

Trial Name:	Sunflowers - Ferocious Trial
Start Date:	05/01/2018
Location:	Greenhouse, HydroGarden Ltd. (52° 23' 40" N 1° 26' 14" W)

Instructions/Information
<p>To observe the performance of sunflower plants grown in re-circulating flood&drain systems with or without addition of Ferocious.</p> <p>Substrates: ROOT!T sponges, VitaLink Clay Pebbles, VitaLink 100% Coir, VitaLink Clay Coir Nutrients: VitaLink – PlantStart, RootStim, Coir Classic Grow SW, Sunflowers Topolino seeds from CN Seeds</p>

Date	Procedure
05/01/2018	ROOT!T sponges pre-soaked in 4 ml/L PlantStart and placed in the propagation LightHouse Clone tent under LUMii EnviroGro Propagation CFL light with 18/6 photoperiod. One seed per each plug.
12/01/2018	Plants re-planted into 0.7 L pots with clay pebbles and with coir substrate. Placed in the 1.2 m ² Lighthouse MAX tent with 600 W HPS, photoperiod 18/6 hours. Watered with 4 ml/L Coir Classic Grow SW and 2 ml/L RootStim.
15/01/2018	Plants watered with 4 ml/L Coir Classic Grow.
17/01/2018	Plants watered with 4 ml/L Coir Classic Grow.
18/01/2018	Plants sprayed with 1 ml/L DOFF insecticide.
19/01/2018	Plants watered with 4 ml/L Coir Classic Grow.
22/01/2018	Plants watered with 5 ml/L Coir Classic Grow.
24/01/2018	Plants watered with 4 ml/L Coir Classic Grow.
26/01/2018	Plants watered with 6 ml/L Coir Classic Grow.
29/01/2018	Plants watered with 7 ml/L Coir Classic Grow.
31/01/2018	Plants watered with 8 ml/L Coir Classic Grow.
02/01/2018	Plants watered with 8 ml/L Coir Classic Grow.
05/02/2018	Plants watered with 8 ml/L Coir Classic Grow.
06/02/2018	Plants transplanted into 3.5 L pots with VitaLink Clay Coir and re-positioned in the greenhouse. 12 plants in each group = in each titan flood and drain system. 70 L of nutrient solution mixed from Hydro MAX Grow in each tank: EC 2.5, pH 6.2. Control tank stayed like this, in Ferocious tank added 75 ml of Ferocious. Two flooding cycles a day for 15 minutes (at 8 am and 4 pm). Above each tank EnviroGro CFL Twin reflector, each with one cool white and one warm white 150 W LUMii EnviroGro CFL used as an additional source of light (12/12 photoperiod from 7 am till 7 pm).
07/02/2018	Both tanks EC 2.5, pH 6.4 – pH adjusted to 6.0.
08/02/2018	Sprayed with 15 ml/L Pest OFF (Guard'n'Aid).
09/02/2018	Both tanks EC 2.5, pH 6.3.
12/02/2018	Both tanks EC 2.6, pH 6.4.
14/02/2018	Both tanks EC 2.6, pH 6.4.

15/02/2018	Due to warm weather added 15 min watering cycle at 12:00. Sprayed with 15 ml/L Pest OFF (Guard'n'Aid,).
16/02/2018	Both tanks EC 2.7, pH 6.5. pH in both tanks adjusted to 6.1.
20/02/2018	Both tanks EC 2.9, pH 6.2.
21/02/2018	Both tanks EC 2.9, pH 6.2.
23/02/2018	Both tanks EC 2.9, pH 6.3. pH in both tanks adjusted to 6.1
26/02/2018	Both tanks EC 3.3, pH 6.1.
28/02/2018	Both tanks EC 3.3, pH 6.1.
02/03/2018	Both tanks EC 3.3, pH 6.2. Nutrient solution in both tanks changed, switched from Hydro MAX Grow to Hydro MAX Bloom. Each 70 L of nutrient solution with EC 2.4, pH 6.3. In the tank for the Ferocious group added 92 ml of Ferocious.
05/03/2018	Both tanks EC 2.4, pH 6.8.
07/03/2018	Left tank EC 2.4, pH 6.2. Right tank EC 2.4, pH 6.1 – pH adjusted to 6.2.
09/03/2018	Both tanks EC 2.7, pH 6.2.
12/03/2018	Both tanks EC 2.6, pH 6.2.
14/03/2018	Left tank EC 2.6, pH 6.2. Right tank EC 2.7, pH 6.1 – adjusted to EC 2.6, pH 6.2.
15/03/2018	Sprayed with 20 ml/L Pest OFF (Guard'n'Aid).
16/03/2018	Left tank EC 2.8, pH 6.0 – pH adjusted to 6.1. Right tank EC 2.8, pH 6.1.
19/03/2018	Both tanks EC 2.8, pH 5.8.
21/03/2018	Left tank EC 3.1, pH 5.7, right tank EC 3.0, pH 5.9. Both tanks topped up with 20 L: EC 2.5, pH 6.0. In the tank for the Ferocious group added 26 ml of Ferocious.
23/03/2018	Left tank EC 2.5, pH 6.1. Right tank 2.4, pH 6.3. Both tanks adjusted to EC 2.4, pH 6.1.
26/03/2018	Both tanks EC 2.6, pH 5.9.
28/03/2018	Left tank EC 2.6, pH 5.7. Right tank 2.7, pH 5.9 - adjusted to EC 2.6, pH 5.7.
29/03/2018	Left tank EC 2.7, pH 5.6. Right tank 2.8, pH 5.7. Both tanks adjusted to EC 2.6, pH 6.0.
03/04/2018	Left tank EC 3.0, pH 5.5 – adjusted to EC 2.9, pH 5.8. Right tank 2.9, pH 5.8.
04/04/2018	Left tank EC 2.9, pH 5.5 – pH adjusted to 5.8. Right tank 2.9, pH 5.8.
05/04/2018	Plants harvested, the end of the trial.

Results

In the following six pictures plants from Control group are in the titan system on the left, plants from Ferocious group are in the titan system on the right.



Picture taken 09/02/2018.



Picture taken 15/02/2018.



Picture taken 01/03/2018.



Picture taken 09/03/2018.



Picture taken 14/03/2018.



Picture taken 21/03/2018.



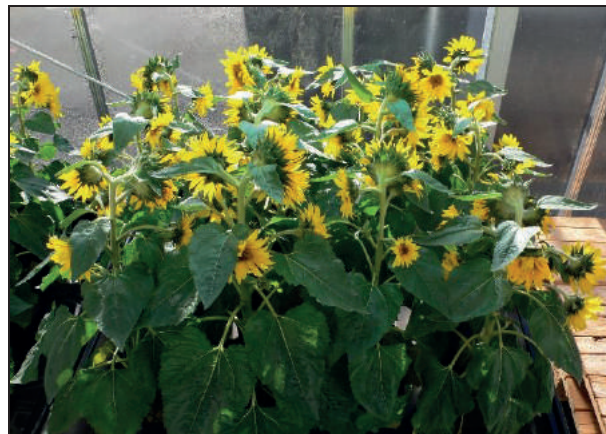
Picture taken 28/03/2018. Ferocious group in the front, Control group in the back.



Picture taken 05/04/2018. Control group on the left in the front, Ferocious group in the back.



Picture taken 05/04/2018.
Detail of plants from the Control group.



Picture taken 05/04/2018.
Detail of plants from the Ferocious group.

Date when fully opened main flower was observed for the first time on each plant.
Position in the schematic corresponds with the position of plants in the greenhouse.

28/3	28/3	27/3	27/3
27/3	27/3	26/3	26/3
26/3	27/3	28/3	28/3

Control group

27/3	28/3	26/3	27/3
27/3	26/3	26/3	27/3
26/3	27/3	27/3	26/3

Ferocious group

Consequence of harvesting plants in both groups for data collection in following tables (Plant No.):

9	10	11	12
5	6	7	8
1	2	3	4

Table showing number of fully opened flowers (main and side ones) per each plant, in total, and on average per group on a day of harvest:

Number of fully open flowers		
Plant No.	Control	Ferocious
1	4	6
2	5	7
3	5	5
4	6	11
5	6	8
6	8	7
7	6	7
8	9	6
9	7	6
10	6	5
11	5	7
12	6	7
Total	73	82
Average	6.1	6.8

Table showing height of plants (in centimetres) of each plant, in total, and on average per group on a day of harvest:

Height of plants [cm]		
Plant No.	Control	Ferocious
1	41	54
2	52	56
3	48	53
4	49	49
5	47	49
6	52	49
7	51	56
8	48	49
9	47	46
10	47	49
11	45	48
12	44	48
Total	571	606
Average	47.6	50.5

Table showing fresh mass weight (in kilograms) of main flower per each plant, in total, and on average per group on a day of harvest:

Weight of main flower [kg]		
Plant No.	Control	Ferocious
1	0.025	0.042
2	0.034	0.047
3	0.025	0.026
4	0.024	0.029
5	0.041	0.020
6	0.032	0.035
7	0.030	0.028
8	0.032	0.026
9	0.039	0.028
10	0.032	0.029
11	0.024	0.028
12	0.022	0.032
Total	0.360	0.370
Average	0.030	0.031

Table showing fresh mass weight (in kilograms) of all opened flowers per each plant, in total, and on average per group on a day of harvest:

Weight of all flowers [kg]		
Plant No.	Control	Ferocious
1	0.039	0.085
2	0.055	0.109
3	0.042	0.060
4	0.046	0.102
5	0.071	0.103
6	0.072	0.124
7	0.066	0.111
8	0.080	0.103
9	0.068	0.093
10	0.048	0.069
11	0.044	0.084
12	0.041	0.083
Total	0.672	1.126
Average	0.056	0.094

Discussion

In this trial, the performance of sunflower plants grown in re-circulating flood&drain systems with or without addition of Ferocious was observed. Ferocious was added to tank with nutrient solution three times in total – when plants were transplanted and placed in the system for the first time, when the nutrient solution was changed due to beginning of flowering, and when the nutrient solution was topped up.

Except of the last week of the trial, when the water level of nutrient solution in both tanks was very low, there were no significant fluctuations observed in pH and EC levels in either of the two tanks. Ferocious didn't seem to affect stability of the nutrient solution mixed from VitaLink nutrients. Although plants from the Ferocious group gained during the trial visibly more biomass, they didn't use more nutrient solution compared to plants from the Control group, as it would be expected.

All plants were healthy and in the similar stage of development. In general, plants from the Ferocious group started to fully open their main flowers slightly sooner. But the full opening of main flowers on plants from both groups was observed during the same period of three consequent days. This can be seen in the schematics in the Results section.

On the last day of the trial, flowers on each plant were counted, cut, and weight. Data can be seen in tables at the end of the Results section and will be discussed here.

Not only plants from the Ferocious group looked bushier than plants from the Control group, their average height was also 6% higher (50.5 centimetres compared to 47.6 centimetres).

Number of fully opened flowers on a day of harvest was higher for plants in the Ferocious group (82 in total and 6.8 in average) compared to plants from the Control group (73 in total and 6.1 in average).

Fresh mass weight of main flowers and all flowers per plant, and in total and in average per group was also evaluated. While there was no significant difference observed in the fresh mass weight of main flowers (0.37 kilograms in total and 0.031 kilograms in average for plants from the Ferocious group compared to 0.36 kilograms in total and 0.030 kilograms in average for plants from the Control group), difference in fresh mass weight of all fully opened flowers was considerable. For plants from the Ferocious group it was 1.126 kilograms in total and 0.094 kilograms in average, while for plants from the Control group this was 0.672 kilograms in total and 0.056 kilograms in average. It is almost 68% increase in fresh mass weight of fully opened flowers when Ferocious was used. As the number of fully opened flowers on a day of harvest was only about 12% higher than in the Control group, this indicates effect of Ferocious on the gain of biomass. This corresponds with the statement describing this product, saying that it allows plants to produce more energy. This might be related to enhanced photosynthetic rate. Ferocious is also believed to be an effective nutrient enhancer, which may have the ability to help the plant more efficiently uptake and absorb nutrients.

Based on the result of this trial and the previous trial when Ferocious was tested on pak choi plants grown in coir, this premium plant optimizer is definitely recommended to be used due to an increase in yields.