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Effect of Storage on the Pasting Characteristics of Yam Tubers

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ABSTRACT
Yam is a popular root and tuber crop which is important as a dietary staple and potential export crop. Storage of yam tubers is an age long practice in yam growing communities of West Africa, while pasting characteristic is an important indicator of potential utilization of yam tubers. The study was carried out to investigate effect of storage of the tubers on their pasting characteristics. Six varieties each of *D. alata* and *D. rotundata* were used for the study. At harvest, the tubers were divided into two groups. The first group was stored in a conventional open-air yam barn for four months, while tubers in the second group were not stored. Pasting characteristics of both fresh and stored tubers were determined by Rapid Visco Analyser (RVA). The result showed that the effect of storage on the yam tubers were species dependent. In *D. alata* there was an increase in peak viscosity (231.36 to 257.56 RVU), breakdown (71.68 to 122.47 RVU), setback (42.58 to 65.99 RVU), while there was a decrease in most of the parameters except break-down and setback viscosities in *D. rotundata*. Generally, a decrease in peak viscosity, holding strength, final viscosity and peak time of the yam tubers during storage was observed, while the breakdown and setback viscosities of the tubers increased significantly ($p < 0.05$) on storage. The industrial implication of this is that starches of stored tubers may have high retrogradation tendencies but more resistance to shear-thinning and have more paste stability during processing.

Keywords: Yam, storage, pasting, viscosity.

Introduction
Yam is a popular starchy staple in West Africa. It constitutes a nutritious, high carbohydrate and high fibre food source. Yam is prized for its excellent eating qualities and potential for being an export crop. Yam as a starchy staple in West Africa is of higher per unit weight fresh tuber than cassava, cocoyam or taro (Orkwor, 1998) and hence generates more income in local markets than these other crops (Tamiru *et al.*, 2008).

Storage of yam tubers is a popular farming practice in West Africa. It is usually done principally to ensure availability of yam tubers during the hunger period of the year (November to June) and to provide seed for the next planting season. Quality of the tuber for the production of yam-based food products is a major criterion for acceptance of yam varieties by the stakeholders: farmers, processors and consumers (Otegbayo *et al.*, 2010). The food quality of stored yam tubers is usually preferred than the fresh yam tubers, hence it is usually more expensive than fresh yam tubers in the market. This is probably because of its perceived better food quality (especially textural quality and taste) compared with fresh tubers (Otegbayo *et al.*, 2011).

Pasting is a result of a combination of processes that follows gelatinization from granule rupture to subsequent polymer alignment due to mechanical

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shear during heating and cooling of starches (Anonymous, 2003). It has been widely reported as an important indicator of cooking and textural quality in foods (Be Miller, 2011; Zhang *et al.,* 2011) and especially textural quality in yam food products such as pounded yam (Otegbayo *et al.,* 2006). It is also an important indicator of the functionality and potential utilization of yam starch (Tamiru *et al*., 2008; Otegbayo *et al*., 2014). The most commonly cultivated yam species in West Africa yam belt (Nigeria, Ghana, Togo and Cote d'ivoire) are *Dioscorea rotundata* Poir *and D. alata* Linn.

Yam is a multi-species crop in which inter and intra-specific variations in their quality attributes have been reported (Egesi *et al.,* 2003; Tamiru *et al*., 2008). According to Otegbayo *et al*., (2011), the effect of storage on the food quality of yam tubers is species dependent and there was pronounced storage effect on *D. rotundata* than *D. alata* tubers. This study was thus conducted to determine the effect of storage of *D. rotundata* and *D. alata* tubers on their pasting characteristics an important indicator of their potential end use.

Materials and Methods

Fresh yam tubers from six varieties of each of *D. rotundata (*Danacha, Lasinrin, Olodo, Abi, Ehuru and TDr 96/02229) and *D. alata* (Florido, TDa 297, TDa 85/00250, TDa 95/00328, Weredede and Agbo) obtained from the yam germplasm of yam breeding unit, International Institute of Tropical Agriculture (IITA), Ibadan were used for this study.

Storage

At harvest a batch of healthy looking tubers was sorted out from each variety, and divided into two groups. The first group was stored in a conventional open – air yam barn (mean temperature 27.4 ± 3.8 ^{o}C; mean relative humidity 52.9 ± 22.4%) for four months before use. Yam tubers in the second group were not stored but used as fresh tubers.

Determination of pasting characteristics

The pasting characteristics of both fresh and stored tubers were studied according to the method of Otegbayo *et al.,* (2006). The yam tubers were peeled, washed, diced and homogenised with a calculated amount of water in a warring blender (Warring blender 21/8110ES, Model 38BL40, Christison Particle Technologies, Gateshead, UK) for 15 min. The blender was used in short bursts to avoid heat generation during the blending. The weight of the tubers used and volume of water was calculated according to the RVA manual (2003), as reported by (Otegbayo *et al.,* 2006).

The weight of starch used for RVA analysis was calculated by correcting it to the dry weight basis by this formula:

Corrected sample weight for RVA (S) = (A x 100) / Sample DM

Volume of water used = (W) =25 - (S-A)

Where A = Sample weight (depending on the type of sample, this is taken from the general guide on weight of sample from RVA manual)

S = Corrected sample weight for RVA
M = Actual moisture content of the sample. W = volume of water used

The pasting profile of yam paste from both fresh and stored yam tubers were studied by means of a Rapid Visco Analyser (RVA) (series 4, Newport Scientific PTY, LTD. Warriewood, NSW, Australia) with the aid of Thermocline for Windows (version 1.1 software, 1996). Parameters studied were: peak viscosity, holding strength, breakdown, final viscosity, setback, peak time and pasting temperature. The 13-min profile was used: idle temperature 50^{o}C for 1 min, then paste was heated from 50^{o}C to 95^{o}C in 3 min 45 sec and then held at 95^{o}C for 2 min 30 sec. The sample was then cooled to 50^{o}C over a 3 min 45 sec period, followed by a period of 2 min where the temperature was controlled at 50^{o}C.