Weed Population Dynamics in Processing Tomato under different Tillage Practices as influenced by Irrigation Method.

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Project Summary: Subsurface drip irrigation conserves water and decreases weed populations compared to furrow or sprinkler irrigation. Conservation tillage systems reduce equipment and fuel costs, in addition to conserving soil and reducing dust. Conservation tillage relies heavily, however, on herbicides for weed control. In dry summer regions, lack of moisture near the soil surface prevents annual weed germination. If subsurface drip can be managed to prevent annual weed germination, the need for herbicides would be reduced or eliminated, and would allow the implementation of conservation tillage without an increased reliance on herbicides.

Design: A two-year field experiment will be conducted at the University of California, Davis. The treatments will compare subsurface drip and furrow irrigation under conventional and conservation tillage. Prior to planting, subsurface drip tape will be installed. Tomatoes will be transplanted using a no-till transplanter; fertilization and other practices will be similar to that of growers. After transplanting, furrow and subsurface irrigation treatments will be imposed. A

split-split-block design with four replications will be used, with main plot being tillage type, sub-plots irrigation type and sub-sub plots being either standard herbicide treatments or no herbicides. Each irrigation/tillage combination will be a minimum of four beds wide and the length of the field. Hence, the treatments will be:

1. Conventional tillage, subsurface drip irrigation with standard herbicide application.
2. Conventional tillage, subsurface drip irrigation with no herbicide.
3. Conventional tillage, furrow irrigation with standard herbicide application.
4. Conventional tillage, furrow irrigation with no herbicide.
5. Conservation tillage, subsurface drip irrigation with standard herbicide application.
6. Conservation tillage, subsurface drip irrigation with no herbicide.
7. Conservation tillage, furrow irrigation with standard herbicide application.
8. Conservation tillage, furrow irrigation with no herbicide.

Standard herbicide treatments in tomatoes will consist of a post-transplant, banded application of rimsulfuron, made at approximately 14 days after transplanting. Comparisons of tillage type will include two intercrop tillage intensities, conventional (minimum, bed disking) tillage and conservation tillage (no-till). A Wilcox Performer implement will be used in the minimum tillage system. No intercrop tillage will be used in the no-till system. Hand weeding will be used in all plots to remove any emerged weeds at approximately 30 to 40 days after transplanting. Single-wheel (one wheel wide rather than two) harvest trailers will be used so as to maintain harvest traffic to the furrows so as to permit dedicated tractor traffic areas, or "zone production" (Carter, 1987).

Improving weed management, while reducing herbicide use is the primary objective of this study. Thus, weed density, cover, species composition, and distribution across the bed will be measured in each plot at 7, 14, 28, and 42 days after transplanting, and prior to any cultivation or

hand weeding. By measuring weed distribution across the bed (assuming weed emergence in the subsurface drip irrigated plots), it may be possible to use very narrow herbicide bands. Hand weeding time will be recorded for each plot in order to assess economic returns.

Furrow irrigation will be applied as needed in amounts that replenish estimated evapotranspiration (ET) losses. Drip irrigations will be applied daily or every other day based on management guidelines recently developed by May and Hanson (Hanson, pers. comm.). End-of-season irrigation cutoff for both systems will be done in accordance with previously developed best irrigation management practices for processing tomatoes (Personal communication, D. May). Applied irrigation water volumes will be monitored using in-line flow meters. Soil water content will be measured in the surface 10 cm at four locations across the bed using a portable time domain reflectometry (TDR) instrument weekly during the first two months following transplanting to assess surface wetting. If surface moisture is excessive, weed germination would be expected to increase.

Plots will be machine harvested for determination of yields and subsamples taken for quality (soluble solid content, color, and disease). Treatment costs and net returns will also be calculated.

In 2005, the study will also be conducted at the West Side REC or with a cooperating grower in that area. Based on the first years results, additional treatments may be added to further refine weed management recommendations.

Initial Results: In the first season of the experiment the drip system showed significantly less weed growth and populations than the furrow system. Both systems had similar tomato plant biomass, and yield. The furrow yield had higher percentages of red fruit while the drip system was greener. We hypothesize that this was due to the late planting date and a learning curve in using the drip system to properly irrigate the plants. We expect that next year the

differences in red fruit as a percentage of total will be minimal.

References:

Carter, L.M., E.A. Rechel and B.B. Meek. 1987. Zone production system concept. Acta Horticulturae 210. Technical communication of the International Society for Horticultural Science. Wageningen, Netherlands. March 1987. Pp. 25 – 34.