RHODE ISLAND INDOOR GROW WITH THE *BRe³* WAND

STANDARD OPERATING PROCEDURE

Patient 2 Patient Rhode Island Cannabis Quality/Yield Test Clone Stage, Vegetative Growth to Harvest Cycles ID# Don Oat

Prepared for:

BioRadiance Grow Science

September 18, 2018

Revision Change Record			
Revision	Date	Responsible Person	Revision Notes
1.0	4/1/18	Don Oat Jr.	Clone Propagation Begins
2.0	4/10/18	Don Oat Jr.	BioRadiance Visit to sign off on Study
3.0	6/3/18	Don Oat Jr.	Veg Stage Ends/Flower Stage Begins
4.0	8/12/18	Don Oat Jr.	Flower Stage Ends/Harvest Begins

Approvals

Don Oat Jr. Principal P2PRI Rhode Island	Papa Guru Farms Principal Master Grower Rhode Island	Steven Cady COO BioRadiance Grow Science	James Wand CEO BioRadiance Grow Science

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1.0 SCOPE AND APPLICABILITY

This testing was done on Holy Grail OG, an Indica dominant strain with a 60:40 Indica/sativa ratio. These plants have a potency that is unmatched at an astounding 30% THC content. What is interesting about the strain is that it is the first of its kind to achieve a perfect score in its category. The strain is also popularly referred to as Holy Grail Kush and is a cross between Kosher Kush and the OG #18 and has a complex flavor that is unique at the same time. It does taste like coffee with lime and hash undertones. But there is nothing different about its aroma and it smells just like it tastes. The buds, however, are dense and large with blueish hues that make it stand apart from the rest of the crowd. Considering its THC content and with as much as 4% CBD levels, the strain proves to be effective due to its various medical applications. The strain offers numerous effects in body and mind that can be uplifting and calming at the same time. Holy Grail OG is renowned for calming anxiety and stress. But that is not all, as it just as effective for patients suffering from pains and aches, nausea and a lack of appetite.

Cannabis Indica flowers are the main source of ∆-9-tetrahydrocannabinol (THC) used as both a medicinal and recreational drug. To produce standardized product, especially with regards to the medicinal platform, it is necessary to control proper environmental factors to inhibit disease pressure as well as produce the most efficacious and bountiful product to maximize quality and yield. For these reasons, indoor cultivation or Indoor Grow operations of cannabis plants are rapidly increasing as more and more states legalize the plant so perfecting the process has become the *Holy Grail*. One of the most important growing factors of cannabis is light and its spectrum which must be optimized to affect the growth, health and cannabinoid concentration. Replication of the sun is the ultimate goal and the wavelength irradiation that the BRe³ Wand projects is the object of the study that shall be executed in an Indoor New England environment. This test trial using the BRe³ Wand vs control shall validate that using the BRe³ Wand not only increases the growth and yield but acts as a biopest deterrent while systemically mechanically strengthening the plant's health and vitality. The final quality and yields from these plants shall be validated by a 3rd party that specializes in this specific measurement.

1.1 SUMMARY OF METHOD

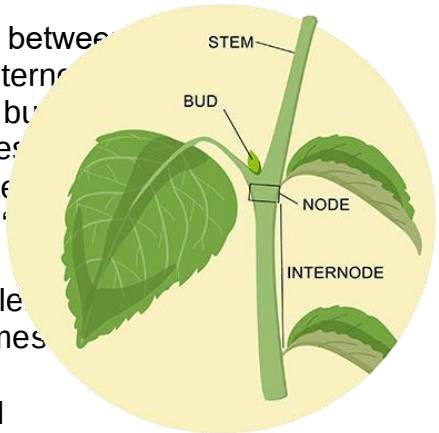
- Cloned plants of a THC strain named Holy Grail. Holy Grail is an Indica dominant hybrid of platinum OG #18 and Kosher Kush.
- The cuttings are on average 4".
- The cloned plants will grow in an EZClone 64 propagation tank and lighting will come from an 8 tube T5 light and a 4-foot BRe³ Wand.
- When clones are rooted and ready (14-17 days), 6 clones will be selected visually for uniformity, root quantity and overall health.
- The selected clones will then be transplanted into 2-gallon soil pots and grown in an indoor temperature range of 65 to 78 degrees Fahrenheit and a humidity of 50%-55%.
- An 8-tube T5 High Output Fluorescent Light (6500K) will be used 24/7 as grow lighting during the vegetative stage

- The BRe³ Wand will be used 24/7 or in accordance with the time periods set by the protocol for each plants growth stage as outlined in the *Procedure Implementation*.
- For each T5 light assembly there will be 1 BioRadiance Wand installed below it at 22" above the plant canopy.
- Vascular Definition, Uniformity in Growth Height, Canopy Density, Stalk Circumference, # of Flowering Heads, and Overall Flower Yield are the principal parameters tested.

1.2 DEFINITIONS

The following definitions apply to this SOP with direct correlation to the test perimeters:

- pH Range for EZClone tank will be 5.5.
- pH Range = the allowable range for soil is 6.2. The allowable range for hydroponics is 5.8 to 6.1.
- Bio-water = dechlorinated water
- Feed= the dechlorinated water mixed with Aptus House & Garden base nutrients and Aptus bio stimulants
- Vascular Stem = the main structure of the plant by which it provides support to leaves/flower and acts as the main transportation system for all fluids (nutrients/water/sugars) from the roots to the leaves. The larger & more stout the vascular system of the stem in turn enables the plant to grow larger as we support larger more robust buds.
- Canopy = the canopy is defined as the area and depth that a plant's leaves tal The larger the canopy the more bud development, also looking for uniformity in canopy size which shows strong health.
- Nodes = The stem of a plant is made up of nodes. The nodes connect the leav stems. Nodes are the joints that connect new stem offshoots. They branch off from the main stalk and eventually create small branches and new budding sites.
- Internodes= The spaces between the plant's nodes. Too much distance betwee Internodes is not a good thing and may point to a weaker plant. If the interno distance is too long, branches and stems become weaker meaning that bu not be properly supported during flowering, with the risk that the branches
- Stacking = As the plants prepare to flower, leaf production slows and inte distance shortens, so the nodes where flowers emerge from are said to ' ultimately becoming the dense masses known as colas.
- Colas = refers to a cluster of buds that grow tightly together. While smalle occur along the budding sites of lower branches, the main cola (sometimes the apical bud) forms at the very top of the plant
- Yield = the quantity of bud that is produced after the harvest of specified batch lot of each strain.



1.3 TEST PROTOCOL

- The T5 fluorescent grow light will be used continually during clone propagation period (24 hours per day).
- Test Trial will consist of twenty-four (24) plants total: with ALL plants under a BRe³ Wand because the last full grow cycle did not use the Wand in Veg Stage and produced a known consistent yield for 10 years in a row.
- BRe³ Wand during Vegetative cycle follows 18 hours on, 6 hours off protocol
- Flowering will be conducted as normal with no Wand included.
- Harvest will commence after approximately14-15 weeks of both Veg and Bloom cycles
    - Veg is 5 weeks
    - Flower is 8-9 weeks
- Test Results of BRe³ Wand vs. multiple years of past crops will be determined by a comparison of the following parameters:
    - Canopy Density
    - Color
    - Internodal Distance
    - Node Density
    - Flowering Heads
    - Vascular Definition- both main stalk & 8 inches up the main stalk
    - Overall Height & Height Growth Uniformity
    - Flower Yield by weight

2.0 CHECKLISTS

The daily operational procedures for ensuring a successful test trial validation study in an Indoor Grow environment is as follows:

- ☑ 8am- Check Indoor temperature and humidity and proper air flow.
- ☑ Check overall look of the Indoor Grow, check plants for any pests, disease pressure, broken branches or anything that looks or smells awry.
- ☑ Check soil hydration to verify preset watering schedule operational.
- ☑ During Clone Propagation stage, check T5 light and power supply to be operational.
- ☑ During Veg stage check T5 light and power supply to be operational.
- ☑ Check BRe³ Wand and power supply- ensure green LED on BRe³ Wand is lit.
- ☑ 5pm- Check Indoor Grow and plants again for issues, corrective action or suspicious characteristics
- ☑ Feed plants if needed per application requirements, such as nutrients / bio water / water
- ☑ Repeat steps again following morning

3.0 SAFETY & SECURITY

The Indoor Grow will be at a secured location and operating in compliance with all local and State Cultivator rules and regulations. All individuals handling/feeding the plants shall always wear nitrile gloves and eye protection.

4.0 INTERFERENCES (Indoor Grow Operation)

1. Indoor Grow Temperature- Without good ventilation, any Indoor Grow can become too warm, even in relatively cool weather. More plants die from excess heat within an Indoor Grow rather than from the cold.

2. Proper Ventilation- Without proper ventilation, Indoor Grows and their plants become prone to a myriad of problems. The heat and humidity from poor ventilation will cause plants to become sick and fall victim to opportunistic bugs, fungus and molds. Correct ventilation serves 3 major purposes:

- Helps to regulate temperature
- Helps ensure plants get plenty of fresh air that they can use to photosynthesize
- Helps prevent pest infestation

5.0 Pest, Mold and Disease Pressure

6.0 APPARATUS AND MATERIALS

6.1.1 Equipment:

- (3) 24inch Hurricane Box Fans
- (1) Soil Hydrometer
- (1) Digital Thermometer

- (1) Portable pH Meter
- Power supply = 110v in wall electrical connections
- (6) T5 High Output Fluorescent Light Fixture- 120 watt
- (6) BRe³ Wands

6.1.2 Raw Materials:

- Soil- PROMIX H.P. with Pearlite
- Aptus® House & Garden Natural Based Line Growth
- Aptus® House & Garden Natural Based Line Bloom
- Dechlorinated Water
- **IMPORTANT NOTE: NO SPRAYING FOR PESTS WAS CONDUCTED FOR THE ENTIRE GROW CYCLE.**

7.0 PROCEDURE IMPLEMENTATION

- Organic soil medium using PROMIX H.P. in 20-gallon growing tubs
- Clones cut to 4-6” in length and inserted in an EZClone 64 propagation tank.
- Each Clone gets transplanted when roots reach 10” in length
- All water used is dechlorinated
- Clone lighting will be delivered by one 8-bulb T5 HO Fluorescent Light Fixture and hung 12” above clone tank.
- BRe³ Wand installed at 12” above EZClone tank
- T5 light is hung at 12” above plants and run 24/7 during vegetative cycle for 6 weeks
- BRe³ wand set at 12” over plants each covering a max at full growth of 16 square feet of canopy
- The wands are fastened using plastic housing aluminum clip ratchet hangers and nylon rope provided by manufacturer
- All lighting is plugged into a 6-plug extension cord
- During the Vegetative Cycle the wands are run for 18hrs on / 6hrs off
- Veg Cycle = 6 weeks
- Flowering Cycle could 8-10 depending on the plants genetic traits
- The BRe³ Wand and the T5 Light are controlled by a 24hour timer

7.1 METHOD CALIBRATION FOR EQUIPMENT

PD Wand Set-up and Continued Application

- Using a tape measure, each BRe³ Wand is set at 12 inches above each plant.
- Using a bubble level each BRe³ wand is checked to ensure each light is hanging perfectly level horizontally so the spectrum coverage is uniformed and accurate
- Power Supply is routinely checked to ensure zero failure

8.0 DATA ACQUISITION

Data collection will be conducted to the established protocols put in place since 2007. Daily data records are on file for growth, water and nutrients added. Prior to the Wands being incorporated into the grow cycle, records were kept for pesticides, and other IPM deterrents. These procedures are no longer being conducted since the Wands were added to the grow protocol.

9.0 RECORDS MANAGEMENT

Good Manufacturing Practice and Requirement of premises, plant and equipment for cannabis growth, quality and yield test for using BRe³ Wand vs Control in Indoor Environment. To achieve the objectives for the test process and appropriate methodology, systems and procedures shall be documented and maintained for inspection and reference; and the manufacturing premises shall be used exclusively for production of cannabis and no other manufacturing activity shall be undertaken therein.

10.0 RESULTS PREP AND PROCEDURE

During course of grow cycle, key characteristics you should expect are that plants should look strong, healthy, vibrant and uniformed in height. The canopy should be dense and stacked. The stalks should be robust and the vascular system shall show no signs of stress. Distance between internodes is also indicative of the health of plant. Growth should be vigorous and green is consistent throughout the plant. Test perimeters for each quantitative property used to compare BRe³ vs Control shall be checked and recorded using different measuring instruments or simply by visual image.

- Canopy = The density of the canopy and how the plant is stacking shall be visually recorded and noted with weekly measurements thru the Veg Cycle
- Flowering Heads = The number of flowering heads per plant shall be quantified
- Internodal Distance = Sum, Average, and Variance of Internodal Distance (lower average internodal spacing is desirable)
- Internodal Density = Sum, Average, and Variance of Nodal Density which is the number of nodes divided by height in cm (greater average internodal density is desirable)
- Vascular Stem (Part 1) = Beginning in Week 4, check main stalk diameter with digital slide caliper- record measurement using outside caliper in inches
- Vascular Stem (Part 2) = Beginning in Week 4thru Week 8 of Veg check diameter 8 inches above main stalk to determine if the thickness of the base is consistent up the plant, using digital caliper in inches
- Height of Plant = Beginning in Week 8 of Veg thru all of Bloom Cycle measure height of plant from soil to top node/leaf or if farther along in flower stage- measure from soil to the apical bud using 4ft yardstick and then record measurement in inches
- Bud Weight = Biomass dry weight of the total # of buds that have flowered, harvested and dried/cured (7-10 days)
  *Bud weight will be measured in grams but will not be done weekly, only once after harvest/cure/drying process.

10.1 RESULT METHODOLOGY

Results of the test regarding plants under the BRe³ Wand could represent an improving, similar and a lower alternative to the control plant. The flower yield obtained will be weighed separately and compared and the production of the highest concentration of cannabinoids shall be determined by independent 3rd party test lab to determine if either has improved, similar or lower than the other.

11.0 TROUBLESHOOTING

- Plants Start drooping right after watering = overwatering or not enough drainage/soil compaction
- Plants stop drooping right after getting water = underwatering, plants need more water.
- The top leaves are “tacoing” or flipping up at the edges = Light and or heat burn. Plants may need more fresh air blowing over top of canopy- open roof vents and doors and turn on box fans.
- During Veg stage or early flowering the lower leaves turn yellow & soft with possible brown splotches then dry out and drop off = plants need higher levels of properly formulated nutrients.
- Leaf tips brown or burnt = nutrient burn, which means your plants are getting too much nutrients in general.
- Leafs are dark green with tips turned sharply down = too much nitrogen, must reduce nitrogen levels.
- High temperature inside Indoor Grow- open roof vents, roll-up sides and doors on both ends will help to keep the temperature more even and will allow some of this heat to naturally escape.

12.0 TEST STUDY SUMMARY

The purpose of this study was to demonstrate that when nutrient, energy, and environmental inputs are controlled, the BRe³ LED light will produce healthier, more robust plants than with plants without the proprietary LED wavelengths.

Two of factors used as indicators of plant health and quality in this experiment were internodal distance and nodal density. These factors were chosen because low internodal distance and high nodal density are signs that a plant is not wasting large amounts of energy on vertical growth alone. In fruiting plants, more vertical growth is far from ideal and is often referred to in the pejorative sense as "stretching". Stretching occurs when a plant is not receiving the complete spectrum required for photosynthesis (specifically, there is not an adequate ratio of red to far-red light, nor is there an adequate amount of blue light) or when the ambient temperature is too high and is undesirable for a number of reasons (Rajapaksa & Kelly, 1992; Appelgren, 1991; Frimanslund & Grimstad, 1993). Stretching generally predicates a reduced fruit yield, results in weak stems that need to be supported, and greatly reduces light penetration to the lower portion of the plant. Internodal distance and nodal density both relate to the number of nodes along the main stem of the plant, and the number of nodes positively correlates with the number of fruiting sites.

12.1 TEST STUDY CONCLUSION

The results of this study have proven that plants grown under the BRe³ Wand vs. multiple years of past crops that delivered consistent results have:

- Greater Canopy Density
- Deeper Green Color
- Closer Internodal Distance by 1/3 to ½ Improvement
- Greater Node Density Leading to More and Stronger Branches
- With More Node Sets, More Flowering Heads by 1/3
- Vascular Definition- both main stalk & 8 inches up the main stalk by 20%+ thicker
- Overall Height & Height Growth Uniformity Dramatically Improved
- Flower Yield by Weight under the BRe³ Wand = 1.20 grams per watt
- Flower Yield by Weight without the Wand over a five-year period = .89 grams per watt