Research Article


Viability of Cassava peels spawn production and mushroom cultivation

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Abstract: This work was carried out to ascertain the viability of spawn produced on cassava peels and used for spawning cassava peels and sawdust substrates and compare the yield with mushroom fruits from the conventional *Sorghum bicolor* known to be the best material for spawn production. Three different species of mushroom cultures were inoculated on cassava peels, two *Pleurotus pulmonarius* strains (FIIRO and Thailand) and *Lentinus squarroslus*. The study of mycelia colonization rate study was done in triplicate. *L. squarroslus* completed colonization within 18 days of inoculation in test tube with a growth mean value of 11.16 cm, the two strains of *P. pulmonarius* (FIIRO and Thailand) completed colonization in 21 days with FIIRO strain having growth mean value of 11.46 cm and Thailand strain 11.20 cm. Cassava peels spawn production was done in two ways, singly and supplemented with rice bran, yield from different species of mushroom (*L. squarroslus* and *P. pulmonarius* (FIIRO Strain) cultivated with cassava peels spawn in the study were compared with sorghum grains spawn. Different weight of 100, 200, 300 g were used for cultivation, sorghum grains spawn produced the highest yield (202.13g) from the two species used followed by cassava peels supplemented with rice bran (179.86 g) and single cassava peels spawn (124.13 g). *L. squarroslus* did not fruit on cassava peels even with the sorghum grains spawn. The differences from the yield of the three spawn was negligible as the differences was not noticeable (cassava peels 124.13 ± 5.21, supplemented cassava peels spawn 179.86 ± 0.64, and sorghum grains spawn 202.13 ± 8.86). This result verified the use of cassava peels in the production of viable mushroom spawn.

Keywords: Cassava peels, Spawn, Mycelia, *Lentinus squarroslus*, *Pleurotus pulmonarius*

1 Introduction

Cassava (*Manihot esculenta*) is a food crop that is cultivated in large quantity in Nigeria and is utilized for local consumption and in commercial preparations both for edible and non-edible purposes. Edible preparations from cassava are used as various staple foods in Nigeria (Rombouts and Nouts 1990), and an average Nigerian will take it as a whole meal or as part of the daily food. According to FAOSTAT (2010), the world production of tropical root crops (TRC) has increased from 665.7 metric tons in 1999 to 719.8 metric tons in 2010, and Nigeria remains the leading producer of cassava crop in the world. Report from the International Society for Tropical Root Crops (ISTRC) conference (2012), shows that 95% of the cassava produced in Nigeria is been consumed locally and only 5% is exported. This high consumption level of the crop has led to a high agricultural waste generation of stalks and peels from the cassava processing. Traditionally, the cassava peels have been used as feed for domestic ruminants and non-ruminants, but with the recent governmental demand for increased production and exportation of cassava, there is need to explore other ways of utilizing the additional quantity of peels and stalks that will be generated as waste from cassava processing.

Banjo et al. (2004) reported that one of the values of commercial cultivation of mushrooms, especially in a developing economy like Nigeria, is the availability of large quantities of several agro–industrial wastes...
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2.1 Collection of biological materials

Fresh Cassava peels was collected from Thai Farms, Osasa, Ijebu-Ode in Ogun State, the peels were sundried for 14 days to crispy, sawdust from saw mill at Mushin in Lagos State and fungi of *Pleurotus pulmonarius* and *Lentinus squarroslus* were gotten from the culture bank of Federal Institute of Industrial Research (FIIRO) Oshodi, Lagos, Nigeria.

2.2 Production of Mother Spawn

Fifteen grams of moistened cassava peels as prepared by Quimio et al. (1990) and Banjo et al. (2004) were dispensed into six test tubes of 30ml and corked with absorbent cotton wool covered with foil paper and thereafter sterilized in autoclave at 15Ib pressure for 2h. After cooling at ambient temperature, the peels inoculated with cultures of *P. pulmonarius* (FIIRO and Thailand species) and *L. squarroslus*. The cassava peels in test tubes were then incubated in the incubator at 28 oC until the mycelia was able to colonize the peels in the test tube. Nine (9) test tubes were filled with cassava peels and inoculated in triplicates for each of the species.

2.3 First Generation Spawn Production.

Single and mixed peels were used in the production of cassava peels spawn, rice bran was used to supplement the peels used in the production. The supplementation was done at ratio 4:1, Cassava peels were moistened by soaking in 2% w/v of calcium carbonate overnight, excess water was drained out and then mixed with 1% w/v of calcium sulphate, the peels were then dispensed in sterilized jam bottles at 150g each while the supplemented were dispensed at 37.5g rice bran and 112.5g of cassava peels mixed together. A total of 18 bottles were autoclaved, 9 bottles were filled with 150g cassava peels and 9 bottles with supplemented cassava peels. The autoclaving was carried out at 15Ib pressure for 2h. They were allowed to cool at ambient temperature after which they were inoculated with the mother spawn of cassava peels of *Pleurotus pulmonarius* (FIIRO and Thailand strain) and *L. squarroslus*. The cassava peels in test tubes were then incubated in the incubator at 28°C until the mycelia was able to colonize the peels in the test tube. Nine (9) test tubes were filled with cassava peels and inoculated in triplicates for each of the species.

2 Materials and Methods

## 2.1 Collection of biological materials

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2.4 Cultivation of Pleurotus pulmonarius on Sawdust and Cassava peels

Four kilograms of sawdust was weighed and mixed with 1kg of rice bran, 100g of calcium carbonate was added to the mixture and then moistened with water to molding stage and 50g of calcium sulphate added to it and mixed, five kilograms dried cassava peels was soaked in water containing 2% calcium carbonate and 1% calcium sulphate overnight according to Grillo et al. (2009). Excess water was drained out the peels after overnight soaking; it was allowed to drain in the air. Sawdust and cassava peels were dispensed into polyethylene bags at 100, 200 and 300g separately. The bags were prepared in triplicates and were pasteurized in the drum with steam at 100°C for 3h. The substrate bags were allowed to cool at ambient temperature before being inoculated with the first generation of cassava peels spawn of Pleurotus pulmonarius at 5% w/v of the bags. They were incubated in a temperature-controlled incubating room until the substrate bags were fully colonized.

The growth of mycelia on cassava peels during the production of mother spawn was measured in centimeter (cm) while the data obtained were subjected to analysis of variance (ANOVA). Test of significance were carried out using Duncan multiple range test at P<0.05.

3 Result and discussion

There was no growth in the first two days of inoculation of the fungi on the peels, L. squarroslus started growth within the third and fourth day of inoculation. The average growth rate recorded for L. squarroslus was 1.97cm within the first twelve days of inoculation while it increased in the last 24h of colonization to 2.50cm. The strains of P. pulmonarius (FIIRO and Thailand) started colonization on the third day of inoculation, FIIRO strain had an average growth of 1.52cm, it increased in the last six days to 2.0cm while Thailand strain had an average growth of 1.40cm and also increased to 2.0cm during the last six days. The two strains were discovered to have a similar growth pattern different from L. squarroslus.

Comparing sorghum, wheat and maize grains that have been in use for spawn production in the previous research work, sorghum and wheat grains takes 10 days to be colonized by fungi of P. pulmonarius while maize grains is colonized by 12-13 days. The high difference in loose and bulk density of cassava peels of 14.84g also contributed to the long days of colonization, the loose density of 9.62g and bulk density of 24.46g. Sorghum grains have a bulk density of 83.06g and loose density 83.04g with difference of 0.02g. This difference of 0.02g makes it easier for hyphae of fungi to grow and cover larger surface area than that of cassava peels with a difference of 14.84g. this was made possible because of the compactness of sorghum grains which was also supported by Belewu et al. (2006).

Tables 2 and 3 show the fruiting weight of different cassava peels used in the cultivation of P. pulmonarius and L. squarroslus, in Table 2, the cassava peels spawn produced was a pure peels of cassava without supplementing it with rice bran that is more proteinous than cassava peels, this invariably affected the fruiting when it was used to cultivate on sawdust and cassava peels. This observation was supported by Banjo et al. 2004 and Anyakorah et al. 2001; they also reported higher nitrogen content (5.67%) in cotton waste than in cassava peels (4.44%). The result also conforms to the report of Chang (1984) that cotton waste gave a higher and more table yield of mushrooms than any other agro industrial wastes which could be due to high proportion of cellulose and compactness on wetting. Rice bran used to supplement cassava peels serves as nutrients booster to Cassava peels. This affected the fruiting pattern of Cassava peels spawn used in the cultivation of P. pulmonarius. There was no fruiting from the cassava peels.
substrates in the cultivation of *L. squarroslus* because the peels do not support the growth of the fungi except on sawdust hence the reason for non-yield from all the cultivation of the specie on cassava peels in all the experiments carried out in the present work. The cassava peels spawn of *P. pulmonarius* supplemented with rice bran gave higher fruit weight (98.06g and 179.86g) than the cassava peels spawn without rice bran supplementation (94.63g and 124.13g). Differences in the fruit weight also were as a result of the variation in the substrates weight of 100, 200 and 300g, the bigger the substrate weight the better the yield and fruiting weight.

In table 4 are the fruit weights of mushroom from cassava peels and sawdust. The sawdust was also supplemented with rice bran as presented in table 3. There was a slight significant difference in the fruit weights of sorghum grains spawn of *P. pulmonarius* and *L. squarroslus* compared to the cassava peels spawn. The 100g weight of Cassava peels and sawdust cultivated with cassava peels spawn had a greater yield than the sorghum grains spawn. The 200 and 300 grams in sorghum grains spawn cultivation had a slight increase in the fruit weight, the 200g weights had a fruiting mean of 5.52 while cassava peels spawn was 4.4 with a mean difference 1.12 and the 300g of sorghum grains spawn was 8.86 while cassava peels had fruiting mean of 5.21 with a difference of 3.65 on cassava peels substrate of *P. pulmonarius*. The fruiting from sawdust in sorghum grains spawn was remarkable than cassava peels spawn of both *P. pulmonarius* and *L. squarroslus*. The remarkable result from sorghum grains could be attributed to the presence of some vitamins like niacin, riboflavin, and thiamin, minerals such as magnesium, iron, copper, calcium, phosphorus and potassium as observed by Food and Nutrition Board (1998). All these nutritional values contributed to the increased fruiting weight from sorghum grains spawn.
4 Conclusion

The use of cassava peels as a planting spawn substrate is established with the colonization rate of the fungi used in the study which was discovered moderately normal compared with the sorghum grains. Rice bran used in the supplementation of the spawn produced enhanced the fruiting of the mushrooms. Apart from rice bran, other agricultural wastes that can used are wheat bran and palm kernel cake (PKC) which are also high nitrogen.

The use of cassava peels in the production of spawn for the cultivation of edible mushrooms will reduce the cost of production of mushroom farmers as the cost of buying sorghum grains spawn has been adjudged by the farmers to be on a high side, the cost of cassava peels in the market is relatively cheaper than that of sorghum grains. This will invariably increase the profit margin of mushroom farmers and encourage more people to take up the business of mushroom farming.

References

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