Effects of Anaerobic Soil Disinfestation Combined or Not with the Herbicide Sandea® on Weed Control, Fruit Yield and Quality of Fresh-market Tomato

Submitted by
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Area wide Project on Anaerobic Soil Disinfestation

Table 1. Summary of cultural practices used on tomato grown with drip irrigation in Immokalee, FL during fall 2015.

Location	Immokalee FL (SWFREC).
Number of treatments	6 (CSF, ASD1, ASD0.5 with or without herbicide) [z]
Experimental design	Split plot (2 factors and 4 replications)
Irrigation	Drip
Plot size	40 ft × 1 bed = 40 ft
Harvest unit	10 plants
Total area	40 × 6 = 240 ft × 4 reps = 960 ft
Plastic laying and fertilization	22 September 2015
Plastic mulch	TIF White/Black (top/underneath)
Planting date	13 October 2015
Variety	Ridge Runner
Linear ft per acre	7,260
Bed spacing (center to center)	6 ft
Plant population	4.840 plants
Bed height	8 inches
Plant spacing	18 inches
Bed width	36 inches
Row run	East-West
Bottom mix	1,000 lb/acre 3-10-4
Fertigation	220 lb/acre of N and 360 lb/acre of K_2O
Harvest date	
1st	4 January 2016
2nd	12 January 2016
3rd	26 January 2016
Planting to 3rd harvest	105 days

[z]CSF: chemical soil fumigation, ASD: anaerobic soil disinfestation.

Table 2. Soil disinfestation treatments applied to tomato grown under drip irrigation in Immokalee, FL during fall 2016.

Treatment [z]	Herbicide	Applied products	Application rate	Application mode
CSF (control)	NO	Pic-Clor 60	200 lb/acre	Bed fumigation
		Initial water	none	
ASD1	NO	Composted poultry litter	9 ton/acre	Incorporated in the bed
		Molasses	1,482 gal/acre	Incorporated in the bed
		Initial water	2 inches	By drip (about 4 hours)
ASD0.5	NO	Composted poultry litter	9 ton/acre	Incorporated in the bed
		Molasses	741 gal/acre	Incorporated in the bed
		Initial water	2 inches	By drip (about 4 hours)
CSF (control)	YES	Pic-Clor 60	200 lb/acre	Bed fumigation
		Initial water	none	
		Sandea®	1 once/acre	Spray on the bed
ASD1	YES	Composted poultry litter	4.5 ton/acre	Incorporated in the bed
		Molasses	1,482 gal/acre	Incorporated in the bed
		Initial water	2 inches	By drip (about 4 hours)
		Sandea®	1 once/acre	Spray on the bed
ASD0.5	YES	Composted poultry litter	9 ton/acre	Incorporated in the bed
		Molasses	741 gal/acre	Incorporated in the bed
		Initial water	2 inches	By drip (about 4 hours)
		Sandea®	1 once/acre	Spray on the bed

[z]CSF: chemical soil fumigation, ASD: anaerobic soil disinfestation.

Table 3. Summary of mean, minimum (Min.) and maximum (Max.) temperature and total rainfall in Immokalee, FL during fall 2015.[z]

Period	Temperature (°F)			Total rainfall
	Mean	Min.	Max.	(inches)
September	79.0	70.2	90.7	3.7
October	77.0	64.0	90.2	1.0
November	75.4	52.5	91.4	2.4
December	73.1	50.8	87.9	1.6
January	61.0	37.5	85.1	5.9
Average/Total	73.1	55.0	89.1	14.6

[z]Weather data obtained from Florida Automated Weather Network (FAWN) from University of Florida/Institute of Food and Agriculture Science (IFAS), South West Research & Education Center in Immokalee, FL.

Table 4. First harvest marketable and unmarketable yield by size categories for tomato grown with drip irrigation in Immokalee, FL during fall 2015.

Treatments [z]	Marketable yield				Unmarketable yield
	Extra-large (5/6)	Large (6/6)	Medium (6/7)	Total	
	(25-lb boxes per acre)				
ASD					
CSF	286 b	25	5	316 b	23 b
ASD0.5	647 a	22	1	670 a	68 a
ASD1.0	661 a	18	0	679 a	57 ab
Sandea					
without	551	26	3	580	51
with	511	17	2	530	48
P value					
ASD	***0.0001***	*0.81*	*0.21*	***0.0001***	***0.01***
Sandea	*0.19*	*0.28*	*0.55*	*0.08*	*0.82*
ASD × Sandea	*0.37*	*0.71*	*0.80*	*0.46*	*0.87*

[z] Within columns, means followed by different letters are significantly different according to Duncan's multiple range test at 5%.

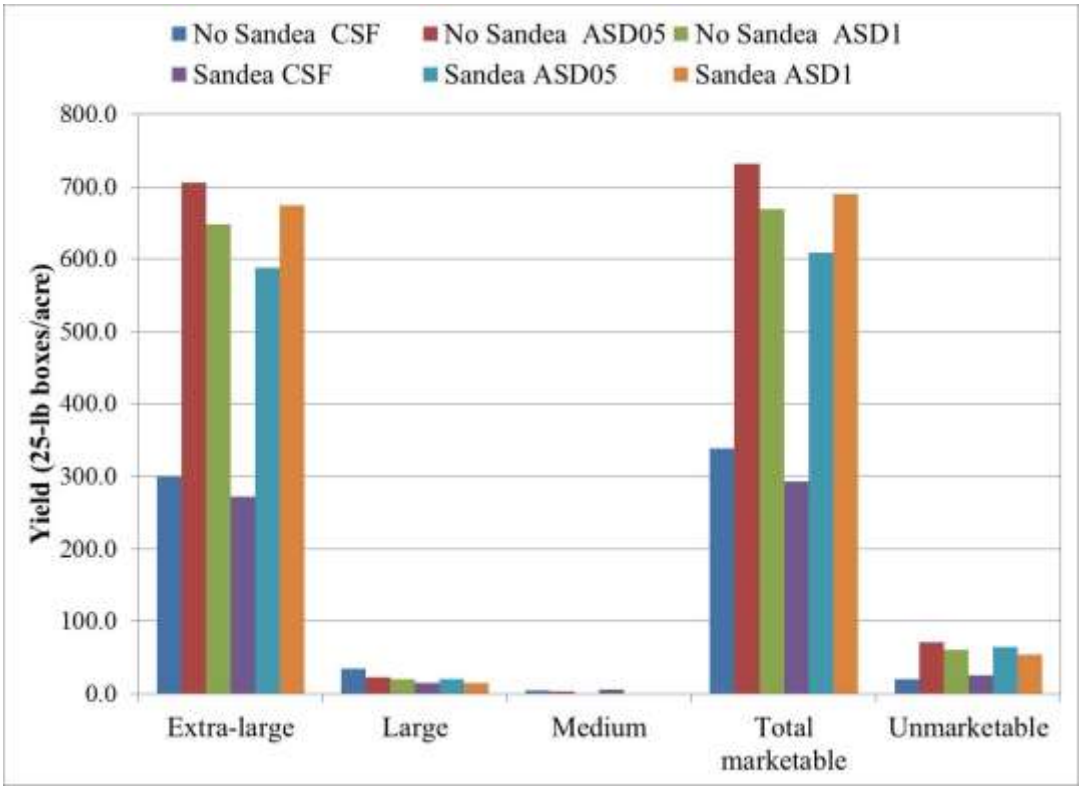

Figure 1. First harvest marketable and unmarketable yield by size categories for tomato grown with drip irrigation in Immokalee, FL during fall 2015.

Table 5. Second harvest marketable and unmarketable yield by size categories for tomato grown with drip irrigation in Immokalee, FL during fall 2015.

Treatments [z]	Marketable yield				Unmarketable yield
	Extra-large (5/6)	Large (6/6)	Medium (6/7)	Total	
	(25-lb boxes per acre)				
ASD					
CSF	502 b	137	26	666 b	53 b
ASD0.5	576 b	118	12	706 b	118 ab
ASD1.0	715 a	131	17	863 a	148 a
Sandea					
without	590	125	19	734	99
with	605	133	18	755	114
P value					
ASD	***0.01***	*0.40*	*0.12*	***0.02***	***0.0002***
Sandea	*0.64*	*0.57*	*0.67*	*0.46*	*0.42*
ASD × Sandea	*0.60*	*0.18*	*0.75*	*0.86*	*0.38*

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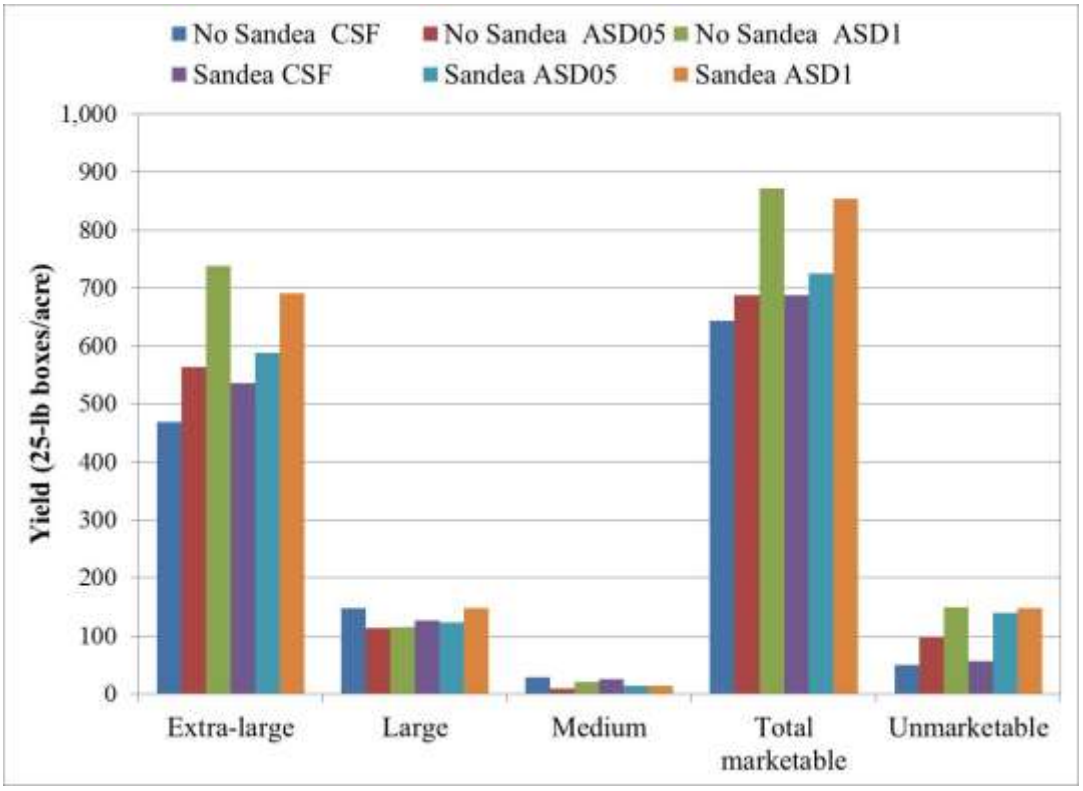

Figure 2. Second harvest marketable and unmarketable yield by size categories for tomato grown with drip irrigation in Immokalee, FL during fall 2015

Table 6. First and second harvest marketable and unmarketable yield by size categories for tomato grown with drip irrigation in Immokalee, FL during fall 2015.

Treatments [z]	Marketable yield				Unmarketable yield
	Extra-large (5/6)	Large (6/6)	Medium (6/7)	Total	
	(25-lb boxes per acre)				
ASD					
CSF	788 b	162	31	982 b	76 b
ASD0.5	1223 a	140	13	1376 a	186 a
ASD1.0	1376 a	149	17	1542 a	205 a
Sandea					
without	1141	151	22	1314	149
with	1117	149	20	1286	162
P value					
ASD	***0.0001***	*0.48*	*0.09*	***0.0001***	***0.0001***
Sandea	*0.67*	*0.92*	*0.46*	*0.56*	*0.56*
ASD × Sandea	*0.60*	*0.18*	*0.92*	*0.77*	*0.54*

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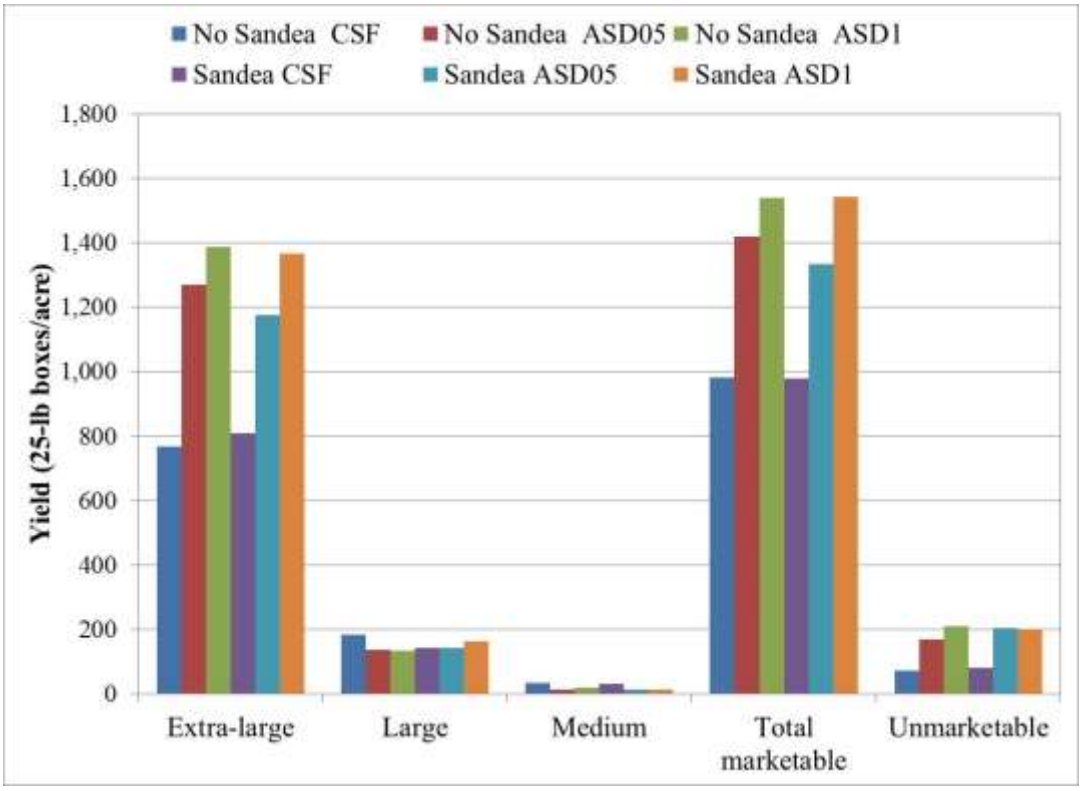

Figure 3. First and second harvest marketable and unmarketable yield by size categories for tomato grown with drip irrigation in Immokalee, FL during fall 2015.

Table 7. Third harvest marketable and unmarketable yield by size categories for tomato grown with drip irrigation in Immokalee, FL during fall 2015.

Treatments [z]	Marketable yield				Unmarketable yield
	Extra-large (5/6)	Large (6/6)	Medium (6/7)	Total	
	(25-lb boxes per acre)				
ASD					
CSF	233 a	219 a	129 a	580 a	111
ASD0.5	102 b	101 b	60 b	264 c	114
ASD1.0	204 a	138 b	90 ab	432 b	150
Sandea					
without	161	147	94	401	107
with	199	158	92	449	143
P value					
ASD	***0.03***	***0.01***	***0.003***	***0.01***	*0.20*
Sandea	*0.13*	*0.61*	*0.95*	*0.15*	*0.11*
ASD × Sandea	*0.95*	*0.57*	*0.08*	*0.82*	*0.59*

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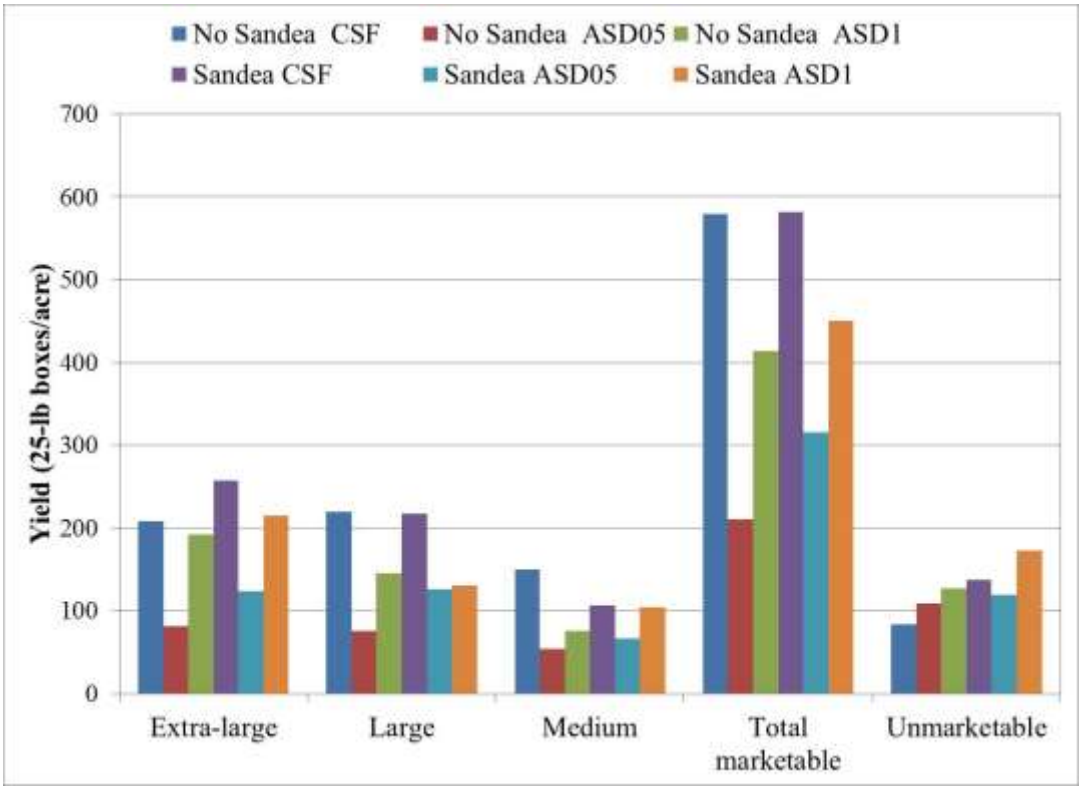

Figure 4. Third harvest marketable and unmarketable yield by size categories for tomato grown with drip irrigation in Immokalee, FL during fall 2015.

Table 8. Total harvest marketable and unmarketable yield by size categories for tomato grown with drip irrigation in Immokalee, FL during fall 2015.

Treatments [z]	Marketable yield				Unmarketable yield
	Extra-large (5/6)	Large (6/6)	Medium (6/7)	Total	
	(25-lb boxes per acre)				
ASD					
CSF	1021 c	381 a	160 a	1562 b	187 c
ASD0.5	1325 b	241 b	73 b	1640 b	300 b
ASD1.0	1580 a	287 b	107 ab	1974 a	355 a
Sandea					
without	1302	298	115	1716	256 b
with	1315	308	112	1735	306 a
P value					
ASD	***0.0001***	***0.004***	***0.001***	***0.001***	***0.0004***
Sandea	*0.82*	*0.57*	*0.85*	*0.70*	***0.02***
ASD × Sandea	*0.69*	*0.35*	*0.15*	*0.98*	*0.91*

[z] Within columns, means followed by different letters are significantly different according to Duncan's multiple range test at 5%.

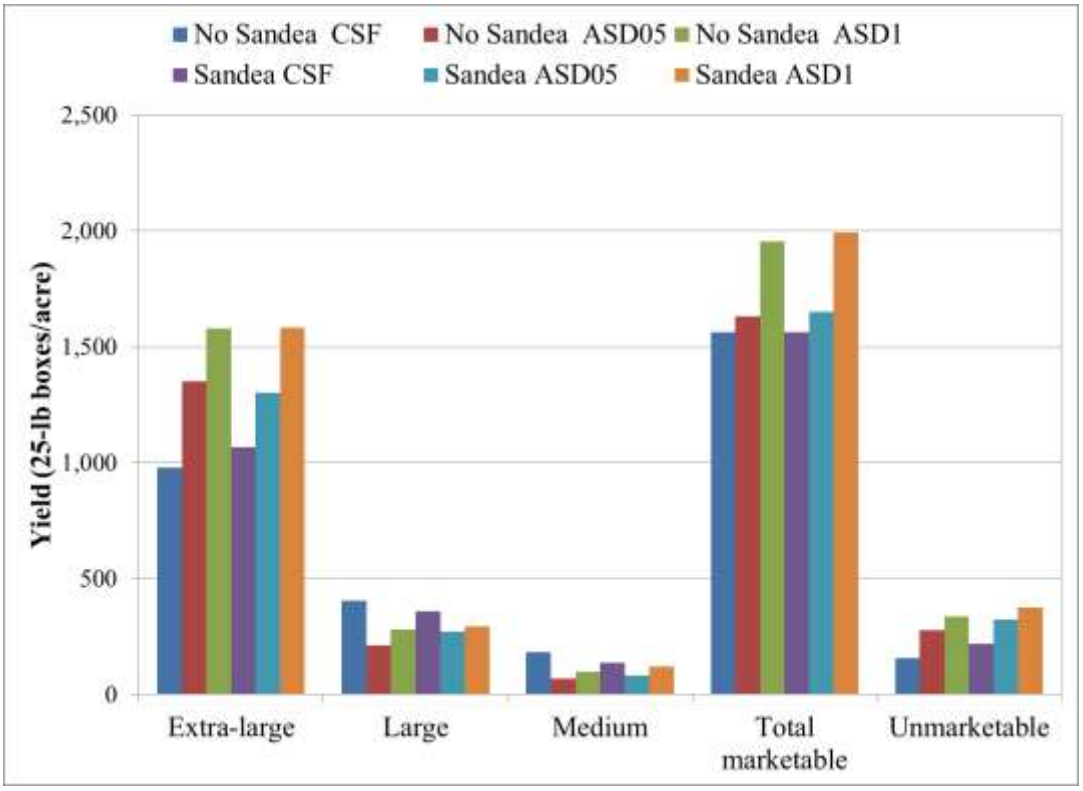

Figure 5. Total harvest marketable and unmarketable yield by size categories for tomato grown with drip irrigation in Immokalee, FL during fall 2015.

Table 9. Soil treatment effects on tomato fruit firmness (expressed as fruit deformation), skin color, Brix°, pH and dry matter content at first harvest on tomato grown with drip irrigation in Immokalee, FL during fall 2015.

Treatments	Deformation (mm)	Color (1-6 scale)	Total soluble solids (Brix°)	pH (0-14)	Dry matter (g kg^{-1} FW)
ASD					
CSF	3.1	5.4	3.2	4.14	26.2
ASD0.5	3.0	5.4	3.1	4.07	25.0
ASD1.0	2.8	5.3	3.2	4.11	25.1
Sandea					
without	3.0	5.3	3.2	4.09	26.1
with	3.0	5.4	3.2	4.13	24.7
P value					
ASD	*0.06*	*0.54*	*0.48*	*0.09*	*0.64*
Sandea	*0.70*	*0.30*	*0.17*	*0.47*	*0.25*
ASD × Sandea	*0.22*	*0.18*	*0.92*	*0.65*	*0.65*

Table 10. Soil treatment effects on weed coverage on tomato grown on beds mulched with totally impermeable film using drip irrigation in Immokalee, FL during fall 2015.

Treatments	Days after transplanting				
	36	50	64	78	105
	Weed coverage (%)				
ASD					
CSF	0.04 b	0.23 b	0.54 b	0.94 b	2.25
ASD0.5	0.48 a	2.49 a	4.60 a	8.16 a	17.63
ASD1.0	0.15 ab	0.83 ab	2.00 ab	3.01 ab	9.31
Sandea					
without	0.38 a	2.10 a	3.83	6.65 a	15.63
with	0.06 b	0.26 b	0.93	1.43 b	3.83
P value					
ASD	***0.0001***	***0.004***	***0.003***	***0.001***	***0.005***
Sandea	***0.01***	***0.02***	*0.07*	***0.03***	***0.01***
ASD × Sandea	***0.007***	***0.02***	***0.04***	***0.02***	*0.06*

[z] Within row, means followed by different letters are significantly different according to Duncan's multiple range test at 5%.

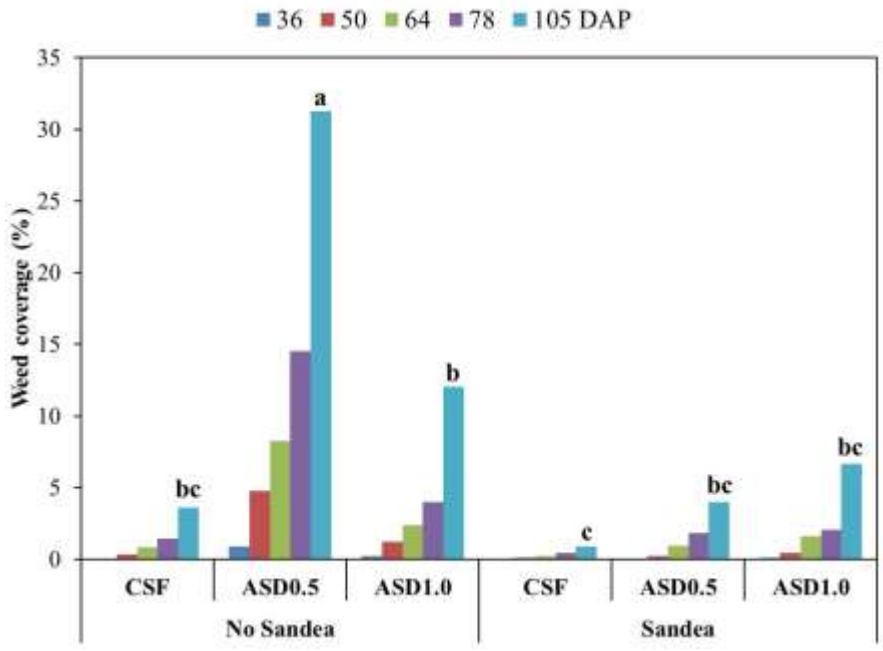

Figure 6. Soil treatment effects on weed coverage on tomato grown on beds mulched with totally impermeable film using drip irrigation in Immokalee, FL during fall 2015.