Innovation brief

RESEARCH PROGRAM ON Livestock

CGIAR

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TRANSFORMING CASSAVA PEEL WASTE INTO HIGH QUALITY LIVESTOCK FEED

KEY MESSAGES

Researchers at the International Livestock Research Institute (ILRI) and the International Institute of Tropical Agriculture (IITA) have developed a way to convert wet cassava peels into a low-cost, high quality cassava mash (HQCP®) to use as animal feed.

Cassava peel mash is cost-effective, efficient, nutritious and can provide an alternative to maize.

Transforming cassava peel waste into cassava mash is an innovative and circular method that reduces environmental pollution, minimizes peel waste, creates employment, generates income, improves outcomes for women and partially replaces maize in the animal feed industry.

The success of HQCP® and its technical and economic feasibility has sparked the interest of entrepreneurs and investors, many of whom are scaling up production to meet demand.

As HQCP® continues to be adopted, communities throughout sub-Saharan Africa and the developing world will benefit from livestock products and protein-rich foods produced at lower cost.

SUMMARY

Across sub-Saharan Africa, cassava is regularly eaten by households and used in the livestock industry. However, cassava production generates considerable waste from discarded tubers and leftover peels. These peels are often left to rot in the sun or are burned, and create an environmental hazard. In response, researchers at ILRI and the International Institute of Tropical Agriculture (IITA) developed an innovative way to convert wet cassava peels into a low-cost, livestock feed known as high-quality cassava peel (HQCP®) mash.

In Nigeria, field trials using HQCP® at livestock farms for pigs, poultry and ruminants have resulted in improved feed efficiency and demonstrated the potential of cassava mash to reduce environmental pollution, minimize post-harvest peel waste, create employment, generate income, improve outcomes for women and partially replace maize in the animal feed industry.

HQCP® has the potential to be a game changer in Nigeria and globally. Currently, there is a huge shortage of livestock feed coinciding with a projected increase in demand for animal products in the next few decades. The conversion of waste from cassava into a safe livestock feed helps resolve the scarcity of animal feed, reduces pastoralist-farmer conflicts over firewood and other resources and lowers the high costs of compound feeds in Nigeria and other cassava-producing countries.

ILRI
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Goats eating cassava peel mash.

INTRODUCTION

Cassava (*Manihot esculenta*) is a major subsistence and commercial crop grown in sub-Saharan Africa, where an estimated 178 million tons are produced annually (FAOSTAT 2019). The crop is consumed by households and used by livestock farmers. However, cassava production is a labor-intensive process that generates considerable quantities of waste.

In Nigeria, about 59 million tons of cassava are produced annually, which results in about 15 million tons of wet peel waste (Okike et al. 2015). These unutilized leftover cassava peels represent both a wasted opportunity and pose environmental risks. Current disposal methods pollute the air, soil and groundwater and create sanitation problems in the processing environment.

As Nigeria's population booms, the demand for livestock products is increasing, yet there is a shortage in supply of livestock feed to feed the animals. Transforming cassava peel waste into animal feed opens up a new cost-effective and more environmentally friendly way to meet that demand.

Globally, demand for animal-derived protein is projected to double by 2050 (FAO 2016). Much of this need will be in developing countries. The growing need for animal resources will require more feed (Thornton 2010). There is therefore an opportunity to scale up this technology beyond Nigeria.

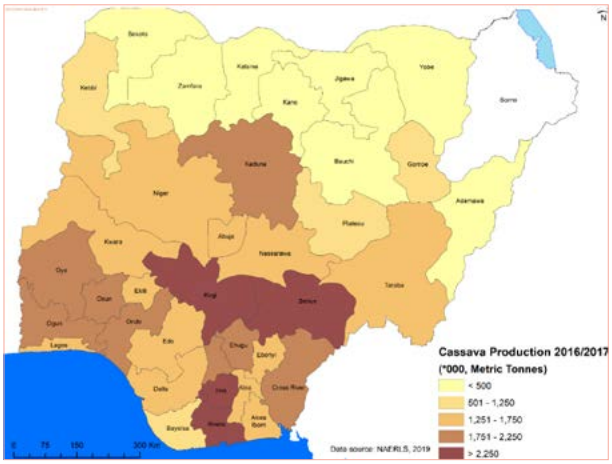

Figure 1: Cassava production across different states of Nigeria.

PRODUCTION AND INNOVATION

Using cassava peel as livestock feed is an age-long practice. The traditional sun-drying method used by farmers takes about two to three days in the dry season but longer in the rainy season. Improperly dried cassava peels can become toxic through the mycotoxins produced by fungi, which can lead to serious health consequences on the people who consume the animal products. This unreliable method has limited the use of cassava peel as livestock feed, leading to large amounts of peels disposed of and transformed to smelly, toxic effluent.

The technology developed by ILRI and other IITA researchers allows cassava peel to be processed more quickly, efficiently and in greater quantities. First, wet cassava peels are grated to promote rapid water loss and speed up the removal of naturally occurring hydrocyanide. Physical dewatering and overnight fermentation aid this process. A pressing machine then produces a cassava peel cake that consists of 40% moisture, as opposed to 70% in fresh peels. The peel cakes are safe for livestock consumption and have a shelf life of seven days. They can also be pulverized further to improve the sieving and drying process. Alternatively, a commercial flash dryer can also produce a HQCP® mash. The final product can be stored for up to 6 months, containing a moisture content of about 10-12%.

HQCP® mash has been tested in feeding trials in Nigeria in collaboration with many large- and small-scale livestock farms. The success of HQCP® and its technical and economic feasibility has also sparked the interest of entrepreneurs and investors, many of whom are scaling up production to meet demand.

Photo ILRI/Tunde Amole

HQCP® production: first step is to grate cassava peels.

From waste to feed:

step-by-step process to produce high quality cassava peel mash

MULTIPLE BENEFITS

- Greater adoption of HQCP® can help meet the growing demand for livestock feed while bringing many benefits to communities, providing jobs and improving the environment.
- The conversion of cassava peels into feed ingredients reduces the amount of lactic acid-laden effluent piles of peels that contaminate nearby streams, wells and underground aquifers. The process also reduces emissions of methane gas from the million tons of fermented peels. (There is a need for a greenhouse gas audit to quantify these emission reductions.)
- Wastewater from HQCP® production can be re-processed as a renewable and clean source of energy via biogas production, which reduces the amount of firewood used for fuel and contributes to efforts to fight deforestation. The slurry from the same process creates a rich and economical organic fertilizer.
- HQCP® processing also reduces the amount of firewood used for fuel and contributes to efforts to fight deforestation. The impact on pasture lands from livestock grazing is also lessened, benefiting the environment.
- Cassava peel mash conversion is low-cost, efficient and provides an alternative feed to maize, which does not have adverse health impacts on livestock. When fine HQCP® mash was used to replace 20% of the maize in broiler rations and 35% of maize in layer rations, for example, there was a 10-15% reduction in the cost of feed.
- Trials with pigs showed that HQCP® fine mash is a good replacement for maize without any adverse effects on the animals (Adesehinwa et al. 2016). For fish farmers, HQCP® can successfully replace maize in the diets of catfish (Orisasona et al. 2019) As a bonus, the cassava peel mash production provided an affordable alternative feed, as maize prices have doubled during the Covid pandemic.

RAPID GROWTH FOR HQCP®

There is a growing market for HQCP® among private entrepreneurs, the public sector, non-governmental organizations and particularly among garri producers in Nigeria. Garri is a West African food staple made from peeled cassava roots.

So far, more than thirty individual entrepreneurs have set up processing plants to meet the demand for HQCP® from large-scale feed mills. In many cases, the mills add the nutritious HQCP® mash in formulated rations, which are sold to poultry farmers.

Similarly, HQCP® mash is sold directly to livestock and fish farmers who feed it to their livestock (cattle, sheep and goats). The mash is sometimes fortified with other ingredients to formulate rations for poultry, fish and pigs.

The growing market for HQCP® is meeting demand among different types of producers. Small-scale entrepreneurs produce between five to ten tons of HQCP® per week. Medium to large scale producers have the capacity to process up to sixty tons per week of wet peels and up to 120 tons per week of dried peels. Meanwhile, commercial feed millers who are producing thousands of tons of feed weekly estimate their requirements for HQCP® at 80-120 tons a week.

To scale up the technology, it will be important to strengthen the capacity of small and medium producers concentrating on the production of HQCP® cake. This cake can then be sold to large scale producers who use flash-dryers to meet industrial demand.

Technologically, two major apps dedicated to livestock feeding, the Smallholder Poultry Feed App and Feed Calculator, have promoted HQCP®.

Meet the entrepreneurs

Rural Nigerian entrepreneur Adeleke Adegoke Ogunlade first learned about HQCP® at an ILRI-led training session on the technology. He now runs one of several dozen cassava-peel factories across Nigeria, selling the dried peel to feed wholesalers who then sell it to livestock producers. Ogunlade is also working with ILRI to offer free training in cassava peel processing for unemployed youth aged 20-25 years. The majority of those working in the new cassava new factories are women, leading to improved incomes and job prospects for women.

Another HQCP® user is John Olateru, a poultry farmer in Ibadan, Nigeria. He is responsible for feeding roughly 50,000 chickens for eggs and human consumption. He tried the HQCP® mash and was not only impressed by the results but noted that it was about half the cost of maize.

Photo ILRI/Tunde Amole

Adeleke Adegoke Ogunlade samples a bag of cassava peel mash. Source A.A. Ogunlade.

BIG BUSINESS AND DEVELOPMENT OPPORTUNITIES

HQCP® is also creating large-scale commercial and development initiatives. German development agency, GIZ–invested in ten new factories with five tons a week capacity for conversion of cassava peel to mash in southwest Nigeria.

The Business Innovation Facility (BIF) is a UKAid sponsored project in collaboration with Synergos Nigeria under the State Partnership for Agriculture Programme (SPA) and funded by the Bill and Melinda Gates Foundation. BIF and Synergos Nigeria have promoted HQCP® in the Nigerian states of Kogi, Benue, Ogun and Oyo. The Federal Capital Territory (FCT) established three new factories and provided equipment for three other factories.

Synergos and the International Fund for Agricultural Development (IFAD) also obtained technical support from ILRI Nigeria's scientific team to train people in cassava processing

Photo ILRI/Tunde Amole

HQCP® production: pulverizing cassava peel cakes into mash.

procedures and to set up cassava processing factories in the country. In 2017, representatives from these three organizations visited two IFAD-Value Chain Development Programme (VCDP) cassava processing sites in Nigeria, one in Niger State (Lokogoma, Wushishi local government area) and the other in Benue State (the Idogodo and Okpokwu local government areas). The cassava peel factories, which were set up by IFAD-VCDP, are to be jointly owned by ten producer organizations and four women processing groups.

At the government level, the Federal and State Ministries of Agriculture and Rural Development partnered with ILRI in organizing a workshop for stakeholders to raise awareness of HQCP®. This was followed by a public awareness campaign using two local dialects, Yoruba and Tiv, broadcast on two state-owned radio stations.

DEVELOPING PROTOCOLS AND REGULATIONS

The government has also developed protocols and regulations. The Standards Organization of Nigeria (SON) has conducted laboratory tests and has adopted standards for quality requirements for nutrient profile, microbial and metallic contaminations, packaging and labeling. HQCP® products are covered by the provisions of a Nigeria Industrial Standard and should be prepared and handled in accordance with the appropriate sections of the Recommended International Code of Practice – General Principles of Food Hygiene (CAC/RCP 1-1969, Rev 4: 2003) and other Codes of Practice recommended by the Codex Alimentarius Commission. Approved details of the protocols are yet to be released.

Feeding protocols by ILRI scientists for HQCP® based on several performance trials for different classes of livestock have also been developed.

IMPLICATIONS AND RECOMMENDATIONS

For now, incorporating HQCP® into livestock feed has proven to be an environmentally friendly and affordable means of boosting feed supplies for livestock while also creating opportunities for entrepreneurship. As this innovative approach continues to be adopted, communities across sub-Saharan Africa and the developing world will benefit from livestock products and protein-rich foods produced at low cost.

There is room to scale up HQCP® production. Studies have shown that HQCP® mash in poultry feed could lead to a USD80 -120 million industry in Africa (Adekeye et al., 2021. Oladimeji et al., 2020), employing an estimated 20,000 people (Okike et. al 2015).

HQCP® could cut the use of maize in feed by twenty percent, reducing competition with maize for human consumption. However, this level of cassava mash production would require supply and demand studies, geographic assessments, new supply chains and infrastructure. It would also require a centralized approach that delivers intermediate cassava peel products from small and medium enterprises to new large-scale industries or distributors.

As HQCP® rolls out, these larger scale operations are key to meeting demand. There will also be a need for regulation and development of standards and quality control protocols as the industry grows. Product standardization and quality control to establish code of practice, standards and safety limits for the use of HQCP® mash for animal feed will be required as markets for the product grow.

Long-term, the potential to go to scale is vast since cassava is an important crop in many other countries besides Nigeria. The HQCP® project is applicable in all cassava-producing countries and individuals from several African countries have already expressed interest. Possible candidates for scaling up HQCP® production include the Democratic Republic of Congo, Ghana, Cote d'Ivoire, Senegal and Sierra Leone.

There is potential for the process to be adopted in cassava-producing regions of Asia and Latin America. Progress on the cassava-peel-for-livestock-feed project is also being closely followed by crop and livestock specialists and by donor organizations such as the United States Agency for International Development.

Photo ILRI/Tunde Amole

HQCP® production: sieving to separate fine mash from coarse mash.

Acknowledgements

This work was conducted as part of the CGIAR Research Programs on Livestock and Fish, Livestock, and Roots, Tubers and Bananas.

Special thanks to researchers from ILRI and IITA, particularly Iheanacho Okike, who collaborated to develop the technology, examine the nutritional value of HQCP® and continue to scale up the work across Nigeria.

IITA
Transforming African Agriculture

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