VOL. 7, NO. 2, FEBRUARY 2012 ISSN 1990-6145
ARPN Journal of Agricultural and Biological Science

www.arpnjournals.com

EFFECTS OF SEASON AND FRUIT SIZE ON THE QUALITY OF 'EGUSI' MELON [*Citrullus lanatus* (Thunb) Matsum and Nakai] SEED

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ABSTRACT

A study was undertaken at the teaching and research farm of the University of Agriculture, Makurdi in the wet and dry seasons of 2005 and 2007 to monitor the effects of season and fruit size on the seed quality of 'egusi' melon [*Citrullus lanatus* (Thunb.) Matsum and Nakai]. Fruits at maturity were harvested and grouped based on their sizes into big, medium and small categories. Data were collected on fruit length, diameter and weight. In addition, number of seeds per fruit, dry seed weight per fruit and 100-seed weight were also taken. Thereafter, seeds were tested for viability before and after storage. Results revealed that seeds from bigger fruits exhibited significant superiority over those from smaller fruits in all the other parameters studied except germination percentage where no significant differences were found among the fruit sizes. Seeds extracted from medium and small fruits produced in the wet season however, produced better storability compared to what was recorded for big fruits. It was therefore concluded that seed crop of *Citrullus lanatus* should be preferably produced during the wet season for high seed vigour. Furthermore, medium and small sized *Citrullus lanatus* fruits could be preferably selected for the production of high quality seeds as the seeds from them stored better than those from big fruits.

Keywords: egusi melon, seed quality, fruit size, season.

INTRODUCTION

Fruit size and shape were acknowledged as been one of the most important and quality parameters of all agricultural produce (Rashidi and Seyfi, 2007). Before the advent of civilization, farmers believed in the ability of plants to transfer desirable characters from parents to the offspring. Based on this belief, the more robust and good appearing seeds from farmers harvest were usually selected for preservation as seed for next planting season. This practice in some rare cases yielded fruitfull results but because the choice for selection was usually based on phenotypic selection without genetic base, the use of the practice has been discouraged. 'Egusi' melon, a fruit yielding cucurbit grown mainly for its seeds, which are used as a soup condiment and oil extraction in the entire West African region, has a wide variation of fruit sizes (Pratt, 1971; Nerson, 2007). Although production of the crop is gradually gaining prominence in Africa and beyond, studies that would reduce incidences of poor germination and seedling emergence in order that farmers may attain the desired plant population and hence higher crop yield are scarce. Nigerian farmers have however witnessed a wide variation in germination and emergence of melon seeds in the field and therefore target plant population densities are hardly met. Consequently, high seed rates are used. NIHORT (2000) recommended the sowing of four seeds per hole and that where seedling emergence is impressive, thinning to two plants per stand should be done. This practice is not only labourious but also wasteful.

Because of the fact that farmers hardly grade melon fruits based on size before seed extraction, the melon seeds used as planting material are derived from fruits of varying sizes. There is therefore some level of uncertainty as to whether or not the varying fruit sizes also has contributions to the poor seed quality currently experienced which has resulted to the adoption of a high seed rate. This study therefore intends to determine the seed qualities of melon fruits classified as big, medium and small fruits and compare their performances in the two production seasons.

MATERIALS AND METHODS

Early and late season crops of 'egusi' melon [*Citrullus lanatus* (Thunb.) Matsum and Nakai] were produced at the Teaching and Research farm of the University of Agriculture Makurdi in 2005 and 2007. Planting was done on 4th May and 2nd September in 2005 and on 25th April and 1st September in 2007 for the early and late season crops respectively. Bulk crop was raised and matured fruits at harvest were categorized visually into three sizes, viz: big, medium and small with mean diameters as ≥13 cm, 10-12.9 cm and <10 cm respectively. Data were then collected on fruit length, diameter and weight. In addition, number of seeds per fruit, dry seed weight per fruit and 100-seed weight were also taken before seeds were tested for viability. For the 100-seed weight, four replicates of 100 seeds for each category were counted and weighed on a Metler balance and the means were determined. Germination tests were conducted on both freshly produced and stored seeds. Four replicates of 50 seeds were counted from each size group of seeds and placed on absorbent paper in Petri dishes which were then moistened with distilled water. Incubation was at room

temperature (about 30° C) for 28 days. Germination counts were taken at two days interval and the absorbent paper was moistened as found necessary. To determine the storage ability (longevity) of seeds of the different treatments, seeds were packed in labeled polyethylene bags and stored at room temperature (about 32°C) in the laboratory for three years. Germination tests were conducted on the stored seeds yearly for three consecutive years. Data collected in respect of all the parameters was subjected to analysis of variance (ANOVA). Those involving percentages were first transformed (angular transformation = arc sin√ %) before analysis. Where significant differences were obtained, means were separated using Duncan's Multiple Range Test at 5 % level of probability.

RESULTS

Table-1 shows that fruit size significantly influenced all parameters except germination percent in both years of production. Also, planting season significantly affected all the parameters in 2005. In 2007, the factor affected fruit weight, number of seeds and dry seed weight per fruit significantly. The interaction between season and fruit size significantly influenced only fruit weight, number of seeds and dry seed weight per fruit in 2005 and all the other parameters except 100-seed weight and germination percentage in 2007.

Table-1. Mean squares from analysis of variance of data obtained in respect of *Citrullus lanatus* fruits of different sizes and seed attributes from wet and dry season productions of 2005 and 2007.

Sources of variation	Fruit length	Fruit diameter	Fruit weight	No. of seeds/fruit	Dry seed wt./fruit	100-seed weight	Germ. %
2005							
Replications	0.070ns	0.025ns	0.011ns	70ns	2.05ns	0.138ns	34.019ns
Fruit size (FS)	59.163**	47.60**	2.725**	84668**	1376.59**	7.220**	133.41ns
Season (S)	2.205**	3.226**	0.095**	7320**	333.59**	20.77**	1392.78**
S x FS	0.001ns	0.069ns	0.039**	315*	15.96**	0.146ns	135.77ns
Error	0.025	0.034	0.0058	74	1.87	0.290	45.024
Total	7.113	5.821	0.3356	10480.12	184.79	2.276	180.572
2007							
Replications	0.111ns	0.026ns	0.010ns	153ns	0.95ns	0.100ns	17.128ns
Fruit size (FS)	63.514**	49.94**	3.698**	85075**	1777.12**	15.41**	68.543ns
Season (S)	0.130ns	0.048ns	0.098**	3094**	38.02**	0.375ns	405.08ns
S x FS	2.809**	1.848**	0.177**	3542**	78.44**	1.7706*	27.263ns
Error	0.115	0.080	0.0093	201	1.29	0.3066	49.793
Total	7.891	6.146	0.4684	10743.76	221.41	2.2363	92.998

ns, *, ** non significant, significant at P = 0.05 and P = 0.01 respectively ANOVA

Fruit attributes

In both years, significant differences were recorded among fruit sizes in respect of fruit length, diameter, and weight with the highest and lowest value obtained from the biggest and smallest fruits respectively (Table-2). In both years, fruits were significantly bigger and heavier when produced during the dry season than during the wet season. Table-3 however shows that though fruits might be generally bigger in the dry than in the wet seasons, fruits sorted into the small category might not significantly differ in weight across seasons. Furthermore, whereas dry season fruits categorized as medium and small fruits respectively were significantly longer than their wet season counterparts were in 2007, the reverse was the case for the big fruit category. Also big wet season fruits were of greater diameter than the dry season ones whereas the reverse was the case in the small fruit category while season had no significant effect on this trait in the medium category.

Table-2. Fruit attributes of *citrullus lanatus* produced in the wet and dry seasons of 2005 and 2007 and categorized as big, medium and small.

	Fruit length (cm)	**Fruit diameter** (cm)	**Fruit weight** (kg)
2005			
Fruit sizes (F)			
Big	15.19 a	15.39 a	1.81 a
Medium	11.63 b	12.59 b	0.93 b
Small	8.930 c	9.760 c	0.49 c
Season (S)			
Wet	11.57 b	12.15 b	1.00 b
Dry	12.27 a	13.00 a	1.15 a
F x S	ns	ns	*
2007			
Big	16.44 a	16.29 a	2.14 a
Medium	12.51 b	13.37 b	1.08 b
Small	9.830 c	10.52 c	0.54 c
Season (S)			
Wet	12.88 b	13.34 b	1.34 a
Dry	12.96 a	13.44 a	1.15 b
F x S	**	**	ns

Means followed by the same alphabet in each year and F / S are not significantly different using DMRT at 5 % probability level

Table-3. Interaction effects of season and fruit size on all the fruit attributes of *Citrullus lanatus* harvested and categorized as big, medium, and small in 2005 and 2007.

2005		
Season	**Fruit sizes**	**Fruit weight**
Wet	Big	1.67 b
	Medium	0.82 d
	Small	0.50 e
Dry	Big	1.94 a
	Medium	1.03 c
	Small	0.47 e
2007		
Season	**Fruit sizes**	**Fruit length**
Wet	Big	17.24 a
	Medium	12.23 d
	Small	9.170 f
Dry	Big	15.63 b
	Medium	12.78 c
	Small	10.48 e
	Fruit diameter	
Wet	Big	16.79 a
	Medium	13.32 c
	Small	9.910 e
Dry	Big	15.79 b
	Medium	13.41 c
	Small	11.13 d

Means followed by the same alphabet in each year and size / season are not significantly different using DMRT at 5% probability level.

Seed attributes

In both years, seed yields (number and weight per fruit) were significantly higher in the big fruits than those from medium and small fruits; yields from the small fruits were also significantly lower than those from medium fruits (Table-4). In 2005, yields were higher in the dry season than in the wet whereas the reverse was the case in 2007. However, Table-5 shows that the dry season fruits were not superior in all cases in 2005. For example, medium size fruits produced in the wet season contained more seeds than the small fruits produced during the dry season. In 2007, whereas the big fruits produced during the wet season contained significantly more seeds than those produced during the dry season, no significant seasons effect was recorded on the other two fruit sizes. The trend in the variations in respect of dry seed weight per fruit in 2005 was similar to that of number of seeds per fruit. In 2007, whereas seeds from fruits produced during the wet season significantly weighed higher than fruits of the same size produced during the dry season, the reverse were the case for the small-sized fruits; the effect of season was insignificant in medium sized fruits. In the same year, significant variations between season in respect of 100-seed weight was only recorded for big fruits in which wet season value was superior to that of the dry season. The corresponding values in respect of the other fruit sizes were similar.

Table-4. Seed attributes of *Citrullus lanatus* produced in the wet and dry seasons of 2005 and 2007 and categorized as big, medium, and small.

	No of seeds/fruit	**Dry seed wt./fruit** (g)	**100-seed wt.**	**Germ.** (%)
2005				
Fruit sizes (F)				
Big	331.2 a	39.76 a	12.45 a	63.95 a
Medium	207.2 b	22.07 b	11.11 b	70.76 a
Small	93.67 c	9.620 c	10.28 b	63.45 a
Seasons (S)				
Wet	190.56 b	19.51 b	10.21 b	58.43 b
Dry	230.78 a	28.12 a	12.35 a	73.67 a
F x S	*	**	ns	ns
2007				
Big	356.8 a	46.63 a	13.92 a	55.22 a
Medium	212.2 b	25.18 b	11.90 b	60.56 a
Small	120.7 c	12.29 c	10.75 c	59.96 a
Seasons (S)				
Wet	243.0 a	29.58 a	12.33 a	54.47 b
Dry	216.8 b	26.68 b	12.04 b	62.69 a
F x S	**	**	*	ns

Means followed by the same alphabet in each year and size/ season are not significantly different using DMRT at 5% probability level.
*Germination data are transformed values.

Table-5. Average values of each of the seed attributes of *Citrullus lanatus* produced in 2005 and 2007 and categorized as big, medium, and small.

Season	Fruit size	No of seeds/fruit	Dry seed wt./fruit	100-seed wt.	Germ. %
2005					
Wet	Big	302.7 b	34.04 b	11.40 bc	52.28 b
	Medium	190.7 d	17. 40 d	9.870 d	67.33 a
	Small	78.33 f	7.100 e	9.350 d	55 70 a
Dry	Big	359.7 a	45.48 a	13.51 a	75.62 a
	Medium	223.7 c	26.73 c	12.35 b	74.19 a
	Small	109.0 e	12.15 e	11.21 c	71.20 b
2007					
Wet	Big	396.3 a	52.21 a	14.64 a	52.46 c
	Medium	220.3 c	25.11 c	11.60 cd	57.21 abc
	Small	112.3 d	11.44 e	10.73 d	53.75 bc
Dry	Big	317.3 b	41.04 b	13.17 b	57.97 abc
	Medium	204.0 c	25.25 c	12.20 bc	63.92 ab
	Small	129.0 d	13.74 d	10.77 d	66.17 a

Means followed by the same alphabet in each year and size are not significantly different using DMRT at 5% probability level.
*Germination data are transformed values.

Seed storage

Table-6 shows that although viability of seeds in all the fruit categories generally declined with age, the longevity of seeds vary based on their season of production. Whereas there was an improvement in germination of wet season produced seeds even after one-year storage, the reverse was the case with dry season seeds. Deterioration had fully commenced on dry season produced seeds after one-year storage and by the second year of storage when both season's productions were evidently affected, dry season seeds were worst off.

Table-6. Effects of season and fruit size on percentage germination of stored *Citrullus lanatus* seeds.

Season	**Fruit size**			**Mean** (%)
	Big (%)	**Medium** (%)	**Small** (%)	
(a) Prior to storage				
Wet	62	68	85	71.67
Dry	87.5	92.5	93.5	91.17
Mean	74.75	80.25	89.25	
LSD 5% Season = 5.95 LSD 5% Fruit size = ns LSD 5% SxFS = ns				
(b) After one year of storage				
Wet	65	91.5	98	84.83
Dry	60	76	82.5	72.83
Mean	62.5	83.75	90.1	
LSD 5% Season = 2.47 LSD 5% Fruit size = 3.03 LSD 5% SxFS = ns				
(c) After two years of storage				
Wet	32.5	38	41	37.17
Dry	4.5	19	25.5	16.33
Mean	18.5	28.5	33.25	
LSD 5% Season = 3.51 LSD 5% Fruit size = 4.29 LSD 5% SxFS = ns				

DISCUSSIONS

The results of this study in which seed yield were higher in bigger fruits compared to smaller ones agrees with the findings of Stephenson *et al.* (1988) in pepper and Marcelis and Hofman-Eijer (1997) in *Cucurbita pepo.* The authors explained that fruits that contained more seeds competed better for available assimilates and therefore achieves greater size.

The superiority exhibited in all other parameters by bigger fruits over the smaller ones did not continue also in germination ability since no significant differences were found in the germination abilities of seeds from the different fruit sizes. This finding agrees with that of Cideciyan and Malloch (1982) who found seed size not to have any effect on percentage germination of *Rumex obtusifollus* or on the heavier seeds of *R. crispus.* Gonzalez (1993) also found seed mass not to significantly (F, $P > 0.05$) affect germination percentage of *Virola koschnyi* Warb. Nielsen (1996) further explained that differences in size and shape of hybrid maize are due to the position of the kernel on the cob. Small rounds seeds tend to come from the tip of the cob, large rounds from the butt of the cob, flats from the middle of the cob but with the various sizes and shapes on the kernel coming from an ear not having any genetic variation.

The better storability of seeds extracted from medium and small fruits compared to what was recorded for big fruits might be due to greater dormancy exhibited at harvest by the seeds of the two former fruit sizes when production was done in the wet season.

The decline in seed viability after a storage period of one and two years respectively is indicative of seed deterioration which is linked with disruption of cell organelles due to free radical production in the cells of embryos. Sung and Jeng, (1994); Sung (1996). Seeds from the three experiments undertaken failed to attain the minimum germinative standard for certification accepted for watermelon production when seeds were tested after two years storage under ambient temperature. The study therefore concluded that seed crop of *Citrullus lanatus* should be preferably produced during the wet season for high seed vigour. Furthermore, medium and small sized *Citrullus lanatus* fruits could be preferably selected for the production of high quality seeds as the seeds from them stored better than those from big fruits.

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