Re-useable plastic crates as a veritable tool for handling of fresh fruits and vegetables: Lagos State as a case study

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Nigerian Stored Products Research Institute (NSPRI) developed plastic packaging crates of International standard and best practices known as reusable plastic crates (RPCs) in lieu of raffia woven baskets (RWBs) for the transportation and storage of fresh fruits and vegetables in 1986. In collaboration with Lagos State Ministry of Agriculture, Global Alliance for Improved Nutrition and Postharvest Loss Alliance for Nutrition (GAIN-PLAN Nigeria) and Union of Vegetable Farm Produce Marketers, a state-wide market capacity building and sensitization workshops, as well as Investigative Research Survey (IRS) on the benefits of using RPCs in lieu of RWBs for food safety, stack-ability, re-useability, ergonomics, availability as well as economic enhancement of FFVs was conducted. Eighteen markets and two transport unions (RTEAN and NURTW) were selected for the workshops and IRS. Five key informants across each category of stakeholders (farmers, transporters, marketers and traders) were randomly selected from each market. Hands-on-practical assessment showed that 20 kg capacity tomato in RPC cost $5.5 compared to 50 kg tomato in RWB at $10.9 with product life span of 3 years long haul and one trip respectively. All the stakeholders involved in the IRS cum capacity building workshops concluded that transiting from RWBs to RPCs is for reduction of postharvest loss between harvest and consumption, food quality and safety and increased income for all.

Key words: Key informants, re-useable plastic crates (RPCs), Raffia Woven Baskets (RWB), fresh fruits and vegetables (FFVs).

INTRODUCTION

Fresh Fruits and Vegetables (FFVs) are not only tender but they carry life and so should be handled with care. Tomato is an important ingredient that is widely consumed in Nigeria. They are commonly eaten in their fresh forms or processed into puree, paste, sauce, dried and whole peeled forms, likewise oranges and plantains. According to Babarinsa et al. (2018), transportation of FFVs in Nigeria from farm to collection centers result in up to 10% loss and transportation to the market result in up to 40% loss in revenue and also create the burden of waste management in the environment. Nigerian Stored Products Research Institute (NSPRI) promoted stackable and nest-able re-useable plastic crates (RPCs) of International Standard and best practices for...
transportation and storage of fresh fruits and vegetables (FFVs) from North to South and vice versa in the early 1990s for tomatoes/onions from Kano to Ibadan and Port Harcourt; and oranges from Ibadan to Kano and plantain from Port Harcourt to Kano. The shallow RPCs were used for tomatoes due to the softness of the fruits, while the deep RPCs were used for sturdy fruits such as oranges, mangoes, plantain, pineapples (Okonkwo et. al., 2018); which has reduced the loss of tomatoes to less than 20% of production. However, this innovative technology had not been widely adopted by the stakeholders because of unwillingness to change and cost implication.

In 2013, Lagos State Government (LASG) Ministry of Agriculture (MOA) started advocating the use of produce vehicles and plastic crates. GEMS4 an NGO funded by UKAID had been on the project of ensuring change from raffia/palm baskets (RWBs) to RPCs in transportation of tomatoes from north to south since 2012. In August 2015, GEMS4 transported tomatoes in RPC to Mile 12 market in Lagos. In May 2017, PLAN Nigeria in collaboration with GEMS4 and RF Yield Wise Initiative organized a crating workshop to create awareness on the need for use of RPCs in FFVs value chain in Lagos, Lagos State.

LASGMOA and NSPRI in conjunction with union of perishable farm produce traders held a one day stakeholders’ forum to kick off the capacity building/market sensitization/awareness creation on produce vehicle/crate project as well as conduct an Investigative Research Survey (IRS) to ascertain the benefits of RPCs, these are the objectives of the study which also include but not limited to; need for improved handling, packaging, transportation and preservation of FFVs using RPCs by stakeholders in Lagos State.

METHODOLOGY

Description of the study area

Lagos State, Nigeria (Figure 1) is situated in the Southwestern geopolitical zone of Nigeria. It shares boundaries with Ogun State both in the North and East and is bounded in the West by the Republic of Benin. Its Southern border stretches for about 180 km along the coast of the Atlantic Ocean. The State occupies an area of 3,577 km² landmass with about 22% (786.94 km²) representing the Lagos lagoons. Lagos State is home to about 20 Millions Nigerians (WPC, 2016) spread across the entire 20 Local Government Areas. The state is very rich in different forms of aquatic ecological zones that support different varieties of fish species and aquatic organisms,
Table 1. Comparative indicators for RWB and RPC.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>RWB</th>
<th>RPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Loss</td>
<td>40%</td>
<td>5%</td>
</tr>
<tr>
<td>Product life span</td>
<td>1 trip</td>
<td>3 years Long haul</td>
</tr>
<tr>
<td>Truck capacity</td>
<td>450 baskets</td>
<td>750 crates</td>
</tr>
<tr>
<td>Unit price</td>
<td>$1.1</td>
<td>$7.4</td>
</tr>
<tr>
<td>Health status</td>
<td>Predispose to sickness</td>
<td>Healthy life</td>
</tr>
<tr>
<td>Income</td>
<td>Little income</td>
<td>Increased income</td>
</tr>
<tr>
<td>Cost effectiveness</td>
<td>Less cost effective</td>
<td>More cost effective</td>
</tr>
</tbody>
</table>

Source: NSPRI/PLAN.

thereby providing productive fishing opportunity for fisher. Lagos is home to traders, artisans, industrialist, civil servant, and office worker.

Methods
LASG (MOA) in collaboration with PLAN Nigeria and NSPRI in conjunction with Union of Perishable Farm Produce Marketers (UPPFPM) and Transport Unions conducted capacity building/sensitization workshops and Investigative Research Survey (IRS) on Produce Vehicle/Crate Project for 18 markets in Lagos State, Nigeria between May and September 2017. UPPPM comprised four categories of stakeholders which include farmers, transporters, marketers and traders; Transport Unions comprised of Road Transport Employer Association of Nigeria (RTEAN) and National Union of Road Transport Workers (NURTW), these stakeholders were regarded and selected as key informants in the Investigative Research Survey (IRS) method carried out in the course of the capacity building.

Description and operation of plastic crates
NSPRI crate was used as a case study. Raw materials required for production are readily available in Nigeria. The manufacturing company purchase the raw materials from Petrochemical at Eleme, Port-Harcourt, Rivers State. It is made of plastic (LDPE) material. The loadable dimension = 520 mm × 360 mm×150 mm. There are intermittent grills on sides and bottom of the crate for aeration (Plate 1). Weight = 1.1 kg. Capacity = 20 kg when loaded with tomatoes. Colour = any desired colour though colour code could be specified. Stacking height = any desired height depending on Packing House and or height of Transportation vehicle, specifically 8-10 layers. There are two carriage slots situated at the two short sides for handling of the crate. The short sides were made male and female. When loaded, the crates are stacked male side on female side in alternating pattern; while it is male on male and female on female when returning empty crates. RPC as an innovation in transportation, packaging and storage of FFVs was compared with RWB using certain indicators which includes; percent loss, product life span, income, health status, and cost effectiveness as shown in Table 1.

RESULTS AND DISCUSSION

Post-harvest loss reduction
It was observed across all the markets visited that certain FFVs took preferences over the others; and are specific to a particular market location. For instance, at Mile 12 market in Kosofe LGA of the state, key informants (selected stakeholders /participants in the capacity building) interviewed elicited responses on reduced postharvest loss and increased income in tomato venture. It was noted that tomatoes transported in RPCs recorded about 5% loss compared to 40% loss in RWBs depicted in Figure 2, this is in line with the submissions of Babarinsa et al. (2018) and Idah et al. (2007), the authors asserts that packaging containers used in transportation of FFVs contributed immensely to the losses recorded in these commodities. Their study further revealed that baskets incurred high in-transit damage of 34.72 to 49.78% (with 41.12% average), while the use of plastic crate reduced this damage to a level of 4.69 to 5.24% (with 4.92% average), thereby reducing damage in crates by 88%.

More income and better hygiene for stakeholders
IRS conducted reveals tomatoes in 20 kg RPC sold higher than in 50 kg RWB. Hands-on-practical assessment showed that 20 kg capacity tomato in RPC cost $5.5 compared to 50 kg tomato in RWB at $10.9. Key informants across all the categories agreed that most customers preferred buying tomatoes in RPCs as physical inspection was easier. At Itire market in Surulere LGA of the state, oranges in RWB loaded and transported in articulated trucks were seen offloading; this was followed by sorting into wholesome and unwholesome ones, subsequently, the wholesome ones were put in 20 kg RPCs, taking into consideration the size and number of oranges that conforms with the agreed measurement by the stakeholders, this also attracted higher prices.

At Ketu and Idi-Oro markets in Kosofe and Mushin LGAs respectively, massive activities in plantain were observed, ranging from offloading from articulated vehicles/trucks, to sorting into wholesale and retail sales Key informants in the trading category observed that they have been selling in a hygienic environment as a result of reduced punctured and rotten FFVs which has increased
their income in the business.

**Life span and cost effectiveness**

RPCs are made of plastic (LDPE) material which confers on it the re-usability characteristic. It is rigid and can stand all weather conditions. Key informants in the transportation category affirm that RPCs which costs $7.4 has a life span of 3 years long haul; whereas RWBs valued at $1.1 can only serve for one-trip haulage described in Table 1. This is a great relieve for them as it has saved them lots of cash and having to regularly restock RWBs for haulage of FFVs.

**Markets structure and transect walk**

Meetings with key informants across the four categories revealed multi-level structures in administrations of the market activities. Markets executives exist from the National representatives to State as well as Local Governments (LGAs); ditto payments of dues, levies, daily tickets, and fines. It also cut across major ethnic divides as certain markets have Arewa and Oodua Headships. Reason for these was to allow religious harmony and peaceful co-existences amongst the ethnic groups. With the permission of the market executives, a transect walk conducted in each markets revealed various market gates, markets sheds with tables, chairs and slabs, trees which prevented direct impact of sunshine, truck packs, administrative buildings with meeting halls, worship centers, convenience buildings, wooden and concrete electricity poles, and waste bins managed by LAWMA. The fore-mentioned are common features in all the markets; though more pronounced in certain markets than others.

**Netted articulated vehicles**

Key informants were encouraged to adopt the use of Netted Articulated Vehicles (NAV) that allow aeration which has been found to have slowed down ripening process and prevent loss. Recommended NAV range from 1 to 15 tonnes capacity vehicles; these the transport unions referred to as 4, 6, 10 and 14 tyres. The carriers/loaders commented that they no longer have bruises and injuries on their palms and hands since they started loading and offloading FFVs in RPCs (Figure 2, Table 1 and Plates 1 to 5).

**CONCLUSION AND RECOMMENDATIONS**

The IRS aspect of the capacity building through key informants revealed that adoption and use of RPCs was indeed a veritable tool for handling of FFVs; due largely to drastic reduction in losses, improved fruit ventilation, increased income amongst others. In line with the findings of this research survey, policy makers must demonstrate the willingness to support the effort of NSPRI/PLAN/GAIN towards making the use of RPCs throughout the States of the Nigerian Federation a vital policy for postharvest loss reduction in FFVs.
Plate 1. Re-Useable Plastic Crates developed by NSPRI.

Plate 2. RPC re-useable plastic crate with tomato.

Plate 3. RWB Raffia woven basket with tomato.
CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

ABBREVIATIONS

RPCs, Re-useable Plastic Crates; RWB, Raffia Woven Baskets; FFVs, Fresh Fruits and Vegetables; NSPRI, Nigerian Stored Products Research Institute; GAIN, Global Alliance for Improved Nutrition; PLAN, Postharvest Loss Alliance for Nutrition; LASG (MOA), Lagos State Government (Ministry of Agriculture); UPFPM, Union of Perishable Farm Produce Marketers; LAWMA, Lagos State Waste Management Authority; NAV, Netted Articulated Vehicles; IRS, Investigative Research Survey; RTEAN, Road Transport Employer Association of Nigeria; NURTW, National Union of...
Road Transport Workers.

REFERENCES


