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Chemical Composition of Edible mushroom (*Pleurotus species*) as Influenced by NPK and Trace Element Application

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ABSTRACT

Mushroom is being widely used as food and food supplements from ancient times. They are increasingly being recognized as one of the important food items for their significant roles in human health, nutrition and diseases. In this study, the nutritional values of two species of mushrooms (Pleurotus sajor caju, and Pleurotus florida) which are very popular among the mushrooms are studied for their chemical aspect as influenced by trace element and NPK. P. sajor caju and P. florida are rich in protein, fibers and mineral contents.

Keywords: Mineral content, Trace element, NPK, Chemical aspect.

INTRODUCTION

Edible mushrooms are the fleshy and edible fruit bodies of several species of macrofungai. They appear either below ground or above ground where they can be picked by hand [1]. Edibility may be defined by criteria that include absence of poisonous effects on humans and desirable taste and aroma [2, 3]. Although they are technically a type of fungus mushrooms are commonly recognized as a vegetable. Edible mushrooms are consumed for their nutritional value and for their culinary value. Edible mushroom includes many fungal species that are either harvested wild or cultivated. Moreover, even normally edible species of mushrooms may be dangerous as mushroom growing in polluted locations can accumulate pollutants such as heavy metals [4]. Edible mushrooms species have been found in association with 13,000 years old archaeological for supposed medicinal properties as well as for food Ancient Romans and Greeks. Particularly the upper classes used mushrooms for culinary purposes [5]. Mushrooms are cultivated in at least 60 Countries. *Agaricus bisporus* (white button mushroom) dominates the edible mushroom market in several forms [7-9]. *Pleurotus* (oyster mushrooms) among the most common in Asian market [9]. Cultivation of oyster mushroom (*Pleurotus species)* is cheapest and easiest among all edible mushroom and common primary decomposer of wood and vegetal residues [10] and also offer good prospects of its commercial cultivation in India due to availability of large quantity of different agro wastes. Being devoid of starch, carbohydrate is available in the form of sugar alcohol (mannitol) and staple food for weight watchers and diabetic patient besides having antiallergic effect. In vitro digestibility values varying from 60-90% have been reported from mushroom protein [11]. The nutritive value of mushroom is suitable for muscle protein build up and well suited to supplement diets. Mushrooms have been

evaluated for their nutritional status on the basis of their chemical composition. Mushrooms contain reasonable amounts of proteins, carbohydrates, minerals, fibers and vitamins [12].

MATERIALS AND METHODS

The experiments were conducted in the mushroom research laboratory of the Department of Plant Pathology, C.S. Azad University, Kanpur.

(i) Mushroom species: V_1 = *Pleurotus florida*, V_2 = *Pleurotus sajor caju*

(ii) Repeat/Replication: Three

(iii) Experimental design: C.R.D (Completely randomized design)

(iv) Substrate: Wheat straw

(v) Fresh yield: Fresh yield obtained by harvesting and weighing of the same.

(vi) Dry yield: Dry yield was recorded after removing the moisture from fresh yield.

Cultivation of *Pleurotus:* *Pleurotus* species i.e. *Pleurotus florida* (V_1) and *Pleurotus sajor caju* (V_2) were grown in three replications inpolythene bags on chopped wheat straw the polythene bags were filled with steeped Wheat straw upto 12 cm and spawning was done all over. The second, third, fourth and fifth layers of substratum were prepared upto the same height of 60 cm and spawned all over the surface. The following treatments were given -

T_1 = Substrate + Control

T_2 = Substrate + Mn as manganese sulphate (0.5PPM)

T_3 = Substrate + N(urea) P and K (Potassium phosphate) 1.5%

T_4 = Substrate + Calcium as (Cao) (.1%)

T_5 = Substrate + mixture of all elements

Chemical Composition: Mature fruit bodies were selected for chemical composition.

(i) Moisture content: 10 g of fresh mushroom were kept in porcelain dish and the process was repeated till constant weight. The moisture content was calculated as below.

$$\text{Moisture \%} = \frac{W_3 - W_1}{W_2 - W_1} \times 100$$

W_1= weight of porcelain dish before drying , W_2 = weight of porcelain dish + sample

W_3 = Weight of porcelain dish after drying

(ii) Protein: For protein estimation the nitrogen content was analysed by micro Kjel dahls methods and value of N was multiplied by the factor 6.25 (AOAC) [13].

(iii) Ash: Ash content was determined by incineration of powdered form of dried mushroom in a muffle furnace at 550°C till constant weight (AOAC).

(iv) Carbohydrate: Carbohydrate content was calculated by difference carbohydrate% = 100-(protein% + ash% + ether extract (Fat %)

(v) Minerals: Moisture free sample were digested in triacid mixture HNO_3:H_2SO_4:$HClO_4$ (9:1:3) mixture determined by using laboratory techniques given by Kanwar and Chopra. various elements were determined by using a ECIL atomic absorption spectrophotometers AAS4129

(vii) Calorific value: The approximate calorific value of mushroom was determined by using Atwater and Bryant factors 4.3, 9.2 and 4.3 K Cal g^{-1} of protein, fat and carbohydrate, respectively Food and Agriculture organization [**14**].

RESULTS AND DISCUSSION

Experimental Findings: The Present investigation entitled "Chemical composition of Edible mushroom (*Pleurotus* species) as influenced by NPK and trace element application" has been undertaken to see the effect of micronutrient on yield, biochemical composition and nutritive value of edible mushrooms. *Pleurotus* species were assessed for their relative performance in respect of fresh and dry matter and *Pleurotus sajor caju* was assessed for higher value. As regard *Pleurotus sajor caju* shows greater value in protein, fat, carbohydrate, calorific value content on dry weight basis. *Pleurotus florida* shows higher value regarding moisture content, ash, manganese potassium phosphorus, sodium and calcium content on dry weight basis. Treatment effect on both the species it was of interest to find that substrate + NPK (T_3) and substrate + mixture of all elements (T_5) was best in this result, T_3 and T_5 application was thus found best from the point of view of yield quality balance as well as for growing mushroom species *Pleurotus sajor caju* and *Pleurotus florida* and adopted as a recommendation for yield maximization in mushroom and proved best species.

Table 1. Variations in fresh yield of edible mushroom due to variety and mineral nutrition (kg bag^{-1}).

Treatment	T_1 = 0.89	T_2 = 1.02	T_3 = 1.28	T_4 = 1.00	T_5 = 1.28
Variety	V_1 = 0.96	V_2 = 1.16			

Table 2. Variations in dry yield of edible mushroom due to variety and mineral nutrition (% on dry wt.)

Treatment	T_1 = 9.84	T_2 = 10.76	T_3 = 9.99	T_4 = 9.00	T_5 = 10.02
Variety	V_1 = 9.57	V_2 = 10.61			

Table 3. Variations in moisture content of edible mushroom due to variety and mineral nutrition (% on dry wt.)

Treatment	T_1= 90.16	T_2 = 89.29	T_3= 89.64	T_4 = 88.00	T_5 = 89.99
Variety	V_1= 90.43	V_2 = 89.36			

Table 4. Variations in Protein content of edible mushroom due to variety and mineral nutrition (% on dry wt.)

Treatment	T_1 = 32.94	T_2 = 32.76	T_3 = 37.87	T_4 = 38.56	T_5 = 37.92
Variety	V_1 = 32.93	V_2 = 34.34			

Table 5. Variations in ether extract (Fat) of edible mushroom due to variety and mineral nutrition (% on dry wt.)

Treatment	$T_1 = 2.26$	$T_2 = 2.01$	$T_3 = 2.08$	$T_4 = 1.09$	$T_5 = 2.03$
Variety	$V_1 = 1.86$	$V_2 = 2.10$			

Table 6. Variations in Ash content of edible mushroom due to variety and mineral nutrition (% on dry wt.)

Treatment	$T_1 = 10.31$	$T_2 = 9.21$	$T_3 = 8.58$	$T_4 = 8.60$	$T_5 = 9.01$
Variety	$V_1 = 8.89$	$V_2 = 8.46$			

Table 7. Variations in Carbohydrate of edible mushroom due to variety and mineral nutrition (% on dry wt.)

Treatment	$T_1 = 56.02$	$T_2 = 54.49$	$T_3 = 51.39$	$T_4 = 50.60$	$T_5 = 51.04$
Variety	$V_1 = 50.68$	$V_2 = 55.10$			

Table 8. Variations in Manganese content of edible mushroom due to variety and mineral nutrition (mg $100g^{-1}$ on dry wt.)

Treatment	$T_1 = 4.73$	$T_2 = 6.03$	$T_3 = 5.33$	$T_4 = 5.00$	$T_5 = 5.46$
Variety	$V_1 = 5.75$	$V_2 = 4.29$			

Table 9. Variations in Potassium content of edible mushroom due to variety and mineral nutrition (mg $100g^{-1}$ on dry wt.)

Treatment	$T_1 = 4192$	$T_2 = 4331$	$T_3 = 4259$	$T_4 = 3968$	$T_5 = 4181$
Variety	$V_1 = 4469$	$V_2 = 3345$			

Table 10. Variations in Phosphorus content of edible mushroom due to variety and mineral nutrition (mg $100g^{-1}$ on dry wt.)

Treatment	$T_1 = 1645$	$T_2 = 1663$	$T_3 = 1587$	$T_4 = 1589$	$T_5 = 1591$
Variety	$V_1 = 1748$	$V_2 = 1325$			

Table 11. Variations in Sodium content of edible mushroom due to variety and mineral nutrition (mg $100g^{-1}$ on dry wt.)

Treatment	$T_1 = 60.83$	$T_2 = 63.73$	$T_3 = 61.79$	$T_4 = 61.00$	$T_5 = 60.12$
Variety	$V_1 = 62.78$	$V_2 = 61.25$			

Table 12. Variations in Calcium content of edible mushroom due to variety and mineral nutrition (mg/100g on dry wt.)

Treatment	$T_1 = 21.42$	$T_2 = 22.31$	$T_3 = 21.59$	$T_4 = 21.59$	$T_5 = 21.50$
Variety	$V_1 = 23.02$	$V_2 = 19.17$			

Table 13. Variations in Calorific value of edible mushroom due to variety and mineral nutrition (Kcal $100g^{-1}$ on dry wt.)

Treatment	$T_1 = 400.32$	$T_2 = 393.67$	$T_3 = 402.62$	$T_4 = 398.22$	$T_5 = 401.64$
Variety	$V_1 = 398.01$	$V_2 = 400.91$			

APPLICATION

This study suggests that NPK and trace elements might be used for commercial production of mushroom and for better nutritive value of these two *Pleurotus species i.e. Pleurotus florida and Pleurotus sajor caju.*

CONCLUSION

On considering most of the results on yield, chemical composition and nutritive value of edible mushroom as influenced by NPK and trace element nutrition. The enhancement of the yield and chemical composition parameters such as protein, potassium, phosphorus, sodium, calcium, manganese and certain nutritive value parameters such as carbohydrate, protein and calorific value by application of these elements enhanced the activity of different enzymes responsible for the synthesis of different constituent. Calcium is required for the development of the vegetative mycelium and the fruit bodies and important inactivating many enzyme systems. Thus, the study suggests that NPK and trace element might be used for commercial production of mushroom and for better nutritive value of these two *Pleurotus species i.e. Pleurotus florida and Pleurotus sajor caju.*

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