

Irrigation Management and Water Source Shift Greenhouse Gas Balance

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Martin Burger, Dept. of Land, Air and Water Resources

With the adoption of subsurface drip irrigation (SDI) in conventional processing tomato production, relatively large (> 50%) reductions in emissions of the greenhouse gas nitrous oxide have been achieved as compared to furrow irrigation.

What are the options for lowering the global warming potential, or 'carbon foot print' of tomato production even more?

We converted the energy used to manufacture nitrogen fertilizer, convey water, till the soil and harvest tomatoes, as well as the direct nitrous oxide emissions into carbon dioxide equivalents to compare the carbon foot print of management practices and irrigation systems.

Table 1. Greenhouse gas emissions of processing tomato cropping systems.

Irrigation & water source	kg CO₂ eq. / ha *
Canal water, diesel pump to pressurize SDI	543 - 866
Ground water, electric pump with variable frequency drive	272 - 402
Diesel pump to lift canal water for furrow irrigation (small field, large pump)	1556
Canal water, furrow irrigation	34
Direct nitrous oxide emissions	
Conventional practice, SDI	323 - 560
Winter cover cropped, SDI	330 - 733
Organic, furrow irrigation	763 - 990
Nitrogen fertilizer	
Conventional	820 - 1200
Organic	-
Fuel for tractors, harvester	
Conventional, SDI	542 - 607
Winter cover cropped	577 - 779
Organic	654

* Data from case studies at Russell Ranch and Yolo County grower fields

Table 2. Carbon foot print examples of tomato production systems in Yolo County.

Cropping and irrigation practice:	kg CO₂ eq. / ha year
Organic farming, furrow irrigation with canal water	1450
Conventional farming, canal water, diesel pump to pressurize drip	2450 - 3230
Conventional farming, electric pump, VFD	2410 - 2470
Winter cover cropped, electric pump, VFD	2090 - 2780
Organic farming, canal water, diesel pump to lift water for furrow irrigation (large pump, small field)	3200
Conventional farming, electric pump, VFD, furrow irrigation	2690 - 3800
Conventional farming, electric pump, VFD, furrow irrigation, excessive fertilizer N rate (300 kg N/ ha)	4100 - 4650