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The Effects of Leaf Colour at Fruit Harvest and Fruit after-Ripening Duration on (*Cucumeropsis mannii* Naudin.) Seed Quality.

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ABSTRACT

A study of the after-ripening behavior of 'egusi-itoo' melon (*Cucumeropsis mannii* Naudin.) fruits was undertaken at the research farm of the University of Agriculture Makurdi in 2005, 2006 and 2007 to monitor its effects on seed quality. Some fruits were harvested when leaves started turning yellow (LTY) while others were harvested when all leaves were dried (ALD). The fruits harvested at the two stages were either processed immediately or were processed after 10 or 20 days of after-ripening. Results revealed that fruits from plants harvested when all plant leaves were dry (ALD) contained significantly more seeds and produced higher seed yield. After-ripening of fruits for 10 and 20 days significantly improved seed germination in 2006 and 2007. The best seed longevity was obtained from ALD fruits that were after-ripened for 20 days while the poorest result was from the non-after-ripened LTY fruits. It was therefore concluded that *Cucumeropsis mannii* fruits should be harvested when all leaves are dry. For higher seed quality still, harvested fruits should be stored to after-ripen for about 10 - 20 days before seed extraction process is initiated.

INTRODUCTION

'Egusi-itoo' melon (*Cucumeropsis mannii* Naudin.) has a long history which dates back to about 4000 years when its cultivation began (Schippers 2000). It is still referred to as the real egusi in West Africa (Schippers, 2000; Egunjobi and Adebisi, 2004) because its production and usage in the region predates all other egusi species. Schippers (2000) reported that the other modern watermelon species predominantly used today (*Citrullus lanatus* and *Citrullus vulgaris*) were first represented by citron melon types and later developed in the Ukraine and Iran into sweet, often red fleshed types. 'Egusi-itoo' melon is a protein-rich food which is used mainly as soup condiment and a snack in most West African countries. Some of its other potential uses, which include oil

extraction, are not fully exploited in Africa on commercial scale in spite of the high quality of oil known to be derived therein.

Egusi-itoo melon has an indeterminate flowering structure, and thus, fruits of varying ages are usually produced per crop stand. Fruit age at harvest has been known to be a major determinant of seed quality. For most crop species, the more matured the fruit is at harvest, the higher the quality of its seeds (Chaudhari *et al.*, 1992 and Shantappa *et al.*, 2006). Nielsen (1996) also reported that different seeds within a fruit do not mature at the same rate. This therefore suggests that the different seeds contained in a fruit are of different ages and therefore of varying qualities.

Apart from the inherent variation that exists among seeds of the same fruit and among fruits of the same plant, it has also been found that farmers also add to this variation due to the post harvest measures fruits are subjected to. Depending on the level of the pressure on land, some farmers harvest melon fruits as soon as leaves senesce while others may not gather the fruits until all the vines have dried. Also, while some farmers harvest fruits and commence processing by breaking open the fruits on harvest day others may pile up the fruits for days before the commencement of the process of seed extraction. It has been reported that fruits harvested even before physiological maturity and allowed some days of post-harvest ripening may produce good quality seeds since seed development continues in fleshy fruits owing to continuous supply of nutrients and food reserves from fruit to seed (Petrov *et al.*, 1981; Oladiran and Kortse 2002; Karnataka, 2008 and Passam *et al.*, 2010).

This study was therefore undertaken to determine the effects of fruit maturity on the seed quality of 'egusi-itoo' melon and to determine if any improvement in seed quality could be derived from post-harvest ripening of the fruits.

MATERIALS AND METHODS

'Egusi-itoo' *Cucumeropsis mannii* Naudin. crop was produced for three consecutive years (2005, 2006 and 2007) at the Crop Production Research Farm of the University of Agriculture Makurdi. Seeds were sown on the flat on 5th, 3rd and 7th June in 2005, 2006 and 2007 respectively. Bulk crop was established and harvesting of fruits were done at two different colour stages i.e. when leaves started turning yellow (LTY) and when all the leaves were dry (ALD). Harvest at LTY and ALD stages was conducted at 150 and 183 days after planting respectively. Fruits harvested at each of the two leaf colour stages were randomly divided into three lots. Fruits of the first lot were broken the same day to initiate the decomposition process (control - 0 day after-ripening duration). In the second lot, fruits were allowed to after-ripen at ambient temperature for 10 days while those of the third lot were subjected to after-ripening duration of 20 days before they were broken up for pulp decomposition and seed extraction. The extracted seeds were washed and sundried. Data were

collected on number of seeds per fruit, dry seed weight per fruit, and 100-seed weight before they were subjected to viability test.

Seeds produced in 2005 were packed in polyethylene bags and stored in an ambient environment (approx. 32^{o}C and 40% relative humidity). Germinability was then tested after one, two, and three years of storage. Germination tests made immediately before and during storage, were conducted on four replicates of 50 seeds each, spread over distilled water-moistened absorbent paper in Petri dishes and incubated at 30^{o}C for 28 days. Counts were taken every other day.

RESULTS

Data analysis revealed that year of production (Yr) significantly influenced the number of seeds per fruit, dry seed weight per fruit, 100-seed weight and germination percentage (Table 1). Leaf colour (LC) influenced all parameters except the number of seeds per fruit. After-ripening duration (AR) had significant effect on only germination percentage while the interaction of LC x AR significantly affected the number of seeds per fruit. Yr x AR had significant effect on number of seeds per fruit and germination while all parameters except 100-seed weight were significantly influenced by the interaction between Yr and LC. The interaction of Yr x LC x AR was not significant.

Table 1 Mean squares from analysis of variance for fruit and seed attributes of *Cucumeropsis mannii* harvested at two leaf colour stages (LTY and ALD) in 2005, 2006 and 2007 and subjected to different after-ripening durations.

Sources of variation	No. of seeds/fruit	Dry seed wt./fruit	100-seed wt.	Germ. %
Replications	353.7 ns	11.59 ns	2.480 ns	320.7 ns
Year of production (Yr.)	20533.4 **	227.92 **	91.375 **	1078.3**
Leaf colour (LC)	1756.7 ns	341.96 **	94.142 **	1099.0**
After-rip. durations (AR)	583.7 ns	12.36 ns	6.813 ns	2010.5**
LC x Yr.	2313.1 *	96.88 **	13.867 ns	405.9 *
AR x LC	3105.2 **	50.84 ns	0.182 ns	168.3 ns
AR x Yr.	1352.9 *	21.53 ns	1.244 ns	408.6 *
AR x LC x Yr.	276.4 ns	20.41 ns	1.844 ns	107.6 ns
Error	455.4	16.68	4.365	109.1
Total	1462.9	35.40	9.138	239.7

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

The number of seeds per fruit was significantly higher in 2005 than the subsequent years. Figure 1 shows that the effects of leaf colour on this trait varied with years of production. Whereas fruits harvested at the ALD stage yielded significantly more seeds per fruit than those harvested at the

LTY stage in 2005, no significant differences were recorded between ALD and LTY in both 2006 and 2007. Figure 2 also shows that the effect of after-ripening duration varied significantly with year of production. In 2005 and 2006 fruit after-ripening did not result in significant differences in the number of seeds whereas in 2007 fruits after-ripened for 20 days significantly yielded more seeds than those after-ripened for ten days while the difference between '0' and ten days after-ripening was insignificant. Figure 3 shows the interaction between Leaf colour and after-ripening duration. No significant differences where recorded at '0' and ten days after-ripening whereas when fruits were after-ripened for 20 days those harvested at ALD stage contained significantly more seed than those harvested at LTY stage.

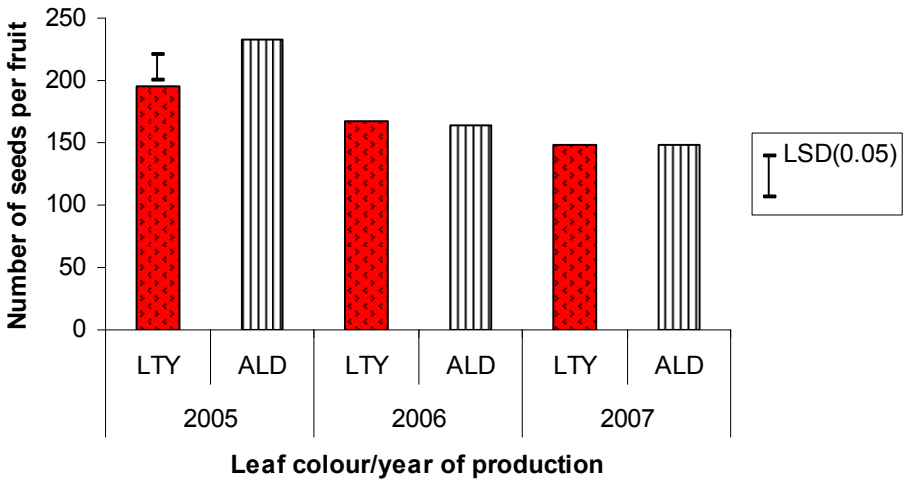

Fig. 1 Interaction effects of leaf colour and year of production on the number of seeds per fruit of *Cucumeropsis mannii.*

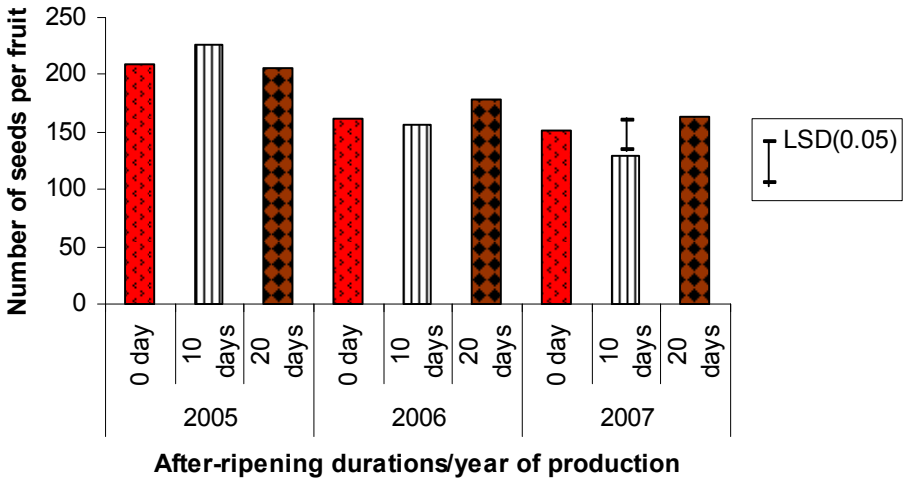

Fig. 2 Interaction effects of after-ripening duration and year of production on the number of seeds per fruit of *Cucumeropsis mannii.*

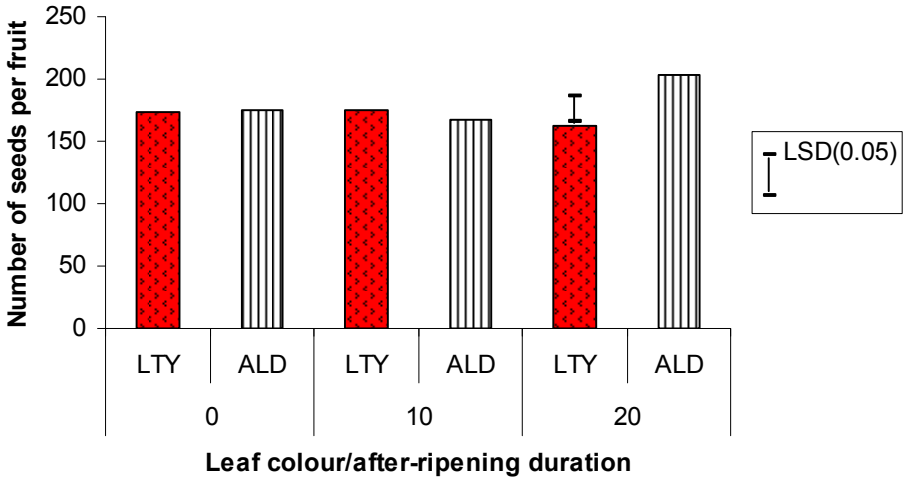

Fig. 3 Interaction effects of leaf colour and after-ripening duration on the number of seeds per fruit of *Cucumeropsis mannii* produced in 2005, 2006 and 2007.

Significantly greater seed yields were produced in 2005 and 2006 than in 2007. Furthermore, fruits harvested at the ALD stage gave higher seed yield than at the LTY stage. However, the effect of leaf colour on dry seed weight per fruit varied significantly with year of production. Whereas significantly higher seed weights were obtained at the ALD stage compared to LTY stage in 2005 and 2007, the difference between the values obtained at the two different leaf stages was not significant in 2006 (Figure 4). In addition, seeds extracted from fruits harvested at ALD stage were significantly heavier than those from fruits harvested at LTY stage (Table 2). Furthermore, the weight of 100 seeds from the 2006 harvest was significantly greater than those of other years; the value obtained in 2005 was also significantly lower than that of 2007.

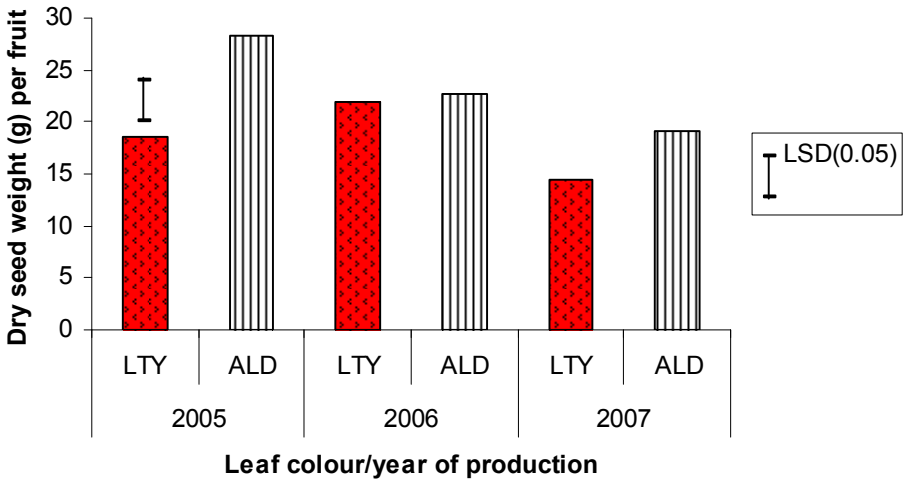

Fig. 4 Interaction effects of leaf colour and year of production on dry seed weight (g) per fruit of *Cucumeropsis mannii.*

Table 2 Effects of leaf colour and year of production on 100-seed weight (g) of *Cucumeropsis mannii* produced in 2005, 2006 and 2007.

	Year of production (Yr.)			
Leaf colour (LC)	**2005**	**2006**	**2007**	**LC means**
LTY	9.69	15.31	10.83	11.94 b
ALD	12.72	16.03	15.00	14.59 a
Yr. means	11.21 c	15.62 a	12.92 b	

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

Though successive after-ripening duration generally resulted in improved seed germination, whether the differences were significant or not depended on the year of production. Figure 5 for example show that whereas after-ripening duration did not significantly affect seed germination in 2005, the after-ripening of fruits produced in 2006 for 20 days resulted in significant improvement in germination compared to the after-ripening periods of 0 and ten days which were similar in effect. Furthermore, in 2007, after-ripening durations of ten and 20 days, which were at par in effect, were significantly better than in the control fruits. Figure 6 shows that the effect of leaf colour on seed germination varied with production year. In 2005 and 2007, there was no significant difference in the germination levels of seeds obtained from fruits harvested at the LTY and ALD stages. Contrary to this, seeds from fruits harvested at the ALD stage germinated significantly better than those from fruits harvested at the LTY stage in 2006.

The trend in which viability usually declines with storage age manifested in this study. Figure 7 shows that germination of all seeds harvested at the two colour stages and subjected to different after-ripening durations was above 70% when seeds were tested before storage. However, a decline in viability was recorded in all seed lots after one year of storage with more remarkable declines from LTY seeds. At all leaf colour stages and storage durations, ALD seeds after-ripened for 20 days yielded the best longevity while LTY seeds not after-ripened at all performed poorest.

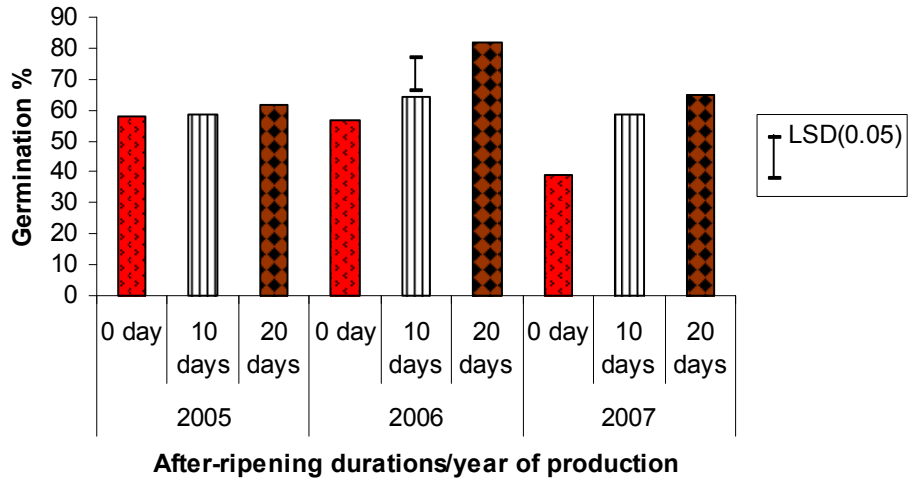

Fig. 5 Interaction effects of after-ripening durations and year of production on the germination of seeds of *Cucumeropsis mannii.*

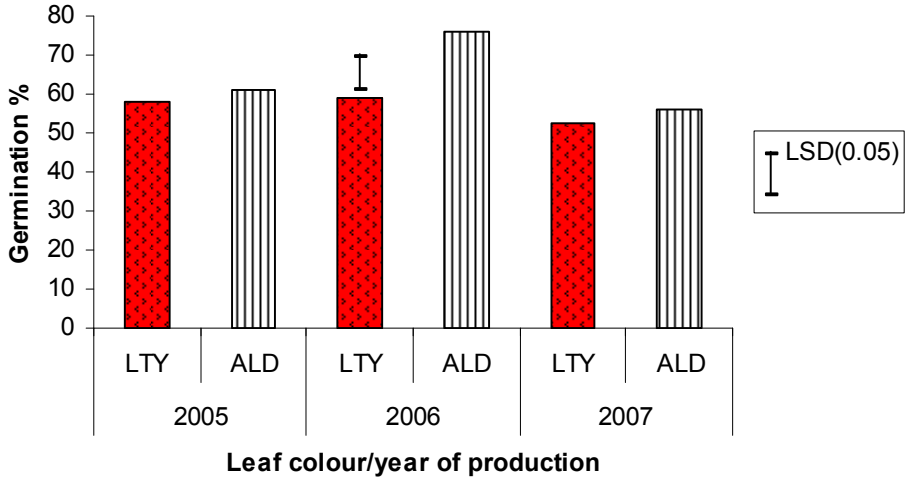

Fig. 6 Interaction effects of leaf colour and year of production on the germination of *Cucumeropsis mannii.*

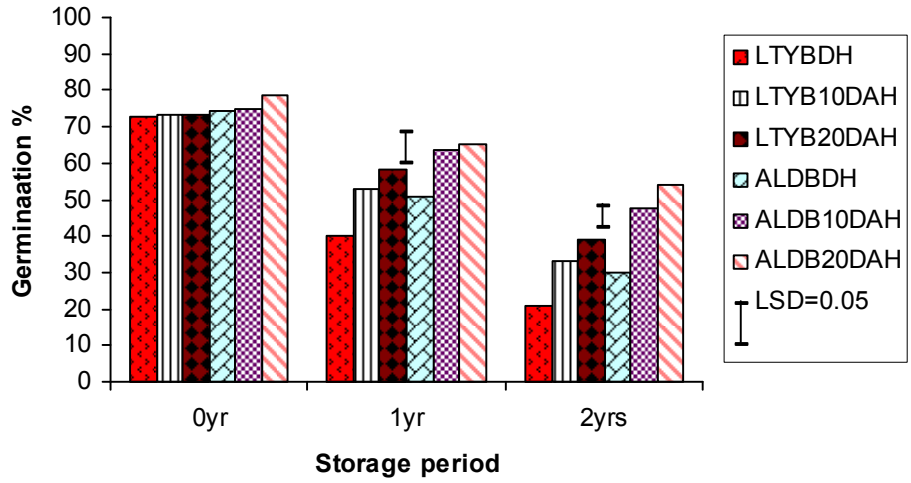

Fig. 7 Variations in germination percentage of *Cucumeropsis mannii* seeds harvested in 2005 at the LTY and ALD stages and stored for 0, 1, and 2 years under ambient conditions.

I LSD at P = 0.05

DISCUSSION

The significantly fewer seeds per fruits, and lower seed weight/yield when harvesting was done at the LTY stage in 2005 could be linked to immaturity at that stage and the subsequent increase in values could be linked to accumulation of assimilates during fruit/seed maturation. This is in agreement with reports by Mayer *et al.* (1991), Goldberg *et al.* (1994), Raz *et al.* (2001) and Bentsink and Koornneef (2008) that as an embryo undergoes maturation, there is food reserve accumulation. Natrajan and Srimathi (2008) also reported that increase in Petunia pod weight with increase in DAA was supported by increase in pod length and width due to the development from zygote to matured seeds. Immature seeds would normally decompose and or float off during processing. The significant improvement in fruit weight and seed yield recorded when fruits were stored for twenty days before processing in this study suggests that seed filling continued in stored fruits. This explanation agrees with that of Passam *et al.* (2010) who also recorded seed filling in-situ and hence higher seed weight of after-ripened fruits of eggplant. The significantly bigger fruits obtained in 2005 in comparison to the subsequent years may have been responsible for the significantly greater seed yields per fruit that were later obtained. Lawes *et al.* (2008) noted a

positive linear correlation between fruit weight and seed dry weight on kiwifruit. They stated that flowers that open earlier have a larger ovary and set larger seeds leading to large fruits explaining that this may be because of either their innate superiority or their position on the vine.

The suggestion that seed filling continued during fruit after-ripening may have been responsible for the significant improvement in germination recorded when fruits were after-ripened for 10 and 20 days in 2006 and 2007. The decline in seed viability after a storage period of one and two years 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).

It is therefore, recommended from this study that for optimum seed quality, fruits of *Cucumeropsis mannii* should be harvested when all leaves on the plant are dry. For higher seed quality still, harvested fruits should be stored to after-ripen for about 10 - 20 days before processing.

REFERENCES

Bentsink, L. and Koornneef, M. (2008). Seed Dormancy and Germination. The Arabidopsis Book. American Society of Plant Biologists. Dol: 10.1199/tab.0119 pp 1 of 18 – 18.

Chaudhari, R. V., Meshram, L. D., Zade, V. R., and Kukade, B. K. (1992). Relationship between maturity and seed quality in tomato. *Agri. Sci. Digest,* **12**: 38 – 40.

Egunjobi, J. K. and Adebisi, A. A. (2004). *Cucumeropsis mannii* Naud. In: Grubben, G. J. H. and Denton, O. A. (Editors). Plant Resources of Tropical Africa 2. Vegetables. PROTA Foundation, Wageningen, Netherlands/Backhuys Publishers, Leiden, Netherlands/CTA, Wageningen Netherlands. pp 253 – 237.

Goldberg, R. B., Palva, G., and Yadegari, R. (1994). Plant embryogenesis: zygote to seed. Science **268:** 605 – 614.

Karnataka, J. (2008). Influence of stages of fruit harvest and post harvest ripening periods on seed quality in paprika chilli (*Capsicum annuum* L.). *Agric. Sci.***21**(2): 266 - 269

Lawes, G. S., Woolley, D. J. and Lai, R. (2008). Seeds and other factors affecting fruit size in kiwifruit. ISHS *Acta Horticulturae* **282:** 1 – 5

Mayer, U., Rutz, R. A. T., Berleth, T., Misera, S. Jurgens, G. (1991). Mutations affecting body organization in the Arabidopsis embryo. *Nature* **353**: 402 – 407.

Natrajan, K. and Srimathi, P. (2008). Studies on Seed Development and Maturation in Petunia. *Reseach Journal of Agriculture and Biological Sciences*, **4** (5): 585 – 590.

Nielsen (Bob), R .L. (1996).Purdue pest management and crop production Newsletter, West Lafayette, IN **47:** 904 – 1150.

Oladiran, J. A. and Kortse, P. A. (2002). Variations in germination and longevity of pepper (*Capsicum annum* L.) seed harvested at different stages of maturation. *Acta Agronomica Hungarica,* **50** (2): 157 – 162.

Passam, H. C., Theodoropoulou, S., Karanissa, T. and Karapanos, I. C. (2010). Influence of harvest time and after-ripening on the seed quality of eggplant. *Scientia Horticulturae,* **125** (3): 518 – 520.

Petrov, H., Doikava, M. and Popova, D. (1981). Studies on the quality of eggplant seed. *Acta Hort.,* **111:** 273 – 280.

Raz, V., Bergervoet, J. H. and Koornneef, M. (2001). Sequential steps for developmental arrest in Arabidopsis seeds. Development **128:** 243 – 252.

Schippers, R. R. (2000).African indigenous vegetables, an overview of the cultivated species. Chatham, UK: Natural Resources Institute/ACP-EU Technical Centre for Agricultural and Rural Co-operation. pp 224.

Shantappa, T., Shekhargouda, M., Merharwade, M. N. and Ravindra, M. (2006). Effects of stages of harvest and drying methods on seed quality in bitter gourd. *Seed Res.*, **34:** 146 – 149.

Sung, J. M. (1996). Lipid peroxidation and peroxide scavenging in soybean seeds during aging. *Physiol Plant*, **97**: 85 – 89.

Sung, J. M. and Jeng, T. L. (1994). Lipid peroxidation and peroxide-scavenging enzymes associated with accelerated aging of peanut seed. *Physiol Plant* **91:** 51 – 55.

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