IPFP SATELLITE PROJECT

MOWING COVER CROPS AND THROWING RESIDUE INTO TREE ROWS FOR WEED CONTROL (MOW AND THROW); USE OF RICE STRAW MULCH FOR WEED CONTROL AND BENEFICIAL INSECT MONITORING IN COVER CROPS

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PROBLEM AND ITS SIGNIFICANCE

The mow and throw technique of mowing cover crops and throwing the residue into tree rows for weed control has been researched and demonstrated in other crops, specifically grapes. Prune growers have not been exposed to the "mow and throw" technology. Rice straw is a significant ag-waste. The rice industry is trying to find alternative uses for this waste product. Cover crops can harbor beneficial insects that may be useful in prune trees.

OBJECTIVE

The objectives of this trial are to demonstrate the mow and throw technique to prune growers, evaluate rice straw mulch for weed control and to collect information about beneficial insect populations associated with cover crops.

PROCEDURES

At two sites seed beds were established and planted with a cereal cover crop that produces significant biomass for use in the mow and throw technique. In October 1997, the Chico site was planted with 100 pounds of Montezuma oat seed per acre. The Gridley site was planted with 125 pounds of RSI-5 wheat seed per acre. In October 1997 a rice straw mulch treatment was established by spreading rice straw in tree rows. The Gridley site included a herbicide strip spray treatment. Both sites included an untreated check treatment. Four replicates of each treatment were established in a randomized block design at each site. Each replicate consisted of five or more trees in straight rows. Weed control data was analyzed by analysis of variance. Data was collected on biomass, economics and beneficial insect populations. Beneficial insect populations were monitored six to eight times using sweep net sampling of the ground cover and beat tray sampling of the prune trees.

RESULTS

In May 1998, the amount of oat and wheat biomass was determined. The oat cover crop produced 2.9 tons per acre biomass while the wheat cover crop produced 3.3 tons per acre biomass. When placed in the tree rows, 3 feet wide, this amounted to 5.8 tons per treated/acre and 6.6 tons per treated/acre respectively. The rice straw mulch was spread 3 feet wide in the tree rows at the rate of six tons per treated acre.

Weed control evaluations in the tree rows were made in May 1998 only between the rice straw, herbicide and untreated treatments (Tables 1 and 2). The cover crop mulch was not evaluated for weed control because rain prohibited the proper use of the mow and throw equipment when the equipment was available. At the Chico site rice straw mulch had no impact on the percent of the ground covered with weeds. In fact, bindweed was significantly worse where rice straw was applied. At the Gridley site rice straw did suppress wild barley and ryegrass compared to the untreated. The pre-emergence herbicide worked best on wild barley and ryegrass but was poorer on crabgrass and barnyard grass. After six months of exposure to Sacramento Valley weather conditions the rice straw decomposed to 67.5 percent at the Chico site and 53.8 percent at the Gridley site compared to the applied coverage.

Cost comparisons of a cover crop, a herbicide and a rice straw program are shown. Rice straw cost one dollar per 80 pound bale. At six tons per treated acre rice straw mulch cost $45 per acre for the straw, plus $67 for hand application for a total of $112 per acre. The establishment of an oat or wheat cover crop cost $46 per acre. A "top end" pre-emergence and contact herbicide program cost $62 per acre.

There were no significant differences between the number of beneficial insects present in the cover crop treatment and the resident vegetation using the beat sampling technique in the trees. This was the case for both the Gridley and Chico site (Table 3 and 4). The wheat cover crop (Gridley site) had significantly more beneficial insects than the resident vegetation (Table 4). The oat cover crop at the Chico site had more beneficials present than the resident vegetation but the differences were not statistically significant (Table 3). Convergent lady beetle adults and larvae were the most prevalent beneficial insect at both the Chico and Gridley sites.

Two field meetings were held at the end of May to demonstrate these weed control techniques, including the mow and throw technique, and to discuss the beneficial insects found in the cover crop.

CONCLUSIONS

Clientele became aware of the mow and throw technology as a result of the two demonstration meetings. Rice straw, as a mulch, needed to be applied at least at twice the rate (12 tons per acre) to have lasting benefit. This would double the cost of the straw to $90 per acre. Hand spreading of the straw would not change significantly, however a mechanized application would lower cost. A 12 ton per acre rice straw mulch, hand applied, would cost $157 per acre. That would be significantly more than a herbicide program. Rodents, utilizing the rice straw or cover crop mulch, could result in tree damage. If a mulch is used, careful attention to rodent damage is needed. Since the cover crops provided approximately the same amount of biomass as the rice straw it can be assumed that weed control would be essentially the same. Previous "mow and throw" research (California Agriculture 1997 51:2) in grapes reported that five times the biomass was needed, as generated in this trial, to get adequate weed control and it cost $43 per acre to perform the mow and throw operation. The total cost of the mow and throw weed control program would be approximately $89 per acre, more than a "top end" herbicide program. The specific equipment

used to perform the mow and throw operation is expensive and currently commercially unavailable. Consequently, this method of weed control is unlikely to be adopted. If adopted it would provide poorer weed control at a higher cost than herbicides.

Cereal cover crops have shown the ability to attract and harbor beneficial insects because of their susceptibility to infestations by aphids which are not significant pests of prunes (oat bird cherry aphid, greenbug, and English grain aphid). These aphids can serve as a food source for beneficial insects when prune trees have few insects present in the spring for these beneficials to feed on. No prune aphids (mealy plum and leaf curl plum aphids) were present in either the Chico or Gridley orchards in the 1998 growing season. The lack of prune aphids as a food source may account for the numerous beneficial insects, which were present in the cover crops, not taking up residence in the prune trees after the cover crop was mowed.

The use of herbicides remains the most economic weed control program.

Table 1. Weed Evaluations in the Tree Row (5/8/98)-Chico Orchard (% cover)

Treatment	Sweet clover	Bindweed	Ryegrass	Rice straw
Untreated	8.8 B	26.8 A	8.0 B	0.0 B
Rice Straw	1.25 B	60.0 B	4.0 B	67.5 A

Means not followed by the same letter are significantly different at the 5 % level.

Table 2. Weed Evaluations in the Tree Row (5/8/98)-Gridley Orchard (%cover)

Treatment	Wild barley	Soft Chess	Ryegrass	Barnyard	Crabgrass	Rice Straw
Untreated	33.8 A	4.0 A	31.25 A	3.8 A	1.25 A	2.0 A
Rice Straw	10.5 B	4.0 A	12.0 B	6.2 AB	1.25 A	53.8 B
Herbicide	.25 C	.5 A	.5 BC	27.5 B	12.5 B	.5 A

Means not followed by the same letter are significantly different at the 5 % level.

Table 3. Beneficial Insect Evaluations-Chico Orchard

Ground Cover Treatment	Sweep Samples in Ground Cover # of Beneficial Insects Present	Beat Tray Samples in Prune Trees # of Beneficial Insects Present
Oat Cover Crop	13.75 A	0.0 A
Resident Vegetation	11.75 A	0.0 A

Means not followed by the same letter are significantly different at the 5% level by Duncan's Multiple Range Test For Mean Separation.

Table 4. Beneficial Insect Evaluations-Gridley Orchard.

Ground Cover Treatment	Sweep Samples in Ground Cover # of Beneficial Insects Present	Beat Tray Samples in Prune Trees # of Beneficial Insects Present
Wheat Cover Crop	31.25 A	0.0 A
Resident Vegetation	8.25 B	0.0 A

Means not followed by the same letter are significantly different at the 5% level by Duncan's Multiple Range Test For Mean Separation.

U.C. COOPERATIVE EXTENSION
COSTS PER ACRE TO ESTABLISH AND OAT OR WHEAT COVER CROP
FLOOD IRRIGATION
K. KLONSKY, L.TOURTE, C. INGLES AND BILL OLSON

Labor Rate: $ 10.72/hr. Machine labor
$ 6.70/hr. Non-machine labor
Interest Rate: 9.00%

Operation	Operation Time (Hrs/A)	Cash and Labor Costs per Acre: Labor Cost	Fuel, Lube & Repairs	Material Cost	Custom/ Rent	Total Cost	Your Cost
Cover Crop:							
Land Prep -Disc 1X	0.33	5.50	2.60	0.00	0.00	8.10	
Cover Crop Seeding	0.11	1.48	0.29	21.00	2.00	24.77	
Spring-Tooth Harrow	0.33	4.30	2.00	0.00	0.00	6.30	
Ring Roller - Finish Seedbed	0.23	2.95	0.58	0.00	0.00	3.53	
TOTAL COVER CROP COSTS	1.00	14.23	5.47	21.00	2.00	42.70	
Interest on operating capital @ 9.00%						3.84	
TOTAL OPERATING COSTS/ACRE		14.23	5.47	21.00	2.00	46.54	

U.C. COOPERATIVE EXTENSION
COSTS PER ACRE FOR HERBICIDE-WEED CONTROL

Operation	Operation Time (Hrs/A)	Cash and Labor Costs per Acre: Labor Cost	Fuel, Lube, And Repairs	Material Cost	Custom/ Rent	Total Cost	Your Cost
Summer Strip	0.14	2.00	1.00	8.00	0.00	11.00	
Dormant Strip	0.14	2.00	1.00	49.00	0.00	51.00	
TOTAL COVER CROP COSTS	.28	4.00	2.00	57.00	0.00	62.00	

U.C. COOPERATIVE EXTENSION
COST PER ACRE FOR RICE STRAW MULCH WEED CONTROL

Operation	Operation Time (Hrs/A)	Cash and Labor Cost per Acre: Labor Cost	Straw Cost/Acre	Total Cost
Rice Straw Mulch	10 acres	$67	$45	$112