IQDHO

Institut québécois du développement
de l'horticulture ornementale

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Characterization Project for the Hexahedron 999

Research Report of Greenhouse Trials
Spring 2008

Presented to:

BIO-Mar Inc.

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Our thanks to:

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1. Summary

Five Québec greenhouse enterprises have tested the Hexahedron 999 structuring device under normal production conditions in the Spring of 2008. These exploration trials were combined to test the effect of the Hexahedron 999 on multiple species of plants under different production regiments. Watering was done by either spring water or conventional city water depending on the supply available. The use of the Hexahedron 999 on Geranium seedlings, Hygrophila Polysperma and Marigold produced superior quality product than the conventional watering systems.

In Brief:

- The Geranium seedlings grown in 4 inch pots were larger, the leaves were greener and they were ready one week earlier than the plants watered with well water only. The Geraniums watered with the Hexahedron 999, bloomed one week ahead of the control plants which had been watered solely with well water.

- The naked root Hygrophila Polysperma plants, grown on flood tables, produced significantly more dried weight when using the Hexahedron 999. The growth gain represents a two week earlier maturity, compared to their typical production calendar which lasts 10 weeks in all.

- The floral buds observed on Marigold plants grown on trays, were larger and bloomed earlier when using the Hexahedron 999, and the plants were slightly taller at the time of sale. The plants also became more voluminous when watered with the Hexahedron 999.

- One business saved time on stripping off the leaves of Geranium plants, on which we observed 50% fewer leaves that needed stripping when using the Hexahedron 999.

In general, the Hexahedron 999 provided as good or better plant growth rate except in one area where some plants developed signs of straggling. Hothouse tomato plants showed no effect on growth or development.

Photo 1: Hexahedron 999 Model provided by Bio-Mar Inc to producers for the purpose of the project.

2. General Methodology

Five greenhouse producers showed an interest in trying the Hexahedron 999. The trials are shown on table 1. On this table we have added the dates of installation of our experimental units. As a rule, at least two visits were scheduled per producer for the season. The first, was to verify the good standing of the device and to define the protocol. The producers visited are presented in Table 1. Extra visits were done to get a visual follow-up on the growth of the plants, and for some, to collect data.

Table 1:
Dates of visits to the greenhouses in the Spring 2008 for visual tracking of the plants

Type of Enterprise	Dates of Visits to the Greenhouses
A - Aquatic Plants Producer	Visited February 18th, 26th and April 4
B - Annual Plants Producer	Visited February 28th, April 1st, April 24th and on May 11
C - Annual Plants Producer	Visited on March 5th, 12th, 13th and April 24th,
D - Lettuce Producer	Visited on February 8th, and March 25th
E - Tomato Producer	Visited on February 15th

TABLE 2:
Plant species grown in each of the five participating enterprises in the Spring 2008

Producer	Species per Enterprise
A	Hygrophila Polysperma
B	Marigold greenhouse Peppers and Dahlia
C	Geranium seeds
D	Lettuce Sativa Flandria
E	Lycopersicom Esculentum Var Trust grafted on Beaufort

3. Methodology, Observation and Results by Enterprise

3.1 Methodology by Enterprise

3.1.1 A: Aquatic Plants Producer

For more details see protocol adapted to each enterprise.

During the course of the trials a significant growth effect was observed on the plants, randomized samples of 15 plants were taken for both treatments. The plants were sent to "Tourbière Berger" to be properly dried and weighted. The total dry mass was statistically analyzed.

3.1.2 B: Annuals Producer

For more details see the protocol adapted to each enterprise.

The seeding of Peppers, Marigold and Dahlia were seeded on February 28th, 2008 and watered with spring water. Measurements were taken on February 28th of the double greenhouse. The plants were transplanted in pots and placed on the ground on March 25th in Greenhouse No. 8. They were then watered with well water. Other measurements were on April 1st, April 24th and on May 1st at which date they were sold.

3.1.3. C: Annuals Producer

For more details see the protocol adapted to each enterprise

The Geranium seedlings were planted in the double greenhouse and were watered by sprinkling. When transplanted, on March 20th, the plants were placed in two separate greenhouses. One was watered with spring water and the other was also watered with spring water with the Hexahedron 999 installed to the watering hose.

3.1.4. D: Lettuce Producer

For more details see protocol adapted to each enterprise

The trials were done in the nursery area only. This test was to verify the effect of structured water on the germination of Boston type lettuce

3.1.5. E: Greenhouse Tomato Producer

For more details see the protocol adapted to each enterprise

Hydroponic tomato plants on slabs were permanently watered with structured water from February to the end of May. One row was watered with city water and the other with the same water but combined with the action of the Hexahedron 999.

3.2 Observations and Results by Enterprise

3.2.1 Observations and Results at A: Producer of Aquatic Plants

The result was very impressive. From the first week, we notice a difference on the mass and the leaf surface. Further, the roots and fans were longer and in greater numbers and all variants were remarkable to the naked eye. Thus, plants with the Hexahedron 999 were more advanced than the control plants, and marketable as early as the 6th week of production instead of the 8th week.

Photo 2: Hygrophila polysperma – April 4, 2008 :

The enterprise saved two weeks on the production cycle and the plants were much more attractive at the time of sale. Further, the producer decreased his water consumption and fertilizer. Because of the shorter growing process, they just did not need to drain the tables to wash them. Typically, algae grows between the fifth and the sixth week on the tables. It is interesting to note that both tables received the same treatment in terms of orientation and duration of the illumination (sodium lamps 14 hours a day) in the greenhouse. Because the tables were on a separate circuit for recirculation of the water and fertilizer, the producer has prevented any cross-contaminating factors that could affect the results. The plants are from the same generation in vitro and were planted on the tables at 2 hour intervals. The only variables between the two tables were those of pH and electrical conductivity (see Table 6).

The dry mass of the aquatic plants, Hygrophila Polysperma, was significantly higher with the use of the Hexahedron 999. The plants had 42.1% more total dry mass after 46 days in the basin with structured water (see Table 3). The results shown in the above pictures demonstrate that the use of the Hexahedron 999 produced more than just an upwards growth trend of the aquatic plants. On average, this significant growth difference was evident 95 times out of a sample of 100.

Table 3 : Total Dry Mass of Plants after 46 days at Producer A

Hexahedron 999		**Well Water**	
Weight (g)		Weight (g)	
Ha1	1,559	Er1	1,676
Ha2	0,955	Er2	0,614
Ha3	0,819	Er3	0,836
Ha4	1,051	Er4	0,672
Ha5	1,23	Er5	0,703
Ha6	1,42	Er6	0,572
Ha7	1,039	Er7	1,556
Ha8	1,372	Er8	0,731
Ha9	1,002	Er9	1,284
Ha10	2,008	Er10	0,962
Ha11	1,411	Er11	0,66
Ha12	1,156	Er12	0,645
Ha13	1,928	Er13	0,676
Ha14	1,292	Er14	1,274
Ha15	1,016	Er15	0,687
Average	**1,284**		**0,903**
Standard Deviation	**0,345**		**0,364**
	b		**a**
ANOVA	p=0,0065		
Duncan	P=95%		

3.2.2 Observation and Results at B : Producer of Annuals

The results were slow to come in the seedling process. One could not visually observe a notable difference between the two plant groups cultivated in the seedling greenhouses. However, when the workers transplanted the seedlings into boxes, they reported that the plants watered with structured water had longer roots than those sprayed with water only.

At the end of the trial, which is the time of sale, we could see the differences in the effect of the water treatment device on the three plant varieties (see Table 4). In the plastic finishing greenhouse, the Dahlia and Marigold plants were always significantly taller with Hexahedron 999 water than with water only, and this was evident throughout the entire growth period in the greenhouse. The effects were measured as early as April 1st. Marigold plants were visibly larger to the naked eye, and had larger flowers with the Hexahedron 999.

Photos 3 and 4 : May 11, 2008

Flowering Marigold with Hexahedron 999 **Flowering Marigold with Water Only**

On May 11th, the Marigold sprayed with water only, appeared to have about 10% more flowers than the Hexahedron 999 plants. However, the diameter of the flowers on the plants watered with the Hexahedron 999 were considerably larger. The producer noted this effect very quickly during the test. Unfortunately, this measurement was not part of our protocol. In Peppers, at the end of the tests, the Hexahedron 999 plants were significantly shorter - on average by 4.6 cm. Obtaining shorter Peppers is a desirable characteristic for the producer.

Photos 5 and 6: May 11, 2008

Support: Peppers with Hexahedron 999 **Pepper with water only**

Table 4 : Difference in Height (cm) of plants – with plain water and Hexahedron 999 water

		February 28		April 1		April 24		May 11		Difference
		Plain	Hex999	Plain	Hex999	Plain	Hex999	Plain	Hex999	
Dahlia	Average	0,45	0,52	3,89	4,78	15,84	17,69	23,1	26,1	Longer
	Standard Deviation	0,34	0,44	0,78	1,35	2,67	2,24	3,53	3,09	
	Duncan							**a**	**b**	Significant
Marigold	Average	1,12	1,04	4,06	3,98	13,17	14,01	17,8	18,7	Longer
	Standard Deviation	0,22	0,17	0,66	0,79	1,13	1,29	1,5	1,68	
	Duncan							**a**	**b**	Significant
Peppers	Average			3,81	2,72	18,86	16,68	28,7	24,1	Shorter
	Standard Deviation			0,78	0,66	2,02	1,75	2,77	2,55	
	Duncan							**a**	**b**	Significant

3.2.3. Observation and Results at C: Producer of Annuals

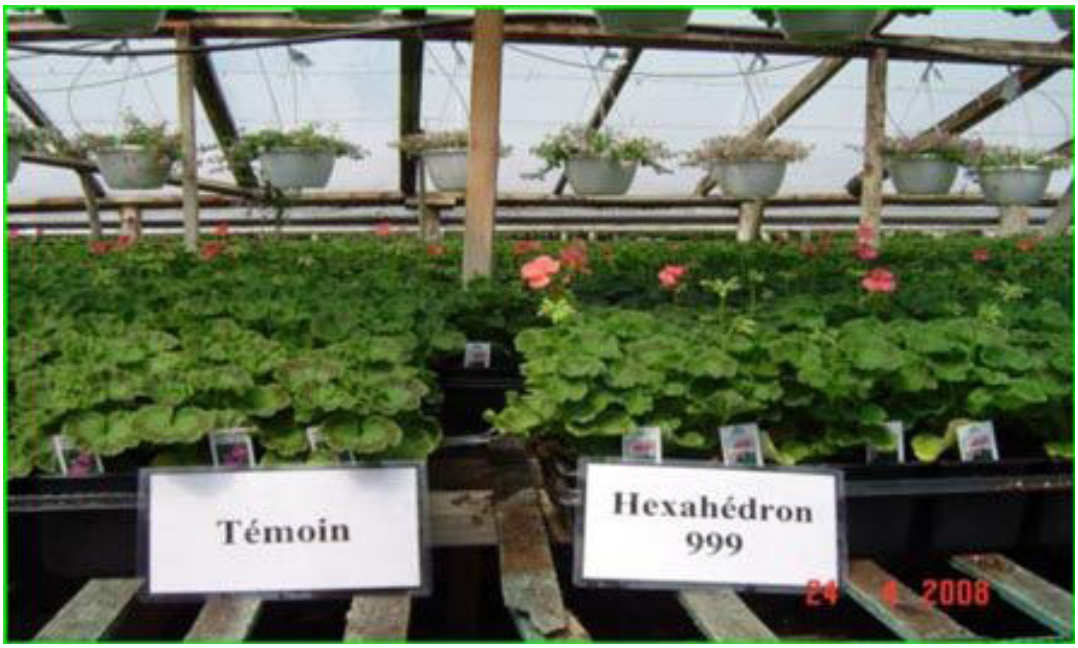
The results are soon to be apparent on Geranium seedlings grown in C

Photos 7 and 8

Seeded Geraniums, on April 24, 2008 : Greenhouse 42 and 44

Photo 9 :

Sowed Geraniums, on April 24, 2008 : Height and Flowering



At the time of the sale, the first observation of the effect of the use of the Hexahedron999 was made by the delivery team. There was a lot less cleaning (yellow leaves to remove) on those irrigated with the Hexahedron 999 than the Geranium irrigated with well water. Sometimes 15 to 20 leaves per tray had to be removed as compared to 30 to 40 on the plants watered with well water.

Plants watered with Hexahedron 999 were more voluminous. The color of the leaves appeared the same. It is the flowering that was the most noticeable. The blooming was earlier and more intense in plants watered with Hexahedron 999. Blooming was observed one week early on plants watered with Hexahedron 999 (as of April 24).

According to the research and development specialists, the company was very pleased with the results. Actually, they were so pleased that they are now testing another annual species, Osteospermum, with the same protocol.

3.2.4. Observation and Results at D : Lettuce Producer

Germination tests were done on lettuce seeds in greenhouse Producer D. These tests were to verify the percentage of germination and the quality of the seedlings after germination but just before transplantation. The result at the germination stage were excellent, whatever the water source. In the first seeding test - there was more loss due to declassification of seedlings with the use of Hexahedron 999. On the seedlings watered with plain water we had 6.1% loss due to declassification; whereas, we observed a 19% loss of seedling watered with Hexahedron 999. Straggling, that is to say the seedlings became too elongated and thin, explained about 14% of the losses. In the second seeding test - germination was excellent with the two types of water. Again more loss was observed with the Hexahedron 999 than with well water : 2.7% compared to 1.6%.

The seedlings planted on February 19 were moved into the first transplantation phase, in Basin 79, on March 3. Visual observations indicated that the leaves, cotyledon and the roots were more developed in the plants watered with the well water only.

On average, on the first plantation day, the aerial part and roots watered by the basin water were longer than the plants watered with the Hexahedron 999.

Because this straggling effect is an undesirable characteristic for this type of production, after two weeks the project was terminated. We strongly suggested on many occasion to restart the test and to continue to culture the lettuce for a longer period, in order to permit the seedlings to be in direct contact with the water treated with Hexahedron 999. The very positive results obtained at Producer A made us suggest to do the same at the Producer D. The producer decided to terminate the trials because of lack of resources. He would have had to dedicate a basin to this and the trial period would have been too long.

Photo 10 and 11

Lettuce with Hexahedron 999 Lettuce with Well Water

Photo 12

Comparison of Lettuce Seedlings after Germination

3.2.5 Observation and Results at E : Greenhouse Tomato Producer

The Hexahedron 999 devices (2) were installed on February 21st, and terminated on June 3rd. The parameters of growth and development were measured on a weekly basis. A tasting test was done on the fruits. Two conservation tests were equally done on the fruits harvested on April 30th and May 30th.

There were no measurable differences between the test groups in the following parameters :

- Diameter of the stems
- Height of the flowers, and
- Length of the leaves

The weekly growth rate of the Hexahedron 999 plants was slightly more, but not significantly. One did not notice any difference between the two test groups, in the speed of appearance of the fruit or in the speed of the harvesting of the fruit. During the test period, we harvested 16.6 kg/m² of tomatoes with the city water and 16.2 kg/ m² with the Hexahedron 999 water. Again, nothing significant.

The grade of the fruits harvested was slightly lower with the Hexahedron 999. During the trials we measured 70% Grade #1 tomatoes with the Hexahedron 999 versus 74% Grade #1 tomatoes with city water. There were more Grade #2 tomatoes with the Hexahedron 999 due to shape deformity of the fruits.

Photo 13 : On the left, plants watered with the Hexahedron 999 and on the right, plants watered with city water :

There was no observable difference in the shelf life of the fruit between the control group and the plot with the Hexahedron 999. The fruits were of the same color and the same firmness. The settling of the shoulder was the same after 14, 26 and 34 days in cold storage at 15° C.

We measured the level of sugar in the fruit through a refractometer. The following table shows the measurements taken :

Table 5 : Measurement of Sugar Levels in Tomatoes
(% of sugar) measured June 3, 2008

Date of tomato crops	Hexahedron 999	Control Group
April 30, 2008	4.4	4.2
May 12, 2008	4.1	4.2
May 28, 2009	4.3	4.5
Average	**4.27**	**4.30**

The above table shows that there was no significant difference, between the two test groups, in the average percentages of fruit sugar.

The tasting panel did not observe a better or a worse taste in the fruit grown with the Hexahedron 999.

3. Conclusion

The Hexahedron 999 device tested in production greenhouses in the Spring of 2008 showed very interesting results on the Annuals that were tested. Vegetables such as Chilli were shorter and stockier with the Hexahedron 999 water. Other species of Annuals should be tested because it seems that there is a positive growth result when plants have an extended contact with the structured water – the tendancy of this was clearly observed. With the lettuce producer, the germination test was inconclusive and should be redone over a longer period of time, as mentioned in the text. In the tomato test, the producers did not observe any significant results in growth, not even of tendancies. The lower percentage of Grade #1 Tomatos and the deformity of the fruit when they are Grade #2 - is what the producer retains from the experience. In tomato and lettuce the effects of straggling were measured. A test should be conducted to verify the effect of electrical conductivity and the Hexahedron 999 on the same vegetables. An increase in the salinity could reduce the effect of straggling which was observed. More elaborate tests should be completed on these vegetables.

The top three producers A, B and C, were happy to keep the device at the end of the research project because they want to continue to use it, because of the positive results achieved in their business. The tests carried out with the five producers have demonstrated unequivocal and definitive positive results, and these results are reliable.

Finally, an understanding of the comprehensive causes that brought about the results could be developed further if Bio-Mar Inc would discuss with University researchers specializing in bio molecular or plants physiology. An explanation of the basic notions, that explains the operation of the device, is one of the sensitive points to decide if a producer will adhere, or not, to this technique of water treatment.

ANNEX

Table 6 : Tables of pH and Electrical Conductivity at Producer A

Date	Conductivity	pH	Addition	New pH	New Conductivity
Table 21 Control Group					
2008-03-03	710	7,5			
2008-03-10	727	8,6			
2008-03-17	8,9	8,5			
2008-03-24	512	8,5			
2008-04-01	540	8,6			
2008-04-07	522	8,63			
2008-04-14	500	8,4	fertilizer	8,6	786
2008-04-21	747	8,78			
2008-04-28	830	7,94			
2008-05-05	419	9,2			
Table 22 Hexadron					
2008-03-03	800	8,7			
2008-03-10	785	8,8			
2008-03-17	613	8,69			
2008-03-24	272	8,69	fertilizer	8,53	560
2008-04-01	550	8,43			
2008-04-07	535	8,59			
2008-04-14	485	8,6	fertilizer	8,58	585
2008-04-21	610	8,79			
2008-04-28	660	7,93			
2008-05-05	318	9,2			

Characteristics of the Hexahedron 999®
Validated by the Spring 2008 IQDHO Research Report

MANUFACTURER'S COMMENTS

For the purpose of these comments we are not addressing Producer D who terminated the test trials after two weeks. The results for Producer D in the IQDHO Report were inconclusive due to lack of personnel and physical resources to continue the experimentation as per the recommendations of the IQDHO Consultant. We would be more than willing to take up this work with Producer D at a future time. At that point we would use the experience of the Spring 2008 trials to verify that all the parameters can be met in his operation in order to increase the chances of obtaining statistical results.

PRIMARY NOTE: Every producer incorporated the Hexahedron 999 Unit into his production without any modifications to his set up or growing methods. This was necessary for the test evaluation and comparison.

When this research report was initially mandated, the objective was to confirm, through an unbiased independent third party, the validity of the success that people had communicated in their testimonies. The IQDHO Research Report has successfully done that … as well as verifying many of the operating requirements and primary claims made by the Inventors. We will outline hereunder the points of validation received from this report.

A. Hexahedron 999 Operating Requirements :

1. The Hexahedron 999 requires a minimum mineral content in the water of 80 ppm in order to maximize the results :

Observation :
Producer B experienced a slow start until the plants were moved. In the germination greenhouse the water was rain water, with low conductivity. In the production greenhouse the water supply was from a well, high conductivity.

Producer A maintained a relatively high conductivity, more than 500. The drop in conductivity on the hexahedron side could imply that the plants consumed the fertilizer (conductivity) better.

2. The Hexahedron 999 requires a minimum flow rate of ½ /GPM and a minimum of 5 psi

Observations :
Producer A used the unit in a recirculation loop. Producers B and C used the unit at the end of the garden hose. Producer E used the unit on a drip system. Thus, Producer A used the unit at maximum flow capacity on a continual basis. Producer B and C used the unit at full flow – and Producer E used the unit at or below minimum flow requirements.

Producer A had spectacular results where the full flow of the unit was maximized. Producer B and C had very good and definitive results. Producer E showed no substantial improvements.

Producer E had the least amount of flow. The watering system for this tomato producer is of a modified drip type. The Hexahedron 999 was installed at the beginning of a dead-end row, thus minimizing the flow effect through the Unit. This could account for the results obtained from Producer E which were not consistent with the results of the other Test Producers – nor were they consistent with the many testimonials from other tomato growers. It would be interesting to experiment with this Producer again. However, some modification to their water delivery system would be required, such as installing a recirculation loop in the test area.

B. Hexahedron 999 Primary Claims :

3. The Hexahedron 999 increases the Biophotons in the water which enhances the life-force energy.

Observations :
Producers A, B and C clearly demonstrated that there was some type of increase in the life-force energy of their test plants evidenced by the rate of growth and maturity. Producer E showed no substantiating results.
In this category note that because the Hexahedron 999 is a life enhancing device, the use of a biocide will compete with the functioning of the Unit. In this type of situation, we can expect the biocide to function less efficiently and the Hexahedron to be less efficient also.

4. The Hexahedron 999 Hexagonally Structures the Water

The primary indicator of Hexagonally Structured Water is an increase in surface tension (which has been verified through Dyne testing at G.E. Canada Laboratories). As a result of this function we have an increased capillarity, which makes nutrients more readily available to the plants, and enhances the growth and maturity cycle.

Observations :
Producer A clearly noted that he had reduced his water consumption and fertilizer. He also noted that it was unnecessary to drain and clean his tables. Producer A harvested two weeks ahead of time and had a substantial increase in the volume of dry mass.
Producer B noted that their plants were larger and flowered earlier. Producer B also noted a larger flower size with the Hexahedron 999. Although we neglected to include "flower size" in the research protocols … this has been a consistent and noted result of the Hexahedron 999 water from the very first testing of the device in 2001 by the Inventors and was confirmed many times in testimonials.
Producer C noted that their plants flowered one week earlier, were larger and more voluminous. Producer C also noted a 50% reduction of wilted leaves at the time of sale.
Producer E showed no substantiating results.
In this category note that because the Hexahedron 999 increases the surface tension of the water the use of surfactants, for instance, and similar chemicals will hinder this function. Therefore, the chemicals will compete with the efficiency of the Hexahedron – rendering both less efficient.

C. Conclusion :

The following claims have been substantiated by one or more of the test results obtained in this Spring 2008 IQDHO Research Report :

- Plants reach maturity faster (according to type of plant)
- Increased yields by up to 20% or more
- Reduce the amount of fertilizer by up to 30% or more
- Less water required for plant hydration – reducing your water bill

The following can be inferred by the Research Report but were not specifically tested – and would require further research and laboratory analysis :

- Increased capillarity
- Better absorption of nutrients
- Better hydration of the cells

We look forward to completing further tests with IQDHO to scientifically confirm other claims received in testimonials. More specifically, we will need to address the vegetable growers with a more definitive protocol. We thank the IQDHO Team for there unbiased approach to this research project. And we thank all the participating Producers in this research.