Assessment of Farmers' Processing Technologies and Utilization of Pearl-Millet (Pennisetum Glaucum) Cultivation in Jigawa State, Nigeria

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ABSTRACT

The study examined the farmers processing technologies and perceived economic utilization of Pearl-Millet cultivation in Jigawa State, Nigeria. One hundred and sixty millet farmers were interviewed for the purpose of eliciting information for the study. The millet farmers were males (79.4%), married (73.1%), Muslims (94.3%) with no formal education (60.0%). 91.3% were within the age range of 21-40 years, household size of 6-10 persons (73.8%) with average monthly income of #1-10,000 (USD0-32.79)(86.3%). Most available technologies for millet utilizations are soaking/cooking and traditional/bioprocessing (98.1%) while thermal improved processing was not really felt (41.2%). Key and most perceived economic utilizations were production of Fura (cooked millet product), Tuwo, Kunu (98.1%) seconded by Ogi (uncooked raw palp), Koko or Akamu (96.9%) among others useful. Major constraints were lack of capital and storage facilities/technologies (97.5%) followed by nomadic Fulani, lack of improved processing skills, weed infestation, processing equipment and extension contact (each being 93.8%) to advocacy (75.6%). The study recommended that government at state and local level tiers should strengthened the extension service delivery by employing more personnel with adequate training to improve the gap of farmers to extension agent contact in the study area. Improved and high yielding varieties of millet should be introduced to farmers with current technologies if any on millet production and utilizations.

***Keywords**: Farmers, Processing Technologies, Perceived, Utilization and Cultivation.*

Agriculture is the main stay of the Nigerian economy and it involves small scale farmers scattered over wide expanse of the area, with small holding ranging from 0.5 to 3.0 hectare per farm land. It is characterised by rudimentary farm systems, low capitalization and low yield per hectare (Kolawole & Ojo, 2007). Millets are a group of highly variable small-seeded grasses, widely grown around the world as cereal crops or grains for fodder and human food. Millets are important crops in the semiarid tropics of Asia and Africa (especially in India, Mali, Nigeria, and Niger), with 97per cent of millet production in developing countries. The crop is favored due to its productivity and short growing season under dry, high-temperature conditions. The most widely grown millet is pearl millet, which is an important crop in India and parts of Africa (Wikipedia, 2016; International Crops Research Institute for the Semi-Arid Tropics [ICRISAT], 2015). Pearl millet is one of the two major crops in the semiarid, impoverished, less fertile agriculture regions of Africa and south-east Asia. Millets are not only adapted to poor, droughty, and infertile soils, but they are also more reliable under these conditions than most other grain crops. This has, in part, made millet production popular, particularly in countries surrounding the Sahara Desert in Western Africa (IAPPS: International Association for the Plant Protection Sciences, 2007). Millets are small-seeded with different varieties such as pearl millet (*Pennisetum glaucum*), finger millet (*Eleusine coracana*), kodo millet (*Paspalum setaceum*), proso millet (*Penicum miliaceum*), foxtail millet (*Setaria italic*), little millet (*Panicum sumatrense*), and barnyard millet (*Echinochloa utilis*). They are known as coarse cereals beside maize (*Zea mays*), sorghum (*Sorghum bicolor*), oats (*Avena sativa*), and barley (*Hordeum vulgare*) (Bouis 2000; Kaur *et al.* 2012). Cereals are the major dietary energy suppliers and provide significant amount of protein, minerals (potassium and calcium) and vitamins (vitamin A and C) (Idem & Showemimo, 2004). Pearl millet is a climate hardy crop which is grown in harsh conditions, but as a subsistence crop among mostly the poor and less privilege of in population. Harvested from an area of 20 m ha the semi-arid regions of Africa pearl millet contributes 19 per cent area to cereal production and according to the ICRISAT (2015) initiative of the grant awarded between 2014 to 2017 which say the overall goal of the project is to enhance sorghum and pearl millet productivity in West and Central Africa (WCA), including Nigeria through cultivation of nutritious hybrids, contributing to food security, income generation, and improved nutrition such as the Pearl Millet (PEO5984 also Known as LCICMV-4) with increased yield of 29per cent over local variety otherwise called ''Jirane'' in Hausa language.

Millets are not placed as a single important commodity in the North American and European food basket at the present time, but their importance as an ingredient in multigrain and gluten-free cereal products has been highlighted. However, in many African and Asian areas, millets serve as a major food component and various traditional foods and beverages, such as bread (fermented or unfermented), porridges, and snack foods are made of millet, specifically among the non-affluent segments in their respective societies (Chandrasekara & Shahidi 2011a; Chandrasekara & Shahidi, 2012). In addition to their nutritive value, several potential health benefits such as preventing cancer and cardiovascular diseases, reducing tumor incidence, lowering blood pressure, risk of heart disease, cholesterol and rate of fat absorption, delaying gastric emptying, and supplying gastrointestinal bulk have been reported for millet (Truswell 2002; Gupta, Srivastava and Pandey, 2012). Millet grains, before consumption and for preparing of food, are usually processed by commonly used traditional processing techniques include decorticating, malting, fermentation, roasting, flaking, and grinding to improve their edible, nutritional, and sensory properties. However, negative changes in these properties during processing are not avoidable because industrial methods for processing of millets are not as well developed as the methods used for processing of wheat and rice (FAO, 2012). Therefore, with value-added strategies and appropriate processing technologies, the millet grains can find a place in the preparation of several value-added and health food-products, which may then result in high demand from large urban populations and non-traditional millet users (Mal, Padulosi and Ravi, 2010). This is why the study sought to assess farmers' processing technologies and utilization of pearl-millet cultivation in Jigawa State, Nigeria.

METHDOLOGY

Study area : The study was conducted in Jigawa State Nigeria. The state was excised from Kano State on August 27, 1991. Jigawa State is one of thirty six states that constitute Federal Republic of Nigeria. It is situated in the North-Western part of the country between latitudes 11.00°N to 13.00°N and longitudes 8.00°E to 10.15°E. The state has a total land area of approximately 22,410 square kilometers with twenty seven (27) local governments (Jigawa Wikipidia, 2014 & National Population Commission [NPC], 2006). It is bordered on the West by Kano State, on the East by Bauchi State and Yobe State and on the North by Katsina State and Republic of Niger (Nigeria [NIG], 2004). The state has a population of 4,348,649 people (National Population Commission NPC, 2006) while the estimated population in 2014 was 5,372,754 at 2.9 per cent rate of population growth. Farming is among the major occupation of the people who are predominantly Hausa/Fulani and were majorly engaged in rural and subsistence farming. The topography is characterized by high land areas which is almost 750 meters. Soil tends to be fertile ranging from sandy-loamy with many pockets of fadama and alluvial plains suitable for the cultivation of rice, sugar-cane, millet, maize, vegetables and sorghum etc. There are usually two seasons in the state viz the rainy season lasting from June through October and dry season spanning from November to May. The mean temperature ranges from 35^0c in October to about 50^0c in May, while mean annual rainfall varies from 700mm to over 1000mm and can last up to 200days in some lowland parts of the state. The major rain fed crops grown in the state includes millet, sorghum, maize, cowpea, groundnut, cocoyam, soy beans (International Funds for Agricultural Development Community Based Agricultural and Rural Development Programme [IFAD-CBARDP], 2004).

Data collection : The population for the study comprises all the millet farmers in Jigawa State under ADP Zones 1 to 4 as the sample unit. A multistage sample technique was employed for the study. In the first stage was a random selection of two local governments from each ADP zones in the State to give zone 1 (Dutse and Jahun), zone 2 (Gumel and Gagarawa), zone 3 (Hadejia and Kirikasamma) and zone 4 (Kazaure and Suletankarkar) respectively. The second stage was a random selection four communities from each of the selected local governments. The third stage was the random selection of five millet farmers from each of the communities from the list of the farmers in JARDA to make a sample size of 160 respondents for the research. The statistical analyses that employed were; Descriptive statistics (percentages, mean, frequency counts, standard deviation). The hypothesis was tested using Chi-square analysis.

RESULTS AND DISCUSSION

Farmers' perceived economic utilization of millet : Table 1, showed the respondent's perceived economic utilization of millet in the study area. The respondents opined that millet is generally used for production of Fura which is like a preparation in the form of soft drink and it is very pleasant when served chilled, Tuwo which is like staple for almost synonymous with

semovita (very palatable to taste) are commonly prepared product and Kunu almost like food of higher satisfaction (98.1%) and soft drink. Production into Palp (96.9%) is another one due to its high nutritional content over other cereals. Palp (Ogi or Akamu or Koko) is a staple delicacy almost throughout West Africa for both the rich and the poor. It can also be blended into composite floor and mix with other food products (94.4%) to produce other good food types; for example it can be mixed with yam floor, cassava floor to produce delicious paste of various types and kinds for food. Direct cooking in form of a product called Couscous is a very common staple food in the north (93.1%), followed by Dambu (83.1%) and Massa (81.3%). Millet by products from milling can also be mixed with yam floor again for good type of Amala to be taking with vegetable (75.0%) or any suitable combination and finally, millet are good source of forage or fodder crops for feeding livestock in the study area (63.1%) as it is palatable and well accepted by the ruminants.

Table 1
Perceived economic utilization of millet by the respondents

Sr. No.	Variables	Frequency	Percentage	Ranking
1.	Feeding Livestock (Forage Crops)	101	63.1	8th
2.	Production of Palp (Ogi, Akamu or Koko)	155	96.9	2nd
3.	Production of Fura	157	98.1	1st
4.	Processing of Tuwo	157	98.1	1st
5.	Production of Kunu	157	98.1	1st
6.	Production of Massa	130	81.3	6th
7.	Production of Kunu Zakki (Soft Drink)	149	93.1	4th
8.	Production of Waina	151	94.4	3rd
9.	Production of Dambu	133	83.1	5th
10.	Millet milling waste + yam flower mixed	120	75.0	7th
11.	Direct cooking (Puremillet likecouscous)	149	93.1	4th
12.	Blended in composite floor and food Products	151	94.4	3rd

Processing technologies available on millet utilization : As shown in Table 2, the respondents were fully into the traditional/ bioprocessing technology that has been in existence from time immemorial together with soaking/cooking which is very common as it is the main technology in the production of staple Ogi, Koko or Akamu (98.1%) as the case may be. Manual milling with stones or hammer mill are also common (85.6%) as this is the only up till now the main existing processing way to reduce the millet into particles for easy processing and consumption, whereas, hand sieve are also used to separate the product obtained from grinding into further smaller and minute forms for easy consumption. After the milling and grinding, the product so obtained are left for some hours to allow for fermentation in which the nutrient content of the millet is expected to breakdown into available constituents for body utilization after consumption (88.1%). Last but not the least is the mechanical processing which is similar to the milling using hammer mill but it is being done with bigger capacity powered electric motor, diesel engine or petrol engine (78.1%) most of which are found all over the rural areas of the state. Thermal improved processing technique is not in vogue in the study area (41.2%) although it is still believed to be embedded in the traditional processing as heating is required to convert the raw product into consumable one for easy consumption.

Table 2
Available processing technologies on millet utilization

Sr. No.	Variables	Frequency	Percentage	Ranking
1.	Thermal improved processing	66	41.2	5th
2.	Mechanical machine processing	125	78.1	4th
3.	Milling andsieving	137	85.6	2nd
4.	Traditional andbio-processing (Fura)	157	98.1	1st
5.	Indigenous soaking andcooking (Ogi)	157	98.1	1st
6.	Fermentation	141	88.1	3rd
7.				

the raw product into consumable one for easy consumption.

Constraints of the farmers to millet farmers in processing : Table 3, showed the constraints to millet processing in the study area. It can be seen among the array of constraints that, lack of storage facilities/ technology for the raw and processed millet products, and lack of capital to purchase the millet for cultivation and consumption purposes (97.5%) are seen as major and critical challenge. Then weed infestation like the parasitic striga, lack of quick and effective processing methods, affordability/lack of processing equipment and intrusion of the nomadic Fulani cattle men and extension contact (93.8%). This implies that the effect or impact of extension services is very scare in the study area and this will make it difficult to spread improved varieties and technologies on this crop to the people in the study area. Lack of advocacy (75.6%) on millet as to the nutritive properties and qualities to foster further research and development of improved strain are difficult, although recently, there were new release of millet from Samaru (samaz varieties) to farmers in Nigeria. This was why lack of improved varieties (55.0%) were seen by slightly above average of the respondents as a bottle neck. Transportation and sustainability of the business for those on commercial production of Ogi, Akamu or Koko is another challenge because the millet are not always available all year round and if they are seen at all, it would be on an exorbitant basis coupled with lack of understanding/ illiteracy level of the respondents (46.9%). Availability of raw material (millet) were also not seen as a challenge as slightly below average (42.5%) of the respondents agreed with this assertion.

Table 3
Constraints of the millet farmer in millet utilizations

Sr.No.	Variables	Frequency	Percentage	Ranking
1.	Lack of capital	156	97.5	1st
2.	Lack of improved varieties	88	55.0	4th
3.	Lack of advocacy on the crop	121	75.6	3rd
4.	Nomadic Fulani Herd men	150	93.8	2nd
5.	Lack of quick and effective processing method	150	93.8	2nd
6.	Affordability/ Lack of processing equipment	150	93.8	2nd
7.	Availability of raw mat erial in the market	68	42.5	6th
8.	Storage facilities/technologies for millet products	156	97.5	1st
9.	Extension contact	150	93.8	2nd
10.	Transportation	75	46.9	5th
11.	Sustainability of the business	75	46.9	5th
12.	Weed infestation	150	93.8	2nd
13.	Lack of understanding/illiteracy level of the respondents	75	46.9	5th

CONCLUSION

Based on the findings of the study, the following conclusions were drawn: the respondents agreed that millet is utilizable in the production of several products like Fura, Tuwo, Ogi, Massa or can be mixed with other food products due to its high nutritional value among the cereals. Majorly, the traditional/bioprocessing, soaking and cooking, fermentation, milling and sieving were among the available technologies for millet processing and utilization while the thermal processing is not really available (41.2%) although, there have been not major improved technology on millet utilization as a nutritive food except for the post-harvest processing technologies and their major source of awareness was from their indigenous background from family, friends and neighborhood interactions (88.1%). The respondents were extremely poor as can be seen with mean income of #7,069.18k (86.3%= USD23.18). Key identified constraints were lack of capital to purchase the millet either for planting or consumption and storage facilities/technologies for the millet and its products (97.5%) amongst others. It is therefore recommended that government at state and local government tiers should strengthen the extension service delivery by employing more personnel with adequate training to improve the gap of farmers to extension agent contact in the study area. Improved and high yielding varieties of millet should be introduced to farmers with current technologies if any on millet production and utilizations.

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