Fuel Use Consumption for Processing Tomatoes

Background: Russell Ranch measures the fuel use for different tractor operations to develop an estimate of energy consumption for each of the cropping systems. Previously, data for these estimates came from standard formulas of ASABE (American Society of Agricultural and Biological Engineers), which were developed based on fuel use for midwestern tractor operations. Operations and soil properties of California's diverse agricultural systems differ substantially from those in the midwest, underscoring the need for measurements more representative of local conditions.

Approach: Fuel use data were measured in processing tomato fields in Yolo County, including Russell Ranch, and the farms of Tony Turkovich, Steve Meeks, and Frank Muller. Data were collected with a Campbell 23X datalogger through a CAN bus port on John Deere tractors. Only new tractors are compatible with this type of data collection, and after 2007, tractors started incorporating a standard CAN bus data port that allows for electronic data collection. Additional data were obtained from filling the fuel tank before and after an operation and measuring the fuel use with a Fill-Rite digital meter. Fuel use data from grower's fields was used whenever possible, and in certain cases, data from Russell Ranch operations were directly used.

Figure 1: Image of CAN bus port

Results: Three cropping systems (Conventional, Mixed and Organic) are compared below in terms of fuel use, averaged over 3 year period from 2010 to 2012. The operations associated with incorporating cover crops contributed the most significant increase to the variation in fuel use across systems.

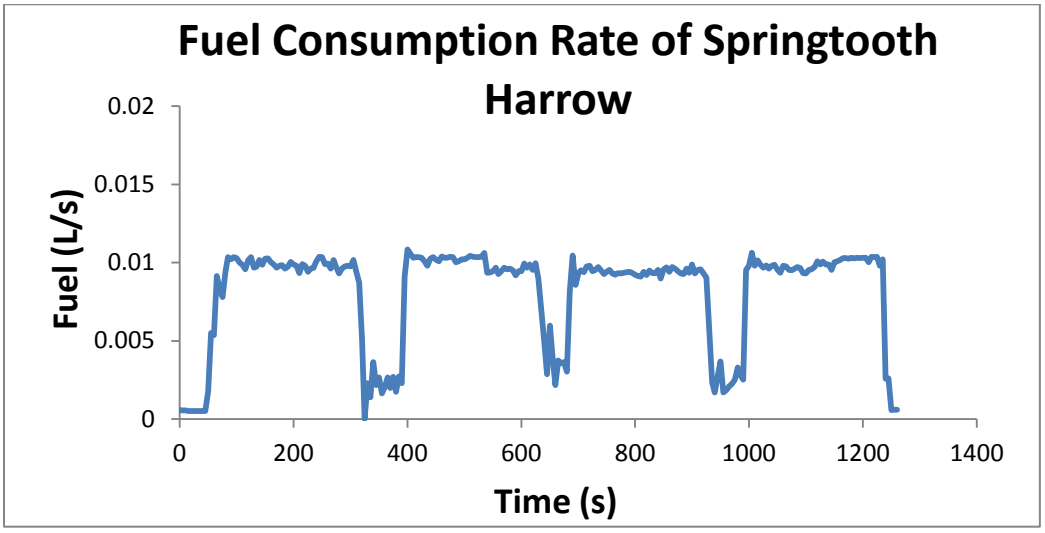

Figure 2: Four passes across a processing tomato field with a 15 ft wide springtooth harrow.

Table 1: Sample operations at for different systems 2011-2012 (begins after wheat harvest).

Conventional	Mixed	Organic
Finish disc (four passes)	Finish disc (four passes)	Finish disc (four passes)
Subsoil (two passes)	Subsoil (two passes)	Subsoil (two passes)
Finish disc	Finish disc	Finish disc
GPS Leveling	GPS Leveling	GPS Leveling
GPS Listing	GPS Listing	GPS Listing
Spray Plots, Round-Up (two passes)		
	Harrow plots (one pass)	Harrow plots (one pass)
	Plant cover crop	Plant cover crop
	Mow cover crop	Mow cover crop
		Apply Compost
	Disc (13 passes, as needed)	Disc (13 passes, as needed)
	GPS list beds	GPS List beds
	Cultivate tomato beds	Cultivate tomato beds
Apply Fertilizer (Pre-plant)	Apply Fertilizer (Pre-plant)	
Cultivate tomato beds	Cultivate tomato beds	Cultivate tomato beds
Run Mulcher	Run Mulcher	Run Mulcher
Roll Beds	Roll Beds	Roll Beds
Transplant Tomato	Transplant Tomato	Transplant Tomato
Cultivate tomato beds (UAN 32)	Cultivate tomato beds (UAN 32)	Cultivate tomato beds
Run Incorporator (Triap, dual)	Run Incorporator (Triap, dual)	Run Incorporator
Spray Plots (sulfur)	Spray Plots (sulfur)	Spray Plots (sulfur)
	Cultivate tomato beds	Cultivate tomato beds
Tomato Harvest	Tomato Harvest	Tomato Harvest

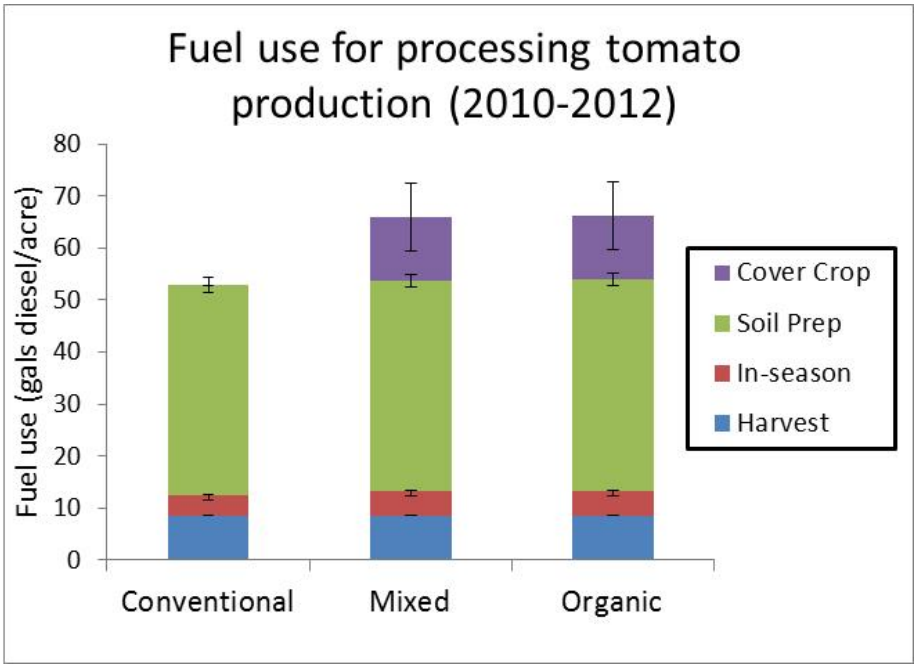

Figure 3: Fuel use for three systems (conventional, mixed and organic) at Russell Ranch from 2010-2012.