How to control herbicide resistant weeds with innovative herbicide strategies?

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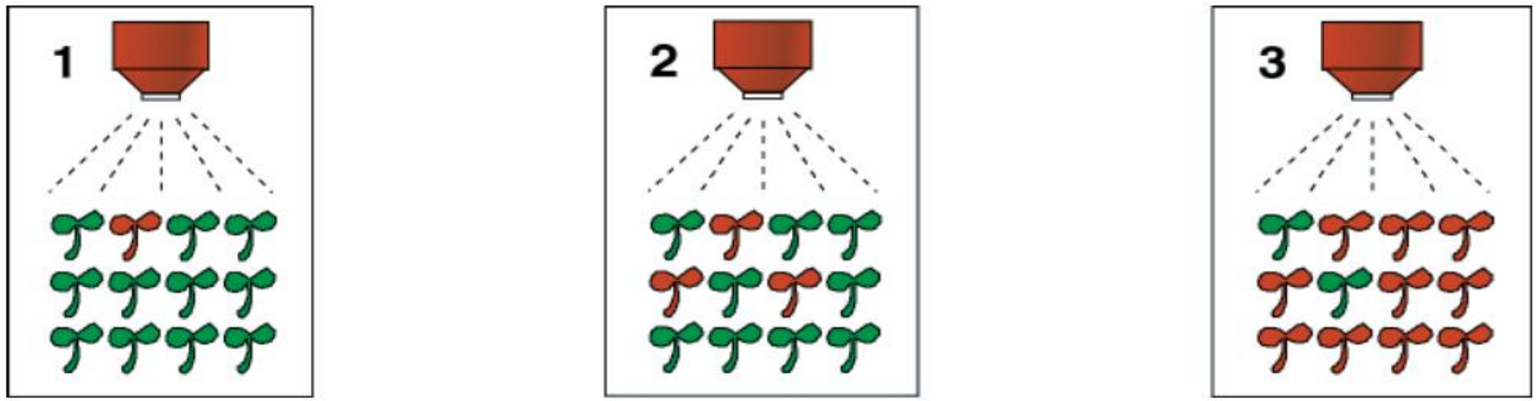
Herbicides

- The use of chemical weed control has become necessary in today's agriculture.
- Ease and convenience of use, less labour requirements and the quick results of chemical herbicide application have made this the most popular approach among farmers.
- Herbicide Mode of Action (MOA) : the way in which the herbicide controls susceptible plants
- 19 herbicide MOA groups (crop life, 2017)

But..

- **Continuous use of the same herbicide for a long period of time ⟶ herbicide resistant weeds**



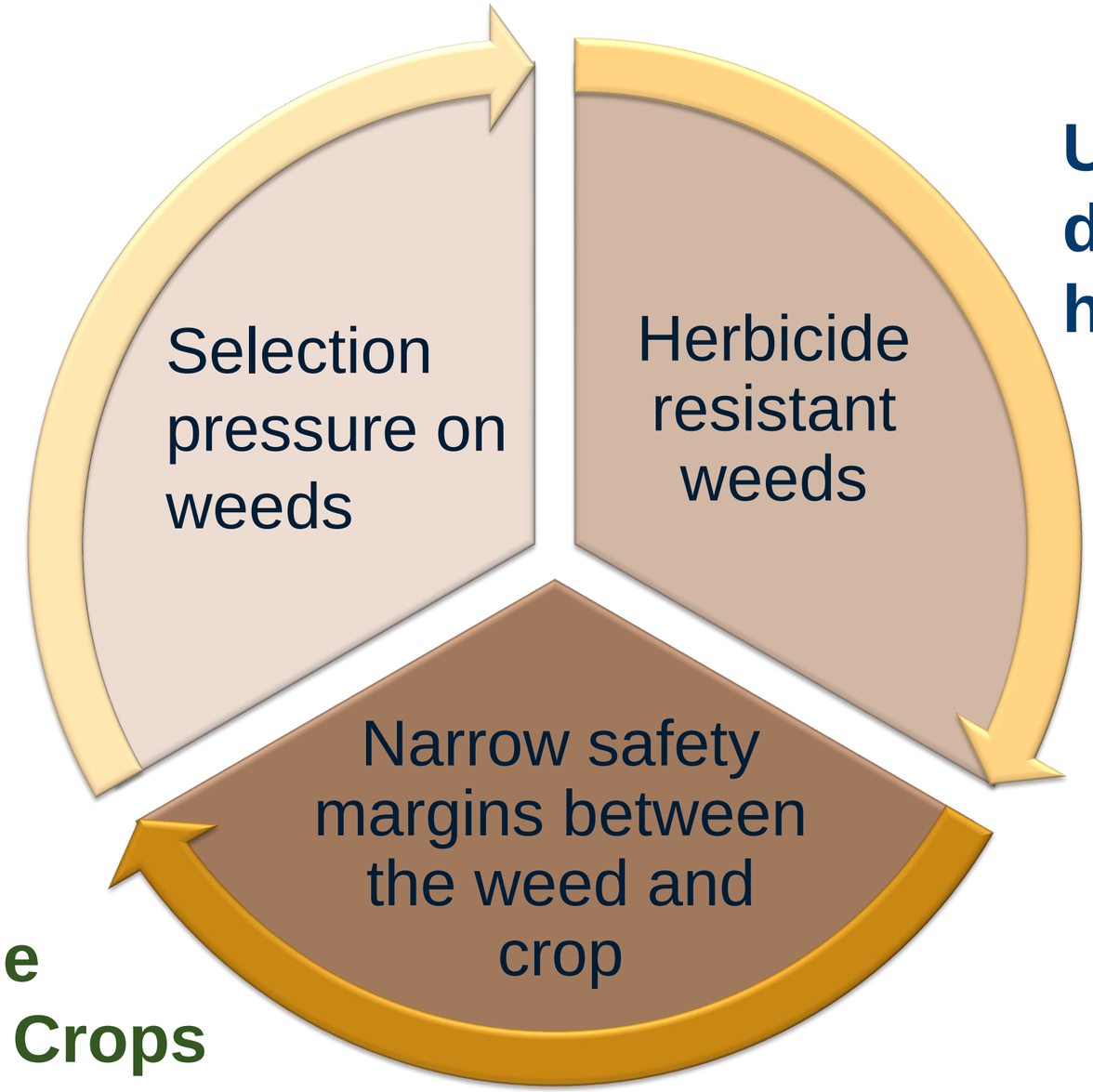
Evolution of herbicide resistance in a weed population (Martin et al., 2000)

Herbicide resistant weeds (HRW)

- A plant's evolved capability to survive the herbicide and complete its life cycle in a previously herbicide susceptible weed population (Heap, 2014)

- 48 herbicide resistant weed species in Australia (Heap, 2017)

Weed control using that particular herbicide MOA



Use of different herbicides

Herbicide Tolerant Crops

Herbicide Tolerant Crops (HTC)

- Developing novel herbicide tolerant traits in plants using mutagenesis or non-mutagenesis methods

- Allows a wide range of herbicide options for farmers

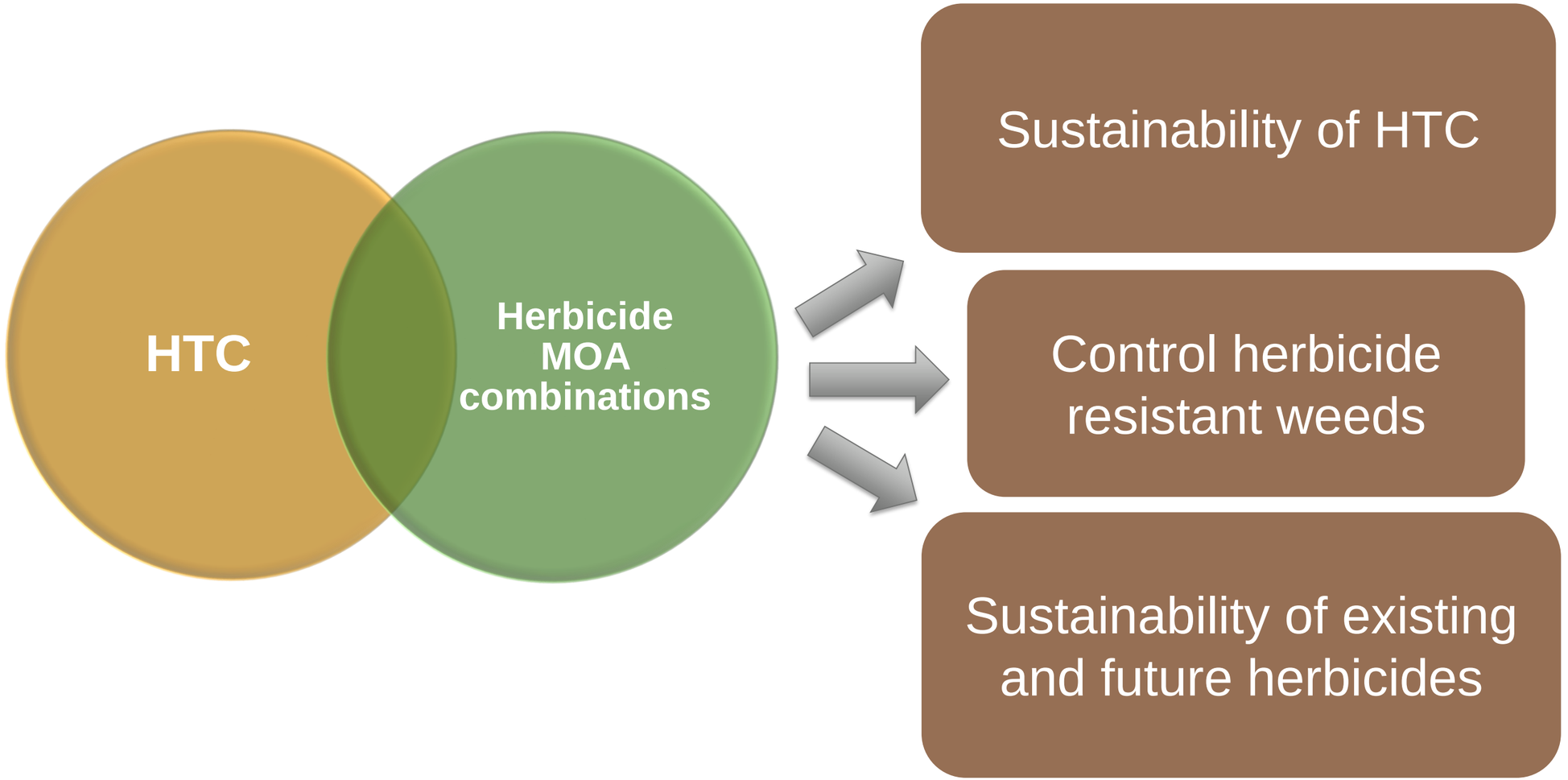
- Can the HTC prevent HRW evolution?
  - **NO!** Weeds may evolve resistance to the whole herbicide MOA

New molecules to deal with herbicide resistant weeds?

- The release of new herbicides to the market has not occurred for three decades (Davis and Frisvold, 2017).

- This situation has made the farmers cognisant of the upcoming challenge of sustainable use of herbicides where an increasing number of weeds can no longer be dealt with by use of existing herbicides.

Research approach



Study species

HTC Faba bean
(*Vicia faba*)

Wild radish
(*Raphanus raphanistrum*)

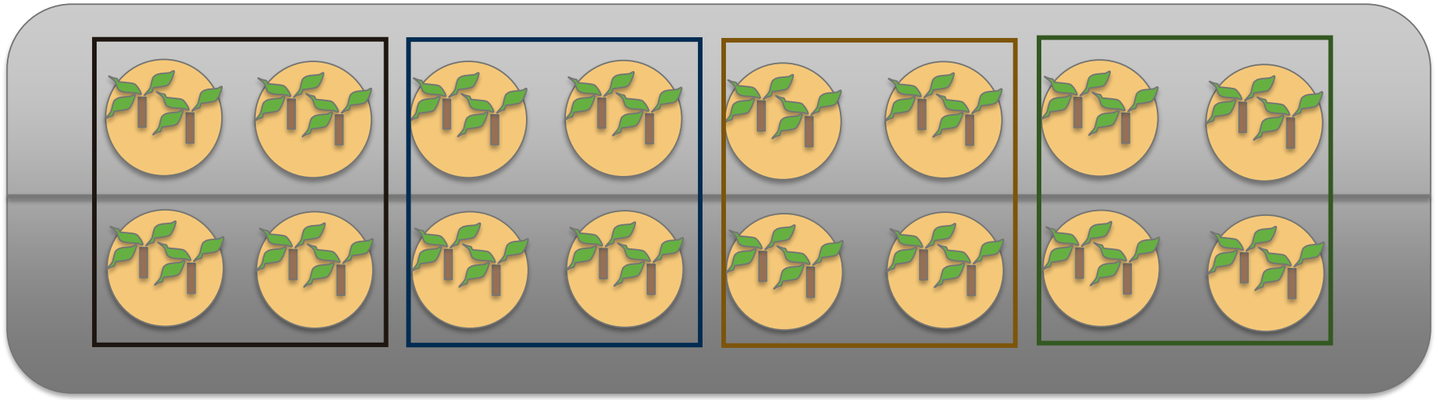
Annual ryegrass
(Lolium rigidum)

Herbicides MOA : Group B & Group C

Approach

Step 1: Best growth stage for group B herbicide application on Faba bean

Imazamox + Imazapyr



Resistant

Susceptible

PSPE | 4 node stage | 8 node stage | Flowering stage

Imazethapyr

Resistant

Susceptible

Step 2. To check the flexibility of Faba bean genotype to different rates of group C herbicides

4 node stage

Metribuzine

R 1 R 2 R 3 R 4 R 5

FB

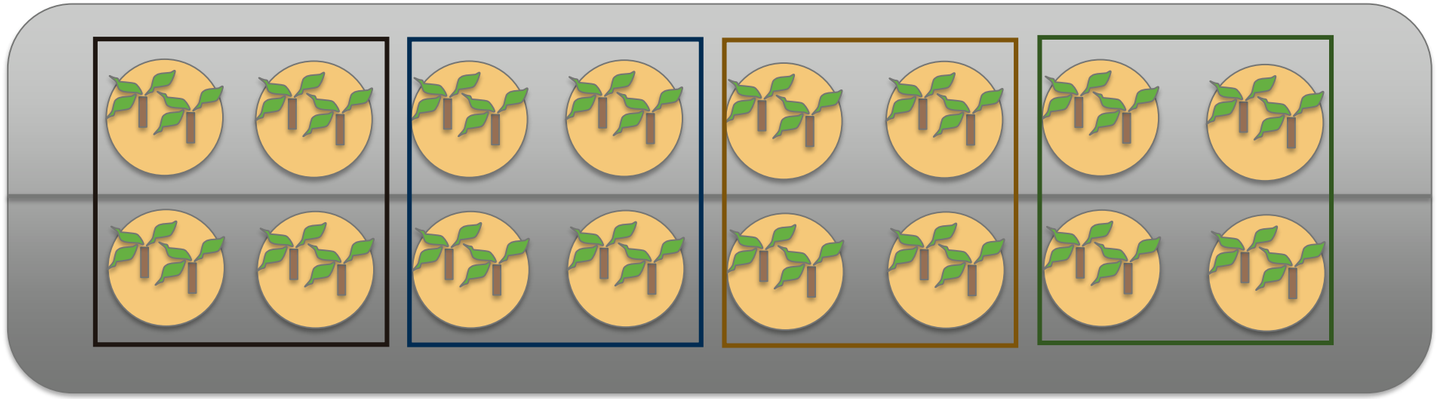
Resistant

Susceptible


Application rate
Group B
Group C
Application time

Step 3. Best growth stage for group B herbicide application to control Wild radish/ Annual ryegrass

Imazamox + Imazapyr



Resistant

Susceptible

2 leaf stage

1 node stage

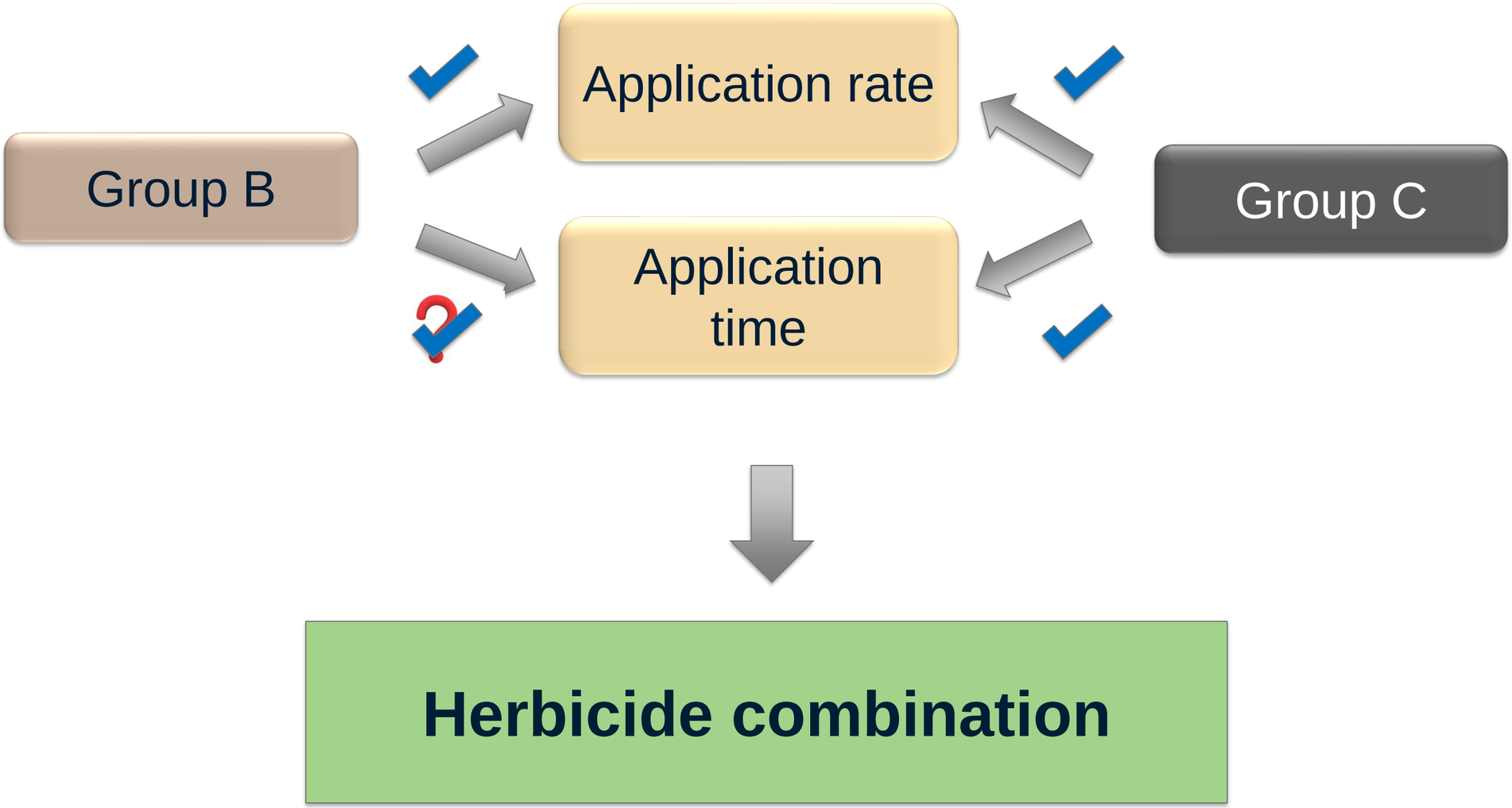
2 node stage

Flowering stage

Imazethapyr

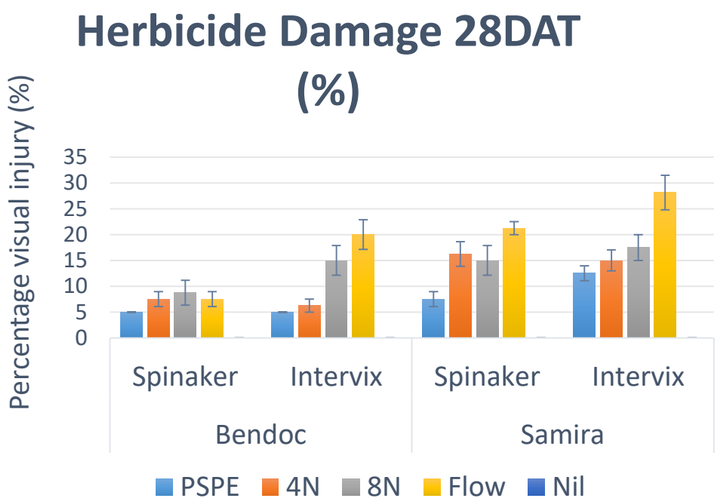
Resistant

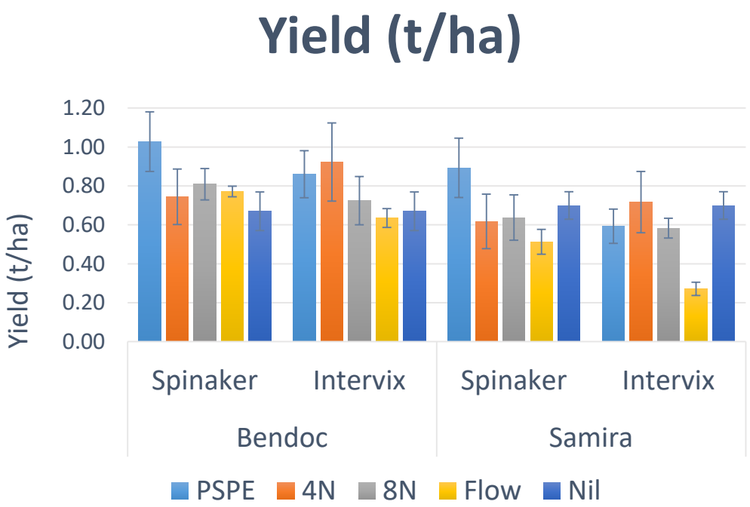
Susceptible

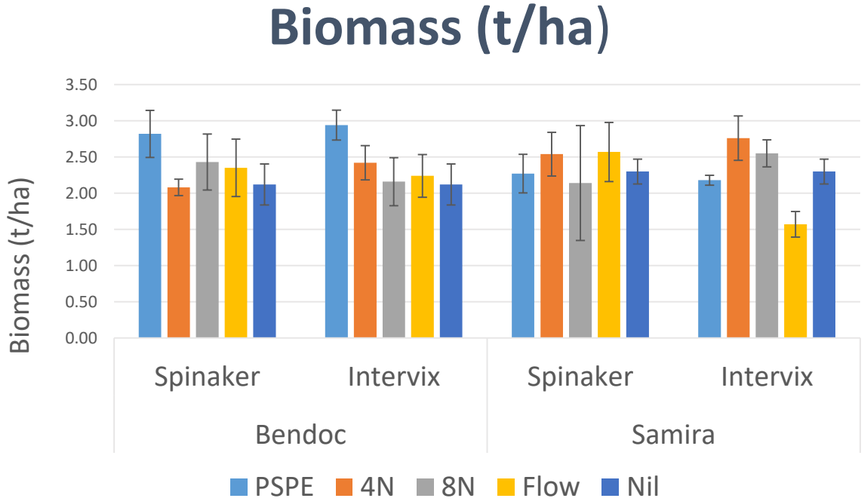

Application rate
Group B
Group C
Application time
Herbicide combination

Observations

Field trial 2018

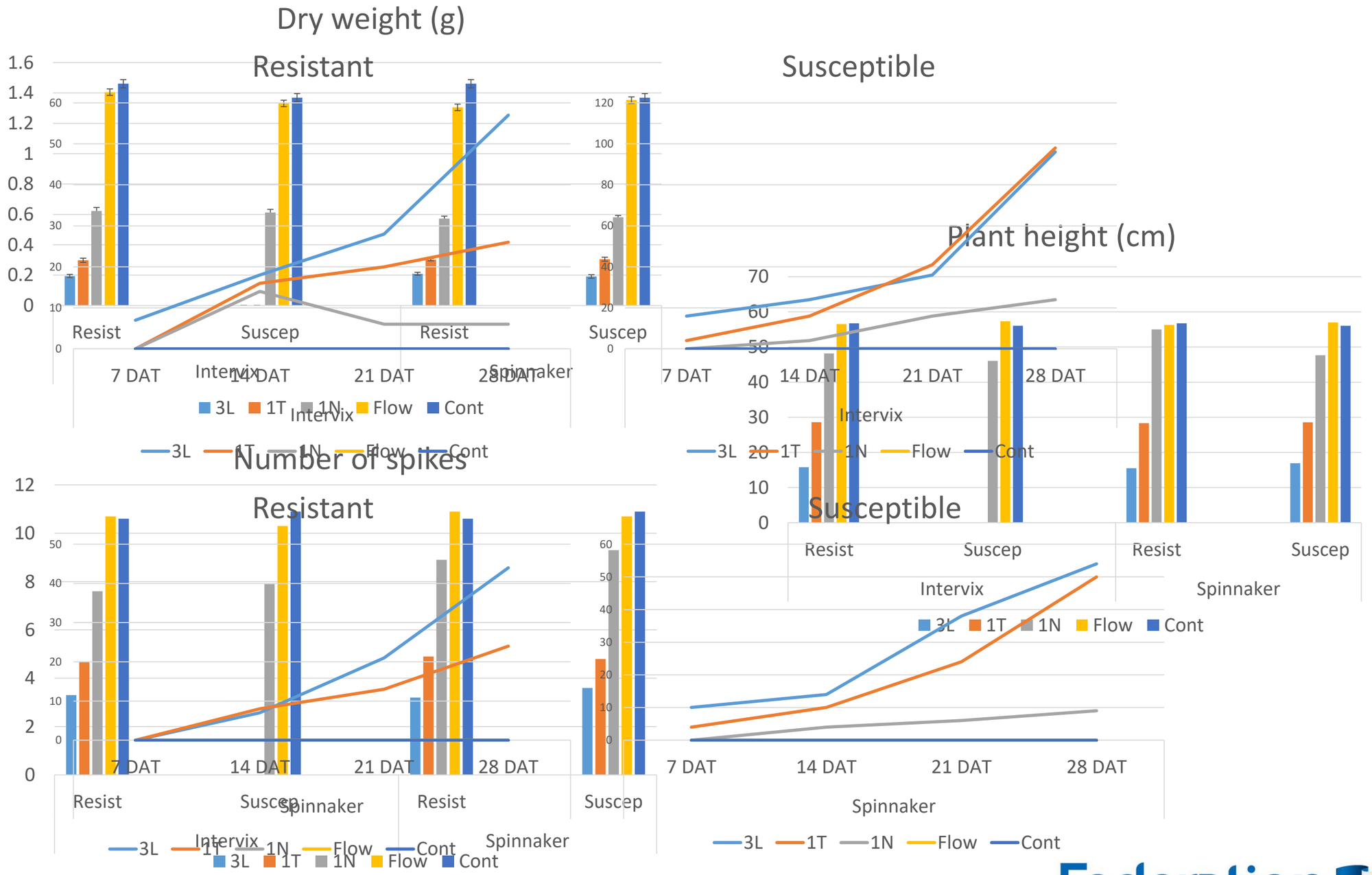




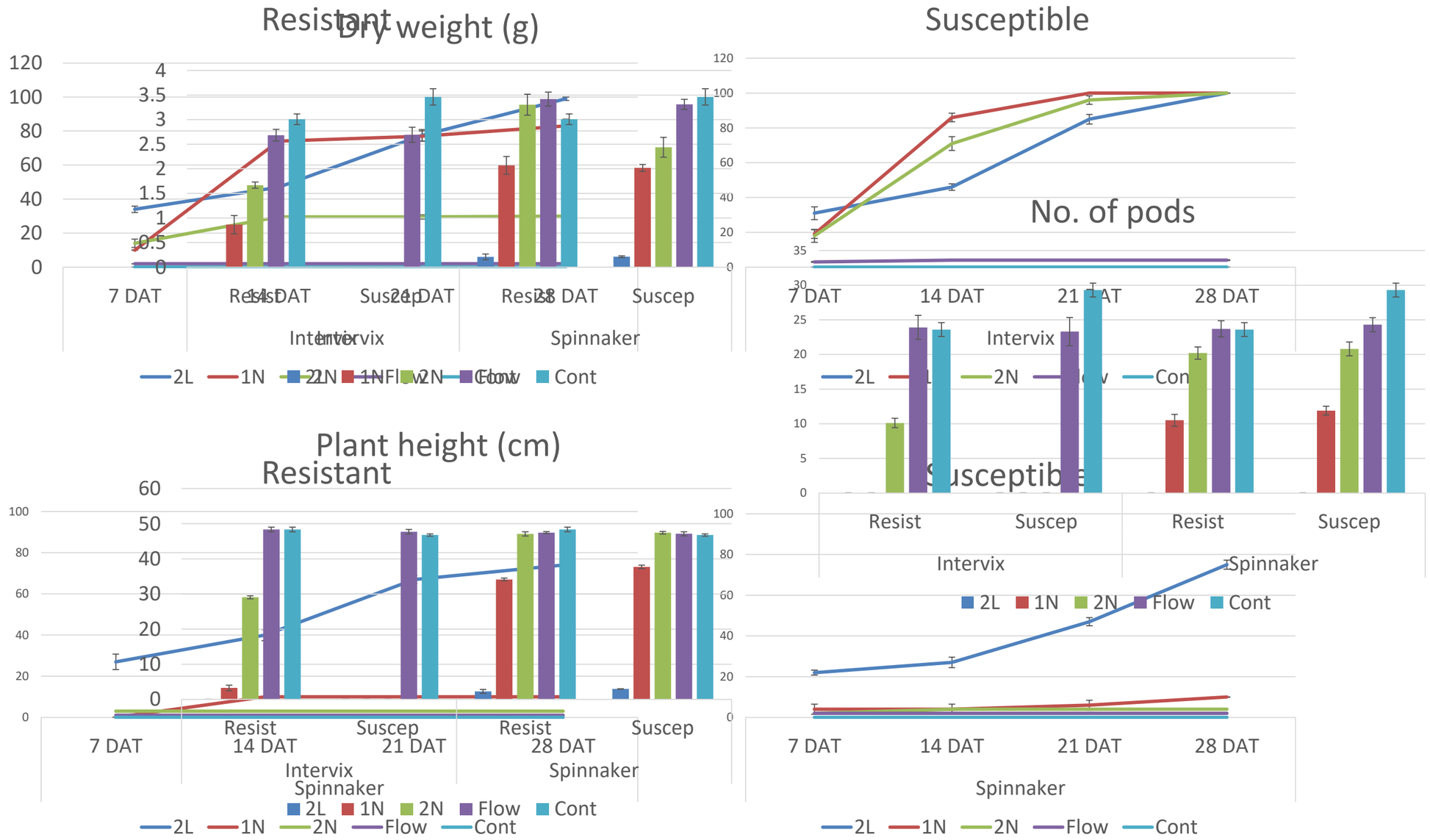


PBA Bendoc proved to be tolerant to both herbicides at all the application timings than PBA Samira

Group B application timing on Ryegrass



Group B application timing on Wild radish



Management implications

- This project will benefit not only the agricultural and weed management authorities but also will directly be beneficial for the local farmers and agronomists.

- It will also provide new leads for future research options in making weed herbicide control more beneficial and sustainable in agricultural system generally.

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thank you