ENGAGE
The Power of Nutrition

Integrate

Trial Report and Business Case

Protected Vine Tomato

Crop | **Piel de Sapo Cantaloupe**

Region of trial | **Agroliner, Almería, Spain**

Date of trial | **September 2015**

Co-operators | **CASI - Thomas Perez Garcia**

Trial Duration | **25 weeks**

The aim of trial was to reduce the water required to grow a 180 day crop of vine tomatoes to reduce overall cost per hectare in water, fertiliser and energy.

INTRODUCTION

CASI tomatoes are the largest fruit cooperative in Almeria covering tomato production. Established in 1944 they now have over 2100 hectares of in house production and managing over 3 million kilos of tomatoes per day from the region during the growing season.

In the 2014/15 season they produced and marketed 220 million kg of tomatoes around the world.

CASI have 1240 member growers with another 535 collaborating and third party growers.

THE ISSUE

Almeria is the most intensive protected production area in the world with now over 140,000 hectares of production in the region.

The average water volume use on irrigation per hectare for tomato production within a 180 day crop is up to 12 million litres (12,000m^3) depending upon the mean temperatures, which creates two issues for the region. Firstly, the cost of water in Almeria, Spain to farmers and growers is €0.54 (2017) per cubic meter so the cost of water is now a major consideration.

Secondly, in 2017, due to the huge use of water from the surrounding mountains, a cap per hectare of water use has been imposed at 10,000m^3 per hectare.

This automatically places all tomato growers at a disadvantage as they cannot optimise production in the way they would traditionally do plus if the temperatures soar they will not be able to respond, placing their crops at risk.

CHOICE OF GROWER AND METHOD OF APPLICATION

CASI chose one of their leading growers to conduct the Integrate trial. Thomas Perez is known in the region for the high quality of his vine tomatoes and owns 10 hectares of production just outside of Almeria. His irrigation system is automatically triggered by moisture sensors within the greenhouses so the accuracy of irrigation could be measured to give a true representation of the comparative benefit in reduction of water of adding Engage's Integrate technology.

Also Thomas grows in soil so that the full benefits of the technology could be seen.

Thomas uses a 3 tank fertiliser system to feed his tomato crop:	
A tank:	Containing Calcium, Nitrogen and Iron sources.
B tank:	Containing Potassium, Phosphate, Magnesium and trace element sources.
C tank:	For the addition of organic and specialist technologies.

TRIAL METHOD

Engage's Integrate technology was added to the C tank at the rate of 2.0 litres into 500 litres of water and then injected at a rate of 1:100, once per month.

Irrigation was then set to inject depending upon moisture content and this would stop once 65% was achieved. From historical data it was known that watering would be set to 4-6 times per day depending upon the weather conditions so number of irrigation readings could be taken. Watering would start early morning and finish late afternoon.

The duration of watering required to reach optimum moisture content could also be measured so it was agreed to record it to allow for strong data. So not to place too much work on Thomas on his staff, six moisture probes would be selected across each plot. These would be flagged and read daily, and then the results would be averaged and reported weekly to CASI. This would result in 25 weeks of readings per plot, per measurement.

Plot size, due to the minimum isolation of irrigation areas was set at 1.0 hectare.

Plots were named as follows:	
Plot 1:	Control – no Integrate added
Plot 2:	Treated – Integrate added

All applications of fertiliser and foliar sprays remained the same at the discretion of Thomas.

RESULTS

The following Charts provide the raw data collected for the duration of the trial. Charts 1.1-1.3 illustrate the number of watering's applied per day taken and reported weekly. Important to note that adjusting the number of watering's was manually controlled by Thomas and his team.

Chart 1.1 – Number of daily watering's for Control plots

Control data - number of watering's per day (mean)

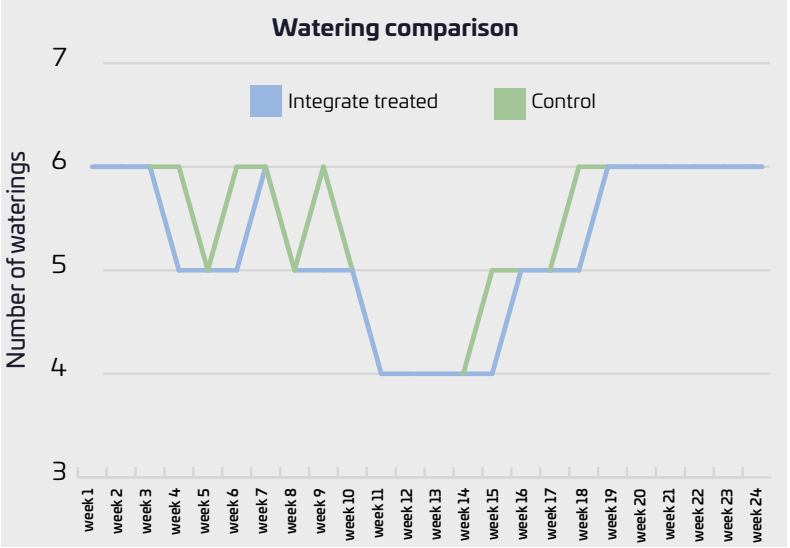
Probe	wk 1	wk 2	wk 3	wk 4	wk 5	wk 6	wk 7	wk 8	wk 9	wk 10	wk 11	wk 12
1	6	6	6	6	5	6	6	5	6	5	4	4
2	6	6	6	6	5	6	6	5	6	5	4	4
3	6	6	6	6	5	6	6	5	6	5	4	4
4	6	6	6	6	5	6	6	5	6	5	4	4
5	6	6	6	6	5	6	6	5	6	5	4	4
6	6	6	6	6	5	6	6	5	6	5	4	4
	6.00	**6.00**	**6.00**	**6.00**	**5.00**	**6.00**	**6.00**	**5.00**	**6.00**	**5.00**	**4.00**	**4.00**
Probe	**wk14**	**wk15**	**wk16**	**wk17**	**wk18**	**wk19**	**wk20**	**wk21**	**wk22**	**wk23**	**wk24**	**wk25**
1	4	5	5	5	6	6	6	6	6	6	6	6
2	4	5	5	5	6	6	6	6	6	6	6	6
3	4	5	5	5	6	6	6	6	6	6	6	6
4	4	5	5	5	6	6	6	6	6	6	6	6
5	4	5	5	5	6	6	6	6	6	6	6	6
6	4	5	5	5	6	6	6	6	6	6	6	6
	4.00	**5.00**	**5.00**	**5.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**

Chart 1.2 – Number of daily watering's for Treated plots

Treated data - number of watering's per day (mean)

Probe	wk 1	wk 2	wk 3	wk 4	wk 5	wk 6	wk 7	wk 8	wk 9	wk 10	wk 11	wk 12
1	6	6	6	5	5	5	6	5	5	5	4	4
2	6	6	6	5	5	5	6	5	5	5	4	4
3	6	6	6	5	5	5	6	5	5	5	4	4
4	6	6	6	5	5	5	6	5	5	5	4	4
5	6	6	6	5	5	5	6	5	5	5	4	4
6	6	6	6	5	5	5	6	5	5	5	4	4
	6.00	**6.00**	**6.00**	**5.00**	**5.00**	**5.00**	**6.00**	**5.00**	**5.00**	**5.00**	**4.00**	**4.00**
Probe	**wk14**	**wk15**	**wk16**	**wk17**	**wk18**	**wk19**	**wk20**	**wk21**	**wk22**	**wk23**	**wk24**	**wk25**
1	4	4	5	5	5	6	6	6	6	6	6	6
2	4	4	5	5	5	6	6	6	6	6	6	6
3	4	4	5	5	5	6	6	6	6	6	6	6
4	4	4	5	5	5	6	6	6	6	6	6	6
5	4	4	5	5	5	6	6	6	6	6	6	6
6	4	4	5	5	5	6	6	6	6	6	6	6
	4.00	**4.00**	**5.00**	**5.00**	**5.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**

Chart 1.3 – Comparison of daily averages per week



The graph, left, illustrates the difference Integrate makes in both reducing fluctuation in watering's per day and extending the time period when watering's can be reduced.

The mean of both charts are:	
Chart 1.1	5.28 watering's per day
Chart 1.2	5.08 watering's per day

Charts 2.1-2.3 illustrate the duration of the watering per day (reported weekly) based upon the soil moisture readings from the six probes. These were controlled automatically and work in unison to control irrigation solenoids.

Chart 2.1- Number of daily watering's for Control plots

Control data - total duration of watering's per day (mean)

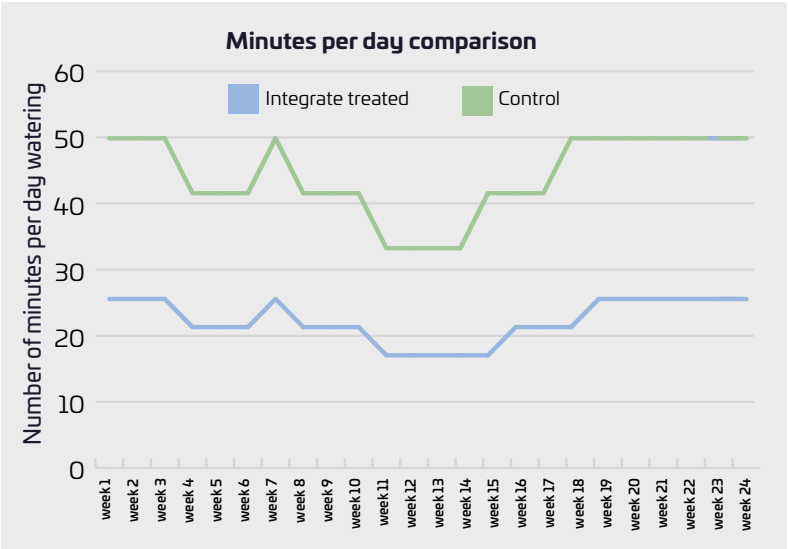
Probe	wk 1	wk 2	wk 3	wk 4	wk 5	wk 6	wk 7	wk 8	wk 9	wk 10	wk 11	wk 12
1	49.86	49.86	49.86	41.55	41.55	41.55	49.86	41.55	41.55	41.55	33.24	33.24
2	49.86	49.86	49.86	41.55	41.55	41.55	49.86	41.55	41.55	41.55	33.24	33.24
3	49.86	49.86	49.86	41.55	41.55	41.55	49.86	41.55	41.55	41.55	33.24	33.24
4	49.86	49.86	49.86	41.55	41.55	41.55	49.86	41.55	41.55	41.55	33.24	33.24
5	49.86	49.86	49.86	41.55	41.55	41.55	49.86	41.55	41.55	41.55	33.24	33.24
6	49.86	49.86	49.86	41.55	41.55	41.55	49.86	41.55	41.55	41.55	33.24	33.24
	49.86	**49.86**	**49.86**	**41.55**	**41.55**	**41.55**	**49.86**	**41.55**	**41.55**	**41.55**	**33.24**	**33.24**
Probe	**wk14**	**wk15**	**wk16**	**wk17**	**wk18**	**wk19**	**wk20**	**wk21**	**wk22**	**wk23**	**wk24**	**wk25**
1	33.24	41.55	41.55	41.55	49.86	49.86	49.86	49.86	49.86	49.86	49.86	49.86
2	33.24	41.55	41.55	41.55	49.86	49.86	49.86	49.86	49.86	49.86	49.86	49.86
3	33.24	41.55	41.55	41.55	49.86	49.86	49.86	49.86	49.86	49.86	49.86	49.86
4	33.24	41.55	41.55	41.55	49.86	49.86	49.86	49.86	49.86	49.86	49.86	49.86
5	33.24	41.55	41.55	41.55	49.86	49.86	49.86	49.86	49.86	49.86	49.86	49.86
6	33.24	41.55	41.55	41.55	49.86	49.86	49.86	49.86	49.86	49.86	49.86	49.86
	33.24	**41.55**	**41.55**	**41.55**	**49.86**	**49.86**	**49.86**	**49.86**	**49.86**	**49.86**	**49.86**	**49.86**

Chart 2.2- Number of daily watering's for Treated plots

Treated data - total duration of watering's per day (mean)

Probe	wk 1	wk 2	wk 3	wk 4	wk 5	wk 6	wk 7	wk 8	wk 9	wk 10	wk 11	wk 12
1	25.56	25.56	25.56	21.3	21.3	21.3	25.56	21.3	21.3	21.3	17.04	17.04
2	25.56	25.56	25.56	21.3	21.3	21.3	25.56	21.3	21.3	21.3	17.04	17.04
3	25.56	25.56	25.56	21.3	21.3	21.3	25.56	21.3	21.3	21.3	17.04	17.04
4	25.56	25.56	25.56	21.3	21.3	21.3	25.56	21.3	21.3	21.3	17.04	17.04
5	25.56	25.56	25.56	21.3	21.3	21.3	25.56	21.3	21.3	21.3	17.04	17.04
6	25.56	25.56	25.56	21.3	21.3	21.3	25.56	21.3	21.3	21.3	17.04	17.04
	25.56	**25.56**	**25.56**	**21.3**	**21.3**	**21.3**	**25.56**	**21.3**	**21.3**	**21.3**	**17.04**	**17.04**
Probe	**wk14**	**wk15**	**wk16**	**wk17**	**wk18**	**wk19**	**wk20**	**wk21**	**wk22**	**wk23**	**wk24**	**wk25**
1	17.04	17.04	21.3	21.3	21.3	25.56	25.56	25.56	25.56	25.56	25.56	25.56
2	17.04	17.04	21.3	21.3	21.3	25.56	25.56	25.56	25.56	25.56	25.56	25.56
3	17.04	17.04	21.3	21.3	21.3	25.56	25.56	25.56	25.56	25.56	25.56	25.56
4	17.04	17.04	21.3	21.3	21.3	25.56	25.56	25.56	25.56	25.56	25.56	25.56
5	17.04	17.04	21.3	21.3	21.3	25.56	25.56	25.56	25.56	25.56	25.56	25.56
6	17.04	17.04	21.3	21.3	21.3	25.56	25.56	25.56	25.56	25.56	25.56	25.56
	17.04	**17.04**	**21.3**	**21.3**	**21.3**	**25.56**	**25.56**	**25.56**	**25.56**	**25.56**	**25.56**	**25.56**

Chart 2.3 Comparison of daily number of minutes per week



The graph, left, illustrates the difference Integrate makes in both reducing fluctuation in watering's per day and dramatically reducing the time period the water is on. The mean of both charts are:

The mean of both charts are:	
Chart 2.1	43.88 minutes per day
Chart 2.2	21.64 minutes per day

What is also important to note is that even though overall irrigation level is reduced, moisture level at root depth was maintained so no loss in crop quality or yield was seen. In fact Thomas is noted as stating plant quality was improved.

TRIAL CONCLUSION

The data clearly shows that the use of Engage's Integrate technology in this trial reduced the overall number of watering's and reduced the mean length of watering from 34-50 minutes per day for the control area to 17-25 minutes per day. In terms of volume it is over 50%

This represents a significant reduction in water volume and reduces cost in water, fertilisers and energy.

ENGAGE
The Power of Nutrition

BUSINESS CASE

The following business case is designed to illustrate the difference in cost based upon the mean saving reductions in water volume used over the season.

Drippers: 3 liters per hour.

Dripper number 23,000 per ha.

With Integrate - 22 minutes per day.

Without Integrate - 44 minutes per day.

Number of days of culture: 180 days.

Price per cubic meter of water: €0.54 (2017 figure).

The amount of fertiliser used is averaged at 3 tonnes of mixed nutrients per hectare for normal production, at a cost of €0.62 per kilo.

Cost of Integrate: with application of 2.0 litres per ha for the initial application and 2.0 per ha for monthly subsequent applications. Total volume per ha is 12 litres per ha.

Cost per litre to the grower is €25.00 per litre therefore total cost per ha is €300.00.

SUMMARY

Water consumption per ha without Integrate:

44 minutes/days **x** drippers @ 3 liters per hour.

44 minutes (2.2L) **x** 23,000 drippers **x** 180 days/1000 liters (cubic meter) = 9,109m^3

9,109 x €0.54 = €4,918.86

Water consumption per ha with Integrate:

22 minutes/days **x** drippers @ 3 litres per hour.

44 **x** (1.1L) **x** 23000 drippers **x** 180 days/1000 litres (cubic meter) = 4,554m^3

4,554 x €0.54 = €2,459.16

A saving of €2,459 per ha

Fertiliser is also reduced by 50% so with the assumption of cost being €1,860.00 per ha then

A saving is €930.00

Total saving with Integrate usage for the crop is €3,389.00 per ha

Once cost of Integrate is added the saving is €3,089.00 per ha

For more information on Integrate or any other products, contact us on

t: + 44 (0) 1257 226590

e: info@engage-agro.com

engageagroeurope.com