



# Hemp Insect Pests

WHITNEY CRANSHAW – COLORADO STATE UNIVERSITY

**Garfield County AgExpo**  
Rifle, CO February 1, 2020

# What type of crop is hemp?



# There are at least 3 kinds of hemp crops from an Insect Management Perspective

- Hemp grown seed and/or fiber
  - Outdoor culture
- Hemp grown for CBD production
  - Outdoor culture
- Indoor culture of any Cannabis crop



## Descriptive Phase

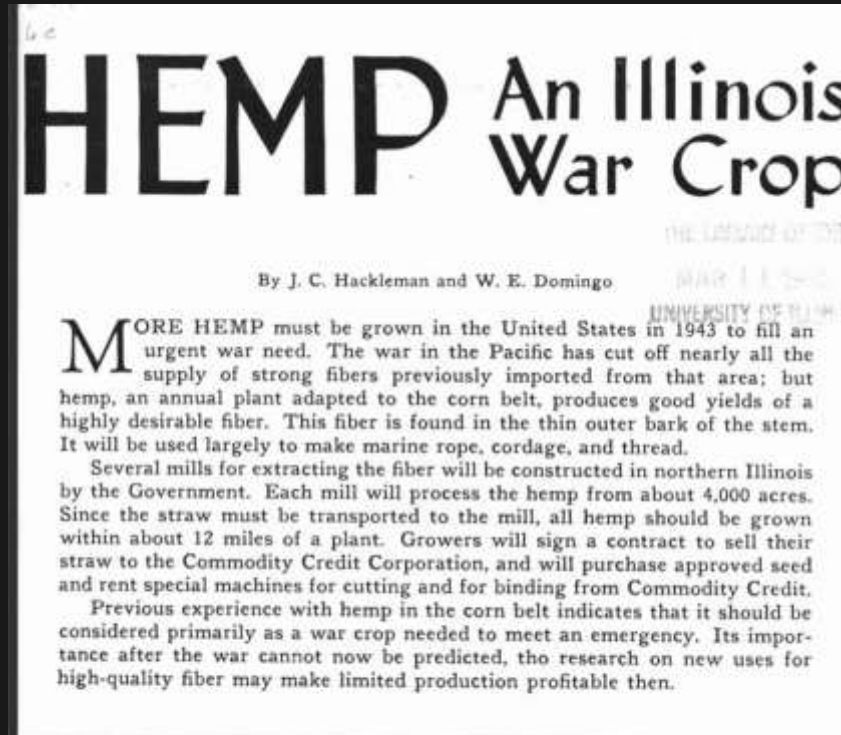
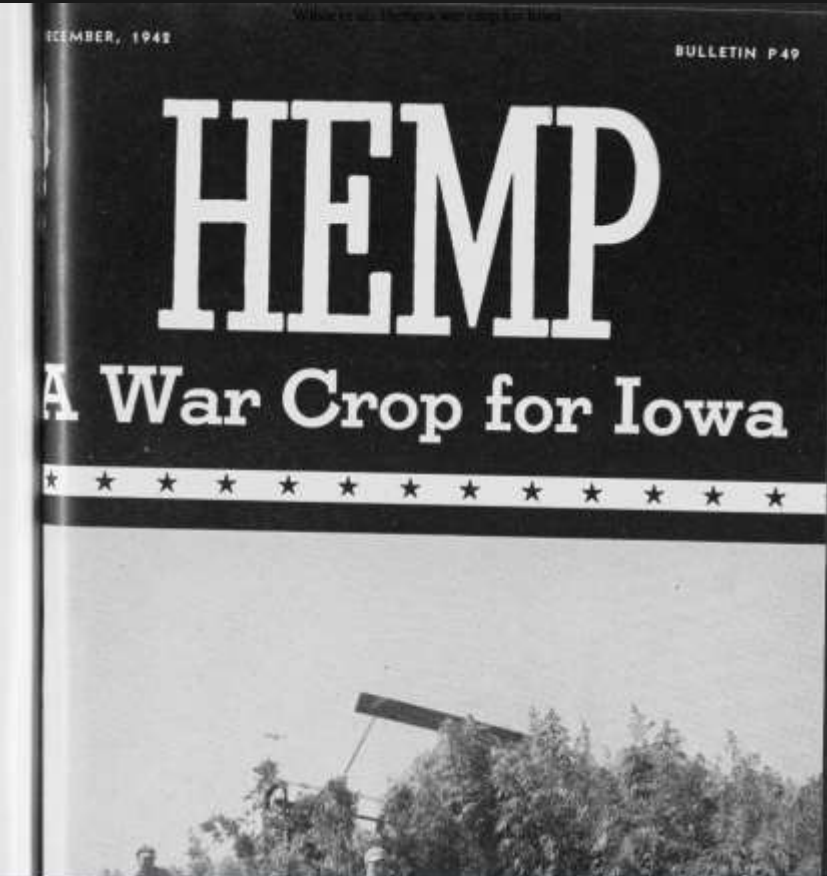


**What kinds of arthropods are we finding in North American hemp crops in this new era?**



***...and what is their association with the crop?***

The only university–derived resources that give any mention of hemp insects in the United States date to the **World War II period**



The entomology details provided were cursory and appear to have little relevance to the present situation

# Key Arthropod Pests of Indoor Grown Cannabis



Twospotted spider mite

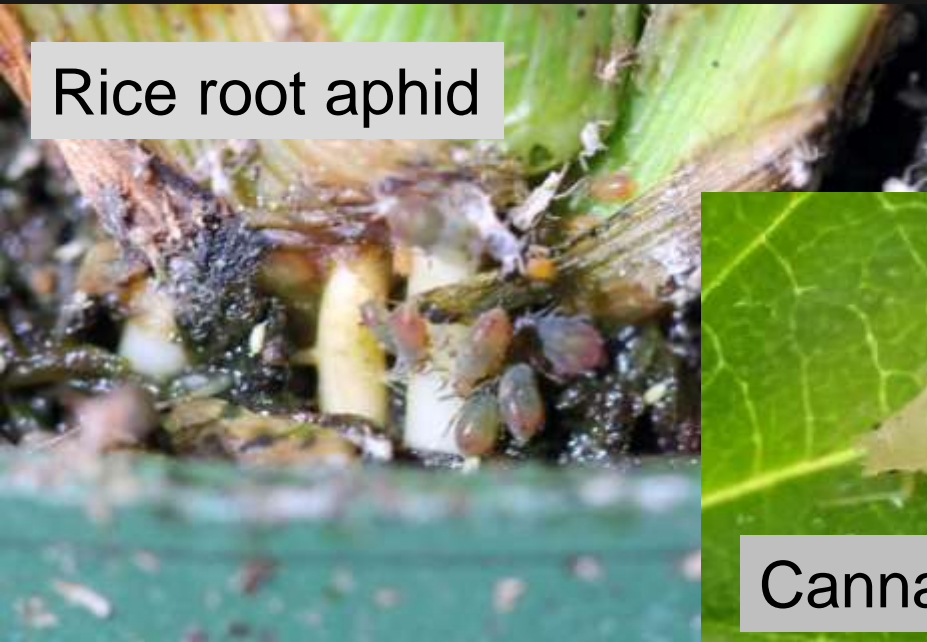


Hemp russet mite



Fungus gnats

Photograph courtesy of Karl Hillig



Rice root aphid



Cannabis aphid



Onion thrips

Corn earworm



# Key Arthropod Pests Emerging in Colorado Hemp Production

Eurasian hemp borer



Grasshoppers



Cannabis aphid



Hemp russet mite

Information collected on insect issues of hemp are made available through the Colorado State University Hemp Insect Website

## Insect Management Considerations in Hemp Production

The **Hemp Insect Website** is designed to provide hemp producers a way to recognize and to better understand the insects, mites, and other “bugs” that are present when this crop is grown in North America.

The goals of the Hemp Insect Website are to:

- (1) Provide description of all insects and mites observed in production of hemp;
- (2) Provide information on the habits of all insects that are associated with hemp production.

At present the Hemp Insect Website does give particular attention to insects and mites that are present within the High Plains/Rocky Mountain area of the western United States. This is because, to date, the most extensive surveys of hemp insects have occurred in this region, mostly in Colorado from 2015 to the present. However, the goal of this website is to provide progressively more comprehensive treatment of insects associated with hemp production throughout North America. Submission of photos and inquiries about insects observed on hemp is encouraged from anywhere and the website should expand as the field of hemp insect pest management develops in the United States and Canada.





# What is a Hemp Insect?



*Zygogramma disrupta* –  
a leaf beetle of ragweed



## What is a hemp insect?

Western corn rootworm



Argus tortoise beetles  
pupating on hemp



*Physiphora demandata* – a  
commonly seen fly that  
develops on decaying OM



Diamondback moth

Lady beetles and other Coleopteran predators



**Hemp may support  
a diverse and  
robust complement  
of natural  
enemy species**

Green lacewings



Syrphid flies



Spiders and other  
arachnid predators



Predatory Hemiptera



# The most common lady beetles found in hemp fields



Convergent lady beetle



Multicolored Asian lady beetle



Sevenspotted lady beetle



Also common were  
*Hippodamia parenthesis*,  
*Olla c-nigrum*, and  
*Coccinella novemnotata*



**Lady Beetle  
Larvae**



# Three species of **Green Lacewings** have been observed in hemp fields



***Chrysopa oculata,***  
***Chrysoperla floribunda,***  
***Chrysoperla nigricornis***

Damsel bug



*Chlamydatus associatus*



**Some generalist  
hemipteran predators**

Spined assassin bug



Minute pirate bugs





Damsel bug nymph (right) and lady beetle

# Damsel Bug

*Nabis alternatus*



A very common insect in hemp fields and a generalist predator of many insects, including caterpillars





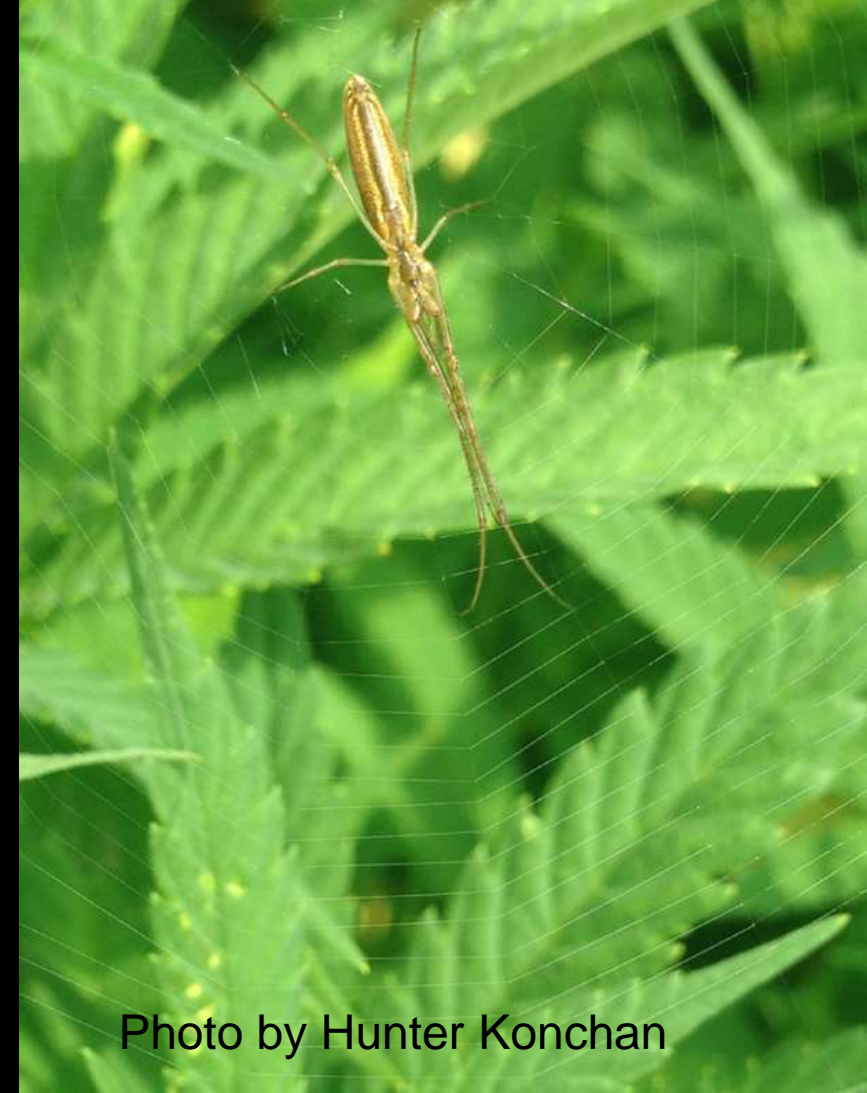


Photo by Hunter Konchan



**Spiders may often be very important natural enemies of insects associated with hemp**

**Hemp may be a very heavily used by many kinds of bees as a pollen source late in the season**



**Honey bee**



**Bumble bees**



**Many species of native solitary bees**

What is the potential value of hemp as a pollen resources for bees in agricultural regions?



**Hemp grown for seed production with pollen producing male plants/flowers**  
– potentially excellent resource for many pollinators



**Hemp grown for extractable compounds (e.g. CBD) without male plants** – not a potential pollen source

**What kinds of arthropods will we find feeding on hemp plants in this new era?**



# Herbivores associated with Hemp

- Leaf feeding species (all crops)
- Stalk borers (all crops)
- Hemipteran seed feeders (seed crops)
- Insects that damage flower buds (CDB crops)

# Insect/Mites with Sucking Mouthparts that Feed on Leaves



**Leafhoppers**



**Spider Mites**



**Aphids**



**Thrips**



**Russet Mites**

There are some fluid feeding insects that occur on the leaves



**Aphids**

Plus some treehoppers, planthoppers, and spittlebugs



**Leafhoppers**







Most surprising  
insect associated  
with the crop?

# Cannabis Aphid

*Phorodon cannabis*



# Cannabis Aphid

- *Cannabis* spp. are the only plants on which cannabis aphid can feed and develop





Outdoors, highest populations are seen late in the season, near harvest. These are often started by migrants that move to the crop in mid-late August and early September.

**Asexual reproduction – giving live birth to a genetically identical daughter – is the norm for aphid reproduction, including cannabis aphid**



No males, no externally laid egg.



Starting in  
midSeptember  
special  
reproductive  
forms appear on  
hemp



# Sexual forms of cannabis aphid and eggs

Late September  
on a hemp leaf

Egg producing form  
female mating with  
winged male

Winged male

Egg producing form  
female with recently  
laid eggs



# Cannabis Aphid

- Beginning in September, with shortening day length, sexual forms are produced (holocyclic life cycle, monoecious)



Eggs are the stage that can survive outdoors between seasons

**How will cannabis aphid survive between seasons in a place with hard freezing winters?**



***... mostly on indoor crops?***

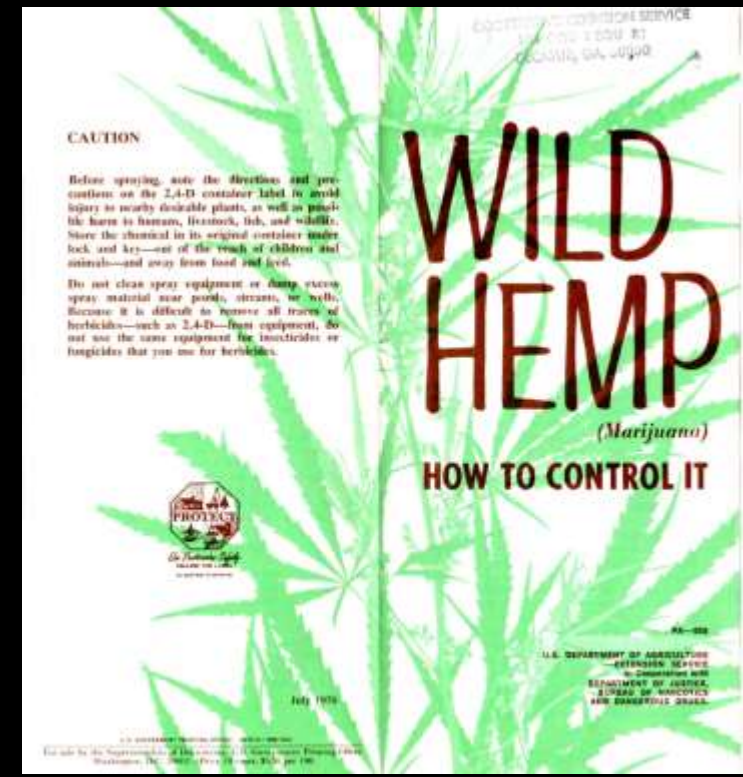






Photograph courtesy of University of Missouri

# Feral hemp - and volunteers - can sustain significant numbers of cannabis aphid between seasons



# Volunteer hemp



Cannabis aphids were collected from volunteer hemp sampled in midMay

Prevention of volunteers can reduce early season populations of cannabis aphid



Outdoors, highest populations are seen late in the season, near harvest. These are often started by migrants that move to the crop in mid-late August and early September.

Lady beetles and other Coleopteran predators



**Hemp may support  
a diverse and  
robust complement  
of natural  
enemy species**

Green lacewings



Syrphid flies



Spiders and other  
arachnid predators



Predatory Hemiptera



Insects with sucking mouthparts that feed on leaves



## Leafhoppers

Damage potential of Colorado species to crop:  
Negligible, at most

# Newly identified insect-vectored pathogen of hemp – beet curly top virus



Beet curly top virus is transmitted to plants by the beetle leafhopper (*Neoaliturus tenellus*)



**Beet Curly Top Virus  
symptoms on hemp**



Beet Curly Top outbreaks are common in western Colorado. **The main crops affected are tomatoes, peppers, squash and beans.**

**The only way a plant gets infected with this disease is a beet leafhopper, which has previously fed on a BCTV-infected plant, feeds on the plant.**



**Essentially all BCTV infections occur from beet leafhoppers, carrying the virus, which migrated into the area in late spring from New Mexico/Arizona**

**Beet leafhopper spends very little time in hemp and does not breed in the crop. It can transmit the virus after feeding for 10-15 minutes.**





- ⇒ WCI Home
- ⇒ Agriculture
- ⇒ Biological Control
- ⇒ Horticulture and Garden
- ⇒ Human and Animal Health
- ⇒ Native Insects
- ⇒ Pesticide and Regulatory

## TOMATO CURLY TOP VIRUS

Bob Hammon, CSU Extension, Tri River Area

Curly top is one of several insect-vectored viral diseases that affect tomatoes. Seventy-five percent losses can occur in Western Colorado when conditions are favorable for the spread of the beet leafhopper (*Circulifer tenellus*), the vector of the virus.

Ideal conditions occur when fall and winter rains in the desert areas of New Mexico, Arizona, and Sonora and Chihuahua Mexico allow winter annual mustards to flourish during the winter months. Beet leafhoppers feed and multiply on these plants, then migrate north on storm fronts and with prevailing

Bob Hammon with the Tri-River Extension office spent many years researching all the available options to manage beet curly top on tomatoes

**Results of this work can be found at the Western Colorado Insects website of the Tri-River Area Extension offices**

### Curly Top Research in Western Colorado

TRA Extension conducted research in tomatoes during 2006-2008 to evaluate methods of controlling curly top virus. In 2006, we conducted demonstration trials to evaluate tomato varieties for resistance to the virus. We also evaluated walls-of-water and floating row covers as control tactics. 2007 research looked at planting dates and row covers as management techniques in trials conducted at the Western Colorado Research Center at Orchard Mesa. Replicated trials were conducted in 2008 to look at the impact of plastic mulch color on curly top incidence. A planting time insecticide and SAR (Synthetic Acquired Resistance) trial was conducted to evaluate control options for commercial growers.

Click the following to view results of those trials.

- [2006](#)
- [2007](#)
- [2008](#)
- [2009](#)
- [2012](#)

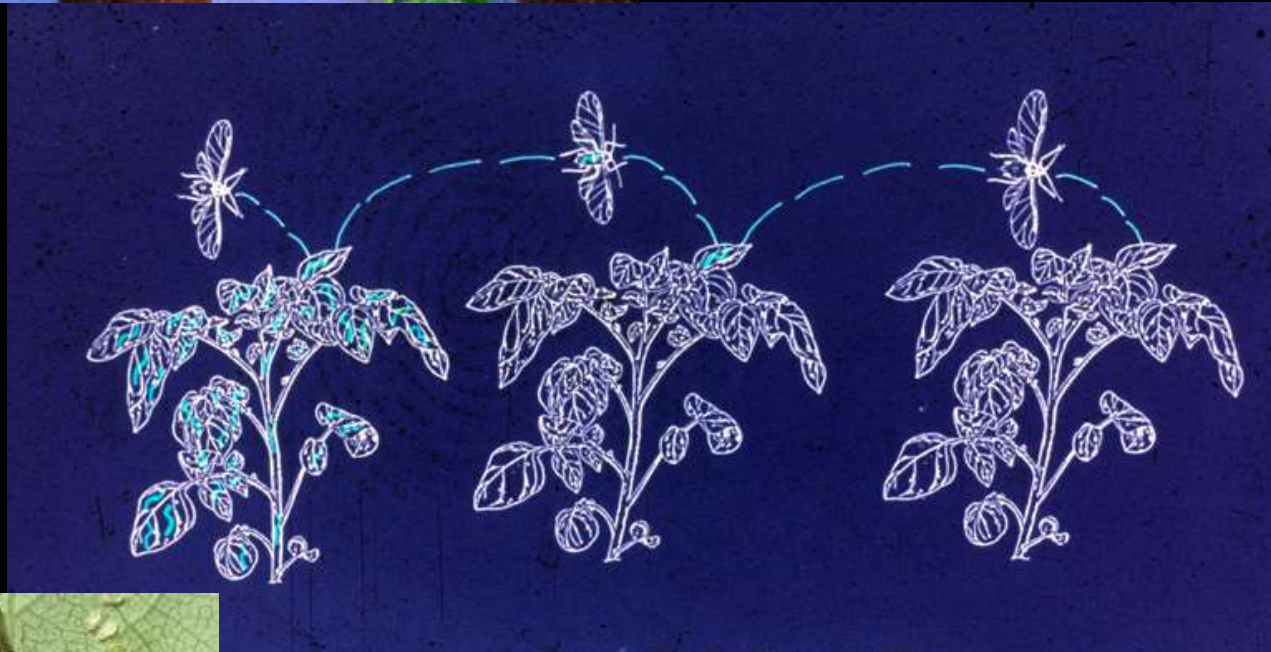
# Mulch and Insects

- **Mulches can:**
  - alter light around plants
  - affect temperatures on plants
  - provide cover for insects around the base of the plants



Figure 1. Tomato planted on metalized vs. black plastic mulch (back - right).

# Reflective Mulches for Control of Insect Vectored Plant Diseases



NON-PERSISTENT VIRUS - PVY

Aphids



Thrips



Leafhoppers





Photograph courtesy of Karl Hillig

# Hemp russet mite

*Aculops cannabicola*

We will come back to this when discussing bud feeders

Photograph courtesy of Karl Hillig

More obvious can be insects that chew leaves of the plant (defoliators)

Grasshoppers



Caterpillars



Beetles

# Various caterpillars chew leaves of the plant (defoliators)



**Yellowstriped armyworm**



**Yellow woollybear**



**Beet webworm**



**Thistle caterpillar**



**Beet armyworm**



**Zebra caterpillar**

**Two late season “woollybear” caterpillars are most common**



**Saltmarsh caterpillar**



**Yellow woollybear**



# Leaf Feeding Beetles



**Palestriped flea beetle**

**Southern corn rootworm adult and damage**



**Western black flea beetle**







**Grasshoppers** (at least five species)





Two species of grasshoppers appear to be particularly damaging to hemp, two-striped grasshopper and differential grasshopper





**Stem feeding seems to cause the most injury by grasshoppers**



These two species  
roost on stems of  
the plants through  
the night – *and*  
*gnaw on stems*



**Grasshoppers that damage hemp lay pods of eggs below ground in late summer. These hatch the following spring**





**Egg pods of grasshoppers.**

**These are destroyed if the ground is tilled.**





In most agricultural settings grasshopper problems originate from undisturbed field edges.



## Field edges and grasshopper management

- Locate hemp some distance from field edge
- Manage grasshoppers in the field edge, before they move into the crop



Grasshopper baits can be used in off-crop sites (e.g., field edges).

***They can not be used in hemp fields!***



The product label for NOLO BAIT is set against a background of a sunset with silhouettes of grasshoppers on plant stems. At the top, a large grasshopper is shown with the text 'NOLO BAIT' below it. Underneath, it says 'FOR ORGANIC PRODUCTION' with a small leaf icon. The main text reads 'NOLO BAIT BIOLOGICAL INSECTICIDE' and 'Nosema locustae Biological Insecticide'. At the bottom, it provides manufacturer information: 'Manufactured in the USA by: MAJR Durango, Inc. 6565 Hwy. 172, Ignacio, CO 81137 Tel: 970-259-3521'. A warning 'KEEP OUT OF REACH OF CHILDREN' and a reference to 'SEE FIRST AID AND PRECAUTIONARY STATEMENTS ON BACK PANEL' are also present. A small table at the bottom left lists ingredients: 'Active ingredient: Nosema locustae Consping\* 0.85%', 'Inert ingredients 99.15%', and 'Total 100.00%'. A note states '\*Contains at least one billion viable spores per 434 grams (1.5 pounds)'. The label also includes fields for 'Net contents' and 'Date Formulated'.

# *Nosema locustae* A microsporidian (fungus) disease of grasshoppers



FOR ORGANIC PRODUCTION

**NOLO BAIT**  
**BIOLOGICAL INSECTICIDE**

*Nosema locustae*  
Biological Insecticide

Manufactured in the USA by:  
M&R Durango, Inc.  
6565 Hwy. 172, Ignacio, CO 81137  
Tel: 970-258-3521

**KEEP OUT OF REACH OF CHILDREN**

SEE FIRST AID AND PRECAUTIONARY  
STATEMENTS ON BACK PANEL

EPA Registration #46149-2  
EPA Establishment #46149-CO-001

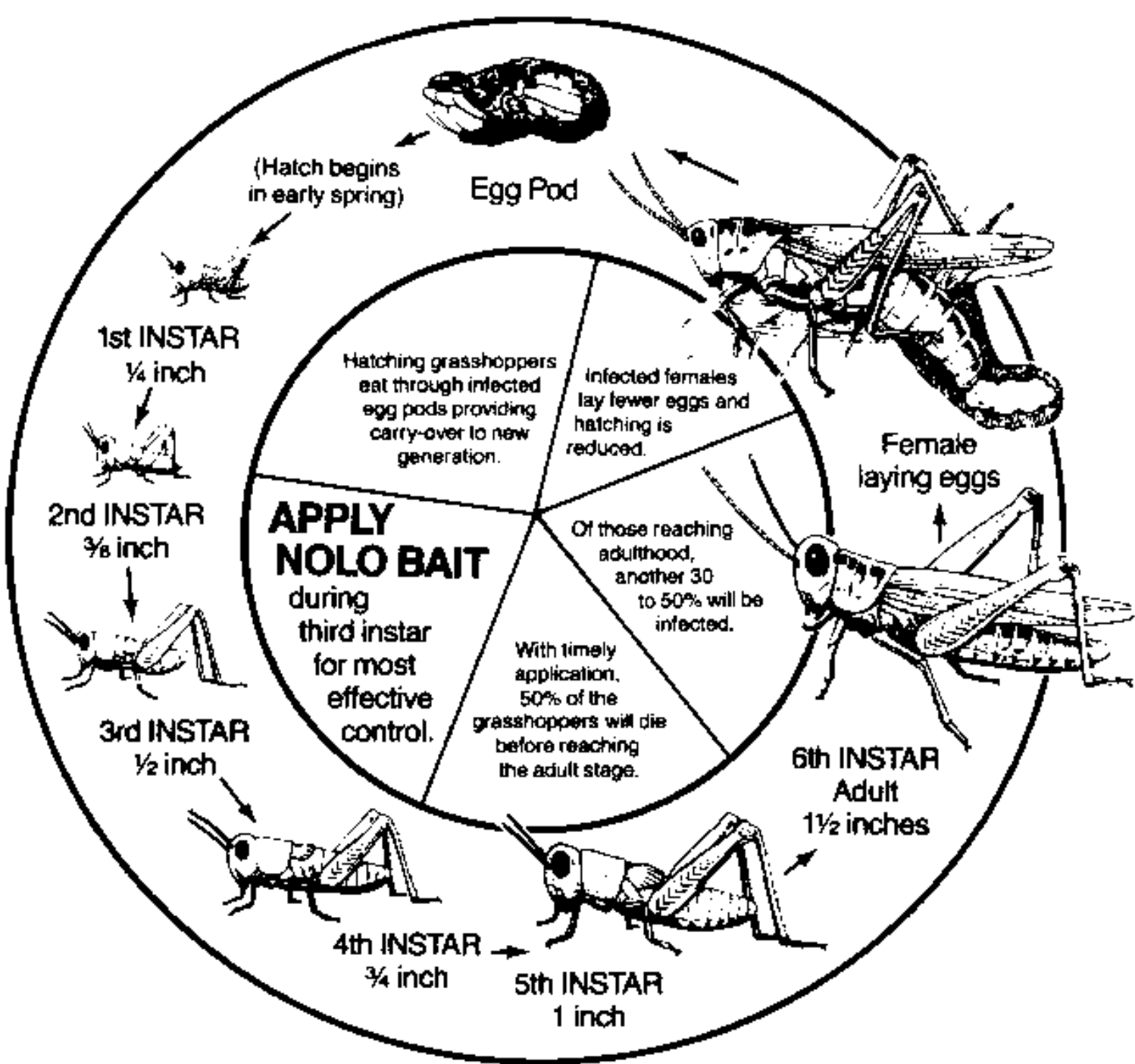
For use in suppressing grasshoppers and Mormon Crickets

Active Ingredient: *Nosema locustae* Canning\* ..... 0.05%  
Inert Ingredients: ..... 99.95%  
Total: ..... 100.00%

\*Contains at least one billion viable spores  
per 454 grams (1.0 pound)

Net contents: \_\_\_\_\_ Date Formulated: \_\_\_\_\_  
Lot# \_\_\_\_\_





If you use *Nosema locustae*, make sure the material is fresh

Apply it when the young grasshoppers are present

# Poultry for management of grasshoppers?





**Handpicking (or sweeping) early in the morning?**

**I got 247 in under 25 minutes when I tried it**





**Hemp response to hail injury can give some insight on how the crop may respond to grasshopper injuries**



**Research questions: What is the relationship between leaf loss (defoliation) and yield? Do plant injuries affect production of important compounds produced by the crop (e.g. THC, CBD)?**

**Perhaps** hail simulation trials **can also** answer questions about effects of insect defoliators in hemp







**European corn borer**



**Eurasian  
hemp borer**

Photograph from the website of the Canadian Hemp Trade Alliance

## **Stem/Stalk Boring Insects**

How important is European corn borer to hemp in the modern era?



Probably not very important anywhere –  
*and it does not occur in western Colorado*

Photograph by Shuresh Chimire

Photograph by Daniel Gilrein

An insect that surprised me a lot when found in Colorado



## Eurasian hemp borer

*Grapholita dilineana*

This is most important to flower buds and developing seeds





Eurasian  
hemp borer  
stalk  
tunneling in  
hemp in  
Wisconsin.

Photograph by Steve  
Tomlins.



**Adults were found in fields from  
5 of the 6 eastern Colorado  
counties visited in 2018**



These constitute a  
known range  
extension to the  
west of 600+ miles



***Recent reports  
of it in Western  
CO! – from human  
assisted transfers***



# Several hemipterans (“true bugs”) feed on flowers and developing seeds of hemp



**Stink bugs (4 species)**



***Lygus* bugs (2-3 species)**



# Hemipteran seed feeders



**False chinch bugs**



**Hyaline grass bug**



**Species of interest where there is continuous culture of seed-producing crops?**



# Seed Feeding Bugs and Hemp

- Feeding concentrated on flowers and developing seed
- Potential damage
  - Aborted seed, damaged seed
- Significant damage??





# Insects that Damage Flower Buds



A particular issue of  
crops grown for  
CBD production



Photograph courtesy of Karl Hillig



Photograph courtesy of Karl Hillig

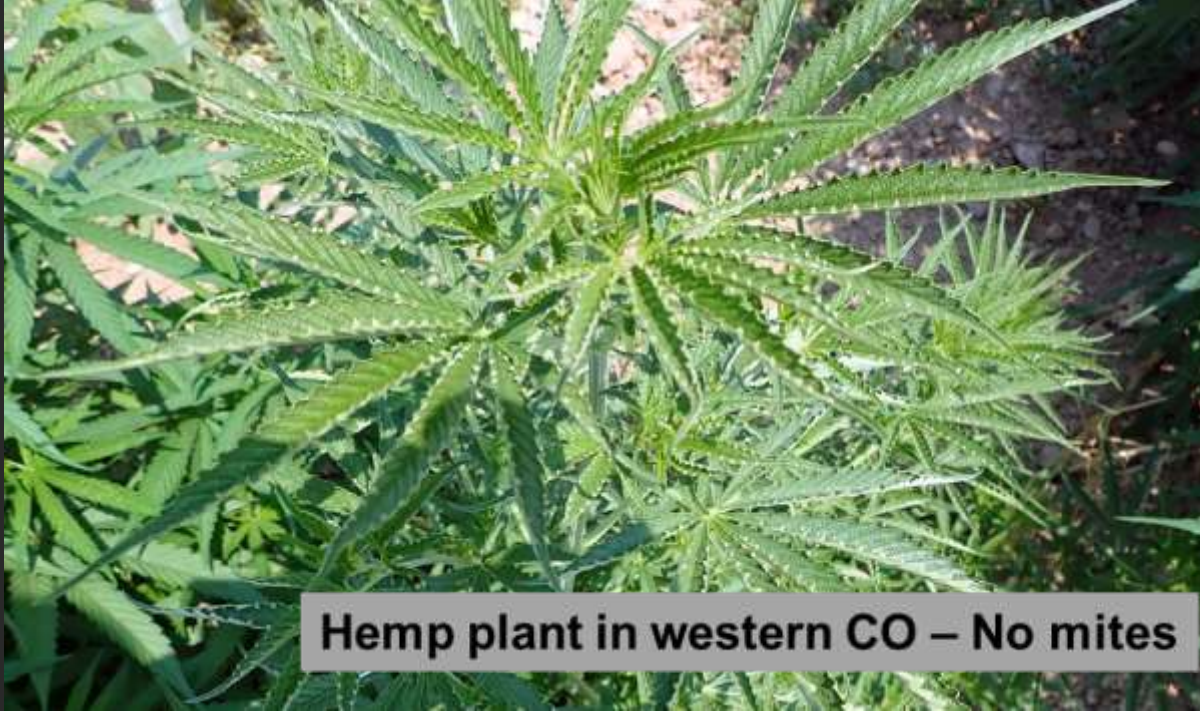
# Hemp russet mite

*Aculops cannabicola*



Is an upward leaf curl a symptom of hemp russet mite injury?





**Yes – and no.** Some cultivars seems to produce an upward leaf curl in response to hemp russet mites. Some do not.

Some genotypes normally produce upward leaf curling in the absence of mites (“taco leaf”).



**Symptoms of hemp russet mite infestation on developing buds of hemp**

**Reduction in bud size and quality is the effect of HRM injury**



# Dispersal



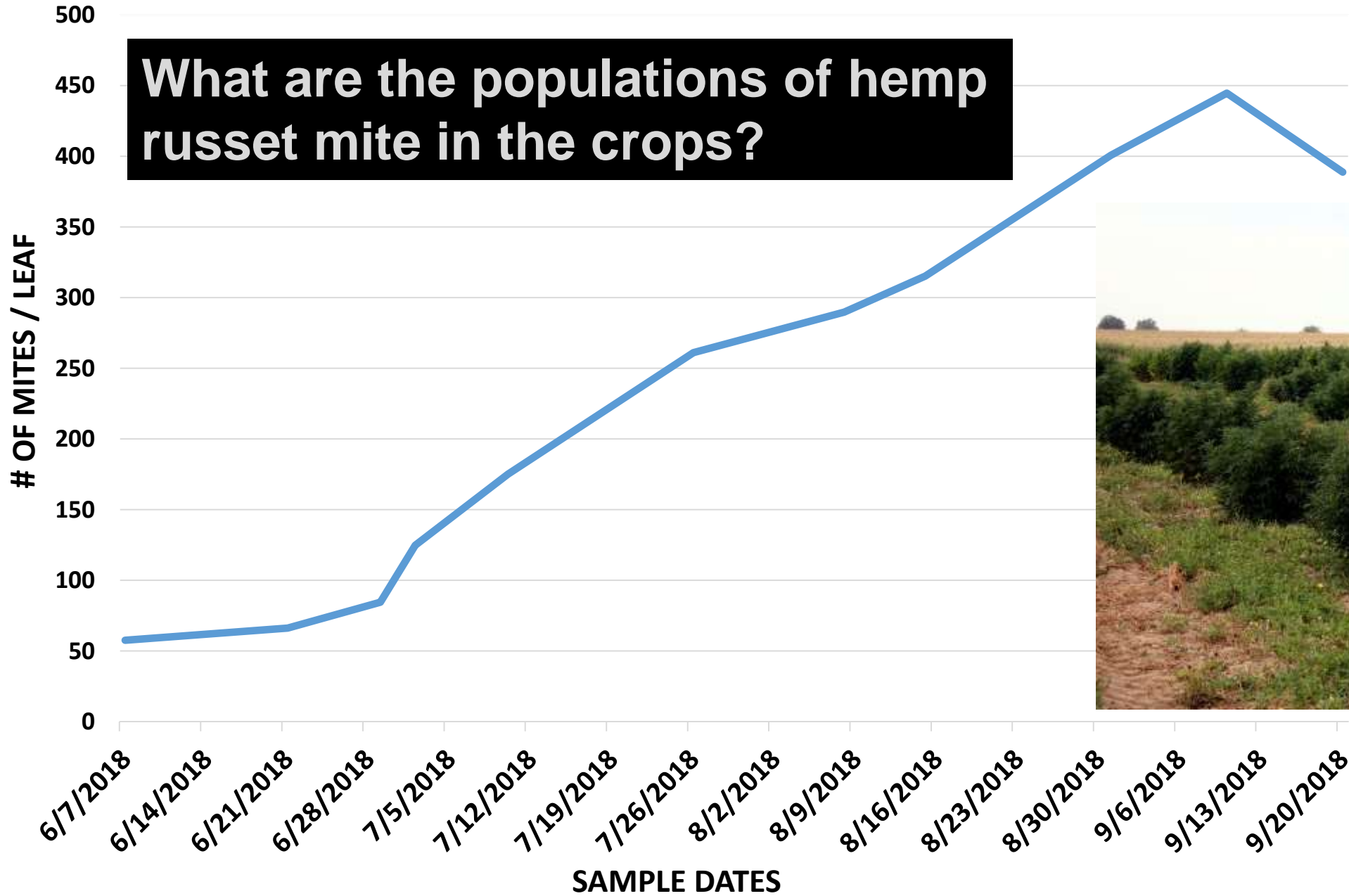
Hemp russet mites could be collected from glass slides placed above the crop canopy

Wind-blown dispersal occurs, as with other eriophyid mites



# HEMP RUSSET MITES # / LEAF

What are the populations of hemp russet mite in the crops?



# What is eating hemp russet mites in the field?



Minute pirate bugs were the only species regularly observed that could credibly be considered a hemp russet mite predator



# Predatory Mites?



University of California IPM Program

Extremely low populations  
were present in fields

Attempts to augment  
populations with release of  
*Amblyseius andersoni* were  
not promising



Direct release on plants



Release with hanging sachet

## No. Russet Mites/Terminal following 3 applications at one week intervals

- SuffOil-X 12.8
- TetraCURB 61.4
- Green Cleaner 67.7
- Untreated Check 239.4



Hemp russet mite is a problem in indoor production – and in field plantings using HRM infested transplants



**Rooted cuttings**



**Mother plants**

**Key to control:**  
**Eliminate HRM from**  
**mother plants**



## Sulfur is an excellent product for eliminating hemp russet mite from hemp

- Only two, retail products are allowed for use on the crop (in Colorado)
- **Key HRM pesticide registration need:**
  - Commercial producer formulation allowable for use on hemp (young plants, well before flowering)
    - Indoor use is critical
    - Outdoor use would be a bonus
  - Certified organic formulation would be nice



# Eurasian Hemp Borer

*Grapholita delineana*





Volunteer hemp examined June 18 were infested with larvae in late stages of development



The last stage larva changes from cream colored to pinkish, as do some other *Grapholita* species



**Exterior symptom of stalk tunneling – leaf flagging**





Eurasian  
hemp borer  
stalk  
tunneling in  
hemp in  
Wisconsin.

Photograph by Steve  
Tomlins.





Serious damage to buds  
was observed in one  
field located in  
northeastern Colorado



# Eurasian Hemp Borer – Potential key pest of crop in North America on cultivars grown for seed?



Photograph by Steve Tomlins



# Management Options for Eurasian Hemp Borer at Present

- Destroy all crop residues at the end of the season that could contain living stages that survive between seasons
- Rotate the location of consecutive hemp crops a considerable distance
- Insecticides????
  - Azadirachtin???????



Most significant  
potential pest of the  
crop in Colorado

## Corn earworm

*Helicoverpa zea*





Corn earworm shows wide range in coloring and patterning on hemp (as with most crops)



Corn earworm tunnels into and can extensively damage developing buds of hemp





**In 2016, 2018 and 2019  
corn earworm caused  
serious losses to CBD  
hemp in southeastern  
Colorado**

**Adults of the corn earworm**



**One night's light trap capture,  
September 8, 2016**



# A fact sheet on Corn Earworm at the **Hemp Insect Website**

Insects that Feed on Hemp – Seed/Bud Feeders

## Corn Earworm

*The insect that has shown the most potential to damage hemp in Colorado is the **corn earworm** (*Helicoverpa zea*). This is one of the most widespread and commonly damaging insects in much of the United States, affecting both field crops and vegetable crops. Evidence of its importance is indicated by it having three accepted common names: corn earworm (when in corn), **tomato fruitworm** (when feeding on fruits of peppers, tomatoes, etc.), and **bollworm** (when feeding on cotton bolls).*

In hemp the primary damage occurs when they tunnel into buds and developing seeds. Damage to hemp by corn earworm has potential to cause significant damage, particularly to crops grown for production of large buds to extract CBD or other pharmaceutical compounds. Potential damage to fiber or seed producing cultivars is likely to be minimal. Populations of this insect vary greatly from season to season in Colorado and will usually peak in hemp during late August and/or September.



Corn earworm caterpillars in hemp. The bottom photo is by Janna Beckerman, [purduehemp.org](http://purduehemp.org)

Parts of Colorado include areas of the northern range of where corn earworm has historically been able to survive through winter (as a pupa in the soil). However, mild winters will allow this



Melissa Schreiner

## Proposed Management Plan for Corn Earworm in Hemp

**Background.** Corn earworm (*Helicoverpa zea*) is a key pest of hemp grown in Colorado. Damage is caused by the larva (caterpillar) that tunnels through and destroys maturing buds. This insect is present every growing season in Colorado, where it may be found on a wide variety of crops and weed hosts. However, population size, and associated damage, can vary greatly from season to season and by location.

Traps (light, pheromone) can be used to capture the adult stage of this insect, a night flying moth. When used over a period of time these traps can provide information on in changes in abundance of the insect, with high trap captures being associated periods of peak egg laying on plants.

The insecticides that have the most potential to control corn earworm - and are allowable by the Colorado Department of Agriculture for use on cannabis crops – are certain strains of the microbial insecticide *Bacillus thuringiensis* (Bt). These are best applied at times coinciding with periods of peak egg laying by the adult moths and subsequent egg hatch, which occurs a couple of days after eggs are laid.

### Use of Traps for Monitoring Corn Earworm

Two types of traps can be used to capture the night flying moths of the corn earworm, light traps or pheromone traps.

Basic design of a **light trap** uses a light, preferably UV, to attract insects that fly at night. The insects then hit a vane and are funneled into a collecting container below. Usually a killing agent (often a dichlorvos Pest-Strip) is placed in the collecting container to minimize damage to the collected insects, particularly damage to the delicate wings of moths, which may be torn by “June bugs” and other other active insects that come to these traps.

Light traps will capture a wide variety of insects, mostly various kinds of moths and beetles. Traps

Present  
proposed IPM  
program for  
corn earworm in  
hemp

An IPM  
Implementation  
Phase effort

# Outline of Corn Earworm Management Program in Hemp

- **Establish a program to monitor flights of adult corn earworms using pheromone traps**
  - This should *begin by midsummer* to establish baseline of adult captures
  - Traps should be *checked twice a week* and the number of new moths recorded

**Pheromone trap used to monitor corn earworm**



# Outline of Corn Earworm Management Program in Hemp

- ***If very high numbers of moths are discovered during flowering, treatment should be considered***
  - ***Bacillus thuringiensis var. aizawi***
    - **Agree WG, XenTari Biological Insecticide**
  - ***Helicoverpa NPV***
    - ***HelicoVex***

# Agree<sup>®</sup> WG

BIOLOGICAL INSECTICIDE

For control of lepidopterous insect pests of certain terrestrial fruits, vegetables, ornamentals and flowers, tobacco, corn, cotton, soybeans, and citrus.

FOR ORGANIC PRODUCTION



Active Ingredient: *Bacillus thuringiensis* subspecies *aizawai* strain GC-91  
Solids, spores and Lepidopteran active toxins\* 50.0%  
Other Ingredients: 50.0%  
Total: 100.0%

\*The percent active ingredient does not indicate product performance and potency measurements are not federally standardized.

KEEP OUT OF REACH OF CHILDREN  
CAUTION

Net Contents: 5 or 20 Pounds  
EPA Reg. No. 70051-47  
EPA Est. No. 67545-AZ-1<sup>†</sup>  
(Lot Number with "G")  
EPA Est. No. 70051-CA-001  
Lot No.:

Manufactured by  
Certa USA, L.L.C.  
9145 Guilford Road  
Suite 175  
Cortez, CO 81321

*Bacillus thuringiensis*  
(*aizawai* strain)

Colorado allowed insecticides that can be used to control corn earworm in hemp



**Andermatt** where Nature leads Innovation  
USA [www.anderstattusa.com](http://www.anderstattusa.com)

# HELICOVEX<sup>®</sup>

Insecticidal Virus for Use in Greenhouses and Open Fields for the Control of the Corn earworm, the Tobacco budworm and the African cotton bollworm

FOR ORGANIC PRODUCTION

Active Ingredient:<sup>\*</sup>  
*Helicoverpa armigera* nucleopolyhedrovirus strain BV-0003 0.60%  
Other Ingredients: 99.40%  
Total: 100.00%

\*Contains a minimum of 7.5 x 10<sup>12</sup> viral occlusion bodies per liter.

SEE SIDE/INSIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS AND FIRST AID

Net Contents:  
Lot No.:  
EPA Reg. No.: 69553-2  
EPA Est. No.:

Manufactured by: Andermatt Biocontrol AG  
Stahlermatten 6  
6146 Grossdietwil  
Switzerland

KEEP OUT OF REACH OF CHILDREN  
CAUTION

*Helicoverpa* Nuclear Polyhedrosis Virus

# Pollinator use may complicate controls if there are insects that are pests of the crop during flowering



Fortunately, the *Bacillus thuringiensis* (Bt) and HelicoVex products used for corn earworm **are compatible with pollinators**





# Agree<sup>®</sup> WG

BIOLOGICAL INSECTICIDE

For control of lepidopterous insect pests of certain terrestrial fruits, vegetables, ornamentals and flowers, tobacco, corn, cotton, soybeans, and citrus.

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(Lot Number with "G")  
EPA Est. No. 70051-CA-001  
Lot No.:

Manufactured by  
Certa USA, L.L.C.  
9145 Guilford Road  
Suite 175  
Columbia, MO 65205

See ad

*Bacillus thuringiensis*  
(*aizawai* strain)

Colorado allowed insecticides that can be used to control corn earworm in hemp



**Andermatt** where Nature leads Innovation  
USA [www.anderstattusa.com](http://www.anderstattusa.com)

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FOR ORGANIC PRODUCTION

Active Ingredient:  
*Helicoverpa armigera* nucleopolyhedrovirus strain BV-0003 0.60%  
Other Ingredients: 99.40%  
Total: 100.00%

\*Contains a minimum of 7.5 x 10<sup>12</sup> viral occlusion bodies per liter.

SEE SIDE/INSIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS AND FIRST AID

Net Contents:  
Lot No.:  
EPA Reg. No.: 69553-2  
EPA Est. No.:

Manufactured by: Andermatt Biocontrol AG  
Stahlermatten 6  
6146 Grossdietwil  
Switzerland

KEEP OUT OF REACH OF CHILDREN  
CAUTION

*Helicoverpa* Nuclear  
Polyhedrosis Virus

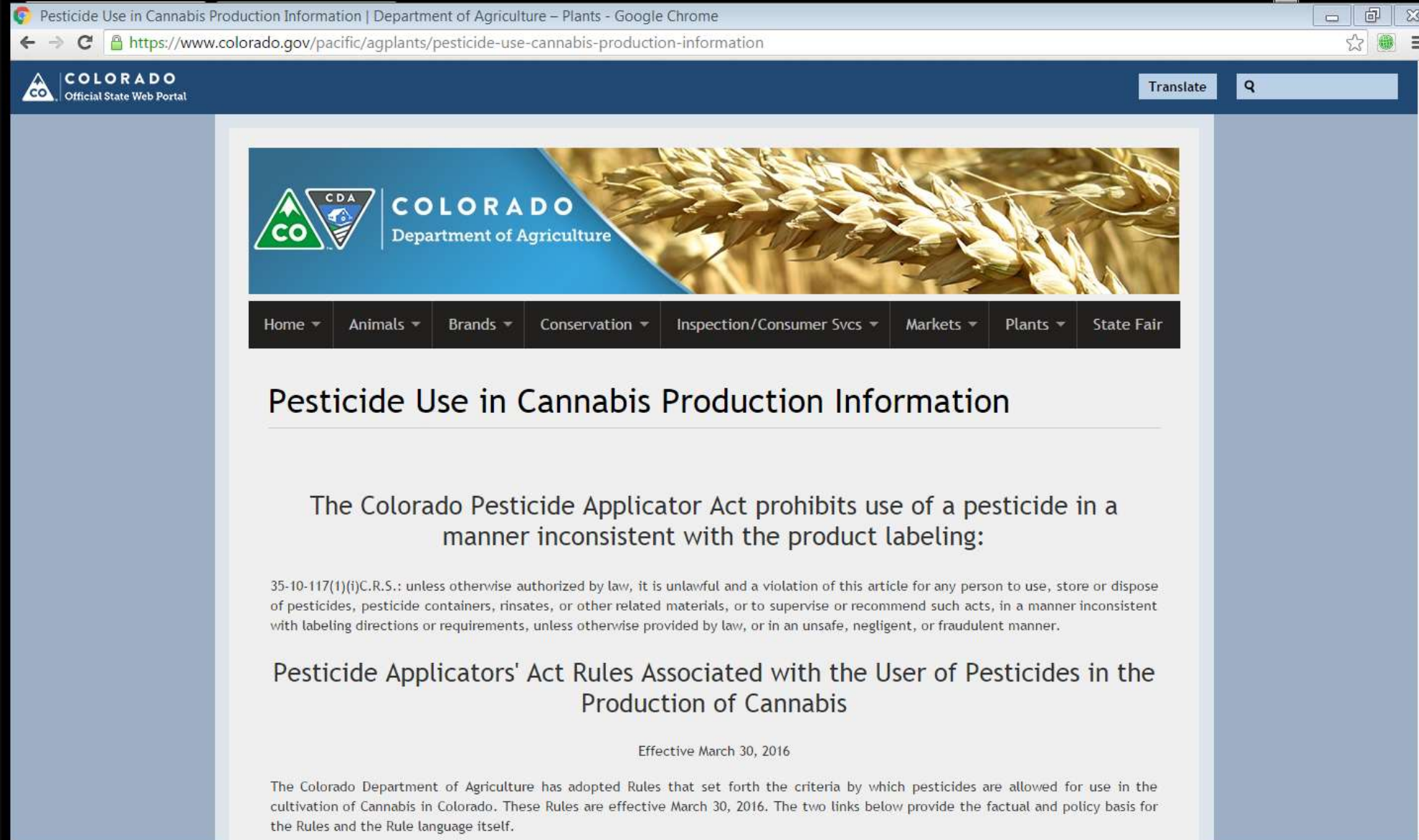
# The Pesticide Conundrum with Cannabis

- All registered pesticides can only be legally applied to sites (e.g., crops) on which they are labeled
- Presently the agency overseeing pesticide labeling (EPA) does not recognize cannabis as a crop site

*Are there pesticides that can be used on this crop now?*

In Colorado, the Colorado Department of Agriculture maintains a website of *pesticides that may be applied to hemp grown within the state*

Not all states that allow hemp production have established guidelines regarding pesticides.



The screenshot shows a web browser window displaying the Colorado Department of Agriculture's website. The page title is "Pesticide Use in Cannabis Production Information | Department of Agriculture - Plants - Google Chrome". The URL is "https://www.colorado.gov/pacific/agplants/pesticide-use-cannabis-production-information". The page features the Colorado Department of Agriculture logo and a navigation menu with options: Home, Animals, Brands, Conservation, Inspection/Consumer Svcs, Markets, Plants, and State Fair. The main content area is titled "Pesticide Use in Cannabis Production Information" and contains the following text:

The Colorado Pesticide Applicator Act prohibits use of a pesticide in a manner inconsistent with the product labeling:

35-10-117(1)(i)C.R.S.: unless otherwise authorized by law, it is unlawful and a violation of this article for any person to use, store or dispose of pesticides, pesticide containers, rinsates, or other related materials, or to supervise or recommend such acts, in a manner inconsistent with labeling directions or requirements, unless otherwise provided by law, or in an unsafe, negligent, or fraudulent manner.

**Pesticide Applicators' Act Rules Associated with the User of Pesticides in the Production of Cannabis**

Effective March 30, 2016

The Colorado Department of Agriculture has adopted Rules that set forth the criteria by which pesticides are allowed for use in the cultivation of Cannabis in Colorado. These Rules are effective March 30, 2016. The two links below provide the factual and policy basis for the Rules and the Rule language itself.

# Criteria for Pesticides Allowed to be Used on Cannabis in Colorado

- **Pesticides that require federal registration under Section 3 of FIFRA**
  - **Active ingredient is exempt from the requirements of food crop tolerance, *and***
  - **Label has directions for use on unspecified food crops, including unspecified food crops grown as bedding plants**
  - **EPA and CDA registration is required**
  - **Pesticide is registered on tobacco**
- **Section 25b minimum risk pesticides (exempt from most federal registration)**

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Example of pesticide label with a very broadly described Crop Site

Labels written in this manner can be interpreted as allowing use on hemp

Such labels are rare



CROPS (including but not limited to)	APPLICA- TION	COMMENTS
Tomatoes, lettuce, cucumbers, peppers, sweet corn, broccoli, cauliflower, cabbage; peas, beans, beets, celery, onions, garlic, leek, asparagus, okra, eggplant strawberries, grapes, escarole ornamentals and flowers	<b>Rate:</b> 1.0 – 2.5 fl. oz. per acre  <b>Method:</b> Sprayer, Aircraft  <b>Equipment:</b> Sprayer, Sprinkler Irrigation, Mist Sprayer	Repeat application as above every 6 – 8 sunny days (counting 2 partially sunny days as 1 sunny day) if monitoring indicates that reapplication is necessary.  Lower rates (every 6 sunny days) may be used during vegetative stages of the crop or when tank mixed with other insecticides.  When flowers, fruits or other harvested structures of the plant are present or when infestation becomes strong, use the higher rates.
Cotton, alfalfa, soybeans, peanuts, potatoes, corn, wheat, sweet potatoes, tobacco, sunflowers, sugar beets, sorghum, floriculture, and border plants		Sweet corn and corn: For very sunny regions (e.g., California), use 0.5 to 1.25 fl. oz./acre every 3 days; for less sunny regions, use 1 to 2.5 fl. oz./acre every 6 to 8 days.  Cover the whole larval hatching period of the treated generation until harvest.

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The screenshot shows a web browser window with the address bar displaying <https://www.colorado.gov/pacific/agplants/pesticide-use-cannabis-production-information>. The page header includes the Colorado Department of Agriculture logo and navigation links: Home, Animals, Brands, Conservation, Inspection/Consumer Svcs, Markets, Plants, and State Fair. The main content area features a large banner image of golden wheat stalks. Below the banner, the title "Pesticide Use in Cannabis Production Information" is displayed. The text states: "The Colorado Pesticide Applicator Act prohibits use of a pesticide in a manner inconsistent with the product labeling:" followed by a legal citation: "35-10-117(1)(i)C.R.S.: unless otherwise authorized by law, it is unlawful and a violation of this article for any person to use, store or dispose of pesticides, pesticide containers, rinsates, or other related materials, or to supervise or recommend such acts, in a manner inconsistent with labeling directions or requirements, unless otherwise provided by law, or in an unsafe, negligent, or fraudulent manner." Below this, the heading "Pesticide Applicators' Act Rules Associated with the User of Pesticides in the Production of Cannabis" is shown, with the effective date "Effective March 30, 2016". The final paragraph explains that the Colorado Department of Agriculture has adopted Rules for pesticide use in cannabis cultivation, effective March 30, 2016, and provides links for the Rules and the Rule language itself.


# Website page to access what Colorado Department of Agriculture considers to be ***not not allowable (= allowable)*** for use on Cannabis in Colorado

## Pesticides Allowed for Use on Cannabis

Each time we update the Cannabis pesticides list or have industry news we will send out an email blast and you can [sign up here](#) to be included. As of March 30, 2016 all past lists will be removed from the CDA website and updates will be made only to the list of approved pesticides that may be used in accordance with Pesticide Applicators' Act Rule - Part 17.

The list developed by CDA is intended to assist Colorado Cannabis growers in identifying which pesticides can be used legally in accordance with the Pesticide Applicators' Act and its Rules in the production of Cannabis (marijuana and industrial hemp), it is not an endorsement or recommendation to use these products in the production of Cannabis in Colorado. These products have not been tested to determine their health effects if used on Cannabis that will be consumed and thus the health risks to consumers is unknown. by including products on this list, therefore, CDA make no assurances of their safety or effectiveness when used on Cannabis and is not responsible or liable for any such use.

To view or download the current list, click the link below:

- Pesticides allowed for use in Cannabis production in accordance with the PAA Rule: Effective June 29th, 2016
  - [PDF](#)
  - [Excel](#) 
- This link provides a list of products that have been removed from the list of pesticides that may be used on Cannabis. These products were either removed from the list prior to the effective date of the rule or were removed as a result of them not meeting the rule criteria as of March 30th, 2016.
  - [Excel](#)
- Selected Examples of pesticides that cannot be used in marijuana production January 13 2016
  - [PDF](#)

Products added since the last update are now highlighted in red on the PDF version of the file. The Excel version has the date that each product was added and can be sorted or filtered by name, date, active ingredient, etc.

A page listing the current products that are allowed for use on all Cannabis (including hemp) grown in Colorado

Colorado product name	Company	EPA Number	Active Ingredients	Percent	Commercial	Personal use	Hemp	Comments	Pesticide Type
#1 Fungus Bully (concentrate)	Solis LLC	25(b)	Sodium Lauryl Sulfate Corn Oil Citric Acid	8.000% 1.680% 1.130%	Yes	Yes	Yes		Fungicide
#1 Feet Bully	Solis LLC	25(b)	Castor Oil Garlic Oil Corn Oil	8.000% 4.000% 4.000%	Yes	Yes	Yes		Insecticide
420 Drench Bully	Solis LLC	25(b)	Sodium Lauryl Sulfate Castor Oil Corn Oil	16.000% 8.000% 4.000%	Yes	Yes	Yes		Fungicide, Insecticide
420 Fungus Bully (concentrate)	Solis LLC	25(b)	Sodium Lauryl Sulfate Corn Oil Citric Acid	8.000% 1.680% 1.130%	Yes	Yes	Yes		Fungicide
420 Feet Bully Concentrate	Solis LLC	25(b)	Castor Oil Garlic Oil Corn Oil	8.000% 4.000% 4.000%	Yes	Yes	Yes		Insecticide
420 Feet Bully Powder	Solis LLC	25(b)	Garlic White Pepper Citric Acid	0.250% 0.130% 0.080%	Yes	Yes	Yes		Insecticide
420 Feet Bully Ready-to-Use	Solis LLC	25(b)	Castor Oil Garlic Oil Corn Oil	0.500% 0.250% 0.250%	Yes	Yes	Yes		Insecticide
70% Neem Oil (Monterey)	Lawn and Garden Products, Inc	70061-3-64705	Clarified Hydrophobic Extract of Neem Oil	70.000%	No	Yes	No		Fungicide, Insecticide
#6 Nites & Mold Ready to Use	NorCal Plant Nutrients LLC	25(b)	Rosemary Oil Lemon Grass Oil Cinnamon Oil Cottonseed Oil	0.300% 0.100% 0.100% 0.100%	Yes	Yes	Yes		Fungicide, Miticide
#6 Nites + Mold Concentrate	NorCal Plant Nutrients LLC	25(b)	Rosemary Oil Lemon Grass Oil Cinnamon Oil Cottonseed Oil	1.200% 0.600% 0.500% 0.300%	Yes	Yes	Yes		Fungicide, Miticide

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Colorado product name	Company	EPA Number	Active Ingredients	Percent	Commercial	Personal use	Hemp	Comments	Pesticide Type
Agri-Fox Systemic Fungicide	Lawn and Garden Products, Inc	71963-1-64705	Phosphorous Acid, Mono- and Di- Potassium Salts of	45.800%	Yes	Yes	Yes	Use allowed prior to final transplant.	Fungicide
Agri-Fox Systemic Fungicide	Liquid Fertilizer Pty. Ltd.	71963-1	Phosphorous Acid, Mono- and Di- Potassium Salts of	45.800%	Yes	Yes	Yes	Use only allowed prior to final transplant, unless grown in restricting hydroponics systems.	Fungicide
Agri-Fox Systemic Fungicide Plus	Liquid Fertilizer Pty. Ltd.	71963-2	Phosphorous Acid, Mono- and Di- Potassium Salts of	60.500%	Yes	No	Yes	Use allowed prior to final transplant.	Fungicide
AIPer-Plus Concentrate	AIPer-Plus	25(b)	Geranium Oil Rosemary Oil Clove Oil	0.300% 0.330% 0.330%	Yes	Yes	Yes		Insecticide
AIPer-Plus Ready to Use	AIPer-Plus	25(b)	Geranium Oil Rosemary Oil Clove Oil	0.150% 0.130% 0.150%	Yes	Yes	Yes		Insecticide
Made Systemic Fungicide	Clary Chemical Corporation	71963-1-1001	Phosphorous Acid, Mono- and Di- Potassium Salts of	45.800%	Yes	Yes	Yes	Use allowed prior to final transplant.	Fungicide

Most all of the CDA allowable pesticides are also allowed in production of Certified Organic crops

# Whether or not a pesticide is allowed to be used in Certified Organic production ***does not mean it is legal to be used in hemp!!***



Database product name	Company	EPA Number	Active Ingredients	Pest	Commercial	Personal use	Hemp	Comments	Pesticide Type
41 Fungus Bulb Systemic	Sella LLC	2004	Sulfur, Lead of Sulfate Cyanide Sulfur Acid	8.000% 8.000% 1.100%	Yes	Yes	Yes		Fungicide
41 Fung Bulb	Sella LLC	2004	Cyanozin Sulfur Sulfur Acid	8.000% 4.000% 4.000%	Yes	Yes	Yes		Insecticide
410 Insect Bulb	Sella LLC	2004	Sulfur, Lead of Sulfate Cyanide Sulfur Acid	16.000% 8.000% 4.000%	Yes	Yes	Yes		Fungicide, Insecticide
410 Fungus Bulb Systemic	Sella LLC	2004	Sulfur, Lead of Sulfate Cyanide Sulfur Acid	8.000% 8.000% 1.100%	Yes	Yes	Yes		Fungicide
410 Fung Bulb Concentrate	Sella LLC	2004	Cyanozin Sulfur Sulfur Acid	8.000% 4.000% 4.000%	Yes	Yes	Yes		Insecticide
410 Fung Bulb Powder	Sella LLC	2004	Sulfur Sulfur Sulfur Acid	8.000% 8.000% 8.000%	Yes	Yes	Yes		Insecticide
410 Fung Bulb Ready-to-Use	Sella LLC	2004	Cyanozin Sulfur Sulfur Acid	2.000% 0.750% 0.750%	Yes	Yes	Yes		Insecticide
206 Neem Oil (Enhanced)	Loam and Control Products, Inc	7005-0-0470	Certified Organic Neem Oil	70.000%	Yes	Yes	Yes		Fungicide, Insecticide
80 Insect & Mite Ready-to-Use	Loam/Plant Nutrition LLC	2004	Resmethrin Limonene Chrysanthemum Pyrethrin	2.000% 0.100% 0.100% 0.100%	Yes	Yes	Yes		Fungicide, Insecticide
80 Insect & Mite Concentrate	Loam/Plant Nutrition LLC	2004	Resmethrin Limonene Chrysanthemum Pyrethrin	1.200% 0.050% 0.050% 0.050%	Yes	Yes	Yes		Fungicide, Insecticide

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Database product name	Company	EPA Number	Active Ingredients	Pest	Commercial	Personal use	Hemp	Comments	Pesticide Type
Agri-Flu Systemic Fungicide	Loam and Control Products, Inc	71062-0-0470	Phosphoric Acid, Manganese and 20-Potassium Sulfate	45.000%	Yes	Yes	Yes	Use only allowed prior to seed emergence.	Fungicide
Agri-Flu Systemic Fungicide	Liquid Nutrition, Inc.	71062-0	Phosphoric Acid, Manganese and 20-Potassium Sulfate	45.000%	Yes	Yes	Yes	Use only allowed prior to seed emergence, unless grown in non-sterilized hydroponic systems.	Fungicide
Agri-Flu Systemic Fungicide Plus	Liquid Nutrition, Inc.	71062-0	Phosphoric Acid, Manganese and 20-Potassium Sulfate	65.000%	Yes	Yes	Yes	Use allowed prior to seed emergence.	Fungicide
Agri-Flu Concentrate	Agri-Flu	2004	Spinosad Resmethrin Clothianidin	5.000% 0.200% 0.200%	Yes	Yes	Yes		Insecticide
Agri-Flu Ready-to-Use	Agri-Flu	2004	Spinosad Resmethrin Clothianidin	0.100% 0.100% 0.100%	Yes	Yes	Yes		Insecticide
Multi Systemic Fungicide	Chemical Corporation	71062-0-040	Phosphoric Acid, Manganese and 20-Potassium Sulfate	45.000%	Yes	Yes	Yes	Use allowed prior to seed emergence.	Fungicide

When hemp “grows up” as a crop, addressed by federal laws and regulations as are all other crops - ***how will the pesticides issues work out?***



***It will very likely vary by the type of hemp crop, and end use***

# Hemp Grown for Fiber and Seed



**For seeds, perhaps this would be considered under Crop Group 20 (Oilseeds, such as sunflower, cotton seed and canola/rape seed)**

***For a strictly fiber grown crop?***

# Hemp Grown for CBD



**This poses some more serious registration problems**





# Hemp Grown for CBD



This poses some obvious registration problems.

This produces an extracted product that is consumed by humans, and in different manners (e.g., ingested, inhaled)



# Hemp Grown for CBD



**This poses some obvious registration problems.**

**This produces a product that is applied to humans, and in different manners.**

**Extraction methods used will affect potential for residues, and these must be studied.**



# You may wish to check out the Colorado Hemp Insect Website for periodic updates on this subject



COLORADO STATE UNIVERSITY

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Hemp Insects

[Home](#) [Hemp Insect Factsheets](#) [Hemp Insect Images](#) [Regulations and Pesticide Use](#) [Got Bugs?](#) [Recommendations](#)

[Future Students](#) [Commencement](#) [Dire](#)

## Insect Management Considerations in Hemp Production

The Hemp Insect Website is designed to provide hemp producers a way to recognize and to better understand the insects, mites, and other “bugs” that are present when this crop is grown in North America.

The goals of the Hemp Insect Website are to:

- (1) Provide description of all insects and mites observed in production of hemp;
- (2) Provide information on the habits of all insects that are associated with hemp production.

At present the Hemp Insect Website does give particular attention to insects and mites that are present within the High Plains/Rocky Mountain area of the western United States. This is because, to date, the most extensive surveys of hemp insects have occurred in this region, mostly in Colorado from 2015 to the present. However, the goal of this website is to provide progressively more comprehensive treatment of insects associated with hemp production throughout North America. Submission of photos and inquiries about insects observed on hemp is encouraged from anywhere and the website should expand as the field of hemp insect pest management develops in the United States and Canada.

Note: This website is limited to insect issues involving hemp, defined as *Cannabis* grown for seed, fiber, or non-THC pharmaceutical products. *This is not a forum for marijuana.* Industrial



# Insects/Mites found in Hemp: Pest Management Needs



Questions????

# **This presentation will be posted at the Colorado State Insect Information Website**

- **Housed at** Department of Bioagricultural Sciences and Pest Management
  - **Search “BSPM CSU”**
- **Within “Entomology”**
- **“Insect Information”**
  - **Extension presentations are posted at the bottom of the page, most recent at end**

COLORADO STATE UNIVERSITY COLLEGE OF AGRICULTURAL SCIENCES Bioagricultural Sciences & Pest Management

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## Insect Information

*All materials needed in another accessible format can be*

### Arthropods of Colorado Fact Sheets

This is a listing of about 200 downloadable fact sheets related to arthropods and other "bugs" found in Colorado. It contains fact sheets that are written for the Colorado Arthropods of Interest program and the Extension fact sheets that are related to insects.

[Fact Sheets](#)

### Miscellaneous Insect Information

This contains a variety of downloadable fact sheets and pamphlets on diverse miscellaneous subjects, from "Bug Mugs" and "Life in a Colorado Water Garden" to "Mystery Bites and Itches" and "Commercially Available Sources of Biological Control Organisms: Sources and Uses in Colorado."

[Resources](#)

#### Some Entomology Hot Links:

- [Colorado Hemp Insect Website](#)
- [Western Colorado Entomology Website](#)
- [IPM Images/Bagwood \(Cranshaw\)](#)
- [IPM Images/Bagwood \(Pearls\)](#)
- [Entomology Resources List](#)
- [Honey Bee Swarm Hotlines](#)



About 200 fact sheets on Colorado "Bugs" linked here



Top of the Colorado State Insect Information Website

### Hemp Insect Information

This links directly to the Hemp Insect Website, which includes information being developed to better recognize and manage insects associated with industrial hemp.

[Hemp Insect Website](#)

### Master Gardener Information

This includes the handouts and PowerPoint presentations (as PDF) used in Master Gardener Entomology training. These will get updated annually at the end of the winter/spring training programs.



[Handouts](#)

[PowerPoint Presentations Used in 2018](#)

### Recent Extension Presentations

This is a listing that provides the PowerPoint presentations (as PDF) of most Extension entomology programs conducted during the past 12 months.

[PowerPoint Presentations/Webinars](#)

This presentation will be found here



Bottom of the Website page