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INFLUENCE ON TEMPERATURE AND RELATIVE HUMIDITY ON FRUITING BODY PRODUCTION OF PLEUROTUS FLORIDA (OYSTER MUSHROOMS) IN THE CROPPING ROOM

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Abstract- The cultivation of Pleurotus florida (oyster mushroom) has emerge as an more and more essential agricultural interest because of its nutritional value, ease of cultivation, and financial viability, in particular in growing international locations. However, a success mushroom manufacturing is exceedingly touchy to environmental parameters, with temperature and relative humidity (RH) being most of the maximum crucial elements influencing the formation and development of fruiting bodies. This assessment explores the influence of these microclimatic conditions in the cropping room environment at the increase and productiveness of P. Florida.Temperature affects mycelial colonization charge, primordia initiation, and standard fruiting, whilst RH determines water availability, fruit frame morphology, and susceptibility to physiological strain. Optimal temperature conditions for fruiting generally range between 20–28°C, and a relative humidity level of 85–ninety five% is taken into consideration ideal for the duration of the fruiting section. Deviations from those situations can bring about odd increase, decreased organic efficiency, and compromised yield satisfactory. This overview synthesizes findings from numerous experimental studies, comparing responses of P. Florida below controlled and fluctuating environmental conditions. It additionally discusses modern approaches which includes automated weather manage systems and low-price conventional strategies to keep favorable situations in exceptional agro-climatic zones. The insights supplied intention to support cultivators and researchers in optimizing

yield and improving the industrial viability of oyster mushroom cultivation.

Keywords-

Pleurotus florida, oyster mushroom, temperature, relative humidity, fruiting body, cropping room, mushroom yield, environmental factors, microclimate, mycelial growth

I. INTRODUCTION

Mushroom cultivation has emerged as a sustainable and green shape of biotechnology with sizeable monetary, nutritional, and environmental benefits. Among the diverse edible mushrooms, species of the genus Pleurotus, normally known as oyster mushrooms, have won prominence because of their adaptability to various agro-climatic conditions, green biodegradation of agricultural wastes, and relatively easy cultivation necessities. Pleurotus florida, especially, is one of the most extensively cultivated species on this genus due to its fast growth, high productiveness, rich nutritional profile, and medicinal homes which include antioxidant, antitumor, and immune-modulatory sports.

Despite the organic robustness of P. Florida, the success of its business cultivation heavily depends on the perfect regulation of environmental situations, specially all through the cropping phase. Among the environmental variables, temperature and relative humidity (RH) are the maximum influential abiotic elements that govern the morphogenesis, yield, and exceptional of fruiting our bodies. These parameters have an instantaneous effect on mycelial metabolism, enzyme pastime, water stability, and respiratory, all of which might be essential to the a success initiation and development of fruit our bodies. An imbalance in temperature or RH can cause suboptimal yields, malformed or discolored fruiting bodies, not on time cropping cycles, and accelerated vulnerability to contaminants and physiological disorders.

The lifecycle of P. Florida consists of three major phases: mycelial colonization (spawn run), primordial formation (pinning), and fruit frame improvement (cropping). While the spawn run segment typically requires barely better temperatures (25–30°C) and mild humidity, the cropping section necessitates a particular microclimate—typically cooler temperatures starting from 20–28°C and better RH tiers among 85–95%—to stimulate the transition from vegetative growth to reproductive development. Proper manipulate of these parameters no longer handiest guarantees top of the line increase however additionally improves the bodily appearance, texture, and shelf-life of the harvested mushrooms, that are critical for marketplace popularity.

Relative humidity plays a critical position in retaining moisture content material in the fruiting bodies and substrate. Insufficient RH can result in desiccation and shrinkage of mushrooms, even as immoderate humidity may additionally create favorable conditions for bacterial blotch, inexperienced mold (Trichoderma spp.), and other pathogenic infestations. Similarly, temperature fluctuations can affect enzymatic processes, prevent metabolic capabilities, and disrupt the synchrony of fruiting cycles.

In current years, mushroom cultivation has elevated from small-scale rural establishments to particularly commercialized operations the use of controlled environment cultivation chambers. Advances in sensor-based totally monitoring, automated misting and air flow structures, and weather-controlled cropping rooms have enabled specific law of temperature and humidity. However, in lots of developing regions, growers still rely upon low-tech cultivation practices, wherein environmental parameters are managed manually or semi-routinely. In both cases, focus and knowledge of the most suitable environmental necessities at some stage in the cropping level are essential for maximizing organic performance, Fig.1. show the diagram of Pleurotus florida (oyster mushrooms).

Fig.1.Pleurotus florida (oyster mushrooms)

II. LITERATURE REVIEW

The productiveness and fine of Pleurotus florida are appreciably inspired by environmental situations, in particular temperature and relative humidity, during the cropping degree. Several studies have highlighted the necessity of maintaining most appropriate temperature and RH to reap most biological efficiency. According to Shah et al. (2004), the proper temperature range for the initiation and improvement of fruiting our bodies of P. Florida lies between 20°C and 28°C, with eighty five–95% relative humidity, which promotes faster pinhead formation and larger, healthier fruiting bodies. Deviations from this variety, particularly immoderate warmness or low humidity, were proven to put off fruiting and decrease yield extensively.

Sarker et al. (2007) validated that high temperatures above 30°C ended in malformed fruiting bodies and a decrease in organic efficiency due to metabolic stress. Similarly, Royse (2001) suggested that better relative humidity complements the floor moisture content material of the substrate and fruiting our bodies, that's critical for cellular enlargement and morphological improvement. However, excessive humidity above 95% can increase the chance of contamination, especially by using Trichoderma spp. And Pseudomonas tolaasii, which motive inexperienced mildew and bacterial blotch, respectively.

In a comparative take a look at on special species of Pleurotus, Pathmashini et al. (2008) located that P. Florida changed into greater sensitive to humidity fluctuations than different species inclusive of P. Ostreatus, with low RH (<seventy five%) leading to shrunk caps and bad sporophore development. Furthermore, Gume et al. (2013) emphasized that superior fruiting isn't most effective depending on regular RH but additionally on steady temperature preservation, as sudden drops or spikes can disrupt the metabolic techniques concerned in fructification.

Technological interventions have additionally been explored to optimize microclimatic situations. Mahadevan (2012) reported that the use of low-cost evaporative cooling structures in polyhouses become powerful in keeping the required RH and temperature at some stage in off-seasons, thereby extending the cultivation length of P. Florida. Additionally, Islam et al. (2009) showed that automated humidity controllers and exhaust lovers in cropping rooms ought to hold the environmental parameters within the most suitable range, resulting in a 20–25% growth in biological performance compared to conventional methods.

Studies by means of Zervakis and Philippoussis (2000) and Ahlawat et al. (2009) additionally aid the perception that controlled surroundings situations lead to improved yield consistency, higher fruit body morphology, and shorter cropping cycles. These findings underline the significance of environmental management in industrial mushroom production structures.

Overall, the reviewed literature certainly establishes that Pleurotus florida cultivation is highly sensitive to temperature and relative humidity, and a hit cultivation calls for careful tracking and management of those variables during the cropping cycle.

III. INFLUENCE OF TEMPERATURE AND RELATIVE HUMIDITY ON FRUITING BODY PRODUCTION

The production of fruiting bodies in Pleurotus florida, like in lots of cultivated mushrooms, is highly sensitive to environmental parameters, mainly temperature and relative humidity (RH), which act as external indicators regulating key developmental transitions. Temperature impacts enzymatic interest, metabolic fee, respiratory, and the physiological reaction of the mycelium, at the same time as relative humidity controls water availability, mobile hydration, and the structural integrity of fruiting our bodies. The interplay between those factors no longer best determines the achievement of each increase segment—mycelial colonization, pinhead formation, and fruit body development—however also impacts the first-class and yield of the mushrooms.

During the initial spawn run phase, the proper temperature range lies between 25°C and 30°C, which promotes rapid mycelial growth and uniform colonization of the substrate. At this level, RH is less essential but must be maintained around 70–seventy five% to save you drying of the substrate and encourage healthful vegetative increase. As the mycelium matures and enters the reproductive segment, a shift in temperature to a decrease range of 20°C to 24°C is important to provoke pinhead or primordia formation. This thermal drop mimics herbal environmental modifications that signal the fungus to reproduce. Without this shift, fruiting is delayed or fails to arise totally. Simultaneously, RH need to be expanded to 85–ninety five%, as primordia are highly sensitive to desiccation. High humidity ensures the essential moisture for mobile growth and supports the integrity of developing systems.

During the fruiting phase, retaining this high RH is vital, as water loss via evaporation can reason deformities such as cracked caps, elongated and skinny stipes, and underdeveloped fruiting bodies. However, RH stages exceeding ninety five% can be negative as they promote the increase of competitor molds and micro-organism, specifically in poorly ventilated environments. Thus, RH should be cautiously balanced—no longer too low to purpose water stress, nor too high to create a microclimate conducive to sickness. Moreover, temperature for the duration of fruiting need to remain slight, preferably among 22°C and 26°C. Higher temperatures (>30°C) regularly result in thermal strain, reducing fruit frame size, delaying harvest time, and increasing the hazard of infection because of weakened fungal immunity.

In tropical and subtropical areas, out of control fluctuations in temperature and humidity pose a primary undertaking, specifically in open or poorly insulated cultivation rooms. Studies have constantly proven that deviations from the optimum range result in extensive discounts in organic efficiency (BE), a key metric of productiveness in mushroom farming. For instance, fruiting our bodies grown at suboptimal conditions exhibit low cap diameter, excessive stipe-to-cap ratio, and reduced marketplace high-quality. Furthermore, choppy environmental situations at some point of cropping can also cause asynchronous fruiting, complicating harvest timing and decreasing batch uniformity.

Therefore, successful cultivation of P. Florida hinges on the grower's capacity to simulate and hold a microclimate that aligns with the biological requirements of the fungus. Whether thru low-cost traditional strategies or high-tech computerized structures, specific control of temperature and humidity is vital for maximizing yield, making sure best, and keeping the sustainability of mushroom manufacturing systems.

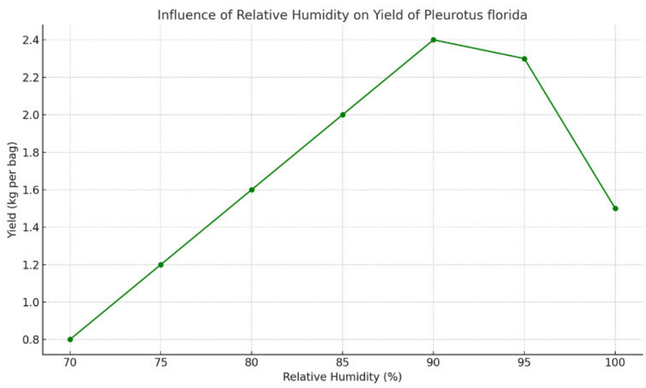

Fig.1. Graph between Relative Humidity and Yield

The graph above illustrates the influence of relative humidity (RH)on thefruiting body yield of *Pleurotus florida* in the cropping room. As shown, yield generally increases with RH up to an optimal level (around 90%), after which it begins to decline.

- 70%–80% RH: At lower humidity ranges, the air is too dry to help optimal fruit body improvement. Water loss from the substrate and the primordia leads to poor pinhead formation, decreased cap growth, and smaller, deformed fruiting our bodies.
- 85%–90% RH: This range supports best hydration situations for P. Florida. High humidity guarantees good enough moisture for fruit frame increase, resulting in higher length, texture, and general yield. Most research and cultivators agree this is the most suitable RH sector for oyster mushrooms.
- 95%–one hundred% RH: While humidity is still high, immoderate moisture begins to create troubles. It may also cause condensation on caps and substrates, which promotes bacterial blotch, inexperienced mould, and other contaminations. This causes a decline in yield and excellent, as visible in the drop past 90%.

Thus, maintaining RH between 85% and 90% during the fruiting phase is critical for maximizing yield and ensuring healthy fruiting body development in *Pleurotus florida*.

IV. ENVIRONMENTAL MANAGEMENT STRATEGIES

Effective environmental management is crucial for optimizing the growth and yield of *Pleurotus florida* in cropping rooms, especially given the species' sensitivity to temperature and relative humidity fluctuations. Maintaining the ideal conditions—temperature between 20°C and 28°C and relative humidity between 85% and 95%—requires both preventive and responsive strategies that vary based on the scale and sophistication of the cultivation setup. In traditional or low-cost mushroom farming systems, growers often rely on simple, locally adaptable methods to control the microclimate. These include regular manual misting of the air and substrate, hanging wet gunny bags or jute sacks around the cropping room to increase humidity, using shade nets or straw thatch to insulate against high outdoor temperatures, and strategically opening or closing ventilation outlets to balance heat and humidity. Such methods, while effective to an extent, demand close observation and frequent adjustment, and their performance may vary with external weather conditions.

In contrast, commercial and semi-commercial setups have adopted more advanced environmental control technologies to ensure consistency in production. Automated misting or fogging systems equipped with humidity sensors are widely used to maintain the desired RH levels without manual intervention. These systems can be programmed to activate at specific thresholds, ensuring continuous optimal conditions, especially during the critical stages of pinhead formation and fruiting. Similarly, temperature regulation is achieved through evaporative cooling systems, exhaust fans, and air-conditioning units, depending on the available resources and climate zone. Evaporative coolers are particularly useful in hot and arid regions, as they simultaneously lower air temperature and increase humidity, thus creating a favorable environment for mushroom development.

Ventilation is another key component of environmental management, as accumulation of carbon dioxide (CO_2) can inhibit primordia formation and lead to elongated stipes and reduced cap size. The use of exhaust fans, air vents, and natural cross-ventilation helps maintain oxygen-rich air and expel CO_2 generated during respiration. In controlled environments, CO_2 levels can also be monitored using digital sensors, allowing growers to adjust airflow as needed. Additionally, the placement of thermometers, hygrometers, and data loggers throughout the cropping room enables real-time monitoring of environmental parameters, allowing for timely adjustments to prevent stress or contamination.

For year-round cultivation, especially in regions with extreme seasonal variations, insulating materials such as polystyrene panels, thermal curtains, or double-layer plastic sheeting can be employed to stabilize internal conditions. Some growers also integrate Internet of Things (IoT) technologies into their operations, using smart controllers to automate and synchronize various systems including lighting, humidity, ventilation, and temperature. These smart solutions not only improve precision but also enhance labor efficiency and reduce the likelihood of human error.

V. FUTURE SCOPE

The future scope of studying the influence of temperature and relative humidity on fruiting body production of *Pleurotus florida* in cropping rooms encompasses multiple promising avenues that can significantly enhance mushroom cultivation efficiency and sustainability.

1. Optimization of Environmental Control Systems:

Advances in weather manipulate technology can permit the development of specific and automatic structures to keep an appropriate temperature and relative humidity tailor-made for every level of Pleurotus florida boom. This can cause extra uniform and predictable fruiting, decreasing crop failures resulting from environmental stress. Understanding the ultimate tiers of those factors will guide the layout of strength-efficient heating, cooling, and humidification structures, minimizing operational charges.

2. Integration of Smart Monitoring Technologies:

The incorporation of IoT (Internet of Things) gadgets and sensors able to continuously tracking temperature, humidity, and different environmental parameters can revolutionize mushroom farming. These technologies allow real-time facts series and automatic modifications, ensuring the cropping room keeps gold standard conditions with out manual intervention. AI-pushed analytics can predict environmental fluctuations and proactively modify settings, similarly boosting productiveness.

3. Strain Selection and Genetic Improvement:

Research on how special Pleurotus florida lines reply to varying temperature and humidity can perceive extra resilient types. Genetic development thru conventional breeding or cutting-edge biotechnological equipment could produce traces with better tolerance to suboptimal environmental conditions. This might increase the geographic and seasonal feasibility of cultivation, making mushroom farming more adaptable to weather variability.

4. Holistic Environmental Modeling:

Future research can consciousness at the interactive results of temperature and relative humidity with other essential factors inclusive of CO2 ranges, light depth, and substrate composition. Developing comprehensive increase models will help in excellent-tuning all environmental parameters simultaneously, optimizing average fruiting body yield, length, and first-class.

5. Sustainability and Resource Efficiency:

By information an appropriate environmental wishes of Pleurotus florida, growers can reduce useless energy and water use, contributing to greater sustainable production practices. Innovations in controlled surroundings agriculture may additionally lead to closed-loop structures that recycle air moisture and warmth, minimizing waste and environmental impact.

6. Commercial Scale-Up and Economic Viability:

Applying the information received from environmental have an impact on research at industrial scale can improve crop reliability and decrease losses. This helps mushroom producers in accomplishing higher profitability and meeting growing marketplace demands. Optimized conditions also improve mushroom shelf-existence and nice, enhancing client reputation.

7. Adaptation to Climate Change:

As international climate patterns shift, information the precise temperature and humidity thresholds for Pleurotus florida will help in growing cultivation protocols which can be resilient to fluctuating environmental conditions. This guarantees solid manufacturing even in areas facing intense climate activities, contributing to meals protection.

VI. CONCLUSION

The successful cultivation of Pleurotus florida, a broadly grown and nutritionally treasured oyster mushroom species, is exceptionally depending on retaining optimum environmental situations, specifically temperature and relative humidity, during the cropping cycle. These elements play a vital position not simplest inside the physiological improvement of the fungus—from mycelial colonization to fruiting frame formation—however also in figuring out the general productivity, satisfactory, and business viability of the crop. Deviations from an appropriate temperature range (20°C–30°C) and relative humidity (eighty five%–ninety five%) can bring about behind schedule fruiting, malformed systems, decreased yields, and elevated vulnerability to microbial infection. As verified in various studies, appropriate shifts in temperature are necessary to cause distinctive developmental stages, especially the transition from vegetative increase to reproductive development. Similarly, steady and sufficient humidity ranges are critical to hold cellular hydration, turgor pressure, and morphological integrity of the growing fruit our bodies. Environmental control strategies—starting from traditional techniques like guide misting and coloration set up to modern, sensor-based computerized systems—are instrumental in preserving the required microclimate, in particular in regions with severe or fluctuating climate conditions. Understanding the difficult courting between temperature, humidity, and mushroom physiology is vital for optimizing cultivation protocols. This now not handiest enhances the organic performance of the production system but also contributes to sustainable, 12 months-spherical mushroom farming. As the call for for purposeful and fitness-selling meals like P. Florida will increase, satisfactory-tuning environmental parameters will stay a cornerstone of medical and realistic efforts geared toward improving mushroom cultivation practices globally.

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