Alfalfa Insect Pests and Their Management in California

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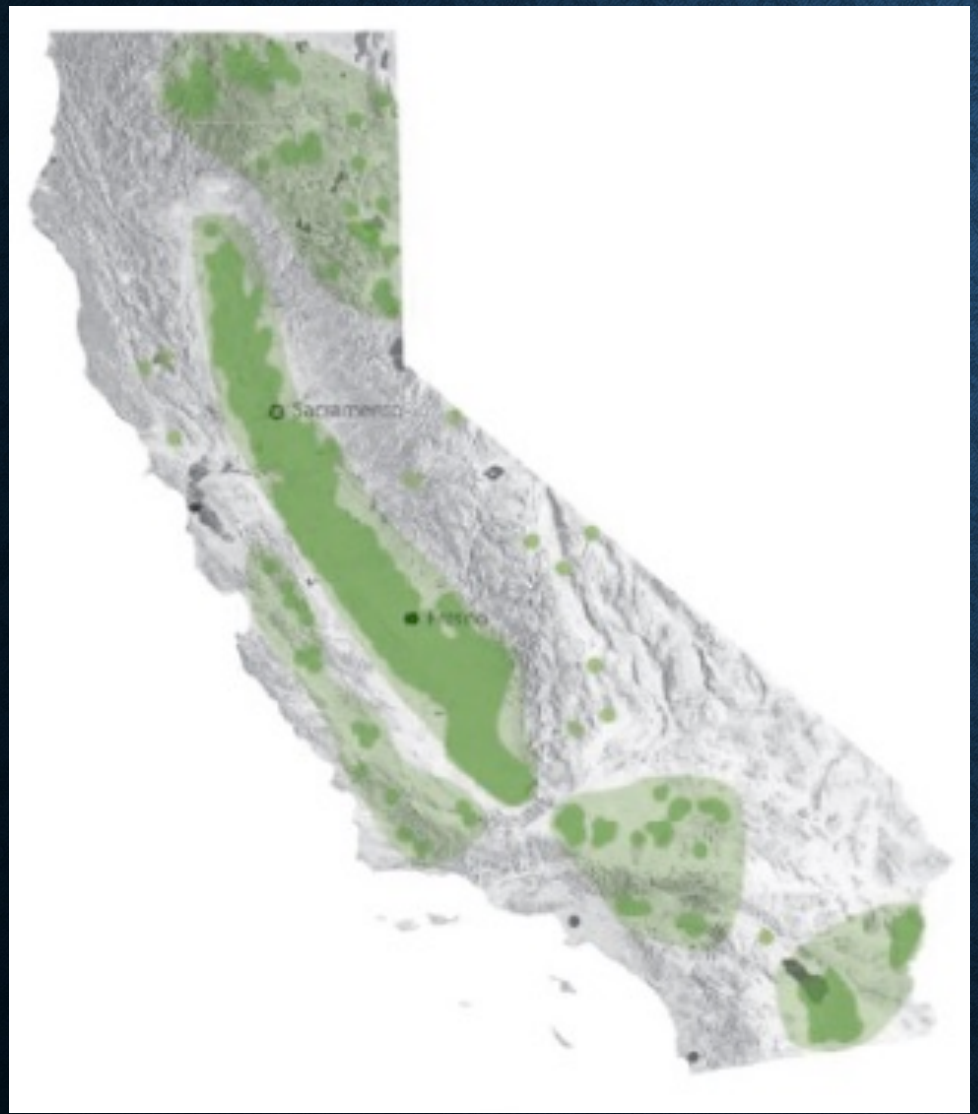
IN CALIFORNIA ALFALFA IS GROWN FROM OREGON TO MEXICO/ARIZONA, FROM SEA LEVEL INTO THE MOUNTAINS



- With this wide diversity of climate and growing areas, it is not at all surprising that different areas of the state have different insect pests or the same pests at different time of the year

LOW DESERT ALFALFA PEST INSECT SEASONALITY

Insect	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Alfalfa Weevil												
Blue Alfalfa Aphid												
Pea Aphid												
Cowpea Aphid												
Alfalfa Caterpillar												
Armyworms/ Granulate Cutworms												
Leafhoppers/ Three Cornered Alfalfa Hoppers												

CENTRAL VALLEY ALFALFA INSECT PEST SEASONALITY

Insect	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Alfalfa Weevil												
Blue Alfalfa Aphid												
Pea Aphid												
Cowpea Aphid/ Spotted Alfalfa Aphid												
Alfalfa Caterpillar												
Armyworms/ Cutworms												
Leafhoppers												

INTERMOUNTAIN ALFALFA INSECT PEST SEASONALITY

Insect	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Alfalfa Weevil												
Blue Alfalfa Aphid												
Pea Aphid												
Cowpea Aphid/ Spotted Alfalfa Aphid												
Alfalfa Caterpillar												
Armyworms/ Cutworms												
Leafhoppers												

POLL QUESTION:
WHAT IS YOUR COUNTY AND WHAT IS YOUR MOST SERIOUS ALFALFA INSECT PEST?

- Poll

  Q.#1. County:_____

- *Pest*
- a). Alfalfa Weevil
- b). Spotted Alfalfa Aphid
- c). Blue Alfalfa Aphid
- d). Cowpea Aphid
- e) Armyworms
- f). Cutworms
- g). Other Caterpillar
- h) Grasshoppers
- i). Other insect_____

ALFALFA WEEVIL LIFE CYCLE

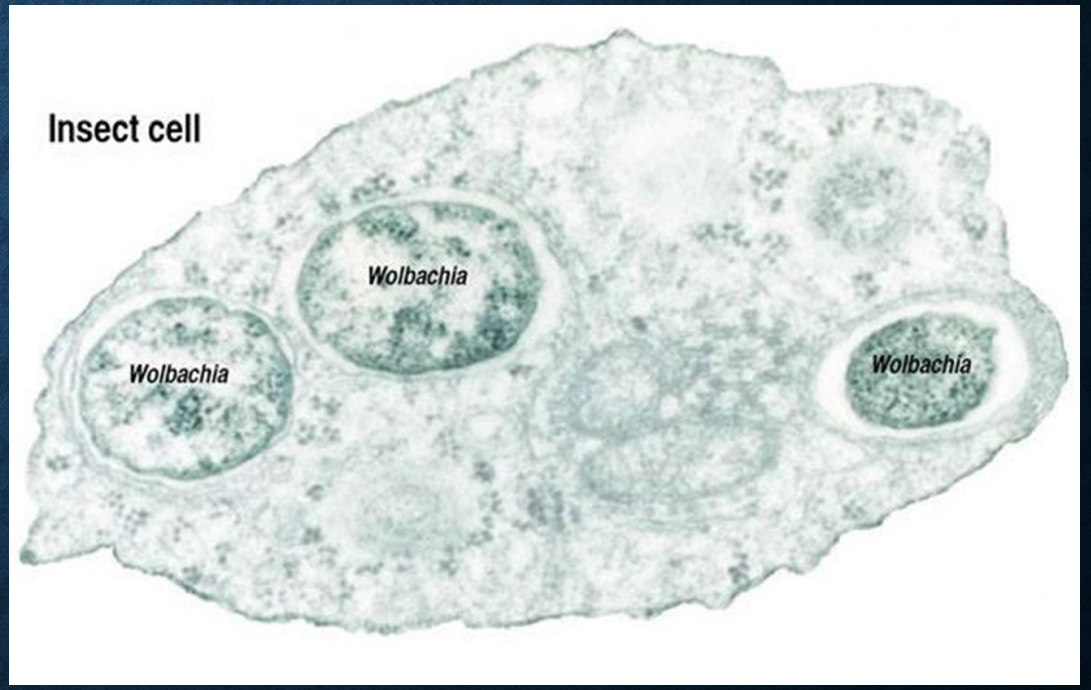
OVER-SUMMERS AS ADULTS – LAY EGGS IN ALFALFA STEMS IN SPRING/WINTER/LATE FALL DEPENDING UPON THE WEEVIL STRAIN

ALFALFA WEEVIL LARVAE AND FEEDING DAMAGE

THREE MAJOR ALFALFA WEEVIL STRAINS IN U.S.: *EASTERN, WESTERN, EGYPTIAN*

- Eastern and Egyptian strains are very similar

- Western strain is infected with *Wolbachia* bacteria



DIFFERENCES BETWEEN WEEVIL STRAINS

EASTERN/EGYPTIAN

- Becomes active earlier in year
- Can lay eggs in stems in fall
- Some reports of enhanced abilities to encapsulate eggs of *Bathyplectes* wasps

DIFFERENCES BETWEEN WEEVIL STRAINS

EASTERN/EGYPTIAN	WESTERN
• Becomes active earlier in year	Becomes active later in year
• Can lay eggs in stems in fall	Not known to lay eggs in fall
• Some reports of enhanced abilities to encapsulate eggs of *Bathyplectes* wasps, a parasite wasp that attacks alfalfa weevil larave	Not active in fall
	Peaks 1-3 weeks later in year than eastern strain

TIME LINE OF ALFALFA WEEVILS AND INSECTICIDAL CONTROL IN THE WESTERN US

- 1904 - ALFALFA WEEVILS FOUND FOR FIRST TIME IN U.S. IN UTAH *(WESTERN STRAIN)*

- 1939 – ALFALFA WEEVILS FOUND AT YUMA, AZ *(EGYPTIAN STRAIN)*

- DAMAGE ACROSS WESTERN STATES

1946

CHLORINATED HYDROCARBON INSECTICIDES STARTED BEING APPLIED FOR ALFALFA WEEVILS

WARNING: Hazardous If Swallowed, Inhaled or Absorbed Through Skin! In case of contact, immediately remove contaminated clothing and flush skin or eyes with plenty of water; for eyes, get medical attention. Wash thoroughly with soap and water after handling and before eating or smoking; wear clean clothing. Do not apply or allow to drift to areas occupied by unprotected humans or beneficial animals. Keep out of reach of children. **DANGER**—Keep away from heat or open flame. Avoid contamination of feed and foodstuffs. To protect fish and wildlife, do not contaminate streams, lakes or ponds with this material. When container is empty, immediately wash thoroughly and destroy. Never re-use.

NOTICE: California Spray-Chemical Corporation makes no warranty, express or implied, concerning this material, except that it conforms to the chemical description on the label. Neither California Spray-Chemical Corporation nor the seller shall be held responsible in any manner for any personal injury or property damage or other type of loss resulting from the handling, storage or use of this material. The buyer assumes all risk and liability therefrom and accepts and uses this material on these conditions.

Manufactured by

CALIFORNIA SPRAY-CHEMICAL CORP.

Richmond, Calif. • Orlando, Fla. • So. Plainfield, N. J.
St. Louis, Mo.

Form W-4617-A
Product No. 2290

ORTHO

Made in U.S.A.

TREATS 2000 SQUARE FEET

NET CONTENTS
ONE PINT

ORTHO® 195

DIELDRIN SPRAY

KILLS

ANTS, LAWN MOTHS (Sod Webworms), WHITE GRUBS, GRASSHOPPERS and Many Other Lawn and Ornamental Soil Insects

ANT LAWN MOTH EARWIG

Active Ingredients	By Wt.
Hexachloro-epoxy-octahydro-dimethano naphthalene (from Dieldrin)	15.8%
Related Compounds (from Dieldrin)	2.8%
Aromatic Petroleum Derivative Solvent	73.4%
Inert Ingredients	8.0%

A SOIL INSECTICIDE

READ ENTIRE LABEL. USE STRICTLY IN ACCORDANCE WITH LABEL CAUTIONS, WARNINGS AND DIRECTIONS.

DIRECTIONS

Apply with an ORTHO Lawn & Garden Sprayer for easy, uniform distribution.

HOME LAWNS: Ants, Lawn Moth (Sod Webworm), Cutworms, Sowbugs, Pillbugs, Wireworms, White Grubs, Snails, Slugs, June Beetle Grubs, Armyworms, Mole Crickets, Crickets, Grasshoppers—8 Tablespoonfuls in 15 gals. water per 500 sq. ft. of lawn area (1½ teaspoonful per gal. water for 33 sq. ft.). Also spray under ornamental plantings. Sprinkle lightly after treatment. Do not permit children and pets to go on treated lawn until the insecticide has been washed off the grass and into soil, and grass has completely dried.

NURSERY, GREENHOUSE AND GARDEN SOILS (where ornamentals are grown): Brachyrhinus Weevils and pests listed under Home Lawns—8 tablespoonfuls in 15 gallons water per 500 square feet (1½ teaspoonfuls per gal. water for 33 sq. ft.). In open soil, mix into top 3 or 4 inches of soil. Do not treat when soil is wet. Apply before rain or sprinkling.

EARWIGS: Apply at above dosage to daytime hiding places, such as lawns, around base of trees, shrubs, along walks, fences and building foundations.

1962

- REPORT BY KNOWLTON (UTAH) THAT 4 OZ./ACRE OF EITHER HEPTACHLOR OF DIELDRIN APPLIED IN EARLY SPRING **FAILED TO CONTROL CONTROL ALFALFA WEEVIL ADULTS AND LARVAE IN 1961-1962** *(15 YEARS ON THE MARKET)*

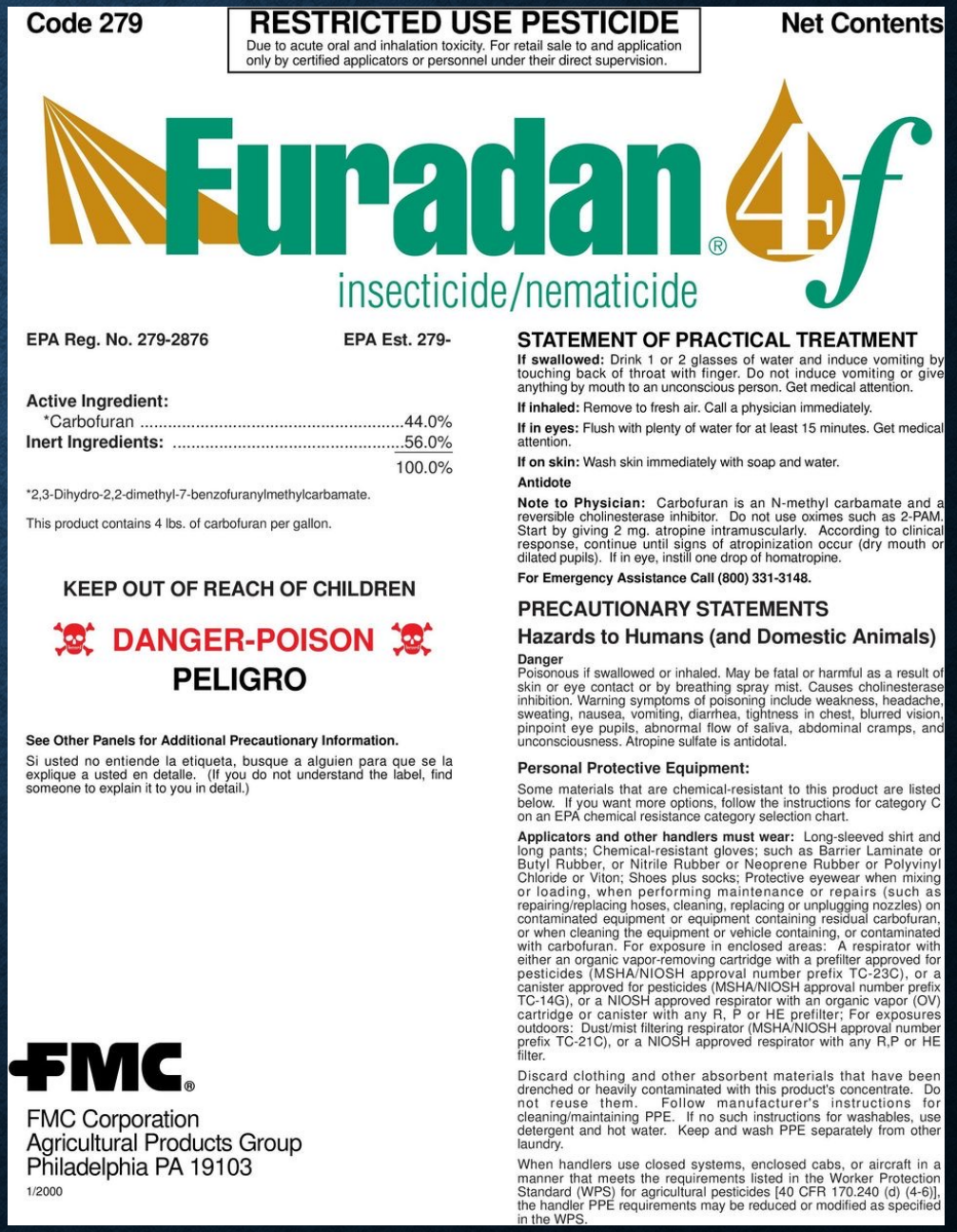
- NEXT SEVERAL YEARS NOTED MANY REPORTS OF INSECTICIDE RESISTANCE FROM ACROSS THE U.S. TO THESE INSECTICIDES ANDY MANY OTHERS IN THIS INSECTICIDE CLASS *(CROSS RESISTANCE)*

1969

- FURADAN BECOMES AVAILABLE FOR USAGE ON ALFALFA, PROVIDES EXCELLENT CONTROL OF BOTH ALFALFA APHIDS AND WEEVILS

2009

- FURADAN USAGE ON ALFALFA CANCELLED.
- THERE WERE NO REPORTS OF RESISTANCE BY ALFALFA WEEVILS TO THIS INSECTICIDE IN THE 40 YEARS IT WAS ON THE MARKET



Code 279

RESTRICTED USE PESTICIDE
Due to acute oral and inhalation toxicity. For retail sale to and application only by certified applicators or personnel under their direct supervision.

Net Contents

Furadan® 4f
insecticide/nematicide

EPA Reg. No. 279-2876 EPA Est. 279-

Active Ingredient:
*Carbofuran 44.0%
Inert Ingredients: 56.0%
100.0%

*2,3-Dihydro-2,2-dimethyl-7-benzofuranylmethylcarbamate.

This product contains 4 lbs. of carbofuran per gallon.

KEEP OUT OF REACH OF CHILDREN

DANGER-POISON
PELIGRO

See Other Panels for Additional Precautionary Information.

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

FMC®
FMC Corporation
Agricultural Products Group
Philadelphia PA 19103
1/2000

STATEMENT OF PRACTICAL TREATMENT

If swallowed: Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person. Get medical attention.

If inhaled: Remove to fresh air. Call a physician immediately.

If in eyes: Flush with plenty of water for at least 15 minutes. Get medical attention.

If on skin: Wash skin immediately with soap and water.

Antidote

Note to Physician: Carbofuran is an N-methyl carbamate and a reversible cholinesterase inhibitor. Do not use oximes such as 2-PAM. Start by giving 2 mg. atropine intramuscularly. According to clinical response, continue until signs of atropinization occur (dry mouth or dilated pupils). If in eye, instill one drop of homatropine.

For Emergency Assistance Call (800) 331-3148.

PRECAUTIONARY STATEMENTS

Hazards to Humans (and Domestic Animals)

Danger
Poisonous if swallowed or inhaled. May be fatal or harmful as a result of skin or eye contact or by breathing spray mist. Causes cholinesterase inhibition. Warning symptoms of poisoning include weakness, headache, sweating, nausea, vomiting, diarrhea, tightness in chest, blurred vision, pinpoint eye pupils, abnormal flow of saliva, abdominal cramps, and unconsciousness. Atropine sulfate is antidotal.

Personal Protective Equipment:

Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for category C on an EPA chemical resistance category selection chart.

Applicators and other handlers must wear: Long-sleeved shirt and long pants; Chemical-resistant gloves; such as Barrier Laminate or Butyl Rubber, or Nitrile Rubber or Neoprene Rubber or Polyvinyl Chloride or Viton; Shoes plus socks; Protective eyewear when mixing or loading, when performing maintenance or repairs (such as repairing/replacing hoses, cleaning, replacing or unplugging nozzles) on contaminated equipment or equipment containing residual carbofuran, or when cleaning the equipment or vehicle containing, or contaminated with carbofuran. For exposure in enclosed areas: A respirator with either an organic vapor-removing cartridge with a prefilter approved for pesticides (MSHA/NIOSH approval number prefix TC-23C), or a canister approved for pesticides (MSHA/NIOSH approval number prefix TC-14G), or a NIOSH approved respirator with an organic vapor (OV) cartridge or canister with any R, P or HE prefilter; For exposures outdoors: Dust/mist filtering respirator (MSHA/NIOSH approval number prefix TC-21C), or a NIOSH approved respirator with any R,P or HE filter.

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d) (4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

WHAT ARE THE MAIN INSECTICIDES/CLASSES THAT HAVE BEEN USED FOR ALFALFA WEEVIL CONTROL IN THE US SINCE FURADAN WAS TAKEN OFF THE MARKET?

PYRETHROID INSECTICIDES

ORGANOPHOSPHATES

(CHLORPYRIFOS, DIMETHOATE)

ORGANOPHOSPHATES

(CHLORPYRIFOS, DIMETHOATE)

INDOXACARB

ALFALFA WEEVIL INSECTICIDE RESISTANCE IN NORTHERN CALIFORNIA IN 2015 – WESTERN STRAIN

PYRETHROID INSECTICIDES TESTED = BAYTHROID XL, WARRIOR II

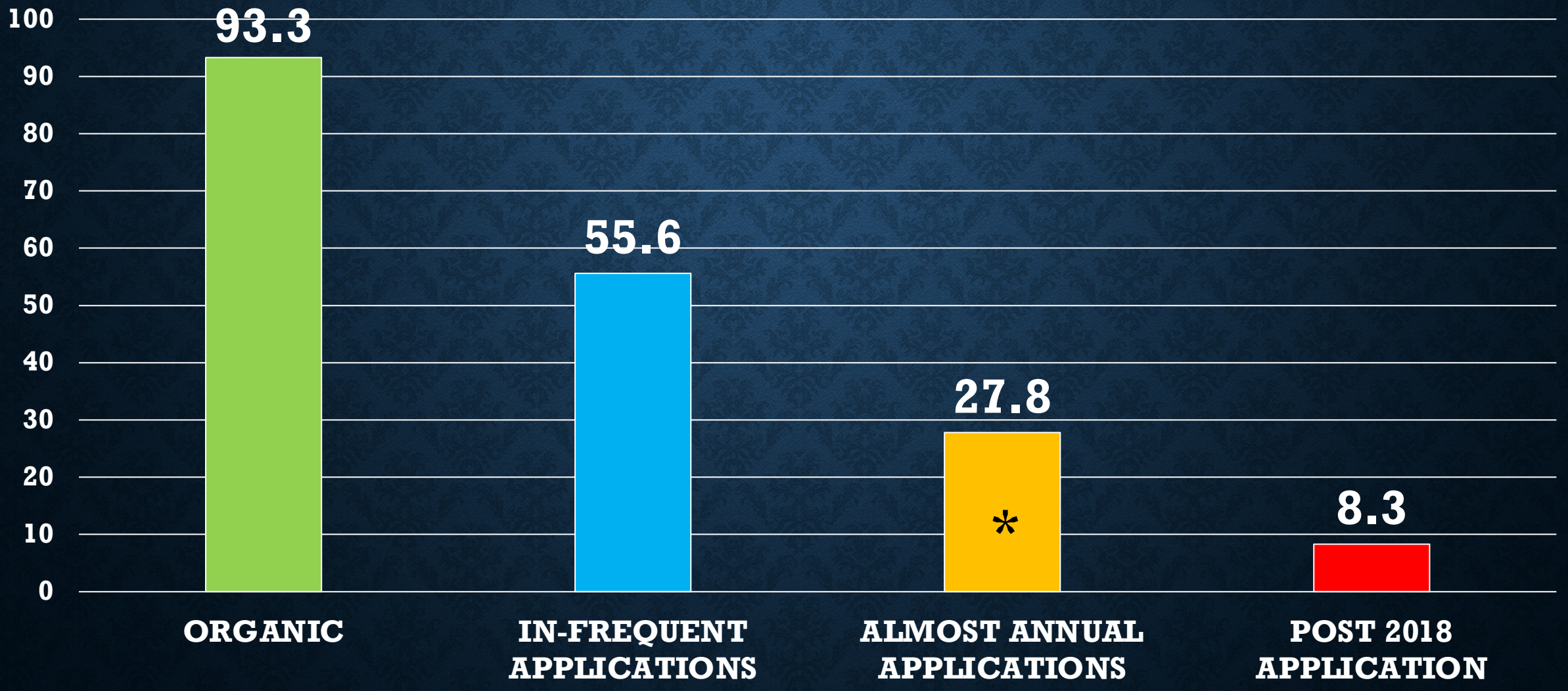
Percent Weevil Mortality from Pyrethroids	
Field Site	**Recommended Rate**
Organic field	92%
Conventional Fields, 1-4	3%-15%

BLYTHE, CALIFORNIA
FEBRUARY 2018

- FIELD FAILURE IN CONTROLLING ALFALFA WEEVILS (Egyptian strain) WITH LAMBDA-CYHALOTHRIN

- LABORATORY BIOASSAYS SHOWED HIGH LEVELS OF INSECTICIDE RESISTANCE

2018 LABORATORY BIOASSAY COMPARISONS FOR PALO VERDE VALLEY ALFALFA WEEVIL LARVAE CONTROL BY 1.92 OZ./ACRE OF WARRIOR II



SUBSEQUENT RESEARCH FOUND THAT:

- CROSS RESISTANCE EXISTED TO ALL PYRETHROID INSECTICIDES TESTED, INCLUDING ACTIVE INGREDIENTS THAT WERE NOT YET IN THE ALFALFA MARKET

- Mixing of weevil populations were occurring. Fields that were organic and had 100% control in one year, had weevil populations with substantial resistance the next year.

- Why was this occurring? Weevils from multiple fields were congregating in over-summering locations and mating and/or going to different fields the next.

- Good news on this is that resistance was highly localized as weevils do not move far by themselves *(seemingly a max of <1.0 miles, usually just the next field over)*

OPTIONS FOR CONTROLLING ALFALFA WEEVILS

- **Do nothing**

OPTIONS FOR CONTROLLING ALFALFA WEEVILS

- **Sheep off**

OPTIONS FOR CONTROLLING ALFALFA WEEVILS

Time the harvest to remove stems that are large enough in diameter for oviposition by adult weevils *(if narrow oviposition window started by <26 degree night)* or cut early if drying conditions are conducive to rapid curing

OPTIONS FOR CONTROLLING ALFALFA WEEVILS

- **Use Insecticides**

ALFALFA WEEVIL LARVAE

UPDATE ON CALIFORNIA THRESHOLDS

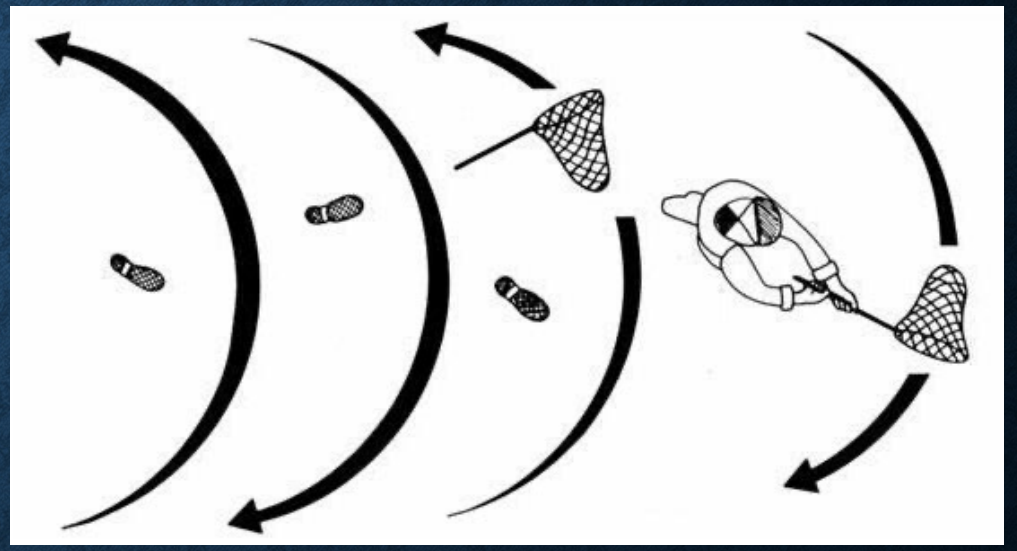
ALFALFA WEEVIL THRESHOLDS

- UC economic threshold has been 20 larvae/ 180 degree sweep.
- This was established using solid seeded (flat planted) alfalfa.
- Hard to do a 180 sweep on bedded alfalfa and have same amount of area sampled as in solid planted alfalfa!

ALFALFA WEEVIL THRESHOLDS

- 

How does a pendulum/ figure 8 sweep compare to a 180 degree sweep?



- Our research shows that the relationship is roughly 3.8:1, thus ~5 weevils per pendulum sweep can be used as a threshold. These deeper sweeps (rather than just stem tips) are more likely to also collect smaller larvae which are easier to kill than larger larvae.

Current Alfalfa Weevil Insecticide Control Efficacy Ratings of Registered Insecticide Products for Areas with Pyrethroid Resistance

Grade relationship to percent control		
A+ = 97-100	A = 94-97	A- = 90-94
B+ = 87-89.9	B = 84-87	B- = 80-84
C+ = 77-79.9	C = 74-77	C- = 70-74
D+ = 67-69.9	D = 64-67	D- = 60-64
F+ = 57-59.9	F = 54-57	F- = 50-54
<F = less than 50% reduction compared to untreated check		

Insecticide and oz. /acre		3-4 days post treatment	6-8 Days post treatment	9-10 days post treatment	13-16 days post treatment
Besiege	5.0	D-	D	F	F
Besiege	10.0	C-	D+	F-	F+
Beta-cyfluthrin	2.8	F+		C-	D
Dimethoate	8.0	<F	<F		<F
Dimethoate	16.0	D-	<F		F
Entrust	4.0	C-	F		
Fastac CS	3.8	<F		<F	<F
Malathion 8	12.0	D-	F+		<F
Prevathon	14.0	D	D-	<F	F
Prevathon	20.0	F+	C-	D-	D-
Sevin XLR Plus	32.0	<F	<F		<F
Sevin XLR Plus	48.0	<F	<F		<F
Steward EC	4.0	B		A	B+
Steward EC	6.0	B		A	A+
Steward EC	6.7	A	A	A+	A
Vantacor	1.25	D-	<F	<F	F+
Vantacor	2.5	D	D	D-	D
Warrior II	1.28	D+	F-		D-
Warrior II	1.92	F	F	F+	F
Dimethoate + Sevin XLR Plus	8.0 + 32.0	D+	<F		<F
Dimethoate + Sevin XLR Plus	16.0 + 48.0	D	D-		F+
Sevin XLR Plus + Warrior II	32.0 + 1.28	B-	D+		B
Sevin XLR Plus + Warrior II	48.0 + 1.92	B-	B		B

**Sevin XLR is providing control primarily due to foliage burn, this level of damage not acceptable for commercial purposes*

ACTIVE INGREDIENT = INDOXACARB

(NOT EFFECTIVE AGAINST APHIDS)

WILL RESISTANCE DEVELOP TO THIS CHEMISTRY?

ROTATION OF INSECTICIDE CLASSES REDUCES RESISTANCE RISK

SOME INTERESTING THINGS ABOUT ALFALFA WEEVILS

- How long do alfalfa weevils live?

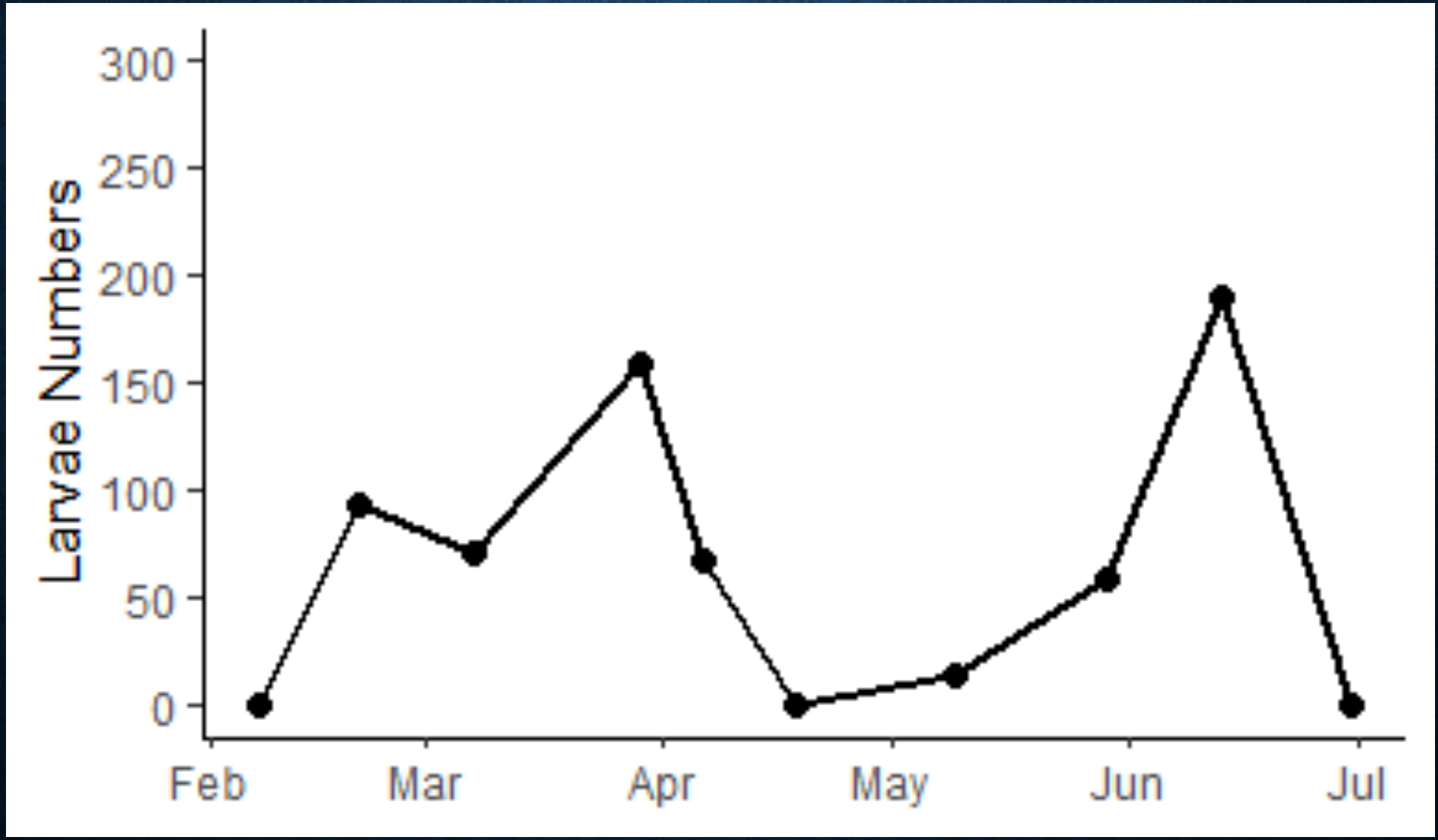
- They have been found to live up to 3 years in outdoor conditions

SOME INTERESTING THINGS ABOUT ALFALFA WEEVILS

Can alfalfa weevils have more than one generation per year?

- Yes, a partial second generation is noted in some years. These weevils are often found in June in locations that had early freezes/cold temperatures early in the fall (brings weevils out of estivation and oviposition begins much earlier than normal.

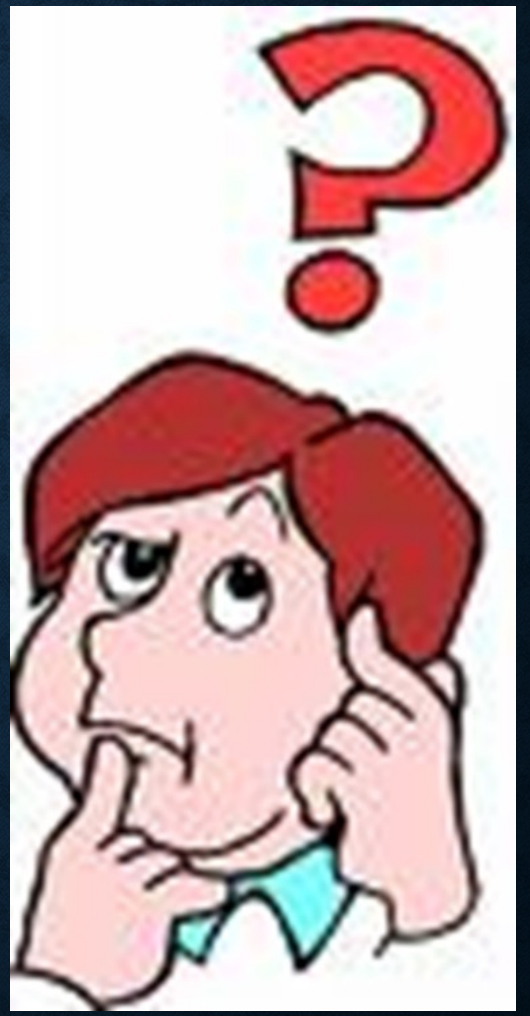
ALFALFA WEEVIL LARVAE COUNTS IN THE SAN JOAQUIN VALLEY, 2018



AS ALFALFA WEEVILS CAN HAVE MULTIPLE GENERATIONS/YEAR

BASED ON THE DATA,

WHY DON'T WE SEE CONTINUOUS FEEDING PRESSURE IN EACH CUTTING THROUGH THE YEAR VS. JUST CERTAIN TIMES OF YEAR?



THERE ARE TWO (2) KEY BIOLOGICAL ASPECTS THAT GOVERN ALFALFA WEEVILS OVIPOSITION

- It takes about 60 day after the new adult female has started her adult life before the ovaries are functional.

- Oviposition stops on the first day of summer when there is a change to shorter day length. This does not apply for fall oviposition however.

SOME INTERESTING THINGS ABOUT ALFALFA WEEVILS

- Predators/parasites of alfalfa weevils typically seen in the low desert include *Bathyplectes* spp. wasps and seven-spotted lady beetles

ALFALFA WEEVILS ARE OFTEN ACCOMPANIED BY APHID INFESTATIONS

WHAT DO WE KNOW ABOUT APHIDS IN ALFALFA?

APHID CONTROL DECISIONS ARE MUCH MORE COMPLEX THAN THOSE FOR ALFALFA WEEVILS

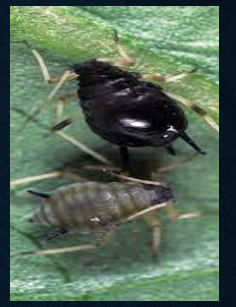
Alfalfa Weevil Larvae

- Alfalfa weevil larvae feed on the most tender growth (usually near growing tip/terminal), thus more exposed to foliar applied insecticides

- Long life cycle (most places only have 1 generation per year)

- Biological control is supplemental/ secondary, not primary

APHID CONTROL DECISIONS ARE MUCH MORE COMPLEX THAN THOSE FOR ALFALFA WEEVILS



- Multiple aphid species can be present at same time
- Multiple generations occur during an alfalfa cutting cycle with short life-cycles
- Winged aphids can migrate into a field in high numbers and do damage quickly
- Some aphid species inject toxins into alfalfa plants as they feed
- Aphids feed not only on stem terminals, but also in crowns, stems, and/or leaf undersides, depending upon species
- There are interactions between alfalfa stem height and insecticide efficacy
- Aphids differ in their response to insecticides by species
- Some aphid species can be greatly reduced/controlled by predators and parasitoids, which can also affected by certain insecticides

APHIDS

POLL QUESTION REGARDING SIVANTO PRIME AND INSECTICIDE RESISTANCE

- If you used Sivanto Prime in 2023, how do you rate its efficacy compared to 2022?
-
- a). Did not use Sivanto Prime
- b). Better efficacy in 2023
- c). Efficacy in 2023 very similar to 2022
- d). Less efficacious in 2023 than in 2022

IN ALFALFA, ONE IS LIKELY TO ENCOUNTER FOUR (4) APHID SPECIES

IN ALFALFA, ONE IS LIKELY TO ENCOUNTER FOUR (4) APHID SPECIES

PEA APHID

IN ALFALFA, ONE IS LIKELY TO ENCOUNTER FOUR (4) APHID SPECIES

BLUE ALFALFA APHID

IN ALFALFA, ONE IS LIKELY TO ENCOUNTER FOUR (4) APHID SPECIES

COWPEA APHID

IN ALFALFA, ONE IS LIKELY TO ENCOUNTER FOUR (4) APHID SPECIES

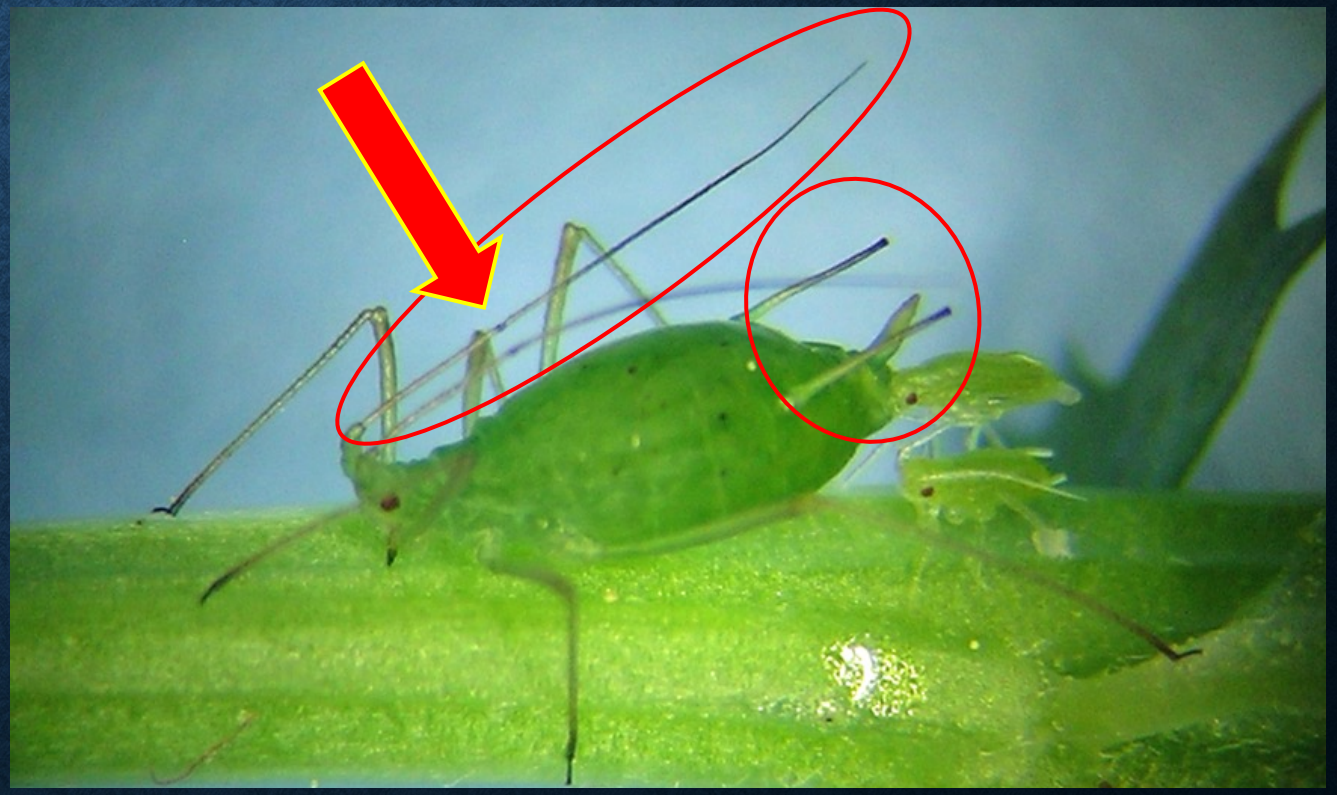
SPOTTED ALFALFA APHID

THERE IS A FIFTH APHID SPECIES, THE ALFALFA APHID, *MACROSIPHON CREELII,* WHICH WAS REPORTED TO BE A PEST OF WESTERN ALFALFA IN 1914

THE ALFALFA APHID LOOKS VERY, VERY MUCH LIKE THE PEA APHID. ALFALFA APHID CHARACTERISTICS

- **Antennae** – dusky on segments I, II and the base of III, with the remainder blackish throughout. Does not usually have multiple sets of bands on antennae, but has black band at end of first segment

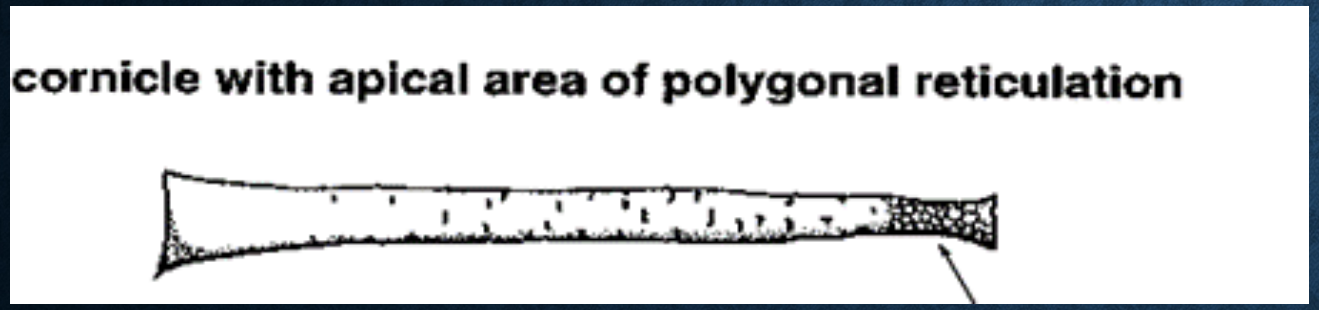
- **Cornicles:** Dusky coloration on distal half. 4-5 rows of polygonal reticulation pattern at tips.



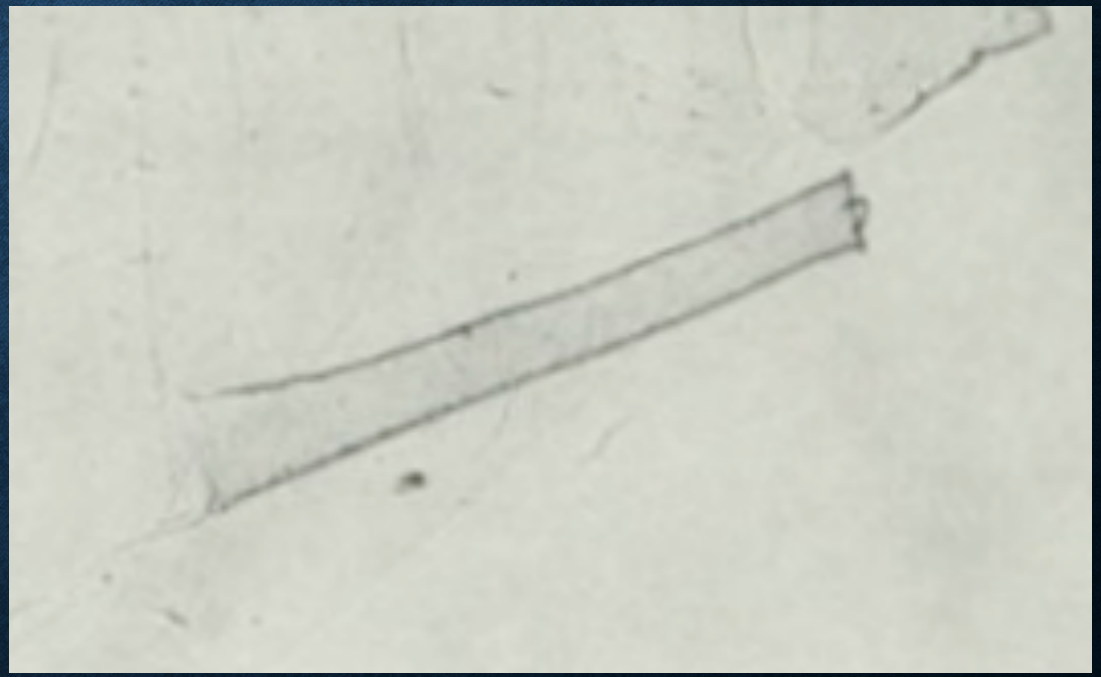
Aphid photo by Andrew Jensen

MACROSIPHON (ALFALFA APHID) VS. *ACRYTHOSIPHON* (PEA APHID AND BLUE ALFALFA APHID) CORNICLES

Macrosiphon



Acyrthosiphon



CORNICLE OF LARGE GREEN APHID IN THE LOW DESERT THIS WINTER

WHILE BOTH THE ALFALFA APHID AND THE PEA APHID ARE FAIRLY LARGE IN SIZE, NEITHER SPECIES HAS BEEN KNOWN TO INJECT A TOXIN INTO ALFALFA WHILE FEEDING

BLUE ALFALFA APHID

BLUE ALFALFA APHID VS. PEA APHID

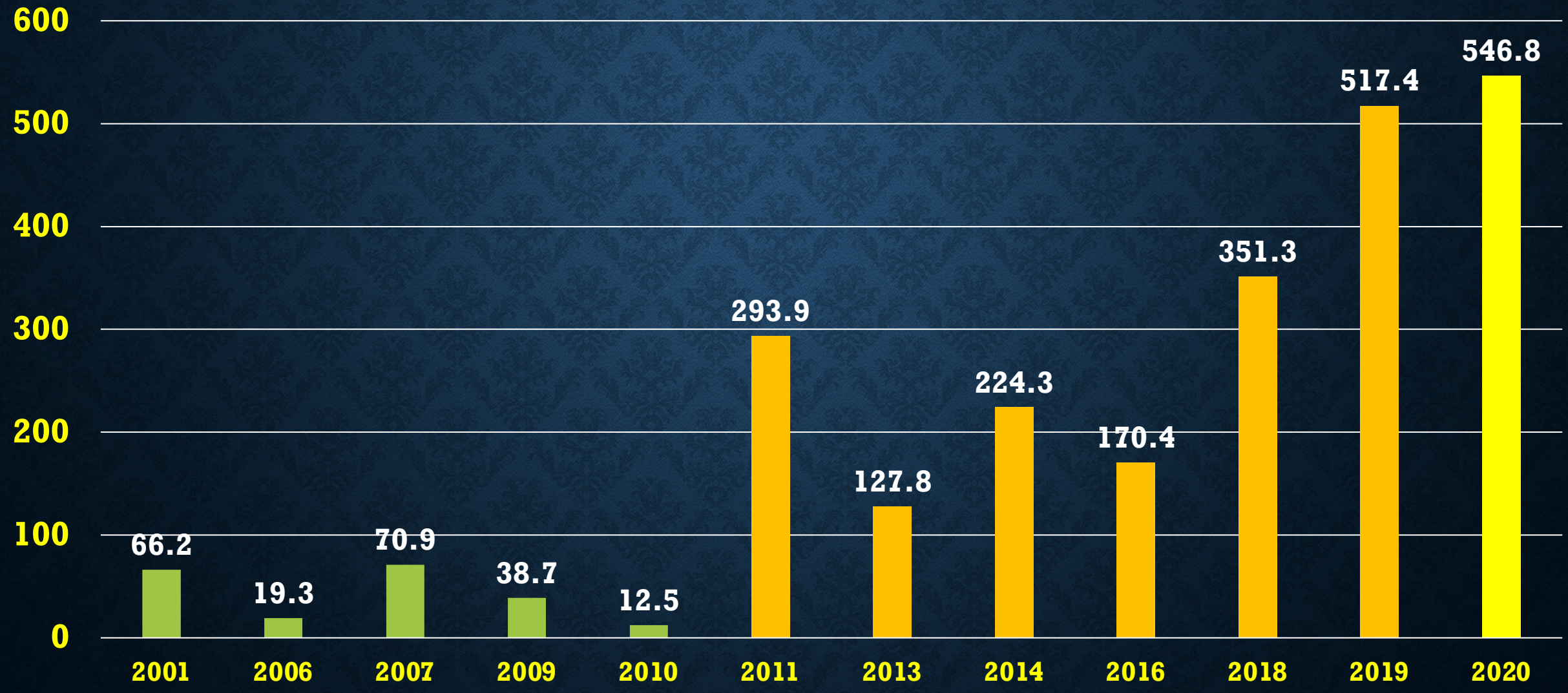
Blue Alfalfa Aphid

Acyrthosiphon kondoi

Pea Aphid

Acyrthosiphon pisum

BLUE ALFALFA APHIDS – MEAN PEAK NUMBER/ SWEEP IN UCCE TRIALS (IMPERIAL & RIVERSIDE COUNTIES)



WHY DOES THE BLUE ALFALFA APHID POSE A THREAT TO ALFALFA PRODUCTION?

- Unlike the pea aphid, the blue alfalfa aphis injects a toxin while it feeds. Crop loss can occur with larger plants and/or severe injury/death of small plants wirh small numbers of aphids

DAMAGE FROM APHID FEEDING, 2019

BLUE ALFALFA APHIDS – WINGED FORMS

HIGH NUMBERS OF BLUE ALFALFA APHIDS MIGRATE INTO PALO VERDE VALLEY IN FEBRUARY-MARCH

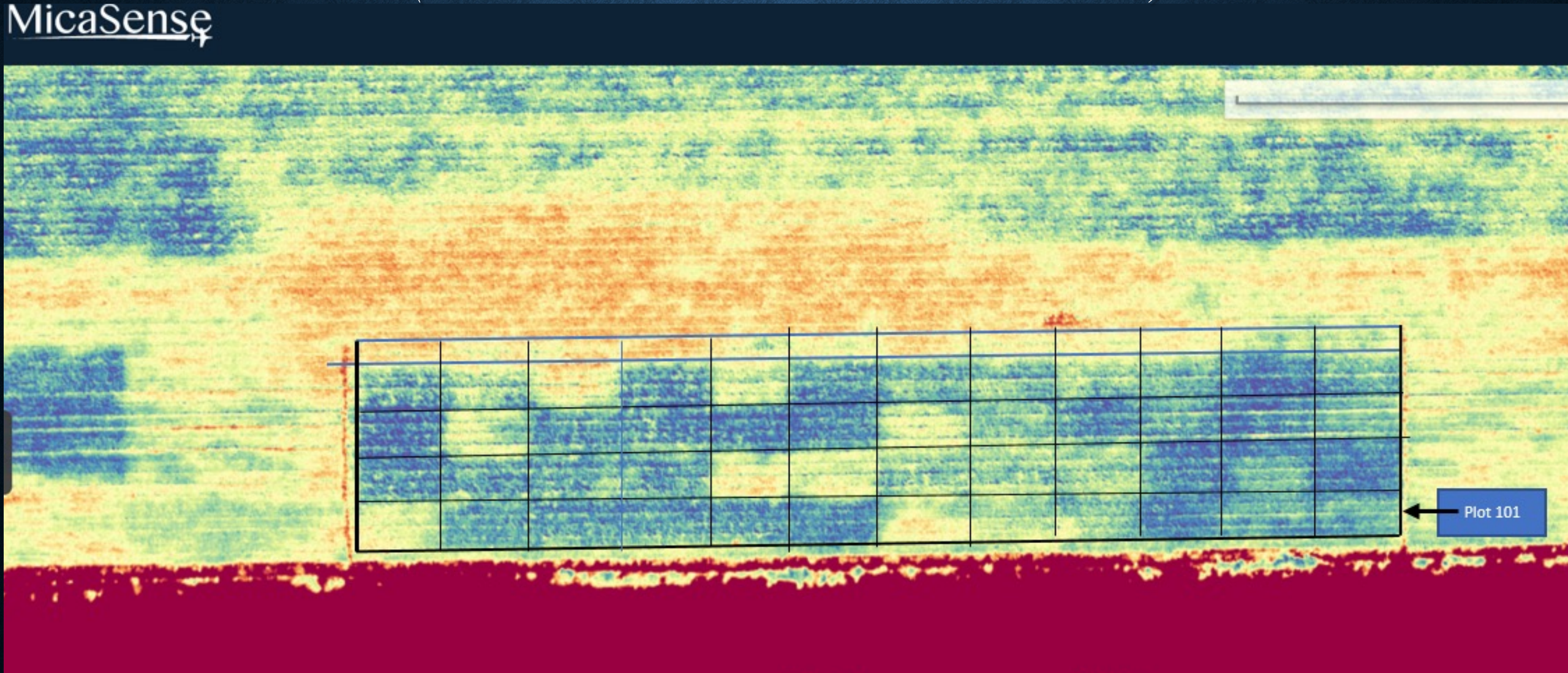
Numbers of blue alfalfa aphids in collected in a water trap indicated about 275 aphids/ square foot in a 2 day period March 13-15, 2020

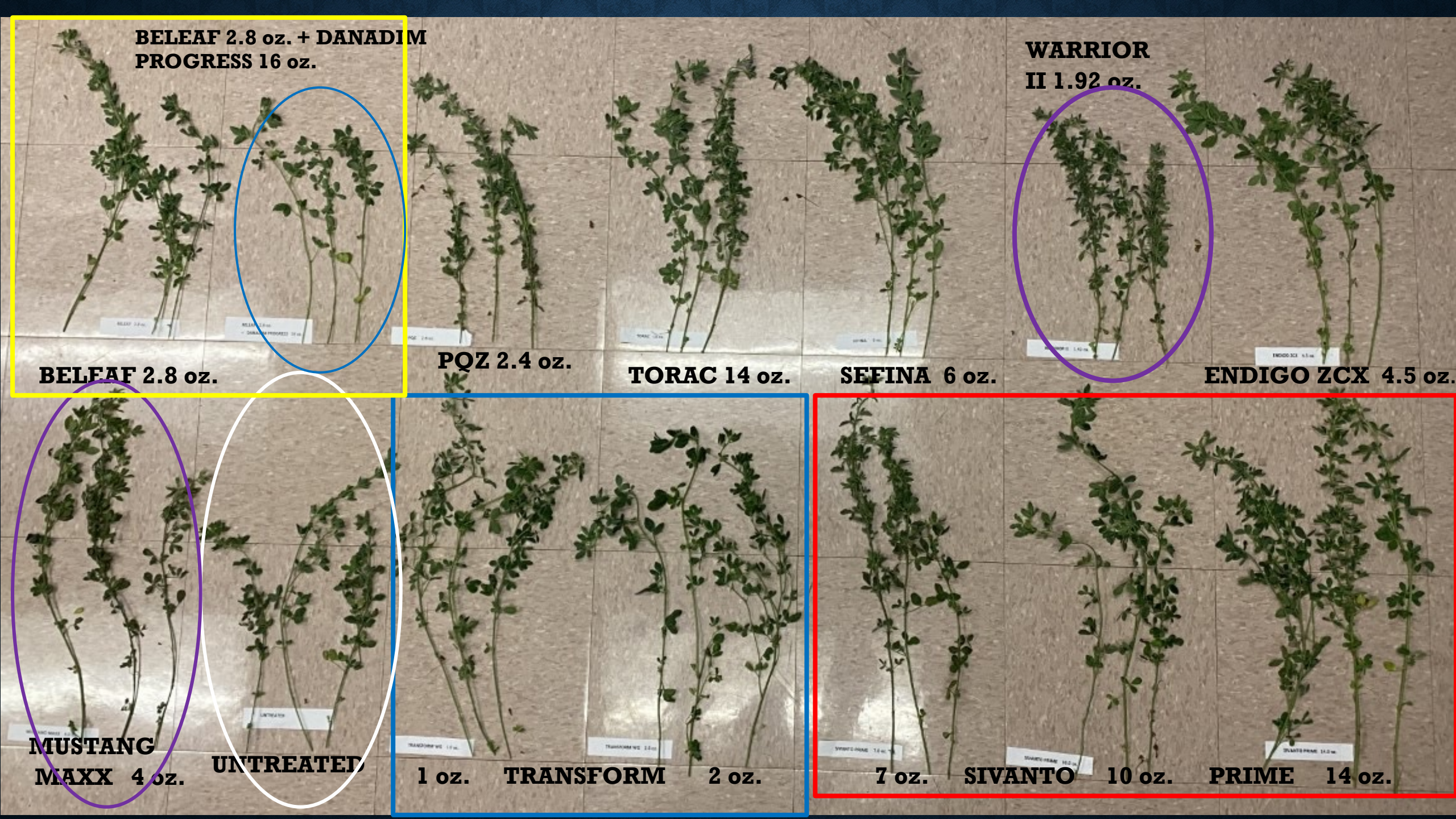
DIFFERENCE AND DAMAGE DUE TO HEAVY MIGRATING POPULATION OF BLUE ALFALFA APHID FEEDING ON ALFALFA IN 7 DAYS.

DO WINGED APHIDS CAUSE GREATER YIELD LOSS DUE TO LARGER SIZE OF APHIDS AND INCREASED TOXINS FROM FROM FEEDING BY LARGER APHIDS?

BLUE ALFALFA APHIDS ON ALFALFA

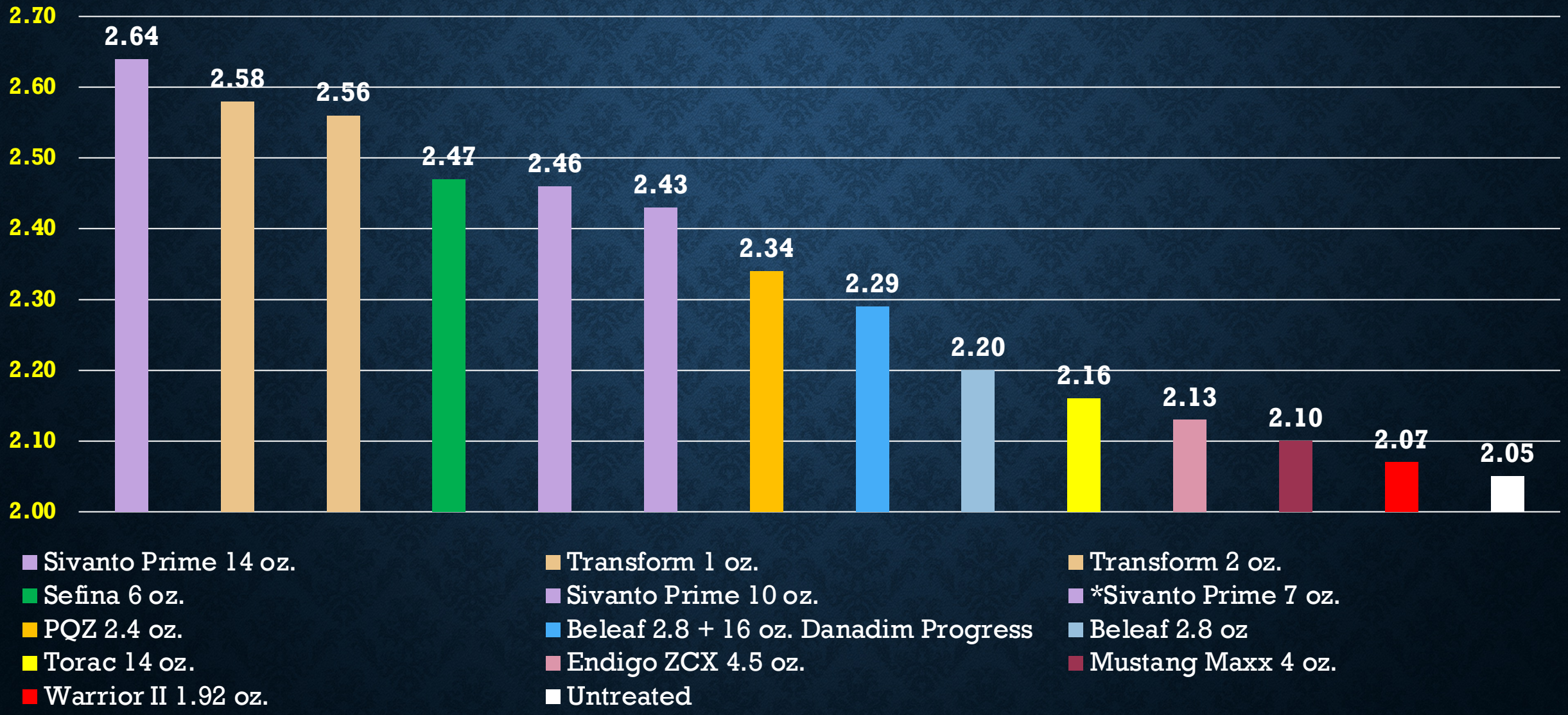
DRONE IMAGERY OF PLOTS AT 23 DAYS POST MARCH 29, 2021, TREATMENT SHOWING DIFFERENCES IN STRESS OF ALFALFA.
DARK BLUE = LESS STRESS/BETTER BLUE ALFALFA APHID CONTROL
(LADYBEETLES PRESENT IN THIS STUDY)



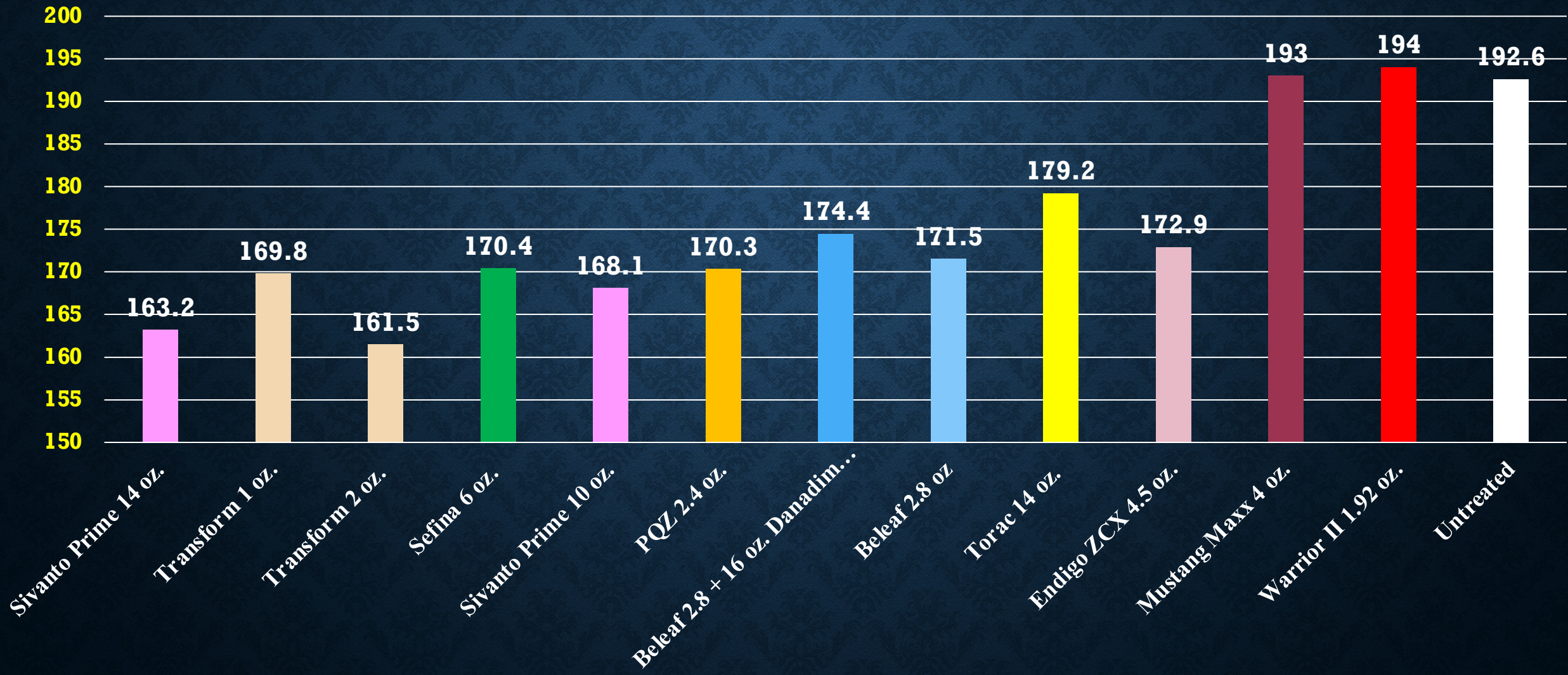

BELEAF 2.8 oz. + DANADIM PROGRESS 16 oz.
BELEAF 2.8 oz.
PQZ 2.4 oz.
TORAC 14 oz.
SEFINA 6 oz.
WARRIOR II 1.92 oz.
ENDIGO ZCX 4.5 oz.
MUSTANG MAXX 4 oz.
UNTREATED
1 oz.
TRANSFORM 2 oz.
7 oz.
SIVANTO PRIME 14 oz.

ALFALFA YIELDS

MEAN YIELD *(TONS/ACRE)* OF NEWLY ESTABLISHED ALFALFA AS AFFECTED BY INTERACTIONS OF BLUE ALFALFA APHIDS, INSECTICIDES & LADYBEETLES, FOLLOWING APPLICATION ON MARCH 29 *(12.25" TALL)* & APRIL 27 HARVEST



MEAN RELATIVE FEED VALUE OF NEWLY ESTABLISHED ALFALFA AS AFFECTED BY INTERACTIONS OF BLUE ALFALFA APHIDS, INSECTICIDES & LADYBEETLES



Blue alfalfa aphid damage comparisons by geographic area

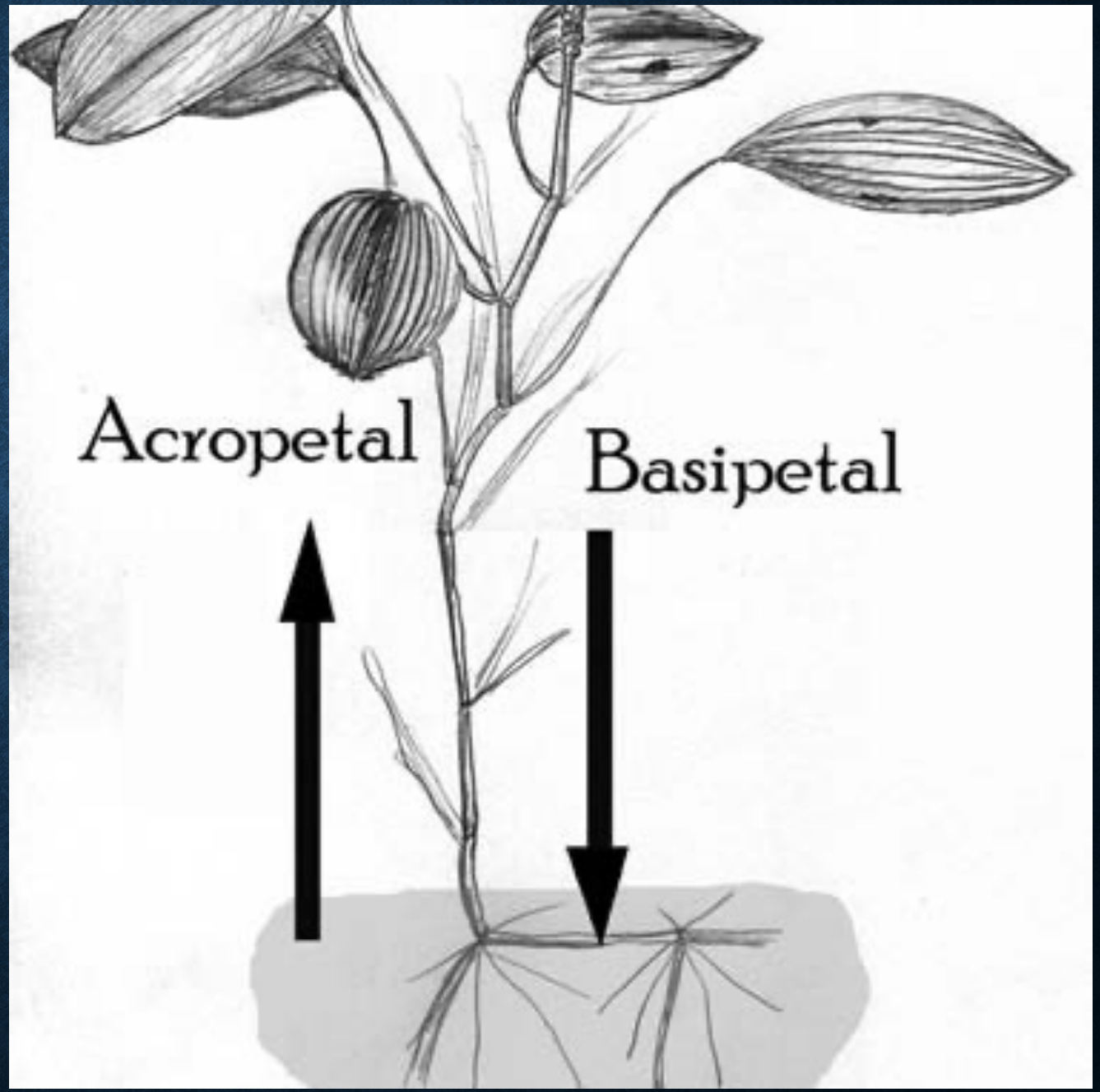
Geographic Area	Alfalfa Growth Rate	Damage from Blue Alfalfa Aphid Feeding	Control /Management
Low Desert *(already established alfalfa hay that is already growing and has been cut)*	**Fast**	Yield losses of **1,000 lbs. hay/acre**	High reliance upon insecticides: Biological controls are often absent/affected by environmental factors.
In-between	**Medium**	Longer period of growth. Yield losses on newly planted hay of **1,200 lbs./acre**, could be greater if aphids arrive earlier in growth cycle.	Ladybeetles often integral part of management. Usage of broad spectrum insecticides can lead to reduction of these biological controls and control reduction.
Intermountain	**Slow**	**Severe**. Can result in **plant death** of large areas of field by feeding on plants in late winter/early spring; losses of **2,420 lbs./acre**	Challenges with control early in season. Slow early growth leaves alfalfa very susceptible to initial infestation. Concern about overwintering forms that potentially survive mild winters.

MANY OF THE SYSTEMIC INSECTICIDES USED IN ALFALFA TODAY ARE NOT FULLY SYSTEMIC, BUT ARE ACROPETALLY SYSTEMIC

THIS MEANS THAT THEY ONLY PROTECT THE INTERCEPTED FOLIAGE WHEN SPRAYED, AND THE NEW GROWTH AFTER THAT.

FOLIAGE UNDERNEATH THE DIRECT CONTACT AREA WILL NOT BE PROTECTED AND APHIDS WILL CONTINUE TO FEED.

BETTER INSECT CONTROL USUALLY NOTED AT 10 DAYS THAN AT 3 DAYS POST TREATMENT



THOUGHTS ON ALFALFA INSECTICIDES FOR CONTROLLING APHIDS

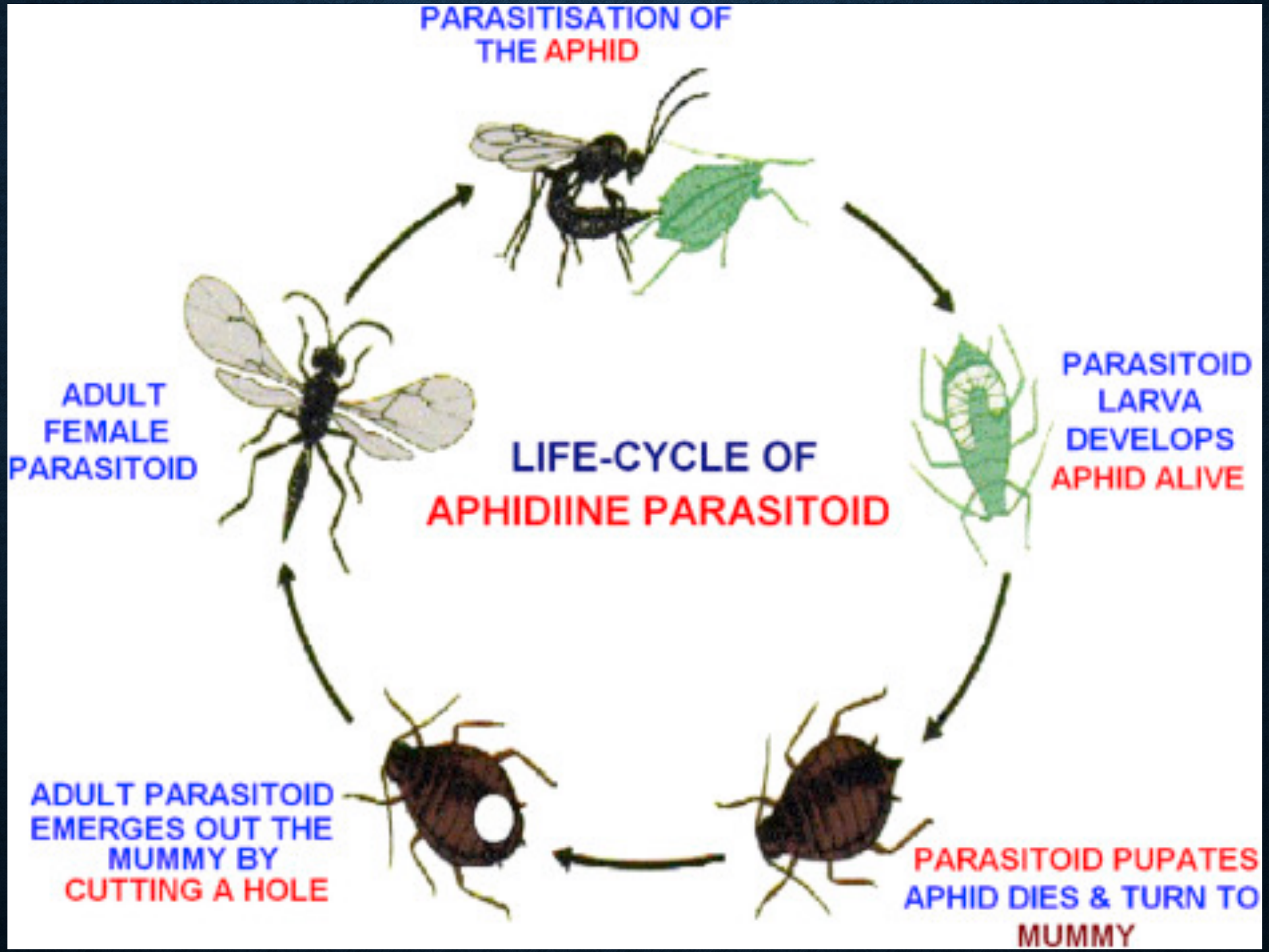
- May need to adapt concepts from fungicides: Preventative vs. Curative

- Slower acting insecticides (Beleaf, Sefina) would be considered more preventative and need to be applied earlier in growth cycle/shorter alfalfa and when fewer aphids are present *(different thresholds)* to negate aphid feeding damage

- Faster acting (Sivanto Prime) would have wider range of application windows.

WILL WARMER/DRIER WEATHER IN FALLS & WINTERS LEAD TO A MORE WIDESPREAD GEOGRAPHICAL AREA AFFECTED BY BLUE ALFALFA APHIDS AND/OR INCREASE THEIR OVERWINTERING SITES?

WHAT ABOUT BIOLOGICAL CONTROLS?


PARASITISATION OF THE APHID
PARASITOID LARVA DEVELOPS APHID ALIVE
PARASITOID PUPATES APHID DIES & TURN TO MUMMY
ADULT PARASITOID EMERGES OUT THE MUMMY BY CUTTING A HOLE
ADULT FEMALE PARASITOID
LIFE-CYCLE OF
APHIDIINE PARASITOID

PARASITIC WASPS *(APHIDIUS ERVI)*

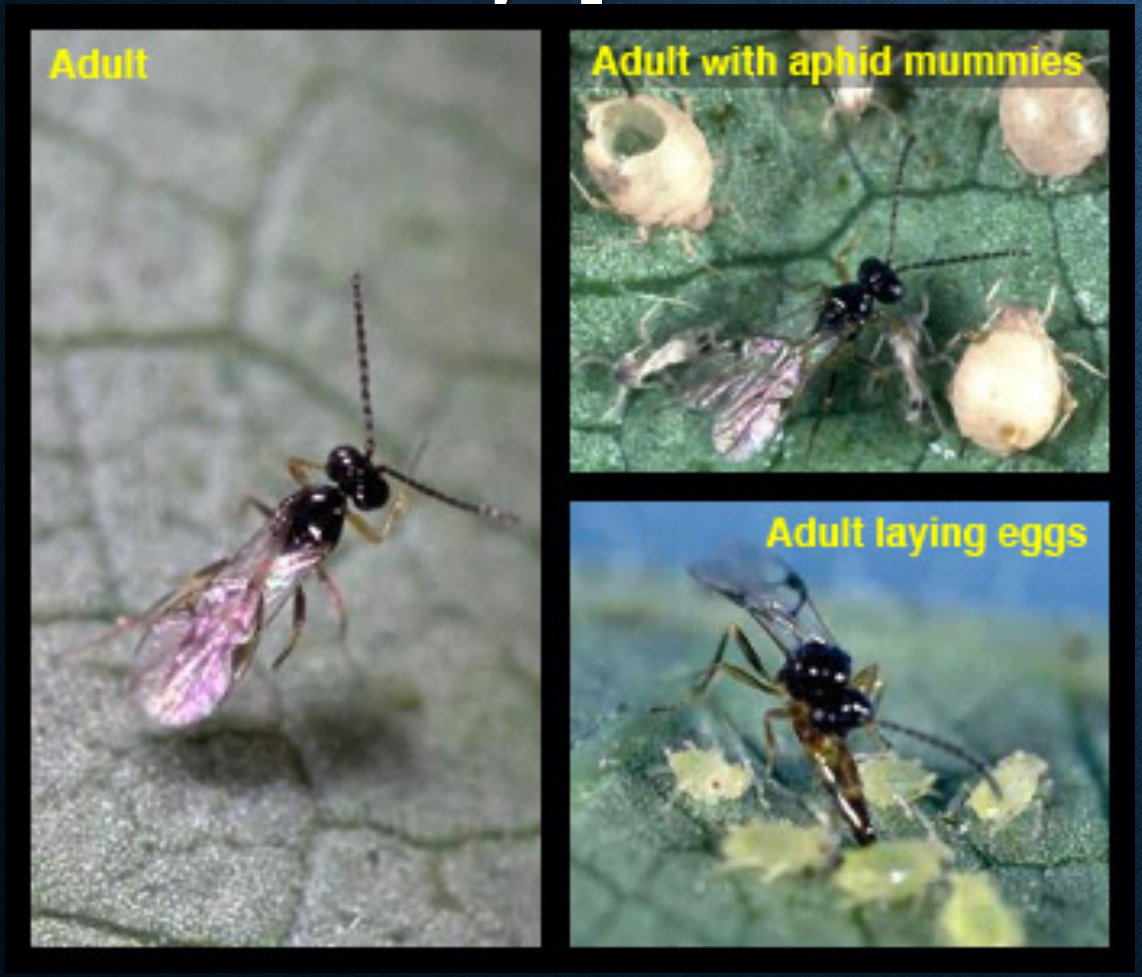
EGGS INSERTED INTO YOUNG APHIDS.

EGGS HATCH AND WASP LARVAE EAT APHIDS FROM INSIDE.

TAKES ABOUT 14 DAYS FOR A WASP TO COMPLETE DEVELOPMENT BEFORE NEW ADULT WASP EMERGES FROM MUMMIFIED APHID

TWO SPECIES OF PARASITIC WASPS OFTEN CAN KEEP COWPEA APHIDS UNDER CONTROL IN LOW DESERT ALFALFA

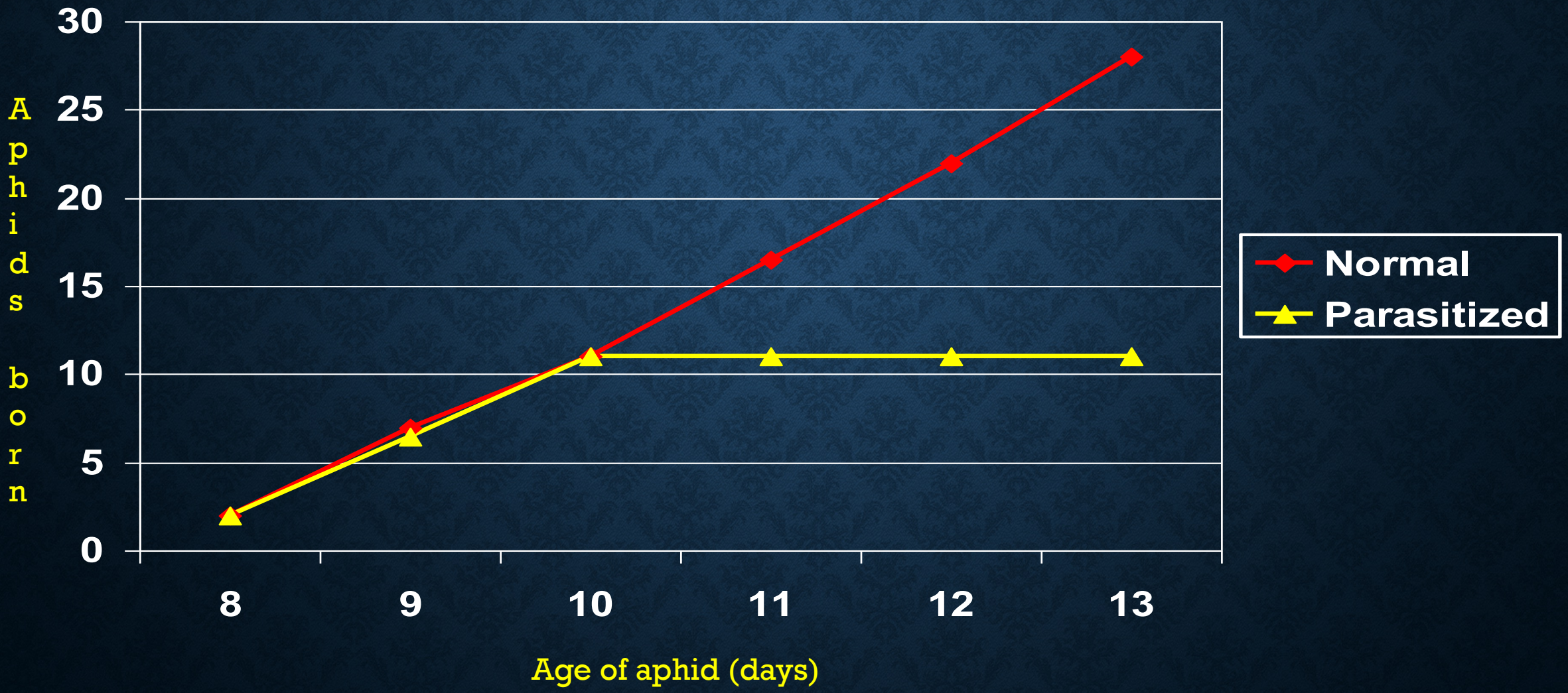
Lysiphlebus



Diaeretiella

BLUE ALFALFA APHID REPRODUCTION

IT TAKES ~6 DAYS FROM WHEN APHID IS PARASITIZED BY PRAON PEQUODORUM UNTIL REPRODUCTION STOPS



SEVEN SPOTTED LADY BEETLE

- Feeds on alfalfa weevil larvae as well as aphids
- Much larger in size than the convergent lady beetle, or other lady beetles encountered in local alfalfa. Larger = eats more aphids!

CONVERGENT LADYBEETLE

- This species was prevalent during the winter months in the low desert, (85% of population) but often dissipates (flies to cooler areas) when temperatures start reaching 85+ F.

- It is not unusual to reach 90 F in February on some days in the low desert.

SEEDLING ALFALFA – LOW DESERT

INSECTS AND SEEDLING ALFALFA – LOW DESERT

THREE INSECTS PRESENT AND DAMAGING SEEDLING ALFALFA IN LOW DESERT ALFALFA IN FALL

- Western Flower Thrips

- Cowpea Aphids

Spotted Alfalfa Aphids

SPOTTED ALFALFA APHIDS

- Unlike other aphids, they feed on primarily on undersides of leaves rather than stems

- Inject a toxin into plants at they feed

- Soil underneath the small alfalfa plants can have a slightly different color due to the honeydew being deposited from high spotted alfalfa aphid populations, concern about seedlings potentially being killed due to their feeding.

WESTERN FLOWER THRIPS

FEEDING ON SEEDLING ALFALFA CAN RESULT MISSHAPEN/PUCKERED LEAVES WITH WHITISH AREAS

WESTERN FLOWER THRIPS

- Have unique mouthparts for insect, more of a scrape and suck rather than piercing-sucking (aphids) or chewing (alfalfa weevils)
- The scraping away of outer leaf cells results in tissue scaring and odd growth (puckering)
- It is also a very beneficial insect, as it is the main predator of two-spotted spider mites in low desert alfalfa
- Reports from Colorado and Idaho of western flower thrips being a problem in summer alfalfa when adjacent grain crops are harvested.

COWPEA APHIDS

COWPEA APHIDS

- Often feed near growing tips, and are usually more problematic in alfalfa that is in 2 (or more) year of stand. First major aphid pest in the fall/winter in these types of stands in the low desert.

- **Legs have bands of color and black 'feet'**

- Inject a toxin as they feed

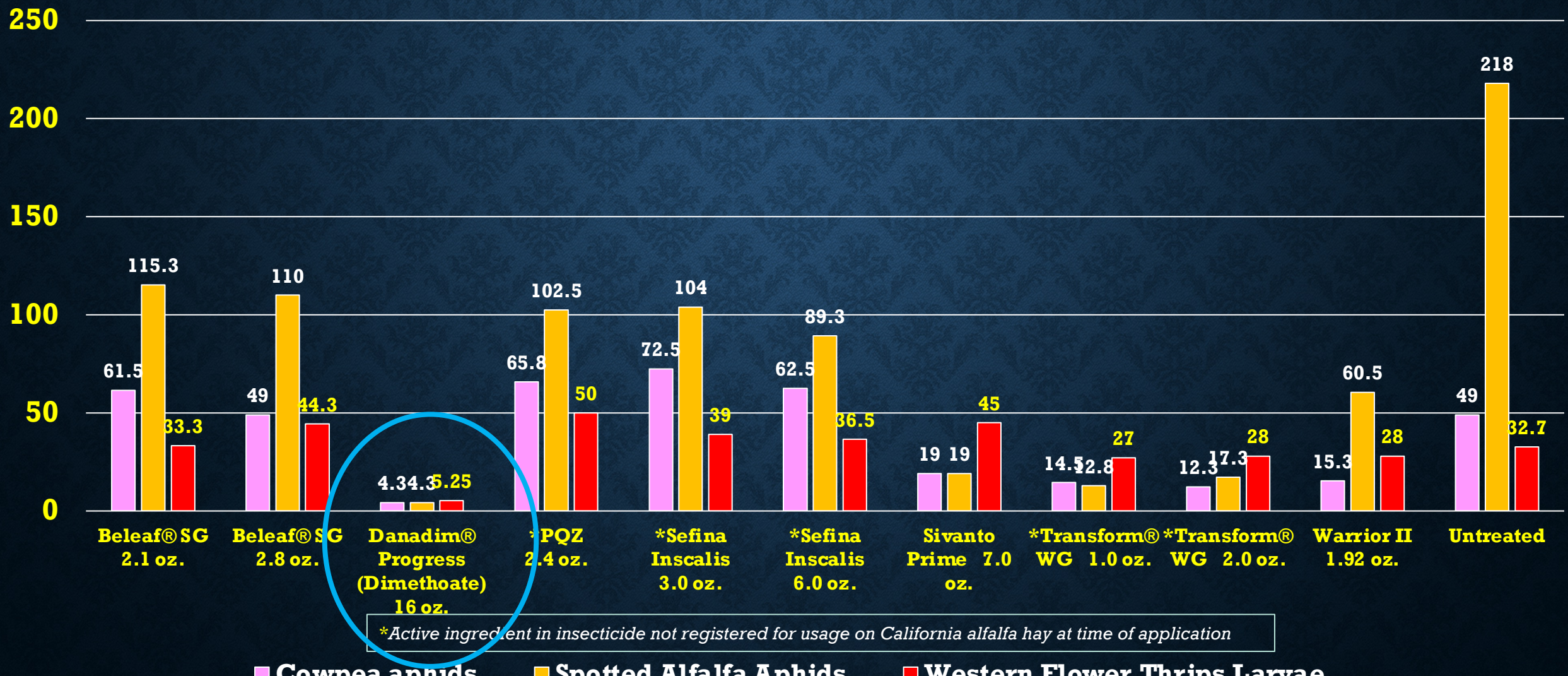
- High numbers of aphid can cause stunting and death of alfalfa stems

COWPEA APHIDS AND INITIAL DAMAGE

SAMPLING SEEDLING ALFALFA

AFTER BEATING THE SMALL ALFALFA STEMS TO DISLODGE INSECTS, THE INSECTS ON THE MANILA FOLDER WERE TRANSFERRED TO CONTAINERS FOR LATER COUNTING

MEAN NUMBER OF COWPEA APHIDS, SPOTTED ALFALFA APHIDS, AND WESTERN FLOWER THRIPS LARVAE PER 46 ROW INCHES OF SEEDLING ALFALFA AT 3 DAYS POST NOV. 14 TREATMENT, RIPLEY, CA, 2019



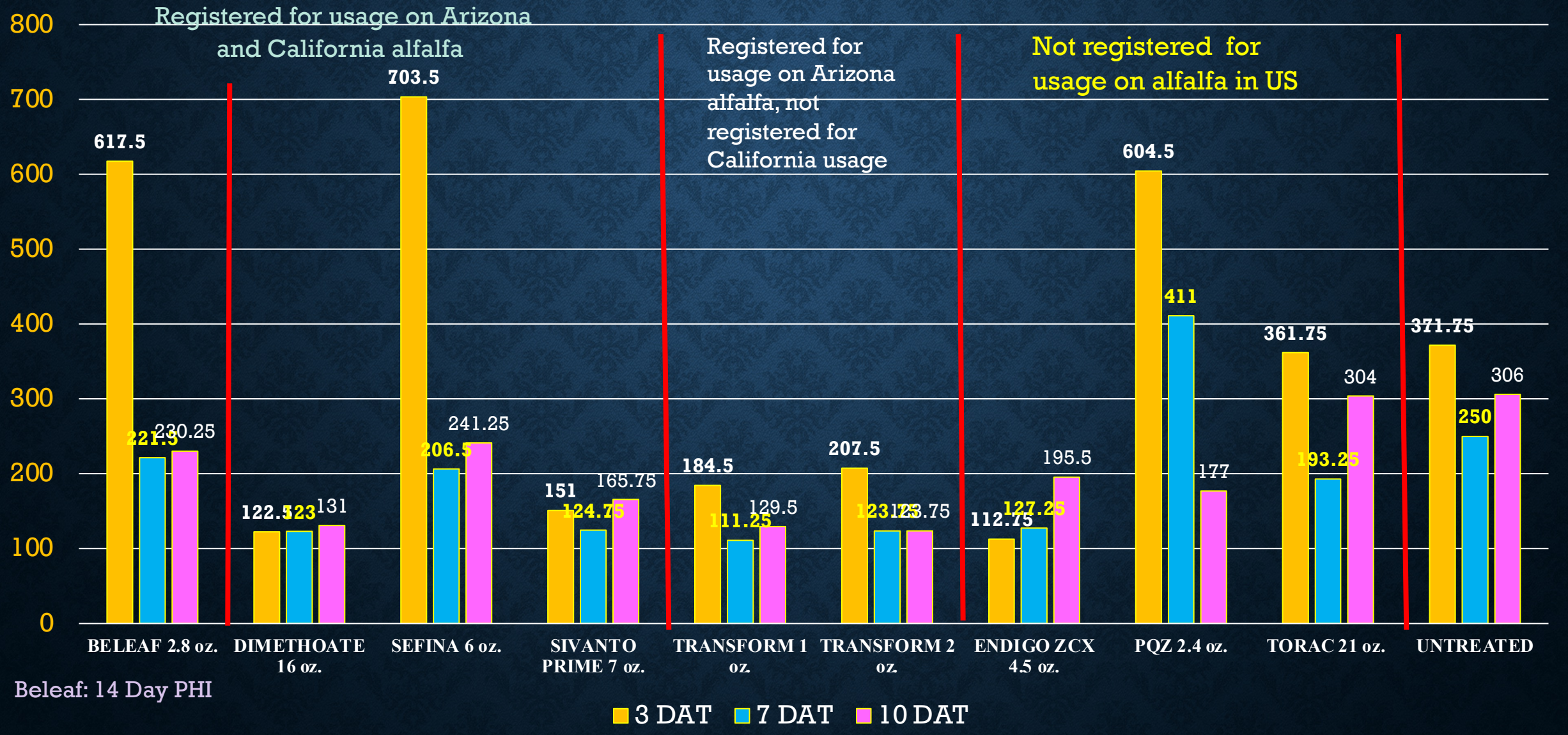
TAKE HOME POINTS FROM LOCAL EXPERIMENTS

- Dimethoate is very effective against cowpea aphids, will want to keep this product available in California if only for this purpose as there are limitations on annual usage for Sivanto Prime and Sefina

- However, dimethoate is not the product of choice for blue alfalfa aphids.

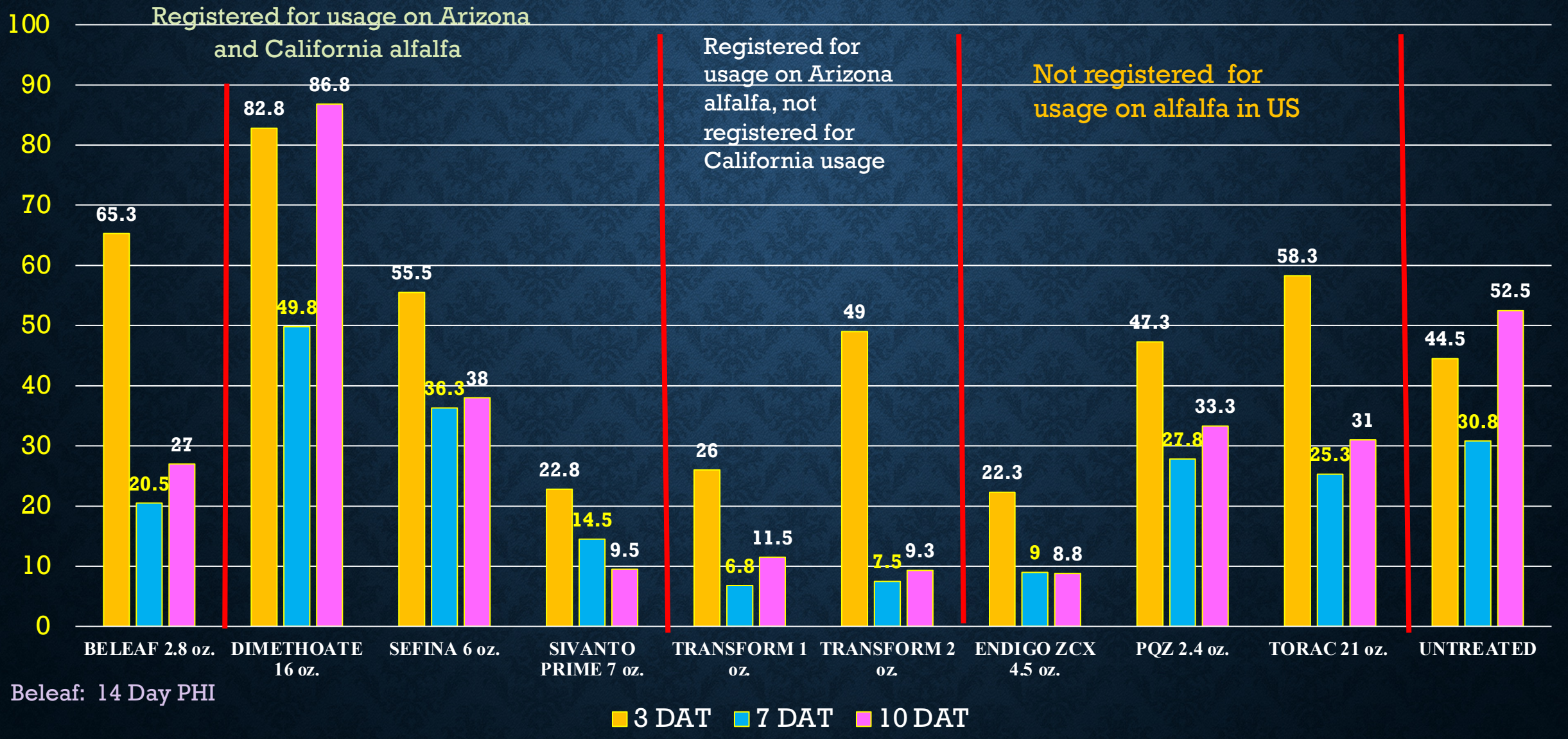
2022 COMPARISON OF APHID INSECTICIDES IN A THIRD YEAR STAND OF ALFALFA

COWPEA APHIDS PER 5 SWEEPS FOLLOWING INSECTICIDE APPLICATION ON FEB. 16, 2022, RIPLEY, CALIFORNIA



Beleaf: 14 Day PHI

APTEROUS BLUE ALFALFA APHIDS/5 SWEEPS FOLLOWING INSECTICIDE APPLICATION ON FEB. 16, 2022, RIPLEY, CA

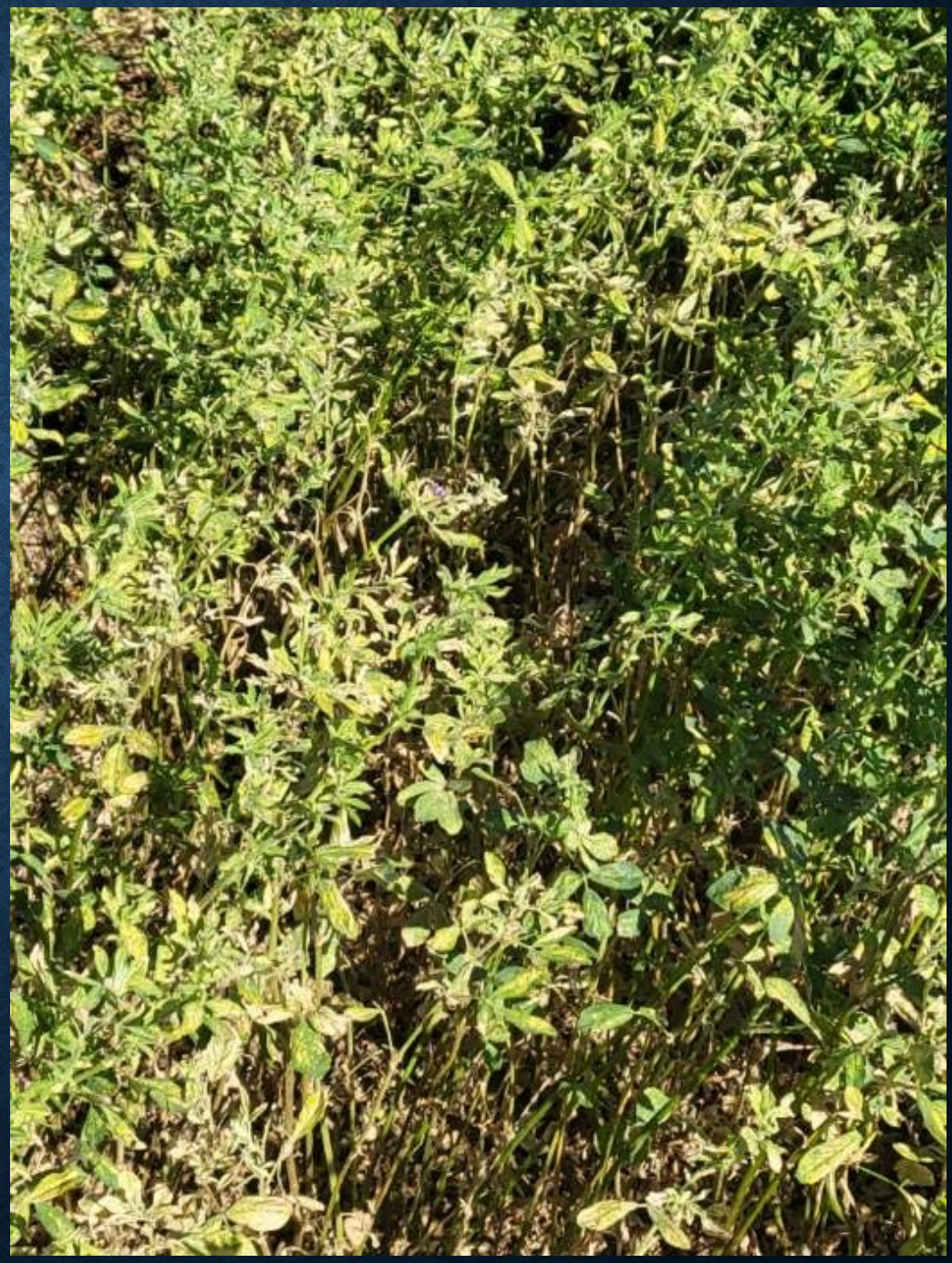


Beleaf: 14 Day PHI

SPIDER MITES

SPIDER MITES CAUSED EXTENSIVE DAMAGE IN MULTIPLE FIELDS IN 2023, AND ARE ALREADY ACTIVE IN 2024.

NOTE THE DEFOLIATION OF THE BOTTOM 2/3 OF STEM



CATERPILLAR PESTS

OF CALIFORNIA ALFALFA

LOW DESERT ALFALFA IS ATTRACTIVE TO MANY CATERPILLARS THAT CAN BE ALFALFA PESTS!

CAN ALMOST BET ON THEM!

- BEET ARMYWORM
- GRANULATE CUTWORM
- ALFALFA CATERPILLAR

- OCCASIONALLY NEEDING TREATMENT
- YELLOW STRIPED ARMYWORM

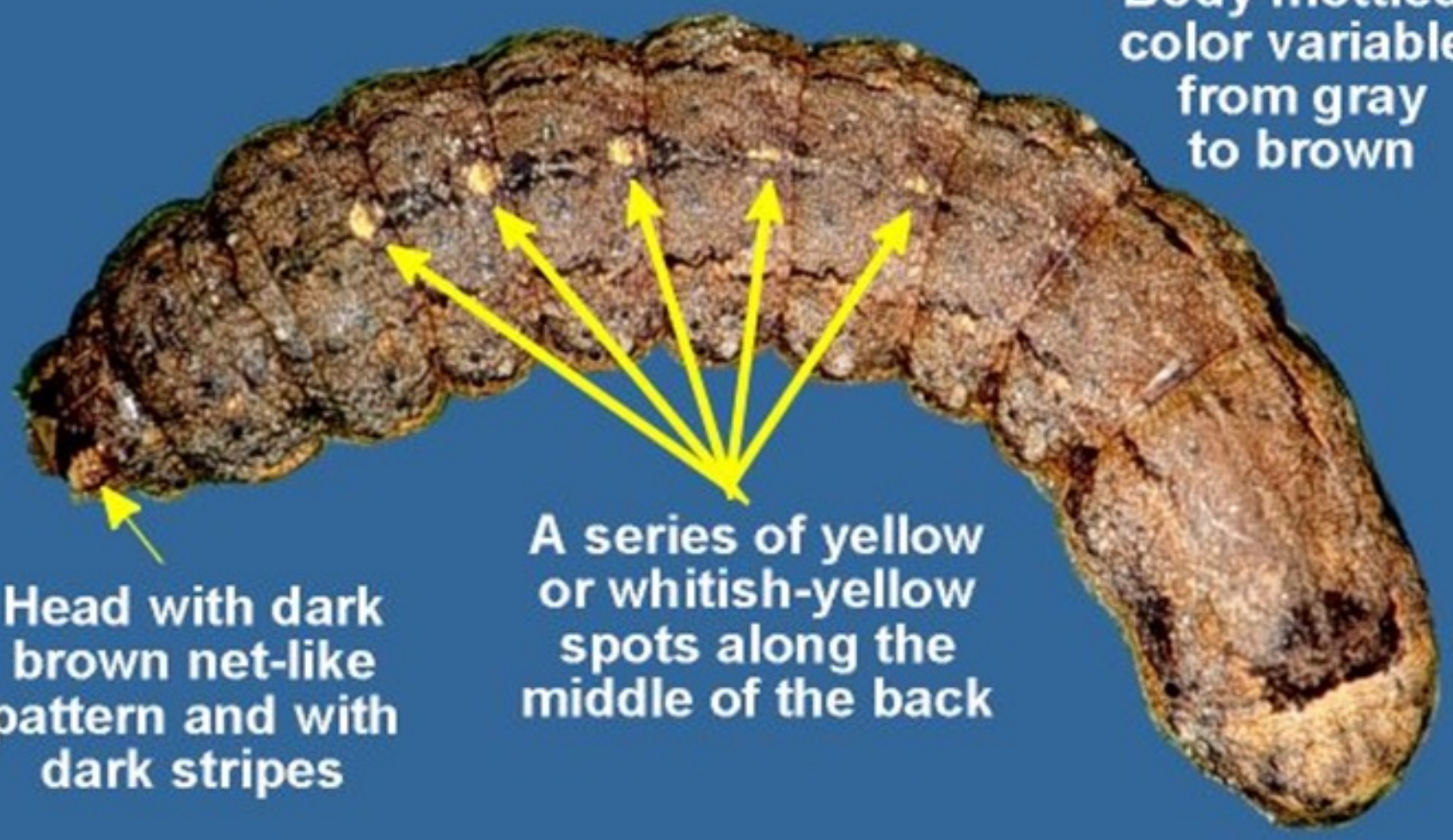
USUALLY THERE, BUT NOT OFTEN NEEDING TREATMENTS

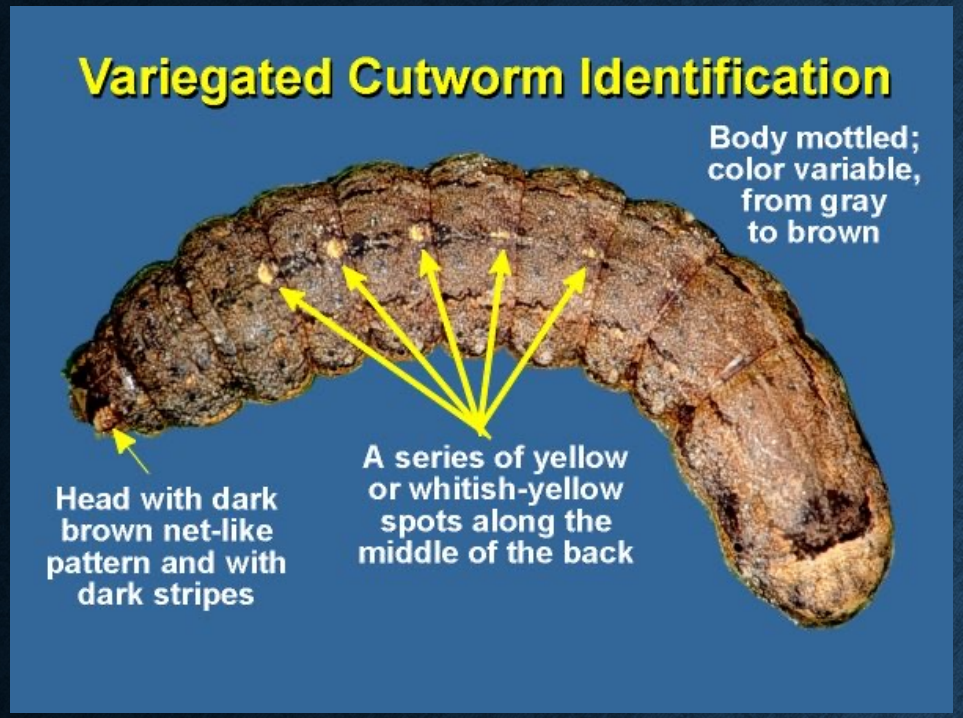
- VARIEGATED CUTWORM
- CABBAGE LOOPER

- INFREQUENT/EVER TREAT FOR THESE?
- ALFALFA LOOPER
- GARDEN WEBWORM
- WESTERN YELLOW STRIPED ARMYWORM

VARIEGATED CUTWORM

Variegated Cutworm Identification



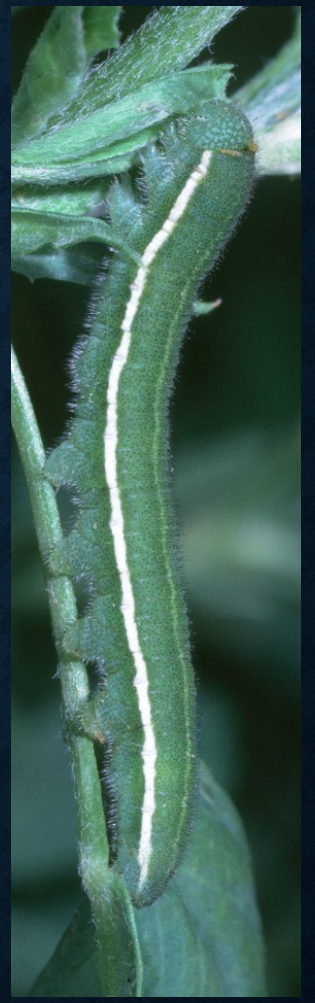


GRANULATE CUTWORM

BEET ARMYWORM

DOT LINED ANGLE*

ALFALFA LEAFTIER*



ALFALFA CATERPILLAR

BIOLOGICAL CONTROL INSECTS ACTIVE AT NIGHT IN ALFALFA FIELDS

CATERPILLAR HUNTER BEETLES

- Adults live for several months/cuttings. Hide during the day
- Major predator of cutworms and other caterpillars
- Known to climb foliage at night in search of caterpillars

ALFALFA LEAFTIER - DIAGNOSTIC CHARACTERISTIC

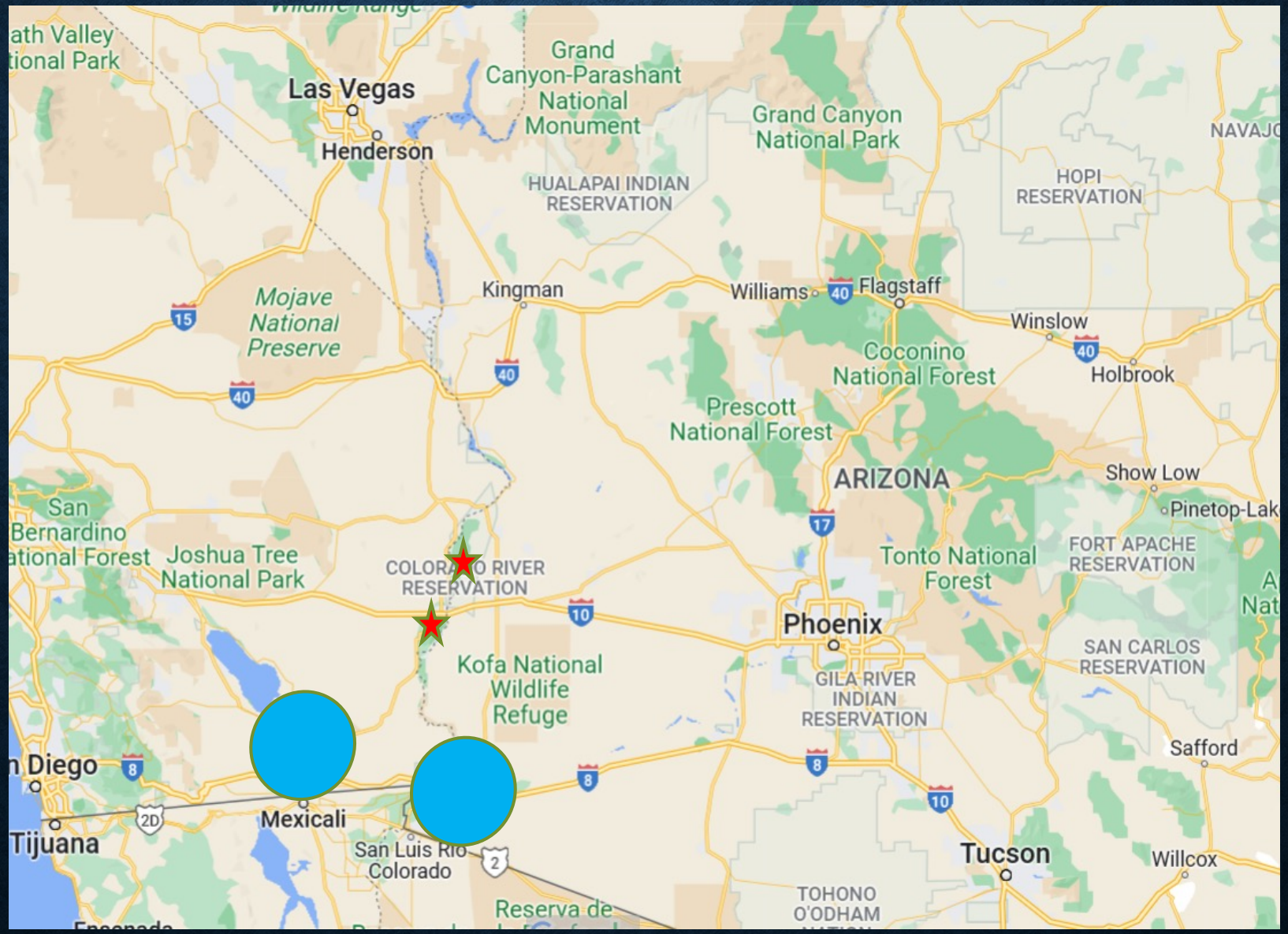
BLACK SCLEROTIZED 1ST THORACIC SEGMENT & LEG

INITIAL INFESTATIONS CAN BE DIFFICULT TO SEE, BUT AS THE NAME INDICATES, THE CATERPILLARS TIE LEAVES TOGETHER, AND FEED WITHIN

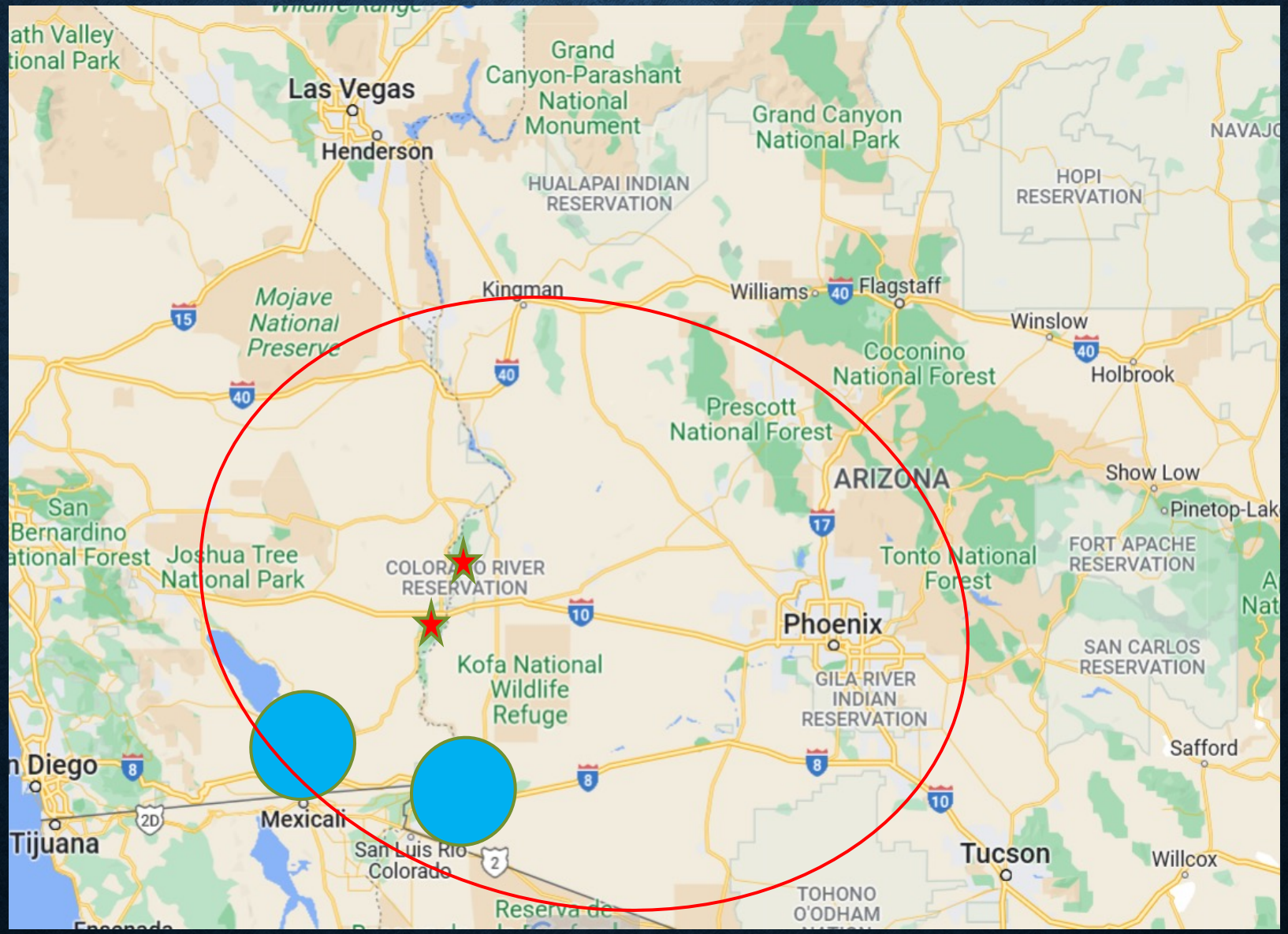
LATER FEEDING DAMAGE LOOKS SIMILAR TO THAT OF ARMYWORMS, BUT THE LEAF-TIERS CAN BE FOUND IN THE TIED LEAVES

CONTINENTAL U.S. KNOWN DISTRIBUTION/ COLLECTIONS PRIOR TO SEPTEMBER 2021

ALFALFA FIELDS WITH ALFALFA LEAF TIER IN 2021



THE GEOGRAPHIC AREA OF ALFALFA FIELDS BEING DAMAGE EXPANDED FROM 2021 TO 2022



BLISTER BEETLES
SITUATIONS WHERE THEY ARE EXPECTED

- Field edges/fields with grasses that have grasshoppers

- Grasshopper eggs are the food source for blister beetle larvae

SUMMARY

- California alfalfa subject to many insect pests, such as alfalfa weevils and aphids, and has year long growing conditions in some areas (highly conducive for insect survival and abundance).

- These insects can cause some serious economic losses

- Insecticide resistance is of high concern as California has fewer registered products to use for rotational purposes than adjacent states

- New insect pests have recently been found

QUESTIONS?