Tropentag 2009
University of Hamburg, October 6-8, 2009
Conference on International Research on Food Security, Natural Resource Management and Rural Development

Nutritional Evaluation Of Cowpea Seedhulls Using Different White Rot Fungi

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INTRODUCTION

Cowpea seedhull is a crop residue which is available in Nigeria in large quantities. It is a post threshing residue which though high in fibre, is finding use in ruminant nutrition. The utilization of cowpea hulls for monogastric livestock feeding has not been realized**.** An approach to circumventing these limitations is microbial enrichment process through fungal fermentation, which Balagopalan (1996) described as an inexpensive tool for breaking down the fibre and increasing the protein level.

Aspergillus niger, *Trichoderma viride* and *Rhizopus stolonifer* are fungi species that have been identified to possess cellulase system which breaks starch and non-starch polysaccharides to monomer sugars which are utilized to produce single cell protein (Balagopalan, 1996; Singh *et al.,* 1990).

In a bid to harness more unconventional feedstuffs to resolve the shortage of livestock feeds and products and environmental pollution, this experiment was designed to assess the nutritional potentials locked up in this crop residue after solid state fermentation with the fungi species.

MATERIALS AND METHODS

Preparation of Sample and Inoculation

Pure cultures of *Trichoderma viride*, *Aspergillus niger* and *Rhizopus stolonifer* were obtained from the culture bank of the Department of Pharmaceutical microbiology and cultivated on PDA slant at 30°c. A 7 days old slant of each of the fungi was used for the fermentation process. 10mls of distilled water was used to harvest the spores of the fungi, the spore count was done using haemocytometer to obtain 10^7 spores which was used for the Solid State Fermentation.

Solid State Fermentation

Solid state fermentations were carried out in 250mL Erlenmeyer flasks, in a controlled temperature chambers at 30 ^oC. The solid substrate contained 30g of milled cowpea seedhull.

Sterilisation was done at 121^{o}C for 20 minutes. The moisture content was adjusted by addition of sterile distilled water prior to inoculation to 53 %. Three mL of each of the inoculums was used to inoculate the substrate. The flask for each fungus was duplicated for each periods of 0, 7 and 14 days harvest.

Chemical Analysis: The samples were analyzed for proximate composition using the procedure of A.O.A.C. (1990). The fibre fractions Acid Detergent Fibre (ADF), Neutral Detergent Fibre (NDF), Acid Detergent Lignin (ADL), Cellulose and Hemicellulose were determined using Van Soest and Mason, (1991).

Statistical Analysis: The data obtained were subjected to statistical analysis of variance (ANOVA) of SAS (1999) while significant means were separated using Duncan Multiple Range test of the same package.

RESULTS AND DISCUSSION

The result of the Proximate analysis, Cellulose, Hemicellulose and Crude fibre fractions of biodegraded cowpea seedhull using different white rot fungus are presented in the tables below. From the result, *A. niger* inoculum resulted in an increase of 110.34% (14.11% to 29.68%), while *R. stolonifer* inoculated samples gave 99.14% (14.11% to 21.45%) increase in CP after 14 days of fermentation.

The CP content of the substrates increased with periods of fermentation because as the day increases, mycelia growth increases, spore formation and germination takes place and this will increase the enzyme secreted by the fungi for extracellular digestion, thus resulting in the accumulation of mycelia protein which ultimately increase the CP of the substrate. The result is in agreement with the work of Abu *et al.*, (1997) biodegrading sweet potato with *A. niger* and obtained an increase of 134.98% (4.95% to 11.83%) and 35.15% when *A. Oryzae* was used (4.97% to 6.69%). Iyayi and Losel (1999) concluded that between day 12 and 15 are the best period for fungi activity, however Aderolu (2000) submitted that between day 0 and 10, none of the growth limiting factors of micro-organism like lack of oxygen, moisture and heat requirement were lacking when using different *Trichoderma sp* on agro- industrial product. The ability of *A. niger* to perform better than other fungi could have resulted from the fast growth rate of *A. niger* and ability produce a multienzymes compared to others. According to de Vries and Visser, (2001) most of commercial enzymes produced today are from Aspergillies. A corresponding decrease in CF content of the seedhull with increase in CP was observed in this study. The reduction in CF content of all the substrates in this study was due to the activities of the fungal enzyme which degraded the non starch polysaccharides. The effects of the microbes include the disruption of the large molecular weight substrates, reduction of viscosity and encapsulation (Campbell *et al.,* 1986).

The Acid detergent lignin (ADL) of *A. niger* fermented substrate decreased with increase in the period of fermentation. Although, there was no significant (p>0.05) difference between day 7 and 14, the ADL content decreased from 11% (day 7) to 9.6% (day 14). The effect of the inoculum of *R. stolonifer* on ADL content revealed a decreased from 13% (day 0) to 8% day (14) which represent 38.46% reduction. This result correlated with the work of Belewu and Banjo, (1999) who observed a decrease of 31.86% and 39.05% in the lignin content when rice husk and Sorghum Stover were degraded with *Pleurotus sojar caju*. The result obtained in this study is justified by the fact that fungus used can produce lignin degrading enzymes such as Lignin peroxidase and Manganese peroxidase (de Vries *et al.*, 1997) which are able to cause the reductions observed in the lignin contents.

Neutral detergent (NDF) and Acid detergent fibre (ADF) were also observed to decrease with increase in the periods of fermentation. The ADF content decreased significantly from 53% to 40%, 53% to 43% and 53% to 41% in *A. niger, R. stolonifer* and *T. viride* fermented substrates respectively. While NDF content also decreased by 23.45%, 22.22% and 23.45% with the inoculums of *A. niger, R. stolonifer and T. viride* respectively**.**

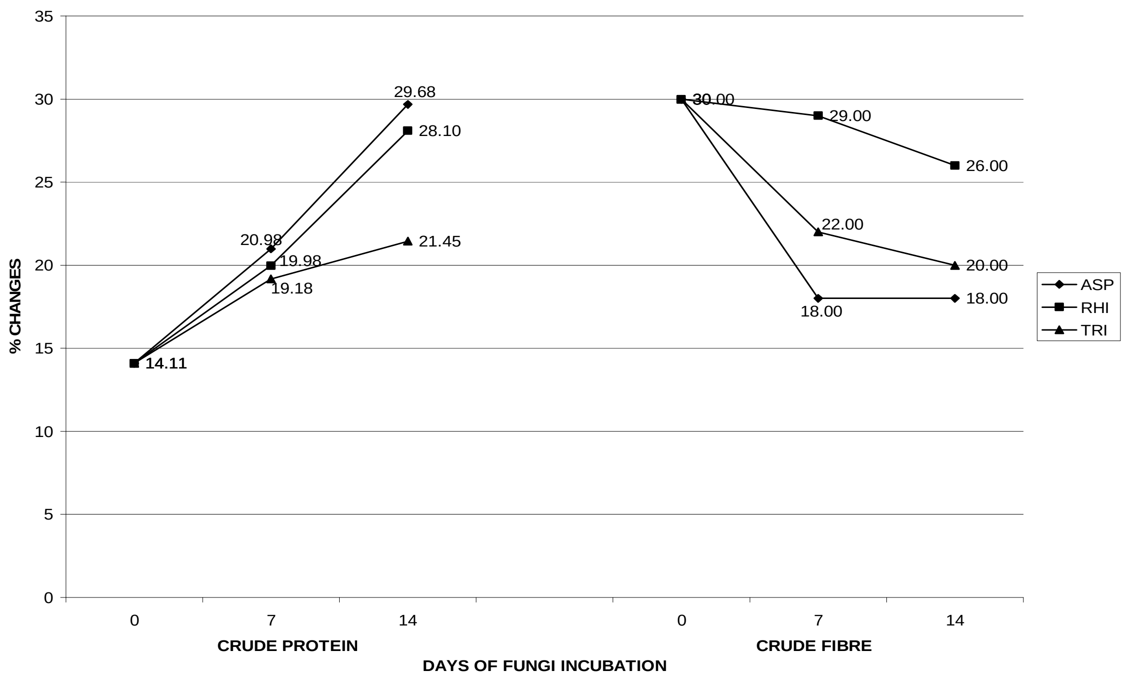

Figure 1: Changes In Crude Protein and Crude Fibre Composition Of Cowpea SeedHull At Different Fermentation Periods Using Different White Rot Fungi

CONCLUSION

The decrease in CF components with a simultaneous increase in the proportion of CP suggests that degradation using *Aspergillus niger* in a solid state fermentation (SSF) compared to *Rhizopus stolonifer* and *Trichoderma viride* can improve the nutritional value of cowpea seedhull thus making it useful as monogastric feed ingredient, provide new and additional source of income to agro-processors and reduce environmental pollution hazards due to its disposal.

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