University of California
COOPERATIVE EXTENSION
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Protective Border Plantings for Ag/Urban Interfaces and Beneficial Insect Support

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Summary

Protective border barriers were established at three sites in commercial floriculture and strawberry fields in San Diego County, California. These border plantings were used to provide a physical barrier between agricultural fields and adjacent urban development, and to evaluate the effects of border plantings on insect populations and crop/barrier interactions. Border plantings consisted of native plants with overlapping flowering periods to provide nectar and pollen to beneficial insects throughout the year. Yellow sticky traps were used to monitor insect populations. Results indicate that protective border plantings: 1) can form attractive physical barriers that help to reduce dust, noise, visual pollution, and spray drift; 2) provide habitat for beneficial insects and pests; 3) support beneficial insects that may help reduce the population peaks of pest insects during spring and summer months; and 4) have no negative impact on adjacent crop fields.

Introduction

Agriculture in San Diego County has a net value of over one billion dollars annually. Production fields are frequently located near housing tracts, shopping centers, roadways, schools, and parks. The viability of this urban interface agriculture depends on the ability of growers to allow their neighbors to enjoy the full benefits of their property. Growers must minimize the noise, dust, flies, spray drift, odors, and field worker improprieties that can be associated with agricultural enterprises.

An excellent way to minimize 'ag/urban interface' problems is to grow a protective border planting between housing and agricultural production fields. Border plantings increase the aesthetic value of agricultural open spaces and screen out unwanted agricultural activities for those living adjacent to production areas. An ideal protective barrier planting consists of plants that: 1) grow quickly and are easy to maintain; 2) provide a good physical barrier to dust, spray drift, and noise; 3) are inexpensive and aesthetically pleasing; 4) do not harbor insect pests that would damage crops or surrounding landscape plantings; and 5) support beneficial insects which prey on crop insect pests. Border planting sites were developed to identify plants which are adapted to border planting use, and to gather information on insect populations that are supported by those plantings.

Materials and Methods Used

Protective border plantings approximately 100 feet in length were established in the fall of 1994 at three sites. The sites were located in northern San Diego County adjacent to a commercial strawberry field, a perennial myrtle field,

and an annual ranunculus bulb production field. The plants used to develop the multi-story border plantings were selected after consultation with university and industry horticulturists, entomologists, ecologists, and crop specialists. Plants were selected for the border plantings (tables 1 & 2) because of their dense foliage, overlapping flowering periods, and ability to support beneficial insects that prey on agricultural pests. Sprinkler systems and tensiometers were installed at each border planting to provide and monitor summer irrigations. Sites were weeded and fertilized every three months.

Table 1. Plant, Beneficial Insect, and Agricultural Pest Associations

Shrubs	***Common Name (Ht)***	***Beneficial Insects Supported***	***Pests Potentially Reduced***
Baccharis pilularis	Coyote Brush (4-8')	Minute Pirate Bug, Hoverflies	Thrips, Aphids, Whitefly, Mites
Ceanothus 'Concha'	Wild Lilac (6-8')	Lady Beetles, Hoverflies	Aphids, Mites, Leafhoppers, Mealybugs
Ceanothus 'Ray Hartman'	Wild Lilac (12-20')	Lady Beetles, Hoverflies	Aphids, Mites, Leafhoppers, Mealybugs
Ceanothus 'Yankee Point'	Wild Lilac (3-6')	Lady Beetles, Hoverflies	Aphids, Mites, Leafhoppers, Mealybugs
Eriogonum fasiculatum	Calif. Buckwheat (2-5')	Wasps, Tachinid Flies,	Aphids, Caterpillars, Leafhoppers, Mites,
Eriogonum giganteum	St.Cathrn's Lace (3-4')	Hoverflies, Minute Pirate Bug	Thrips, Whitefly, Mealybugs, Corn Earworm
Heteromeles arbutifolia	Toyon (6-10')	Tachinid Flies	Caterpillars, Squash Bugs, Stink Bugs
Rhamnus californica	Coffeeberry (12-15')	Tachinid Flies, Lady Beetles	Aphids, Caterpillars, Leafhoppers, Mites
Zauschneria californica	Calif. Fuchsia (1-2')		
Groundcovers			
Achillea sp.	Yarrow (8-12")	Hoverflies, Lady Beetles, et al	Aphids, Mites, Whitefly, Leafhoppers, et al
Myoporum parvifolium	Boobialla (3-6")	Beneficial Wasps, Tachinid Flies	Caterpillars, Aphids, Leafhoppers, et al
Clumping Grasses			
Muhlenbergia rigens	Deer Grass (2-3')	Lady Beetles	Aphids, Leafhoppers, Mites, Mealybugs
Stipa pulchra	Needlegrass (1-2')	Lady Beetles	Aphids, Leafhoppers, Mites, Mealybugs

Table 2. Flowering Periods of Selected Border Plants

	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Coyote Brush	xxxxxx									xxxxxxxxxxxxxxxxxx		
Ceanothus sp.		xxxxxxxxxxxxxxxxxxxxxxxxxxx										
Coffeeberry				xxxxxxxxxxxxxx								
Yarrow sp.				xxxxxxxxxxxxxxxxxxxxxxxxx								
Toyon					xxxxxxxxxxxxx							
Buckwheat					xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx						

Border plantings were well established by July 1995 and insect observations began. Three yellow sticky insect traps (3"x 5") were placed 15 feet apart at the top of the canopy at each border planting to monitor beneficial and pest insect populations. Control sites were established in the same manner, in clear areas next to the agricultural production fields and 200 yards upwind from the border plantings. At the strawberry production site additional sets of three traps each were placed 25 feet and 50 feet from the border planting and control plot to monitor insect populations inside the strawberry field. Traps were collected each week from July 1995 to August 1996. A representative strip (1"x 5") in the center of the sticky traps was scored for beneficial and pest insects. Beneficial insects were classified into Araneida and Acari orders (spiders and mites), wasp superfamilies Chalcidoidea and Proctotrupoidea, and families Ichneumonidae and Braconidae; predacious hemipterans such as assassin bugs, damsel bugs, minute pirate bugs, big eyed bugs, homopteran lacewings; coleopterans such as lady beetle, and rove beetle; and syrphid fly. The pests were classified into the Acari order, or ant, aphid, leaf beetle, fruit fly, fungus gnat, leafhopper, moth fly, plant bug, psyllid, stink bug, thrips, tortricid moth, and whitefly families.

The reduction of spray drift by border plantings was measured at each site by placing posts 10 feet apart, one post in front of and one behind border planting and control plots, in-line with wind direction. Water sensitive paper strips (1" x 5") were attached to the posts at 2, 3.5, and 5 feet above the soil. A hand sprayer was adjusted to deliver various droplet sizes and used to simulate spray applications. Water was sprayed directly toward the soil surface from a height of 3 feet for one minute. Spraying was done 6 feet up-wind from the front post. Spray drift was evaluated at the plots in 3 to 5 mph winds and droplets, which hit the water sensitive paper strips, were counted.

Results

Insect trap data averages for three sites (figure 1) show higher pest populations in border plantings when compared to control plots from September through December 1995, when the border plants were becoming established. Pest peaks during this time were due to combinations of whiteflies, leafhoppers, and thrips. This trend reversed itself in April/May 1996 and pest populations became higher in control plots, when the border plantings were better established. Pest population peaks in May/June were due to thrips. Border plantings maintained higher populations of beneficial insects on the average when compared to control plots.

Figure 1. Average insect levels in border plantings and unplanted control plots for 3 sites (figures 1a, 1b, and 1c).

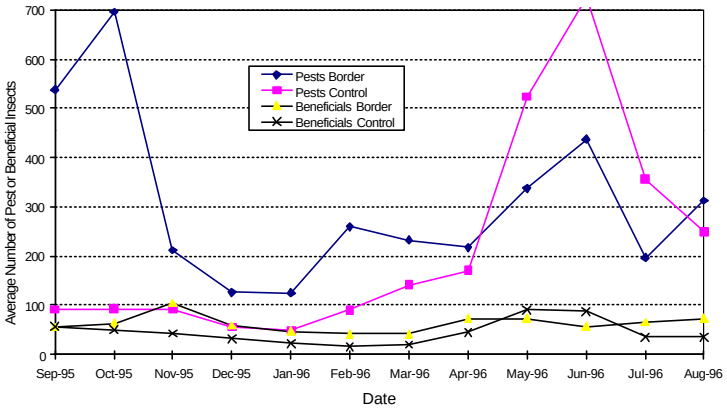
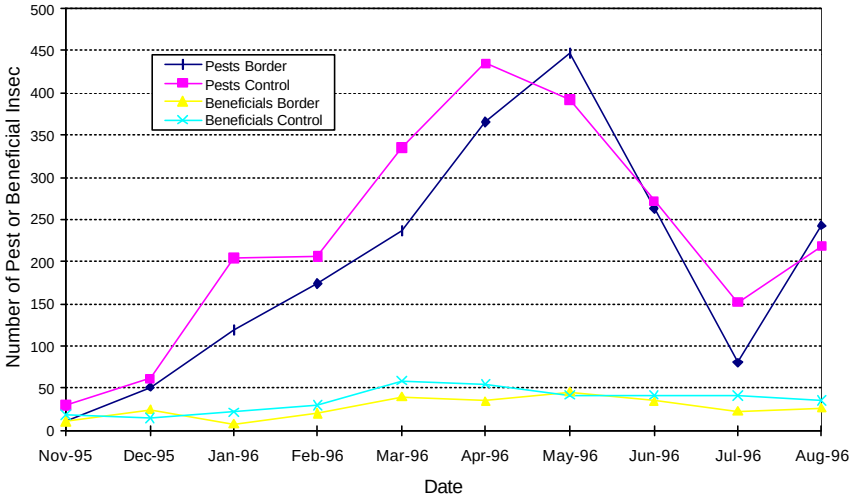


Figure 2. Effects of border planting and control plots on insects within strawberry field (averages of 25' & 50' traps).



Averages of insect trap data from 25 and 50 feet into the strawberry field (figure 2) indicate that these small research border plantings, which were down wind from the agricultural fields, had no impact on beneficial insect populations within the strawberry field. Having the border planting next to the field did not increase the pest insect population within the strawberry field.

Counts of spray-drift droplets collected on water sensitive paper, from in front of and behind control plots and border plantings, indicate that border plantings significantly reduce field spray-drift in low wind conditions (table 3). Numbers of droplets intercepted by water sensitive paper decreased significantly from front to back posts in control plots (plots with no border plants) because larger droplet sizes dropped out due to gravity alone. Smaller droplets, however, are moved great distances by wind. These smaller droplets were reduced 96% by the border plantings when average counts from the back posts (controls vs. border plantings) were compared in these trials.

Table 3. Effect of border plantings on number of spray droplets intercepted at 6 feet and 16 feet from the spray source (averages of data from 5 trials).

Height	Border Plantings		Controls (No Plants)	
of trap	Front Post at 6'	Back Post at 16'	Front Post at 6'	Back Post at 16'
5'	43	1	46	12
3.5'	110	1	101	43
2'	241	5	219	101
Avg.	131 a*	2 c	122 a	52 b

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

Discussion and Conclusions

Results indicate that protective border plantings: 1) can form attractive physical barriers that help to reduce dust, noise, visual pollution, and spray drift; 2) provide habitat for beneficial insects and their prey; 3) support beneficial insects that may help reduce the population peaks of pest insects during summer months; and 4) have no apparent

negative effect on pest insect populations within adjacent crop fields. Bio-diversity and overlapping flowering that extends throughout the year are keys to increasing populations of beneficial insects. Therefore, several different native plant species, which give year-round flowering, were incorporated into the border plantings. Beneficial insect populations were increased within the border plantings in these small-scale test plantings. This had no apparent effect, however, on beneficial insect populations within adjacent agricultural fields. If border plantings were larger and up-wind from the fields, more impact of beneficial insect populations within the fields might be expected.

Neighboring property owners expressed appreciation for the border plantings. They thought the border plantings were visually attractive, they noticed a reduction in noise and dust, and requested that the plantings be expanded in size. Spray drift is a serious concern for property owners living adjacent to agricultural fields. The multi-story border plantings developed in these research trials almost eliminated spray drift in the low wind conditions under which most agricultural spraying is completed.

Growers favored the plantings but were concerned about the cost of installing and maintaining the plantings during the first two years of establishment. The border plantings in this project were established rapidly with 5 and 1-gallon plants. These large plants cost $130 per 50 linear feet of planted border. The cost could have been reduced if smaller plants had been used during establishment. The plantings required mini-sprinkler summer irrigation for rapid establishment. The native plants chosen for this project are tolerant to drought conditions and can be maintained, in most cases, without additional irrigation after establishment. Native drought resistant plants, which are established rapidly with the use of frequent irrigations and fertilization, can experience significant leaf loss when summer irrigations are withdrawn. A slow weaning process to fewer summer irrigations helps to prevent the shock of sudden summer irrigation removal.

The costs associated with establishing border plantings for reducing dust, spray drift, noise, and visual pollution are justified when urban development is down-wind, close to agriculture, and neighbors are unfriendly toward agricultural activities. The support of beneficial insects by border plantings with overlapping flowering periods, is an important added benefit to the physical barrier that multi-storied border plantings provide.