Harvesting as a Management Practice for Avoiding Excessive Damage by the Seed Bug, *Dysdercus superstitiosus* for Quality Seed Production in Okra, (*Abelmoschus esculentus*(L) Moench)

BY

RIVERS, Eseabasi Udofia
Department of Crop Science,
Faculty of Agriculture, University of Uyo, Uyo, Akwa Ibom State

&

EWETE, Francis Kola
Department of Crop Protection and Environmental Biology,
Faculty of Agriculture, University of Ibadan, Ibadan, Oyo State

ABSTRACT

The physiological state at which okra fruits are harvested for seed production and the infestation of seed sucking bugs are the two major factors militating against quality seed production. This study was conducted to elucidate the best time to harvest okra fruits for quality seed production in relation to the seed bug, Dysdercus superstitiosus causing damage to the seeds. Seeds of okra variety NH47-4 were planted in a Randomized Complete Block Design (RCBD) comprising four blocks which represented four replications and four plots in each block representing the harvesting regimes (viz 28, 35, 42, and 63 days after flowering (DAF)) as the treatments. Flowers were tagged daily on each plant and fruits that developed were harvested at each of the treatments. Weekly assessment of Dysdercus superstitiosus was done by direct count through random sampling with replacement method. After fruit harvesting and sun-drying, seed viability and damage were assessed. Seeds from fruits harvested at 28, 35 and 42 days after flowering (DAF) gave significant percentage germination being 42.50, 71.25 and 47.50%, respectively. Harvesting at 35 DAF had significantly the highest seed germination being 71.25 percent. Increasing population of Dysdercus superstitiosus as evidenced on fruits harvested at 63 DAF which was 18.75 significantly ($p<0.05$) increased percent seed damage by 86.20 and reduced seed germination to 15.00 percent.

Keywords: Okra, Harvesting, *Dysdercus superstitiosus*, Population, Seed quality.

INTRODUCTION

Okra, *Abelmoschus esculentus* L. Moench, belongs to the family Malvaceae. It is the most important fruit vegetable crop and a source of calorie (4550kcal/kg) for human consumption. It ranks first before other vegetable crops (Babatunde *et al*., 2007). Okra contains carbohydrates, proteins and vitamin C in large quantities and mineral elements such as calcium, potassium, phosphorus etc (Adeboye and Oputa, 1996). Okra leaves are considered good cattle feed, but this is seldom compatible with the primary use of the plant. Okra has medicinal properties which can be; antispasmodic, demulcent, diaphoretic, diuretic, emollient and

stimulant. Its mucilage from mature pods and roots can be used as a plasma replacement which produces antibodies in cells of the body. Industrially, it is used in making paper and textiles (Nilesh *et al*., 2012).

Despite the high nutritional value of okra, its productivity is low due to limited availability of quality seeds. This problem of obtaining good quality seeds has been one of the major constraints in raising the present status of okra production from the house-hold level into a commercial enterprise. Seed is the most critical input for successful crop production, in addition to other costlier inputs such as fertilizer, irrigation, herbicides, insecticides, fungicides needed to guarantee efficient crop production. A good quality seed must conform to the following criteria; Genetic and physical purity, physiologically viable and free from damage by insects, diseases and weed seeds.

In okra, the physiological state at which the fruits are harvested for seed production and the infestation of insect pests especially the seed sucking bug (*Dysdercus superstitiosus* which feeds on developing pods and seeds, piercing them to suck sap thereby causing seeds dryness and shrivelling), are two of such pre-storage factors militating against quality seed production. Determination of an accurate time of harvest has been reported as being a major constraint in ensuring high seed quality of some crops (Oladiran and Kortse, 2002; Demir *et al*., 2004; Khatun *et al*., 2009). Harvest time is a major factor responsible for physiological maturation level, size and vigour of seed. Therefore, the objectives of this study is to determine the best time to harvest okra fruits for quality seed production in relation to the seed bug, *Dysdercus superstitiosus* causing damage to the seeds.

MATERIALS AND METHODS

The study was carried out in the field and laboratory. The field study was conducted at the Practical Year Training Programme (PYTP) farm, Faculty of Agriculture and Forestry, University of Ibadan, Ibadan, Oyo State, Nigeria. The land used was cleared, ploughed and harrowed. The laboratory experiments were carried out at the Entomological Research Laboratory of the Department of Crop Protection and Environmental Biology, University of Ibadan, Ibadan, Nigeria. Seeds of okra variety NH47-4 were obtained from Eagle seeds shop, Orogun, Ibadan. The ploughed land was laid out in a Randomized Complete Block Design (RCBD) comprising four blocks which represented four replications and four plots in each block representing the harvesting regimes (viz 28, 35, 42, & 63 days after flowering (DAF)) which formed the treatments. Each plot size was 3.6m x 4.05m and separated from each other by a guard row of 0.6m. The total land area used was 16.2m x 18m.

Planting was done 1st May 2014; four seeds were planted per hole at a distance of 0.9m and 0.45m between and within rows, respectively. There were 5 rows per plot and 10 plants per row. The plots were watered manually twice daily before germination during the dry season. Thinning was done to maintain two plant stands per hill after two weeks of seedlings emergence. All the plots were given pre-flowering insecticide treatment using 0.05 percent dimethoate at 0.2 kg a.i. per hectare and 0.12 per cent monocrotophos at 1.2kg a.i. per hectare, respectively. The plots were subsequently weeded at five and nine weeks after sowing.

At anthesis, flowers were tagged daily on each plant. Fruits that developed from tagged flowers were harvested in each plot at 28, 35, 42 and 63 days after flower opening depending on the

treatment. The harvested fruits were sun- dried, shelled and the seeds were stored in envelopes according to the harvesting regime.

Weekly assessments to determine insect abundance was conducted from first week of flowering to fifteen weeks after flowering (WAF). Abundance of *Dysdercus* sp. was estimated once a week by direct counts of insects on a third of the plant population per plot using random sampling with replacement method.

Seed damage assessment (Laboratory experiment) was carried out by shelling twenty dried pods randomly selected from each treatment replicated four times, the seeds were counted and wrinkled seeds were considered damaged. Percent seed damage (SD) was computed thus:

$$\% \text{ SD} = \frac{\text{Number of damaged seeds}}{\text{Total number of seeds}} \times \frac{100}{1}$$

Seed viability test (Laboratory experiment) was determined by actual germination test by plating twenty randomly selected seeds in a Kilner jar containing a 9-cm No.1 Whatman filter paper kept moist with sterile distilled water. Germination counts were taken on the 5th day and expressed as a percentage of the total number of seeds plated. Each test was replicated four times in a Completely Randomized Design (CRD).

$$\% \text{ Germination} = \frac{\text{Number of germinated seeds}}{\text{Total number of seeds plated}} \times \frac{100}{1}$$

Data obtained from number of fruits produced per plant, seed germination and seed damage assessment as well as insect population assessment were analyzed using analysis of variance (ANOVA) and means separated using least significant difference (LSD) at 5% probability level.

RESULTS

Effect of harvesting regime on fruit production

In Table 1, harvesting at 28 DAF gave a significantly higher fruit production when compared with harvesting at 63 DAF being 51.25 and 9.75 fruits respectively. There was no significant difference in fruits harvested at 35 DAF and 42 DAF (table 1).

Table 1: The Effect of harvesting regime on the mean number of fruits produced per plant

Treatment (DAF)	Mean number of fruits per plant (HR)
28	51.25 ± 9.17a
35	34. 75 ± 9.46ab
42	31.75 ± 3.87b
63	9.75 ± 4.15c
LSD (P<0.05)	17.73

- Mean ± SE followed by the same letters are not significantly different at P = 0.05.
- Days After Flowering (DAF).

Effect of harvesting regime on population of *Dysdercus superstitiosus* and seed damage

The population of *Dysdercus superstitiosus* was significantly higher ($p<0.05$) in fruits harvested at 63DAF being 18.75 per plot compared with fruits harvested at 28, 35 and 42 DAF being 0.00, 0.25 and 1.25 percent respectively. Seeds were significantly damaged ($p<0.05$) in fruits harvested at 63 DAF by 86.20 percent compared with fruits harvested at 28, 35, and 42 DAF (table 2).

Table 2: Effect of harvesting regime on Dysdercus superstitiosus population and seed damage

Treatment (DAF)	*Dysdercus* sp. population density	Percentage seed damage
8	0.00 ± 0.00b	76.13 ± 4.04ab
35	0.25 ± 0.29b	65.08 ± 10.88bc
42	1.25 ± 0.99b	54.65 ± 6.56c
63	18.75 ± 6.09a	86.20 ± 2.69a
LSD (P<0.05)	8.33	19.45

- Mean ± SE followed by the same letters are not significantly different at P = 0.05
- Days After Flowering (DAF)

Effect of harvesting regime on seed viability

In Table 3, the percentage seed viability was significantly higher ($p<0.05$) in seeds harvested at 35 DAF (71.25) followed by harvesting at 42 and 28 DAF which were 47.50 and 42.50 percent, respectively compared with seeds harvested at 63 DAF (15.00) which was significantly lower ($p<0.05$).

Table 3: The effect of harvesting period on okra seed germination

Treatment (DAF)	Percentage seed Germination
28	42.50 ± 17.72ab
35	71.25 ± 21.13a
42	47.50 ± 21.92ab
63	15.00 ± 6.24b
LSD (P<0.05)	49.63

- Mean ± SE followed by the same letters are not significantly different at P = 0.05
- Days After Flowering (DAF)

DISCUSSION

Okra fruit production per plant was high in early harvesting; this was evident in 28 DAF indicating that harvesting okra fruits early will give an increasing number of fruits produced per plant which makes it advantageous to fruits production farming. This may be attributed to increased vegetative growth and proliferation of more side branches as a result of long duration of rain which kept the soil constantly moist for the plant. Singh *et. al.* (2003), reported that

optimum stage of harvest influences the seed germinability and vigour i.e. the stage after physiological maturity at which the seed is harvested affects the percent germination and vigour. Ibrahim and Oladiran (2011), reported that germination of okra seeds harvested earlier than 35 days after anthesis (DAA) was poor and also added that germination up to 97% were obtained at 42 DAA when fruits were straw-coloured, ridges completely split and the seeds were black in colour.

In this study, the high percentage seed germination exhibited by fruits harvested at 28, 35 and 42 DAF is indicative of seed maturity and readiness for harvesting. Singh *et. al*. (2003) who reported seed maturity in okra 27 and 26 days after flower opening and recorded 89.2 and 84 percent germination, respectively. Similar results were also reported by Baruah and Paul (1997) and Singh *et al.,* (2003). It was also observed that increasing population of the seed bug, *Dysdercus superstitiosus* largely contributed to the reduction in seed germination and hence the reduction in seed quality as clearly shown in which the highest *Dysdercus* population, 18.75, and highest percent seed damage were recorded on fruits of 63 DAF.

The traditional practice of leaving okra fruits for too long on the plants before harvesting as evidenced by the 63-day harvesting regime should be discouraged. This practice pre-disposes the fruits as well as the seeds to weather vagaries and excessive feeding and damage by *Dysdercus superstitiosus* resulting in a substantial reduction in seed quality. Munthali and Tshegofatso (2013), reported that *Dysdercus* sp. was most abundant during the late podding period of plants (delayed harvest), causing damage on the pods as well as the seeds. Similarly, Critchley (1997) and Schaefer and Ahmad (2000) reported that *Dysdercus* sp. suck sap from okra causing production of distorted, unmarketable pods and shriveled seeds. Adewusi and Oshipitan (2013) also reported positive correlation between number of damaged pods and number of *Dysdercus* sp.

CONCLUSION AND RECOMMENDATION

One of the major constraints to quality seed production in okra is to establish the best stage to harvest the fruits for seed production in order to minimise excessive feeding by the seed sucking bug, *Dysdercus superstitiosus*. Based on this work, fruits harvested at 35 and 42 days after flowering (DAF) produced the best quality seeds in terms of seed viability and less damage due to *Dysdercus* sp. infestation. At this stage, the fruits are orange to straw-coloured with partial to completely split ridges on the fruit wall.

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