Alternative Irrigation Scheduling: Kc and SMS based watering effects on watermelon production

Luke Miller[1*], Timothy Coolong[1], George Vellidis[2], Wesley Porter[2], Erick Smith[1], and Osama Mohawesh[3]
[1]Department of Horticulture, The University of Georgia, 2360 Rainwater Road, Tifton, GA 31793
[2]Department of Crop and Soil Sciences, The University of Georgia, 2360 Rainwater Road, Tifton, GA 31793
[3]Department of Plant Production, Mutah University, Mutah St., Karak, Jordan 61710

Introduction

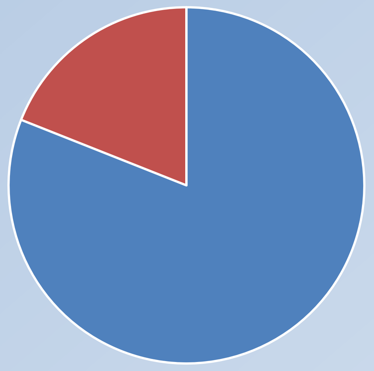
Much of the concern with irrigation of watermelon (*Citrullis lanatus*) is with regard to reduced water use efficiency and increased runoff of water and nutrients due to excessive irrigation. Precise ways to schedule irrigation can be determined from plant available water and soil water balance. Soil water balance can be determined from crop evapotranspiration (ETc), a measurement of estimated daily crop water use. This has been used to increase water savings in irrigating cotton, citrus and strawberries through the use of Smartirrigation apps (Vellidis et al. 2015) and is being field tested to improve irrigation scheduling in watermelon production. The Vegetable App irrigation schedule is calculated based on meteorological data gathered from the Georgia Automated Environmental Network (GAEMN) excluding rainfall. This is due to the frequent use of plastic mulch in vegetable cropping systems which limit the amount of precipitation absorbed by plant roots. A days after planting model is used to distinguish developmental stages in order to adjust the crop coefficient through the season. Until crop coefficients are developed the Vegetable App utilizes crop coefficients developed by the University of Florida (Shukla et al. 2013), to determine watermelon crop water use.

Methods

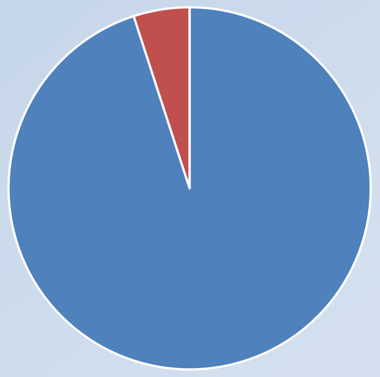
Five-week old transplants of 'Melody' seedless watermelons with the pollinizer 'Sp6' (Syngenta Greensboro, NC) were planted on 30 March 2016. Plants were grown using black plastic mulch with drip irrigation. Plants were irrigated based on three scheduling regimes: the Smartirrigation Vegetable App, a soil moisture-based system (Coolong et al 2011), and a checkbook method based on current University of Georgia recommendations for growers (Harrison, 2009). Plots were arranged in a randomized complete block design with at least four replications of each treatment. Water use was recorded daily during the season. Fruit were harvested three times starting 90 days after planting. Five representative fruit from each treatment and harvest period were analyzed for hollow heart, total soluble solids, and firmness. Data for water use and yield were subjected to ANOVA using procedure of JMP, version 12.0 (Statistical Analysis Software, SAS systems, Cary, NC, USA). When the ANOVA indicated significant effects, means were separated using Tukey's HSD, with $p < 0.05$ considered to be statistically significant.

Conclusions

- **Soil moisture sensors used 85% less water and did not significantly reduce yields compared to watermelons grown under the checkbook method and the Vegetable App.**
- Water use by the Vegetable App increased greatly after the sixth week of the study largely attributed to a rise in reference evapotranspiration and crop coefficient
- **Watermelon production under the Vegetable App was not significantly affected, however, it generated 7% greater yields while using 5% less water as compared to the current UGA checkbook method**
- Comparable values of Brix, firmness and presence of hollow heart demonstrated that there was not a reduction in quality based on irrigation treatment



Vegetable App water usage 81% of grower standard after 5 weeks



Vegetable App water usage 95% of grower standard after 15 weeks

Results

Figure 1: Cumulative water usage based on irrigation regime, (SMS) Soil Moisture Sensor, (App) Vegetable App, (Grower) Checkbook Method

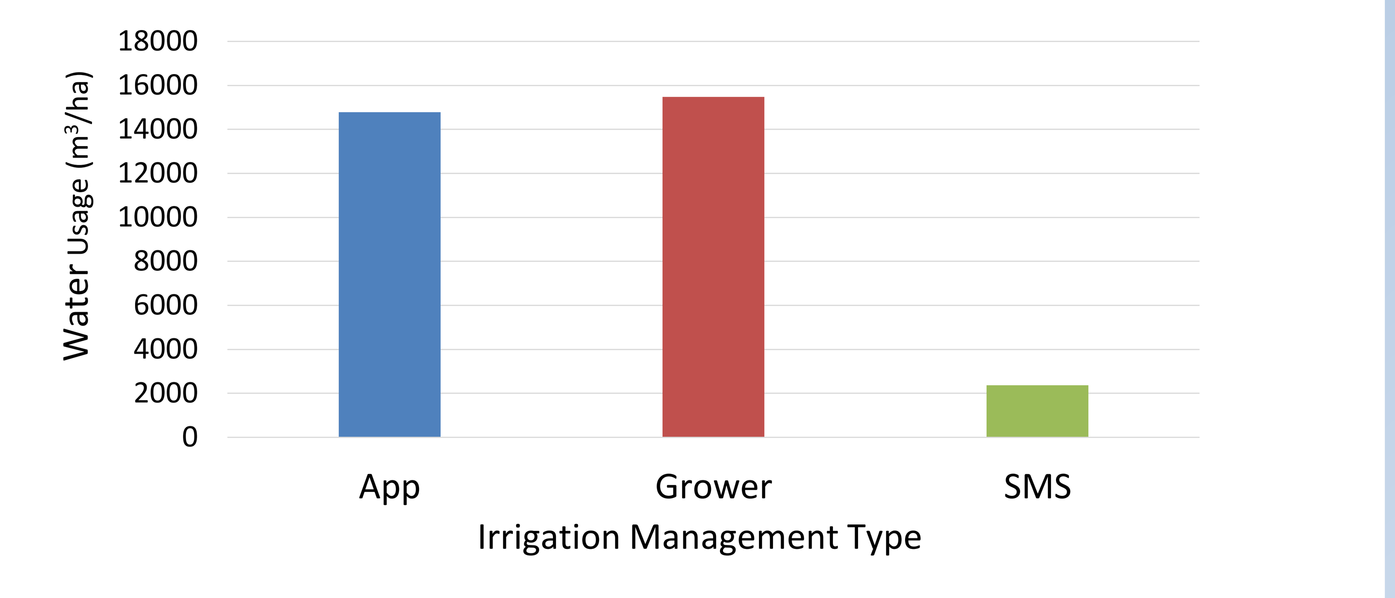
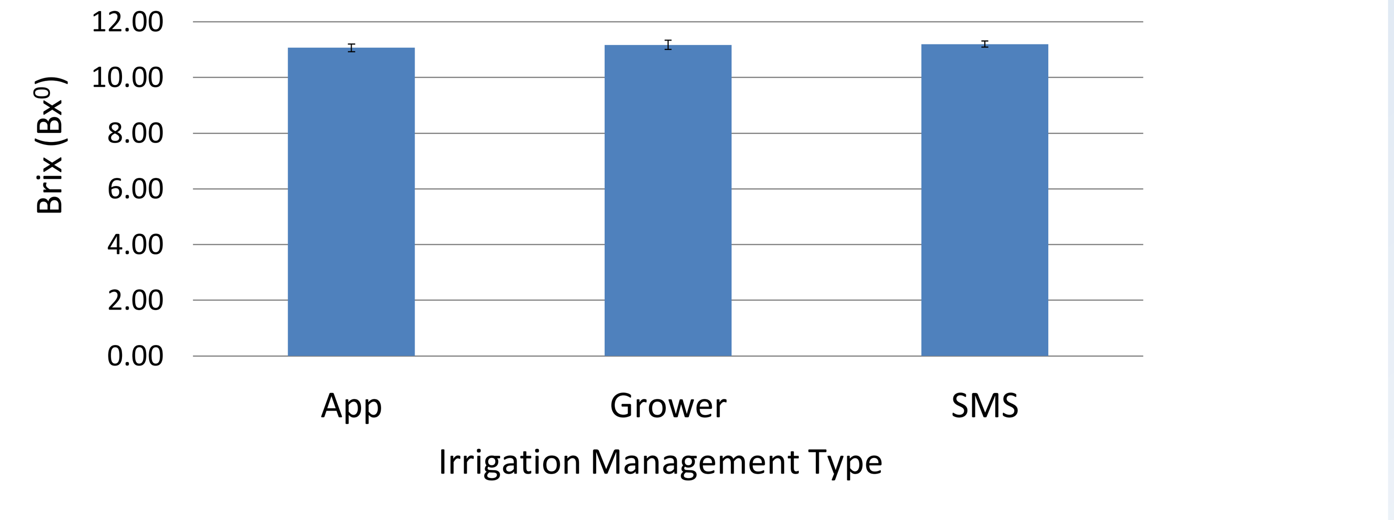


Table 1. Initial yield and total yield weight based on 60 count fruit per treatment (SMS) Soil Moisture Sensor, (App) Vegetable App, (Grower) Checkbook Method

Treatment	Total Yield	First Harvest	60 Count[z]	45 Count	36 Count	30 Count
			(kg/ha)			
App	92050a[y]	37650a	3550a	15180a	16150a	2770a
Grower	86000a	45300a	7220a	17510a	16840a	3730a
SMS	71100a	26660a	5870a	10880a	5470a	4440a

[Z]60, 45, 36, and 30 count fruit based on weights of 4.1-6.1, 6.2-7.9, 8-9.8, and ≥9.9 kg per fruit, respectively.
[y]Values within the same column followed by the same letter are not significantly different according to Tukey's Honest Significance Difference Test (*P<0.05*)

Figure 2. Average brix levels for watermelon production (SMS) Soil Moisture Sensor, (App), Vegetable App, (Grower) Checkbook Method



Literature Cited.

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