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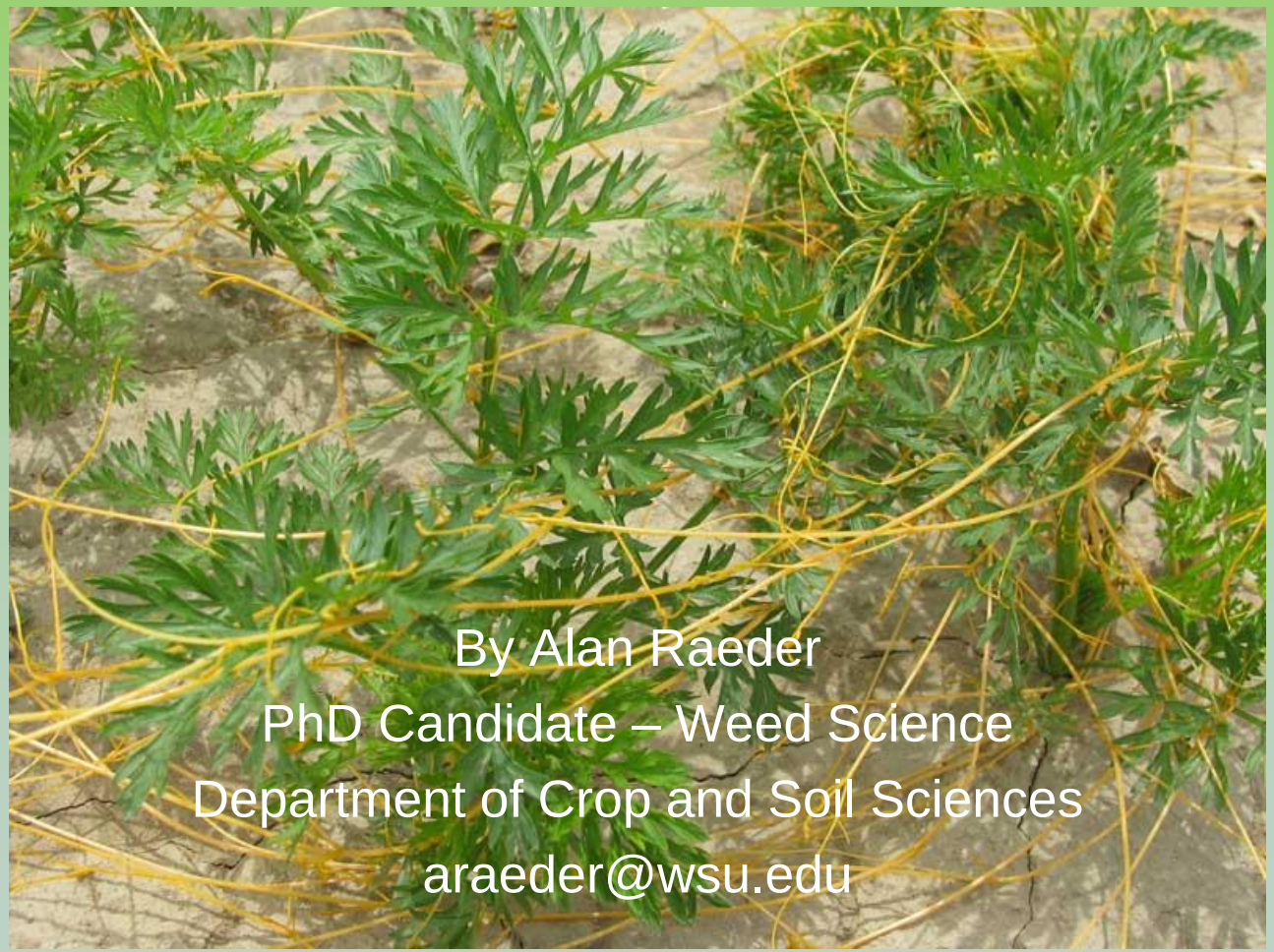
# WEED MANAGEMENT SCIENCE



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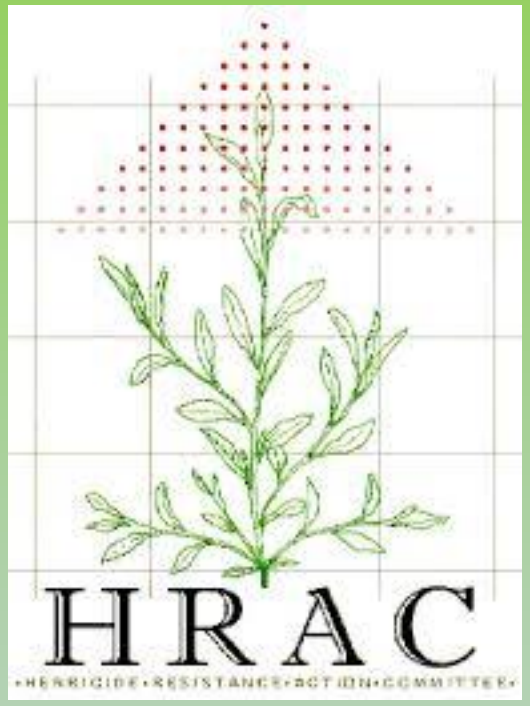
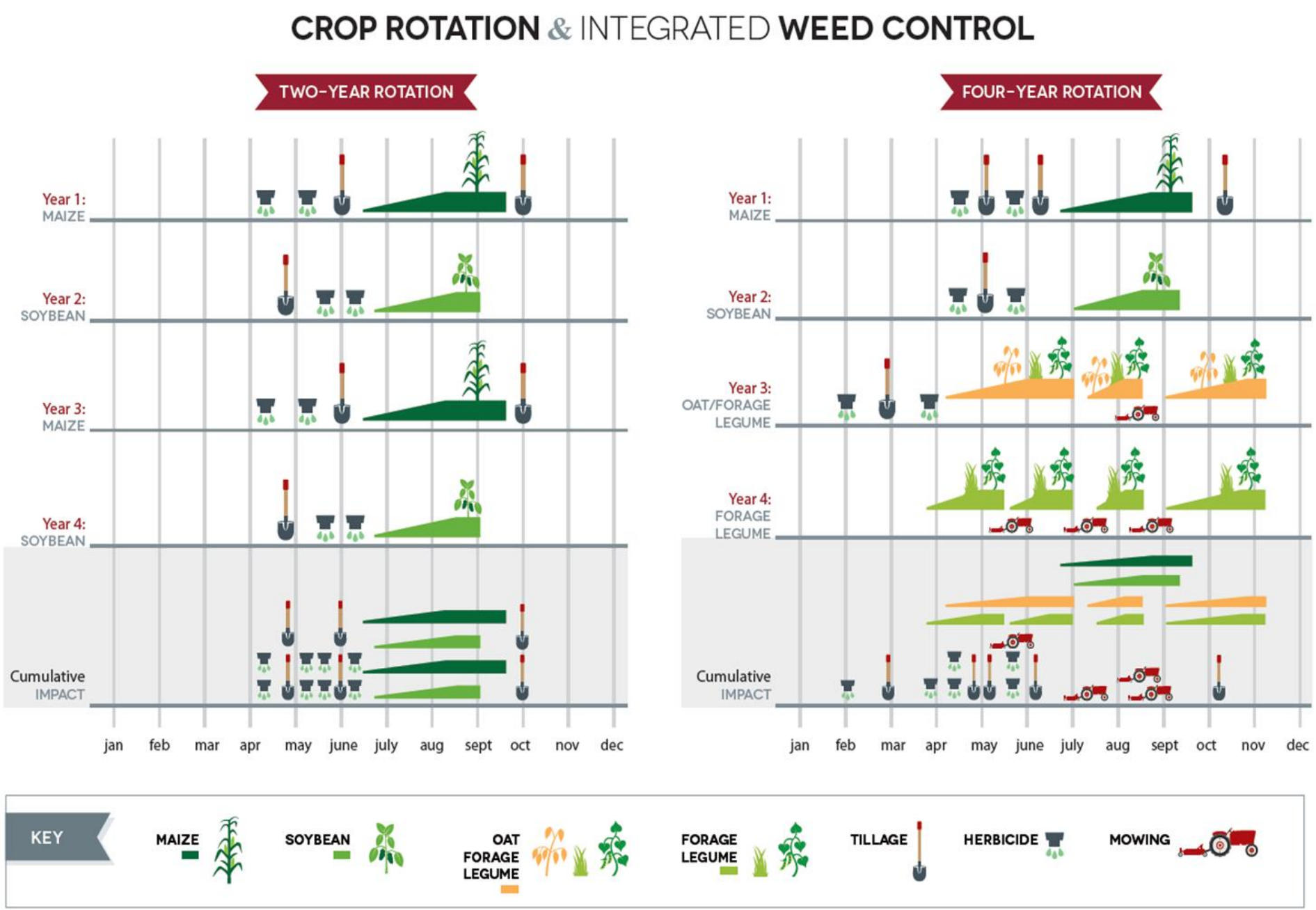
# Components of Weed Management Science

1. **Prevention**
2. **Nonchemical** Methods of Weed Management
   - Mechanical Practices
   - Cultural Practices
3. **Chemical** Methods of Weed Management





Integrated Weed Management (IWM)




**Prevention**, Non-chemical, Chemical

Wheat with wheat and wild oats

## Prevention

- Stop weeds from contaminating an area.
- It is important to address a potential problem.
  - EVEN a problem that may not exist yet.
- May require lots of attention to detail.
  - Can be difficult for large farm operations.

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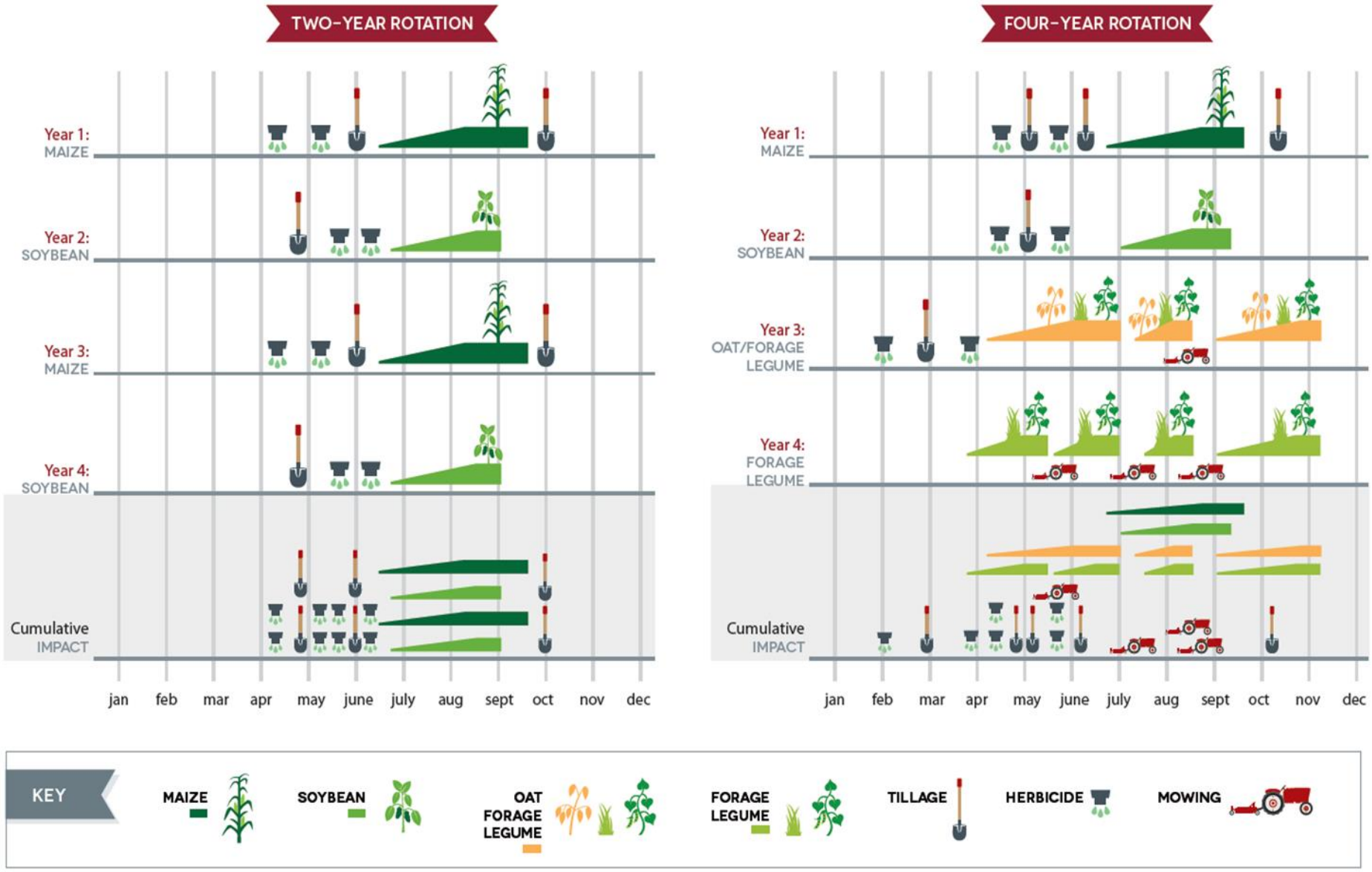
# Prevention

- What does prevention entail?
  - Avoid carrying weed seeds between fields.
    - Trucks
    - Equipment
    - Planting crop seed free of weed seeds
    - Straw bales (packed into center pivot tracks)
  - Scout for new weeds (patch treatments).




- **Eradication:** of above ground plant material. What about vegetative and seeds?
- **Control:** short term goal = control above-ground material, reduce number of seeds produced, limit plant's ability to reproduce vegetatively.

- **Management:** long term goal = reduce weed pressure over many years by **prevention**, **non-chemical**, and **chemical** control methods.




Prevention, **Non-chemical**, Chemical

# Non-Chemical Weed Management

- Mechanical Weed Management:
  - tillage and mowing
- The main objective of tillage for weed management = up-root weeds and/or bury seeds.
  - Environmental conditions following tillage are very important (e.g., soil moisture or rain)

# Non-Chemical Weed Management

- Types of Tillage
  - Primary (initial soil disturbance, 6-24 inches).
    - Moldboard plow and chisel plow - cut and invert soil, bury plant residues and weed seeds

http://www.biofortified.org/2014/08/concentrate-organic-matter-at-surface-to-improve-soils/

- Secondary (can also be primary tillage).
  - Fast
  - Soil disturbance, not inversion of soil
  - Tools include double disk, harrows, torsion or finger weeders, field cultivator, rotary hoes, vertical row brushes, spring tooth harrow, rod-weeders, and cultipacker (harrow and roller)

# Non-Chemical Weed Management

- Inter-row cultivation
  - Disrupt soil (up-root weeds) between rows.
  - Can control weeds within inches of crop plants.
  - Does not control weeds in crop rows.
- Mowing
  - prevent seed production as well (alfalfa).

# Non-Chemical Weed Management

- Cultural weed management utilizes practices common to good land, crop, and water management.
- Requires knowledge of how crop is grown, soil, weed history, environment.

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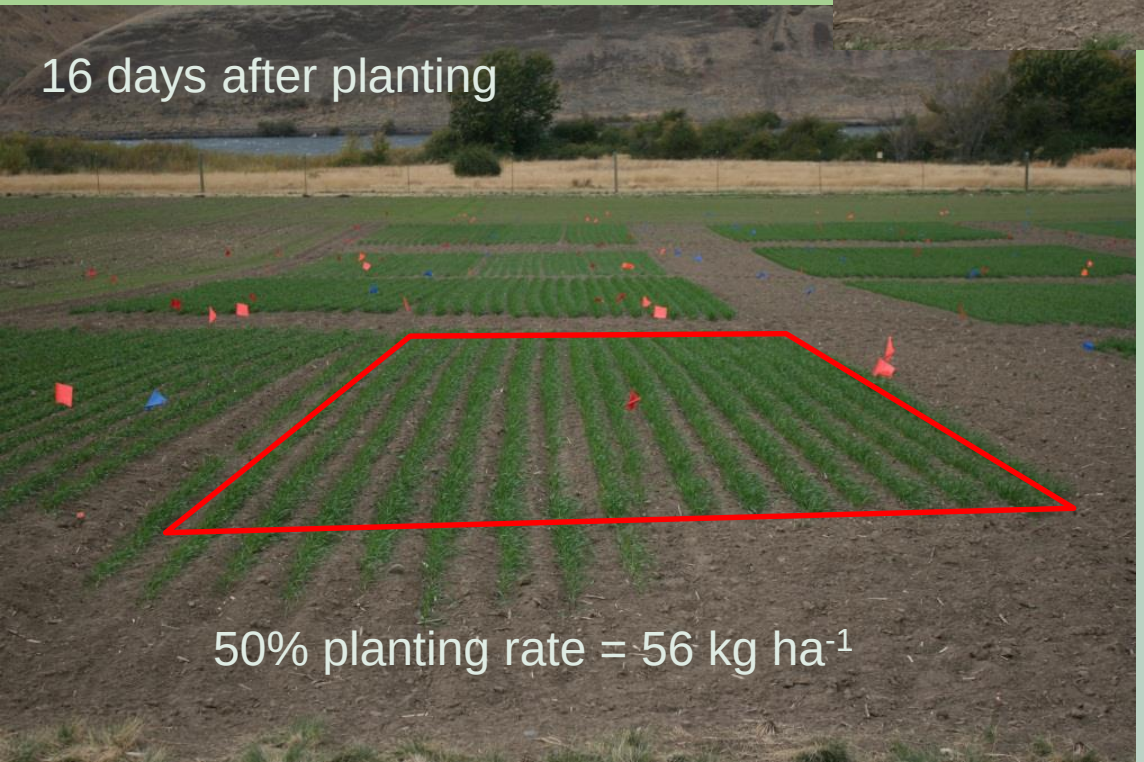
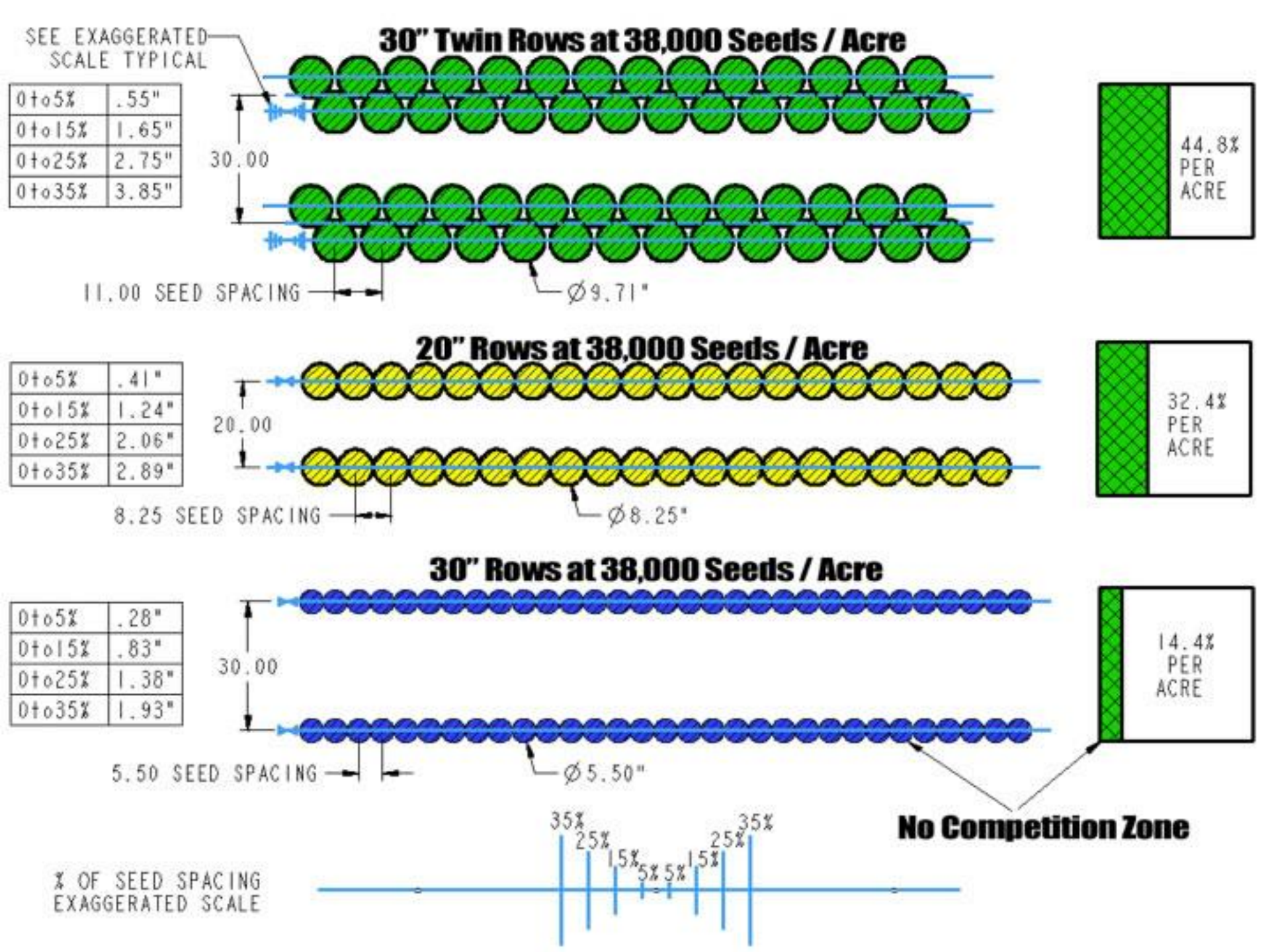
# Non-Chemical Weed Management

- Practices include manipulation of
  - **Crop rotation**
  - planting date
  - **row spacing**
  - planting population
  - crop cultivar (related to planting date)
  - fertility (placement)
  - use of mulches, cover crops, smother crops
  - management of water


16 days after planting
125% planting rate = 140 kg ha-1


16 days after planting
50% planting rate = 56 kg ha-1


SEE EXAGGERATED SCALE TYPICAL
0to5% .55"
0to15% 1.65"
0to25% 2.75"
0to35% 3.85"
30" Twin Rows at 38,000 Seeds / Acre
30.00
11.00 SEED SPACING
Ø9.71"
44.8% PER ACRE
20" Rows at 38,000 Seeds / Acre
0to5% .41"
0to15% 1.24"
0to25% 2.06"
0to35% 2.89"
20.00
8.25 SEED SPACING
Ø8.25"
32.4% PER ACRE
30" Rows at 38,000 Seeds / Acre
0to5% .28"
0to15% .83"
0to25% 1.38"
0to35% 1.93"
30.00
5.50 SEED SPACING
Ø5.50"
14.4% PER ACRE
No Competition Zone
% OF SEED SPACING EXAGGERATED SCALE
35%
25%
15%
5%
5%
15%
25%
35%

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# Non-Chemical Weed Management

- Using cultural weed management results in
  - variable crop-weed competition
  - variable crop-crop (cover) competition
  - assistance with weed management
- Can be very useful when other options are not available.

TABLE 4. Jointed goatgrass head density, total biomass, spikelet biomass, and 1

| | Head density | | Total biomass | |
|---|---|---|---|---|
| | 1998 | 2000 | 1998 | 2000 |
| | no. $m^{-2}$ | | g $m^{-2}$ | |
| Isoline (relative height) | | | | |
| rht1 (short) | 581 | 585 | 239 | 378 |
| rht4 (tall) | 438 | 509 | 128 | 315 |
| LSD (P = 0.05) | 137 | NS | 45 | 60 |
| Seed Size | | | | |
| Large | 371 | 559 | 132 | 357 |
| Mixed | 491 | 528 | 178 | 335 |
| Small | 666 | 555 | 240 | 349 |
| LSD (P = 0.05) | 168 | NS | 55 | NS |
| Seeding rate | | | | |
| 40 $m^{-1}$ row | 630 | 598 | 227 | 376 |
| 60 $m^{-1}$ row | 388 | 496 | 140 | 318 |
| LSD (P = 0.05) | 137 | NS | 45 | NS |

[a] Abbreviation: NS, not significant.

(Yenish and Young, 2004)

# CROP ROTATION

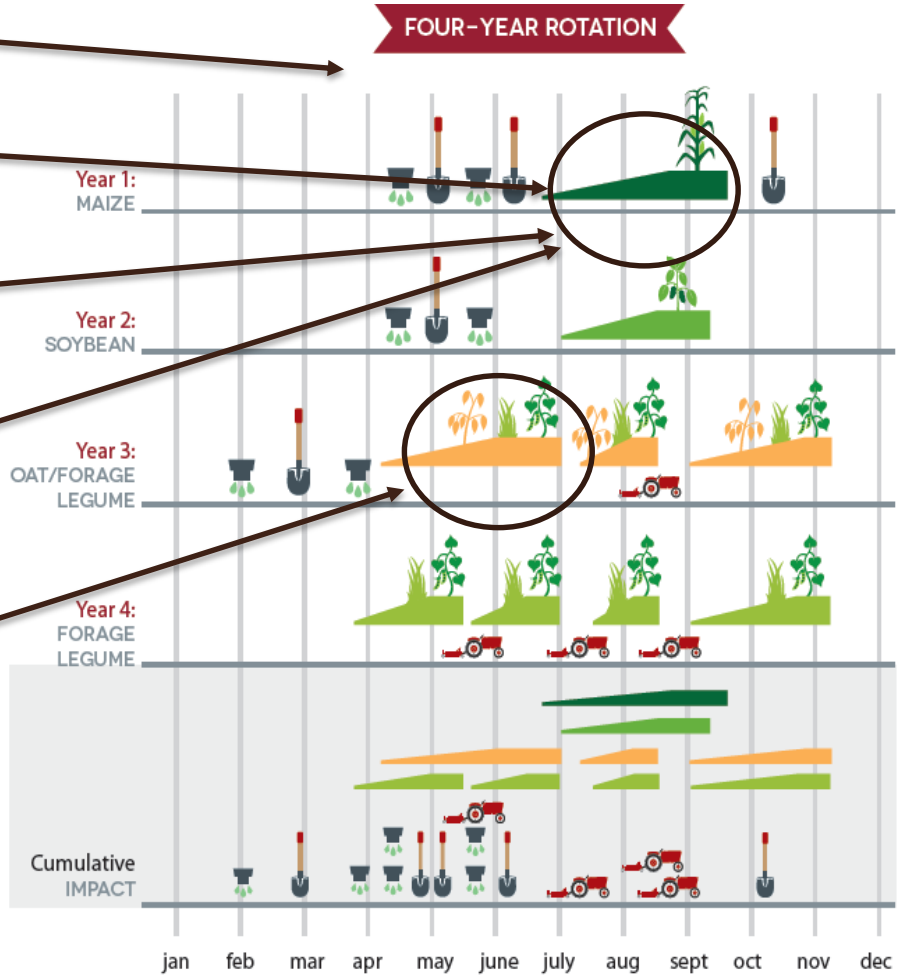
## Planting Date

## Crop Spacing, Crop Population, Crop Cultivar

## Fertilizer Placement

## Mulches, Cover and smother crops

## Water Management




KEY

MAIZE

SOYBEAN

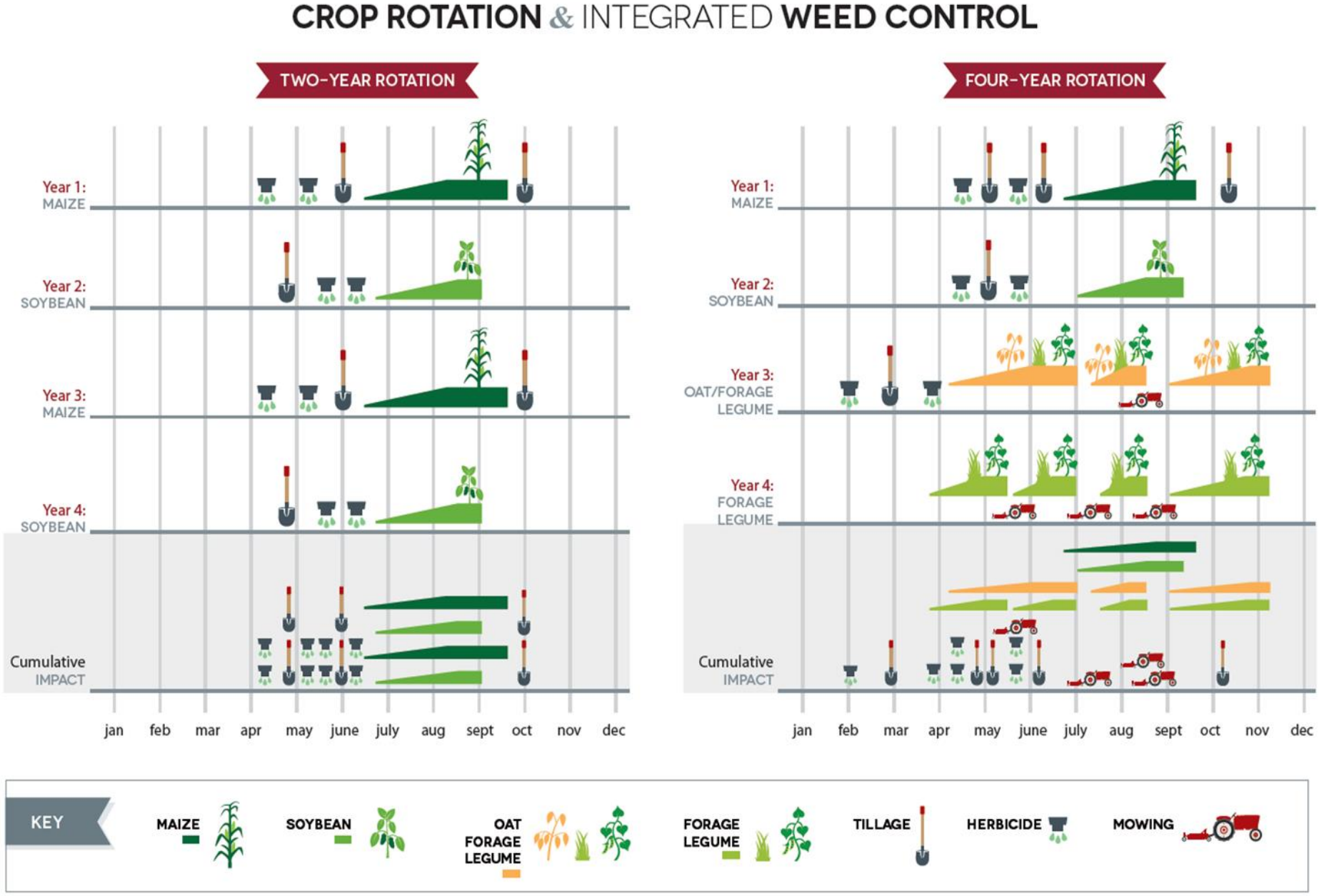
OAT FORAGE LEGUME

FORAGE LEGUME

TILLAGE

HERBICIDE

MOWING




Prevention, Non-Chemical, **Chemical**

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# Chemical Weed Management


PROWL® H2O herbicide

Roundup POWERMAX® HERBICIDE

Dual II Magnum®

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# Chemical Weed Management

- **How do herbicides work?**

- **Rather: How are herbicides classified?**

- Understand how herbicides are classified to understand how different types of herbicides kill plants.
- The essential attribute of most herbicides = SELECTIVITY.
  - Selectivity = differential tolerance; some plants are affected, others are not.

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# Chemical Weed Management

- Herbicide classification based on selectivity

| Herbicide classification | Examples |
|---|---|
| Crop in which it is used | Corn, potato, wheat |
| Observed effect | Yellowing, necrosis, bleaching |
| Site of uptake | Foliar-active or soil-applied |
| Contact vs. systemic activity | Paraquat vs. glyphosate |
| Selectivity | Plant age, grass, broadleaf |
| Time of application | Preplanting, preemergence, postemergence |
| Chemical structure | Triazine, Sulfonylurea |
| Site of action | Photosystem II, ALS Inhibitor |

# Chemical Weed Management

- **Systems of herbicide classification most used or well known**
  - The Weed Science Society of America (WSSA) Mechanism of Action List.
    - http://wssa.net/wp-content/uploads/WSSA-Mechanism-of-Action.pdf


- Classifies herbicides by **site of action** and **chemical structure**.

# Chemical Weed Management

- WSSA List of Herbicide Mechanisms of Action
  - **Group 1**: ACCase Inhibitors
  - **Group 2**: Acetolactate Synthase Inhibitors
  - **Group 4**: Synthetic Auxins
  - **Group 9**: EPSP Synthase Inhibitors




# Chemical Weed Management

- WSSA List of Herbicide Mechanisms of Action
  - Other groups: **3**, **15**, 23, **5**, 6, 7, 8, 16, 10, 11, 12, 13, 27, **14**, 17, 25, 26, 18, 20, 21, 28, 29, **22**, and 24.

PROWL H2O herbicide

AAtrex 4L

CHATEAU HERBICIDE WDG

Dual II Magnum

Gramoxone

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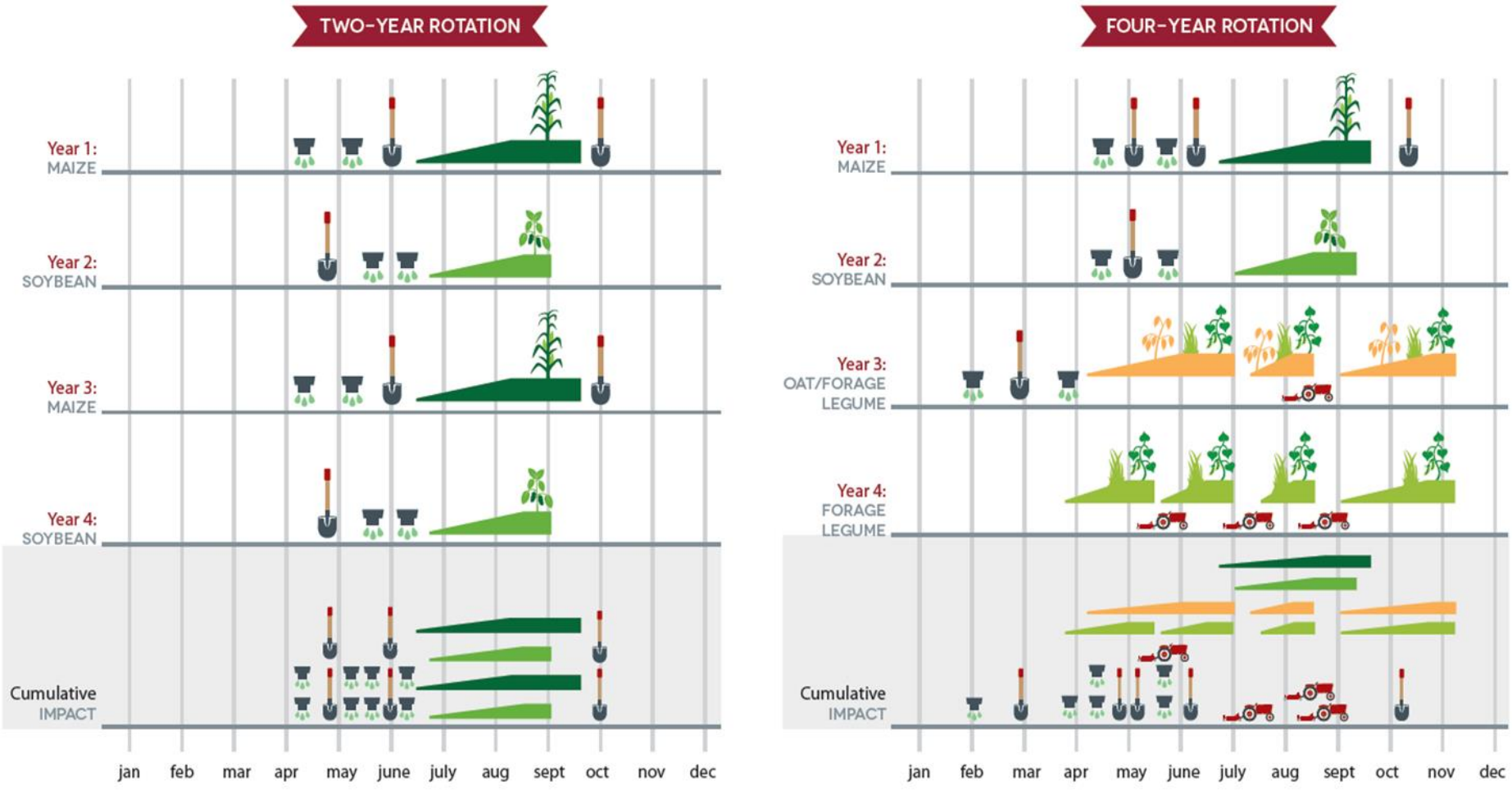
# CROP ROTATION & INTEGRATED WEED CONTROL




KEY

MAIZE | SOYBEAN | OAT FORAGE LEGUME | FORAGE LEGUME | TILLAGE | HERBICIDE | MOWING

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# Conclusions

| Components of IWM | |
|---|---|
| Prevention | Take action, prevent potential problems |
| Non-chemical | Consider weed management when making tillage and cultural decisions |
| Chemical | Use non-chemical weed management practices to take advantage of herbicide selectivity |

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- Further reading →
- **QUESTIONS**