A Review of Postharvest Losses in Fruits and Vegetables in Nigeria: The Need for an Extension Strategy

O. C. Adebooye
Department of Plant Science
Obafemi Awolowo University
Ile-Ife

and

A. J. Farinde
Department of Agricultural Extension & Rural Sociology
Obafemi Awolowo University
Ile-Ife

Abstract

The paper reviewed cases of postharvest losses of fruits and vegetables in Nigeria and identified an extension strategy to stem the losses. The paper highlighted some harvesting and handling methods that can be presented through the extension services to the farmers to stem postharvest losses. To reach the Nigerian farmers, the paper suggested the use of target system approach with integrated mass media approach, group contact method, all in combination to educate farmers on how to reduce postharvest losses. It was also obsserved that cooperative and collaborative efforts of governments, non-governmental organizations, corporations, individuals and groups are highly necessary in solving the problem of postharvest losses in Nigeria.

1.0 Introduction

In fruit and vegetable production much attention is given to increasing production by research on breeding, improved varieties, optimizing fertilizer and crop water requirements, appropriate pest and disease control and other farm management aspects. We can often ensure that high quality fruits and vegetables are produced by providing farmers with adequate production techniques under favourable growing weather conditions, the right soils and adequate moisture. However, much of the researches and energy devoted to production and marketing of fruits and vegetables will be of little value if provision is not made for proper handling to stem postharvest losses (Wills and Seberry, 1990).

Because of postharvest losses much of the effort put into production of quality food is wasted, with no financial reward. Wills and Seberry (1990) stated that all types of losses need to be considered, including weight loss, loss of quality and nutritional value, financial loss and loss of marketing opportunities. Therefore, the aim of postharvest technology is to prevent undesirable changes between harvest and consumption.

Fruits and vegetables, even after harvest, are still living. They respire converting metabolites into carbon dioxide and giving off heat, energy and water. There may be rapid metabolic changes associated with ripening and senescence such as a greatly increased respiration rate, accelerated softening, water loss, and changes in chemical constituents like pectins, starches, sugars and acids (Proctor et al., 1981). The sum total of the processes is undesirable textural change followed by biodeterioration of fruits and vegetables. Such fruits and vegetables are rendered unmarketable and uneatable in developed states of the world but may yet be consumed in developing countries due to poverty. This is probably one of the reasons why diseases that are contractable through decaying fruits and vegetables are more rampant in

developing countries of the world. Such diseases include several mouth infections, diarrhoea and dysentry.

2.0 A review of Postharvest Losses in Nigeria

Generally, food production is reducing slowly while hunger and malnutrition are on a fast increase. Booth and Coursey (1972) observed that increased food production cannot satisfy the increasing food demand unless attention is focussed on reducing postharvest losses. This will create an opportunity for providing a substantial amount of food for consumption and other uses. World production of fruits and vegetables is increasing (though slowly) with most of the increases occuring in developing regions (FAO, 1986). The increase in production can go a long way to solve the problems of hunger and malnutrition if the products are preserved in a wholesome state for future consumption. However, it is disheartening that much of the products is lost due to improper or lack of postharvest handling methods.

Joseph and Adeoti (1996) classified postharvest losses of fruits and vegetables in Nigeria into (1) damaged but marketable (2) damaged but unmarketable. They concluded that most of the losses are due principally to mechanical damage which often gives room for further damage by pathogens. In transit from northern to southern Nigeria, they found that tomato recorded higher damage than onions, while in transit from southern to northern Nigeria, oranges recorded higher losses than kolanut. In his budget speech for 1997, the Nigerian Head of State, General Sanni Abacha, stated that about 40% of food produced in Nigeria are wasted due to lack of postharvest processing and conservation, and inaccessibility of our rural community to the market.

FAO (1986) estimated that product losses between harvest and consumption account for 20-33% of all food produced. The report further stated that the size of losses varies greatly with different commodities, depending on their degree of perishability and handling history, and may reach 100% in some circumstances. Because of postharvest losses, much of the effort put into production of quality food is wasted, with no financial reward.

Leafy vegetables, according to Wills and Seberry (1990), contain about 98% water, and upon exposure to a dry atmosphere in the tropics for as short as two hours, they may lose 10% of their weight, resulting in loss of quality and financial reward. The water content of fruit vegetables has been reported by several authors; tomato, 95% (Omole, 1989); onion bulb, 86% (Pursglove, 1985); mango fruits, 87% (FAO, 1986); and banana/plantain 70% (Purseglove, 1985). The degree of perishability has been shown to be directly related to the water content of fruits and vegetables (AVRDC, 1990; Wills and Seberry, 1990; Duckworth, 1966 and Okigbo, 1990).

Experience in Nigeria has shown that postharvest losses in fruits and vegetables occur mainly as a result of inappropriate harvesting methods, poor handling technique and complete lack of storage facilities.

Therefore, in a broad sense, postharvest losses can be classified as:

a. Poor harvesting methods. This will include:

   i. throwing stones to harvest fruits

   ii. using "go-to-hell" to harvest fruits and allowing the fruits to drop directly on the ground.

   iii. shaking orange and pawpaw trees to harvest ripe ones.

   iv. cutting branches of Chrysophyllum albidium (agbalumo) to harvest ripe fruits.

   v. harvesting of fruits at the wrong point, i.e. wrong cut from the parent.

b. Poor handling techniques. This will include:

i. throwing harvested fruits and vegetables into basket without any consideration for impact or injury

ii. loading fruits into vehicles with great impact.

iii. off-loading fruits on to the ground with great impact.

iv. pressing and forcing fruits and vegetables into containers.

v. mixing undamaged with damaged fruits and vegetables.

vi. mixing disease-infected with disease-free fruits and vegetables.

c. Complete lack of storage facilities. Generally for fruits and vegetables in Nigeria, there is no organised storage system. Even at the local level where majority of the food is produced, farmers stand to lose all their products whenever there is a glut in the market.

The Central Bank of Nigeria (CBN) (1994) report on major agricultural products in Nigeria listed 29 crops that did not include tomato, onions, peppers, citrus and mango. The list included "Vegetable" with no clear distinction between leaf and fruit vegetables. Thus, the data given by the report are of little value and are unreliable for the purposes of this presentation.

In order to avoid using unreliable national data, an attempt is made in this paper to use data on fruits and vegetable yields published by Nigerian scientists from Nigerian universities and experimental results of the Nigeria Horticultural Research Institute (NIHORT), Ibadan. The average leaf and fruit vegetable yields reported are as stated below:

Tomato: 5 tons/ha in southern Nigeria (Alofe and Somide, 1982)

20 tons/ha in northern Nigeria (Simons and Sobulo, 1975)

Pepper: 2.5 tons/ha in southern Nigeria (Aliyu et. al, 1996)

3.09 tons/ha in northern Nigeria (Ado, 1991)

Okra: 4.8 tons/ha in southern Nigeria (Adeboye and Oputa, 1996)

5.2 tons/ha in northern Nigeria (Katung et. al., 1996)

All data on leaf vegetables yields were obtained from publications of NIHORT, Ibadan. They are as follows:

Amaranth	26.8 tons/ha
Celosia	24.6 tons/ha
Solanum	27.2 tons/ha
Telfairia	40.4 tons/ha

3.0 Estimation of Postharvest Losses

Calculations were based on postharvest losses of 20-33% reported by FAO (1986) and 40% given by General Sanni Abacha (1997). Therefore, five percentages were chosen between 20% and 40% i.e. 20%, 25%, 30%, 35% and 40% and losses were calculated per hectare.

Table 1

Estimation of postharvest losses in fruit vegetables

Fruit Vegetable	Fruit Yield (tons/ha)	Estimated Losses (tons/ha)				
		20%	25%	30%	35%	40%
Tomato SN*	5.00	1.00	1.25	1.50	1.75	2.00
NN	20.00	4.00	5.00	5.00	7.00	8.00
Pepper SN	2.50	0.50	0.63	0.75	0.88	1.00
NN	3.09	0.62	0.77	0.93	1.08	1.24
Okra SN	4.80	0.96	1.20	1.44	1.68	1.92
NN	5.20	1.04	1.30	1.56	1.82	2.08

*SN = Southern Nigeria

NN = Norhern Nigeria

Table 2

Estimation of postharvest loses in leaf vegetables

Leaf Vegetable	Leaf Yield (tons/ha)	Estimated Losses (tons/ha)				
		20%	25%	30%	35%	40%
Amaranth	26.80	5.36	6.70	8.04	9.38	10.72
Celosia	24.60	4.92	6.15	7.38	8.61	9.84
Solanum	27.20	5.44	6.8	8.16	9.52	10.88
Telfaria	40.40	8.08	10.1	12.12	14.14	16.16

Postharvest losses were also calculated on indigenous leaf vegetables. Leaf yields obtained by Adebooye (1996) were used.

Table 3

Estimation of postharvest losses in indigenous leaf vegetables

Indigenous Leaf Vegetables	Leaf Yield (tons/ha)	Estimated Losses				
		20%	25%	30%	35%	40%
Basella alba	30.8	6.16	7.7	9.24	10.78	12.32
Grassocephalum Crepidoides	25.4	5.08	6.35	7.62	8.89	10.16
C. biafrae	40.8	8.16	10.2	12.24	14.28	16.32
L. taraxacifolia	28.6	5.72	7.15	8.58	10.01	11.44
S. nigrum	27.2	5.44	6.8	8.16	9.52	10.88
Celosia trigyna	27.6	5.52	6.9	8.28	9.66	11.04

Table 1, 2 and 3 show the estimated postharvest losses on the fruits and leaf vegetables that are consumed in Nigeria. It can be suggested that the longer the products stay after harvest the more the degree of biodeterioration. There is no doubt that losses can reach 100%, especially in tomato if there is a glut in the market.

The amount/quantity of products lost between 20 and 40% is so high that efforts have to be made to stem this loss. Establishment of processing units and storage systems is the likely option that can put the postharvest losses under control. However, majority of the farmers live in rural areas where there is no electricity supply and majority of these farmers are illiterates.

Thus, there is the need to employ extension strategies to educate farmers on how their harvesting practices/methods and handling methods can reduce or completely eliminate the fast deterioration of fruits and vegetables. If fruits and vegetables are carefully handled at harvest, there is the assurance that injury will be minimal and storage life can be extended, at least, by some days.

Since most farmers live in rural areas where there is usually no electricity supply, storage systems that require electricity will not be feasible. Therefore, low-input technology like those mentioned in 1997 Budget Speech may be a viable alternative.

For farmers to adopt a new harvesting method or postharvest handling or low-input technology, there is the need for intervention by extension agents. Therefore, the major extension strategies that can be employed to assist farmers to reduce postharvest losses of their fruits and vegetables are discussed below.

4.0 Extension Strategies for Prevention of Postharvest Losses

It is important to clarify and align extension objectives at the policy level so that they reflect the overall agricultural development goals of the country concerned (Swanson et. al., 1989). The overall agricultural policy of Nigeria now is to harness all available resources to increase agricultural productivity and rural incomes. Rural incomes can be increased if the degree of postharvest losses is minimised as enumerated in the 1997 budget speech. This goal points to the fact that the government is committed to increasing agricultural production as well as broad-based agricultural development. To achieve a broad-based agricultural development, extension must focus on the technological needs of all categories of farmers, not just a single category of large,

progressive farmers who are already high access farmers. The goal of extension should be to serve the need of all, irrespective of sex, age and socio-economic background, but especially the low-access farmers who still produce most of our agricultural output. To do so will result in more broad based technology utilization found in rural Nigeria. The scientists in all the research institutions, faculties of agriculture and universities of agriculture in Nigeria should adopt strategies of integrated approach for improvement on the control of postharvest losses or prevention techniques for fruits and vegetables. The improvement will include, according to Joseph and Adeoti (1996); Improvement in production zones, harvesting methods, handling, transportation, distribution channels, extension services and finance and recommendation.

At this level, the development of postharvest losses prevention techniques for fruits and vegetables could be enhanced through the 'farmer-back-to-farmer' model, which emphasizes involvement of farmers in the identification of farm constraints and in the testing and fine-tuning of proposed technologies.

This is in contrast to the 'top-down' approach or model where the scientists, because of their education or status, "know" what is best for the farmer's situation. The 'farmer-back-to-farmer' model starts from the assumption that research must begin and end with the farmer. The farmers and the extensionists are active in the research process. They contribute their practical knowledge of farming, their perception, evaluation potentials and tested solutions. The 'farmer-back-to-farmer' model, according to Rhoades et. al., (1985), recognises four distinct activities for effective technology transfer in any system.

These are:

i. diagnosis to defined problems; this could be enhanced through base data analysis or exploratory survey of the Nigerian society;

ii. interdisciplinary team research to develop potential solutions. The likely disciplines for prevention/control of postharvest losses of fruits and vegetables are: agro-climatology, entomology, plant pathology, agricultural engineering, civil engineering, agronomy, food science and technology and agricultural economics, agricultural extension and rural sociology;

iii. On-farm and experimental station testing and adaptation of proposed solution(s) to farmers' conditions - this stage occurs at the research stations and on farmer's farm depending on the type of fruit(s) and vegetable(s) and the part of Nigeria where they are grown;

iv. Farmer evaluation and adaptation of technology, and monitoring of its adoption.

Farmers are, and should be, active participants in all the four stages which are closely linked in a continous information flow process. Because the farmer is involved in the development of fruit(s) and vegetable(s) harvesting, handling, packaging, storage, transportation and marketing techniques as stated above, there is the likelihood that the results would be of more practical value to the farmers than when the technique(s) are alien to them.

At this stage, only few farmers have the knowledge and adoption of the control/or prevention of postharvest loss techniques. The few farmers are participants in the development process. The practical techniques available to these few farmers need to be taught to the mass of Nigerian citizenry, e.g. fruits and vegetable farmers in direct production as well as wholesalers and retailers.

To reach the Nigerian masses with these techniques, the target.system approach with integrated communication strategies is recommended.

4.1 **Target system approach:** This involves identification of target group/system and identification of the most effective method(s) to reach them, which may be through:

i. mass media i.e. radio and television, cinema, video films (electronic media) and posters, news bulletin, news papers (print media)

ii. group contact method(s) e.g. group meeting, group discussion, demonstration, lecture/class and farm tour/field day and agricultural shows; and

iii. individual contact method which in most cases is farm or office visit.

Mass media approach: is greatly emphasised here because of its advantage of reaching many people at a time with the same information within a relatively short time (Farinde & Jibowo, 1995).

Also, there are few extension agents to reach all the farmers at a time with the same message at equal intensity.

The use of mass media approach involves the use of television and radio to relay extension packages on each of the postharvest loss prevention techniques to the target audience. This could be done in two ways:

i. rural broadcasting, and

ii. media house agricultural programme.

Rural Broadcasting: The aim of rural broadcasting is to reach rural people (target audience) with agricultural information/techniques which are culturally acceptable to the people in the language they understand. Rural broadcasting consists essentially of the following:

a. Training of the producer and packaging of the extension message(s) in a useful, understandable and acceptable form to the target audience.

b. Ensuring that the agricultural broadcast corresponds to farmers' need and time. This problem could be solved if farmers are participants in the development process of the postharvest los prevention techniques. The time of broadcast could be in the evening when farmers are back from the farm.

c. Development of cassette-tape information programme to be used by the village extension agent at the village television/radio site to teach or remind the farmers of what they heard/taught/learnt during the television/radio broadcast. In addition, use of cinema and video films is highly recommended.

Media house agricultural programme: The aim is to broadcast to Nigerian people, most importantly, farmers, a well-packaged extension information either on weekly or fortnightly basis. This will complement other methods of reaching the farmers.

The media house strategies would consist of:

i. Training the producer or presenter of an agricultural programme such as documentary programme on appropriate harvesting handling, packaging, transportation, storage and marketing techniques of fruits and vegetables as developed through the 'farmer-back-to-farmer' model.

ii. Identification and invitation of competent personalities on each of the postharvest loss prevention technique(s) as guest on the Guest Forum slot. Questions and answers shall be used in local language. The time and topic to be treated should be made known to the local people by the village extension agents (VEAs).

iii. Transformation of the extension message into drama on the drama slot. This needs recruitment of capable hands to play major parts or scenes in the drama. The above three outlets of reaching the farmers (documentary programmes,

Guest Forum and Drama) are also possible through rural broadcasting.

However, the knowledge and role of the extension agents is highly fundamental to the success of the mass media strategies as explained above. The education or training of the extension personnel to update and upgrade their knowledge about the postharvest loss prevention techniques, extension methodology and preparation and use of the media method are very vital. The extension agent should be trained regularly through workshops, seminars or fortnightly training sessions as operated in the Training and Visit (T & V) extension system. The technical knowledge of harvesting, handling, packaging, transportation storage, processing, marketing and postharvest treatment is well explained (Adekunle and Oladoja, 1996).

4.2 **Group contact method:** Group contact method brings the extension worker into face-to-face interaction with several farmers on the farm. Some of the group methods that could be used with rural broadcasting and media house agricultural programme include method and result demonstrations, group meeting and discussion, lecture and farm tour/excursions. The farmers, the wholesaler and retailers, transporters and entrepreneurs could be organised into groups of primary producers, distributors and marketers of fruits and vegetables in each locality.

Any of the group methods could be employed to reinforce what has been taught and learnt during radio and television broadcast. Result demonstration is usually done on the farm of a co-operating farmer (which will now be a group farm) to show the superiority of new farm practices over the local ones, or a way of showing a wider audiene what some farmers are already doing. Method demonstration is employed to teach new skills i.e. the postharvest loss prevention techniques from harvesting to marketing stage.

Group meetings and discussion could be employed by each of the groups; producers, distributors and marketers of fruits and vegetables in the rural areas to understand fully the extension packages from radio and television broadast through brainstorming and question and answer session. The village extension agent should provide technical guidance to such discussion which should be preceded by a lecture. Farm tour and farm visit/excursions through which farmers seek information and advice where available could be used to widen farmers' social horizon of agricultural information.

It must, however, be emphasized here that the target audience approach with integrated communication strategies could only work effectively if the efforts of government, groups, non-governmental organisations (NGOs), private organisations and individuals are combined to provide:

i. television and radio centres for each target community or group.

ii. electricity to rural areas

iii. all-season motorable feeder roads

iv. cottage industries that process the fruit and vegetables into finished products

v. storage facilities and

vi. marketing facilities

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