Effects of AgTonik's AGT-50™ Organic Acid Trace Mineral Complex on Hydroponically Grown Cannabis

Results of a Study Conducted for AgTonik, LLC

May, 2016

For more information visit www.MrFulvic.com

Study Coordinator: *Ralf K. Ostertag*
Analytical Laboratory: *PSI Labs*
Horticultural Management: *Michael E. Ostertag*
Financial Management: *Andrew J. Bruex*
Technical Editor*: T.A. Janson*

Disclaimer: This study was conducted in the State of Michigan in accordance with all Michigan Medical Marijuana statutes. The grower is licensed by the State of Michigan to supply medical cannabis to State Registered patients. The courier transport of laboratory samples to PSI Labs was also conducted with strict adherence to the applicable State Medical Marijuana statutes.

Effects of AgTonik's AGT-50™ Organic Acid Trace Mineral Complex on Hydroponically Grown Cannabis

Introduction:

AgTonik's AGT-50™ Organic Acid Trace Mineral Complex (AGT-50™) is a pure, water extracted organic acid/trace mineral complex. Manufactured by AgTonik, LLC of Portage, Michigan, USA, the product is derived from a rare mineral deposit with a unique organic acid and micro-mineral profile. AGT-50™ has been found to promote the health and growth of soybeans, increasing yields by 30 %. The primary purpose of this study is to evaluate if the same effects can be duplicated in regards to yield production when AGT-50™ is fed to hydroponically grown plants in this case; cannabis. The secondary purpose is to investigate whether the accelerated growth rates produced by AGT-50™ have any effects on cannabinoid or terpene profiles.

Materials and Methods:

The cannabis plant was chosen for this study because of its short growing period and versatility in regards to growing mediums and environments.

Six seeds in all were readied for germination. Three seeds germinated (50% germination) and were promptly planted in Pro-Mix HP Mycorrhizae ™. The resulting mother plants were fed nutrients from Technaflora Plant Products Ltd. These mother plants were grown under a 24-hour light cycle for a period of nine weeks using standard, full-spectrum grow lights.

Clones for this study were harvested from the most vibrant of the three mother plants and placed in cloning trays under a 24-hour light cycle. The cloning solution used was General Hydroponics ® RapidStart Rooting Enhancer, which was administered via the EZ-Clone ® Original 30 Slot Cutting System Plant Cloning Equipment.

After 10 days, the twelve most vibrant clones of uniform size were chosen for planting. Six clones for the control group and six clones for the AGT-50™ group were planted in Oxygen Pot System's 6 Site Digital XL Super-Flow Hydroponic Grow System, an ebb and flow hydroponic bucket system. The growing medium was Growstone's GS-1 Hydro Stone Substrate, an inert glass particle stone. Each group was fed via their own distinct six bucket Super-Flow system.

Reverse osmosis water was used throughout the course of this study. Technaflora nutrient products were given in equal amounts to the control group and to the AGT-50™ group. The AGT-50™ group was fed one milliliter of AGT-50™ per gallon of feed water throughout the vegetative and flowering growth cycles. Feed water was maintained at a 6.0 pH using General Hydroponics ® pH Up when necessary, which was infrequently.

The control group and the AGT-50™ group were grown in the same room, which was maintained at a temperature of seventy to seventy-five degrees Fahrenheit throughout the growth cycles of the plants. Lighting for the vegetative growth cycle was two 1,000-watt Triple XO metal halide lamps with six-inch venting. At three weeks, the plants were moved into the flowering stage. The light cycle length was reduced to twelve hours and Technaflora nutrient products were changed to the flowering nutrient protocol. Lighting for the flowering cycle was two 1,000-watt high pressure sodium lamps with six-inch venting.

The feed water cycle was set to five hour intervals with a 20-minute feed cycle. Water temperature was kept between sixty-five and seventy degrees Fahrenheit. The AGT-50™ used in this study contained more than 30 organic acids and a diverse variety of naturally occurring trace minerals and elements.

Test samples were collected at the four-week, eight-week and twelve-week points in the life cycles of both cannabis test groups. Sterilized 100 mL laboratory test sample vials were used with a tamper resistant seal. Samples were delivered via a private courier to Precision Safety Innovation (PSI) Labs at 259 Jackson Plaza, Ann Arbor Michigan 48103. A chain of custody document was obtained from PSI Labs prior to transport

Tests performed by research chemist, Dr. Spivak-Birndorf, at PSI Labs, included tests for cannabinoid content, terpene content, THC content and microbial profiles.

Data was collected on a weekly basis, including: amounts of feed water consumed, plant heights, room temperature, room humidity, light cycle hours, photo records, lab sample records and chain of custody documents. Strict study protocols were maintained throughout the research process.

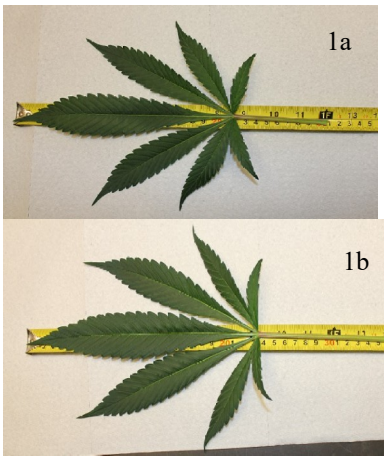
Raw Data, Weeks One to Four:

At three weeks of vegetative growth, plants showed distinct differences in growth rate, height and size, number of leaves, leaf size and water consumption between the control group and the AGT-50™ group. The AGT-50™ plants had an average height of 15.5 inches after three weeks of growth, compared to an average height of 10.5 inches for the control group. A 35.2% difference in overall height between the two groups is significant.

After three weeks of vegetative growth, the plants were moved into the flowering stage, at which point, the AGT-50™ group plants were consuming almost twice the amount of feed water as were the control group plants.

By the fourth week, the girth and height of the AGT-50™ plants

development was thicker and lusher in the AGT-50™ group during the fourth week. Below, compare the following fourth week photos: Figure 1a, the largest leaf from control group (12 inches long); and, Figure 1b, the largest leaf from AGT-50™ group (14.5 inches long). (Please look at the number where the end of the leaf stem touches the measuring tape).



Laboratory Results after Four Weeks of Growth:

At the end of the fourth week, the first set of laboratory samples was clipped and transported to PSI Labs. The chain of custody, numbered 31116, completed the transfer of the samples to scientists at PSI Labs.

The control group showed a 2.6% THC content, with a margin of error of ± 0.3%, while the AGT-50™ showed a 2.4 % THC content with a margin of error of ± 0.2%. The minor cannabinoids CBG, CBC and THCV were slightly lower in the control group than in the AGT-50™ group. Given the negligibility of the difference in values between the groups, and also the margin of error, it was concluded that the results for the AGT-50™ group and the control group concerning minor or major cannabinoids after four weeks of growth were virtually identical.

Total terpenoid content for the control group was 0.037 % (370 ppm), while the AGT-50™ group quantified at 0.048 % (480 ppm). Although there is a more than 100 ppm difference between these values, Dr.Spivak-Birndorf of PSI Labs pointed out that the RSD (relative standard deviation) at this early stage can be as great as 50%, making it difficult to obtain results that show the actual variability between the two groups. Leafy material in general is a difficult medium with which to measure terpenes.

Raw Data, Weeks Five to Eight:

In the AGT-50™ group, the onset of flowers was observed during the fifth week of growth. The control group showed no onset of flowering during the fifth week. At this point, the uptake of feed water in the AGT-50™ group was twice that of the control group. Simultaneously, the tallest fifth week plant in the AGT-50™ group was 9.5 inches taller than the tallest fifth week plant in the control group. During the sixth week, the AGT-50™ group plants had noticeably more flowering sites than did the control group plants. Also during the sixth week, calyx development in the AGT-50™ group plants appeared thicker and more abundant than in the control group plants.

During the eighth week of growth, the feed water consumption by the control group plants leveled off, while the AGT-50™ group plants continued to increase their feed water consumption. See Chart C-1 below.

Feed Water Consumption: Gallons Consumed per Week *[Chart C-1]*

	week 4	week 8	week 12
Control Group	4.5 gal	14.3 gal	7.0 gal
AGT-50™ Group	8.5 gal	21.3 gal	9.0 gal

The differences in overall plant size and in flower production between the plants of the AGT-50™ group after eight weeks of growth as compared to plant size and flower production in the control group are noticeably superior. Compare the following eighth week photos: Figure 2a, a control group plant; and, Figure 2b, an AGT-50™ group plant.

Laboratory Results after Eight Weeks of Growth:

At the end of the eighth week, the second set of laboratory samples was clipped and transported to PSI Labs. The chain of custody, numbered 41116, completed the transfer of the samples to scientists at PSI Labs.

The control group showed a 11.0% THC content, with a margin of error of ±1.1%, while the AGT-50™ showed a 13.4% THC content, with a margin of error of ±1.3%. The AGT-50™ group had a higher THC content in the eighth week of growth (or, in the fifth week of the flowering cycle). The minor cannabinoids CBG, CBC and THCV in the control group were also lower than in the AGT-50™ group. Terpene levels were virtually identical in both groups. Factoring in the margin of error, it was concluded that there is no difference between the constituent contents of either group, however, the higher THC content in the AGT-50™ group indicates a potential area of further investigation into plant maturation rates, given that the AGT-50™ plants may have been maturing more quickly than the control group plants.

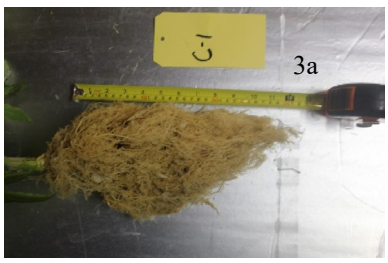
Raw Data, Weeks Nine to Twelve:

The greatest change at nine weeks into the growth cycle (which was also six weeks into the flowering cycle) was the drastic drop in feed water consumption, which dropped in both groups by 36%. The number of flowering sites continued to be greater in the AGT-50™ group plants and the thickness and abundance of flowers in the AGT-50™ group plants was noticeably greater than in the control group plants. The plants also stopped growing in height during the ninth week; the control group leveled off at 25.0 inches for the shortest plant, and 34.0 inches for the tallest plant, while the AGT-50™ group leveled off at 32.0 inches for the shortest plant, and 42.0 inches for the tallest plant. The AGT-50™ group plants averaged 20% taller than the control group plants at this stage.

During the tenth week, the feed water consumption of the control group dropped another 17.5%, while the AGT-50™ group showed a 5% increase in feed water consumption from the previous week. The flower development on the lower stems of the AGT-50™ group plants was far more profuse than it was on the control group lower plant stems.

Water consumption during the final (or, twelfth) week of growth leveled off at seven gallons per week for the control group and nine gallons per week for the AGT-50™ group. At this stage, the AGT-50™ group continued to show superior flower development.

At the end of the twelfth week, the plants from both groups were harvested. Photos were taken of the root ball of the largest plant from the control group and of the root ball of the largest plant from the AGT-50™ group. The root development of the AGT-50™ group plant was significantly more pronounced. Below, compare the following twelfth week photos: Figure 3a, the root ball from the largest control group plant was 12 inches in length; and, Figure 3b, the root ball from the largest AGT-50™ group plant was 24 inches in length.



3a

3b

Laboratory Results after Twelve Weeks of Growth:

After the harvest at the end of the twelfth week, the final set of laboratory samples was clipped and transported to PSI Labs. The chain of custody, numbered 51616, completed the transfer of the samples to scientists at PSI Labs. The samples consisted of a flower each from the largest plant in the control group and the largest plant in the AGT-50™ group. The plants had been dried and cured for ten days before these final samples were clipped.

Lab results showed that the AGT-50™ group concentrations of a couple different terpenes, e.g., terpinolene and beta-ocimene, were 500 ppm greater than in the control group.

THC levels were equal in both groups, at 14.7%. This demonstrates that adding AGT-50™ to hydroponic feed water does not reduce THC concentration, in spite of the accelerated growth rate.

Total terpene content was 8800 ppm (0.88%) in the AGT-50™ group, 11.3% higher than the control group with 7800 ppm (0.78%). Although total terpene values for the two different groups may seem significantly different, the margin of error allows for the range of deviation.

The total cannabinoid content of both test groups remained virtually the same, especially when the margin of error is factored in. The AGT-50™ group had a total of 16.3% total cannabinoid content, while the control group had a 16.4% total cannabinoid content.

Moisture content of the dried flowers was also equal in both groups, at 13%, which indicates that overall moisture content was not increased in the AGT-50™ group despite the much greater feed water consumption and growth rate in that group.

Raw Data Throughout Plant Growth Cycles:

Control Group Data:

Total amount of feed water consumed: 91 gallons.
Average height of plants: 29.5 inches.
Average amount of feed water consumed per week: 7.58 gallons.
Average temperature of the grow room: 71.21 degrees.
Average humidity of the grow room: 42.91.
YIELD: 23.2 ounces (657.17 g).

AGT-50 Group Data:

Total amount of feed water consumed: 134.5 gallons.
Average height of plants: 37 inches.
Average amount of feed water consumed per week: 11.20 gallons.
Average temperature of the grow room: 71.21 degrees.
Average humidity of the grow room: 42.91%.
Amount of AGT-50™ used during growth cycle: 134.5 mL.
Cost of AGT-50™ per mL: 0.165 USD.
Total cost for AGT-50™ for this study: < $23.00
YIELD: 29.3 ounces (830.64 g).

DISCUSSION OF RESULTS

Results of this study show conclusively that AGT-50™ can increase the height and size of cannabis plants by 20% and the yield by 20.9%. Previous test plot results were further validated by this study, in which soy bean fields showed an impressive yield increase of 30%. Field winter wheat grown with AGT-50™ produced an extra eleven bushels per acre and showed a 13% increase in yield.

In addition to the impressive yield increases, the significantly greater feed water consumption by the AGT-50™ group represented a dramatic difference between the two groups. It is interesting to note that the water consumption of the AGT-50™ group was almost twice that of the control group at the midway point in the life cycle of the plants. The feed water consumption for plants in the AGT-50 group totaled 134.5 gallons for the entire growth cycle; while the control group feed water totaled 91 gallons for the entire growth cycle. A question as to whether the greater water consumption in the AGT-50™ group would affect potency, especially in regards to cannabinoid content, was initially posited; however, no corresponding decrease in potency was reflected in the laboratory analyses.

The AGT-50™ group plants had a healthier overall look in the leaves, flowers and stems. Yellowing during the early part of the growing cycle was observed in the control group plant leaves, while no such yellowing occurred in AGT-50™ group plant leaves.

All laboratory samples were tested at the independent laboratory for mold, bacteria and pests and were found to be negative for these values throughout the course of this study.

The primary mode of action of AGT-50™ within the plant is as a nutrient vehicle, transporting nutrients into the cells at accelerated and more efficient rates. AGT-50™ supplies plants with a complex of organic acids. Indoor crops are typically grown in nutrient mediums that are especially void of these acids. **AGT-50™ has been analyzed by third party quantification laboratories verifying the presence of more than 30 organic acids including; fulvic, humic, gallic and cinnamic acids and rare trace elements that the plant would otherwise go without. The diversity of these organic compounds makes a considerable difference in the overall health and size of the plant.** The findings in this study will be valuable to growers of cannabis and other indoor crops.

Growers are facing considerable increases in expenses and competition while the cost of producing continues to increase. The ability to consistently increase yields with AGT-50™, without sacrificing product potency or quality, translates into a far greater profitability for the grower. The cardinal finding of this study is that AGT-50™ will substantially increase yields without sacrificing potency levels of desirable plant (or, medical cannabis) constituents and this finding is reported here for the first time. **This further validates that AGT-50™ is a material that impressively increases the yield and the overall health of plants.**

Additional photos and laboratory report data available upon request.

Control Group Largest Plant at 3 weeks 12 inches tall

AGT-50™ Group Largest Plant at 3 weeks 18.5 inches