ANALYSIS OF POST-HARVEST (STORAGE) LOSSES OF SORGHUM AMONG WOMEN FARMERS IN KAURA LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA

Banta, A.L. and Manza, E.A.G.
Department of Agricultural Economics and Extension, Kaduna State University, Kafanchan Campus, Kafanchan, Kaduna State, Nigeria.
Corresponding author e-mail: bantaayuba@yahoo.com

Received 4th May, 2015 Accepted 20th July, 2015

Abstract
This study is aimed at analysing post-harvest (storage) losses of sorghum among women farmers in Kaura Local Government of Kaduna State. The specific objectives of the paper are: to describe the socio-economic characteristics of sorghum farmers; examine the methods of sorghum storage; identify the agro-chemical used in sorghum storage; examine the spoilage percentage of losses and monetary values of stored sorghum among women farmers; and determine the constraints facing sorghum storage. Results indicate that both married women and widows were engaged in sorghum production and storage. Multi-stage random sampling technique was employed using structured questionnaires and oral interviews. Data collected was analyzed using simple descriptive statistics. The results show that majority of women were literate and employed several methods of storage. Categories of agro-chemicals used include, powdered, tablets, and the liquid type. It was recommended that farmers should be educated on proper methods of agricultural storage, appropriate methods of handling agro-chemicals that require specific skills for safe food and environment.
Keywords: Assessment, Sorghum, Post-harvest losses,Storage, Agro-Chemicals

Introduction

Agriculture, including crop and animal husbandry, inland and marine-fisheries, forestry and agro-forestry has been Nigeria's living industry for several decades (Abubakar, 2007). Agricultural productivity among the farmers is low as most of these farmers realize 20-30% of the potential yields expected from crops and animals they produce(Abubakar,2007;Adewoyin etal.,2011) Although remarkable progress has been made in increasing food production worldwide, approximately half of the population in developing countries does not have access to adequate food supplies; thus the food security problem is worsening because food losses occur throughout the supply chain from production, post-harvest, processing and marketing (Nzeh *et al*.,2012).

The expression, post-harvest losses means a measurable quantitative and qualitative loss in a given product. These losses can occur during any of the various phases after harvest. This definition must also take into account cases of product deterioration. The actual losses from an economist point of view are the sum of the losses in quantity and quality of the products which inevitably means loss of money. In addition to direct economic losses there are those resulting from poor management of post-harvest systems. They are evidenced by lack of growth in production and in the income of the farmers (Mbah *et al*., 2007).

Important in many developing countries, particularly in Africa are on farm losses during storage, when the grains are being stored for consumption or while the farmer await a selling opportunity or rise in prices.

Pre and post-harvest crop losses in developing countries are higher than the global average and impact more severely on already endangered livelihood. Post-harvest losses are product specific and take place at any stage in the supply chain that is in the field during storage and in the market, when being transported. It has been estimated that at least 10% of Africa's crop production is lost on and off farm. Post-harvest losses can be 20% in grains, 30% in tubers and 40% in fruits and vegetables (Shepherd, 1993).

The value of post-harvest grain losses in Sub-Saharan Africa is at about $4 billon a year. This lost could meet the minimum annual food requirement of at least 48 million people (Semendo, 2011). Losses occur when grains decay or when they have been infested by pests, fungi or microbes, and physical losses are only part of the equation. Losses can also be economic, resulting from low prices and lack of access to market for poor quality or contaminated food. Studies indicate that post-harvest losses of major food commodities in Nigeria are enormous as these losses result from microbial spoilage, contamination with dirt and mycotoxins, especially aflotoxins, attack by insects, birds and rodent pests as well

as nutrient deterioration and biochemical changes (Adesina,2007).

There is low adoption of available storage and processing technologies coupled with inadequate storage facilities resulting in large post-harvest losses, often in the range of 30-50% of the annual food production (Adesina, 2007; Harris and Carl, 1976). Post-harvest crop management is critical in crop production. This is due to the fact that substantial losses occur during storage especially in developing countries, a major part of which is due to insects attack (Mbah *et al*., 2007).

Presently, uses of synthetic chemicals serve as one of the most reliable and cost-effective means used in the management of losses caused by stored products pests.(Yusuf and Usman, 2010). Reducing food losses is increasingly recognized as part of an integrated approach to realizing agriculture's full potential, along with making effective use of today's crops, improving productivity on existing farmland, and sustainably bringing additional acreage into production.

There have been numerous attempts by developmental partners, governments and agencies rendering technical assistance over the years to reduce post-harvest losses in developing countries. Despite these efforts, losses are generally considered to have remained high although as noted, there are significant measurement difficulties usually encountered. One problem is that while engineers have been successful in developing innovations for drying and storage, these innovations are often not adopted by local farmers. While good on- farm drying will or reduces mycotoxins levels, this means nothing to farmers unless they receive a premium for selling dry grains to traders and mills.

There is potential for loss throughout grains harvesting and along the marketing chains. Certain shellers can damage the grain making insect-penetration easier. Incomplete threshing usually occurs in regions with high labour costs, particularly at harvest time, when labour is too scarce and expensive to justify hand stripping after an initial mechanical threshing.

Ideally, most grains should be dried to acceptable level within 2-3days of harvest (Harris *et al.,* 1976). One of the problems of assessing levels of post-harvest losses is in separating weight loss caused by the very necessary drying operations from weight loss caused by other controllable factors. Insects and motes (arthropods) can of course, make a significant contribution towards the deterioration of grains and nutrient losses caused by their activity (Proctor, 1994). Grains damaged by weevils are characterized by adult's emergent holes. Grains attacked may be virtually unfit for human consumption(Peter and Amatobi, 2000). The detection of damage may not necessarily indicate the need for control but may be an indication that loss may occur if steps are not taken to identify the source; nature and extent of damage (Lale,2002).Similarly, there have been increasing concerns over food-borne diseases and poisoning. Obviously, post-harvest management determines food quality and safety competitiveness in the market and the profits earned by producers (Adewoyin *et a*l., 2011).

Harvest System Losses include;

1. A late harvest, for example, can bring about losses from attacks by birds and other pests.
2. Insufficient drying of grains can cause losses from the development of moulds, and insects.
3. Threshing can cause losses from broken grains and encourage the development of insects.
4. Poor storage conditions can bring about losses caused by the combined action of moulds insects, rodents and other pests.
5. Transport conditions or defective packaging of grains can lead to quantitative losses of products
6. Finally, in addition to these factors, there are others which can often be partly responsible for post- harvest losses, such as for example; marketing practices, sectarian policies and other socio- economic aspects

In many developing countries, overall post-harvest losses of cereals and legumes of about 10-15 percent are fairly common. In some regions of Africa and Latin America, higher rates are found up to 50 percent of the quantity harvested (Yusuf and Ahmed,2005). They further argued that up to now, we do not have reliable data on the true level of post-harvest losses as this problem of post-harvest losses leads to the problem of sustainable food production, as farmers are discouraged from production in the face of glut and lack of adequate storage facilities. Food losses contribute to high food prices by removing part of the food supply from the market.

The broad objective of this study is to examine the post-harvest (storage) losses of sorghum among women farmers in the study area. The specific objectives include to:

1. describe the socio-economic characteristics of sorghum farmers;
2. examine the methods of sorghum storage in the study area;
3. assess the use of agro-chemicals in stored sorghum;
4. examine the spoilage and percentage of losses and monetary values of stored sorghum
5. determine the constraints of sorghum storage in the study area.

Methodology

The Study Area

The study was conducted in Kaura Local Government Areaof Kaduna State in theSouthern Guinea Savannah. The study area lies between Latitude 9 15 North and between $10^0$18 North, Longitude 8^0 East and $9^0$15 East. It covers an area of about 529 square kilometres with a population of about 222,597 (NPC, 2006) of which 107,210 (about 50%) are women. These women are predominantly farmers and participate in both livestock as well as in crop production.

Sampling Procedure and Data Collection

A multi-stage sampling technique, which involved more than one stage in the sampling procedure, was adopted as the most suitable technique. The first stage involved purposive selection of the three sampled districts namely, Kaura, Tum and Kajim. The second stage involved purposive selection of six (6) villages out of the three selected districts, and the third stage involved selecting the sampled women using the random sampling technique. A total of 91 questionnaires were administered to the sampled women were returned out of which 90 were found fit for analysis. Data was obtained with the aid of structured questionnaires and oral interviews.

Statistical Technique

Descriptive statistics which include tables, percentages and averages etc. was used to analyze the data. Estimates were carried out based on grain percentage weight loss as applied by Yusuf and Ahmed (2005).The percentage weight loss formular is specified as

$$WL = \frac{P - Q}{P} \times 100$$

Where: WL=Percentage weight loss, P=Initial weight of grains, Q=Final weight of grains

Results and Discussion

Socio Economic Characteristics of Sorghum Farmers

The result in Table1 shows that farmers of age category 41-50 (37%) and 51-60 (43%) years were the major producers and those involved in storage of sorghum. This implies that farmers consider sorghum as a staple food of the farming families. It also shows that sorghum production and storage is embarked upon by energetic women in the study area for food needs.

Table 1: Socio-economic characteristics of Women Sorghum Farmers

Variable	Number of Respondents	Percentage
Age		
21 – 30	2	02.22
31 – 40	16	17.78
41 – 50	33	36.67
51 – 60	39	43.33
Total	**90**	**100.00**
Marital Status		
Married	64	71.11
Widow	26	28.89
Total	**90**	**100.00**
Level of Education		
None	9	10.00
Adult	12	13.13
Primary School	23	25.56
Secondary School	37	41.11
Tertiary	9	10.00
Total	**90**	**100.00**
Years of Farming Experience		
1 – 10 years	10	11.11
11 – 20 years	25	27.78

21 – 30 years	30	33.33
31 – 40 years	15	16.67
41 – 50 years	10	11.11
Total	**90**	**100.00**
Number of Extension Visits per year		
2 – 4	80	88.89
5 – 7	8	8.89
8 – 10	2	2.22
Total	**90**	**100.00**
Primary Occupation		
Civil Servant	10	11.11
Farming	55	61.11
Trading	25	27.78
Total	**90**	**100.00**

Source: Field Survey Data, 2012

The marital status of the women shows that about 71 percent are married while about 29 percent are widows. This result implies that both married and widows are engaged in sorghum production and storage for the purpose of food security. Empirical result indicates that majority of the respondents had secondary school education (41.00 percent) followed by those who had primary school education (about 26 percent). Few of them had both adult education(13 percent) and tertiary education(10 percent). The overall view shows that most women were literate meaning that they could read and possibly interpret instructional materials to improve sorghum storage.

The result in Table1 shows that the farmers had experience in farming and storage ranging from decades indicating that the farmers have relevant experience that help to produce and store sorghum grains for their usage and or marketing .Occupation of these women shows that 11 percent were civil servants , about 28 percent were traders and about 61 percent were full time farmers. One of the implication of the findingis that women in the study area would need to be taught modern skills of agricultural storage as majority of the participants depend on agricultural production to improved their living standards.

Methods of Sorghum Storage

Result in Table 2 shows that farmers employed different methods of storage to ensure the preservation of the product for longer period of time.The storage methods identified among farmers in the study area were as follows: grains storage in polythene bags (about 43 percent), storage in store (about 32 percent), storage in fabricated metal silos (20 percent) and those stored in plastic containers(3.33%).

Table 2: Methods of Sorghum Storage

Method	No. of Respondents	Percentage
Storing unthreshed in a store	29	32.22
Storing in polythene bags	39	43.44
Storing in fabricated metal silos	18	20.00
Storing in plastic containers	3	03.33
Storing unthreshed in a store and polythene bags	1	1.12
Total	**90**	**100.00**

Source: Field Survey Data, 2012

Agro-chemicals used in Sorghum Storage

The result in Table 3 shows that powdered agro-chemicals (fumigants) (about 49 percent were mostly used. This was followed closely by those who used phostozine tablets (furmigant) with about 38 percent. The least was liquid agro-chemical with about 13 percent. The findings suggest that this must have been because they believe that the agro-chemicals increase storage life of the grains and reduce losses caused by rodents or insects.

Table 3: Type of Agro-Chemicals Used in Sorghum Storage

Agrochemical	No. of Respondents	Percentage
Phostozine tablets (fumigant)	34	37.77
Powdered Agro-chemical	44	48.88
Liquid Agro-chemical	12	13.33
Total	**90**	**100.00**

Source: Field Survey Data, 2012

Grain Spoilage and Naira Value

The result in Table 4 shows the average quantities of spoilage in Kilogrammes and the percentage losses per year of production in the study area. The year 2011 ranked highest with 1.6 percent with corresponding loss of N110,000. This result suggests that farmers incurred losses in physical terms which translated to monetary values in the years (2008-2011) under consideration.

Table 4: Estimated Average Grain Spoilage and Post-Harvest Losses Among Women Sorghum Farmers

Year	Total quantity of Sorghum (kg) A	Average quantity (kg) B	B as % of A	Estimated Losses (₦)
2008	43,700	300	0.7	30.00
2009	54,000	N.A.	N.A.	N.A.
2010	59,000	100	0.2	10,000
2011	67,600	1,100	1.6	110,000
2012	76,200	700	0.9	70,000

Source: Field Survey Data, 2012, N.A=not available

Constraints of Sorghum Storage

The constraints faced by sorghum farmers in Kaura LGA as established by the results of the study in Table 5 showed that untimely application of agro-chemicals (about 56 percent) was themajor problem followed by ineffective agro-chemicals on stored products (44 percent). This implies that farmers need to be guided on types of agrochemicals and time and method of application for effective storage of the sorghum grains.

Table 5: Constraints of Sorghum Storage in the Study Area

Constraint	No. of Respondents	Percentage
Untimely application of agro-chemicals	50	56
Ineffective agro-chemicals or stored products	40	44
Total	**90**	**100.00**

Source: Field Survey Data, 2012

Conclusion

The women sorghum farmers in the study area indicated that both pre-harvest and post-harvest losses control is very important in agricultural production and products. Sorghum grain storage enhanced available food for family consumption and farm income.

Recommendations

The following recommendations were made:

1. Farmers should be educated on proper storage of agricultural grains so as to increase the ratio of harvested sorghum grains available as food to man and his animals and for the market for sale.
2. Farmers should be well informed by agricultural workers, non-governmental organisations and private individuals on the dangers of wrong handling of agro-chemicals and the good skills of handling them to ensure safety.
3. Storage facilities such as metal silos, plastic containers, and assorted pesticides should be made available to farmers at subsidized and affordable prices.

References

Abubakar, B.Y. (2007). Revamping and Refocusing of National Agricultural Research. *Being Text of an paper presented at the 41st Annual Conference of Agricultural Society Nigeria, held at Ahmadu Bello University, Zaria 22nd -26th October 2007*

Adesina, M.A(2007).National Food Security Challenges: The Role of Post Harvest loss Prevention . *Being Text of Paper Presented at the Conference of the of Agricultural Society of Nigeria, held at Ahmadu Bello University, Zaria 22nd -26th*

Adewoyin,O.B; Ajayi A.J.; Fagbayide,S.D.and Esiet E.E.(2011). ChangingConcepts of Quality and Quality Management in Post – harvest Handling of pepper(Piper nigrum). *Proceeding of the 25th Farm Management Association of Nigeria (FAMAN) Conference held 5-8th Sept at the Federal College of Agriculture, Akure, edited by Odedina, S.A; Osuntade,O.B., Adebayi K., Awodun M.O and Fapohunda O.O.*

Harris K.l. and Carl J.L.(1976). Post Harvest Grain Loss Assessment Methods. A Manual Methods for the Evaluation of Post- harvest losses. American Association of Cereals Chemists.

Peter, A.E and Amatobi, C.I.(2000).Relative Resistance of Some Cowpea Varieties to Callasobruchus maculatus. *Journal of Sustainable Agriculture vol.17 No. 2/3 pp.68-75*

Lale N.E.S.(2002). *Stored Products Entomology and Acarology in Tropical Africa* Mole Publication, Nigeria pp. 15-55

Mbah O.I. ; Eketo T.O and Okorie M.N. (2007).Toxicity of Some Biopesticides to Sito philus zeamaiz on maize Storage. *Proceeding of the 41st Annual Conference Agricultural Society of Nigeria ASN held at Institute of Agricultural Research (IAR), Ahmadu Bello University, Zaria*

Nzeh, E,C.;EbohE.C.;Nweze, N.J.; Nzeh, C.D.;Eboh,R.O.; Orebiyi, J.S; Lembi J.;Ugochukwu A.I and Nwankwo U.M(2012)Adaptation to Climate Change in Nigeria Agricultural Sector and its Contemporary Challenges. In*: Proceeding of the 26th Annual Conference of the Farm Management Association of Nigeria Held at MichealOkpara University of Agriculture, Umudike Nigeria, Otober 15th-19 pp.76-83*

O.O. Olfajo, D.F. Omokore, G.N. Ankpa and S.A. Sani (eds). Pp. 661-667

*Yusuf, S.R. and Ahmed, B.I.(2005).*Effect of Application Rates of Some Plant Materials in the Control of Maize Weevil (Sitophilus zeamais) in Stored Maize. *Journal of Pure andApplied Science 8(2):180-187*

Yusuf, S.R. And Usman, R.(2010). Comparative Efficiency of Bio-nimbecidine to Pirimiphos-Methyl in the Management of Cowpea Bruchid (Callosobruchus maculatus FAB.)Infestations and Damage. *Proceeding of the 24th Annual Conference of the Farm Management Association of Nigeria held 11-14 Oct. At Adamawa State University Mubi, Nigeria. Neils, J.S; Khobe, D.; Jaa far-Furo, M.R. ; Futuless, K.N (eds.) pp. 79-81*

Proctor, D.L. (1994). Grain Storage Techniques,Food and Agricultural Organisation (FAO), Rome.

Shepherd, A.W.(1993). Economic and Marketing Aspects of Post-harvest handling of Grains, FAO, Rome.