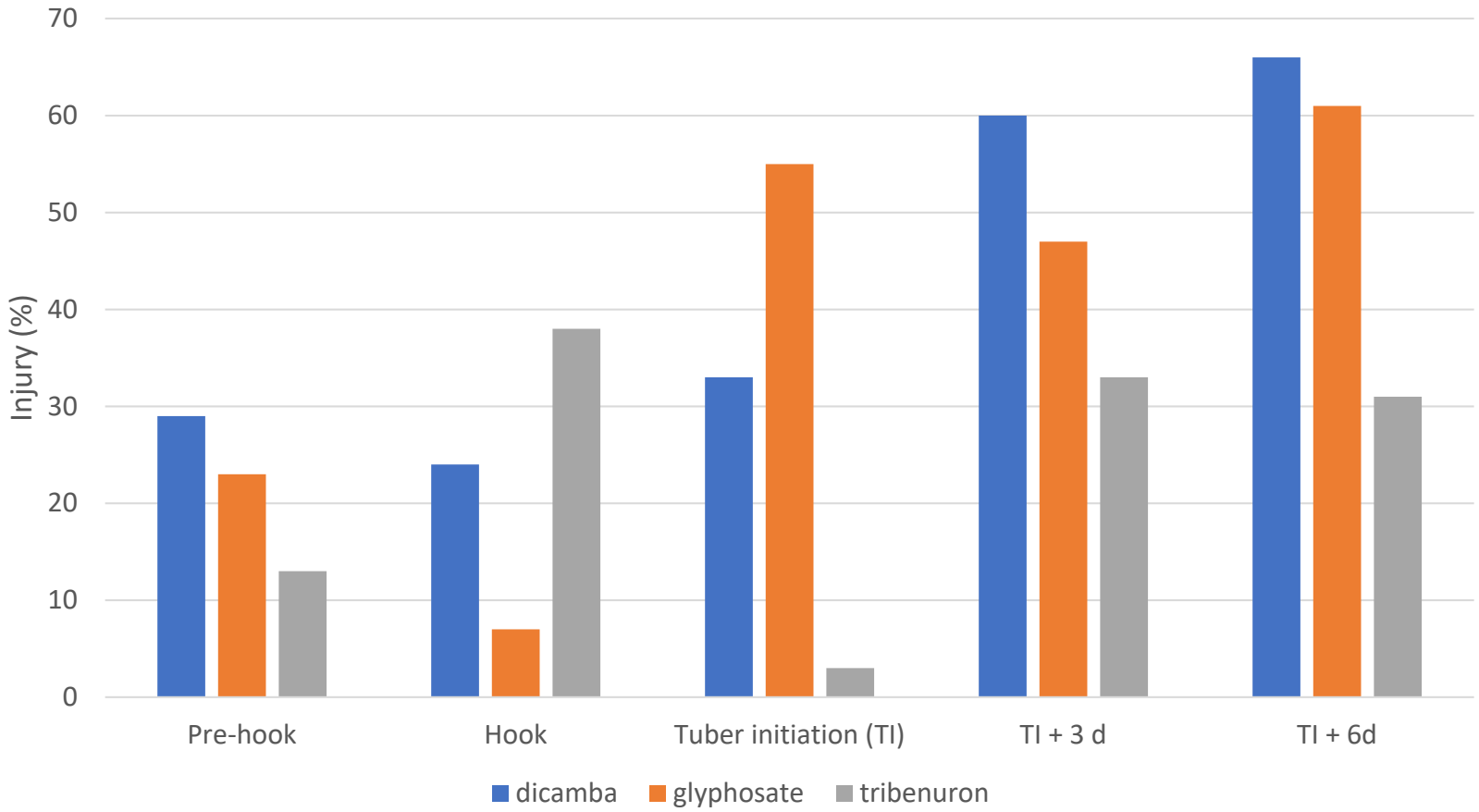
| Trt No. | Treatment Name | Rate | Rate Unit | Appl Timing | Tuber Yield (cwt/A) 9/11/2019 B's | Culls | 2-4 oz | 4-6 oz | 6-10 oz |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Dual Magnum | 1 | pt/a | HS | 38.44 abc | 11.77 - | 207.56 abc | 171.81 b | 106.68 ab |
| | Metribuzin | 0.5 | lb/a | HS | | | | | |
| 2 | Dual Magnum | 1 | pt/a | HS | 33.43 bc | 14.41 - | 195.61 bc | 223.91 a | 118.31 ab |
| | Chateau | 0.5 | oz/a | HS | | | | | |
| 3 | Dual Magnum | 1 | pt/a | HS | 32.21 c | 14.24 - | 184.22 c | 205.64 ab | 131.93 a |
| | Chateau | 1 | oz/a | HS | | | | | |
| 4 | Dual Magnum | 1 | pt/a | HS | 30.91 c | 16.03 - | 170.90 c | 212.21 ab | 146.17 a |
| | Chateau | 1.5 | oz/a | HS | | | | | |
| 5 | Dual Magnum | 1 | pt/a | HS | 46.06 a | 9.94 - | 229.85 ab | 164.33 b | 62.90 b |
| | Spartan | 1 | oz/a | HS | | | | | |
| 6 | Dual Magnum | 1 | pt/a | HS | 45.70 ab | 10.13 - | 208.08 abc | 169.29 b | 83.70 ab |
| | Spartan | 2 | oz/a | HS | | | | | |
| 7 | Dual Magnum | 1 | pt/a | HS | 41.44 abc | 8.07 - | 243.25 a | 164.54 b | 91.76 ab |
| | Spartan | 3 | oz/a | HS | | | | | |

Means followed by same letter or symbol do not significantly differ (P=.05, LSD).

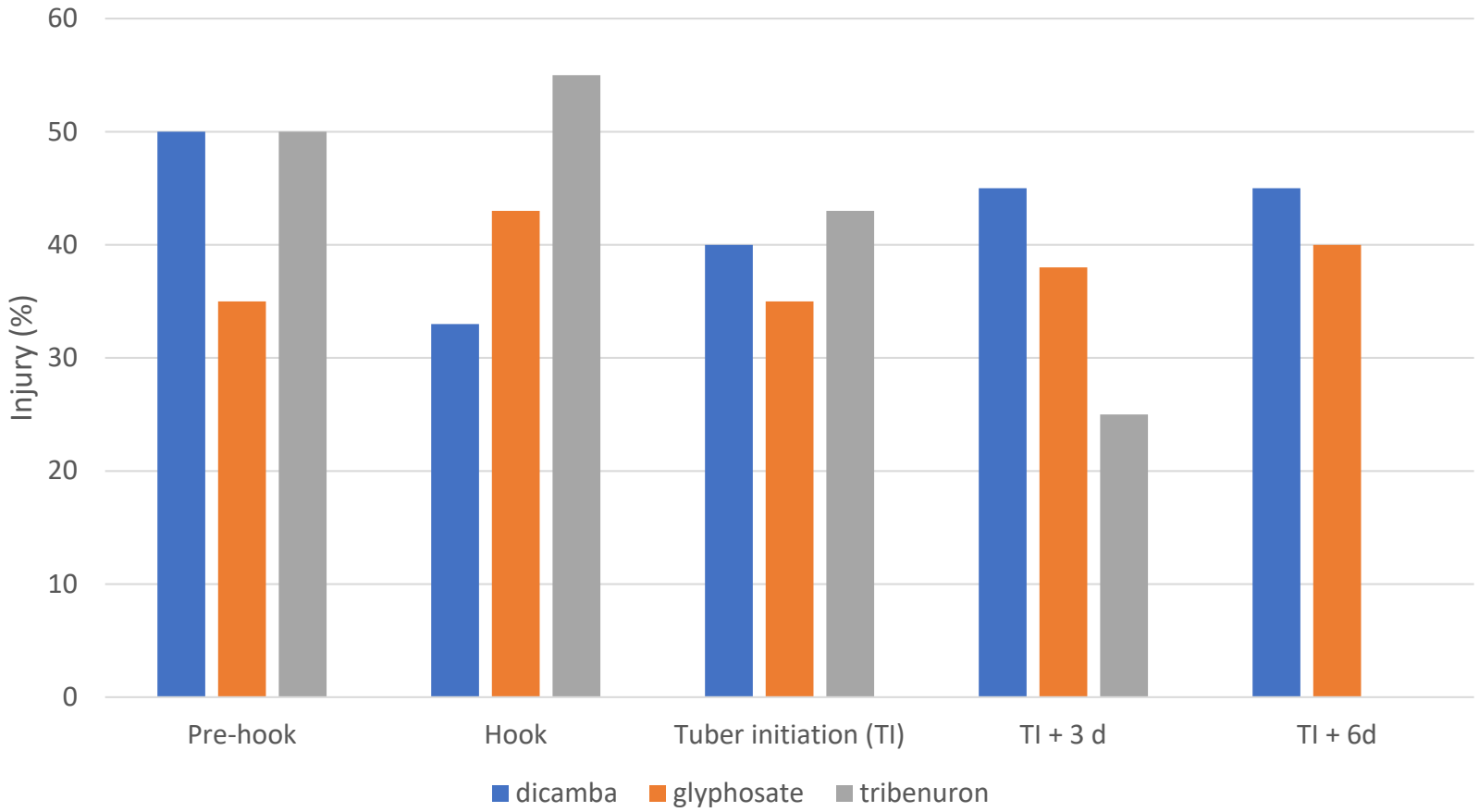
- Injury observed with Chateau that increased with rate
- By one month after treatment, no injury observed with lower two Chateau rates
- No effect on overall tuber yield compared to standard herbicides
- Trend toward fewer B's and more larger tubers with Chateau

# Off-target herbicide near potato seed production: refined risk

# Potato response to off-target herbicides: winter grow-out



# Potato response to off-target herbicides: 2019 field planting



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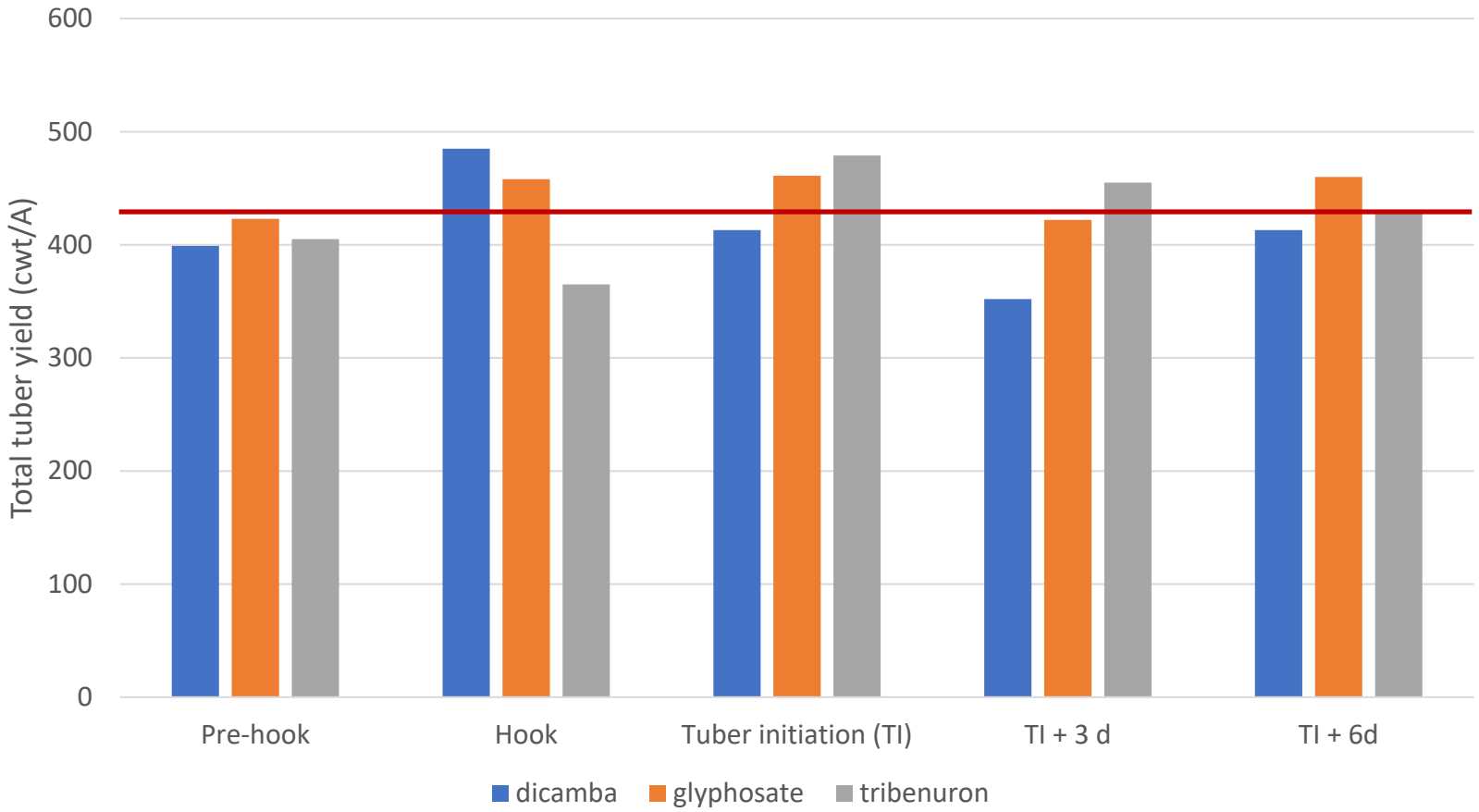

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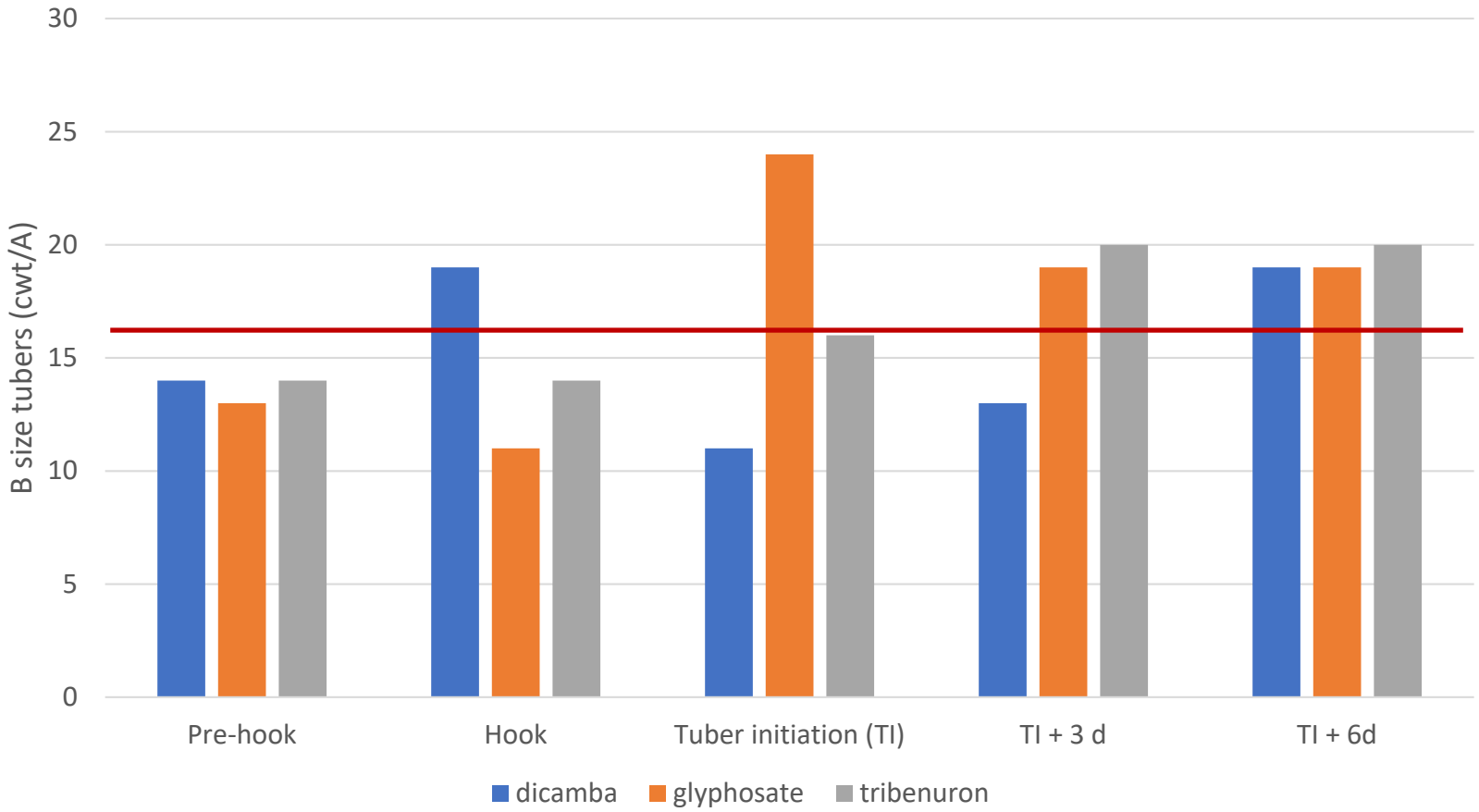
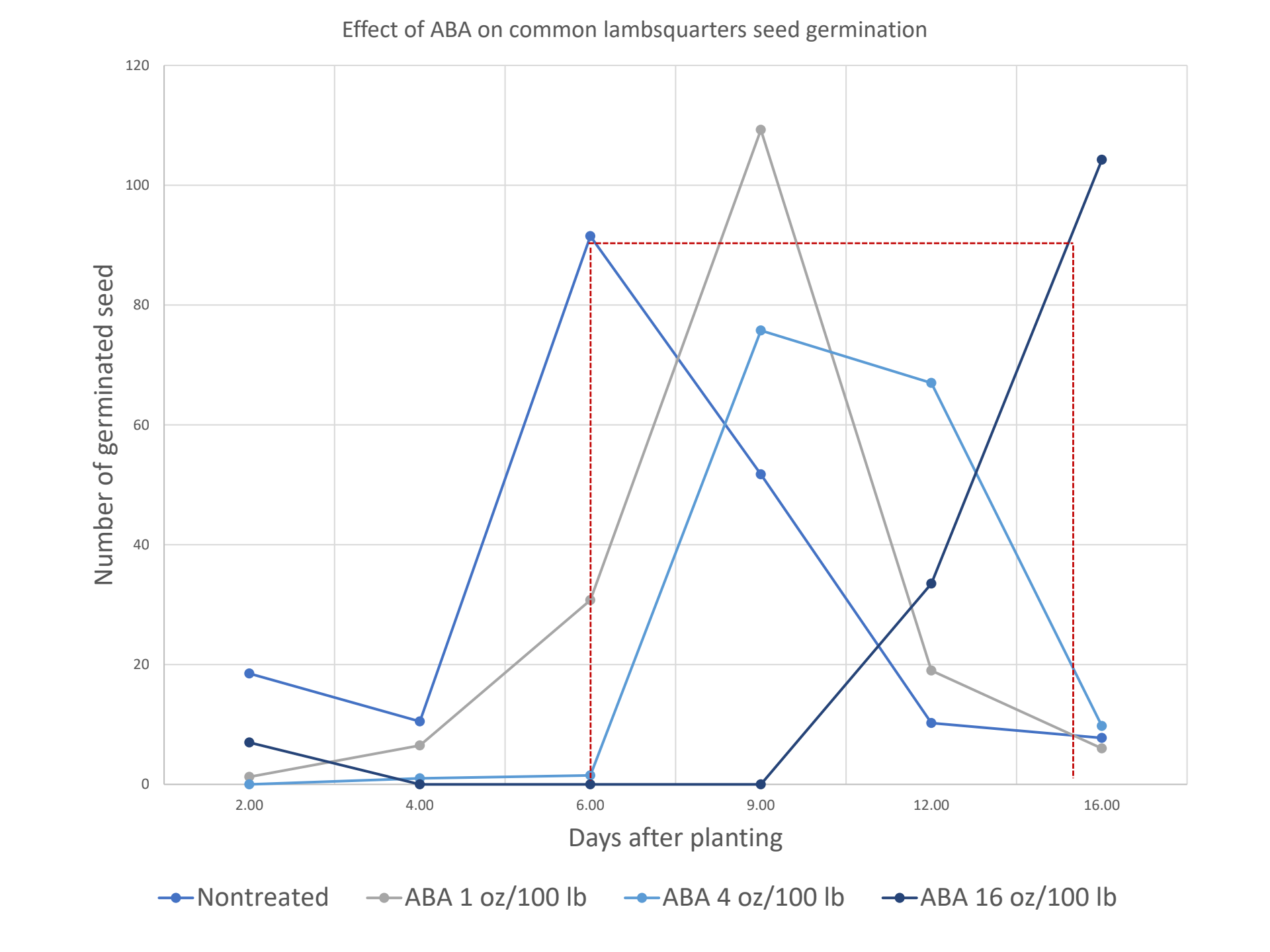
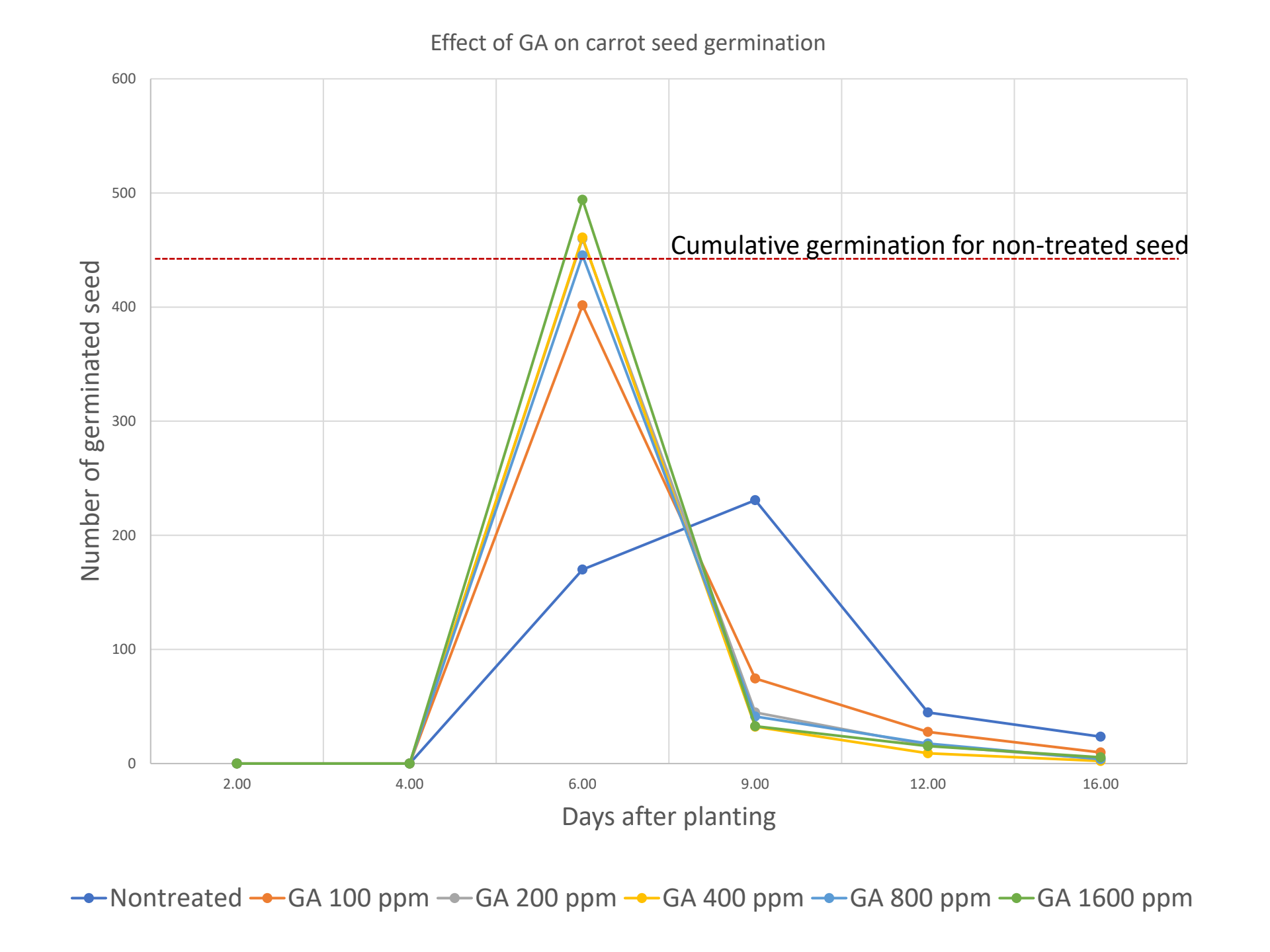


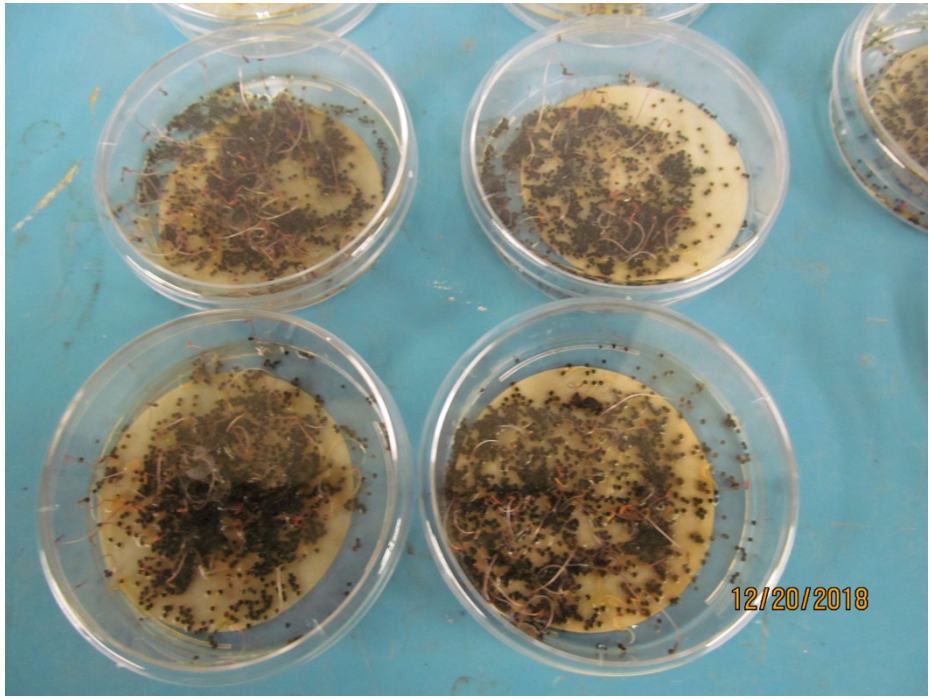

Can we influence weed and crop germination to create a competitive advantage?
12/20/2018


Effect of ABA on common lambsquarters seed germination
Number of germinated seed
120
100
80
60
40
20
0
2.00
4.00
6.00
9.00
12.00
16.00
Days after planting
Nontreated
ABA 1 oz/100 lb
ABA 4 oz/100 lb
ABA 16 oz/100 lb

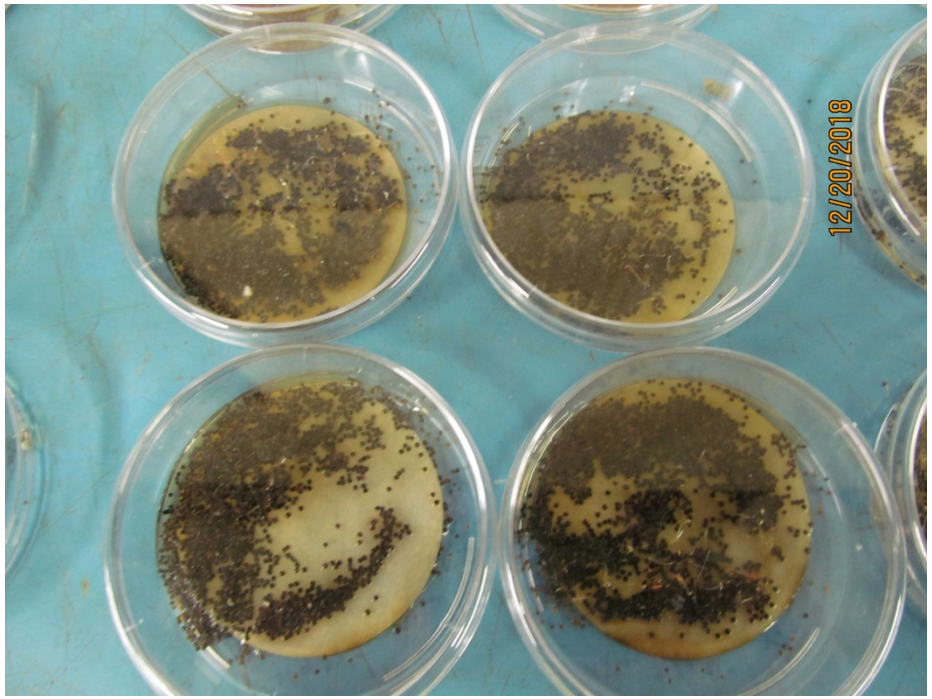

Effect of GA on carrot seed germination
600
500
400
300
200
100
0
Number of germinated seed
Cumulative germination for non-treated seed
2.00
4.00
6.00
9.00
12.00
16.00
Days after planting
Nontreated
GA 100 ppm
GA 200 ppm
GA 400 ppm
GA 800 ppm
GA 1600 ppm

# ABA, common lambsquarters
## 9 days after planting

**Non-treated**

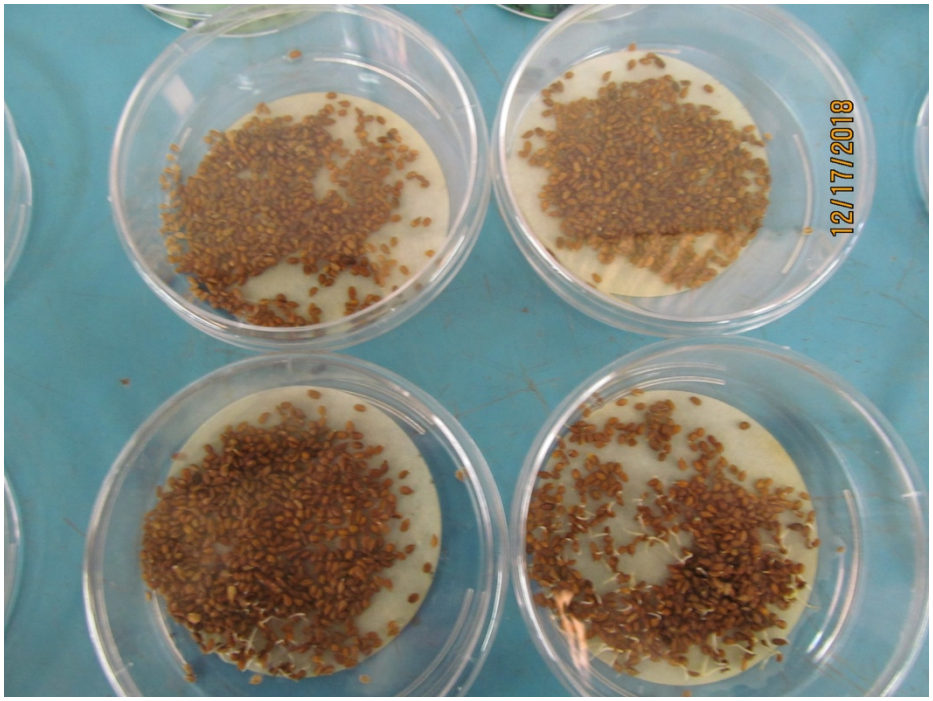



**16 oz/100 lb seed**

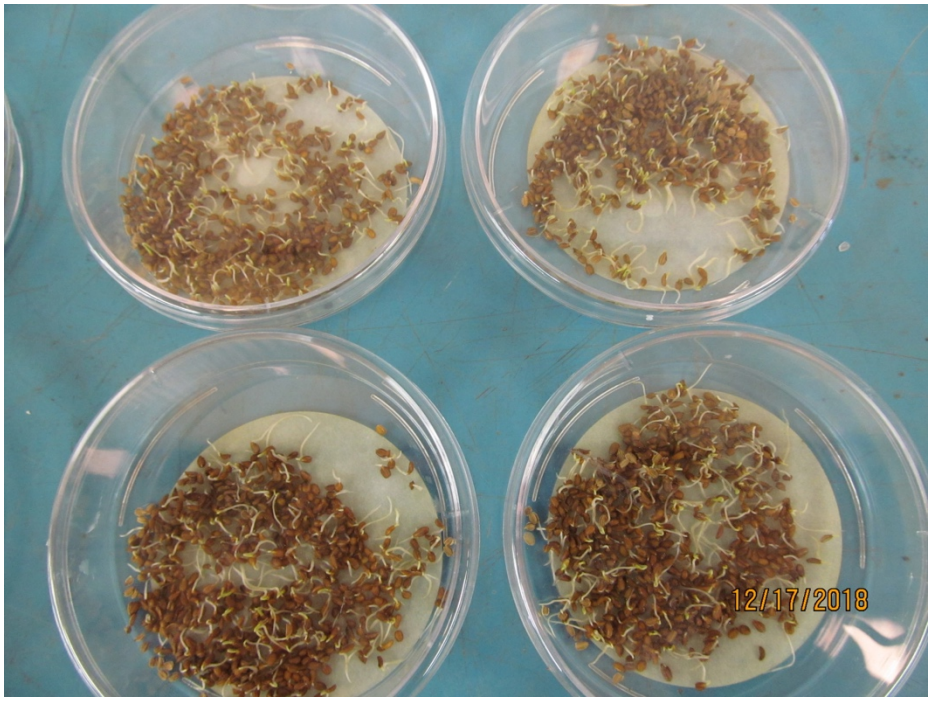


# GA, carrot
## 9 days after planting

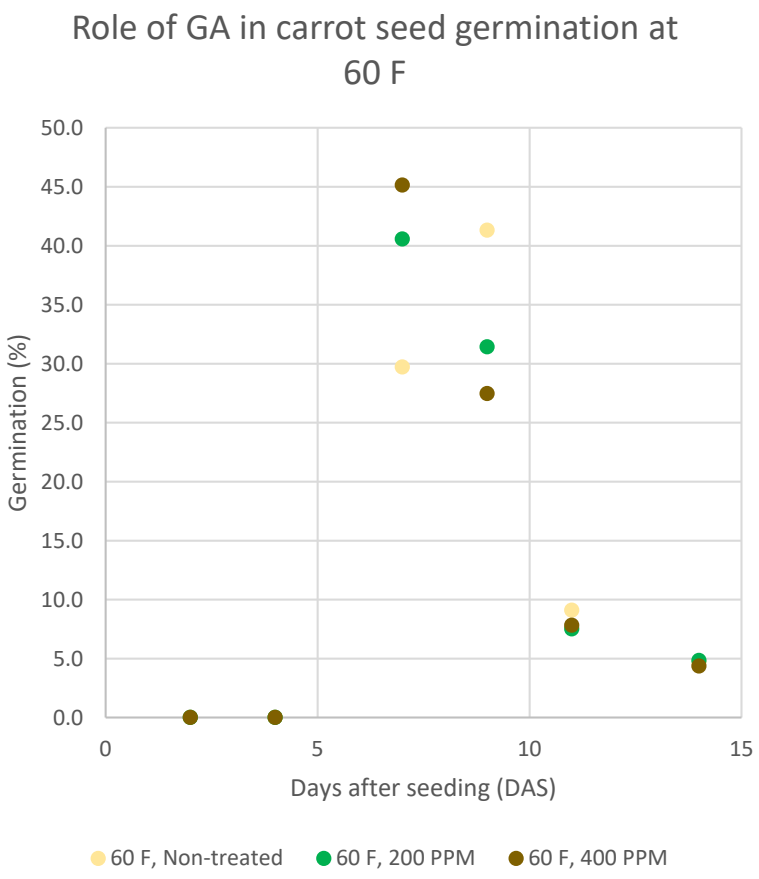
**Non-treated**

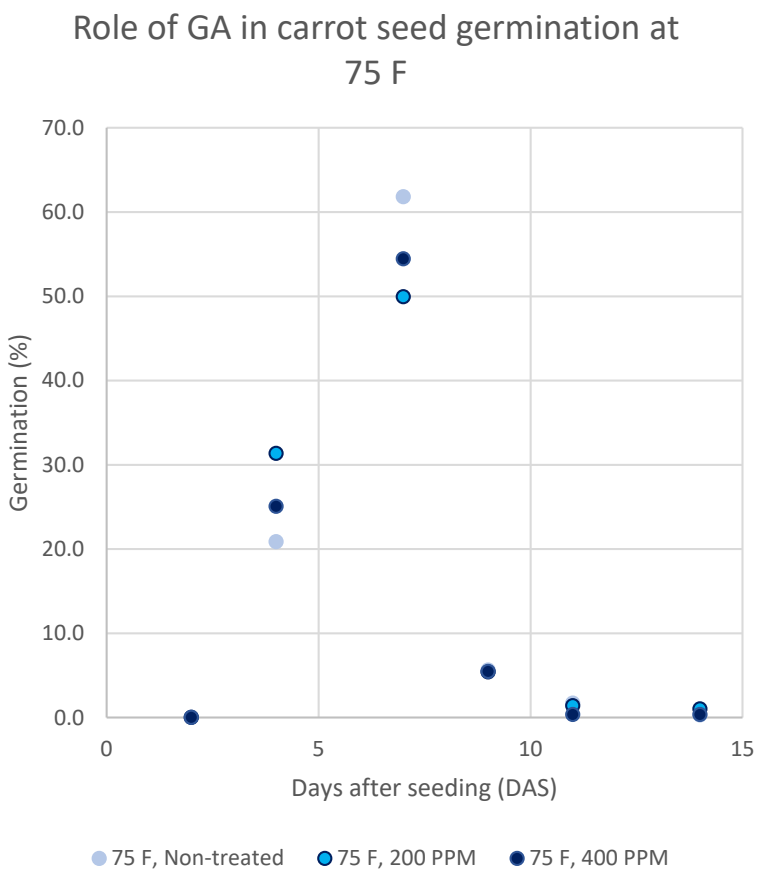



**800 ppm**



# Temperature makes a difference



# Toward practical application

**Non-treated**

**ABA**


**GA**

# The future: holistic integrated weed management systems

Current state:

Cupar, 3-row, no GA, early planting

Future state:

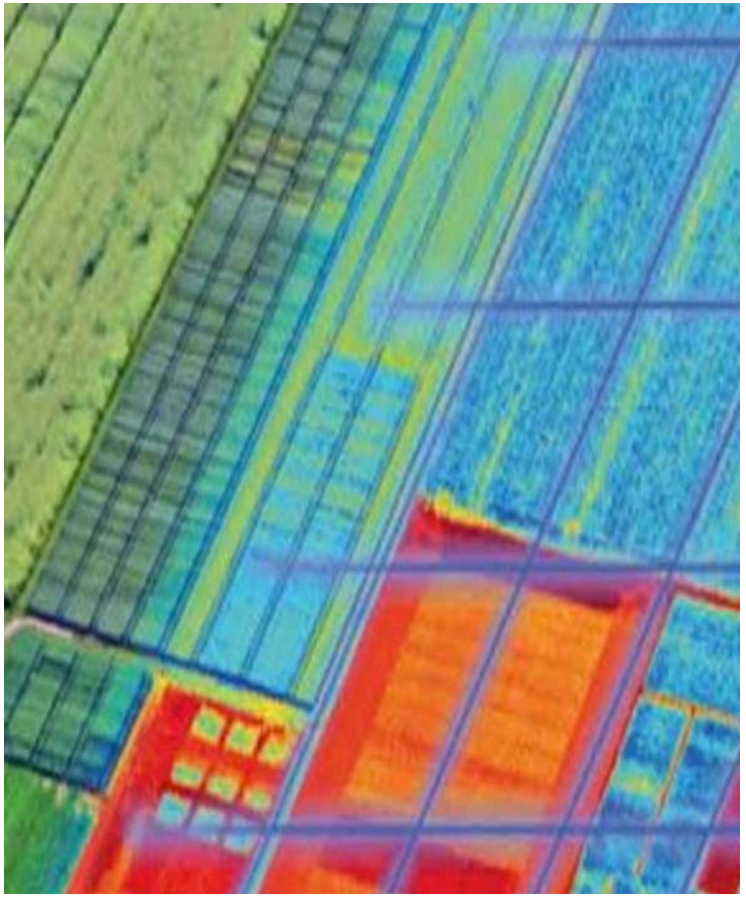
Canada, 5-row, GA, late planting

# Thinking creatively to put the “I” back in IPM

## Automated weeding

AGCO Fendt/MARS system

## Remote sensing



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