WALNUT HUSK FLY

- 2009 Research Results
- 2008 Research Results
- GF-120
- Spray Recommendations
- Trapping
- WHF Impacts on Nut Quality

CHEMICAL CONTROL OF WALNUT HUSK FLY IN ENGLISH WALNUTS 2009

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WHF – ADULT FLY AND DAMAGE

METHODS

- Twelve treatments were replicated four times in a randomized block design with individual tree replicates in a ‘Hartley’ orchard near Hollister, CA.
- Treatments were applied with a hand-gun orchard sprayer operating at 200 psi with a finished spray volume of 300 gal/acre.
- Foliar sprays were applied on July 21, August 14 and September 3 to coincide with trap capture increases.

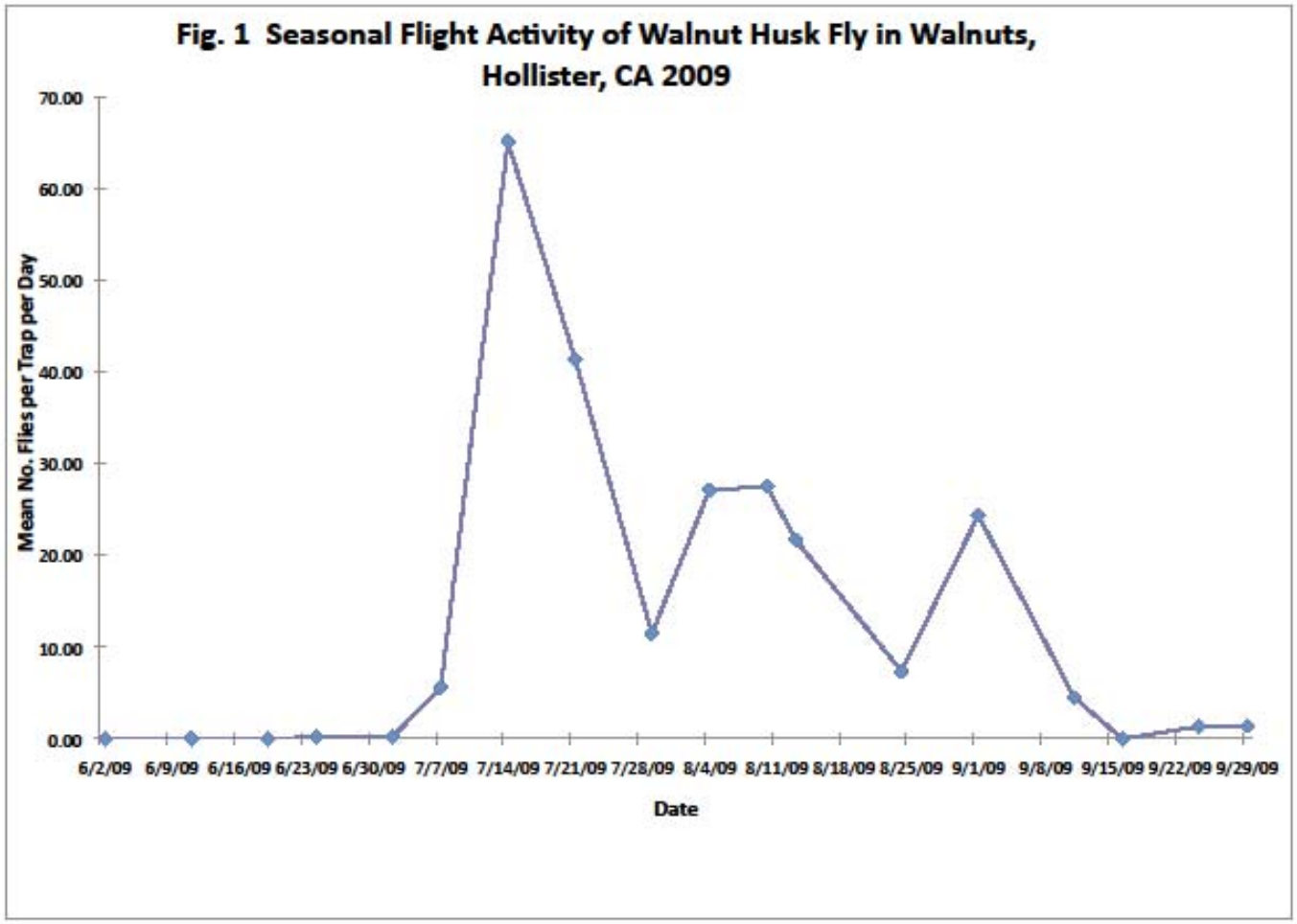
Fig. 1 Seasonal Flight Activity of Walnut Husk Fly in Walnuts, Hollister, CA 2009
Mean No. Flies per Trap per Day
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
6/2/09
6/9/09
6/16/09
6/23/09
6/30/09
7/7/09
7/14/09
7/21/09
7/28/09
8/4/09
8/11/09
8/18/09
8/25/09
9/1/09
9/8/09
9/15/09
9/22/09
9/29/09
Date

TREATMENTS 1

1. Assail 30SG	8.0 oz/ac
+ Dyne-Amic	0.5% v/v
2. Assail 30SG	6.4 oz/ac
+ Dyne-Amic	0.5% v/v
+ Nu-Lure	3 pt/ac
3. Assail 30SG	6.4 oz
+ Dyne-Amic	0.5% v/v
4. Assail 30 SG	4.0 oz/ac
+ Dyne-Amic	0.5% v/v
+ Nu-Lure	3 pt/ac

TREATMENTS 2

5. HGW86 10SE	16.9 oz/ac
6. HGW86 10SE	16.9 oz/ac
+ Dyne-Amic	0.5% v/v
7. HGW86 10SE	16.9 oz/ac
+ Dyne-Amic	0.5% v/v
+ Nu-Lure	3 pt/ac
8. Altacor 35WDG	4.0 oz/ac
+ Dyne-Amic	0.5% v/v

TREATMENTS 3

9.	Altacor 35WDG	4.0 oz/ac
	+Nu-Lure	3 pt/ac
10.	Delegate 25WG	6.4 oz/ac
	+Dyne-Amic	0.5% v/v
11.	Provado 1.6F	6.4 oz/ac
	+Dyne-Amic	0.5% v/v
	+Nu-Lure	3 pt/ac
12.	Dyne-Amic	0.5% v/v
	+Nu-Lure	3 pt/ac

EVALUATION

Twenty-five nut samples per replication were evaluated on Sept 11 and 100 nut samples on Sept 29 for walnut husk fly damage. They were rated as “stings”, 1 = up to ½ inch larval damage, 2 = ½ inch up to complete husk damage but no exit holes and 3 = larval feeding up to complete husk damage with exit holes. Only the results for total damage are shown in the next slides.

RESULTS 1

1.	Assail 8.0 oz + Dyne-Amic	4.5 a
2.	Assail 6.4 oz + Dyne-Amic + Nu-Lure	4.3 a
3.	Assail 6.4 oz + Dyne-Amic	3.5 a
4.	Assail 4.0 oz + Dyne-Amic + Nu-Lure	3.8 a
5.	HGW86	25.3 bc
6.	HGW86 + Dyne-Amic	37.5 c
7.	HGW86 + Dyne-Amic + Nu-Lure	13.5 ab

RESULTS 2

8.	Altacor + Dyne-Amic	28.5 bc
9.	Altacor + Nu-Lure	35.3 c
10.	Delegate + Dyne-Amic + Nu-Lure	36.0 c
11.	Provado + Dyne-Amic + Nu-Lure	5.8 a
12.	Dyne-Amic + Nu-Lure	40.5 c

CONCLUSIONS

Excellent control:

1. Assail with or without Dyne-Amic or Nu-Lure
2. Provado with Dyne-Amic and Nu-Lure

Good control statistically but not numerically:

1. HGW86 with Dyne-Amic and Nu-Lure

Poor control:

1. HGW86 with or without Dyne-Amic
2. Altacor with either Dyne-Amic or Nu-Lure
3. Delegate with Dyne-Amic and Nu-Lure

CONTROL OF WALNUT HUSK FLY IN ENGLISH WALNUTS 2008

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DESIGN

- Nine single tree treatments were replicated 4 times in a mature ‘Hartley’ walnut orchard near Hollister, CA using a RCB design.
- Materials were applied with a handgun sprayer at 250 gal/ac at three timings (7/2, 7/22, 8/12)
- Evaluations of infestation were conducted 3 times (9/2. 9/18, 9/27)

TREATMENTS

1. Assail 30 SG	8.0 oz/ac
Dyne-Amic	0.25 V/V
2. Delegate 25 WG	3.2 oz/ac
Nu-Lure	3 pt/ac
3. Provado 1.6F	7.0 oz/ac
Dyne-Amic	0.25% V/V
4. Baythroid XL	2.8 oz/ac
Nu-Lure	3.0 pts/ac
5. Altacor 35 WDG	4.0 oz/ac
Nu-Lure	3.0 pts/ac

TREATMENTS

6. Leverage	5.1 oz/ac
Dyne-Amic	0.25 % V/V
Nu-Lure	3 pt/ac
7. Provado 1.6F	7.0 oz/ac
Delegate 25WG	3.2 oz/ac
Nu-Lure	3.0 pts/ac
Dyne-Amic	0.25% V/V
8. Assail 30 SG	8.0 oz/ac
Delegate 25WG	3.2 oz/ac
Nu-Lure	3.0 pt/ac
9. Untreated	----

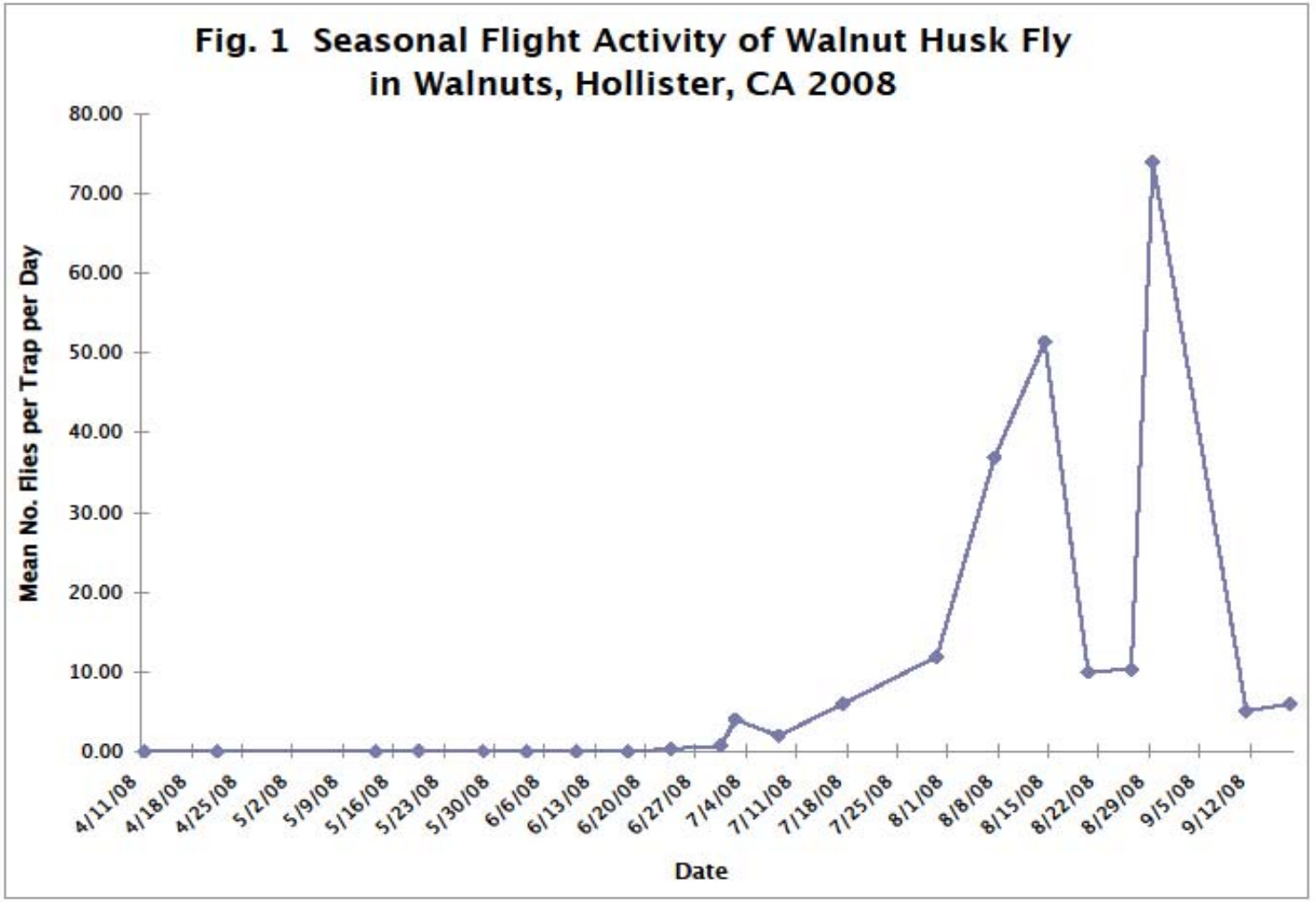
Fig. 1 Seasonal Flight Activity of Walnut Husk Fly in Walnuts, Hollister, CA 2008
Mean No. Flies per Trap per Day
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
4/11/08
4/18/08
4/25/08
5/2/08
5/9/08
5/16/08
5/23/08
5/30/08
6/6/08
6/13/08
6/20/08
6/27/08
7/4/08
7/11/08
7/18/08
7/25/08
8/1/08
8/8/08
8/15/08
8/22/08
8/29/08
9/5/08
9/12/08
Date

THIRD EVALUATION 9/27

	1st	2nd	3rd	Exit	Total
1.Assail+Dyne-Amic	0.0 a	0.0 a	1.0 a	3.0 a	4.0 a
2.Delegate+Nu-Lure	0.0 a	1.0 a	6.0 ab	10.0 a	17.0 a
3.Provado+Dyne-Amic	0.0 a	0.0 a	0.0 a	4.0 a	4.0 a
4.Baythroid+Nu-Lure	0.0 a	0.0 a	1.0 a	2.0 a	3.0 a
5.Altacor+Nu-Lure	0.0 a	2.0 a	18.0 c	35.0 b	55.0 c
6.Leverage+Dyne-Amic +Nu-Lure	1.0 ab	1.0 a	1.0 a	2.0 a	5.0 a
7.Provado+Delegate +Nu-Lure+Dyne-Amic	0.0 a	1.0 a	3.0 ab	9.0 a	13.0 a
8.Assail+Delegate +Nu-Lure+Dyne-Amic	1.0 ab	0.0 a	0.0 a	1.0 a	2.0 a
9.Untreated	2.0 b	2.0 a	9.0 b	24.0 b	37.0 b

RESULTS

- At the third evaluation, WHF larval infestation was significantly higher for Altacor + Nu-Lure when compared to all other treatments including the untreated check. Larval infestation was significantly lower for all other treatments when compared to the untreated check.

CONCLUSIONS

- All of the treatments except Altacor + Nu-Lure are effective for the control of walnut husk fly. The Delegate + Nu-Lure treatment had elevated infestation levels when compared to the other effective treatments.
- Our treatments should have included a Nu-Lure bait treatment without insecticide.
- This study did not show any larvicidal activity by Provado or Assail, in contrast to one of our previous experiments.

GF-120

- We did the first research work on GF-120 in walnuts in San Benito County about ten years ago working with Dow
- GF-120 contains a very effective WHF bait
- It is very safe to use and is organically acceptable and has been effective when used correctly
- It is usually applied with converted weed sprayers mounted on or behind ATV's – usually with one nozzle on each side pointed at about a 45 deg angle

GF-120 USE DIRECTIONS

- For WHF, GF-120 is used at 20 oz of GF-120 per acre in 30 to 100 ounces of water
- Spray with a coarse spray, not a fine mist
- The larger volumes of water may be more useful in areas of low humidity
- If you are using a handgun, make a “W” or “M” spray pattern

GF-120 USE DIRECTIONS

- There have been control failures with GF-120 especially in the Central Valley with hotter, drier conditions
- GF-120 should be used only for low populations of WHF or in organic orchards
- Clean out the traps after spraying – if they are still catching flies a few days later, you need to spray again. We have applied as many as 7 sprays in one season.

RECOMMENDATIONS

- **UC IPM GUIDELINES**
- Nu-Lure Insect Bait or Monterey Bait +
- Provado (Imidacloprid)
- Malathion
- Asana (Esfenvalerate)
- Lorsban (Chlorpyrifos)
- Delegate (Spinetoram)
- Entrust (Spinosad) – organically acceptable
- Imidan (Phosmet)

RECOMMENDATIONS CONTINUED

- Based upon our recent research, we feel the following insecticides + bait are also effective:
- Baythroid (beta-Cyfluthrin)
- Leverage (Cyfluthrin + Imidacloprid)
- Assail (Acetamiprid)

HOW TO APPLY

- Apply all sprays as a bait spray. Large droplet size is preferred. You do not need full coverage.
- Begin application when trap counts begin to rise rapidly.
- Spray every 21 to 25 days depending upon trap counts. Check traps to make sure they drop to near zero between sprays.
- Continue spraying as long as traps indicate a significant population until 3 weeks before harvest or at hull split.

LOW VOLUME CONVENTIONAL SPRAYS

- Low volume spray applications of conventional insecticides have also been effective.
- Malathion at 1.125 gal plus 1.5 gal Nu-Lure Insect Bait in 5 gal water per acre has worked well
- Check labels for minimum allowable rates of water to use per acre – some are 5 gal others are 20 gal
- Applied with handgun or ATV-mounted weed sprayer with nozzles at 45 deg

FULL COVERAGE AIRBLAST OR SPEED SPRAYER APPLICATIONS

- Full coverage non-baited sprays for codling moth control will give some protection against WHF if the material applied is effective for both
- These sprays are not as effective as bait sprays for WHF control and should be followed by careful monitoring
- Adding bait to full-coverage sprays is expensive due to the large volumes of bait

TRAPPING

- Use a yellow sticky trap such as the Trece AM trap UNBAITED with an ammonium carbonate supercharger
- Place traps at 6 feet and an additional trap high in the tree in orchards with large trees
- Replace sticky trap once a week – they get a thin film of dust on them or fly parts that limit effectiveness
- Replace ammonium carbonate once a week or when it gets wet – do not dump on the orchard floor

THE IMPACTS OF WALNUT HUSK FLY INFESTATION ON ENGLISH WALNUT QUALITY

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WALNUT HUSK FLY IMPACTS ON QUALITY

- Walnut husk flies infest the hulls of walnuts beginning as early as June and continuing into September
- Only the hull is infested, not the kernel
- Visible impacts are the hull adhering to the shell and shell staining
- There have been anecdotal references to mold, shrivel and kernel darkening
- Only one previous research report in the 1980's looked at the economic impact of walnut husk fly damage

RESEARCH ON THE IMPACTS OF WALNUT HUSK FLY ON WALNUT QUALITY

- From 2005 through 2008, samples were collected from several orchards with a range of varieties. These samples were paired samples – 100 nuts infested with WHF and 100 nuts uninfested from the same trees. These were hulled, dried and loose adhering hull was scraped off. They were then rated for a wide range of quality characteristics.

CHARACTERISTICS MEASURED

- Although many other characteristics were measured this talk will concentrate on the following:
- External: Mean nut weight, % adhering hull, % large sound nuts
- Internal:% edible yield, % mold, % shrivel, % extra-light kernel color, reflected light index (light bounced off of composite samples)
- Overall: Relative value (Edible Yield X Reflected Light Index X .0364)
- Thanks to Diamond Walnut for processing samples

MEAN NUT WEIGHT (g)

		Infested	Uninfested
2005	Serr	11.24	12.05
2005	Tulare	12.35	13.03
2005	Vina	9.55	11.01
2006	Chandler	10.3	10.9
2007	Hartley	10.42	11.11
2007	Tulare	10.32	13.00
2007	Chandler	7.46	9.62
2008	Payne	11.14	11.36
2008	Hartley	11.39	11.38

% ADHERING HULL

		Infested	Uninfested
2005	Serr	91.0	0.0
2005	Tulare	93.8	0.0
2005	Vina	78.1	0.0
2006	Chandler	90.0	0.0
2007	Hartley	90.6	0.0
2007	Tulare	100.0	0.0
2007	Chandler	5.2	2.9
2008	Payne	91.1	0.0
2008	Hartley	56.8	0.0

% LARGE SOUND NUTS

		Infested	Uninfested
2005	Serr	2.4	87.2
• 2005	Tulare	4.8	98.7
• 2005	Vina	0.0	84.2
• 2006	Chandler	0.0	97.0
• 2007	Hartley	0.0	87.3
• 2007	Tulare	0.0	100.0
• 2007	Chandler	0.0	64.8
• 2008	Payne	4.4	95.8
• 2008	Hartley	1.0	93.7

% EDIBLE YIELD

		Infested	Uninfested
2005	Serr	35.8	51.6
2005	Tulare	44.4	52.5
2005	Vina	29.4	43.6
2006	Chandler	40.0	47.0
2007	Hartley	39.3	45.9
2007	Tulare	43.0	54.0
2007	Chandler	45.4	51.4
2008	Payne	39.4	50.1
2008	Hartley	35.2	41.9

% MOLD

		Infested	Uninfested
2005	Serr	3.4	0.0
2005	Tulare	2.5	0.0
2005	Vina	12.4	0.0
2006	Chandler	14.0	0.0
2007	Hartley	26.0	0.0
2007	Tulare	4.1	0.0
2007	Chandler	32.8	0.0
2008	Payne	20.0	0.0
2008	Hartley	10.2	0.0

% EXTRA-LIGHT KERNEL COLOR

		Infested	Uninfested
2005	Serr	0.0	22.0
• 2005	Tulare	0.0	35.0
• 2005	Vina	0.0	21.0
• 2006	Chandler	0.0	24.0
• 2007	Hartley	6.9	73.6
• 2007	Tulare	0.0	73.2
• 2007	Chandler	0.0	70.4
• 2008	Payne	20.5	75.6
• 2008	Hartley	5.1	64.2

% SHRIVEL

		Infested	Uninfested
2005	Serr	6.7	0.0
• 2005	Tulare	1.2	0.0
• 2005	Vina	21.9	0.0
• 2006	Chandler	0.0	5.0
• 2007	Hartley	0.0	0.0
• 2007	Tulare	2.1	0.0
• 2007	Chandler	3.7	1.0
• 2008	Payne	0.0	0.0
• 2008	Hartley	1.1	0.0

REFLECTED LIGHT INDEX

		Infested	Uninfested
2005	Serr	45.9	51.3
• 2005	Tulare	44.4	53.9
• 2005	Vina	47.9	50.4
• 2006	Chandler	50.0	56.9
• 2007	Hartley	49.7	57.9
• 2007	Tulare	47.2	55.9
• 2007	Chandler	47.2	55.6
• 2008	Payne	49.5	55.2
• 2008	Hartley	46.4	57.1

RELATIVE VALUE

		Infested	Uninfested
2005	Serr	0.60	0.96
• 2005	Tulare	0.72	1.03
• 2005	Vina	0.51	0.80
• 2006	Chandler	0.72	0.97
• 2007	Hartley	0.71	0.97
• 2007	Tulare	0.74	1.10
• 2007	Chandler	0.78	1.04
• 2008	Payne	0.71	1.01
• 2008	Hartley	0.60	0.87

IMPACTS ON SOME SELECTED NUT CHARACTERISTICS

	-WHF	+WHF
• % Mold	0.0	13.9
• % Edible Yield	48.7	39.1
• % Extra-light kernels	51.0	3.6
• Reflected light index	54.9	47.6
• Relative value	0.97	0.68

SUMMARY: IMPACTS DUE TO WHF – 2005 to 2008

- MEAN NUT WEIGHT: 9.2 % LOSS
- % ADHERING HULL: 80.9 % VS 0.4 %
- % LARGE SOUND NUTS: 0.0 % VS 97.6 %
- % EDIBLE YIELD: 21.1 % LOSS
- % MOLD: 11.9 % VS 0.0 %
- % SHRIVEL: 5.0 % VS 0.8 %
- % EXTRA-LIGHT KERNELS: 0.9 % VS 37.1 %
- REFLECTED LIGHT INDEX: 12 % LOSS
- RELATIVE VALUE: 31 % LOSS

EARLY VERSUS LATE WHF DAMAGE – CHANDLER 2007

	EARLY	LATE	UNINFESTED
• MEAN NUT WEIGHT:	7.46	9.09	9.62
• % ADHERING HULL:	5.2	3.6	2.9
• % LARGE SOUND:	0.0	0.0	64.8
• % EDIBLE YIELD:	45.4	52.0	51.4
• % MOLD:	32.8	26.4	0.0
• % SHRIVEL:	3.7	0.9	1.0
• % EXTRA-LIGHT	0.0	10.6	70.4
• REFLECTED LT INDEX:	47.2	50.7	55.6
• RELATIVE VALUE:	0.78	0.96	1.04

LATE DAMAGE WHF IMPACTS

- Late WHF damage does not appear to reduce % edible yield or increase % shrivel.
- Late WHF damage increases % adhering hull and % mold. It decreases mean nut weight, % large sound, % extra-light kernel color, reflected light index and relative value.

EXAMPLES OF WHF DAMAGE TO WALNUT KERNELS

UNINFESTED

EARLY INFESTATION

LATE INFESTATION

Compton 2010walnutday (3).ppt