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Effects of Stage or Fruit Harvesting and After-Ripening on the Seed Quality of Garden Egg (*Solanum Melongena* L.)

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Abstract: *A study was conducted on Elongated green stripe and Large white varieties of garden egg (Solanum melongena L.) during the 2015 cropping season at the Teaching and Research Farm of the University of Agriculture Makurdi. The purpose of this study was to determine the effects of stage of fruit harvesting and after-ripening on the seed quality of garden egg. The design used for the experiment was Randomized Complete Block Design with three replications. Flowers of both varieties were tagged at anthesis to determine the age of the fruits at each harvest stage. Fruits of the two varieties were harvested at three harvest stages named: about to ripen (AR), fully ripened (FR) and over-ripened (OR) stages. Seed extraction from fruits was also conducted at three after-ripening durations which were: immediately after harvest i.e. before storage (BS), after five days of after-ripening (A5ds) and after ten days of after-ripening (A10ds). Evaluations were made on fruit length, diameter and weight. Fresh and dry seed weight, number of seeds per fruit and hundred seeds weights were also determined. Significant (P= 0.05) increases in values for fruit and seed attributes progressed from harvest at about to ripen stage to harvest at fully ripened stage. No significant (P= 0.05) increases in the values for those traits were recorded with a further delay of harvest from fully ripened to over-ripened stage. Seed germination values of 46, 55 and 68% significantly progressed from AR, FR to OR respectively. In the same vain the germination of seeds from after-ripened fruits also significantly progressed from 41, 59, to 69% at BS, A5ds, and A10ds respectively. It was therefore, recommended that garden egg fruits for seed production should be harvested at over-ripened stage and after-ripened for about ten days before seed extraction.*
Key words: *harvest, after-ripen, assimilates, seed quality.*

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I. Introduction

Garden egg (*Solanum melongena*) belongs to the family of *Solanaceae* and the genus *Solanum* with over one thousand species worldwide. It originated from the tropical Africa and has now become a vegetable with increasing popularity worldwide (Pessarakli and Dris, 2003). Garden egg is grown mainly for food and medicinal purposes. Okon *et al.* (2010), reported that nutritionally, garden egg contains water (92.5%), protein (1%), fat (0.3%) and carbohydrate (6%). The report went further that medicinally, a meal of garden egg has proven to benefit patients from raised intraocular pressure (glaucoma) as well as in heart disease and arteriosclerosis.

Depending on the intended use, garden egg is harvested at different stages in the life cycle of the plant. When it is for consumption, fruits are preferred when they are still fresh before the seeds ripen, that is before fruit colour change commences. Ripe fruits have a lower market value and are less palatable. Usually once started, harvest continues on a regular interval in order to encourage development of more fruits. Fruits left on the mother plant to mature delay the development of new fruits. Farmers generally believe that once seeds are not fully ripened, they would not germinate. They therefore allow fruits from which seed extraction is intended to over-ripen on the stand before harvest. Khatun *et al.* (2009) advised that seeds should be harvested at proper time to ensure their quality in terms of germinability and vigour.

Carrera *et al.* (2008) defined after-ripening as a time and environment regulated process occurring in the dry seed, which determines the germination potential of seeds. As stated above, farmers do not have a specific time that guides their harvest operation. They also do not keep to any specific schedule on when seeds are extracted from the harvested fruits. Some farmers allow ripened fruits to remain and dry on the mother plant before harvest. Even after harvest, such fruits remain intact with seeds preserved in them and are extracted only when they are to be planted. Others on the other hand harvest the ripe fruits and either slice or cut open to facilitate proper drying in the sun. These dried fruit parts are also stored with seeds preserved for extraction at the time of sowing. It is therefore important that seed farmers obtain information about when to harvest, and the post harvest handling operations required.

II. Materials And Methods

Elongated green stripe and Large white varieties of garden egg (*Solanum melongena*) were grown during the 2015 cropping season at the Teaching and Research Farm of the University of Agriculture Makurdi. Three replicates of the two varieties were raised in a Randomised Complete Block Design and monitored as they developed. At flowering, flowers of both varieties were tagged at anthesis to determine the age of the fruits at each harvest stage. Harvesting was conducted at three designated stages i.e. at about to ripen stage (AR) when fruits were 25 days after anthesis (DAA), at the fully ripened stage (FR) when fruits were 30 DAA and at the over-ripened stage (OR) when fruits were 35 DAA. Seed extraction from fruits was also conducted at three after-ripening durations which were: immediately after harvest i.e. before storage (BS), after five days of after-ripening (A5ds) and after ten days of after-ripening (A10ds). Evaluations were made on fruit length, diameter and weight. Fresh and dry seed weight, number of seeds per fruit and hundred seeds weights were also determined before seeds were tested for viability. Germination tests were conducted on freshly produced seeds. Four replicates of 50 seeds each were 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.

III. Results

3.1 Effects of Harvest Stage on Seed Quality

All the fruit attributes (i.e. length, diameter and weight) recorded significant ($P < 0.05$) increases between the first stage of harvest (AR) and the second stage (FR) (Table 1). Whereas this increase continued on fruit weight even up to the third stage of harvest (OR), fruit length and diameters conversely recorded declines at that stage. General increases were recorded in seed attributes (i.e. Number of seeds per fruit, fresh and dry seed weight as well as the 100-seed weight) from AR through FR to OR stages.

Table 1 Interaction effects of Harvest Stage and Varieties on Fruit and Seed attributes

Harvest stage	Variety	FL(cm)	FD(cm)	FW(g)	NS/F (g)	FSW/F (g)	DSW/F (g)	100-SW (g)
AR	**EGS**	7.89	7.3	85.4	385	3.23	1.22	0.35
	LW	5.39	13.0	202.4	916	7.83	3.13	0.36
FR	**EGS**	9.44	8.3	123.5	375	3.77	1.49	0.42
	LW	6.07	22.5	258.1	926	8.96	3.45	0.37
OR	**EGS**	8.46	8.2	114.3	384	3.64	1.37	0.38
	LW	6.19	14.8	296.8	1095	9.51	4.29	0.40
LSD=0.05		**0.49**	**9.62**	**27.64**	**165**	**1.23**	**0.58**	**0.03**

3.2 Percentage seed germination at the different harvest stages

Figure 1 shows that seed germination ability improved with later harvest stages. At the first stage of harvest when fruits were about to ripen, only about 46 % average seed germination was obtained for the two varieties. This improved to about 55 and 68 % at fully ripened and over-ripened stages respectively.

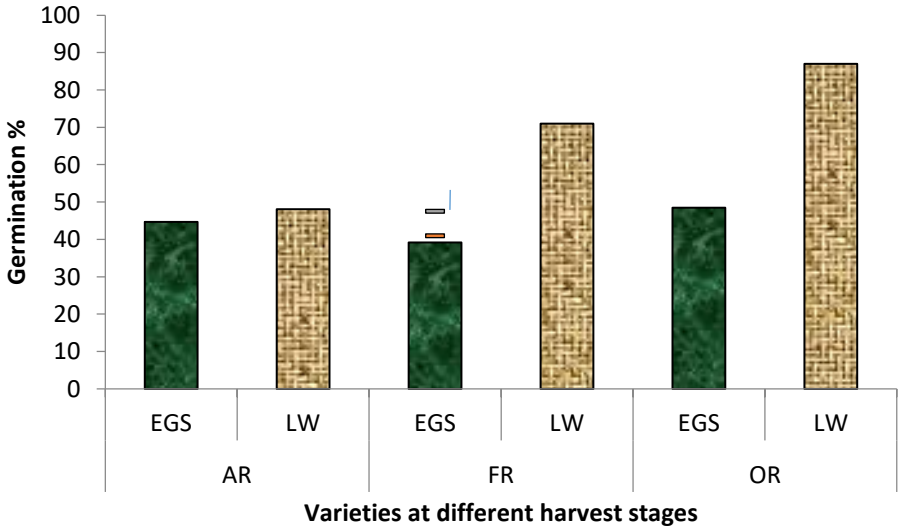

Figure 1 Variations in percentage germination of garden egg fruits harvested at different stages
LSD at P = 0.05

3.3 After-ripening effects on fruit and seed attributes

Table 2 shows that the after-ripening behavior of fruit attributes did not record any consistent trend among the two varieties. Although fruit attributes (i.e. length, diameter and weight) of varieties after-ripened at all durations generally did not result to any significant changes, fruits of EGS variety which were not after-ripened and those after-ripened for ten days were significantly ($P < 0.05$) longer than those after-ripened for 5 days. Also, LW variety fruits after-ripened for 5 and ten days significantly weighed higher than those not after-ripened.

Seed attributes also followed the same trend as after-ripening did not result in any significant ($P \leq 0.05$) change in number of seeds of the two varieties. However, fresh and dry seed weights as well as 100-seed weight of LW variety after-ripened for 5 and ten days were significantly higher than those not after-ripened.

Table 2 Interaction effects of after-ripening and variety on fruit and seed attributes

Variety	Aft. Dur.	FL	FD	FW	NS/F	FSW/F	DSW/F	100-SW
EGS	**BS**	8.99	8.0	116.5	383	3.81	1.41	0.39
	A5ds	8.15	7.7	97.0	344	3.13	1.17	0.37
	A10ds	8.66	8.0	109.8	417	3.71	1.49	0.39
LW	**BS**	5.81	21.8	232.0	991	7.75	3.28	0.33
	A5ds	6.02	14.2	264.3	928	8.74	3.59	0.40
	A10ds	5.83	14.2	261.0	1017	9.80	4.01	0.41
LSD=0.05		**0.50**	**ns**	**27.64**	**ns**	**1.23**	**0.56**	**0.03**

4.4 Effect of after-ripening on seed germination

Successive after-ripening durations resulted in improved seed germination (Figure 2). The two varieties recorded average germinations of 41, 59 and 69 percentages at BS, A5ds and A10ds respectively.

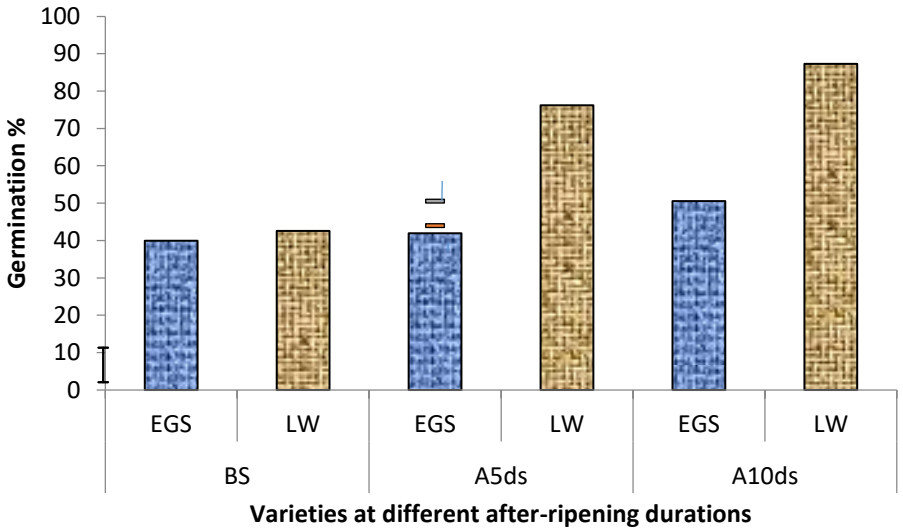

Figure 2 Variations in germination % of garden egg seeds after-ripened at different durations
LSD at P = 0.05

3.5 Interaction effects of varieties on after-ripening behaviour

The positive effects of after-ripening on garden egg fruits produced in this study were more pronounced on the Large white variety than the Elongated green stripe variety. Table 3 shows that when seeds of Elongated green stripe variety harvested at the about to ripen stage were tested for viability before storage, the germination produced was not significantly different with the seeds tested after five days of after-ripening. However, when seeds of Large white variety harvested at the same stage were tested before storage no germination was recorded. The germination however, significantly rose from zero to 54.17 % when tested after five days of after-ripening.

Table 3 Interaction effects of harvest stage, after-ripening durations and variety on the percentage germinations of garden egg seeds

		Percentage germinations	
Harvest stages	**After-ripening durations**	**EGS variety**	**LW variety**
AR	BS	38.14	0.00
	A5ds	34.75	54.17
	A10ds	61.35	90.00
FR	BS	37.44	42.67
	A5ds	42.36	84.42
	A10ds	37.39	85.93
OR	BS	44.25	85.08
	A5ds	48.74	90.00
	A10ds	52.53	85.94
LSD = 0.05		**11.34**	**11.34**

IV. Discussion

The increase in values recorded for fruit length, diameter and weight from AR to FR is an indication of progressive increase in the accumulation of assimilates during fruit maturation. This is in agreement with reports by Raz *et al.* (2001) and Bentsink and Koornneef (2008) that as an embryo undergoes maturation, there is food reserve accumulation. The failure of fruit length and diameter to record further increases at the OR stage while only increases in weight continued to this stage is an indication that maximum fruit size was attained at FR stage but there was still dry matter accumulation which resulted only in weight increase at this stage. Ortola *et al.* (1988) found fruits which had attained maximum growth rate to result into enhanced transport toward the fruit until maturation, pointing out that there is usually an increase in sink strength of the fruit at this stage of development.

The situation in which fruit length, diameter as well as number of seeds per fruit did not yield increases with after-ripening durations was expected because once a fruit is harvested; it is completely detached from its major sources of nourishment which results to development in size. However, the positive responses of fresh and dry seed weights as well as 100-seed weights to five and ten days after-ripening show that even when development in size and number had ceased, there was still a movement of assimilates from the fruit endosperm into the seed within the after-ripening period. In a study conducted to determine the effects of season, time of fruit harvesting and after-ripening durations on the quality of 'egusi' melon [*Citrullus lanatus* (Thumb) Matsun and Nakai] seeds, Kortse and Oladiran (2013) only found after-ripening duration to significantly influence 100 seed weight and germination percentage while the other parameters studied (i.e. fruit weight, number of seeds per fruit and dry seed weight per fruit) were not significantly affected.

The higher germination recorded by the last stage of harvest agrees with Shaheb *et al.* (2015) who found highest germination of French bean seeds to be obtained from the latest harvest. Also, the improvements in germinations recorded from successive after-ripening durations agrees with Dias *et al.* (2006) who found a short period of post-harvest fruit storage to improve physiological seed quality of tomato. Earlier, Passam *et al.* (2010), reported that although eggplant is a non climacteric species and fruit do not ripen after harvest, nevertheless seeds within the fruit continue to fill and mature after harvest, hence storage of prematurely harvested fruit prior to seed extraction permits the seeds of these fruit to after-ripen in situ and thereby increases seed size and germination. It was therefore, recommended that garden egg fruits for seed production should be harvested at over-ripened stage and after-ripened for about ten days before seed extraction.

References

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

[2] Carrera, E., Holman, T., Medhurst, A., Dietrich, D., Footitt, S., Theodoulou, F. L. and Holdsworth, M. J. (2008). Seed after-ripening is a discrete developmental pathway associated with specific gene networks in Arbidopsis. The Plant Journal 53(2): 214-224 Jan. 2008

[3] Dias, D. C. F. S., Ribeiro, F. P., Dias, L. and Vidigal, D. (2006). Tomato seed quality in relation to fruit maturation and post-harvest storage. Seed Science and Technology 34(3):691-699 Sept. 2006.

[4] Khatun, A., Kabir, G. and Bhuiya, M. A. H. (2009). Effects of harvesting stages on the seed quality of lentil (Lens culinaris L.) during storage. Bangladesh Journal of Agricultural Research 34(4):565-576

[5] Kortse, P. A. and Oladiran, A. J. (2013). Effects of season, time of fruit harvesting and after-ripening durations on the quality of 'egusi' melon [Citrullus lanatus (Thumb.) Matsum and Nakai] seed. International Journal of Scientific and Research Publications, vol.3(2)

[6] Okon, E. U., Anslem, A. E. and Nsikan, E. B. (2010). Technical efficiency and its determinants in garden egg (Solanum spp.) production in Uyo metropolis, Akwa Ibom state. The Journal of Field actions. Field Actions Science Reports. Special issue 1 2010: Urban Agriculture

[7] Ortola, A. G., Monerri, C. and Guardiola, J. L. (1988). Estimulacion del desarrollo del fruto en el mandarino Satsuma mediaute la aplicacion de acido naftalen acetico. Actas de Horticultura 1:22 - 27

[8] Passam, H. C., Theodoropoulou and I. C. (2010). Influence of harvest time and after-ripening on the seed quality of eggplant. Scientia Horticulturae 125(3): 518 - 520
[9] Pessarakli, M. M. and Dris, R. (2003). Effects of pruning and spacing on the yield and quality of egg plant. Food, Agriculture and Environment, vol. 1(2):215-216
[10] Raz, v., Bergervoet, J. H. and Koornneef, M. (2001). Sequential steps for developmental arrest in Arabidopsis seeds. Development **128:** 243-252
[11] Shaheb, M. R., Islam, M. N., Nessa, A. and Hossain, M. A. (2015). Effect of harvest times on the yield and seed quality of French bean. Research Journal of Agriculture and Forestry Sciences. 13(1):01-13

P. A. Kortse. "Effects of Stage or Fruit Harvesting and After-Ripening on the Seed Quality of Garden Egg (Solanum Melongena L.)." IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS), vol. 10, no. 9, 2017, pp. 10–14.