Project No. 93-ZI4 - Air Quality Aspects of Almond Production

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Objectives: Evaluate the role of all aspects of almond production to the San Joaquin Valley. What is needed is a way to:

1. Isolate a given agricultural operation from all other sources of dust, natural or man-made.
2. Evaluate the effect of this operation, positive or negative, on PM-10 aerosol.
3. Calculate the impacts, positive or negative on potential receptors area away from the local operations.

Results:

The California Central Valley has persistently elevated levels of fine, inhalable aerosols as measured by California Air Resources Board PM-10 aerosol samplers. PM-10 stands for particulate matter below 10 micrometers (about 1/100 the thickness of a humans hair) which can be ingested deep into the human respiratory system posing potential health effects. Under the National Clean Air Act and their amendments, as well as the California Clean Air Act, Air Pollution Control Districts in nonattainment of national and state standard levels form plans and regulations to reduce PM-10 levels. To help address these tasks, the role of California agriculture needs to be understood. We are continuing to measure the impacts, both positive and negative, of agriculture upon PM-10 levels. Two years ago we quantified the levels of PM-10 generated by almond harvest operations. Last year and this year, we examined how much particulate matter is "filtered" out of the atmosphere by a typical almond orchard canopy.

Our measurements have shown a very small but measurable decrease in PM-10 downwind of an almond orchard canopy. This suggests that an almond canopy could have a measurable positive impact (reduction) upon PM-10. Although our measurements (upwind, inside and downwind) show a small decrease in the horizontal downwind gradient, other measurements (David Grantz) have shown a slight emmission of PM-10 upward from a canopy during a post-harvest period when the leaves were covered with dust. As expected, compositional analysis of the PM-10 samples showed that the majority of the PM-10 mass was composed of soil particles (about 65% of the mass). Currently a repetition of improved measurements when the leaves were relatively "dust-free" is being reduced to provide more data to better understand the true impact of an almond canopy upon PM-10 levels.

Project No. 93-Z14B - PM-10 Fluxes To And From An Almond Orchard

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Objective:

1. Evaluate the role of the developing almond canopy in emitting or removing PM_{10} (respirable particles) from the air.

Results:

The San Joaquin Valley violates current air quality regulations for respirable particles less than ten microns diameter (PM_{10}). These are a human health hazard because they enter the deep lung and do not leave.

In 1992 we showed following harvest that the almond canopy emitted slight amounts of PM_{10}. We thought this might reflect resuspension of dust put into the canopy during harvest. In 1993, therefore, we examined the whole production season to test this hypothesis.

Using a 30 foot tower installed in a Fresno County almond orchard we used the Bowen ratio-energy balance method to measure particle transport above the canopy. Figure 1 shows that early in the season (May) transport occurred only near midday, and was always from the orchard to the air. Over the entire day only slight emissions of PM_{10} occurred. The expected result -- removal of PM_{10} from the air by the orchard -- was not observed during this first sampling period. Data from later in the growing season are essentially consistent with this conclusion. Further analysis of dust gradients from the orchard floor up to the canopy may tell us more about the causes of this particulate emission, and suggest ways to reduce it further.