



INFORMATION PLATFORM "CENTER FOR INNOVATIVE THINKING"  
UKRAINIAN INSTITUTE OF SCIENTIFIC STRATEGIES  
EUROPEAN UNION RESEARCH DEPARTMENT  
SCIENTIFIC AND PUBLISHING CENTER "PROGRESS"

# EDUCATION AND SCIENTIFIC PROGRESS

PROCEEDINGS OF THE INTERNATIONAL SCIENTIFIC  
AND PRACTICAL CONFERENCE



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# VETERINARY SCIENCES

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## EFFICIENCY OF GROWING DIPOROUS MUSHROOMS IN GREENHOUSES

**Abstract.** It has been proven that the technology of growing two-spore mushroom (*Agaricus bisporus*) is effective when using successive stages using a solution of cellulase and succinic acid. As a result of the research, it was found that the use of cellulase enzymes and succinic acid in the composition of irrigation water contributes to an increase in the hydrolysis of cellulose contained in the substrate and an increase in the transformation of nutrients from the substrate into the biomass of the edible mushroom two-spore mushroom (*Agaricus bisporus*). When using solutions of cellulase and succinic acid, the chemical indicators in the two-spore champignon are improved due to an increase in the content of: proteins by 12.5%, carbohydrates - 9.0% and fats - 9.0% ( $P \leq 0.05$ ). Irrigation of the champignon substrate with water containing 0.01% cellulase and 0.01% succinic acid increases

the yield of mushrooms by 14.1%. The technological process of growing champignons includes four independent but interrelated technologies: preparation of the substrate (compost), preparation of the covering material, cultivation of the planting material – mycelium (mycelium) and cultivation of the crop. After the compost is covered with mycelium, covering is required – application of covering material. It is necessary for the formation and growth of fruit bodies. At the same time, the cover soil prevents the compost surface from drying out, retains moisture necessary for mushroom growth, promotes gas exchange between the substrate and the external environment, and, due to the slightly alkaline reaction (optimal pH value 7.4), converts acidic products of mushroom metabolism into bound forms.

**Keywords:** edible mushroom, champignon, technological processes of cultivation, covering mixtures, inoculation, compost, solutions of cellulase and succinic acid.

Edible mushrooms, in particular, champignons, are a valuable dietary product, as they contain all essential amino acids, fiber, which normalizes the activity of beneficial microflora in the human body, and removes toxic substances, including cholesterol, from the body [1, p. 77; 2, p. 5]. They contain minerals, a number of vitamins, as well as biologically active substances that have antitumor, antiviral, anti-inflammatory and other medicinal properties. At the same time, mushrooms contain few lipids and easily digestible carbohydrates, which makes them low-calorie. The development of the production of edible mushrooms, especially champignons, in Ukraine is gaining wide practical importance [3, p. 810; 4, p. 703].

The technological process of growing champignons includes four independent but interrelated technologies: preparation of substrate (compost); preparation of covering material; cultivation of planting material - mycelium (mycelium); cultivation of crops [5, p. 83; 6, p. 79].

To prepare the cover soil, peat (90%) was used with the addition of sand and chalk (5%). Cover mixtures were also prepared from sandy and light loamy soils, river sand, perlite, zeolite, etc. The components were mixed and sieved through a

sieve with a hole diameter of 3–4 cm, after which they were disinfected. For this purpose, a formaldehyde solution was used (10 dm<sup>3</sup> with a mass concentration of 3–4% per 1 ton of cover soil) or the mixtures were steamed for 6–10 hours at a temperature of 60–70°C [7, p. 275].

Inoculation of the substrate with mycelium was carried out at a temperature of the latter 25–28 °C. Depending on the type of mycelium used, the rate of its sowing is determined. 500 g of compost mycelium or 300–400 g of grain mycelium are applied per 1 m<sup>2</sup>. It should be noted that an average of 100 kg of substrate is placed per 1 m<sup>2</sup> of a rack or bed. The bulk of the seed mycelium, about 80%, is applied to a depth of 12–15 cm, the rest is evenly scattered over the surface and slightly compacted. After inoculation, the surface was covered with paper, which was moistened daily. The substrate temperature during this period was maintained within 22–25 °C, the air temperature was 1–3 °C lower.

The humidity of the compost was about 68%, the air - 93-98%. During the growth of the mycelium, fresh air can not be supplied to the cultivation room. The mycelium grew well even at a 2,0% concentration of CO<sub>2</sub>.

Growth phases: I – mycelium growth; II – transition from vegetative growth to fruiting (started approximately 2 weeks after applying the covering material and ended with the beginning of fruiting); III – fruiting. Well-prepared compost was permeated with white, thick mushroom mycelium for 14–20 days. After that, the paper was carefully removed and thrown away.

Peat (90%) with the addition of sand and chalk (5% each) was used to prepare the cover soil. Cover mixtures were also prepared from sandy and light loamy soils, river sand, perlite, zeolite, etc. The components were mixed and sieved through a sieve with a hole diameter of 3–4 cm, after which they were disinfected. For this purpose, a formaldehyde solution was used (10 dm<sup>3</sup> with a mass concentration of 3–4% per 1 ton of cover soil) or the mixtures were steamed for 6–10 hours at a temperature of 60–70°C.

The cover soil was applied to the surface of the compost in an even layer 3–5 cm thick. In the first week after its application, the compost temperature was maintained

at (22–25) °C for rapid growth of the mycelium. The cover soil was watered daily so that water passed through it but did not wet the top layer of compost with the mushroom mycelium. Approximately 2 weeks after the top dressing, the mycelium reached the surface of the cover soil. At this time, the temperature in the room was reduced to 18 ° C by ventilation. For 2–3 days after this, watering was continued. However, immediately after the formation of fruiting body embryos - primordia, which falls on the 15–17th day from the moment of applying the covering soil, watering was stopped. During this period, the room was ventilated: the CO<sub>2</sub> concentration should not exceed 0.2%. When the fruiting body embryos reached the size of a pea, watering was resumed. The water consumption rate was 1 dm<sup>3</sup> per 1 m<sup>2</sup> per day (in two doses).

The mushroom began to bear fruit 21–23 days after budding. Fruiting bodies appeared periodically. This is called the waves of fruiting in mushroom growing. It is due to the fact that after the appearance of the maximum number of mushrooms and their collection, the mycelium is replenished with nutrients and water for the appearance of the next wave, which begins in 6–10 days. The first two waves are the most productive.

During the fruiting period, the optimum air temperature was – 16 °C, relative humidity – 85–90%, CO<sub>2</sub> concentration – up to 0.1%. To ensure optimal gas regime parameters, ventilation of the room is required at the rate of 3–4 m<sup>3</sup>/m<sup>2</sup> h. The harvest period lasts 30–60 days, during which 5–6 waves are formed. However, the first three waves, which end on the 30–40th day, provide 70–80% of the total harvest. Therefore, extending the harvest period beyond these periods is economically inexpedient.

When using solutions of cellulase and succinic acid, the chemical indicators of the two-spore champignon are improved due to an increase in the content of: proteins by 12.5%, carbohydrates - 9.0% and fats - 9.0% (P≤0.05). Irrigation of the champignon substrate with water containing 0.01% cellulose and 0.01% succinic acid increases the yield of mushrooms by 14.1%. The greatest economic efficiency in the technology of two-spore champignon under the action of cellulase and succinic acid

was obtained when using filtered water containing 0.01% cellulase and 0.01% succinic acid. The cultivation efficiency was 275.5 hryvnias for 9.84 kg per 1 m<sup>2</sup>, which is 34.2 hryvnias, or 14.2% more than in the control variant.

Therefore, the technological process of growing champignons includes four independent but interrelated technologies: preparation of substrate (compost), preparation of covering material, cultivation of planting material - mycelium (mycelium), and cultivation of the culture using solutions of cellulase and succinic acid.

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