CSU, Chico Smart Sprayer Report
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Methods to reduce pesticide applications have received increased attention in recent years in light of increasing environmental concerns. Recently, a vision-sensor-based precision chemical application sprayer (Smart Sprayer) has been developed to increase performance, reduce costs, and decrease off-site impacts. The report below discusses: 1) research results of a trial to determine the relationship between pesticides savings and percent trees missing in an orchard and 2) economic analysis of the orchard sprayer.

Trial Results

A trial was set up to evaluate the relationship between pesticides savings and percent trees missing in an almond orchard. The trial was set up in a mature 18-year-old almond orchard at the CSU, Chico Farm that contained variable numbers of missing trees (from 0 to over 80% missing trees). The experiment was conducted in during the month of November, where the trees had lost about 75% of their leaves.

There was a positive, linear relationship between percent saving and percent missing trees (Figure 1). The regression line indicated that: 1) every 1 percent increase in missing trees resulted in a 0.64% increase in pesticide application savings; 2) with no missing trees the pesticide savings averaged 26%. Missing trees caused the sprayer to shut off and thus increase pesticide savings. Almond trees adjacent to gaps formed by a missing tree can increase growth slightly to intercept the light, however, almond trees cannot grow large enough to close the canopy and fill the gap caused by the missing tree. The almonds are a mid-sized tree and do not have the genetic potential to grow into a large tree.

Estimating the relationship between percent missing trees and percent pesticide savings, however, is less useful for tree species that can grow and fill gaps caused by missing trees (e.g. walnut, pecan). In addition, percent pesticide savings vary depending on tree spacing and on the age of the orchard. Young pecan and peach orchards, for example, averaged pesticide savings around 30% (data collected this past fall). A better predictor of pesticide savings would be percent light penetration in the orchard. A further advantage of this method is that once the relationship between light penetration and pesticide savings is established on-the-ground, aerial photos and geographical information technology can be employed to determine savings in many orchards very quickly and economically. A senior student at Chico State is currently collecting these data.

Economic Analysis

An economic analysis was conducted by Christie Adams, Agriculture Business Instructor, CSU, Chico. The goal of the economic analysis was to determine how long it would take for the savings resulting from decreased pesticide use to pay for the Smart Sprayer technology. In other

words, the analysis was used to determine how long it would take for the Smart Sprayer technology to pay for itself. The assumptions for this analysis include:

1. Cost $15,000 of smart sprayer technology
2. Computed at 50, 100, 200, and 300 acres
3. Optimistic approach - $200 chemical cost per acre and 25% savings
4. Pessimistic approach - $175 chemical cost per acre and 20% savings

The recovery costs at various sized farms (from 50 to 300 acres) are below:
Optimistic approach - cost recovery in years

50 acres	6.5 years
100 acres	3.25 years
200 acres	2.75 years
300 acres	1.05 years

Pessimistic results - cost recovery in years:

50 acres	9.5 years
100 acres	4.5 years
200 acres	2.5 years
300 acres	1.5 years

Both analyses indicate that the cost to recover the initial investment of the Smart Sprayer is very rapid. In a 300 acre farm, for example, the grower would recoup the investment in just over one year. These analyses corroborate data presented at the Durand Wayland website (http://www.durand-wayland.com/sprayers/smart_spray/smartspray.html), and indicate that this technology is very promising as a cost effective BMP for reducing off-site impacts of pesticide application.

Figure 1: Relationship between pesticide savings and percent trees missing in a mature almond orchard.