PROXIMATE PROFILING, NUTRITIVE COMPONENTS, AND DEGRADATION OF SWEETCORN LEAVES (F1 SUGAR KING) BY EDIBLE FUNGI

[1]Abiola-Olagunju, O., [2]Shosanya, A.A., [3]Ajibola, W.O., [1]Adediran, K.O. and [4]Mako, A.A.
[1]Department of Biological Sciences, Lead City University, Ibadan Oyo State
[2]Department of Biology, Federal College of Education, Abeokuta, Ogun State
[3]Department of Horticulture, Federal University of Agriculture, Abeokuta, Ogun State
[4]Department of Agricultural Science, Tai Solarin University of Education, Ijagun, Ogun State
*Corresponding author: abiolaolagunjuoluwanike@gmail.com; 08135658830

ABSTRACT
Sweet corn (SC), now becoming a fast-acceptable delicacy as a snack and party delight in Nigeria, especially among the elite circle, has reduced the urge for conventional corn while (SC) waste then poses a serious issue (global warming) when added to waste generated by conventional maize stover. Sweet corn leaves (SCLs) were collected, oven-dried at 105 ^{0}C, and milled. Phytochemical analysis (tannin, saponin), vitamins, and minerals of the (SCLs) were determined, while the degradation of the sweet corn leaves with edible fungi (Pleurotus pulmonarious (Pp) was carried out for 21 days. Results showed that (SCLs) contain phytochemicals such as tannin and saponin, essential to support the reduction of enteric methane production in ruminant animals at non-toxic levels. Vitamins and minerals were also present. Effect of degradation with edible fungi (Pp) revealed that the Crude protein content of (SCLs) increased from 4.08% to 6.04% while Crude fiber content reduced from 25.1% to 22.72%. The findings revealed that degradation with edible fungi (Pp) added value to the nutrient content of (SCLs) which serves as an alternative feed for animal use, and as a means of improving climate-smart agriculture for an eco-friendly environment.
Keywords: Agricultural wastes, Degradation, Chemical composition, *Pleurotus pulmonarious*, Sweetcorn leaves

INTRODUCTION

Various authors have implicated agro-waste such as corn, millet, sorghum waste, and others, in their diverse perspectives as preponderance contributing to the effect of climate change through the depletion of the ozone layer. (Hamza,1989; Villario *et al,* 1995; Lawal *et al,* 2012; Bhatt. *et al,* 2020). A detrimental effect that is a serious pointer to food insecurity, that the world is experiencing today. Though conventional maize waste has found fast stable and essential use as feed for ruminant animals, yet majority of these maize farmers still do not utilize the waste adequately thereby causing social nuisance apart from its major contributory effect on global warming by burning of unused bulk. Sweet corn (SC), which is now becoming a fast-acceptable delicacy as a snack and party delight in Nigeria, especially among the elite circle, has reduced the urge for conventional corn. Its high acceptability also comes with its pile of waste, which adds to the existing waste generated from conventional corn and might pose another serious threat to climate change through improper disposal systems soon. Although SC waste has been used tremendously in other countries of the world in the feeding of ruminant animals successfully (Idikut *et al* 2009) there is a dearth of information on the use of its waste after harvest in Nigeria.

One of the strategies to utilize agricultural wastes and other bulky products is through the use of edible fungi such as edible mushrooms to reduce the fibre and also help in obtaining protein-rich substances. (Adenipekun *et al.,* 2012). The use of Solid State Fermentation (SSF) to upgrade the nutritive value of agricultural by-products and for enzyme production has increased due to a high positive result in the quality of the wastes produced in several countries (3.5 billion tonnes per year) representing a potential solution in feeding animals in developing countries (Robinson, 2003). Therefore, this study aimed to find an urgent need to convert Sweet Corn Leaves (SCLs) to more productive and eco-friendly use through Solid-State Fermentation (SSF) with edible fungi to produce a value-added product as animal feed other than seen as another volume of under-utilized waste.

MATERIAL AND METHODS

Sample Collection

Sample of Sweet corn leaves (SCLs) were collected from Agricwas farm, Aboke village, Lagelu local government, Ibadan, Oyo state. The samples were taken to the laboratory at Lead City University for wilting overnight. The next day, the samples were chopped into smaller portions before the oven drying at 105^{o}C for 3 days until a constant weight was obtained for dry matter determination in the laboratory. It was milled thereafter and stored inside a covered jar.

Fungus

Pure cultured plates of *Pleurotus pulmonarious* (*Pp*) were obtained from the Federal Institute of Industrial Research Oshodi (F.I.I.R.O.) Lagos. The pure culture was maintained on a plate of potato dextrose agar (PDA) and kept at 4ºC freezer temperature till use. The jam bottles used for these experiments were thoroughly washed and dried for 10 minutes at 100^0C. 25g of the milled sample was weighed into each specimen bottle and 70ml of distilled water was added. The bottles were tightly covered and sterilized in the autoclave for 30 minutes at 121ºC and allowed to cool down. Each of the treatments was replicated thrice. The milled sweet corn served as the substrate.

Inoculation

Pp was inoculated at the centre of the substrate and covered immediately. The inoculated substrates were kept in the incubator at 30^0C and 100% relative humidity. The growth was monitored for 21 days. After this, the experimental bottles were harvested by autoclaving again to terminate the mycelia growth. Samples of the degraded SCLs were oven-dried to constant weight for chemical analysis.

Chemical Composition

DM (Dry Matter) was determined by oven drying the milled sample to a constant weight at 105^0C for 8 hours. Crude protein was determined by the standard Kjeldahl method AOAC (1995) while Crude fibre, Ether extract, and Ash were determined according to AOAC (2012).

Phytochemicals and Mineral Analysis of Sweetcorn Leaves

Phytochemical analysis was carried out according to the Association of Official Analytical Chemists AOAC (2005)

Mineral Analysis

A total of nine minerals were analysed. Degraded and undegraded sweet corn leaves were digested with HNO3, HCIO3 mixture (nitric acid, perchloric acid) (20:5v/v) the digest was made up to 100ml in a standard volumetric flask with deionized water**.** P, K, Mn, Zn, Mg, Fe, Mn, Se and Cu. In the digest were determined with the atomic absorption spectrophotometer model 420 (Gallenk CMP and CO LTD) phosphorus in digest was estimated with vanadomolybrate solution. The colour so developed was read with a spectrophotometer at 420m/u.

Statistical analysis

Data collected were analysed and subjected to the analysis of variance procedure of SAS (2012). Significant means were separated using the Least Significant Difference (LSD) method of the same package.

RESULTS AND DISCUSSION

Table 1 shows the proximate profile of Sweetcorn Leaves (SCLs) before and after degradation with *Pp (*white rot fungi*)*. DM and CF showed a decrease in composition after degradation from 66.11 to 65.10 and 25.10 to 22.72 respectively. A reduction in the DM after degradation observed in this work could result from a favorable environment for the microflora in the *Pp* to multiply by using the SCLs as their source of carbon. This is in line with the findings of Adenipekun *et al.* (2012) that a higher liquid volume increased corn stover degradation. Therefore, this result could invariably have been the reason for a reduced outcome in the CF also obtained due to the high activity of the *Pp* on the SCL after degradation. This finding compared favorably with those reported for some fungal-treated residues (Akinfemi and Ogunwole, 2012). Adenipekun *et al*., 2012; Hawu *et al.,* 2022). This work's CP and ash results also showed an upshoot after degradation from 4.08 to 6.04 and 25.10 and 22.72. White rot fungi were also observed to have increased the CP content of rice husk to compensate for low protein nutrients consumed by animals in the tropical environment (Belewu and Banjo (1999)). The same was observed for ash contents. The increases observed before and after across all mineral content could be because mushrooms contain appreciable amounts of mineral elements. (Adenipekun *et al.,* 2012).

Table 1: **Proximate (%) composition of Sweet Corn Leaves before and after degradation**

PROXIMATE COMPOSITION		
Parameters	**Before degradation (%)**	**After degradation (%)**
Dry matter	66.11±0.06	65.10±0.04
Crude protein	4.08±0.01	6.04±0.01
Crude fibre	25.10±0.02	22.72±0.02
Ether extract	23.64±0.02	24.78±0.02
Ash	7.20±0.01	8.28±0.01
Nitrogen free extract	33.13±0.03	33.43±0.03

Table 2 shows the mineral, and phytochemical components of the Sweetcorn Leaves (SCL) before and after degradation with Pleurotus *pulmonarious (*white rot fungi*)*. While a significant ($p<0.05$) increase in the amounts of the phytochemicals is essential for the upgrade of nutritional quality of the Sweetcorn Leaves, an increase recorded for Tannin and Saponin in this work 63.99 - 65.99 and 91.12 - 94.12 mg/100 mg before and after degradation respectively, is a great pointer to the fact that biodegradation of Sweetcorn Leaves can help to reduce the effect of greenhouse gas by decreasing methane and ammonia formation in the rumen of an animal. This indicates their effectiveness as anti-methanogenic agents across contrasting diet types (Anuraga *et al.,* 2020). The findings in this work show that degradation with edible fungi (Pleurotus *pulmonarious*) added value to the nutrient content of Sweetcorn Leaves which serves as an alternative feed for animal use, and also as a means of improving climate-smart agriculture for an eco-friendly environment.

Table 2: Nutritive value of sweet corn leaves before and after degradation with *Pleurotus pulmonarius.*

MINERALS			PHYTOCHEMICALS		
	Before degradation (g/kg)	**After degradation (g/kg)**		**Before degradation (mg/100mg)**	**After degradation (mg/100mg)**
Potassium	14.02±0.05	15.06±0.06	Saponin	63.99±0.12	65.99±0.12
Magnesium	2.82±0.03	3.89±0.02	Tannin	91.12±0.23	94.12±0.20
Phosphorus	1.65±0.07	1.95±0.08	Phenol	235.09±0.10	238.09±0.11
Sodium	0.84±0.02	0.98±0.03	Alkaloid	23.72±0.03	25.72±0.02
Mg/kg			Oxalate	17.895±0.04	18.895±0.05
Iron	71.37±0.04	77.12±0.04	Phytate	125.95±0.14	128.95±0.13
Manganese	233.12±0.24	241.11±0.14			
Zinc	58.06±0.11	60.06±0.13			
Copper	7.71±0.02	8.71±0.01			
Selenium	0.012±0.01	0.212±0.02			

CONCLUSION

The findings in this work show that degradation with edible fungi (*Pp*) added value to the nutrient content of Sweetcorn leaves thereby making another source of nutritive ruminant feed. Converting sweetcorn leaves to edible a more nutritive ruminant feed, reduces its environmental nuisance and improves climate-smart agriculture for an eco-friendly environment. Sweetcorn farmers can also use this feed as a source of extra income either by converting it to ruminant feed for sale or also considering integrated farming. (crop and animal production)

REFERENCES

Adenipekun C.O., Okunlade.O.A and Ogunjobi.A.A. (2012). Effect of Pleurotus tuber-regium Singer on the degradation of rattan wood and maize stover. *Journal of Applied Biosciences*, 51:3633-3641. ISSN 1997-5902.

Akinfemi, A. and Ogunwole, O. A. (2012). Chemical composition and in vitro digestibility of rice straw treated with Pleurotus ostreatus, Pleurotus pulmonarius and Pleurotus tuber- regium. *Slovak Journal of Animal Science*, 45(1): 14 - 20. Available from: https://www.researchgate.net/publication/301282447

Anuraga Jayanegara, Yogianto Yogianto, Elizabeth Wina, A. Sudarman, Makoto Kondo, Taketo Obitsu, Michael Kreuzer**.** (2020). Combination Effects of Plant Extracts Rich in Tannins and Saponins as Feed Additives for Mitigating in Vitro Ruminal Methane and Ammonia Formation by Animals, *10*(9), 1531; **https://doi.org/10.3390/ani10091531**.

AOAC. (2005). Official Methods of Analysis of the Association of Official's Analytical Chemists.18th ed. Association of Official Analytical Chemists. Arlington, VA, USA, 2005.

AOAC (1995). Official Methods of Analysis. 16th Edition Association of Analytical Chemist, Arlington, VA R. Srinivasan

AOAC. (2012). Official Methods of Analysis, 19th ed. (Association of Officials Analytical Chemists, Arlington, VA).

Bhatt, K. Lai, S., and Joshi. B. (2020). Bioconversion of agricultural wastes to produce amylase from Bacillus. Venezesis KB. 2216: Purification and Characterization. Biocatalysis and Agricultural Biotechnology, 28, 101703.

Belewu,.M. A. and Banjo,N.O (1999). Bio delignification of Rice Husk and Sorghum Stover by edible Mushroom (Pleurotus *spp*). Tropical Journal of Animal Science 1:137-142

Hamza,.A.(1989). Utilization of agro-industrial residues in Alexandria: Experience and Prospects. Biological wastes 29:107-121.

Hawu, O., Ravhuhali, K.E., Mokoboki, H.k., Lebopa,.C. K. and Sipango,N. (2022). Proximate Analysis*, In vitro*,Dry matter digestibility and Palatability Index of Legume Residues and Maize Straws for Ruminants. Legume Research 45(5):601

Idikut,.I., Arikan,. B.A., Kaplan. M., Guven.I., Atalay. A.I. and Kamalak, A. (2009). Potential Nutritive Value of Sweet Corn as a Silage Crop with or without Corn Ears. Journal of Veterinary Advances 8(4): 734-741. ISSN 1680-5593. https://www.researchgate.net/publication/348542380

Lawal E.T., Ademola, S.G., Owoseni, A., Atobatele, O.E., Adebiyi.O.A and Akomolafe.D.O (2012). Changes in the Nutritional Quality of Corn Offal Fermented with Pencillium Notatum and Penicillium citrinum. Elixir Applied Biology 49 (2012). Available online at w.w.w.elixirjournal.org.

Liang JS, Nabi,.M. Zang.PY, Zang.GM, Cai., YJ,Wang QY,Zhou ZY, Ding YR (2020). Promising biological conversion of lignocellulosic biomass to renewable energy with rumen microorganism. A comprehensive review. https//doi.org/10.1016/biotech 2020.123765.

Robinson, T and Nigam P. (2003). Bioreactor design for protein enrichment of Agricultural residues by solid-state fermentation. J. Biochem. Eng. 13, 197-203

SAS (2012). Statistical Analytical Systems. SAS Version 9.2 Users guide. Carry, NY: SAS Institute

Sebetha, E.T and Kutu F.R. (2016). Sweetcorn Production and Soil Chemical Properties Under Different Practices in Dry Land of South Africa. https://www.researchgate.net/publication/309953318_ Ciencia eTecnica Vitivinicola. Vol.31(n. 10, 2016) ISSN:0254-0223

Villaro MC, Martcalvo J, Volarsek 1995. Cuban Mexican experience in the cultivation of Pleurotus *spp* Dev. Ibero.Mycologia 12:9-11.