Food Chemistry **47** (1993) 7–10

Storage properties of melon seeds (*Cucumeriopsis edulis*)

O. N. Ubani,* J. S. Opadokun, J. O. Williams, A. Akimnusi, D. A. Akano & J. N. Ikeorah

Nigerian Stored Products Research Institute, PMB 5044, Ibadan, Nigeria

(Received 27 November 1991; revised version received and accepted 11 August 1992)

Unshelled melon seeds (ex Fiditi Nigeria) fumigated and stored at ambient conditions for 10 months in five different containers (metal drum, plastic bucket, clay pot, polythene lined jute bag and ordinary jute bag) were sampled at 3 monthly intervals for chemical, microbiological and entomological analyses. The oil content of the seeds in all containers increased by 0·37–3·03%, while the protein content of the seeds rose by 5·8–7·48%. No container effect on the chemical composition of the seeds was apparent. External and internal mouldiness of the seeds increased by 39–59% and 12·4–19·4% respectively in all the containers. Aflatoxin contamination was not detected in the seeds. The high level of mouldiness was reflected in the increase in the free fatty acid content of the seeds (4·23–5·57%) in all containers.

Insect damage to seeds was 14·0% in jute bags after 9 months in storage. The initial germinability of the seeds was 70%. There was a significant decrease in germinability at the end of the storage period being lowest (8·0%) in the clay pot and jute bag.

INTRODUCTION

Melon seeds (*Cucumeropsis edulis*) are produced in the semi-savannah (Middle Belt) zones and the humid rain forests of Southern Nigeria. The seeds (Egusi) are a very popular condiment in local soups and stews. When freshly harvested and washed, melon seeds are roasted with the shells and eaten as a snack in some parts of Nigeria. The oil content is also extracted by local methods and hawked for sale, while the cake is baked and sold as a snack.

Much work has been carried out on the storage of oil seeds such as cocoa, groundnuts and cotton seeds (Opadokun *et al.*, 1976; Oyeniran, 1977), but there is a paucity of information on the storage properties of melon seeds considering their importance in the diet of most Nigerians. Melon seeds are a source of oil and protein. Oyenuga (1968) reported that melon seeds, when used as the main source of protein in a well balanced ration for rats, were readily digestible and their biological value was inferior only to that of animal protein.

The handling and storage practices prior to sale by farmers who produce melon seeds differ. Most farmers wash the seeds after removal from the gourds before drying, but others, especially from the Western parts of Nigeria do not wash the seeds before drying, thereby rendering the melon seeds messy and unattractive. These practices may be an important factor in the storability of the seeds. We therefore decided to study the effect of medium term storage on the quality of melon seeds produced in Oyo State of Nigeria.

MATERIALS AND METHODS

Unshelled melon seeds were purchased from the same locality in Fiditi, Oyo, where they were produced. The seeds were sun-dried and fumigated with aluminium phosphide (phostoxin) before storage in the following containers: metal drum with lid, air-tight plastic bucket, clay pot with polythene cover, polythene-lined jute bag, and ordinary jute bag. Each storage container had two replicates of 10 kg of melon seeds. The containers were kept on the shelf at ambient conditions.

Chemical, microbiological and entomological studies were carried out on the seeds, and subsequent sampling for the above studies was at 3 monthly intervals. The quality of the melon seeds was assessed during storage using the following parameters: proximate analysis of the seeds (percentage moisture, crude fat, free fatty (FFA) acid and crude protein), level of mouldiness, aflatoxin content, insect damage and percentage germinability.

The AOAC (1980) method was used for the proximate analysis. After sampling, the seeds were shelled and ground for analysis. Moisture content was deter-

* To whom correspondence should be addressed.

Food Chemistry 0308-8146/93/$06.00

Table 1. Quality assessment of melon seeds during storage in metal drum at ambient conditions

Period of sampling (month)	Moisture (%)	Mouldiness (%)		Aflatoxin content (ppb)	Crude fat (%)	FFA (%)	Crude protein (%)	Insect damage (%)	Germinability (%)
		External	Internal						
Initial									
November	6·12	18·00	5·60		53·77	4·37	24·0	0	70·00
March	5·18	50·00	13·00		55·54	4·27	27·6	0	65·00
June	4·92	57·00	4·10		55·59	5·29	26·7	0	50·00
September	4·52	66·00	21·00		54·18	9·94	30·3	4	30·00

mined by the air oven method at 104 ± 2°C with a ventilated oven. The crude fat was extracted with *n*-hexane using a Soxhlet extraction unit. Free fatty acid was determined by titration with standardized sodium hydroxide. Crude protein was determined by the semi-micro-Kjeldahl method using selenious powder as catalyst.

The level of mouldiness was determined by a direct plating method. Some of the melon seeds were shelled and surface-sterilized with 70% ethanol and washed in three changes of distilled water. The seeds were then plated aseptically on molten malt extract agar to which penicillin and streptomycin had been added to suppress bacterial growth. The same procedure was carried out with unshelled seeds.

The aflatoxin content was determined by the EEC method of aflatoxin analysis (Schuller & Egmond, 1982). The ground material was extracted with chloroform and methanol. The eluate was evaporated to dryness on a water bath. The residue was dissolved with a known volume of chloroform and subjected to thin-layer chromatography on silica gel using diethyl ether/methanol/water mixture as the development solvent. The aflatoxin content was estimated using U.V. light (long wave) by comparison with a known aflatoxin standard.

The germinability of the seeds was determined by embedding a known number of seeds in moist cotton wool in Petri dishes for germination. The number of seeds which germinated after 4 days was used to calculate the percentage germinability. The seeds were examined for insect damage and the pests were identified.

Physical observation included free flow, odour and discoloration of the seeds.

RESULTS AND DISCUSSION

The results of the quality assessment of the melon seeds during storage in the different containers are shown in Tables 1–5.

The initial moisture content of the seeds was 6·12%. This value is the safe moisture level for the storage of oil seeds (Hall, 1963). The oil content was 53·77% with a free fatty acid level of 4·34% at the onset of the experiment. Oyenuga (1968) reported a crude oil content of 50·2% and Osagie *et al.* (1986) an oil content of 48·8% with moisture contents of 11·19% and 7·5% respectively. The crude protein content was 24·0% and the ash content was 3·55%. This level of ash is in line with the values of 3·4% and 3·9% respectively reported by Oyenuga (1968) and Osagie *et al.* (1986).

The moisture content of the seeds decreased from the third month in all storage containers, with the seeds in the clay pot recording the lowest decrease (4·94%) from the initial level.

The crude fat and protein increased for all replicates from the third month and remained fairly constant up to the sixth month of storage. There was no variation in the ash content. After 9 months in storage there was an increase in the free fatty acid content. This finding was associated with internal mouldiness of the seeds which was as high as 27% and 18% in the clay pot and plastic bucket respectively. Lipolytic enzymes in the moulds could have caused the lipolysis of the fat in the seeds.

Our data suggest that the major food nutrients, such as protein and oil, increase with the length of storage period of melon seeds.

The unshelled seeds were 18% mouldy externally. Internal mouldiness was only 5·60% at the beginning of the experiment. There was a steady increase in the

Table 2. Quality assessment of melon seeds during storage in plastic bucket at ambient conditions

Period of sampling (month)	Moisture (%)	Mouldiness (%)		Aflatoxin content (ppb)	Crude fat (%)	FFA (%)	Crude protein (%)	Insect damage (%)	Germinability (%)
		External	Internal						
Initial									
November	6·12	18·00	5·60		53·77	4·37	24·0	0	70·00
March	5·47	45·50	15·00		54·84	3·29	28·8	0	56·00
June	5·07	45·50	15·00		55·97	5·29	26·5	0	52·00
September	5·64	59·00	18·00		54·46	9·28	30·8	0	40·00

Table 3. Quality assessment of melon seeds during storage in clay pot at ambient conditions

Period of sampling (month)	Moisture (%)	Mouldiness (%)		Aflatoxin content (ppb)	Crude fat (%)	FFA (%)	Crude protein (%)	Insect damage (%)	Germinability (%)
		External	Internal						
Initial									
November	6·12	18·00	5·60	—	53·77	4·37	24·0	0	70·00
March	4·94	51·50		—	53·76	3·72	28·8	0	66·00
June	5·29	61·50	16·50	—	54·93	7·16	26·6	0	62·00
September	5·53	77·00	27·00	—	56·28	6·67	30·3	0	8·00

Table 4. Quality assessment of melon seeds during storage in polythene-lined jute bag at ambient conditions

Period of sampling (month)	Moisture (%)	Mouldiness (%)		Aflatoxin content (ppb)	Crude fat (%)	FFA (%)	Crude protein (%)	Insect damage (%)	Germinability (%)
		External	Internal						
Initial									
November	6·12	18·00	5·60	—	53·77	4·37	24·0	0	70·00
March	5·31	47·50	15·00	—	55·70	5·06	29·5	0	36·00
June	4·97	56·30	18·50	—	55·18	3·76	28·6	0	50·00
September	4·35	66·00	22·00	—	56·85	8·61	31·5	0	36·00

Table 5. Quality assessment of melon seeds during storage in ordinary jute bag at ambient conditions

Period of sampling (month)	Moisture (%)	Mouldiness (%)		Aflatoxin content (ppb)	Crude fat (%)	FFA (%)	Crude protein (%)	Insect damage (%)	Germinability (%)
		External	Internal						
Initial									
November	6·12	18·00	5·60	—	53·77	4·37	24·0	0	70·00
March	5·08	23·00	6·67	—	55·72	4·83	27·3	5	60·00
June	5·19	31·50	22·15	—	54·90	6·43	28·7	6	52·00
September	5·74	57·00	25·00	—	54·22	8·56	29·9	14	8·00

percentage of external and internal mouldiness in all storage containers. The highest level was found in the clay pot (51·50–77·00%) between the third and tenth months. No aflatoxin was detected in the seeds throughout the storage period. The apparent non-detection of aflatoxin in the seeds tested could be due to the internal mouldiness being considerably low. The fungi isolated from the seeds were *Aspergillus niger*, *A. tamarii* and *A. flavus*, *Rhizopus arrhizus*, *Penicillium citrinum* and *Fusarium moniliforme.*

Kuku (1979) reported that the storage of melon seeds at 75% relative humidity or above, resulted in mouldiness of the seeds.

The germinability of the seeds was 70% at the onset of the experiment. There was a steady decrease in the germinability of the seeds in all containers during the storage period. The lowest level was found in the clay pot and jute bag (8·00%) at the termination of the experiment. Insect damage was observed in seeds in the jute bag from the third month of storage and in the metal drum after the tenth month of storage. The two containers recorded 14% and 4·0% insect damage respectively. The insects detected were *Ephestia* spp. (moth), *Tribolium castaneum* (flour beetle) and *Oryzaephilus* spp. (saw toothed grain beetle).

The seeds were free flowing in the containers except in the clay pot and jute bag. A prominent rancid odour was perceived in all containers after 10 months. This could be attributed to an increase in the free fatty acid content of the seeds. The seeds that were stored in the jute bag also had a musty odour normally associated with products stored for a long time in jute bags.

The quality of the melon seeds used in this study may be associated with poor handling by farmers who produced them prior to sale.

ACKNOWLEDGEMENTS

We acknowledge with gratitude the Management of Nigerian Stored Products Research Institute (NSPRI) for making available the funds and materials required for this project. We thank the technical staff of NSPRI, especially Mrs S. O. Oladipo and Messers Agidi, Areoye, Alomi, Fadumiye, Umoren and Osanyinro, for their assistance.

REFERENCES

AOAC (1980). *Official Methods of Analysis*, 13th edn. Association of Official Analytical Chemists, Washington, DC.

Hall, E. D. W. (1963). Some essential considerations on the storage of food grains (cereal, legumes, and oil seeds) in Tropical Africa. FAO Informal Working Bulletin, No. 24.

Kuku, F. O. (1979). Deterioration of melon seeds during storage at various relative humidities. *Rep. Nigerian Stored Prod. Res. Inst.*, 1976–77. Technical Report No. 14, pp. 117–19.

Opadokun, J. S., Kazaure, I. & Qureshi, A. H. (1976). Oil content of the 1971–72 Nigerian Groundnut Crop, on delivery to Nigerian Oil Mills. *Rep. Nigerian Stored Prod. Res. Inst.*, 1972. Technical Report No. 4, pp. 39–41.

Osagie, A. U., Okoye, W. I., Oluwayose, B. O. & Dawodu, O. A. (1986). Chemical quality parameters and fatty acid composition of oils of some under exploited tropical seeds. *Niger. J. Appl. Sci.*, **4**(2), 151–62.

Oyeniran, J. O. (1977). The influence of moisture absorption on internal mouldiness of cocoa beans during storage in controlled atmosphere. Nigerian Stored Products Research Institute 14th Annual Report, 31 pp.

Oyenuga, V. A. (1968). *Citrillus vulgaris* (the water melon). In *Nigeria's Food and Feeding Stuffs, their Chemistry and Nutritive Value*, 3rd edn. Ibadan University Press, 87 pp.

Schuller, P. L. & Van Egmond, H. P. (1982). Determination of Aflatoxin B_1 in feeding stuffs. Based upon Method of European Communities (O. J. L102, 9–17 dated 5.4.1976). Amended by Drs P. L. Schuller and H. P. Van Egmond.