

SUNTEC TEST SUMMARY:

- **Test Performed by:**



INTERNATIONAL HYDROPONIC CONSULTANTS

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- **Test Perimeter:**

Evaluation of Greenhouse tomato growth, yields & quality as influenced by the BIOWAVE SUBSONIC RESONANCE TECHNOLOGY.

- **Objectives:**

To determine the effect of the new BioWave technology on the growth, development, yield and fruit quality (Brix) of a hydroponic tomato crop (hybrid beefsteak) as compared to untreated (screened) crop grown under the same conditions.

- **Treatments:**

I - BioWave treated hybrid tomato plants grown in coconut fiber.

II- Untreated (control) plants grown in coconut fiber.

- **Testing:**

I - Visual (photographic) differences in seedling and plant size.

II - Time to first flowering, time to first anthesis, time to first harvest.

III - Fruit number per plant.

IV- Fruit weight/size distribution.

V - Marketable and total yield (note any physiological disorders).

VI - Fruit Brix (total soluble solids) – Brix is an indication of sugar/solids level.

VII- Mineral leaf analysis x 2 treatments.

VIII - The leaf mineral analysis is for:

- Nitrogen %
- Phosphorus %
- Potassium %
- Sulphur %
- Calcium %
- Magnesium %
- Sodium %
- Iron mg/Kg
- Manganese mg/Kg
- Zinc mg/Kg
- Copper mg/Kg
- Boron mg/kg

Note: If any significant differences show in leaf mineral levels between the BioWave and control treatments mid trial, then we would repeat the leaf analysis a couple of times (we don't know exactly what processes within the plant the BioWave has the most effect on, so its important to do the leaf analysis at least once).

- **Materials & Methods:**

Hybrid greenhouse tomato seedlings (Cultivar 'Libell' F1) would be raised in standard Grodan Rockwool propagation cubes and given a dilute nutrient solution (distilled water + hydroponic nutrients) for the first 3 weeks of growth. Once germination has occurred, seedlings will be randomly assigned a treatment and replication. A minimum of 42 plants in 3 replications will be used in this trial. Guard plants will be used were necessary. All seedlings will be placed in either the control or treated growing areas one week post germination and planted into coconut fiber growing media when approx. 3 weeks of age.

Because the Bio-Wave technology emits sub-sonic resonance waves, every effort will be made to screen the control crop using metal mesh and mineral wool insulation screen walls (to be constructed). Both treated and untreated plants must be grown in the same greenhouse to ensure viable data is obtained. The Bio-Wave machine will be positioned in the treatment crop so as to give the most effect to the treatment plants (note: area which can be treated is restricted to 50x50 feet – suggested Bio Wave machine be placed in centre of crop)

Plants will be grown at a density of 2.5 plants per square meter. A standard nutrient solution (CNS17 grow and bloom) will be applied to all plants at standard EC levels for tomato growth to

a 10% run off. PH will be maintained within the range 5.8 – 6.2 in the leachate. Crop will be trained, managed, pollinated and sprayed for pests and diseases as required.

Any crop timing differences and variations in plant height and development will be noted (photographic evidence will be taken). One foliar mineral leaf analysis test will be carried out to determine if any differences in nutrition have occurred. Fruit will be harvested from each plant and replication and assessed for quality, yield, marketability and physiological disorders (blossom end rot, deformities etc). All data will be scientifically analyzed to determine treatment differences.

- **Reporting:**

Full statistical analysis carried out on all data collected and a complete report including photos, results and conclusions will be provided at trial completion. All research updates, reports and photographs are strictly confidential.

- **Test results update:**

- **January/7/2011: Attached are some pics taken today of the trial showing the 2 sides of the wall and some of the plants (can't quite get the whole crop into a photo!) – The dividing wall is in the middle of the photo, the BioWave treatment area is on the left, the control untreated on the right. There is a visible height difference which has been starting to show with the BioWave plants appearing to be taller and 'heavier' than the untreated plants, however we will try and quantify that observation by doing some actual plant measurements and leaf numbers etc. We have recorded light readings through the day on both sides of the wall and light levels are very even on both sides which is great. The plants are just starting to put out their first flower truss now, so we can also record which treatment flowers/sets fruit first.**

Regards

Dr Lynette Morgan

Scientific Director

Suntec International Hydroponic Consultants

- Picture 1:



BioWave Area

Control Area

Date: 1/7/11

- Picture 2:



BioWave Area

Control Area

Date: 1/7/11

- **January/16/2011: The trial is looking good – see attached pic for the latest differences in plant height and development (BioWave on left of wall, untreated crop on right). The height difference was measured about a week ago, the BioWave treated plants were an average of 863.48mm, the untreated plants average was 717.83mm. Also there is a difference in the time of flower opening with the BioWave plants having an average of 1.57 open flowers and 12.65 leaves and the control plants 0.08 open flowers and 10.83 leaves. The difference in flowering and height between the two sides of the wall is noticeable**

Regards

***Dr Lynette Morgan
Scientific Director
Suntec International Hydroponic Consultants***

- Picture 3:



BioWave Area

Control Area

Date: 1/16/11

28 January 2011:

Date Sown: 20 November 2010

Date planted: 20 December 2010

System: Coconut fiber grow slabs with standard hydroponic nutrient (CNS17)

Treatments: BioWave treated and untreated (control) with divider wall.

Crop stage of development as at 28 Jan – all plants are flowering on the first 2-4 trusses, fruit set has occurred on first and second trusses, fruitlets are expanding rapidly in the early stages of development.

Observations: TREATMENT DIFFERENCES:

Treatment	Height	No of open flowers	No of leaves
BIOWAVE	863.48 mm	1.58	12.65
UNTREATED CONTROL	717.83 mm	0.08	10.83

(all values are means for each crop)

Second Assessment: 26 January 2011

	Height	Size of largest fruitlet	No of fruitlets set
BIOWAVE	1369 mm	39.78 mm	14.74
UNTREATED	1127 mm	11.22 mm	7.57

Number of trusses in flower – BIOWAVE = 3.57, UNTREATED = 2.35



BioWave Plant



Control Plant

Date: 1/28/11

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Dr Lynette Morgan
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- **Third Assessment : 28 February 2011:**

The crop is growing well, the last assessment of the fruit showed the following:

Average fruit size of largest fruit on first truss:

BioWave treated	72.83 mm (number of trusses on average per plant 6.91)
Untreated	43.91 mm (number of trusses on average per plant 5.13)



BioWave plant



control plant

date: 2/28/11

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- **First Harvest: 11 March 2011**

Here are the photos of the first fruit harvest from the BioWave trial (BioWave fruit only, no ripening seen on the untreated fruit as of this morning). The fruit quality is excellent, all fruit harvested were marketable.

Also, here is the data from the first harvest:

Number of fruit harvested	Total fruit weight harvested	Average fruit size
BioWave: 22	BioWave 3230 g	BioWave 147 g
Control Nil	Control Nil	Control Nil



BioWave 1st Harvest
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Control Harvest **Date: 3/11/11**

- **3/16/11: Foliar Mineral Test:**

The foliar mineral analysis tests have come back from the lab (see values below). The results indicate no real treatment difference in any of the foliar mineral levels between the BioWave treated and untreated crops – there is always a little natural variation between samples, but not enough to indicate any treatment differences. Both analysis results show healthy levels within the optimum range for tomatoes.

- Foliar Mineral analysis results

ELEMENT	BIOWAVE	CONTROL
Nitrogen	5.5%	5.4%
Phosphorus	0.83%	0.86%
Potassium	5.3%	5.5%
Sulphur	1.85%	1.84%
Calcium	3.02%	2.90%
Magnesium	0.60%	0.65%
Sodium	0.07%	0.08%
Iron	109 mg/Kg	137 mg/kg
Manganese	450	390
Zinc	15	16
Copper	94	103
Boron	36	45

The BioWave treatment continues to have more fruit being harvested than the control treatment. The effect of the BioWave treatment increase stimulation of photosynthesis and other biochemical reactions dealing with assimilate production and have no significant affect on mineral uptake.

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