Demographic characteristics, agricultural and technological profile of acha farmers in Nigeria

Theresa K. Philip*, Isaac N. Itodo

(*Dept. of Agricultural and Environmental Engineering, University of Agriculture, Makurdi, Nigeria*)

Abstract: A quantitative research was undertaken to determine the demographic characteristics, agricultural and technological profile of acha farmers using structured questionnaire. The demographic profile of the respondents showed that 44% of the farmers are 30 - 44 years old, 25% aged 45 - 59 years, 17% are 15 - 29 years old and 10% are 5 - 14 years old, while 4% represented those of 60 years and above. Farmers that had no formal education were 57%, those that went through adult education were 8%, while the remaining 18%, 14% and 3% had primary, secondary and tertiary education respectively. Regarding agricultural profile the study showed that most of the acha farmers have farm holdings of less than 3 ha and most of them planted the white acha (*Digitaria exilis*) variety. All the farmers use manual power, emanating from self, hired, family or communal labour employing the hand-tool technology. Acha production and processing is at zero mechanization level, therefore 100% of the farmers indicated a desire for the mechanization of acha farming operations. This information is an indication that acha production needs to be mechanized and this can be done by introducing simple motorized technologies affordable to the farmers.

Keywords: acha farmers, agriculture, demographic characteristics, *digitaria spp*, Nigeria, technological profile.

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1 Introduction

Acha (*Digitaria spp.*) is probably the oldest African cereal. Acha, also known as findi, fonio, hungry rice, fonio blanc and petit mil is the dry seed of *Digitaria exilis* (Jideani, 1999). For thousands of years, West Africans have cultivated acha across the dry savannas. Indeed, it was once their major crop. Even though few other people have ever heard of it, this crop still remains important in areas scattered from Cape Verde to Lake Chad. In certain regions of Mali, Burkina Faso, Guinea, and Nigeria, for instance, it is either the staple or a major part of their diet (TNAP, 1996; Vodouhè et al., n.d.).

There are over 300 *Digitaria* species, which are sometimes grown as fodder; only three or four are sometimes grown as cereals (CIRAD, 2004). The crop is perhaps one of the world's fastest maturing cereals, producing grains just 6 to 8 weeks (42 to 56 days) after they are planted for the extra early varieties (Ibrahim, 2001). The late varieties take up to 150 days to grow

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***Corresponding author: Philip, T.K.** Dr. Dept. of Agricultural and Environmental Engineering, University of Agriculture, Makurdi, Nigeria. E-mail: tessyphils@yahoo.com

(CIRAD, 2004). In West Africa, the two common species cultivated are *Digitaria exilis* or fonio, white fonio, fundi or findi, acha, hungry rice and *Digitaria iburua* or black fonio, iburu etc. Of the two species, white fonio (*Digitaria exilis*) is the most widely grown and used.

A total area of 347,380 hectares was devoted to acha production in Africa in 2002, with Nigeria alone producing half of that area (FAOSTAT, 2003). Cruz (2004) reported a production area of 380,000 hectares with an output of 250,000 tons of grain annually. Acha is grown in commercial quantity in various parts of Nigeria. Plateau State is the largest producer of acha in Nigeria with an estimated production of 20,000 tonnes per annum (Gyang and Wuyep, 2005).

Despite its ancient heritage and wide spread importance, knowledge of acha's evolution, origin, distribution, and genetic diversity remains scanty even within West Africa itself (TNAP, 1996). Acha, though one of the oldest and richest cereals of West Africa is still unknown to many people and neglected by research and extension services, which has lead to a decline in its cultivation. This is because acha can no longer compete with the crops that have come to dominate the world food supply and that are supported by seed supply, production and post-harvest technologies and extension services.

The crop has received but a fraction of the attention accorded to sorghum, pearl millet, and maize considering its importance in the rural economy and its potentials for increasing food supply. Acha is one of the most nutritious grains; its seed is rich in methionine and cysteine, amino acids vital to human health which is deficient in major cereals such as wheat, rice, maize, sorghum, barley and rye (Ibrahim, 2001).

Acha production and processing have been at a zero mechanization level and no proper research effort has been carried out towards its mechanization in Nigeria (Philip, 2011). There are no machines for planting, harvesting, threshing and dehulling of acha crop on Nigerian farms. In order to bring acha to prominence, its competitiveness has to be addressed by providing appropriate information and technologies that can support its mass production.

The aim of this research is therefore, to identify the demographic characteristics, agricultural and technological profile of acha farmers in Nigeria. The study also intends to identify the causes of decline in acha production and possibly proffer a solution.

2 Materials and methods

A structured questionnaire was developed and administered to 120 randomly selected acha farmers in four selected acha farming districts of Plateau State, Nigeria. This was used to determine the socio-demographic characteristics, agricultural and technological profiles of Plateau acha farmers. Some of the demographic characteristics considered were age distribution, household size and composition, occupational distribution and educational status. Agricultural profile determined were type of cereals and acha variety grown, experience in growing acha, reasons for growing acha, cropping system practiced, average farm size, factors influencing the choice of variety and the value with which acha is held compared to other cereal crops. The technological profile determined included sources of labour, type of implements and machines in use and access to tractors.

The questionnaire also ranked the various tasks involved in acha production on the basis of the farmers' desire for mechanization. Ranking was also carried out to determine acha production operations based on cost and time. Simple percentages were used to present the data collected.

3 Results and discussion

3.1 Demographic characteristics

120 questionnaires were administered but only 100 farmers (83.3%) responded. The farmers fell into the following age group with their percentages; 30 - 44 years (44%), 45 - 59 years (25%), 15- 29 years (17%), 5 - 14 years (10%). In the age group of 60 years and above made up of 4% of the respondents, the farmers were old and weak and would rather retire completely from acha production.

Farmers that had no formal education were 57%, those that had adult education were 8%, while the remaining 18%, 14% and 3% had primary, secondary and tertiary education respectively. The large number of illiterates involved in acha production could be an impediment to the transfer and use of motorized technologies on the farms and this could also contribute to their low financial standing. Adapting new crop varieties and appreciating extension services may also be difficult because of the farmers' level of literacy.

Regarding the gender, 60% of the respondents are men, but it does not imply that they participate more in acha production. The male dominated response could be attributed to interaction, cultural, traditional or religious reasons. Concerning the marital status of the respondents, 25% are single, 10% divorced and 65% married.

3.2 Agricultural Profile

Of the various cereal crops 30% of the farmers cultivate acha is the highest compared with other cereal crops grown. The analysis showed that 20%, 10%, and 10% cultivate maize, sorghum and millet respectively while 30% cultivate a combination of the various cereal crops. The analysis showed that most of the farmers (40%) have been growing acha for over 20 years. 40% of the farmers grow acha for consumption purposes only, while 15% grow acha for commercial purposes and 45% for consumption and commercial purposes. This is a clear indication that acha serves as food for consumption majorly and secondarily as a source of income.

Two main varieties of acha are majorly grown, the white acha (*Digitaria exilis*) and black acha (*Digitaria iburua*). Most farmers (70%) cultivate the white acha while 6% cultivate the black acha, 24% grow both species. The reasons given by the farmers on why they preferred to cultivate the white acha were; higher yield, ease involved in its dehulling, availability of planting materials, preference by consumers, early maturity and adaptation. The problems in acha cultivation as given by farmers were the small grain size, followed by low yield, lodging of stem and shattering. Though, many advantages were given for the preference of cultivating the white acha over the black acha, the general problems given for the cultivation of acha maybe a major set-back for its production. This could be checked by mechanizing its production and improving the varieties. In spite of the problems involved in cultivating acha, 85% of the farmers hold acha in high value compared to 12% and 3% who hold acha in average and low value respectively. The high value farmers attach to acha could be the reason why it is still cultivated by farmers though at a low level, this has kept the existence of the crop.

The quantity of acha planted by the respondents showed that 15% planted 8 - 10 kg/ha, 20% planted 11 - 13 kg/ha, 45% planted 14 - 16 kg/ha and 20% planted above 16 kg/ha. Quantities harvested by 38% was 400 - 600 kg/ha, 32% was 700 - 900 kg/ha, 20% was 1000 - 1200 kg/ha and 10% harvested above 1200kg/ha. From the analysis, a high quantity of acha of 14 - 16 kg/ha was planted by 45% of the farmers, but a low quantity of 400 - 600kg/ha was harvested by 38% and 700 - 900kg/ha by 32%. Twenty percent have yields between 1000 - 1200 kg/ha while only

10 % harvested above 1200 kg/ha. This is a clear indication that the average production of acha per hectare is relatively low compared with crops like maize and rice that can produce as high as 2½ - 4 tonnes/ha and 3½ - 5 tonnes/ ha respectively (Jideani, 1990).

3.3 Technological Profile

As a source of labour, 95% of the farmers employ manual means on the farms and the source of this labour was derived mainly from self (35%), family (20%), communal (10%) and hired labour (5%). The remaining 30% was a combination of the various sources of power. A combination of manual and machine power was used by 5%, the machine power was mostly employed for seedbed preparation and spraying (application of chemicals). Most of the farmers (93%) don't have access to tractors, while only 2% and 5% always and rarely respectively have access to the use of tractors. The hand-tool technology was used by 96% of the farmers which is usually associated with drudgery; this may be because they don't have access to tractors. This means that the mechanization of acha production must essentially start from simple motorized technologies capable of increasing area cultivated by farmers, affordable, easy to use and maintain.

43% of the farmers were usually faced with the problem of shortfall in labour, while 57% indicated they had no labour shortfall. Labour shortfall was usually critical and observed during harvesting by 26% of the farmers followed by dehulling (25%), threshing (18%), weeding (16%), and land preparation (15%). Analysis of Table 1 shows the various types of labour employed for acha production, indicating the most dominant for each operation as: land clearing (self labour: 45%), land preparation (family labour: 28%), planting (self labour: 50%), weeding (family labour: 38%), harvesting (family labour: 40%), threshing (family labour: 38%), and dehulling (family labour: 38%). This is an indication that acha production is mostly a family venture carried out by both male and female in all the operations as indicated on Table 2. This is also a clear indication that the farmers were actively involved in all aspects of acha production.

Table 1 Sources of labor to farmers for farm operations (%)

Operation	Self	Hired labour		Family labour		Communal labour	
	(S)	(H)	S + H	(F)	H + F	(C)	C + H
Land clearing	45	8	9	22	12	3	1
Land preparation	25	8	14	28	15	6	4
Planting	50	3	8	30	8	0	1
Weeding	30	10	12	38	4	6	0
Harvesting	17	5	11	40	12	10	5
Threshing	23	7	13	38	10	8	1
Dehulling	30	8	6	38	10	7	1

Table 2 Labor distribution based on gender (%)

Activities	Male	Female	Both
Land clearing	21	24	55
Land preparation	23	32	45
Planting	35	25	40
Weeding	13	60	27
Harvesting	18	30	52
Threshing	30	22	48
Dehulling	5	90	5

All the farmers indicated a desire for the mechanization of acha farming operations. On the single operation they would want mechanized, the indication was 15% for dehulling, 10% for harvesting and threshing each, while the least of 2% indicated land clearing and planting. For the mechanization of more than one of the production operations, dehulling and harvesting had the highest of 31% from respondents while the least of 10% was a combination of dehulling, weeding and harvesting. This shows that the mechanization of acha production must essentially dwell in dehulling and harvesting.

Dehulling is a 100% manual operation. Analysis of Table 2 shows that 90% of the female folks participate in dehulling. Other activities having higher female participation were land clearing (24%), land preparation (32%), weeding (60%) and harvesting (30%) as compared to the men's participation (21%, 23%, 13% and 18% respectively). The other percentages show a combination of male and female participation in the indicated operations. This is a clear indication that women participate more actively in acha production than men especially in the dehulling aspect. Women in the age range of 30 - 39 years representing 40% of the respondents participated more in dehulling followed by those in the age range of 20 - 29 years which represents 25%. The age ranges of 10 - 19 (15%), 40 - 49 (10%) and 50 - 59 years (10%) had fewer women participating in dehulling probably due to the tedious nature of pounding, which is performed by the use of mortar and pestle and this requires strength. The older age group participation in dehulling could also be low because of their gradual withdrawal from the strain involved in the operation. This could explain why no woman of 60 and above years was involved in dehulling.

From Table 3 harvesting operation was ranked as the most costly operation, followed by weeding, land preparation, land clearing, threshing, dehulling and planting. On man-hour usage weeding was ranked highest followed by harvesting, land preparation, dehulling, land clearing, threshing and planting. From the analysis it can be deduced that harvesting and weeding were the most costly and time consuming operations. These farm operations when mechanized will reduce drudgery and cost of production. In this wise, those simple motorized and functional technologies, which have been considered obsolete in technologically advanced countries may find relevance here.

Table 3 Ranking of farm operations on the basis of cost and time

Operation	Cost	Time spent
Land clearing	4th	5th
Land preparation	3rd	3rd
Planting	7th	7th
Weeding	2nd	1st
Harvesting	1st	2nd
Threshing	5th	6th
Dehulling	6th	4th

4 Conclusions

The demographic characteristic, agricultural and technological profile of Plateau State acha farmers was studied using questionnaires. Most of the acha farmers were aged 30 - 59 years with little or no formal education. Both male and female were found to be involved in acha production which is carried on a small portion of land of less than 3 ha. The production of acha was mostly done for consumption purposes while a little percentage is left for commercial purposes. It was discovered that most of the farmers cultivated the white acha (*Digitaria exilis*) because of the ease in its production when compared with the black acha (*Digitaria iburua*). The basic source of power is through human labour using hand tools.

All the respondents (farmers) indicated their desire for the various acha production operations to be mechanized so as to make it more attractive and sustainable. This can be achieved by introducing simple and affordable machines for the farmers. The Asian countries have developed appropriate technology which have revolutionized their agricultural mechanization by the use of the two-wheel drive which is a lesser gadget than the two-wheel drive.

It is believed that the manufacture of simple equipment and machines will be appropriate for most acha farmers in a developing country like Nigeria. This is given their common small farm size of less than 3 ha and low economic power. It is expected that these simple machines will easily be accepted and adopted by the farmers given their literacy level. Mass adoption will also certainly lead to local manufacture of most components giving rise to employment opportunities to many people.

The public administrator has a role to play by making policies that will revive research institutes to enable them carry out researches for authentic results towards mechanizing acha. These research activities should be stimulated towards addressing the existing biological, agronomic and mechanization constraints that currently discourage the expanded production of acha. Government can also empower these farmers in form of bank loans, review salary/wages and provide cottage industries.

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