Project Number 80-G4
Project Researcher: Jennings/Rice
Project Name: Volatile Constutuent of Almonds - Navel Orangeworm

Comparisons of Wheat Bran and Almond Press Cake Baits in NOW Egg Traps

R. E. Rice, T. W. Johnson, J. Profita, and R. A. Jones

With increased emphasis on control and management of the navel orangeworm in almonds during the mid-1970's, it was necessary to develop effective methods for monitoring NOW populations under field conditions. In the absence of sex pheromone traps for NOW males, a technique for monitoring NOW oviposition behavior was developed. The NOW "egg trap", as it was subsequently named, utilizes a wheat bran, honey, water, and glycerine mixture to produce food (or host) odors which attract female NOW and result in egg-laying on the surface of the traps.

These traps have been available for commercial use by fieldmen and pest control advisors. However, acceptance of the traps by potential users was something less than desired, due to performance problems with the traps. The major drawback of the egg traps has been the erratic performance of the bran bait. The moisture content of the wheat bran bait was fairly critical, and the traps required frequent servicing to maintain optimum moisture levels. Traps that were too wet (from rain or sprinklers) or too dry (due to exposure to hot weather) did not attract females; oviposition, egg hatch, and population trends were thus difficult to measure satisfactorily. Trap efficiency also declined significantly where high numbers of mummy nuts or new-crop split hulls were present.

For these reasons, attempts were made in 1980 to improve reliability and performance of the NOW egg traps by substituting a better bait and attractant for the standard wheat bran bait. Comparisons of almond press cake and wheat bran bait were made for relative numbers of eggs laid on egg traps, and for seasonal correlations or variations in population trends using the two baits. Field tests were conducted in three mature almond orchards in widely separated areas of the state.

One test was placed in a 100 acre orchard in the northern Sacramento Valley near Chico. Almond cultivars in this orchard were Nonpariel, NePlus, and Thompson. Standard egg traps containing 15 gms. of press cake were compared to traps with 15 gms. of bran bait. Ten paired replicates were used, with replicate sets placed 10-15 trees apart; the two traps in each replicate were placed 3 trees apart, on the north side of the trees. Eggs on traps were counted twice weekly; press cake bait was changed weekly, and bran baits were changed twice weekly. Traps were placed in trees 7-8 ft. high, ca. midway between the drip line and trunk.

A second test was conducted in an 80 acre orchard in the Stockton area, near Manteca. This orchard was planted to Nonpariel, Thompson, and Merced cultivars. In this test, 8 paired replicates were used, with one rep in each 10 acres. Traps in each replicate were placed in adjacent trees. Egg counts, trap maintenance, and bait changes were identical to procedures in the Chico test. The third test was carried out in a 15 acre block of a large orchard in Fresno County near Caruthers. This orchard was planted to Nonpareil, NePlus, and Milow cultivars. Ten paired replicates were also used in this test, with the two traps in each replicate placed one meter apart in the same tree. Egg counts, trap maintenance, and procedures were the same as in the other two tests, except that the bran bait was changed once per week rather than twice.

The results of these comparisons show that in all three orchards, the traps containing almond press cake bait collected more eggs per trap per week than did the standard wheat bran bait (Fig. 1, 2, 3). Unfortunately, the press cake traps were not placed into the orchards in time to compare baits during the first egg depositions in April. However, there were no obvious seasonal variations or deviations in oviposition trends between baits through the remainder of the year. Many of the weekly egg totals showed the press cake traps with at least two to three times more eggs than traps with an equivalent amount of bran bait (15 grams per trap).

The most notable difference in the two baits was the greater numbers of eggs laid on press cake traps. This was particularly noted in the orchards with higher egg numbers and (presumed) moth populations. Even in the orchard with the lowest oviposition levels (Caruthers), egg counts on the press cake traps during the critical first flight were superior to the wheat bran traps. Later in the season, problems occurred in this orchard with traps of both types becoming wet from under-tree sprinkler irrigations which tended to inactivate both baits. This problem could be avoided with the use of low trajectory sprinkler heads at pre-determined trap stations located within the orchard.

In comparing these two types of bait for commercial use by growers and PCA's, the press cake seems to have several advantages over the bran bait. Press cake can be used as a dry powder or meal, does not require mixing prior to use, and does not require frequent trap servicing to maintain adequate moisture levels in the bait. Shelf life of the dry bait should also be longer under normal storage conditions. The most encouraging thing about the press cake, however, is its greater attraction for female moths and increased oviposition levels throughout the season. This should greatly increase the reliability of the NOW egg traps, and lead to their greater acceptance and use in almond pest management programs.

In anticipation of commercial use of almond press cake meal in egg traps for the 1981 season, comparisons of cake particle sizes were made between the U. C. lab ground cake, and two commercially ground cake meals provided by Liberty Vegetable Oil, Santa Fe Springs, California. Four standard screens were used, giving five groups of particle sizes. The results of these comparisons are given in the table below:

Screen No.	Mesh in: Inches	Mesh in: Microns	Press Cake particle size (μ)	% in 100 g sample U.C. Lab	% in 100 g sample LVO regular	% in 100 g sample LVO fine
20	0.0331	841	>841	7.5	30.7	29.7
40	0.0165	425	425-841	25.2	32.3	30.9
60	0.0098	250	250-425	33.2	30.8	32.1
100	0.0059	150	150-250	29.6	5.7	6.8
			<150	4.5	0.5	0.5

The first obvious difference in these samples was the higher percentage of meal retained on the 841 micron screen from the two LVO samples. This is thought to be simply a reflection on the difference between commercial or industrial grinders and lab sized counter-top grinders. Quite a few of the particles in this size group from LVO were weighed individually at 0.2-0.4 grams each, so these relatively large chunks or particles quickly added a lot a weight to this size group.

There were relatively small differences in the amounts of each sample in the next two groups, those amounts retained on the 425μ and 250μ screens. Another large divergence between samples came in the amounts retained on the 150μ screen. This again reflects the differences between industrial and lab sized grinders. One rather surprising result was the relatively slight difference in screenings between the two LVO samples. The only real difference noted in these two samples was the greater number of "very large" particles in the regular grind, vs. just "large" (but still >841μ) particles in the fine grind.

In looking at the combined percentage of meal in the middle ranges, 150-841μ in size, we see that the U.C. grind used in the field in 1980 had ca.

88% of the sample in this range, while the regular and fine commercial samples had 68.8% and 69.8% of their totals in this range respectively. At this stage of evaluation, it is doubtful that these variations in particle size would result in significant differences in attraction of female navel orangeworm moths in the field.

II. Evaluation of control strategies for navel orangeworm and peach twig borer.

Several spray schedules and materials were evaluated for control of NOW and PTB in a large block of mature almonds near Caruthers, Fresno County. Mummy almonds were removed from trees in December and disced under in early March. However, this sanitation treatment was not as clean as in previous years. Seven treatments, comprised of different materials and timings, were applied to 13 acre blocks by the grower, using concentrate applications at 100 gpa. At harvest, samples of 200 nuts were taken from each of ten Nonpariel trees in each treatment and examined for NOW and PTB damage.

The results of the treatments are tabulated in Table 2. These data show:

a) With only a partially effective sanitation program, navel orangeworm and twig borer damage can reach very high levels in the absence of chemical treatments for NOW and PTB (Treatment 1).

b) The application of a standard dormant spray (oil plus OP insecticide) can reduce PTB damage by at least 75%, and also reduce secondary NOW damage by ca. 70-75% as well (Treatment 2).

c) Sanitation, plus the use of a dormant oil-phosphate treatment followed by either a May or a hullsplit treatment, can reduce worm damage by ca. 90% or more, compared to an unsprayed check (Treatments 1 vs. 3, 4, 6 and 7). There were no clear-cut differences between materials in the dormant treatments (Treatments 4 vs. 6), or in dormant sprays with and without oil (Treatments 6 vs. 7).

d) These data show no notable differences between a single chemical treatment for NOW (May or hullsplit), and multiple treatments at both May and hullsplit (Treatments 5 vs. 3, 4, 6 or 7). Similar results have been obtained in several previous test plot evaluations.

III. NOW oviposition studies.

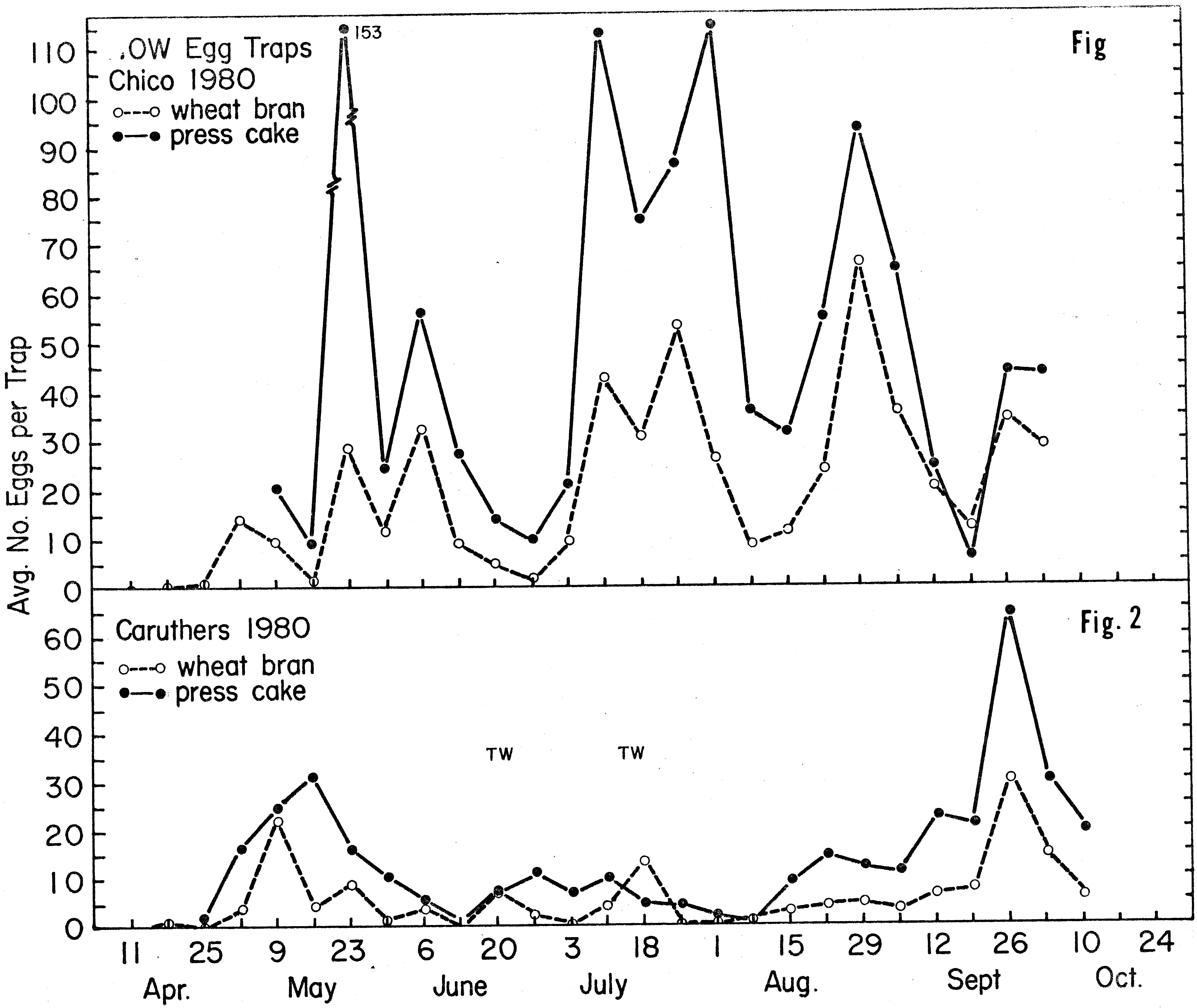
Observations were made on NOW egg deposition in trees that had been dusted with almond press cake meal and in trees without press cake dust. In a block of 10 yr. old almonds, 10 trees (Merced cultivar) were each dusted with 1.0 kg of meal, applying the material with a Hudson back-pack rotary-type vegetable duster. A standard NOW egg trap was placed in each treated tree, and in each of ten untreated check trees. Traps were observed twice weekly for egg deposition. Trees were treated and traps placed on July 24, 1980; final egg trap counts were made on October 3, ca. 1 week after the trees were knocked.

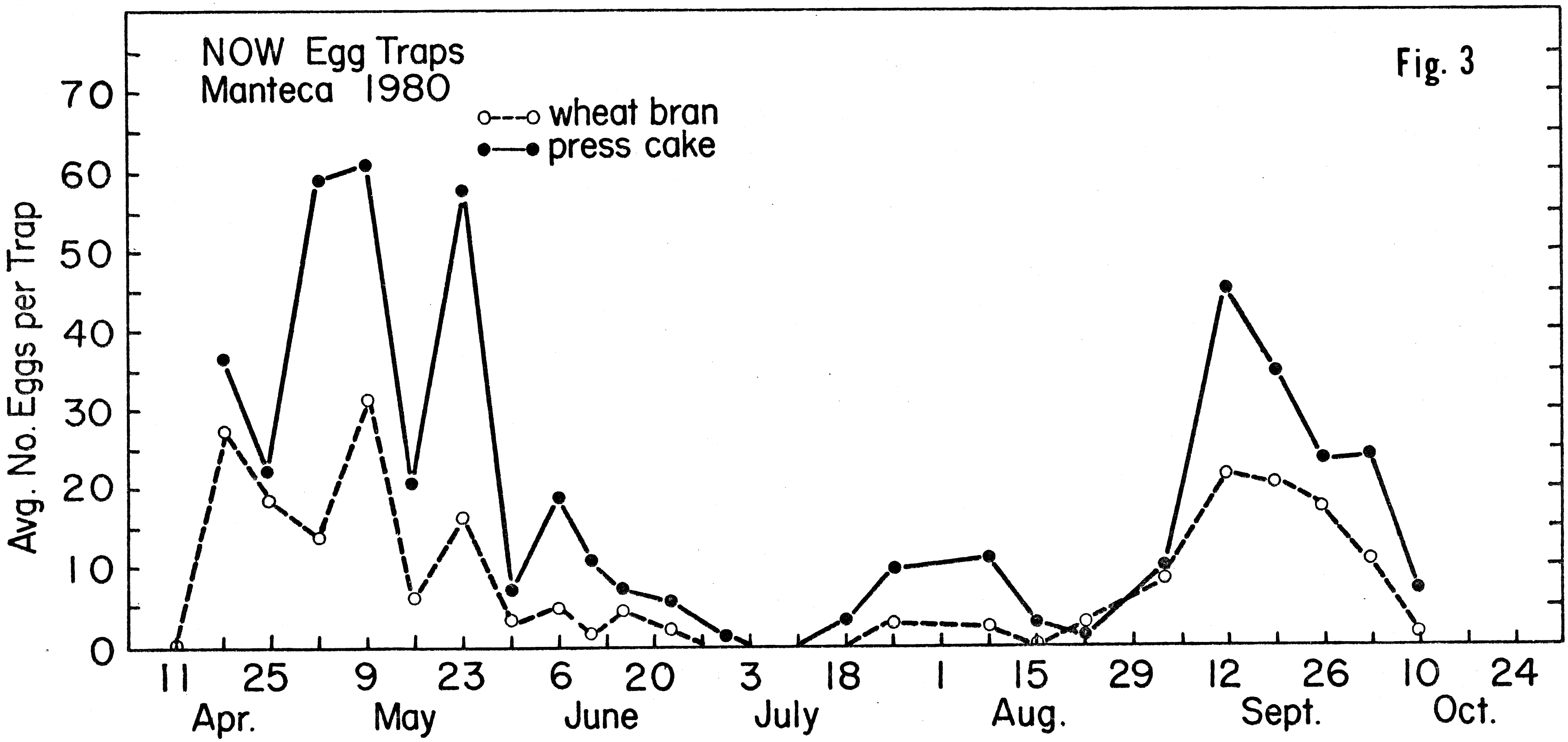
In the treated trees, NOW eggs were deposited on 55.9% of the available traps during the test period. In the untreated check trees, 60.9% of the traps contained NOW eggs during the test. This indicates that NOW females found egg traps equally well in treated and untreated trees. However, only 983 eggs were laid on traps in treated trees, while the 10 traps in the check trees received a total of 1580 eggs, or 37.7% more than the dust treatment. This suggests that NOW females in the treated trees were depositing a significant number of eggs in locations other than on traps.

Comparisons of nut infestations at harvest (Sept. 24) showed no significant differences in NOW damage in cake-treated and untreated trees (9.7% vs. 7.8% NOW respectively). The reasons for the discrepancies between egg deposition data on traps and infested nut meats at harvest is not known at this time.

Table 2. Evaluation of spray schedules and chemicals for control of NOW and PTB in almonds. Caruthers, Calif. 1980.

	Treatment	Date	A.I./ 100 gals.	Gals./ acre	% Infested nut meats NOW	% Infested nut meats PTB	% Infested nut meats Total worms
1	Dormant - Cu + oil	1/80	6 gals.	100	20.9	6.3	27.2
	June - supreme oil	6/16/80	6 gals.	100			
2	Dormant - Cu, oil, Diazinon	1/80	6 gals. 2.5 lbs.	100	5.5	1.5	7.0
	June - supreme oil	6/17/80	6 gals.	100			
3	Dormant - Cu, oil, Diazinon	1/80	6 gals. 2.5 lbs.	100	2.2	0.5	2.7
	June - oil, Diazinon	6/18/80	6 gals. 2.5 lbs.	100			
	Hullsplit - Ambush	9/1/80	0.2 lb.	100			
4	Dormant - Cu, oil, Diazinon	1/80	6 gals. 2.5 lbs.	100	1.3	0	1.3
	May - Guthion	5/16/80	2.0 lbs.	100			
	June - oil, Diazinon	6/17/80	6 gals. 2.5 lbs.	100			
5	Dormant - Cu, oil, Diazinon	1/80	6 gals. 2.5 lbs.	100	1.2	.05	1.3
	May - Guthion	5/16/80	2.0 lbs.	100			
	June - oil, Diazinon	6/17/80	6 gals. 2.5 lbs.	100			
	Hullsplit - Ambush	9/1/80	0.2 lb.	100			
6	Dormant - Cu, oil, Supracide	1/80	6 gals. 2.0 lbs.	100	1.1	0.2	1.3
	May - Guthion	5/8/80	2.0 lbs.	100			
	June - oil, Diazinon	6/18/80	6 gals. 2.5 lbs.	100			
7	Dormant - Cu, Supracide	1/80	2.0 lbs.	100	2.2	0.6	2.8
	May - Guthion	5/8/80	2.0 lbs.	100			
	June - oil, Diazinon	6/18/80	6 gals. 2.5 lbs.	100			


.OW Egg Traps
Chico 1980
wheat bran
press cake
153
Fig
Caruthers 1980
wheat bran
press cake
TW
TW
Fig. 2
Avg. No. Eggs per Trap
110
100
90
80
70
60
50
40
30
20
10
0
60
50
40
30
20
10
0
11
25
9
23
6
20
3
18
1
15
29
12
26
10
24
Apr.
May
June
July
Aug.
Sept
Oct.


NOW Egg Traps
Manteca 1980
wheat bran
press cake
Avg. No. Eggs per Trap
0
10
20
30
40
50
60
70
11
25
9
23
6
20
3
18
1
15
29
12
26
10
24
Apr.
May
June
July
Aug.
Sept.
Oct.
Fig. 3

F I E L D D A T A S H E E T

R. E. RICE — U. C. DAVIS — ENTOMOLOGY

CROP: Almonds	VARIETY:	TEST NO: PTB-80-1	
TYPE OF TEST: Dormant Efficacy		DATE: 1-30-80	
GROWER: Harvey Bailey		TEMP. °F: 55	
LOCATION	ROAD: Anchor & Parlier (SE corner)	HUMIDITY:	
	AREA: Orange Cove — COUNTY: Fresno	WIND	MPH: 0-4
COOPERATOR(S):			DIRECTION: variable

	COMMON	SCIENTIFIC	PRECOUNT
INSECTS/ MITES COUNTED:	1 Peach Twig Borer	*Anarsia lineatella*	
	2		
	3		

		CROP STAGE
DATE(S) APPLIED:	1 Jan. 30, 1980	Dormant
	2	

	TYPE	SPEED	PSI	
EQUIPMENT:	1 Handgun		250	
	2			

PLOT: NO. REPS - 4 REP. SIZE - 4 tree TREE SPACING - 24' x 24'

SAMPLE METHOD: Twig strikes

COUNT METHOD: No. twig strikes/rep; counted 4-10-80

NO.	COLOR CODE	MATERIAL	FORMULATION	RATE AI/100 gal H_2O	GPA	Tank pH	
1		Check	-	-	-		
2		Pounce + 1.5% oil	3.2E	0.025#+1.5 gal	400		
3		Pounce + 1.5% oil	3.2E	0.05#+1.5 gal	400		
4		Imidan + 1.5% oil	50W	0.5#+1.5 gal	400	7.6	
5		Imidan+1.5% oil+Buffer-X	50W	0.5#+1.5 gal +1 pt.	400	6.7	
6		Diazinon + 1.5% oil	50W	0.5#+1.5 gal	400		

FIELD DATA SHEET

R. E. RICE | U. C. DAVIS | ENTOMOLOGY

CROP: Almonds	VARIETY: Nonpariel	TEST NO: PTB-80-2	
TYPE OF TEST: May Efficacy		DATE: 5-12-80	
GROWER: Clarence De Freitas		TEMP. °F: 65	
LOCATION	ROAD: Brawley south of Mt. View	HUMIDITY:	
	AREA: Caruthers, CA COUNTY: Fresno	WIND	MPH: 2-4
COOPERATOR(S):			DIRECTION: NW

INSECTS/ MITES COUNTED:	COMMON	SCIENTIFIC	PRECOUNT
	1 Peach Twig Borer	Anarsia lineatella	No dormant spray
	2		
	3		

DATE(S) APPLIED:		CROP STAGE
	1 May 12, 1980	3rd leaf trees; post-bloom, non-bearing
	2	

EQUIPMENT:	TYPE	SPEED	PSI	
	1 Handgun		250	
	2			

PLOT: NO. REPS - 7 REP. SIZE - Single tree TREE SPACING - 22'

SAMPLE METHOD: Twig infestations

COUNT METHOD: No. of infested twigs per rep; counted 6-4-80.

NO.	COLOR CODE	MATERIAL	FORMULA-TION	RATE AI/100 gal H_2O	GPA	Tank pH	
1		Check	-				
2		Pounce	3.2E	0.025#	400		
3		Pounce	3.2E	0.05#	400		
4		Imidan	50W	0.5#	400	7.3	
5		Imidan + Adjust	50W	0.5# + 1 pt.	400	4.5	
6		Diazinon	50W	0.5#	400		
7		Pydrin	1.2EC	0.025 lb.	400		
8		Pydrin	1.2EC	0.05 lb.	400		

PTB 80-1
Treated 1-30-80
Counted 4-10-80

Peach Twig Borer
Dorment Efficacy Test

Treatment	Lbs. A.I./ 100 gals.[1/]	No. strikes per rep. I	II	III	IV	Total
Check	-	8	3	0	1	12
Pounce	0.025	0	0	0	0	0
Pounce	0.05	0	0	0	0	0
Imidan	0.5	0	0	0	0	0
Imidan + Buffer-X	0.5 + 1 pt.	0	0	0	0	0
Diazinon	0.5	0	0	0	0	0

1/All treatments with 1.5 gal. PGSO-2 oil/100 gal. H_2O.

Counted 6-4-80

PTB-80-2
SUMMARY

Treatment	Lbs. A.I./ 100 gals.	No. PTB strikes/rep. I	II	III	IV	V	VI	VII	Total
Check	-	15	17	18	17	33	33	26	159
Pounce 1X	0.025	0	0	0	0	0	0	0	0
Pounce 2X	0.05	0	0	0	0	1	0	0	1
Imidan	0.5	0	0	1	2	0	1	0	4
Imidan + Adjust	0.5 + 1 pt.	0	0	0	0	1	0	0	1
Diazinon	0.5	0	0	0	0	0	0	0	0
Pydrin 1X	0.025	0	0	0	0	0	0	0	0
Pydrin 2X	0.05	0	0	0	0	0	0	0	0

PTB 79-1

Table 1. Control of peach twig borer with dormant sprays.[1/]

Material[2/]	Form.	AI/ 100 gal.	No. PTB strikes per repl. 1	2	3	4	Total
Ambush	2E	.05 lb.	2	0	0	0	2 a
Ambush	2E	.1 lb.	0	0	0	0	0 a
Diazinon	50W	.5 lb.	3	0	0	1	4 a
Imidan	50W	.5 lb.	9	4	1	2	16 a pH 7.4
Imidan + 1 pt. Buffer-X	50W	.5 lb.	1	1	1	2	5 a pH 5.4
Check	-	-	30	22	16	19	87 b

1/ Treated Feb. 5, 1979. 4 reps, 9 trees each. Counted April 12, 1979.

2/ All treatments (except check) with 1.5 gal. Volck oil/100 gal. H_2O.

PTB 79-2

Table 2. Control of peach twig borer with May sprays.[1/]

Material	Form.	AI/ 100 gal.	No. strikes per repl. 1	2	3	4	Total[2/]
Ambush	2E	.05 lb.	0	0	0	0	0 a
Ambush	2E	.1 lb.	0	0	0	0	0 a
Diazinon	50W	.5 lb.	0	0	1	0	1 a
Imidan	50W	.5 lb.	1	2	0	2	5 a pH 7.5
Imidan + 1 pt. Buffer-X	50W	.5 lb.	0	0	0	0	0 a pH 6.4
Imidan + 2 pts. Buffer-X	50W	.5 lb.	0	0	0	0	0 a pH 6.2
Check	-	-	19	33	65	22	139 b

1/ Treated May 10, 1979. 4 reps, 4 trees each. Counted May 31, 1979.

2/ Means followed by the same letter are not significantly different at the 5% level, DMRT.

EFFECT OF PTB MAY SPRAYS ON EUROPEAN RED MITE IN ALMONDS

TREATMENT	A.I./ 100 GAL.	ERM/100 LEAVES-POST TREATMENT[1/] 27 DAYS	41 DAYS	63 DAYS	
CHECK	0	10 / 120	27 / 121	26 / 135	- motile forms / - eggs
AMBUSH 2E	.05 LB	6 / 62	22 / 218	86 / 846	
AMBUSH 2E	.10 LB	10 / 102	26 / 334	185 / 584	
DIAZINON 50W	.5 LB	4 / 122	17 / 104	8 / 204	
IMIDAN 50W	.5 LB	6 / 92	13 / 133	19 / 160	
IMIDAN + 1 PT. BU-X	.5 LB	10 / 202	17 / 113	45 / 158	
IMIDAN + 2 PT. BU-X	.5 LB	0 / 34	27 / 83	10 / 134	

1/SPRAYED 5/10/79, HANDGUN @ 400 GPA; FOUR 4-TREE REPS/TRTMNT.

Comparisons of Wheat Bran and Almond Press Cake

Baits in NOW Egg Traps

R. E. Rice, T. W. Johnson, J. Profita, and R. A. Jones

With increased emphasis on control and management of the navel orangeworm in almonds during the mid-1970's, it was necessary to develop effective methods for monitoring NOW populations under field conditions. In the absence of sex pheromone traps for NOW males, a technique for monitoring NOW oviposition behavior was developed. The NOW "egg trap", as it was subsequently named, utilizes a wheat bran, honey, water, and glycerine mixture to produce food (or host) odors which attract female NOW and result in egg-laying on the surface of the traps.

These traps have been available for commercial use by fieldmen and pest control advisors. However, acceptance of the traps by potential users was something less than desired, due to performance problems with the traps. The major drawback of the egg traps has been the erratic performance of the bran bait. The moisture content of the wheat bran bait was fairly critical, and the traps required frequent servicing to maintain optimum moisture levels. Traps that were too wet (from rain or sprinklers) or too dry (due to exposure to hot weather) did not attract females; oviposition, egg hatch, and population trends were thus difficult to measure satisfactorily. Trap efficiency also declined significantly where high numbers of mummy nuts or new-crop split hulls were present.

For these reasons, attempts were made in 1980 to improve reliability and performance of the NOW egg traps by substituting a better bait and attractant for the standard wheat bran bait. Comparisons of almond press cake and wheat bran bait were made for relative numbers of eggs laid on egg traps, and for seasonal correlations or variations in population trends using the two baits. Field tests were conducted in three mature almond orchards in widely separated areas of the state.

One test was placed in a 100 acre orchard in the northern Sacramento Valley near Chico. Almond cultivars in this orchard were Nonpariel, NePlus, and Thompson. Standard egg traps containing 15 gms. of press cake were compared to traps with 15 gms. of bran bait. Ten paired replicates were used, with replicate sets placed 10-15 trees apart; the two traps in each replicate were placed 3 trees apart, on the north side of the trees. Eggs on traps were counted twice weekly; press cake bait was changed weekly, and bran baits were changed twice weekly. Traps were placed in trees 7-8 ft. high, ca. midway between the drip line and trunk.

A second test was conducted in an 80 acre orchard in the Stockton area, near Manteca. This orchard was planted to Nonpariel, Thompson, and Merced cultivars. In this test, 8 paired replicates were used, with one rep in each 10 acres. Traps in each replicate were placed in adjacent trees. Egg counts, trap maintenance, and bait changes were identical to procedures in the Chico test. The third test was carried out in a 15 acre block of a large orchard in Fresno County near Caruthers. This orchard was planted to Nonpareil, NePlus, and Milow cultivars. Ten paired replicates were also used in this test, with the two traps in each replicate placed one meter apart in the same tree. Egg counts, trap maintenance, and procedures were the same as in the other two tests, except that the bran bait was changed once per week rather than twice.

The results of these comparisons show that in all three orchards, the traps containing almond press cake bait collected more eggs per trap per week than did the standard wheat bran bait (Fig. 1, 2, 3). Unfortunately, the press cake traps were not placed into the orchards in time to compare baits during the first egg depositions in April. However, there were no obvious seasonal variations or deviations in oviposition trends between baits through the remainder of the year. Many of the weekly egg totals showed the press cake traps with at least two to three times more eggs than traps with an equivalent amount of bran bait.

The most notable difference in the two baits was the greater numbers of eggs laid on press cake traps. This was particularly noted in the orchards with higher egg numbers and (presumed) moth populations. Even in the orchard with the lowest oviposition levels (Caruthers), egg counts on the press cake traps during the critical first flight were superior to the wheat bran traps. Later in the season, problems occurred in this orchard with traps of both types becoming wet from under-tree sprinkler irrigations which tended to inactivate both baits. This problem could be avoided with the use of low trajectory sprinkler heads at pre-determined trap stations located within the orchard.

In comparing these two types of bait for commercial use by growers and PCA's, the press cake seems to have several advantages over the bran bait. Press cake can be used as a dry powder or meal, does not require mixing prior to use, and does not require frequent trap servicing to maintain adequate moisture levels in the bait. Shelf life of the dry bait should also be longer under normal storage conditions. The most encouraging thing about the press cake, however, is its greater attraction for female moths and increased oviposition levels throughout the season. This should greatly increase the reliability of the NOW egg traps, and lead to their greater acceptance and use in almond pest management programs.

UNIVERSITY OF CALIFORNIA, DAVIS

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

3450 Chemistry Annex

COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

DAVIS, CALIFORNIA 95616

December 29, 1980

Robert K. Curtis
Associate Research Director
Almond Board of California
Post Office Box 15920
Sacramento, CA 95813

Dear Bob:

Enclosed are two copies of our Annual Report.

With best regards and hopes for a great New Year,

Sincerely yours,

Walt

Walter G. Jennings

WGJ:cr

Enclosure

Copy to Dick Rice

VOLATILE CONSTITUENTS OF ALMONDS AND NOW CONTROL

W. Jennings, R. E. Rice, J. A. Settlage and S. Hoeying

Annual Report 30 December 1980

1. OBJECTIVES. To isolate and identify those volatile constituents of almond functioning as attractants and/or ovipositional stimulants for the NOW. Fulfillment of this objective would permit more effective field monitoring, and could lead to useful trapping procedures and techniques for directing the female moth to deposit eggs where the survival rate of the emerging larvae would be low.

2. INTERPRETIVE SUMMARY. Isolation and identification of various almond volatiles has been accomplished with a high degree of success over the past few years that this project has been active. A laboratory bioassay is highly desirable to help ascertain which of these many compounds are the ones of interest, but bioassay procedures are fraught with perils. However we have established that press cake, the residue of infested almonds from which the oil has been expressed, is highly attractive; action was recently taken to substitute this material for the wheat bran bait previously used in field monitoring traps.

3. EXPERIMENTAL PROCEDURE. The development of a more sensitive bioassay yielding reproducible results (and preferably immediately accessible to the chemist) was deemed to be highly desirable. Accordingly, space was obtained and a moth colony was established. It became evident after several months effort that sustained egg-laying activity could not be demonstrated in spite of adjustments and variations in parameters such as illumination, air flow, type of trap or population density. While the results can sometimes be

used as crude indicators of probable field response, they can be easily overinterpreted.

Techniques for effectively separating all of the volatile constituents en mass, and presenting these under conditions where their rate of release was more controlled, have also been explored. Preliminary results indicate that cotton plugs, impregnated with mineral oil, effectively absorb and slowly release volatiles from ground press cake, when swept with nitrogen gas. This trapping technique is being developed under conditions amenable to chemical testing and chromatographic separation of the absorbed volatiles.

4. RESULTS. Based on the preliminary bioassays, field trials of almond press cake versus traditional wheat bran baits were conducted by other groups. Their data, shown in Figure 1, indicate that in every case where moths were reasonably active, considerably more egg deposition occurred on the press cake baited traps. As the number of eggs becomes small, the possibility for variation and error becomes much larger; when these low-response results are ignored, the consistent superiority of the press cake bait over conventional wheat bran bait is quite evident, as shown in Figure 2.

5. DISCUSSION. Eventually, these results must be applied under field conditions; work of many other investigators, dealing with laboratory bioassay of phenomenons, etc., indicate that substances active under laboratory conditions are not always effective when exposed in the field. Our efforts are now concentrated on amassing larger quantities of press cake volatiles. These will be fractionated and subjected to laboratory bioassay (Parlier) to gain some crude indication of which fractions may be more interesting. Extensive field tests will then be conducted on these latter, during the coming spring.

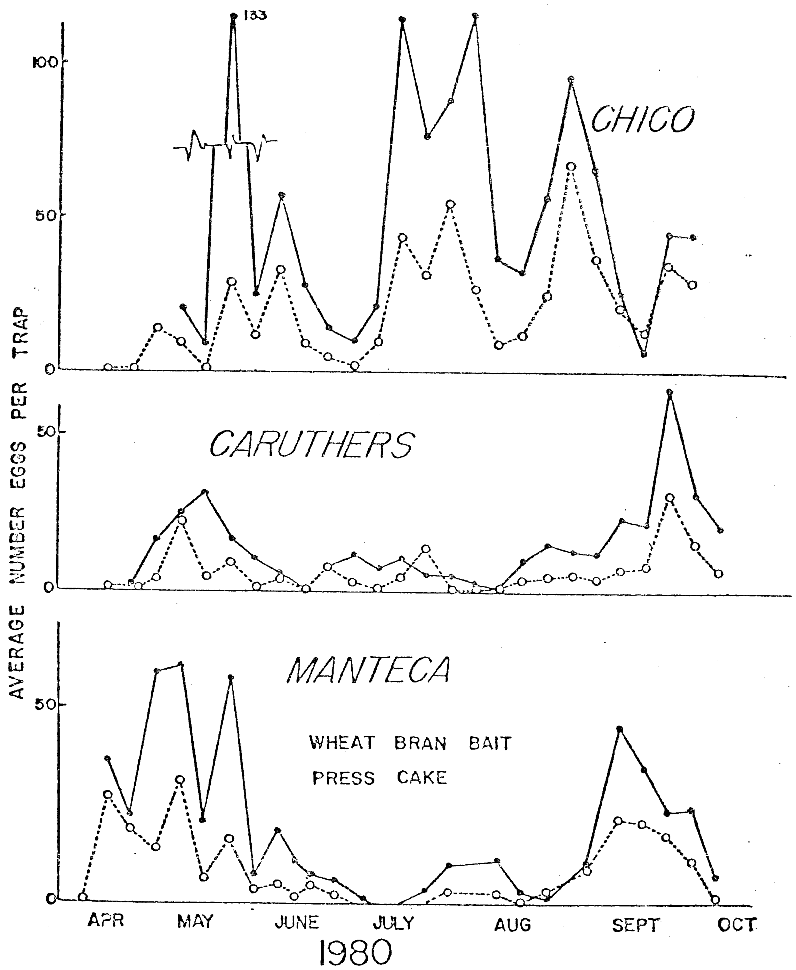


Figure 1. Egg counts on traps baited with conventional, wheat bran bait (O) and press cake bait (◉) and presented simultaneously. From data of Rice, Johnson, Profita and Jones.

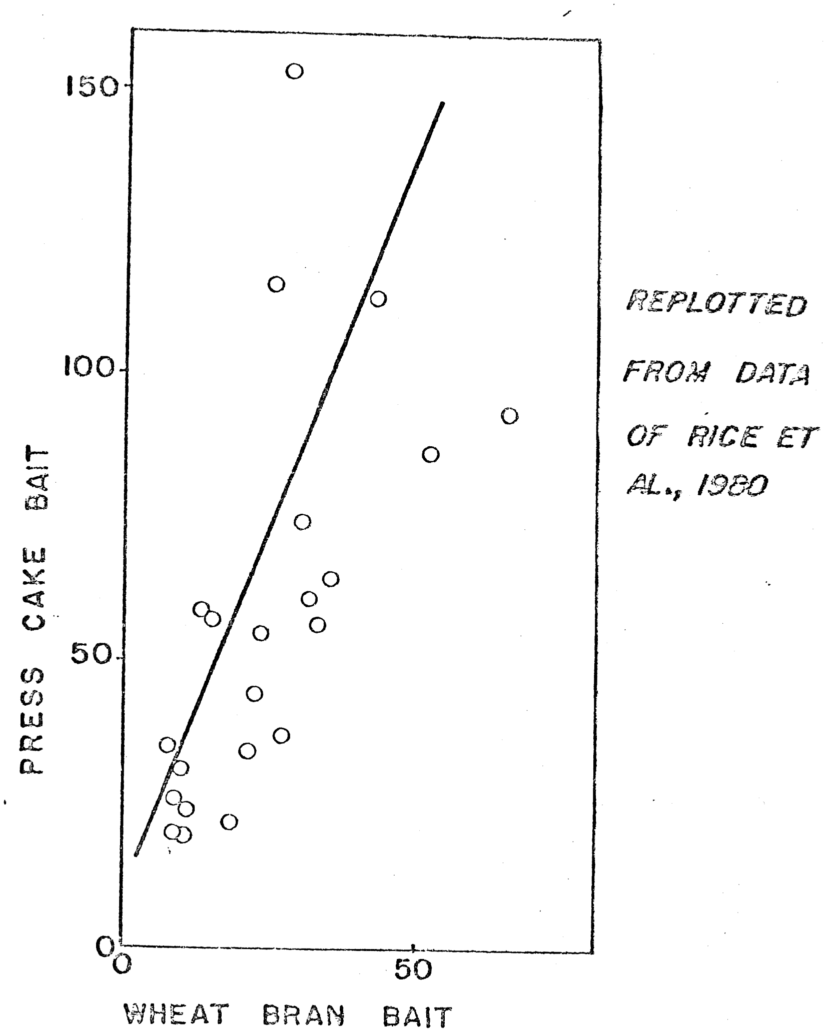


Figure 2. Relative preference of egg-laying moths, conventional wheat bran bait versus press cake bait. Occassions in which at least one trap failed to elicit at least twenty eggs were discounted in this comparison. The best-fit line, calculated on the basis of regression analysis, indicates a three-to-one preference for the traps baited with press cake.

VOLATILE CONSTITUENTS OF ALMONDS AND NOW CONTROL

W. Jennings, R.E. Rice, J.A. Settlage, S. Hoeying

For distribution at the Almond Growers Conference
Sacramento, California
8 December 1980

These studies have been predicted on the assumption that the egg laying behavior of the female Now moth is influenced by volatiles emanating from a prospective food source; the validity of this assumption still seems high.

Our efforts have been directed toward isolating and identifying the active volatile principle. This would permit (1) better trapping methods for more accurate monitoring of moth populations in the field, and (2) use of that substance as a control: its indiscriminant application to soil, tree trunks and traps could encourage misdirected egg laying; resulting in a larval hatch under conditions where the survival rate would be low.

Several fractions isolated from infested almonds and infested almond frass have been found to function as attractants, as evidenced by egg counts. To enable year-round testing, a laboratory bioassay would be preferable to a field bioassay, which is limited to the spring flight, but laboratory methods involve many problems. In addition, compounds that are active in lab bioassay are not always active when they are presented in the field. Hence, while lab methods may be used for preliminary screening, testing must ultimately be done in the field.

One of the interesting facts to emerge from these studies was that lab bioassay indicated that press cake, the residue from oil-expression of infested almonds, was highly attractive material as evidenced by much higher egg counts than were obtained on wheat bran baits, infested almond extracts, or other test materials. This has been corroborated by field testing, and on the results of these trials, it has been recommended that press cake be used to replace wheat bran baits in commercial trans. (see report of Rice, Johnson, Profita and Jones, 1980). The superiority of press cake seems to hinge as much on physico-chemico characteristics such as release rates (i.e., "apparent" volatility) of the volatile attractants as on their chemical nature.

We are presently examining some of the physico-chemico relationships of the volatiles in almonds and press cake, and employing our lab bioassay as a rough screening procedure to gain additional information about these fractions which we plan to subject to extensive field testing in the coming year.

Project No. 80-G4
(Continuation of Project No. 79-G3)

Cooperator:
University of California
Department of Food Science and Technology
3450 Chemistry Annex
Davis, California 95616

Project Leader: Dr. Walter G. Jennings Phone (916) 752-2163

Personnel: Dr. R. E. Rice, Fong-Yi Lieu, Jim Settlage

Project: Navel Orangeworm Research
Volatile Constituents of Almonds

Objectives: Isolation and identification of long range and ovipositional attractants present in almonds, and insect frass from infested almonds.

Progress: Previous work on this project has resulted in the isolation and identification of a range of volatile constituents, some of which probably function as long range attractants and guide the female n.o.w. to a food source. A second short range stimulus is then required to induce egg laying at that food source. Because infested almonds serve as a powerful stimulus for both attraction and egg laying, it is apparent that they--and ether extracts of infested almonds--must contain both long and short range attractants. Previous work has indicated that the active principle is associated with the frass from infested almonds.

A quantity of frass, recovered from large batches of infested almonds, was subjected to ether extraction, and the excess ether removed. The material was subjected to bioassay by Dr. Rice and found to be highly attractive.

Plans: It is proposed to utilize night viewing apparatus, preference tunnels, sticky traps, etc. to ascertain which of the more volatile constituents identified in previous phases of this project serve as long range attractants.

Various combinations of the fatty acids isolated from this year's study (and if necessary, their related degradation products) will be presented in concert with the more effective long range attractant(s) and bioassayed via egg count.

Toward these goals, portions of the bioassay work will be moved from Parlier to Davis where they are more immediately available, but will remain under the direction of Dr. Rice.

Almond Industry Participation $9,210

UNIVERSITY OF CALIFORNIA

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO   SANTA BARBARA • SANTA CRUZ

80-64

Division of Agricultural Sciences
San Joaquin Valley
Agricultural Research and Extension Center

9240 So. Riverbend Avenue
Parlier, California 93648
Tel. (209) 646-2794

December 24, 1980

To: Dale Morrison
Bob Curtis

From: Richard E. Rice *Dick*
Entomologist

Re: 1980 Almond Research Report

Enclosed is a summarized report on most of our research on almonds during 1980. Due to time constrictions, I simply made up a composite from previous reports, letters, etc., and hope you will bear with me.

Best Wishes to you both for the New Year.

RER:sf

Enclosure