Oregon State University Extension Service

Integrated Pest Management for the Cereal Leaf Beetle

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Malheur Co. Entomology Short Course
Four Rivers Cultural Center, Ontario, OR
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Objective

Overview of……

- CLB History/Background and Economic Implications
- CLB Biology, Phenology & Injury Symptoms
- Integrated Pest Management Options

Cereal Leaf Beetle

Oulema melanopus (Coleoptera:Chrysomelidae)

- Native to Europe and Asia
- First official record in U.S. = Michigan 1962
- Now widespread across eastern & mid-western states and into Canada
- First found in OR, ID & WA in 1999

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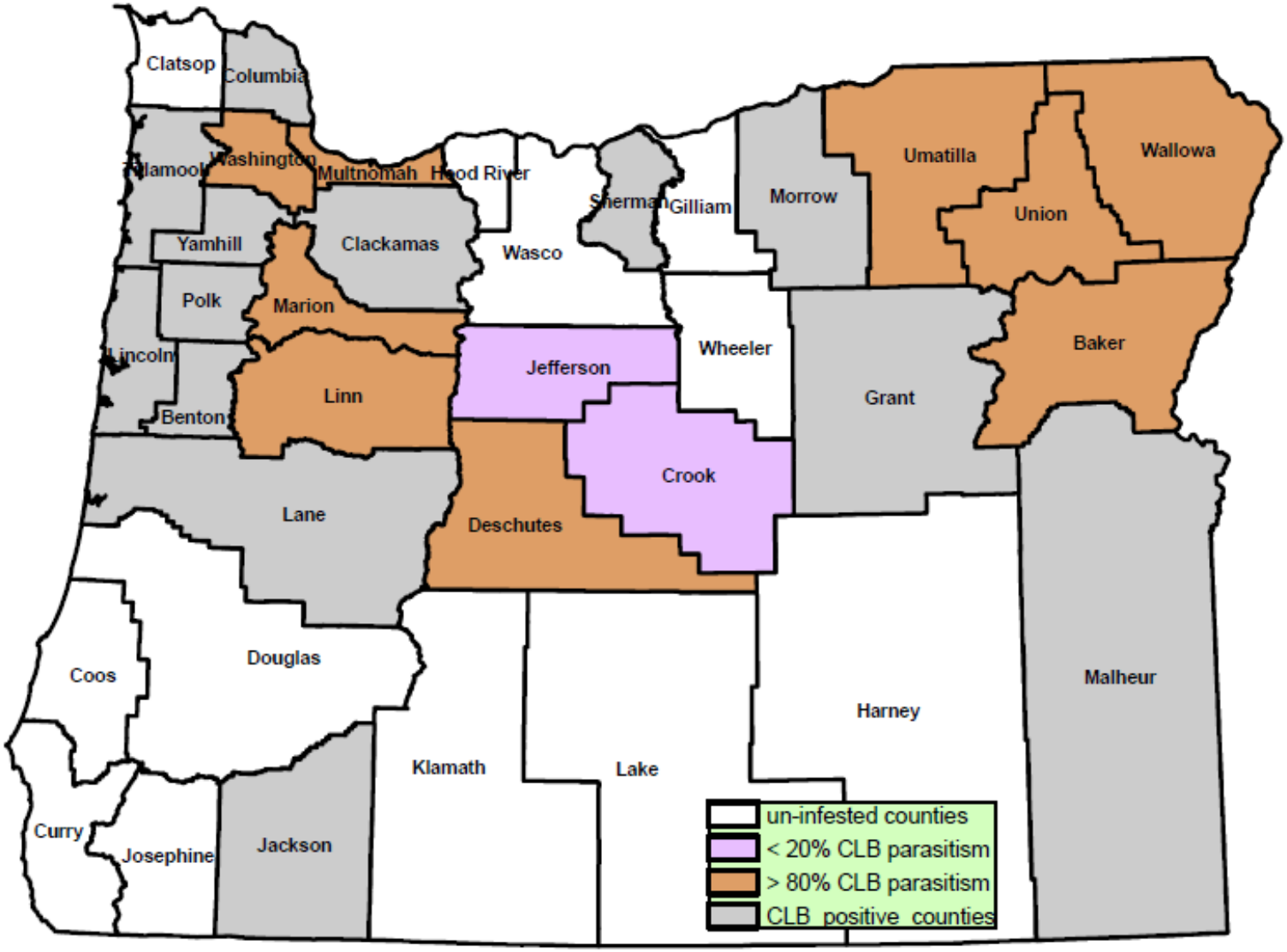
Cereal leaf beetle and larval parasitoid wasp (*T. julis*) distribution in Oregon - 2010



ODA IPPM Annual Survey = 24 infested counties in 2012

2009 ISDA CEREAL LEAF BEETLE SURVEY INFESTED COUNTIES

Oulema melanopus

Boundary 1994
Bonner 1998
Kootenai 1998
Shoshone
Benewah 2005
Latah 2004
Clearwater 2007
Nez Perce 2004
Lewis 2004
Idaho 2004
Lemhi 2003
Adams 2000
Valley 2000
Washington 1998
Payette 1998
Gem 1998
Boise 1997
Custer 2003
Clark 2001
Fremont 2001
Jefferson 1998
Madison 1998
Teton 2002
Butte 2002
Canyon 1997
Ada 1996
Elmore 1997
Camas 1998
Blaine 1995
Bonneville 1995
Bingham 1995
Gooding 1997
Lincoln 1997
Minidoka 1996
Jerome 1995
Owyhee 1996
Power 1995
Caribou 1996
Bannock 1994
Twin Falls 1996
Cassia 1995
Oneida 1995
Franklin 1992
Bear Lake 1995

Uninfested County

Infested Counties

Darcy Heckathorne

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Yield Loss Potential – Small Grains

Yield Loss = damage level + crop stage/vigor

dryland –vs- irrigated, low –vs- high vigor

In OR and WA, yield losses up to 25% in spring wheat and 18% in winter wheat have been observed

In eastern/mid-western states, yield losses up to 55% in spring wheat and 75% in oats & barley

Low yield impact when damage occurs during late head fill

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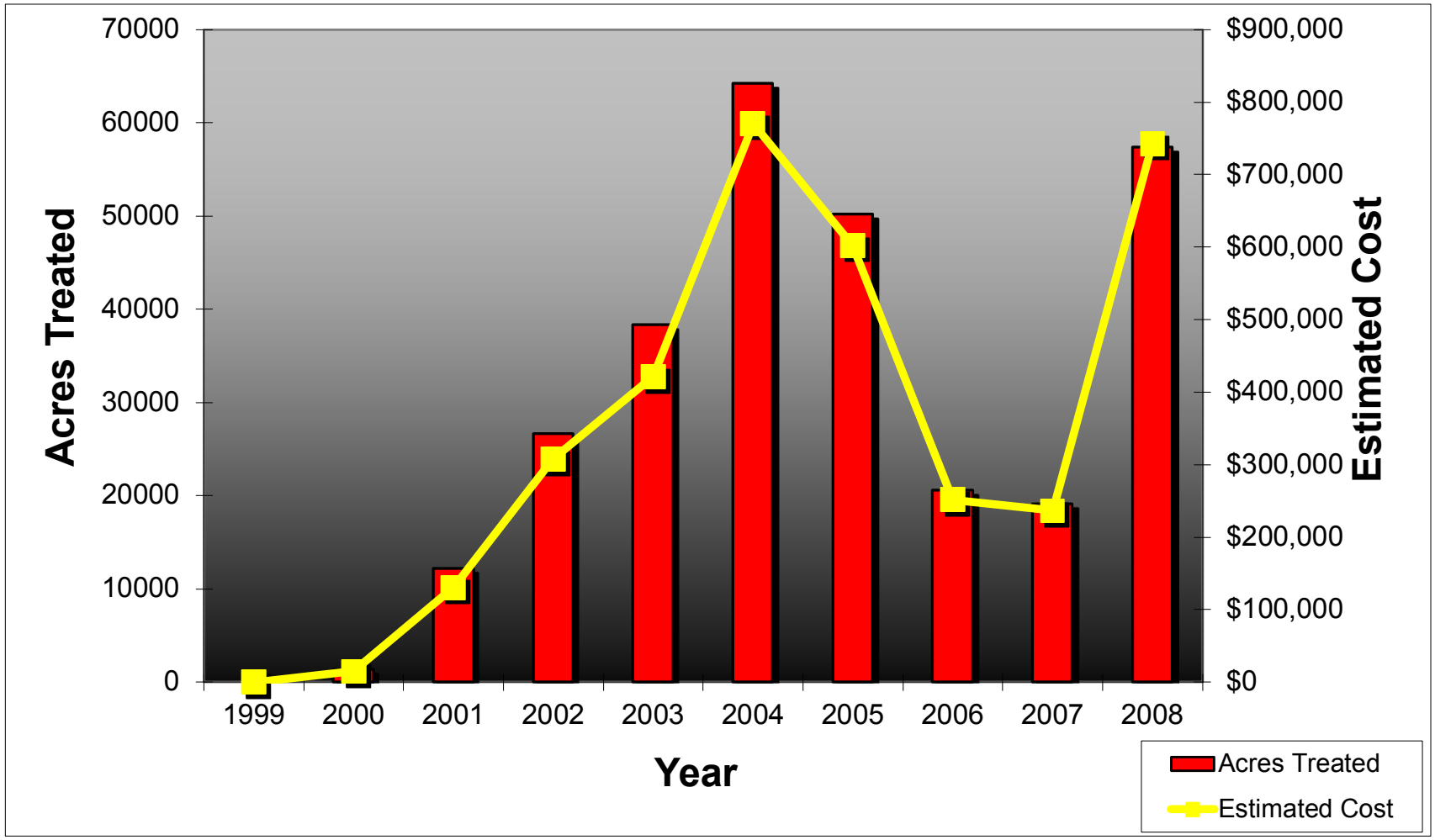
Acreage Treated & Estimated Cost of CLB Control in OR



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CA Exterior Quarantine for CLB

CLB not found in CA…..restrictions for certain ag products entering CA

- Small grains, straw/hay, grass sod, grass & forage seed, fodder/plant liter, Christmas trees, used harvesting equipment & machinery

CLB-infested counties – products must be certified by state department of ag the shipment has been treated for CLB

- Cleaning, fumigation

Non-CLB infested counties – must certify the origin from un-infested counties (County of Origin Certificate)

Exemptions do exist

- Part of crop transported, previous use, packaging type, time of year, etc.

CLB – Host Crops & Weeds

Many grass crop, forage and weedy species

- Small grain
  - winter –vs- spring
- Corn
- Sorghum
- Rice
- Timothy
- Orchardgrass
- Millet
- Brome spp.
- Reed canarygrass
- Fescue spp.
- Ryegrass spp.
- Bluegrass
- “wild” grasses
  - native & introduced
- Wild oat
- Quackgrass
- Jointed goatgrass
- foxtail

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CLB – Damage on corn

CLB – Turfgrass seed

Heavy CLB damage on Per. ryegrass in Marion County…

Seedling grass seed fields may serve as over-wintering sites for new adults.

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CLB Life Stages - Adult

- Approx. ¼” long
- Black head
- Orange-red thorax & legs
- Metallic, bluish-black wing covers (elytra)
- Chew completely through the leaf
- ***Drop to the ground when disturbed***

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CLB Life Stages – Adult "Lookalike" spp.

- Several other small beetles that may look similar……
- Soft-winged flower beetle (Coleoptera: Melyridae)
- Native predator feeds on aphids, alfalfa weevils and immature stages of several other insects.

Lookalike Collops sp. (left) and adult CLB (right). (Photo by G. Clevenger)

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CLB Life Stages – Larva

~ 1/16” at 1st instar

~ ¼” at 4th instar

Black head, pale yellow body under black slime (fecal material)

Resemble small slugs

CLB Life Stages – Larva

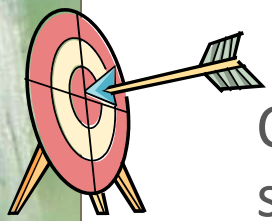
Inter-veinal feeding

Consume mesophyl & upper leaf cuticle

“window-pane” or “frosted” appearance

90% of damage during last 2 instar stages

Active 3 to 4 weeks



Control needed ***prior to*** this stage if infestation at or above threshold

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Extremely isolated case of FROST damage?

CLB Life Stages – Larva

CLB pupa (Photo by G. Clevenger)

Larva “disappear” mid to late June

Drop to ground

Pupate in soil within earthen cells (difficult to find)

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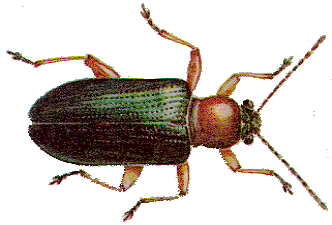
Life Cycle (1 generation/year)

Cereals



Mature corn
New stands of grasses

Adult (over-wintering) — Egg — Larva — Pupa — Adults (new summer)

April — May — June — July

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CLB Phenology – Malheur Co.

Over-wintering adults can emerge late March

Eggs = early to mid-April

4th instar larvae = late May to early June
(approximately ¼” in length)

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CLB – Habits & Preferences

Adults over-winter in protected sites near grain fields

- Grain stubble, grass crowns, permanent vegetation, riparian areas, etc.

Adults very active on calm, sunny days

- Prefer spring planted grains (e.g. oats)
- Can migrate to successively younger stands

Females begin laying eggs ~ 2 weeks after emergence

- can lay up to 300 eggs over 6-week period

New summer adults

- Do not mate
- Dormant during high heat (aestivation period)
- Migrate to any available grass host (corn, grass seed, other) to feed prior to over-wintering

Mortality over-winter can range 40-70%

- Extreme temperatures, introduced / natural predators

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IPM Options – Field Scouting

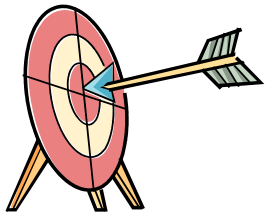
Primary tool in all IPM programs!

Correct identification of the pest

Start when temps reach mid-50s and continue through early grain fill

- Winter wheat = 2 nodes present
- Spring grain = soon after emergence (1 – 2 leaf, adult damage concern)

Goal = determine peak **1st & 2nd instar larvae**



Monitoring over time helps determine peak levels:

adult infestation - egg laying - larvae development

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IPM Options – Field Scouting

10 X 10 scouting technique

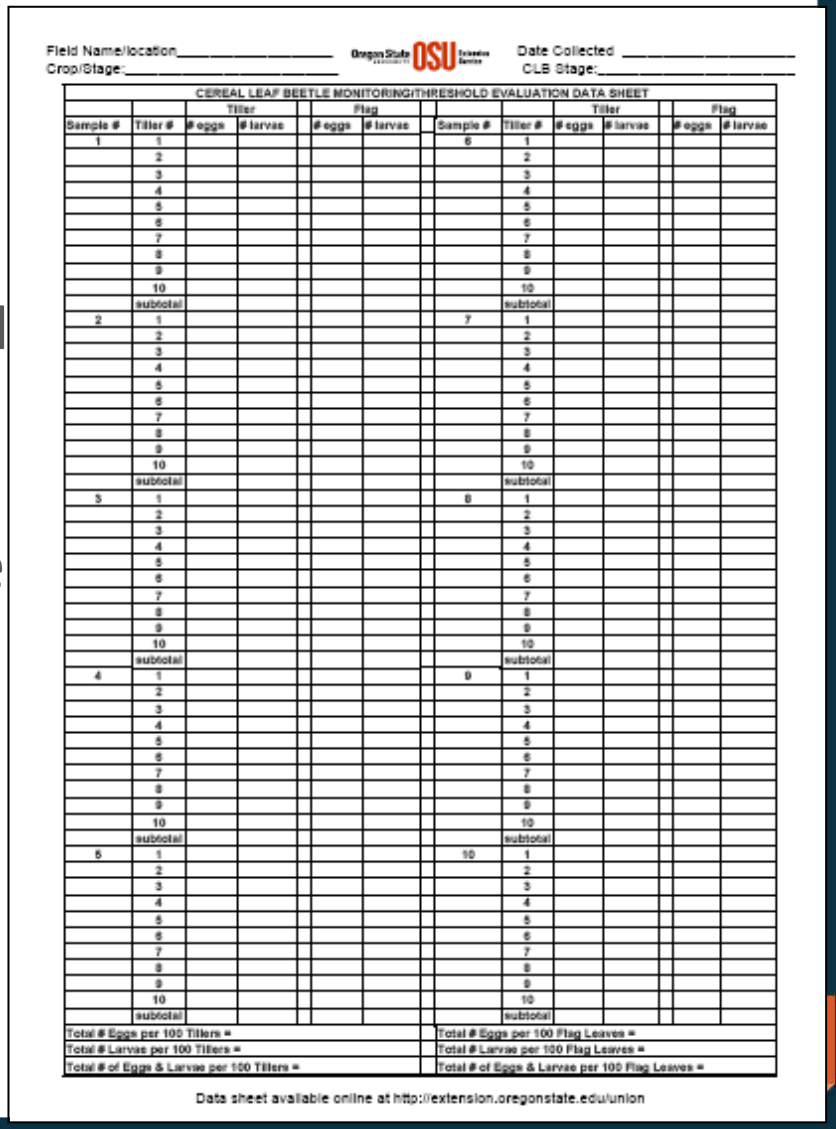
Check 10 tillers every 10 acres

- W pattern across field, check field edges apart

Record # of eggs, larvae per tille and flag leaf (adults?)

High % eggs….scout again a few days later

Data sheet available in OR CLB IPM publication later in 2013



Field Name/location_____ Date Collected _____
Crop/Stage:_____ CLB Stage:_____

CEREAL LEAF BEETLE MONITORING/THRESHOLD EVALUATION DATA SHEET

		Tiller		Flag				Tiller		Flag	
Sample #	Tiller #	# eggs	# larvae	# eggs	# larvae	Sample #	Tiller #	# eggs	# larvae	# eggs	# larvae
1	1					6	1				
	2						2				
	3						3				
	4						4				
	5						5				
	6						6				
	7						7				
	8						8				
	9						9				
	10						10				
	subtotal						subtotal				
2	1					7	1				
	2						2				
	3						3				
	4						4				
	5						5				
	6						6				
	7						7				
	8						8				
	9						9				
	10						10				
	subtotal						subtotal				
3	1					8	1				
	2						2				
	3						3				
	4						4				
	5						5				
	6						6				
	7						7				
	8						8				
	9						9				
	10						10				
	subtotal						subtotal				
4	1					9	1				
	2						2				
	3						3				
	4						4				
	5						5				
	6						6				
	7						7				
	8						8				
	9						9				
	10						10				
	subtotal						subtotal				
5	1					10	1				
	2						2				
	3						3				
	4						4				
	5						5				
	6						6				
	7						7				
	8						8				
	9						9				
	10						10				
	subtotal						subtotal				

Total # Eggs per 100 Tillers =	Total # Eggs per 100 Flag Leaves =
Total # Larvae per 100 Tillers =	Total # Larvae per 100 Flag Leaves =
Total # of Eggs & Larvae per 100 Tillers =	Total # of Eggs & Larvae per 100 Flag Leaves =

Data sheet available online at http://extension.oregonstate.edu/union

IPM Options – Economic Thresholds

Current Threshold Levels: Small Grains

Pre-Boot until Flag Leaf Fully Emerged (Feekes 1-8):

3 larvae and / or eggs per tiller

Boot stage and later (Feekes 9+):

1 larvae per tiller

Flag leaf contributes ~50% of photo-synthates during early to mid-grain fill (Simmons, 1987)

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CLB Impact on Soft White Spring Wheat Yield – Union Co.

Treatment	Larvae per Tiller[1]	Larvae per Flag Leaf[1]	Flag Leaf Damage[2]	Yield Loss
	#	#	% area	%
2004				
No Insecticide	0.7	0.6	25	13
Insecticide	0.1	0.1	1	0
2005				
No Insecticide	3.1	1.0	na	19
Insecticide	0.1	0.1	na	0

[1]Approximately 14 days after insecticide application.
[2]Flag leaf defoliation determined when 90% of CLB larvae initiated pupation.

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Early detection can help reduce yield loss, improves bio-control and no “slimy”pants!

Options for Integrated Pest Management

IPM is based on interactions between……

pests **beneficial organisms** **environment** **crop**

Relies on natural mortality factors & control tactics that cause least disruption to such factors

(e.g. natural predators, weather)

Important IPM Tactics = *monitoring* and *utilizing multiple control practices*

Chemical Cultural (limited) Biological

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IPM Options – Insecticides: Small Grains

Several foliar-applied products registered for CLB

- 2012 PNW Insect Management Handbook
  http://www.ipmnet.org/IPM_Handbooks.htm
- Several of these products also registered for use in field corn and/or silage corn

Be Sure and Follow Label Instructions!

Various restrictions for grazing, forage, fodder, hay, straw & grain (PHI, max amount applied per season, etc.)

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IPM Options – Insecticides: Small Grains

IRAC Site of Action Group #	Product
1 A	Lannate
3 A	Baythroid XL
3 A	Silencer, Warrior
3 A	various pyrethrins
5	Radiant SC
15	Dimilin 2L

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IPM Options – Insecticides: WHEAT only

IRAC Site of Action

Group #	Product
1 B	chlorpyrifos (various)
3 A	Tombstone
3 A	Proaxis
3 A	Mustang Max (and triticale)
1 B + 3 A	Cobalt
1 B + 3 A	Stallion

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IPM Options – Insecticides: Barley only

IRAC Site of Action Group #	Product
3 A + 4 A	Endigo ZC

Insecticide Resistance Management - CLB

- Rotate site of action groups, avoid consecutive use of same group
- Tank mixtures /pre-mixes with different site of action group #
- One application typically will control CLB infestation – Timing is Key!
- Monitor treated CLB populations for efficacy

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Insecticide Resistance Management - CLB

Rotate site of action groups

- avoid consecutive use of same group

Tank mixtures /pre-mixes with different sites of action

- Must be registered for intended use!

Timing is Key!

- Typically, only one well-timed application is needed for CLB control

Monitor treated CLB populations for efficacy

Using IPM tactics help prevent resistance development

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IPM Options – Insecticides: Small Grains

Note: new requirements for ***pyrethroid*** products in "Precautionary Statements" section of label…….

Buffer Zones

- 10 ft vegetative filter strip between field edge and down gradient aquatic habitat…….plus…….
- 25 ft no spray buffer zone…..plus……

Spray Drift Prevention Requirements

- Droplet size medium or coarser (ASAE S572 standards)
- Measure wind speed prior to application
  (adjacent to site prior to application, upwind side)
- More on label

IPM Options – Cultural Control Tactics

Sound agronomic practices that favor well-established stands

- Vigorous, well-tillered, non-stressed plants
- Tolerate damage from CLB infestations below threshold levels

CLB-resistant varieties not identified yet in PNW

- Resistance mechanism = leaf hairiness

Oat trap crop management tactic

- CLB adults prefer small, young oat plants for egg-laying
- Seeding oat border strips 2 weeks after spring wheat effective (Roberts et al. 2010)
- Untreated oats provide refuge for introduced and natural predators

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IPM Options – Oat Trap Crop Tactic

IPM Options – Biological Control Tactics

No natural predators when CLB first arrive in new area

- Insecticides first line of defense

Introduced CLB-specific parasitoid wasps have been used over the last 40+ years

- Successful example of “classic” biological control
- Natural enemies are imported and released in a new region for permanent establishment

Once established, help maintain CLB populations below economic threshold levels w/o insecticides

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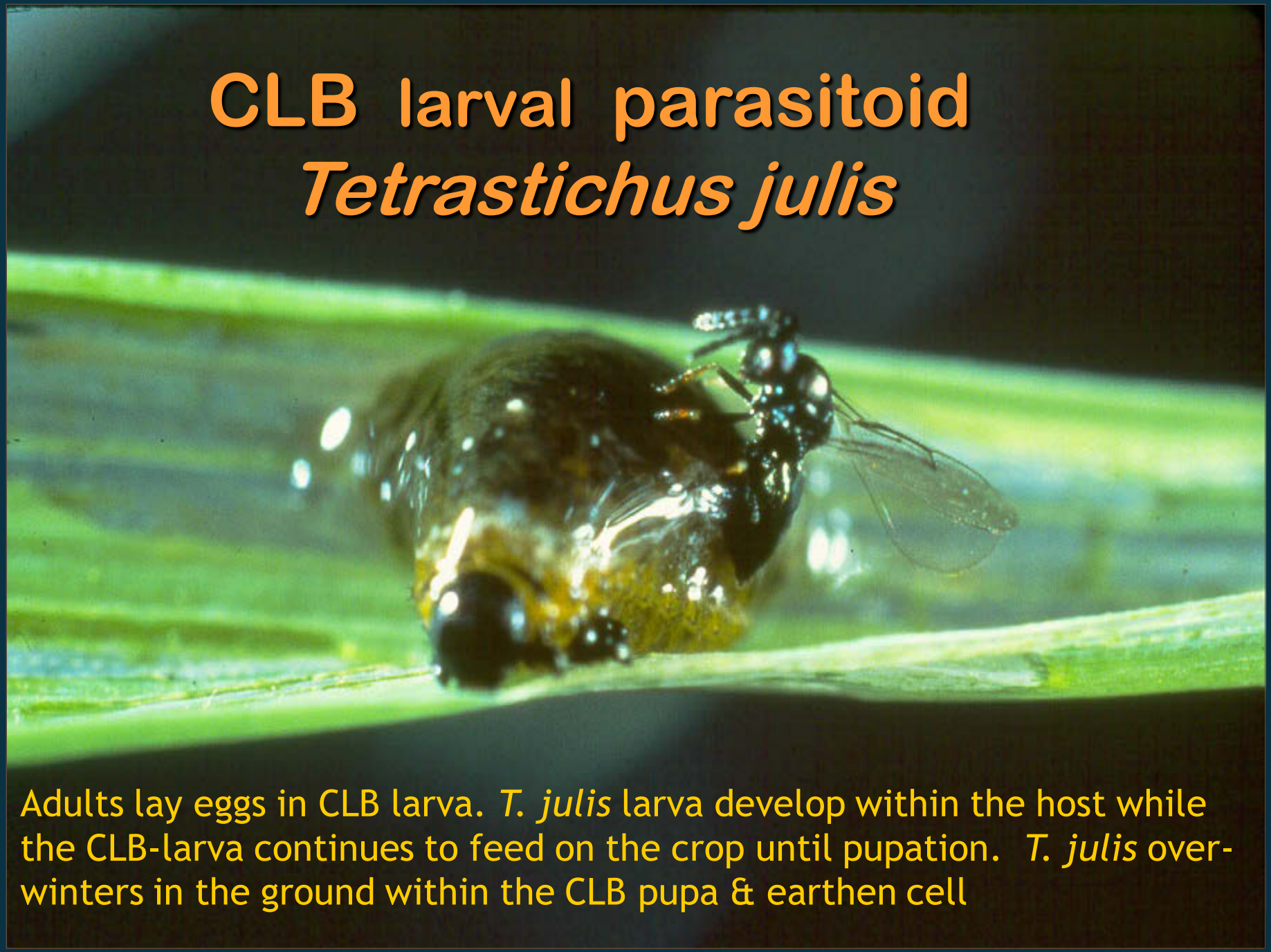
Oregon CLB Bio-control Project

ODA, USDA-APHIS and OSU

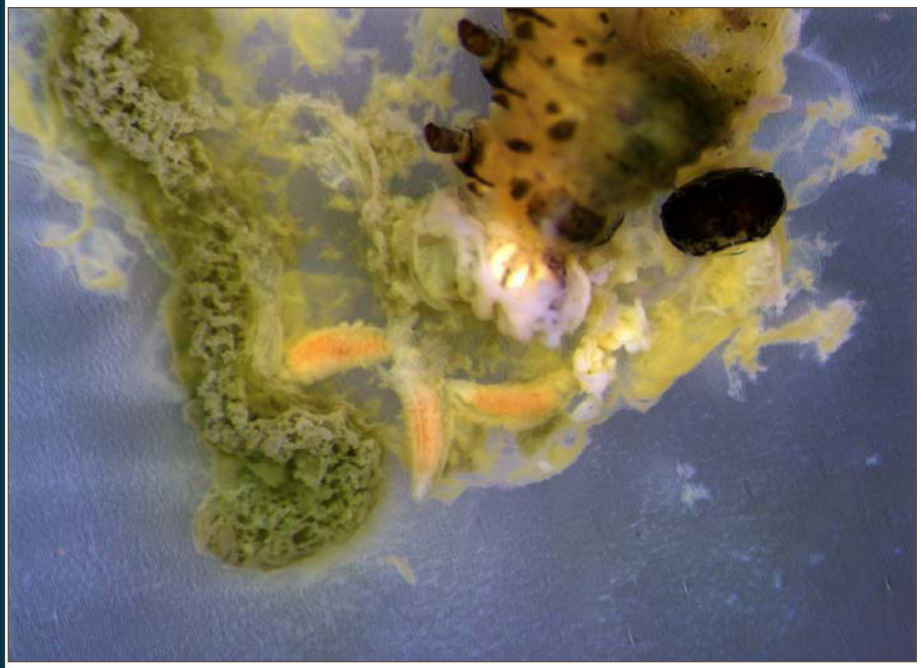
CLB larval parasitoid *Tetrastichus julis*



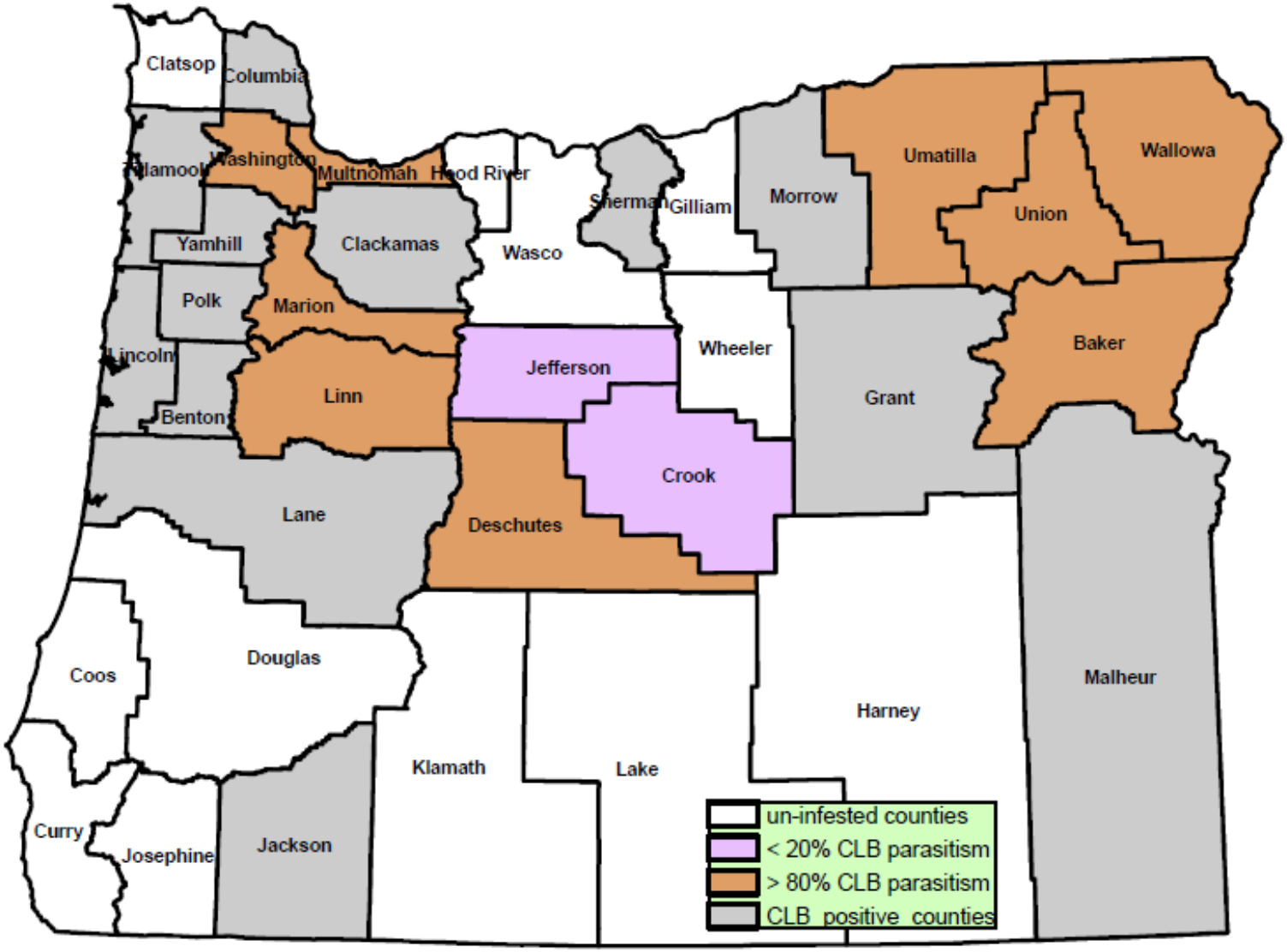
Adults lay eggs in CLB larva. *T. julis* larva develop within the host while the CLB-larva continues to feed on the crop until pupation. *T. julis* over-winters in the ground within the CLB pupa & earthen cell

T. julis larvae recovered from CLB larva

Mike Cooper,
Idaho State Department of Agriculture

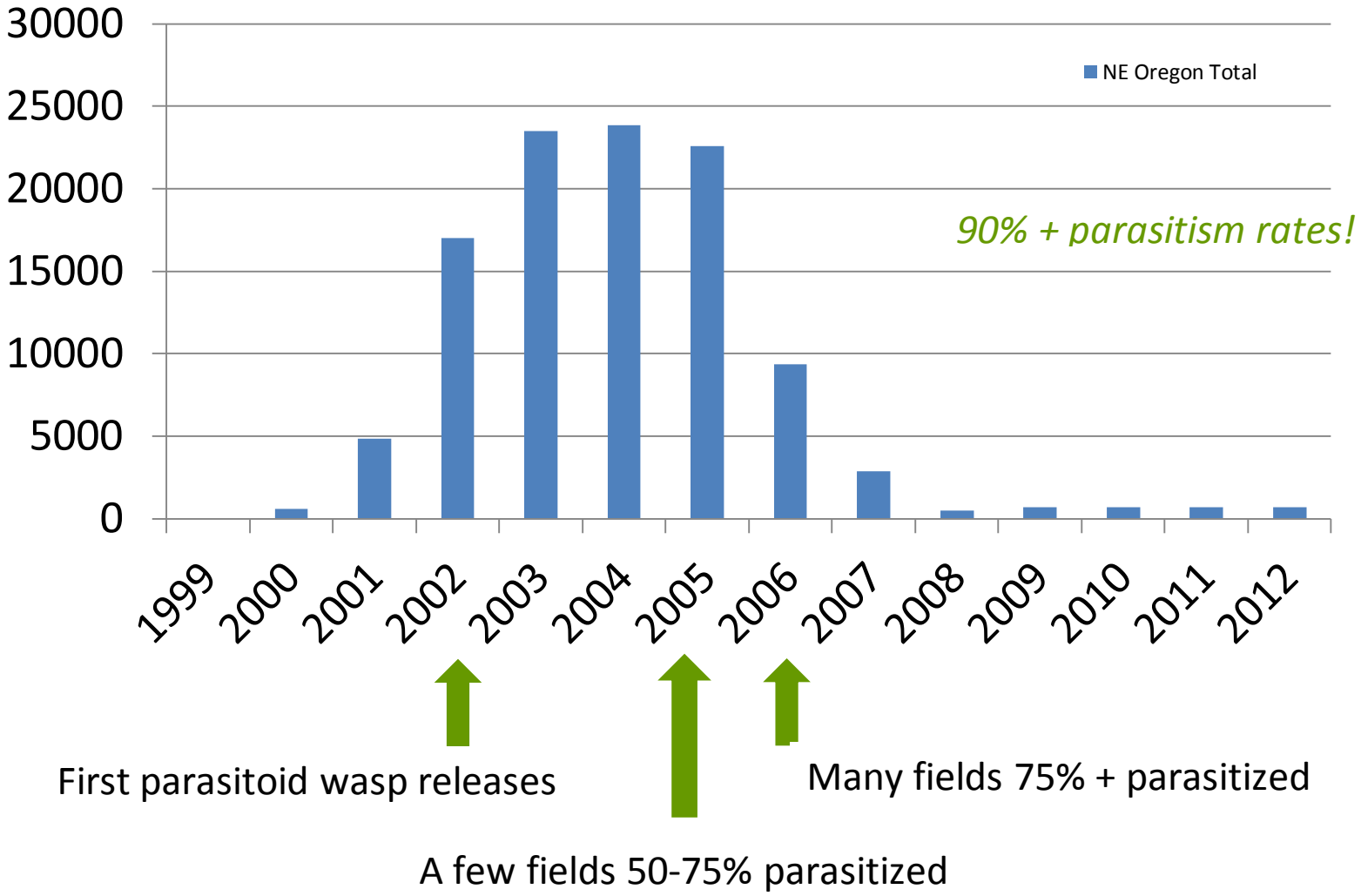


Cereal leaf beetle and larval parasitoid wasp (*T. julis*) distribution in Oregon - 2010



ODA IPPM Annual Survey = 24 infested counties in 2012

CLB Treated Acreage Trend for NE Oregon



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2009 Cereal Leaf Beetle Parasite

Tetrastichus julis

Darcy Heckathorne

Oregon State University

Untreated areas within treated fields and near field borders promote survival of introduced parasitoids and natural predators

Convergent lady beetle
Hippodamia convergens

Closing Comments

CLB IPM has proven very effective in established areas

- Occasional “hot-spots” do occur
- Since 2007, less than 1000 acres in NE OR have needed CLB control

Monitor CLB populations levels then consider……

- Does it meet/exceed the economic threshold level?
- What percentage of the population are eggs?
- Do small larvae make up the majority of the population?
- Are the CLB larva parasitized? If so, at what level?

CLB larva samples can be tested by contacting the OSU Plant Clinic (737-3472)

If control necessary, leave untreated area within field to serve as refuge for ***T. julis***

IPM Resources

Insecticide Resistance Action Committee –

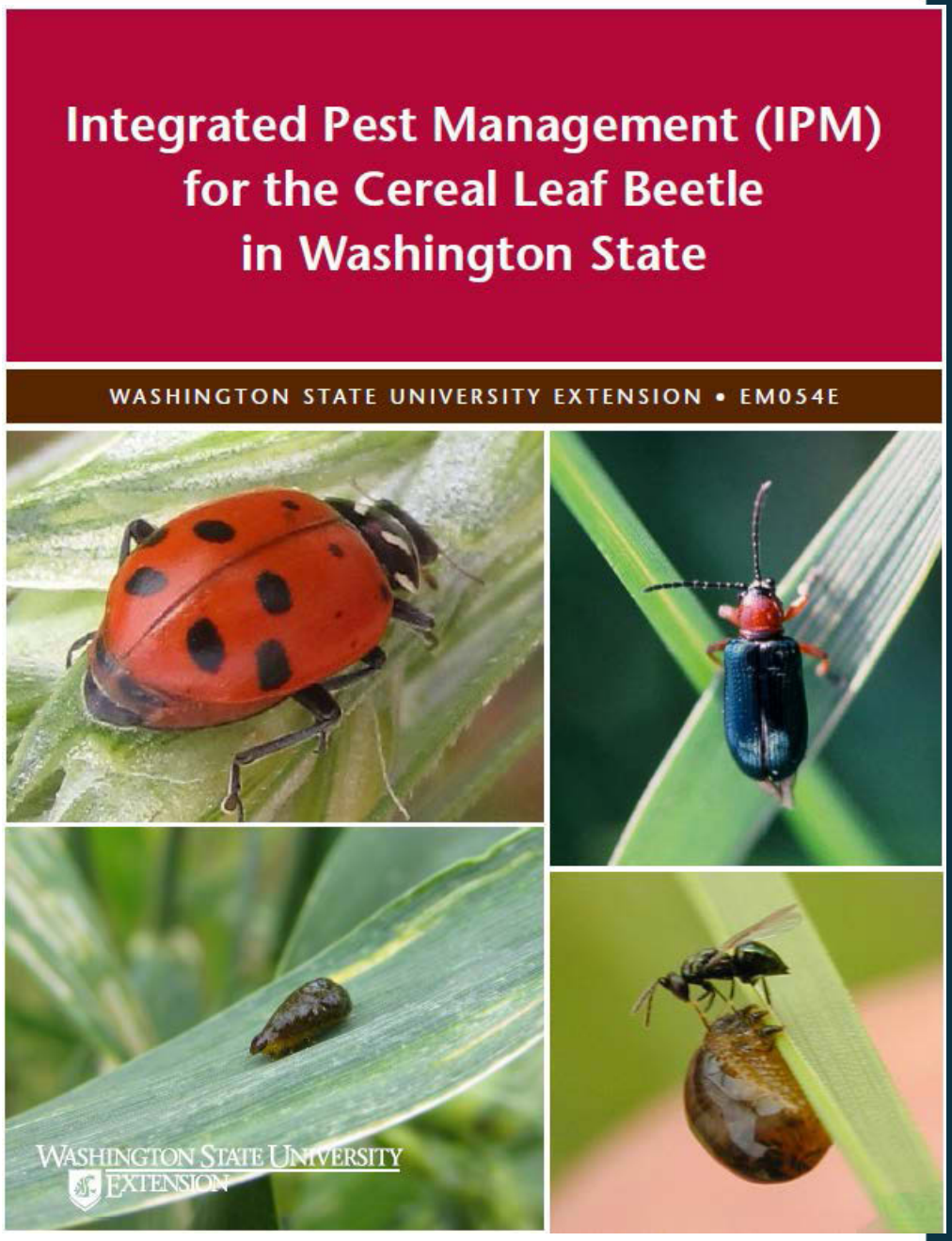
http://www.irac-online.org/

OSU - IPPC

http://www.ipmnet.org/

Western Region IPM Center

www.wripmc.org



Any Questions? Thanks!