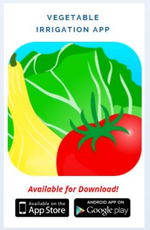
The Use of Smartphone Application (Smartirrigation Vegetable) for Irrigation Scheduling in Tomato (*Solanum lycopersicum* Mill.) Production

Ibukun T. Ayankojo[1] and Kelly T. Morgan[1]
[1]Southwest Florida Research and Education Center, 2685 29 N, Immokalee, FL 34142

Introduction

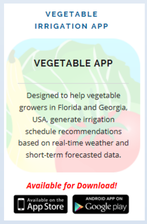


In Florida, tomato (*Solanum lycopersicum*) is the second most valuable agricultural commodity next to orange with total harvested area of 11,540 ha and total cash receipts of about 565 million dollars in 2011 (FDACS 2013). Understanding of proper irrigation management in Florida sandy soils is crucial so as to maintain nutrient in the root zone, increase yield, water and nutrient use efficiencies and reduce any adverse impact of production on the environment (Zotarelli et al., 2009). Therefore, SmartIrrigation (SI) Apps are worthy alternative irrigation scheduling method using real-time and location specific weather data (Migliaccio, 2014).

Goal and objectives

Overall goal was to evaluate a smartphone application (SI Veg. App) for irrigation scheduling in tomato production.

- ✓ Compare use of schedules on seasonal water use
- ✓ Evaluate irrigation schedules on tomato biomass accumulation and yield
- ✓ Determine nutrient and water use efficiencies from scheduling methods



How to use the App?

Download the App (SmartirrIgation vegetable) for free from your app store or google play, and use the example on the right to schedule your irrigation (Fig. 1).

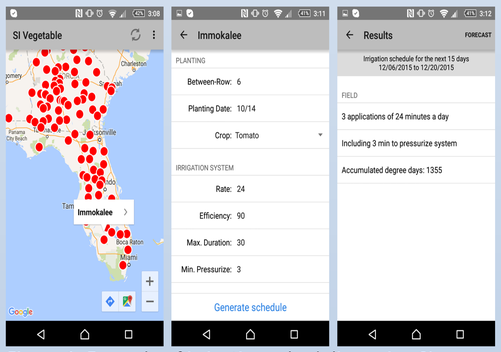


Figure 1. Example of irrigation scheduling using SI Vegetable for tomato production.

Are there other SI Apps for other crops?

Yes, other SI Apps (Fig. 2) and information are available at http://smartirrigationapps.org/

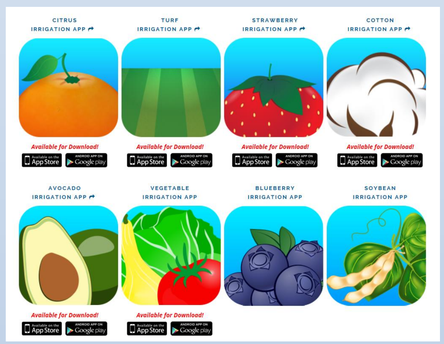


Figure 2. SI Apps for various crops in Florida

Methodology

Figure 3. Preplanning operations during fall and spring seasons in Immokalee FL. (Photo credit Dr. F. DiGioia and I. Ayankojo)

Table 1. Treatment specifications for tomato irrigation study during spring and fall seasons in Immokalee, FL.

Treatments	Flow per Emitter (Lh^{-1})	Distance Between Emitter (cm)
100% IFAS Rate	0.91	31
66% App Rate	0.61	31
100% App Rate	0.91	31
150% App Rate	1.36	31

Result and Discussion

Table 2. Effect of irrigation rates on total N accumulation during spring and fall seasons of 2015 in Immokalee, FL.

Treatment	Fall 2015 ($kg.ha^{-1}$)			Spring 2016 ($kg.ha^{-1}$)		
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
100% IFAS	370	3080	2730	36.17	1968	2948
66% App	460	3210	3680	35.81	1788	2557
100% App	330	3450	3480	46.67	1796	2778
150% App	370	2800	2860	28.8	1667	3105
P-value	*0.07*	*0.11*	*0.08*	*0.4*	*0.49*	*0.67*

- ➢ No significant differences were observed among irrigations rates for total biomass accumulation at all sampling dates

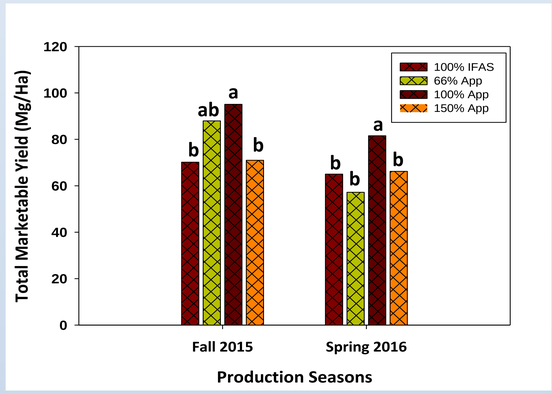


Figure 4. Effect of irrigation rates on total marketable yield during fall 2015 and spring 2016 in Immokalee, FL.

- ➢ 100% SI App was significantly higher in total marketable yield in in both season seasons
- ➢ Results indicates that irrigation scheduling using a real-time scheduler is better than historic ET scheduler in tomato

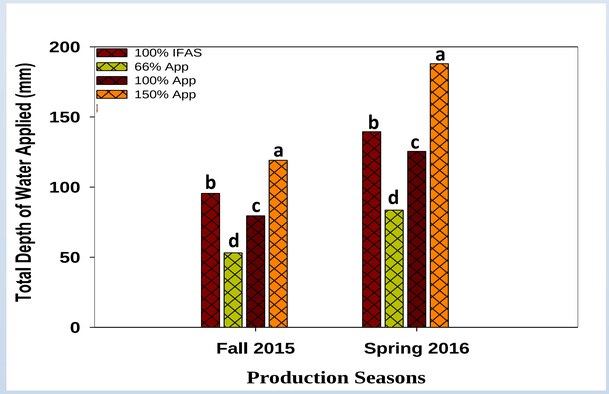


Figure 5. Total water use in depth by treatments for fall 2015 and spring 2016 in Immokalee, FL.

- ➢ Total irrigation was highest for 150% SI App and lowest for 66% app for both seasons
- ➢ Total water savings for 100% SI App over 100% IFAS were 17% and 15% for fall and spring seasons respectively

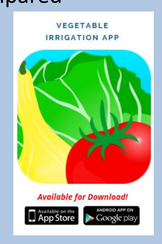
Table 3. Nitrogen (NUE-N) and water (WUE) use efficiencies spring and fall seasons

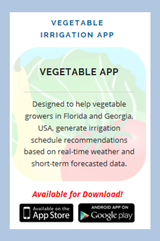
Treatment	----------Fall 2015----------		----------Spring 2016----------	
	WUE ($kg\ m^{-3}$)	NUE - N ($kg.g^{-1}$)	WUE ($kg.m^{-3}$)	NUE - N ($Kg.g^{-1}$)
100% IFAS	71.55 c	0.31 b	22.36 b	0.29 b
66% App	161.03 a	0.40 ab	34.70 a	0.26 b
100% App	121.06 b	0.44 a	32.97 a	0.36 a
150% App	57.62 c	0.31 b	17.89 b	0.30 b
P-value	*0.00033*	*0.31*	*<0.01*	*0.01*

- ➢ WUE was higher with 100% app compare to 100% IFAS
- ➢ 100% App was most N efficient, although not different from 66% app during fall season
- ➢ Lower efficiency in higher irrigation rates suggests nutrient leaching

Conclusion

- ✓ Real-time and location specific irrigation scheduling (SI App) improve tomato performance compared to schedule based on historic ET (IFAS)
- ✓ SI vegetable App significantly saved more water over IFAS recommendation
- ✓ Both WUE and NUE-N were greater for SI compare to IFAS schedule in tomato production
- ✓ 100% App schedule resulted in greater yield compared with 100% IFAS
- ✓ Lower NUE-N for 100% IFAS and 150% App suggests nutrient leaching





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