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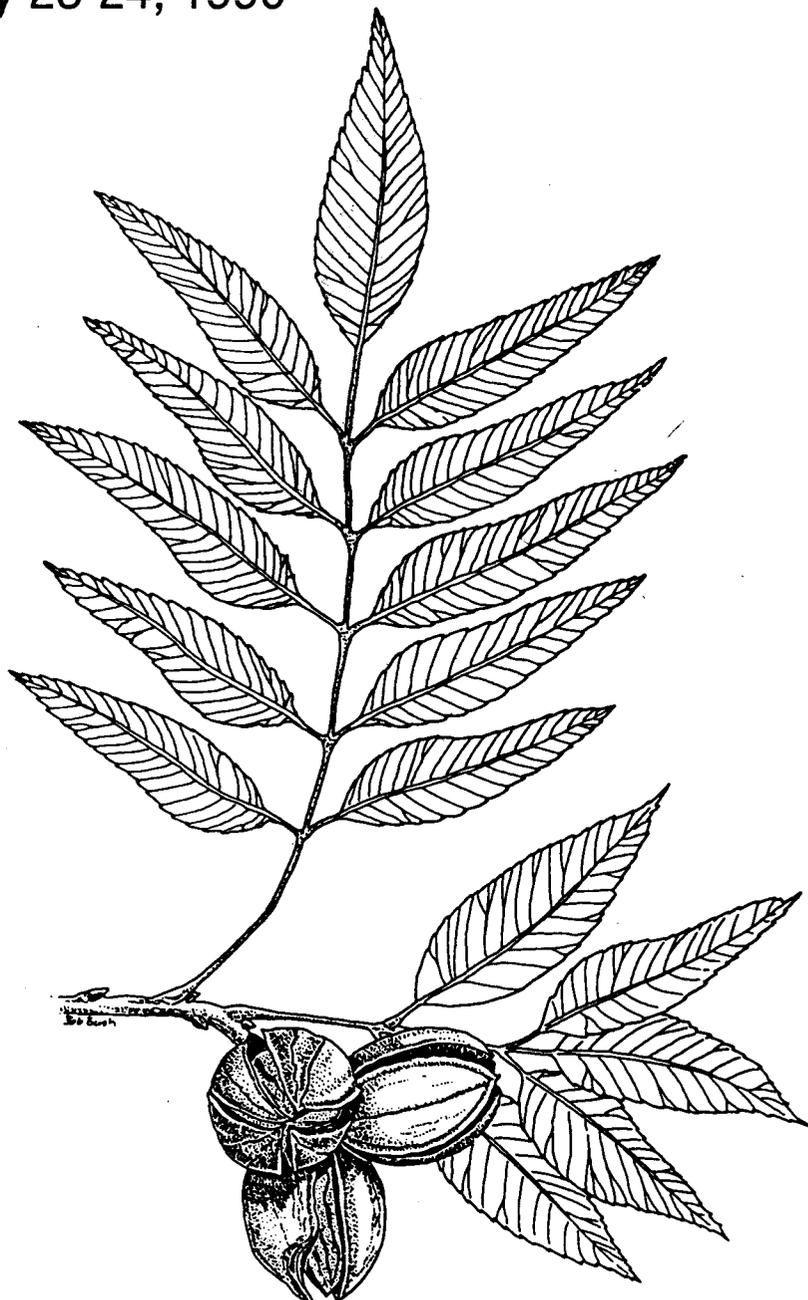
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# Pecan Husbandry: Challenges and Opportunities

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# WINTER LEGUMES IN THE TEXAS PECAN IPM PROGRAM

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## ABSTRACT

Winter legumes were planted in Texas pecan orchards to evaluate their potential to attract natural enemies of the yellow pecan aphid. During two years of testing, hairy vetch has shown potential for incorporation into a pecan Integrated Pest Management (IPM) program. The most abundant group of natural enemies attracted to legumes were the *Coccinellids*.

## INTRODUCTION

One of the major problems facing pecan producers today is the lack of an effective insecticide, or method, to control the yellow pecan aphid complex. This complex includes the blackmargined aphid [*Monellia caryella* (Fitch)] and the yellow pecan aphid (*Monelliopsis pecanis* Bissell). In Texas, where insecticides are applied in most years for the pecan nut casebearer (*Acrobasis nuxvorella* Neunzig) the resurgence of yellow pecan aphids behind insecticide treatments is a major concern.

Yellow aphids have been shown to physically damage pecan by feeding on the vascular system of the leaves (Teddars 1978). Also, public concern about pesticide use and the loss of insecticides for the pecan industry have put a greater emphasis on biological control of insect pests. One area that holds potential for biological control of pecan insects is through habitat manipulation (Teddars 1983). Unlike most agricultural row crops, pecan are not a true monoculture; therefore, offers the potential for interplanting to manipulate insect populations. This strategy has been used in pecans in the southeast (Teddars 1983) and in pear orchards in the state of Washington (Fye 1983).

One group of plants that is well suited for intercropping are the legumes. Prior to the 1960's, summer and winter legumes were part of pecan production systems. During this time the main function of the legume was to supply nitrogen (Blackman 1948, Grossard 1948, White 1981). Although summer legumes were used, producers shifted to winter legumes due to concerns that summer cover crops competed with pecans for moisture.

As part of the Texas pecan (IPM) program, winter legumes were established in demonstration orchards in the fall of 1988 and 1989 to evaluate their potential to attract natural enemies of the yellow pecan aphid complex. In addition to monitoring insect populations, other attributes of legumes such as reseeding ability, maturity time, stand density and ability to suppress weeds were also noted.

## METHODS AND MATERIALS

On October 28, 1988, seven winter legumes (Table 1) were seeded in a 242.9 ha pecan orchard in Burleson County. Legumes were inoculated immediately prior to seeding then overseeded into the native vegetation with a cyclone hand seeder at the indicated rates. The soil type for this orchard was a westwood silt loam with a pH of 7.5.

In a nonreplicated test, each legume was seeded between the tree rows from dripline to dripline on both sides of one row of trees. Two middles of native cover were left as a buffer between each legume. Vegetation under the dripline of the trees was not suppressed during the study. Plot size for each legume consisted of two rows approximately 8 m x 250 m each.

At a second demonstration, five legumes (hairy vetch, Cahaba White vetch, alfalfa, Bigbee berseem clover and Clare subclover) were seeded on October 28, 1988 in a clean tilled orchard in Taylor, Texas (Williamson County). Legume seed were inoculated then seeded into a prepared seed bed with a cyclone hand seeder. After seeding, all plots received a light disking to cover the seed. Except for Clare subclover which was seeded in one strip on the outside edge of the orchard, each legume was seeded in the row middles on both sides of one row of trees. Each middle was approximately 6.5 m x 130 m. No buffer area was left between the different legumes. The soil type for this orchard was a Houston clay with a pH of 7.5.

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Sampling for natural enemies was initiated on April 11, 1989 in both Burleson and Williamson Counties and continued until May 30, 1989 or until a cover had matured. Sampling consisted of making 50 sweeps with a 35.56 cm diameter sweep net in each plot. Insect counts were made directly from the net after each 10 sweeps and natural enemies were tallied according to their group (*Coccinellids*, *Chrysopids*, spiders, etc.).

In 1989, demonstrations were expanded to orchards in five additional counties (Navarro, Lavaca, Caldwell, DeWitt and Pecos). Legumes planted in 1989 were: hairy vetch, Cahaba White vetch, Bigbee berseem clover, Clare subclover, Mt. Barker subclover, Koala subclover and Tibbee crimson clover. Locations where each of these legumes were planted are listed in Table 2.

Large plot trials were established in Burleson, Lavaca, Navarro and Williamson Counties in 1989 based on evaluating the results of 1988 trials. In Burleson County, hairy vetch was seeded on November 6 over 3.23 ha and Cahaba White vetch, Bigbee berseem clover and Koala subclover on 1.62 ha plots. Seeding of these plots was accomplished with a cyclone hand seeder, seeding into the native clover.

In Lavaca County, Clare and Koala subclovers, Bigbee berseem clover and hairy vetch were drill seeded into a prepared seedbed on December 3, 1989. Plot sizes were: Clare subclover, 3.25 ha; Bigbee berseem, 3.25 ha; Koala subclover, 2 ha; and hairy vetch, 0.4 ha.

At a demonstration orchard in Navarro County, hairy vetch, Cahaba White vetch, Bigbee berseem and Tibbee crimson clovers and Mt. Barker subclover were seeded with a brillion seeder into a prepared seedbed on October 19, 1989. Plots were solid planted with each plot approximately 0.65 ha.

At the 1988 Williamson County site, the hairy vetch plot was expanded to 0.9 ha, while Bigbee berseem was planted over 0.2 ha. Seed were applied with a cyclone hand seeder into a prepared seed bed with both plots receiving a light disking to cover the seed.

Since many native pecan bottoms are grazed in Texas, two demonstrations were established to look at the influence of grazing on legume cover cropping. Demonstration orchards in Caldwell and DeWitt Counties were grazed with cattle during the fall, winter and spring. In Caldwell County,

hairy vetch, Bigbee berseem clover and Koala subclover were drill seeded into native vegetation in early December between rows of trees. Each cover was seeded on approximately 1.0 ha.

In DeWitt County, hairy vetch, Bigbee berseem clover and Mt. Barker subclover were seeded in small plots approximately 6 m x 50 m in a mixed improved native and budded orchard. Cattle were allowed to graze during the winter and spring.

Sampling for natural enemies began during April at all locations by making 100 sweeps with a 35.56 cm diameter sweep net in each legume plot. Collections from the net were placed in a container of 70% alcohol and taken back to the office for examination.

## RESULTS AND DISCUSSION

### 1988-1989

In the 1988-89 demonstrations, only hairy vetch, alfalfa and Bigbee berseem clover produced stands that could be sampled. Clare subclover produced a very weak stand in Williamson County and no stands were obtained from subclovers in Burleson County. Red clover at the Burleson County site only emerged in small patches and was not sampled for insects.

Insect counts during the spring of 1989 showed that natural enemies were generally higher in hairy vetch than in other legumes or native cover in Burleson and Williamson Counties. Populations of natural enemies peaked in hairy vetch in Burleson County on May 9, 1989 (Table 3) and on May 2, 1989 in Williamson County (Table 4).

*Coccinellids* and spiders made up the highest percentage of natural enemies in all covers at both locations. The most common *Coccinellid* collected at both locations was the convergent lady beetle *Hippodamia convergens* Guerin-Meneville. Other common *Coccinellids* collected at both locations were the seven spotted lady beetle *Coccinella septempunctata* L., *Cycloneda munda* (Say) and *Scymnus* (Pollus) *loewii*.

Hairy vetch produced moderate stands at both locations and reduced weed competition except for johnsongrass, *Sorghum halepense* and wild lettuce, *Lactuca* sp., during late May. Hairy vetch had mature seed and could be shredded or disked by the first week of June. Bigbee berseem matured a little earlier, around May 23.

1989-1990

A hard freeze during mid December froze out or severely reduced many of the plots seeded in November. In Burleson County, no stands were obtained in the large plots. Stand failure was due to a combination of the freeze and fire ant activity. The freeze was also responsible for failed stands of subclover in Navarro, Lavaca and Caldwell Counties.

Hairy vetch, which had reseeded from the 1988-89 trials, had two to three inches of growth at the time of the December freeze. The vetch plots received some burning from the freeze but stand density in the spring was unaffected. In fact, stands produced in the spring of 1990 in Burleson and Williamson Counties were much denser than those of the previous year.

Alfalfa produced a good stand in 1989, but was discontinued from the trials because of its season long competition with pecans for moisture.

A hairy vetch demonstration in Pecos County was seeded too late (February) to achieve any fall growth and the stand failed to develop.

In Caldwell and DeWitt Counties where legume plots were grazed, competition from native vegetation and pressure from grazing did not allow stands to develop. Indications from these trials are that legumes planted under grazing may not have the opportunity to generate significant numbers of natural enemies.

Samples of insect populations during the spring of 1990 showed that natural enemies of the yellow pecan aphid were higher in legume plots than in the native vegetation. In Lavaca County, where pecan nut casebearer was treated with chlorpyrifos (Lorsban 4E), natural enemy populations in the berseem plot were reduced but reestablished within two weeks (Table 5).

In Navarro County, Tibbee crimson had high populations of natural enemies early due to the early maturity of the clover. By May 24 both the Tibbee crimson and Bigbee berseem clovers had matured and sampling of these plots was discontinued. One aspect of a cover crop that may be useful is to provide a harborage area for natural enemies during periods when insecticides are applied for the first generation pecan nut casebearer. In this demonstration hairy vetch still maintained predators on May 24 (Table 6), which is about the time for first generation pecan nut casebearer in this area.

After samples were checked for primary aphid predators, they were checked for predaceous thrips. Edelson and Estes (1987) list predaceous thrips of the family *Phaeothripidae* that has been observed to feed on pecan aphids. Most of the thrip species identified from all samples at all locations were in the genus *Frankliniella*. Species of thrips identified were *F. occidentalis*, *F. tritici*, *F. fusca*, *Sericothrips variabilis*, *Plesiothrips ayarsi*, *Thrips tabaci*, *Neohydatothrips cingulatus*, *Aeolothrips duvali*, *A. bicolor*, *Stomatothrips* sp. *A. duvali*, *A. bicolor* and *Stomatothrips* sp. are predaceous species.

## CONCLUSIONS

The results of this work are based on two years of information and a limited number of winter legumes have been screened. It may be possible that summer legumes may have a place in some management systems for increasing aphidophagous insects in the orchard (Bugg and Dutcher 1989). Although several studies on the effects of natural enemies on yellow aphid populations have been conducted (Edelson and Estes 1987, Liao et al. 1984), the full effect of natural enemies coming from cover crops on early season yellow aphid populations requires further evaluation.

One limiting factor that was not examined in these studies was the impact of the red imported fire ant RIFA, *Solenopsis invicta* Buren on natural enemy populations. It has been shown that the RIFA is a major predator of lacewing eggs, larvae and pupae (Teddars et al. 1989) and could be a major limiting factor for any type of biological control program. RIFA were present in all demonstration orchards.

Other aspects of legume cover crops such as reseeding ability, cold hardiness, weed suppression and stand density will be important in an IPM program. It will be just as important to evaluate any limiting aspects of a cover crop. Limiting factors may include soil types, producing undesirable insects either for pecans or surrounding crops and surrounding crops such as corn or grain sorghum which may compete with pecans for beneficial insects.

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Table 1. Legumes seeded during 1988 at Burleson and Williamson Counties.

Legume	Seeding rate Kg/Ha
Hairy vetch - <i>Vicia villosa</i> Roth	28.06
Cahaba White vetch - <i>Vicia sativa</i> x <i>V. cordate</i>	28.06
Alfalfa - <i>Medicago sativa</i>	16.85
Bigbee Berseem clover - <i>Trifolium alexandrinum</i>	11.24
Red clover - <i>Trifolium pratense</i>	16.85
Clare subclover - <i>Trifolium subterraneum</i> L.	11.24
Mt. Barker subclover - <i>Trifolium subterraneum</i> L.	11.24

Table 2. Legumes screened during 1990 in different counties.

County	Legumes						
	Hairy vetch	Cahaba vetch	Bigbee berseem	Koala	Clare	Mt. Barker	Tibbee crimson
Burleson	x	x	x	x			
Caldwell	x		x	x			
Dewitt	x		x			x	
Lavaca	x		x	x	x		
Navarro	x	x	x	x		x	x
Pecos	x						
Williamson	x		x				

Table 3. Average<sup>1</sup> number of natural enemies<sup>2</sup> per sweep from Burleson County - 1989.

Date	Hairy Vetch	Alfalfa	Berseem	Bigbee Native
4/11	0.48	0.40	0.84	0.30
4/19	0.34	0.66	1.00	0.42
4/25	0.56	0.42	0.45	0.30
5/2	0.54	0.30	0.12	0.48
5/9	0.96	0.42	0.40	0.16
5/19	0.23	0.26	0.30	0.12
5/23	0.64	0.38	0.32	0.18
5/30	0.22	0.34	---- <sup>3</sup>	0.04

<sup>1</sup> Average of 50 sweeps.

<sup>2</sup> All post embryonic stages of *Coccinellids*, chrysopids, syrphids and spiders.

<sup>3</sup> No sample taken because cover had matured.

Table 4. Average<sup>1</sup> number of natural enemies<sup>2</sup> per sweep from Williamson County - 1989.

Date	Hairy Vetch	Alfalfa
4/11	0.14	0.36
4/24	1.82	1.04
5/2	7.00	2.34
5/16	1.00	0.94
5/23	0.34	0.46
5/30	0.24	0.36

<sup>1</sup> Average of 50 sweeps.

<sup>2</sup> All post embryonic stages of *Coccinellids*, chrysopids, syrphids and spiders

Table 5. Average<sup>1</sup> number of natural enemies<sup>2</sup> per sweep from Bigbee Berseem Clover and native vegetation in Lavaca County - 1990.

Date	Bigbee Berseem Clover	Native Cover
4/16	0.44	0.08
4/25	0.18	0.04
5/1	0.36	0.08
5/7 <sup>3</sup>	0.33	0.02
5/17	0.04	0.05
5/23	0.58	0.26

<sup>1</sup> Average per 100 sweeps.

<sup>2</sup> All post embryonic forms of *Coccinellids*, chrysopids, syrphids and spiders.

<sup>3</sup> Sprayed for pecan nut casebearer on 5/9/90 with chlorpyrifos (Lorsban 4E)

Table 6. Average<sup>1</sup> number of enemies<sup>2</sup> per sweep from Navarro County - 1990

Date	Hairy Vetch	Bigbee Berseem	Tibbee Crimson	Native
4/10	0.07	0.15	0.17	0.05
4/17	0.20	0.20	0.60	0.15
4/24	0.46	0.31	0.78	0.14
5/1	0.35	0.56	0.54	0.28
5/8	0.69	0.34	0.15	---- <sup>3</sup>
5/18	1.41	0.42	0.10	0.04
5/24	0.98	---- <sup>4</sup>	---- <sup>4</sup>	0.04

<sup>1</sup> Average from 100 sweeps.

<sup>2</sup> All post embryonic forms of *Coccinellids*, chrysopids, syrphids and spiders.

<sup>3</sup> No sample taken because plot was recently shredded.

<sup>4</sup> No sample taken because cover had matured.