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Optimization of the Yield of the Cultivation of Cannabis Sativa in Controlled Environment for Medicinal use in Puerto Rico

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1. Introduction

In Puerto Rico, the cultivation of Cannabis sativa for medicinal use is mainly carried out in Puerto Rico. controlled environments, such as grow rooms and greenhouses. This plant, native to Central Asia, adapts to various climates, but its optimal performance depends on precise control of environmental conditions [1].

1.1. Plant Biology

Cannabis sativa is a dioecious (Unisexual) plant with male and female that is the only one to produce the flower. Different generational factors can cause the presence of a Hermaphrodite plant [1]. The cultivation of Cannabis sativa has spawned two variations: hemp and medical cannabis/ medical marijuana. This characteristic is present in analyses where a THC of less than 1% and high CBD is classified as hemp and any candidate above 10% THC is classified as cannabis medicinal [1]. Cannabis cultivation is susceptible to any change in temperature, humidity, watering, and lighting. These changes generate changes in the physical characteristics of the plant and variations in biomass. [1-3].

2. Materials and Methods

Growth Plan and Materials The experiment was conducted in a culture room with conditions approved by the Puerto Rico Department of Health. The plants were grown in rockwool and coco perlite, with a 12-hour light regime for control vegetative growth and flowering. The room is set from scratch with a temperature of 130° F. This allows us to create the temperature and humidity conditions required for the natural environment of the room. The experimental unit consists of 882 plants planted in a wool slap and 294 plants planted in coco perlite. The plants were sown from clones and vegetatively brought for 2 weeks and 4 days. During the week-long planting period, the clones are bombarded by lots of light and periods of drought between irrigation. The humidity in the room is kept high to stimulate root growth.

2.1. Environmental Parameters

Keeping the temperature between 6882°F and humidity between 50-70% is crucial for optimal development.

	Temperature	Humidity	CO2
Average	78.92	65.38	1297.2

Table 1: Average Temperature Vegetative Moisture and CO2

EC Veg	pH
3.0	5.8

Table 2: EC and pH During the Week Vegetative

During this period, you should have the main lights on for 12 hours and have moonlight for 12 hours. This allows the flower not to develop completely and the plants to spike during these weeks that range from 2 to 4 weeks of vegetative [4].

The hours of light and NPK nutrition through controlled irrigation guarantees a stretch in the optimal vegetative stage for the medical cannabis plant. The watering of the plants is divided into 4 periods: during the day they range from 7:00 am, 9:00 am, 11:00 am and 1:00 pm, with an average of 1.30 minutes. What can vary depends on the temperature and humidity conditions of the room on a daily basis.

Middle	EC	Humidity	Temperature
Coconut Perlite	2.50	45.52	78.50
Work Slap	2.80	52.50	79.20

Table 3: Humidity, Temperature and EC of Substrate

2.2. Flowering

The change to flowering is made once the plants reach a certain height from the grassroots. This allows us to control growth and maintain a growth standard. The light during this period is divided into 12 hours of darkness and 12 hours of light. This allows the stimulus for flower production to be generated within 2 weeks of the change [2-4].

Temperature	77-82
humidity	58-60
CO2	1300 - 1800
EC	3.0
pH	6.0
EC Runoff	6.34
pH runoff	5.5-6.2

Table 4: Temperature, Humidity, CO2, EC and PH

The second stage is the fattening of flowers. This is the most important and most important stage impact on cannabis flower. Any alteration at this stage creates small flowers or will keep the flowers Immature. This stage is marked by a high production of leaves and the explosion of flowers throughout the plant. Controlled leaf removal is important to allow the entire plant to obtain light. This will allow the number of liveries per plants.

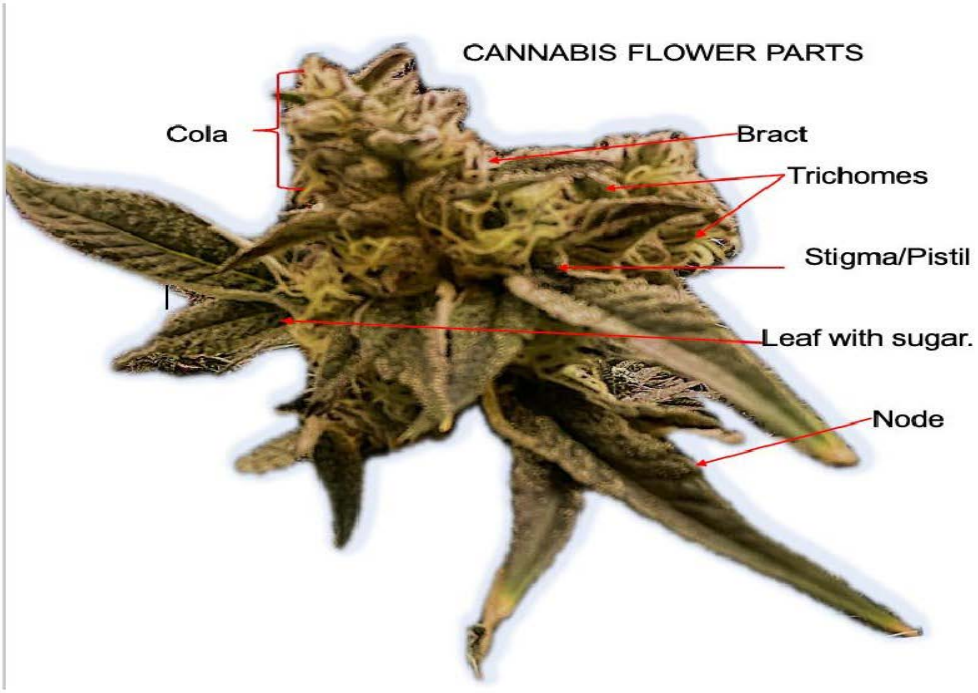

Figure 1: Cannabis Flower Pate

The third stage is the beginning, maturation and expression of sugar in the leaves of the cannabis plant. This sugar expression marks the way to the completion of the process, being the important point to add phosphorus and potassium and eliminate hydrogen in stages [5,6]. The NPK formula adjusts according to the growth stage, increasing phosphorus and potassium to allow flower fattening.

Temperature	75 80
humidity	50 -58
CO2	1800
EC	3.0
pH	6.0
EC Runoff	6.34
pH runoff	5.5-6.2

Table 5: Temperature, Humidity, CO2, EC and PH

The fourth and final stage is the maturation process in which the flower completes its density. After ripening, the plants do not require much watering and low temperatures. Indica plants begin to express color changes with maturation, sativa plants observe a deep green color. When these four phases of flowering are completed, 9 weeks of flowering are completed. It is the optimal time for flowers to be characterized by the maximum expression of THC, CBD, and cannabinoids in the plant [7].

Temperature	68 - 72
humidity	50 -58
CO2	500
EC	3.0
pH	6.0
EC Runoff	6.34
pH runoff	5.5-6.2

Table 6: Temperature, Humidity, CO2, EC and PH

3. Discussion of Results

Flowering is divided into four distinctive stages, each with specific light and nutrient requirements. Strict control of these factors ensures high-quality production and maximum cannabinoid and THC content [1,8]. Artificial light should be monitored to avoid variations that can cause stress to the plants, which directly affects the development and quality of the final product.

These variations cause immature flowers, excess moisture in the plant and root area; causing the expression of fungus in the ripening flowers and the loss of the plant due to excess water.

The plant requires a minimum of 9 hours of light and a maximum of 15 hours to mark full flowering light times in the flowering stage that marks less than 8 hours, or the incorrect variation of lights can mark low yields and the presence of hermaphrodite plants 1, [2-4].

Temperature variations should not exceed 4°F to avoid humidity problems and improper flower formation, which would negatively impact the production of THC and other cannabinoids. During the day the temperature should not exceed 84°F and during the night 77°F cannot be hotter as this brings increased humidity and problems in the formation of flowers [9].

Optimization of the Nitrogen, Phosphorus, and Potassium (NPK) mixture for medical cannabis should vary [10,5]. In the vegetative stages, plants require a greater amount of nitrogen for their vegetative growth. As flowers are expressed, it is necessary to decrease nitrogen and increase phosphorus and potassium [6]. This allows the plant to accelerate its flower fattening and maturation. This prevents the revegetation of the silver by having some variation in the hours of light [1].

The optimization of the harvest of medical cannabis must be controlled from the establishment of the growing environment. The plant requires a continuous controlled environment. From the moment the plants arrive in the grow room until they are ready for harvest. They require attention to every detail. Any changes in the parameters of the fourth generates a change in the Plant behavior. Change in room humidity, change in the composition of the substrate fertilizers. Among other details that should be investigated further. Harvesting cannabis Medicinal has a time of 9 weeks. Using an effective defoliation technique and the right combination of NPK we can obtain a harvest with a high yield of THC and millennials [7].

4. Conclusion

Optimizing medical cannabis cultivation in Puerto Rico requires rigorous control of environmental conditions from planting to harvest. Any deviation in the set parameters may affect significantly the performance and quality of the product [11,12].

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