

Effects of seeding rates on N fixation, and seed production of red clover in interaction with effects of IPM in controlling lesser clover leaf weevils and the impacts on pollinators



Forage Seed Conference
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Red clover for seed production

- Short-lived forage legume (perennial)
- Two types:
 1. Medium (multi-cut) early flowering (ON, QC & U.S)
 2. Mammoth (single cut) late flowering (BC, SK & AB)



Red clover values

- High potential to increase Soil Organic Mater (SOM) and Nitrogen.
- Suppress weeds, and breaks up heavy soil.
- Breaks disease and insect cycle.
- Good companion crop in grass mixture.

Estimation of N fixation in 4 legumes (kg/ha)

Legume crops	Gray Luvisol (Bayl)	Black solod (Landry)
Red Clover	334	250
Alfalfa	442	171
Sweet Clover	214	125
Alsike clover	303	152



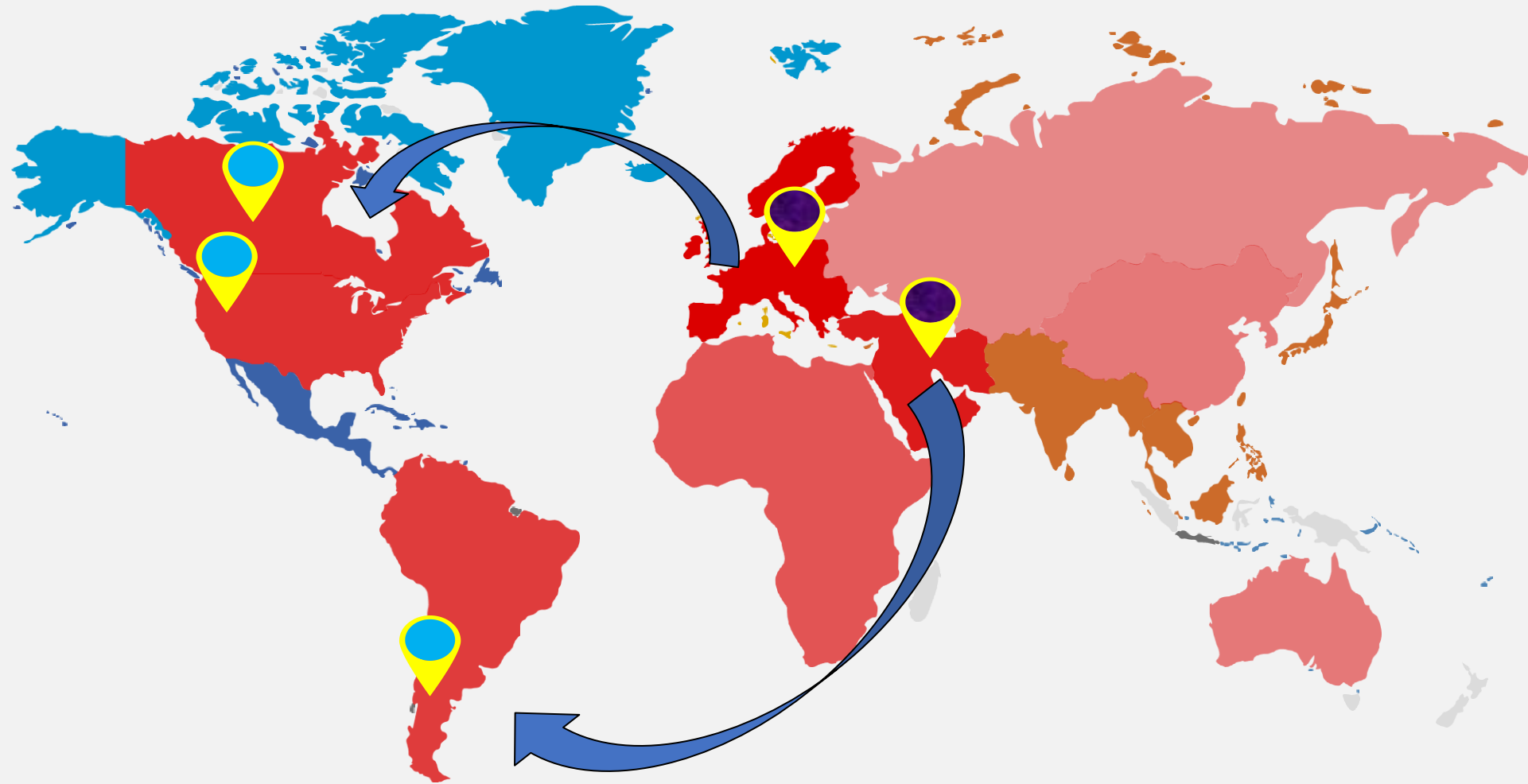
Forage seed production in Saskatchewan (2018)

Crop Kind	Weight (kg)	Total Values (\$)
Alsike clover	3373,754	\$ 1,383,879
Birdsfoot trefoil	4,989	\$ 22,000
Cicer Milkvetch	1,000	\$ 4,758
Red Clover	1,860,145	\$ 4,216,766
Sweet Clover	662,560	\$ 847,730
Annual Ryegrass	277,270	\$ 217,762
Crested Wheatgrass	145,894	\$ 393,841
Dahurian Wild Rye	32,245	\$ 62,160
Hybrid Bromegrass	190,507	\$ 651,336
Intermediate Wheatgrass	47,955	\$ 137,060
Meadow Bromegrass	25,938	\$ 80,709
Perennial Ryegrass	402,736	\$ 506,255
Red Top	20,934	\$ 135,384
Slender Wheatgrass	44,732	\$ 122,599
Smooth Bromegrass	9,806	\$ 27,822
Timothy	833,988	\$ 1,023,232
Totals	4,937,899	\$ 9,840,148

Lesser clover leaf weevil (LCLW)

- First reported in Saskatchewan in 1985.
- Seed yield reduced by 80% (loss of \$2M – 1986)
- Both larvae and adults can cause damage to red clover.

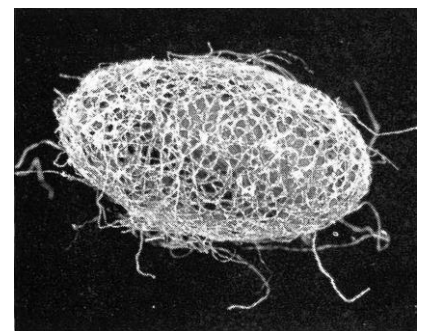
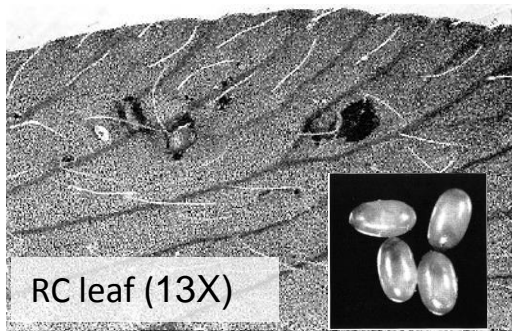
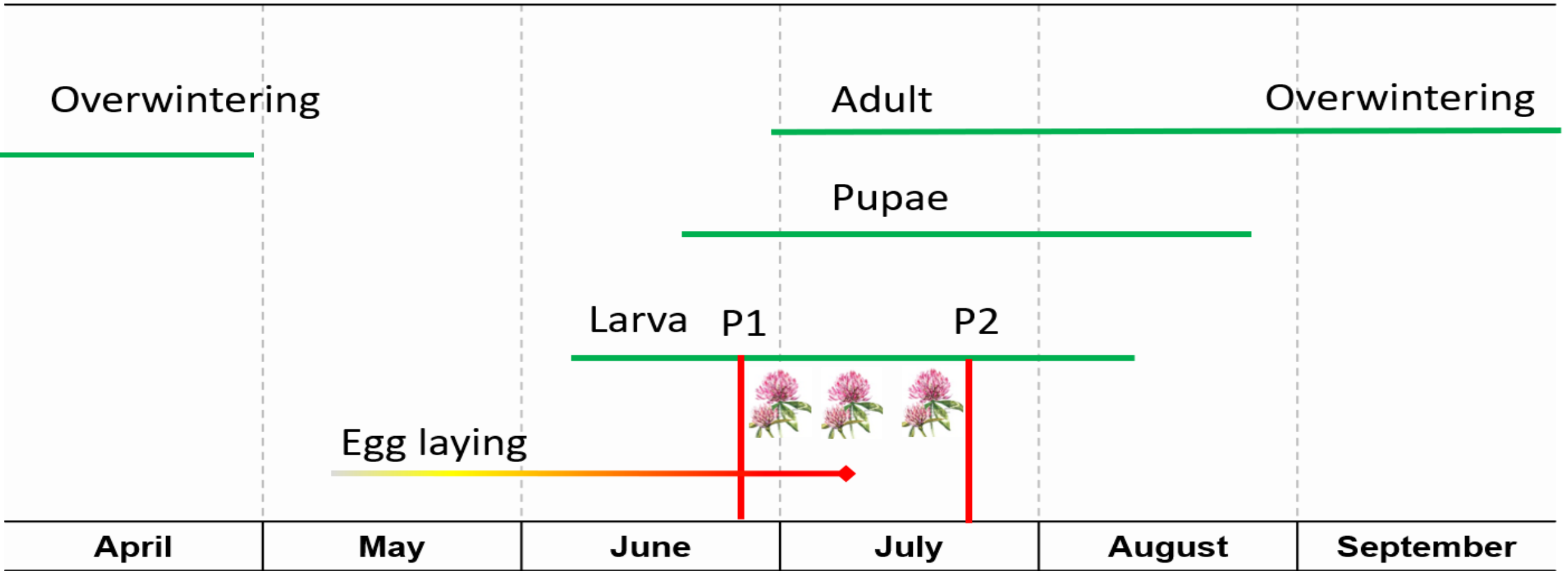




- Found natively in Europe, Western Asia, & northwest Africa
- It has been naturalized in North America during last two centuries



Lesser clover leaf weevil biology in SK



Weiss & Gillott (1993). *The Can. Entomol.* Vol.125(5): 831-837
Brandt and Ginter (2017). *SFSDC Annual report 2015-2016*

Management Options

- **Cultural:** burning of red clover fields in spring (where permitted).
- **Biological:** parasitoids (Ichneumonidae, Bracon sp.)
- **Chemical:** Decis and Poleci (deltamethrin), IRAC Group 3, Foliar



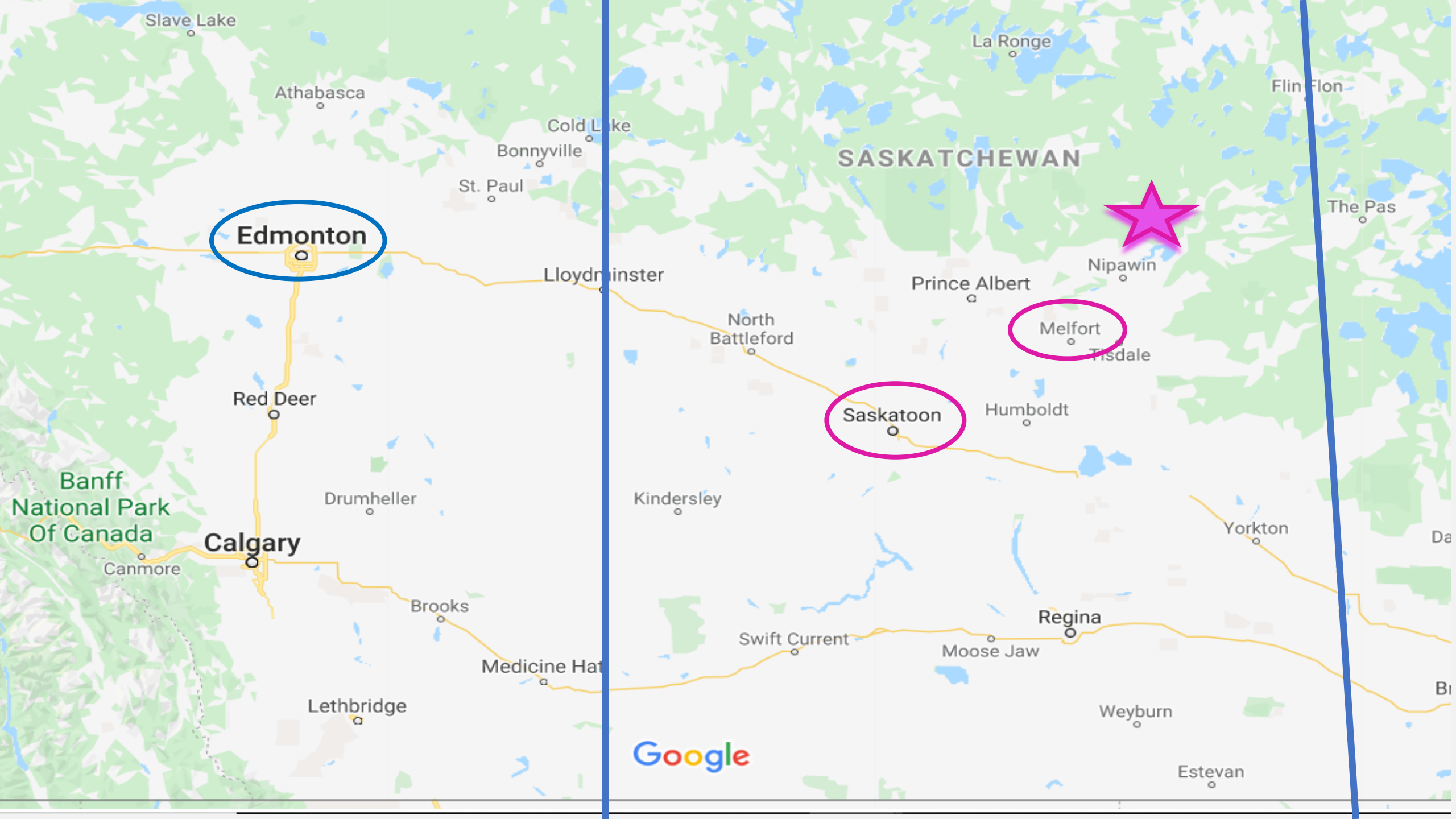
Potential alternatives

Exirel (Cyantraniliprole) - IRAC Group 28

Voliam Xpress (Lambda-cyhalothrin & chlorantraniliprole) - IRAC Group 3 & Group 28

- Provides fast knockdown and residual activity.
- Conserves beneficial arthropods to help in pest control.
- Extended residual control.
- Efficacy on both sucking and chewing pests of agronomic crops.





Edmonton

SASKATCHEWAN



Melfort

Saskatoon

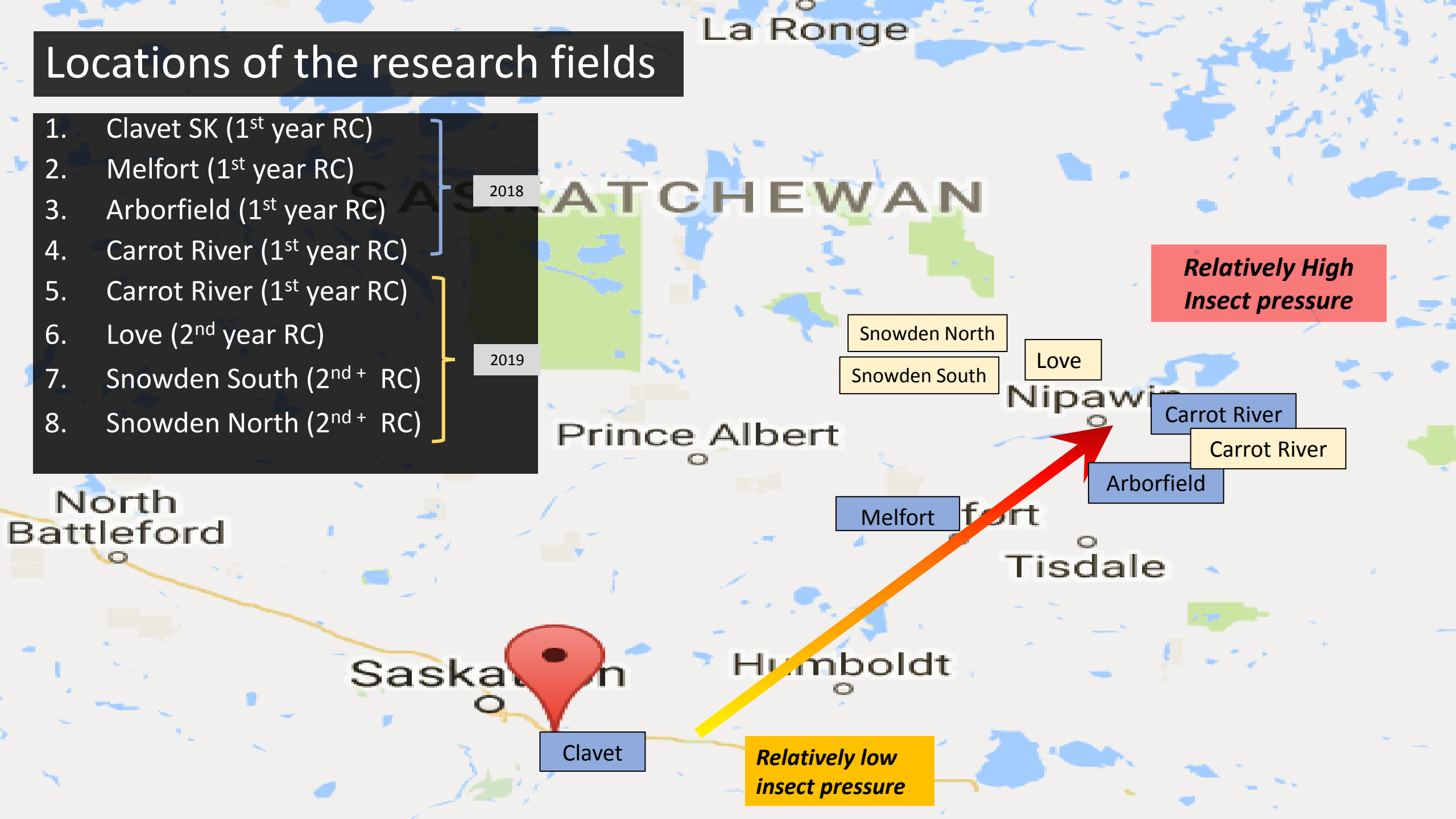
Google

Locations of the research fields

- 1. Clavet SK (1st year RC)
- 2. Melfort (1st year RC)
- 3. Arborfield (1st year RC)
- 4. Carrot River (1st year RC)
- 5. Carrot River (1st year RC)
- 6. Love (2nd year RC)
- 7. Snowden South (2nd+ RC)
- 8. Snowden North (2nd+ RC)

2018

2019



**Relatively High
Insect pressure**

**Relatively low
insect pressure**





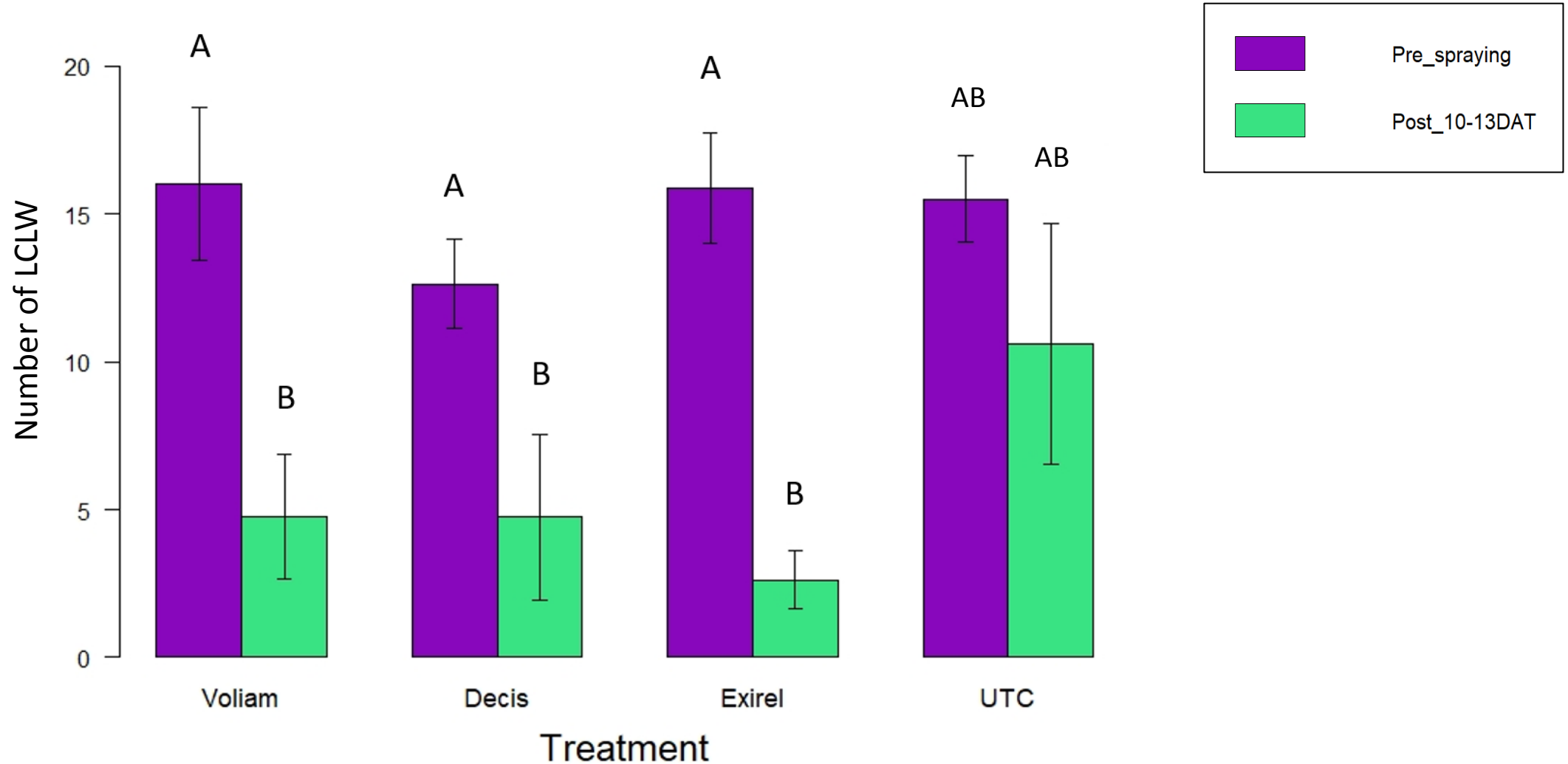
Evaluation of treatments on LCLW

Four weevil control strategies: VoliamXpres, Decis, Exirel, and untreated control.

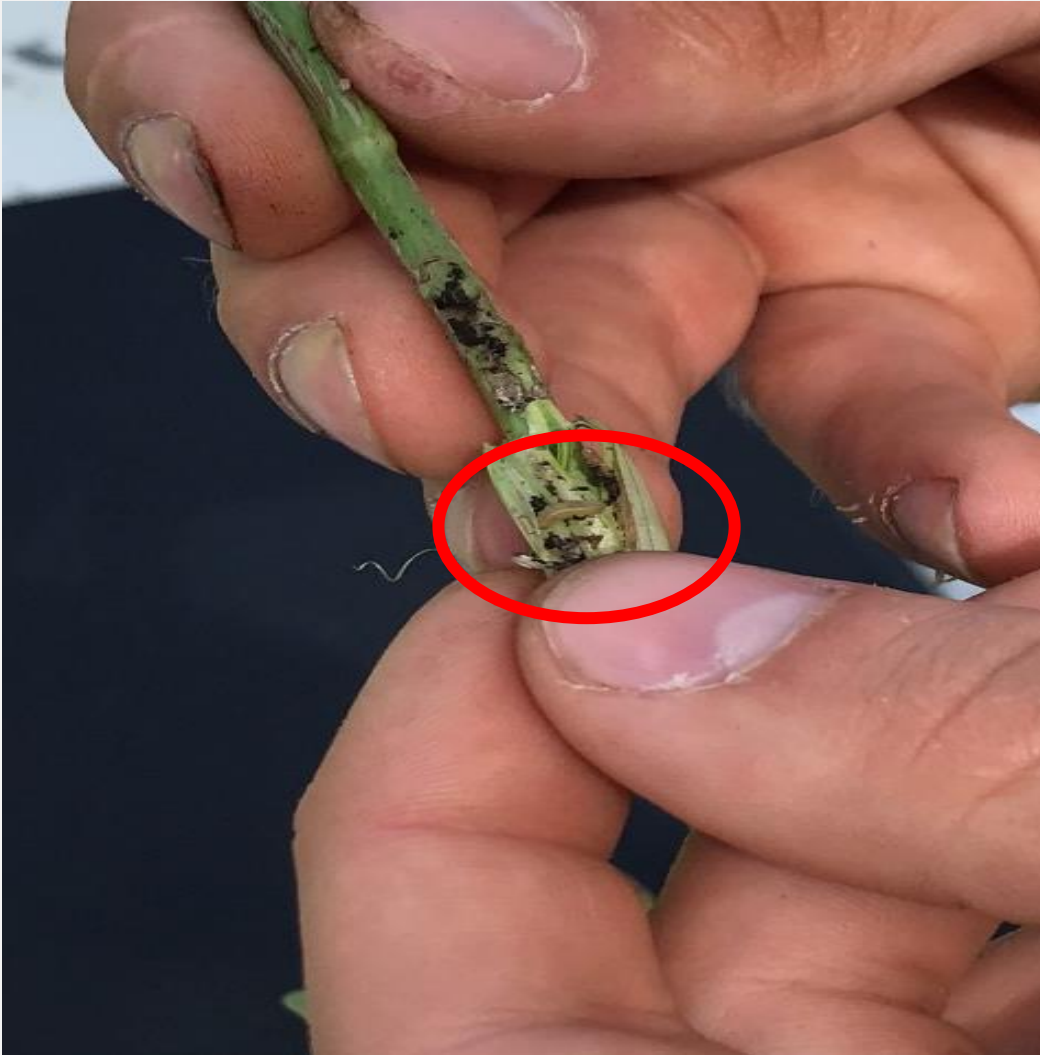
1. Rearing larva in a laboratory (20 stems).
2. Field scouting (10 stems).
3. Sweep netting and yellow sticky cards.



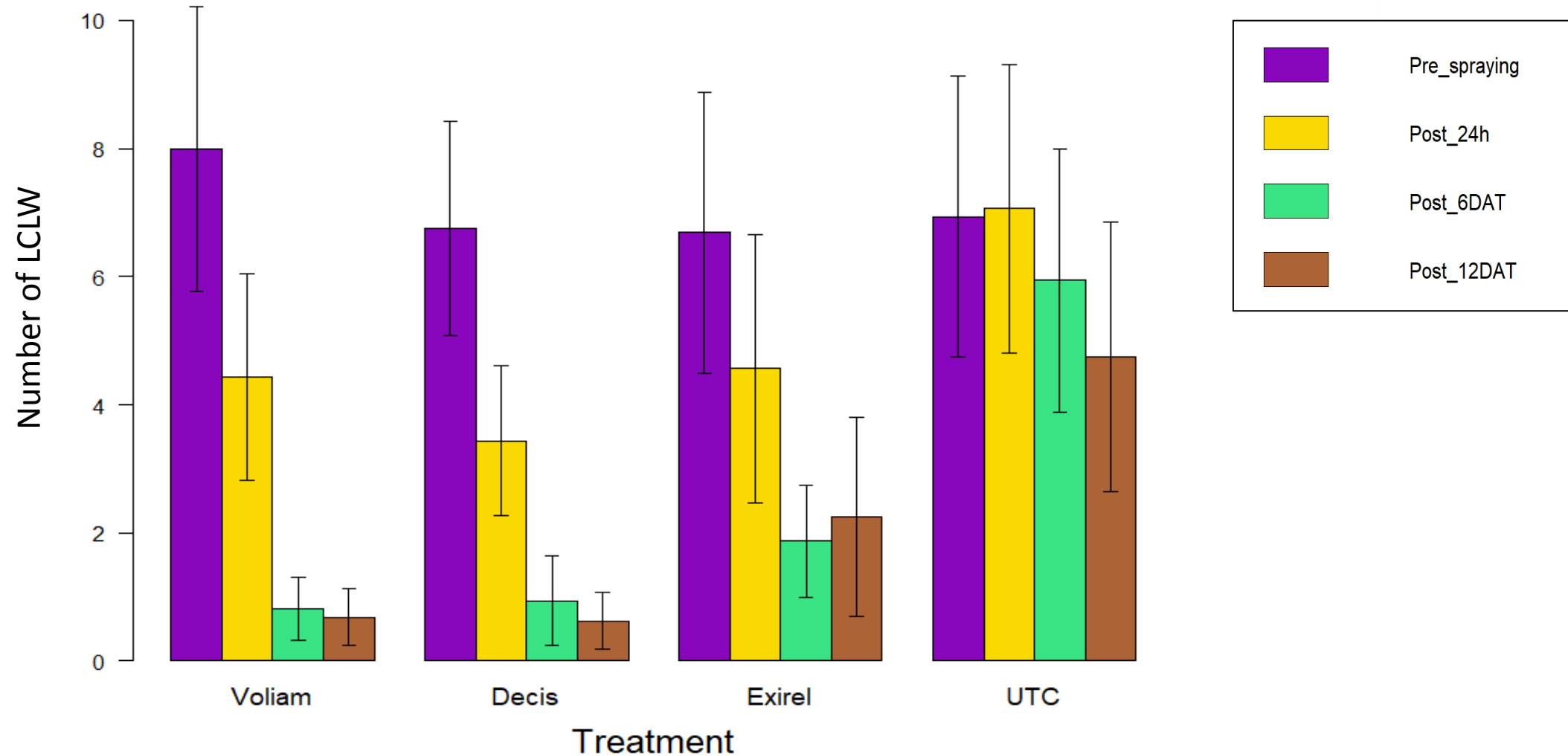
Insecticide treatments reduce weevil number (lab experiment)



2. Field larvae counting (10 stems)

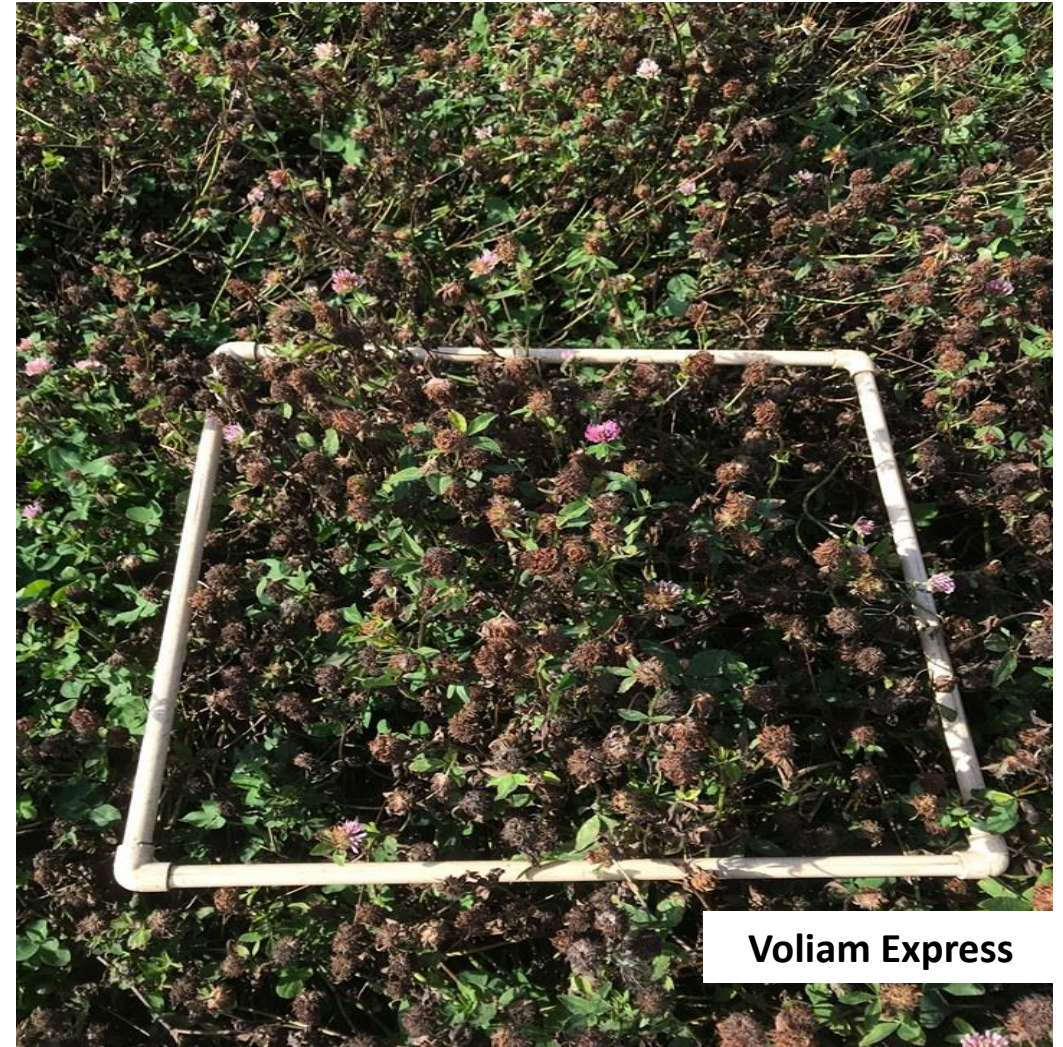
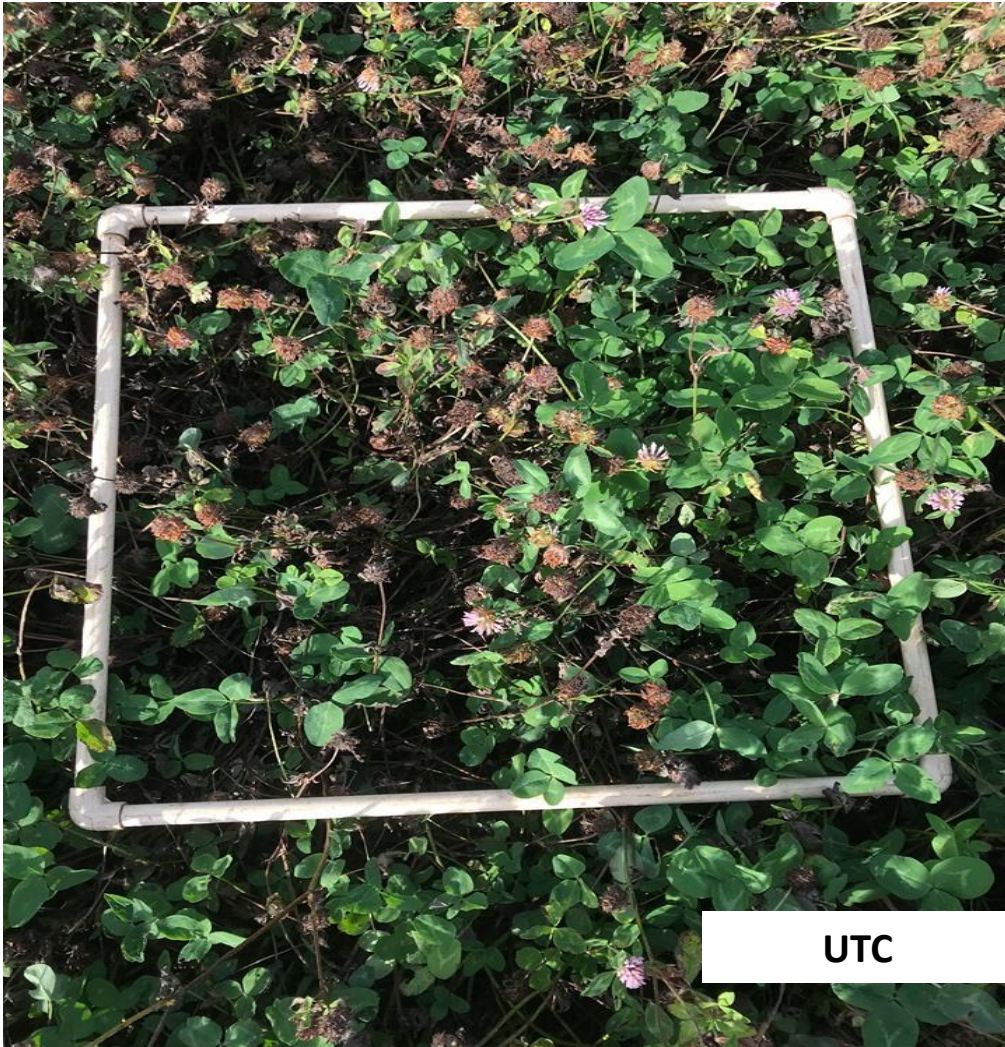


Insecticide treatments reduce weevil number, but not immediately

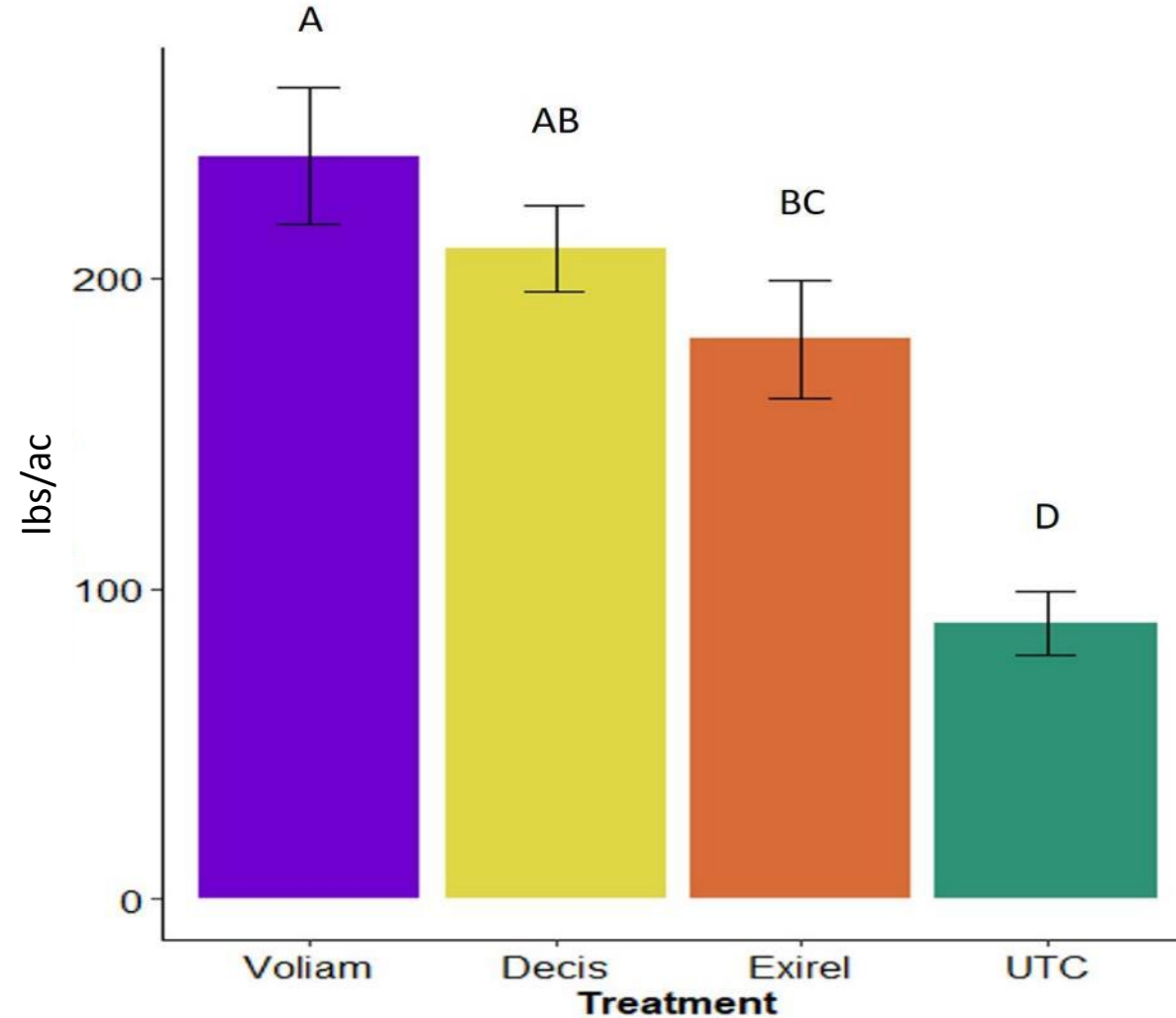


Yield differences

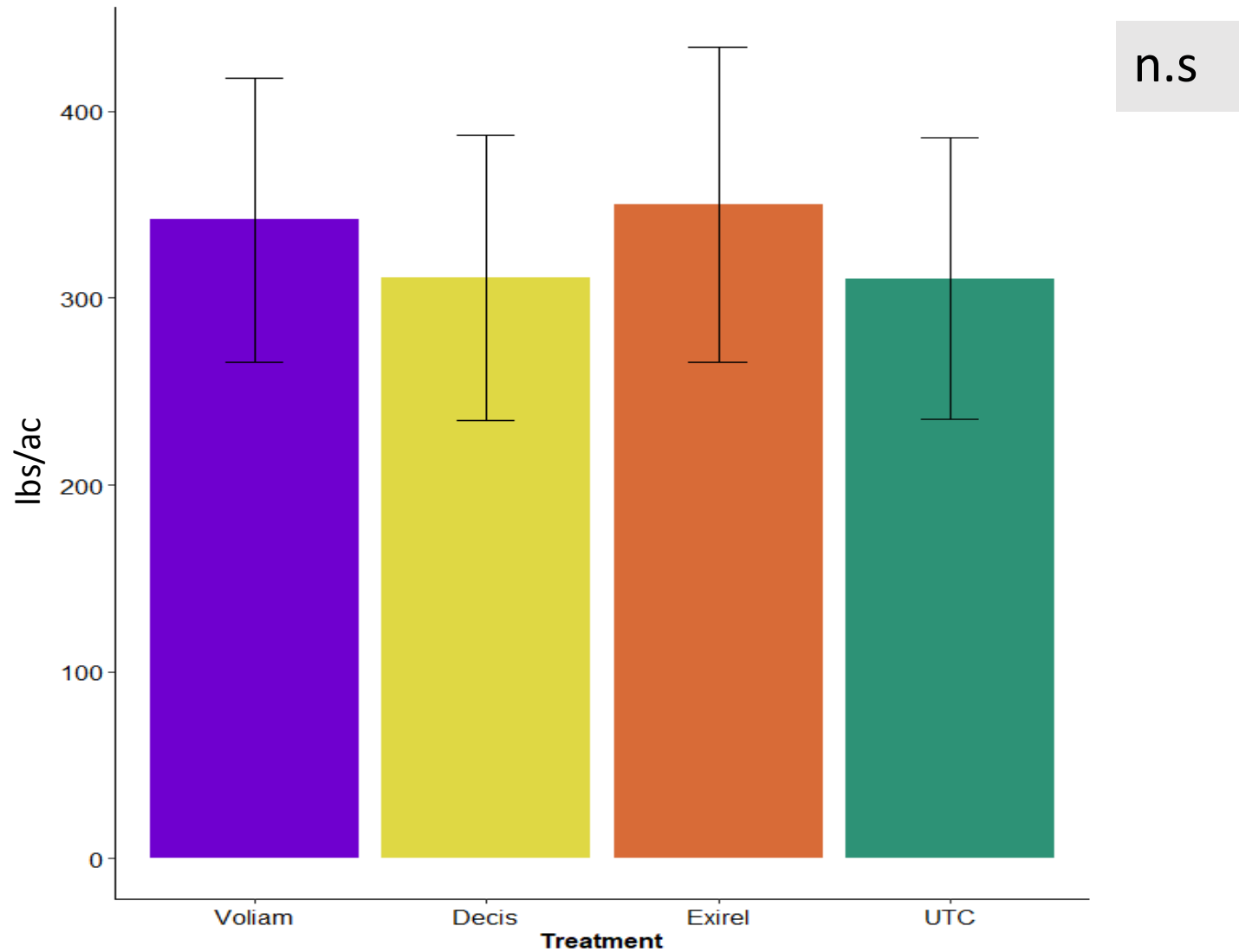
High LCLW pressure sites (Snowden North & Snowden South)



Seed yield differences between treatments (High LCLW pressure sites)



Yield differences between treatments (Low LCLW pressure sites)

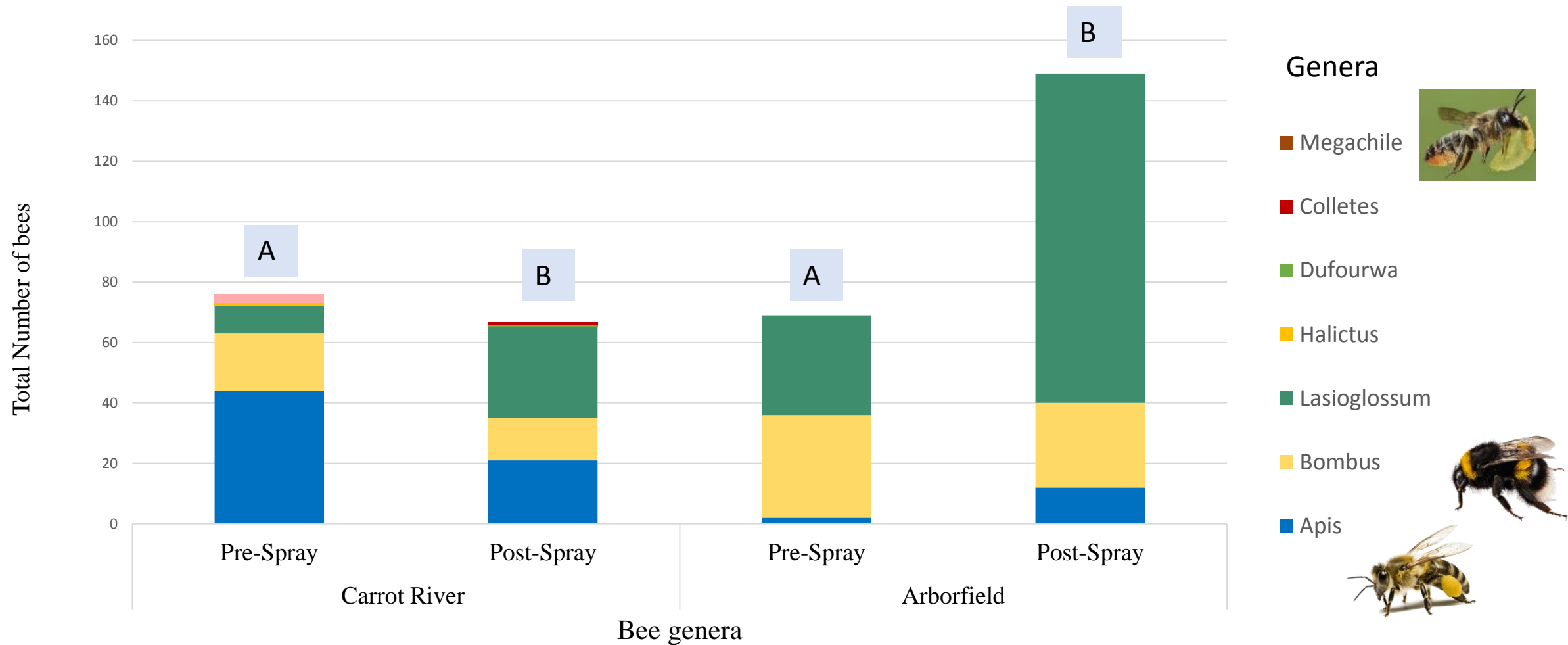


Evaluation effects of pesticides on pollinators number and diversity

Estimation of pollinators community:

- “Bee-Cups”
- “Blue Vane Traps”





Over 10 genera were identified from each of the two sites in north Saskatchewan before spraying and after spraying.

- Insecticide treatments did not have a significant effect on bees abundance.
- However, time (pre and post spraying) significantly affected the number of bees.



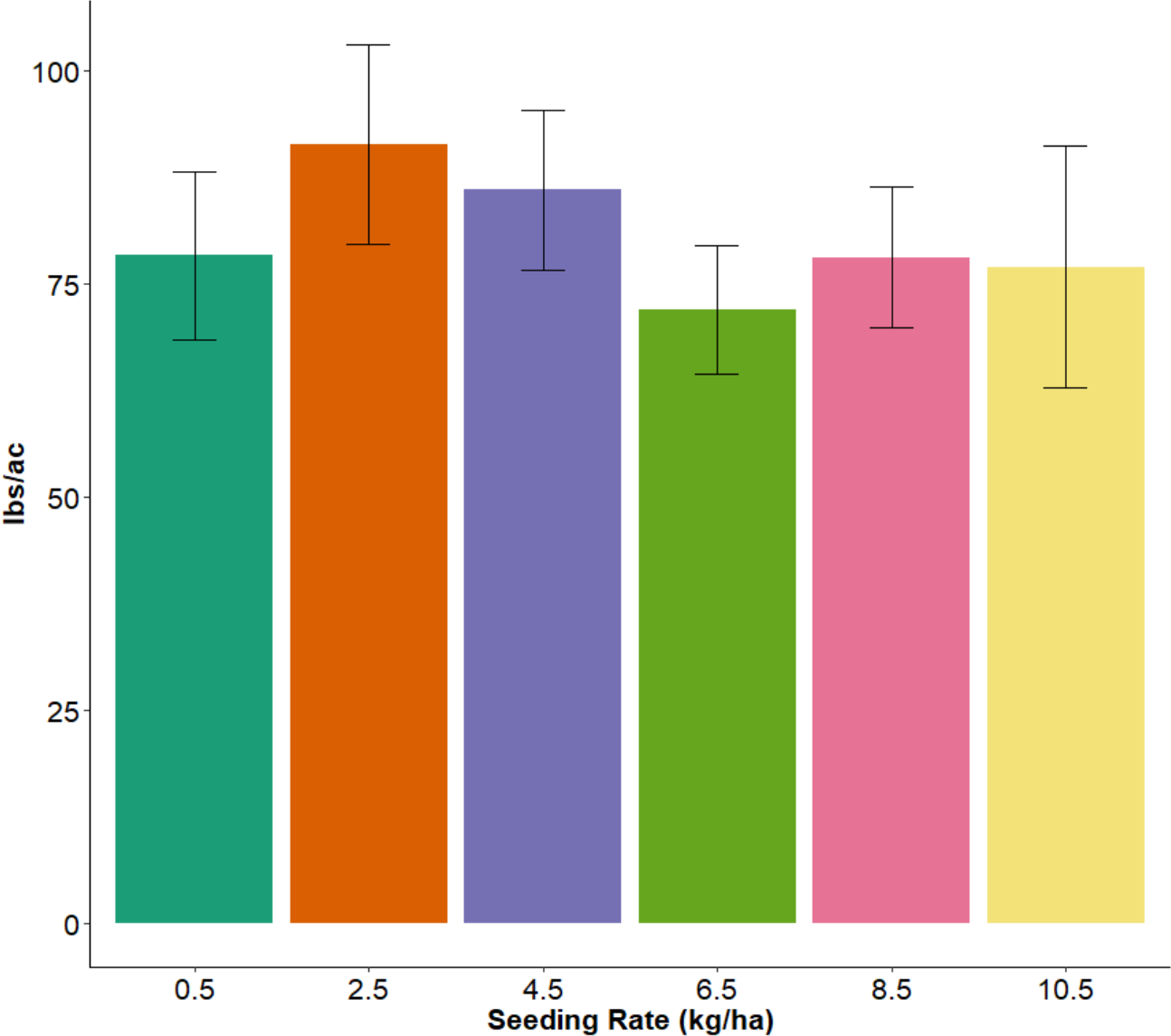


Optimal seeding rates for N fixation, and seed production

- Treatments include six seeding rates (0.5, 2.5, 4.5, 6.5, 8.5, and 10.5 kg/ha)
- Two locations: Clavet (LFCE), Melfort (AAFC Research Farm)



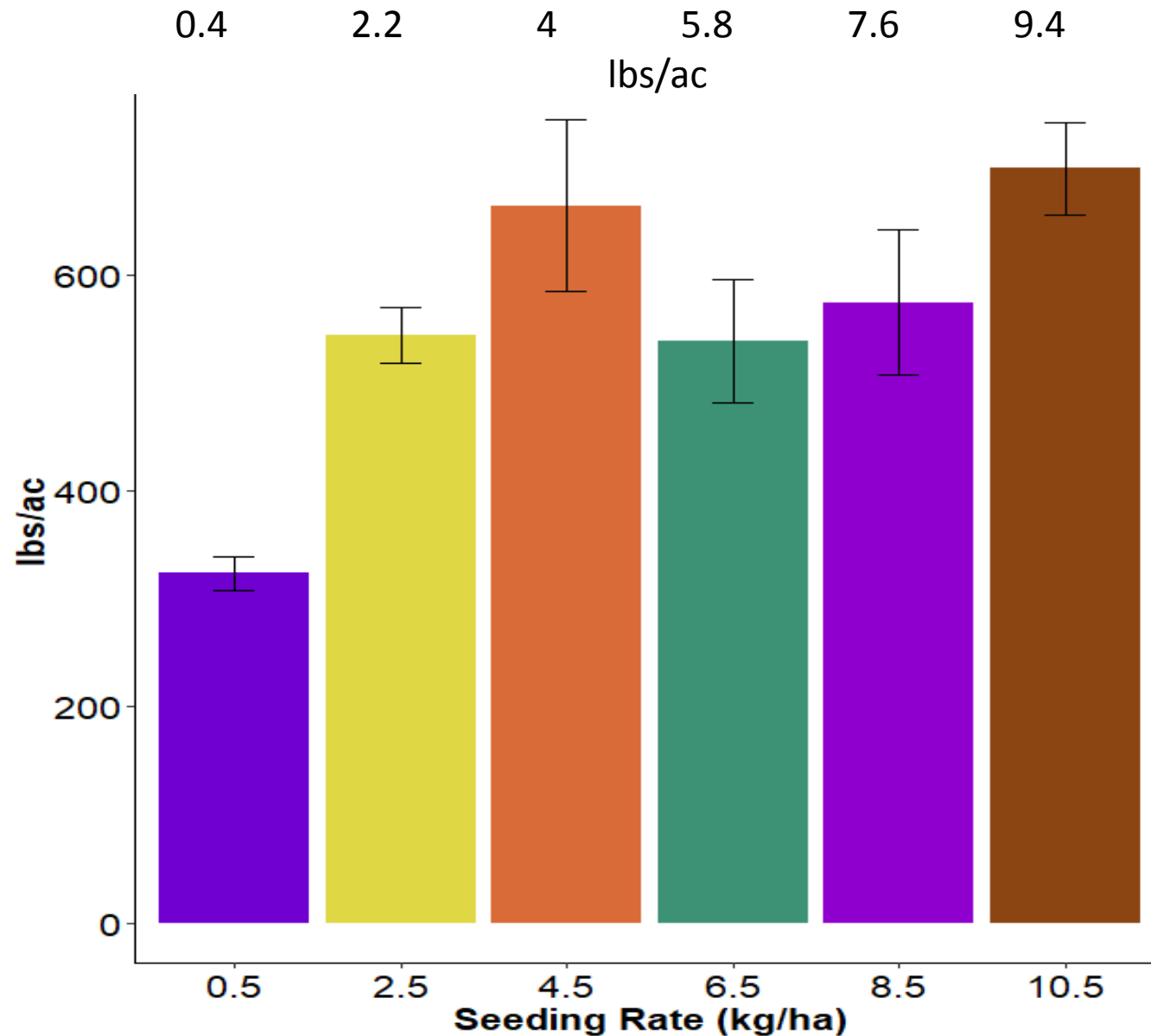
Seed yield in six seeding rates (poor precipitation, Clavet)



Total Precipitation

Year	Precipitation (mm)
2018	207.7
2019	266.4
Avg. 15 years	363.1

Seed yield in six seeding rates (high precipitation, Melfort)



Total Precipitation

Year	Precipitation (mm)
2018	332
2019	312.4
Avg. 15 years	419.7

Greenhouse experiment

6 different seeding rates were used (0.5, 2.5, 4.5, 6.5, 8.5, 10.5)

1 replicate had half the watering regime (34 L) while the other 2 replicates had full watering regimes (68 L)

Height of plants, flower production and seed yield were measured

Materials and methods

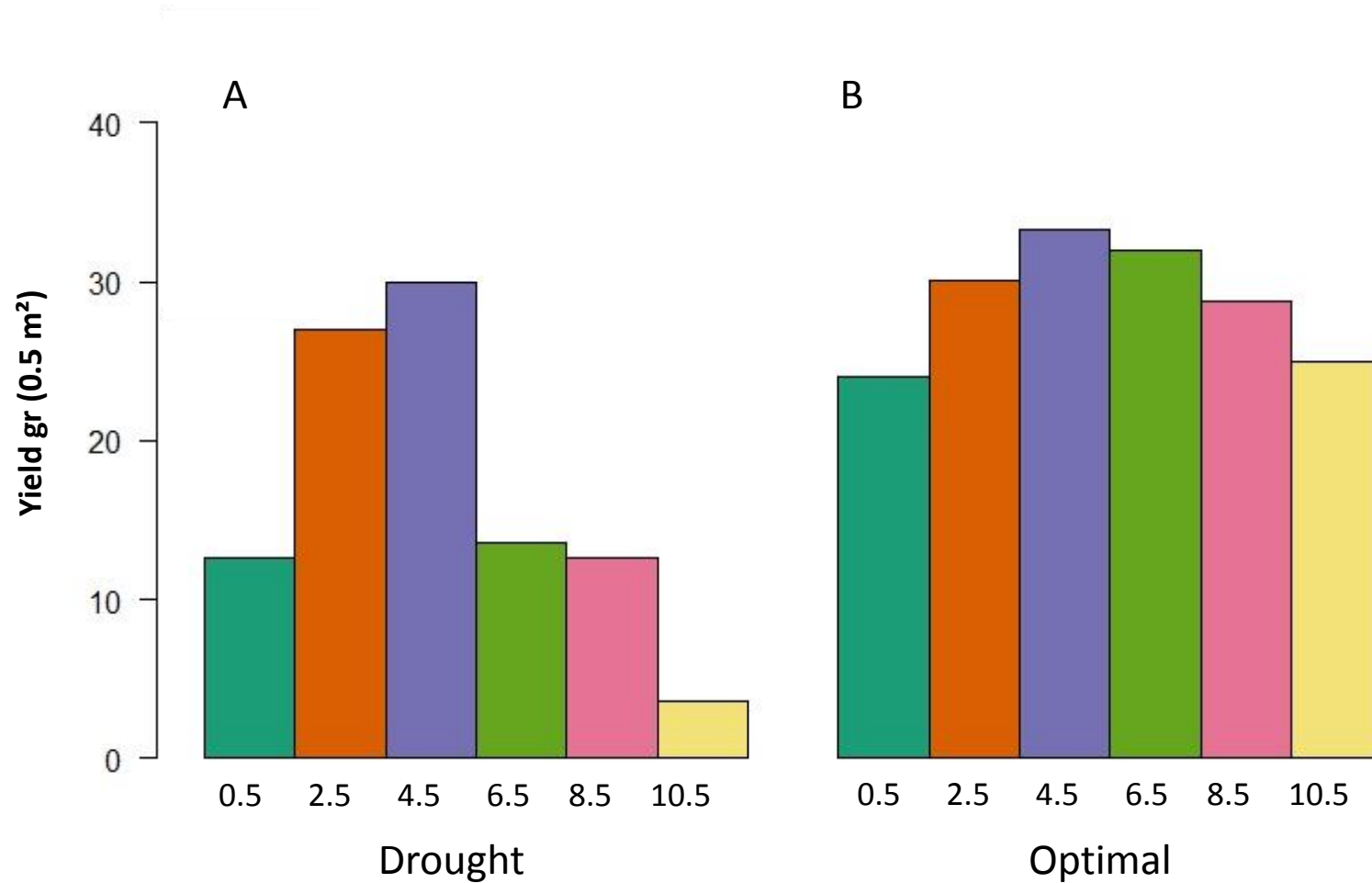


Flower Observations



- The half watered seeding rates showed the lower height averages as well as lower flower production consistently.
- 4.5 kg/ha had optimal flower production in both optimal and drought regimes.

Seed yield (drought VS optimal water regimes)



Conclusions:

- Both alternative insecticides are effective at controlling LCLW pressure.
(Voliam Xpress may not be registered)*
- Most of the red clover pollinators are native bees.
- No resistance to Decis was observed.
- Voliam Xpress and Decis performed better yield protection than Exirel.
- No yield response with low LCLW pressure.

Conclusions:

- 0.5 kg/ha is too low, more weeds in the 1st year.
- 4.5 kg/ha is an optimal seeding rate for both drought and optimal moisture condition.
- N fixation data is under analysis.



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Thank you

