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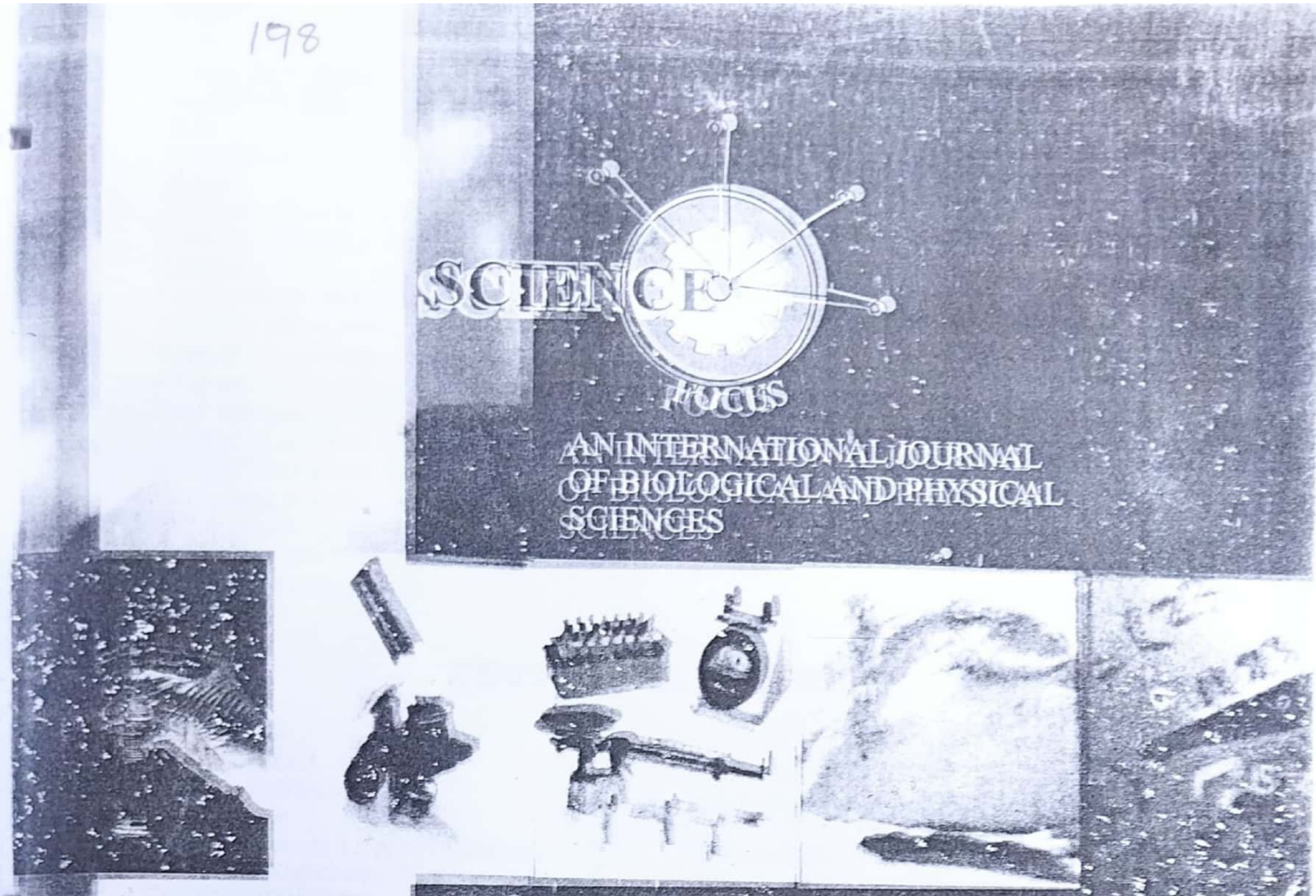

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Effect of fruit age and position on mother-plant on fruit growth and seed quality in Okra (*Abelmoschus esculentus* L. Moench)

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Abstract

The study was conducted at the Federal University of Technology, Minna, Nigeria. Okra (*Abelmoschus esculentus* L. Moench) seeds of variety NHAe47-4 were sown at a spacing of 40 cm along ridges constructed 75 cm apart. Following emergence, thinning was done to leave one plant per stand. Flowers were date-tagged at anthesis (i.e. immediately they opened). The fruits that developed in positions 1, 3, 5 and 7 were harvested at 14, 21, 28, 35, 42, 49, and 56 days after anthesis (DAA). Seed germinability was determined before and during storage. Except for the initial increase in fruit weight between 14 and 21 DAA in position 7, no increases were generally recorded with delay in harvesting. Generally, there were no significant increases (P>5%) in fruit diameter and length in all positions between 14 and 56 DAA. However, fruits of position 7 were significantly (P<5%) shorter and slimmer than those from other positions. There were significantly fewer seeds per fruit in position 7 than in the other positions at all the DAAs. A slight increase was recorded in the weight of wet seed between 14 and 21 DAA. This was followed by a decline as from 21 DAA or 28 DAA depending on fruit position. Seed moisture content declined generally with DAA and one hundred-seed weight increased between 14 and 35/42 DAA. However, position did not influence 100-seed weight generally. Prior to storage, germination of seeds harvested earlier than 35 DAA was poor. Germination of up to 97% and the ability of the seeds to maintain viability for long, were obtained at 42 DAA when fruits were straw-coloured, ridges completely split and the seeds were black in colour. Across DAAs, seed weight and survival ability were best in fruit positions 1, 3 and 5.
Keywords: Anthesis; fruit position; seed quality; vigour; longevity; okra.

Introduction

Okra (*Abelmoschus esculentus* L. Moench) is widely grown as a vegetable. The immature fruit is eaten green, either fresh or prepared by boiling or frying and used in soups and stews (Bleasdale, 1984). Its nutritional value lies in its high amount of calcium and phosphorous. It also contains protein, carbohydrate and fibre and some amounts of vitamins (Tindall, 1983). Because of the nutritional and economic importance of okra, it is imperative that adequate attention be given to ways of producing the seed in such a way that high quality is ensured.

The major aim of a gene bank curator is to conserve seeds in a way that would ensure high quality for a long time. Even if storage condition is ideal, seed longevity is still known to be affected by the crop production procedures which are adopted by the farmer. The physiological state at which a seed is harvested and the position of fruit on the mother-plant are two of such pre-storage factors. The stage during seed development at which seeds attain maximum quality is subject of some controversies. Harrington (1960) reported that seeds attain maximum quality at the end of the seed filling period and that thereafter viability and vigour declines. In some other species however, the best quality may not be obtained until sometimes afterwards (Kameswara *et al.*, 1991). In tomato, Demir and Ellis (1992) reported that mass maturity (end of the seed-filling period) occurred 41 and 39 days after anthesis in the first and second

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trusses respectively. Their results also revealed that the ability of seeds to germinate was not detected until after mass maturity and that the onset of germinability occurred 35, 45 and 55 days after anthesis in the first, second and third trusses respectively. In general, seeds germinated more rapidly the later they were harvested and when first dried. Agrawal (1980) stated that okra seed pod should be harvested when they are dry (i.e. about 35 days after anthesis). Delayed harvest may lead to low germination and vigour due to adverse weather conditions in okra (Agrawal, 1980; TeKrony *et al.*,1980) and pepper (Dias *et al.*, 2006). Mugnisjah and Nakamura (1984) reported that early harvest may result in poor germination and vigour in soyabeans. The common practice in okra is the harvesting of fruits from all positions at the end of the rains. Thomas *et al.* (1979) stated that the position at which a carrot or celery seed is produced on the plant can markedly affect its size, germination characteristics and size of the ensuing seedling. In both species the lowest percentage seed germination and seedling emergence were obtained from seeds produced on primary umbels (first formed seeds). A similar result was also recorded in tomato by Dias *et al.* (2006). Fruit size is also known to vary with position on mother-plant. Ho and Hewit (1986) reported that during rapid growth in tomato, both the rates of maximum growth and of starch accumulation of proximal fruits are higher than those of distal fruits. However, when the assimilate supply is abundant, the proximal fruit could gain more weight than the distal ones. The objective of this study therefore, was to examine the effects of the position of a fruit on the mother-plant on its growth and seed development.

Materials and methods

The research was conducted at the Teaching and Research Farm of the Federal University of Technology, Minna (9^0 0'N; 6°30'E), Niger State, Nigeria. The average rainfall and temperature during the study period were 1011.9 mm and 31.3^{0}C respectively. Seeds of okra (*A. esculentus* L. Moench) variety NHAe 47-4 were sown on the flat 75 cm apart between rows and 40 cm apart along the rows. Thinning was done to leave one plant per stand two weeks after emergence of the seedlings to give a plant population of 33,333/ha.. Atrazine and pendimentaline (1.32 and 2.05 kg a.i/ha) were tank mixed and applied to control weeds.The plots were subsequently weeded at four and nine weeks after sowing. Opening of the flowers is normally used to index anthesis on the field and flowers were date-tagged immediately they opened. Fruits that developed from tagged flowers were harvested at 14, 21, 28, 35, 42, 49, and 56 days after anthesis (DAA) from positions 1, 3, 5, and 7 numbering from the base of the plant. Soon after harvest, fruit weight, length and diameter were taken. For 100-seed weight determination, four replicates of 100 seeds each were counted and weighed on a Metler balance to index seed vigour. Determination of moisture content (on wet-weight basis) of seeds was done by the oven drying method at 130^0 C for one hour. For the storage studies, seeds of the different treatment combinations were placed in small open plastic containers and then positioned in an incubator running at 30^0 C and at a relative humidity of about 70% to accelerate ageing according to the method of Delouche and Baskin (1973).

Prior to and at four-weekly intervals during storage which lasted for 18 weeks, germination was determined by counting seeds from the different lots on to moist absorbent paper in Petri dishes. There were four replicates of 50 seeds each and the paper was normally moistened with distilled water as found necessary. The dishes were arranged inside an incubator running at 30^{0}C. Germination counts were taken every-other-day for 28 days and the final count was expressed as a percentage of the total number of seeds incubated. The fruit and germination data generated were subjected to analysis of variance (ANOVA) based on completely random design. Means were separated by LSD where significant differences between treatments were obtained.

Results

Fruits from positions 1, 3 and 5, declined in fresh weight from 49.3, 48 and 46.2 g respectively at 14 DAA to 10.5, 10.4 and 10.1 g at 42 DAA (Fig. 1). The weights remained almost constant thereafter. An initial increase in weight was recorded between 14 and 21 DAA in fruits harvested from position 7, followed by a decline at later harvests. Fruits harvested from position 7 were generally significantly lower in weight than in the other positions, more especially when compared to positions 1 and 3. They were also generally slimmer and shorter than those from other positions (Figs. 2 and 3). Fruits from positions 1, 3 and 5 generally contained significantly more seeds than those from position 7 (Fig. 4). The study further

revealed that there was a general decline in the weight of fresh seeds per fruit after 21 DAA in position 7 and after 28 DAA in positions 1, 3 and 5 (Fig. 5). Seeds extracted from fruits in position 7 weighed

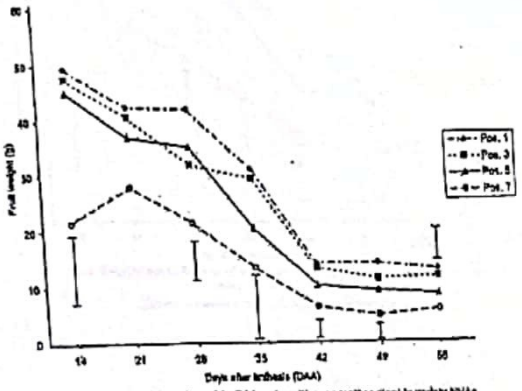

Fig. 1: Fruit weight (g) as affected by DAA and position on mother plant in variety NHAe 47 - 4

I LSD 5% to compare weights from different positions

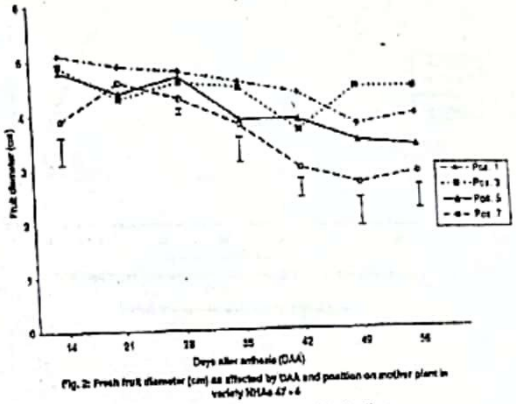

Fig. 2: Fresh fruit diameter (cm) as affected by DAA and position on mother plant in variety NHAe 47 - 4

I LSD 5% to compare fruit diameter from different positions

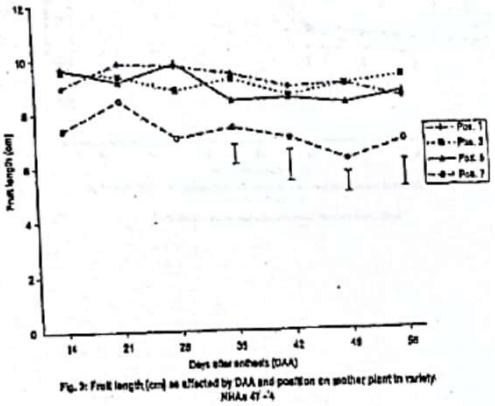

Fig. 3: Fruit length (cm) as affected by DAA and position on mother plant in variety NHAe 47 - 4

I LSD 5% to compare fruit lengths from different positions

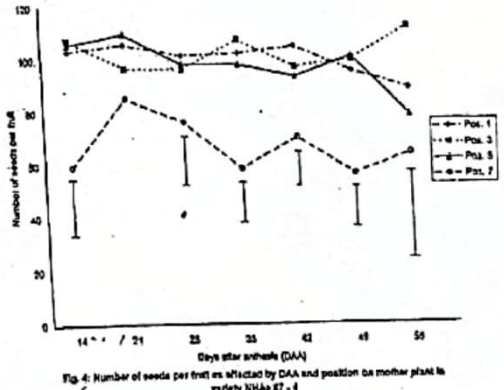

Fig. 4: Number of seeds per fruit as affected by DAA and position on mother plant in variety NHAe 47 - 4

I LSD 5% to compare number of seeds from different positions

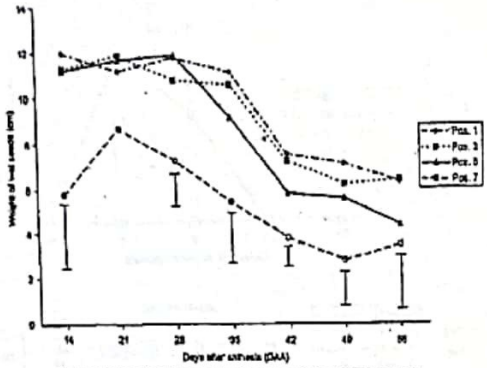

Fig. 6: Weight of wet seeds (g) as affected by DAA and position on mother plant in variety NHAs 47 - 4

I LSD 5% to compare weight of wet seeds from different positions

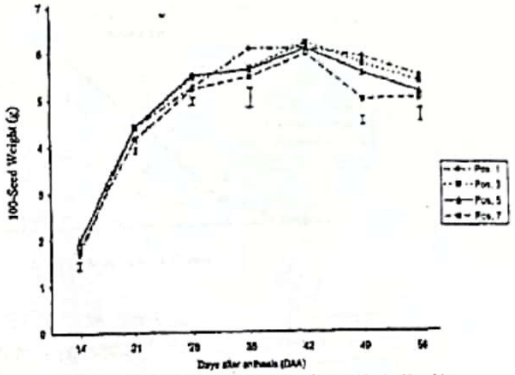

Fig. 7: 100 Seed weight (g) as affected by DAA and position on mother plant in variety NHAs 47 - 4

I LSD 5% to compare 100 seed weights from different positions

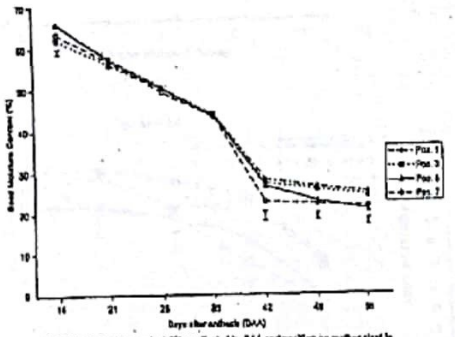

Fig. 8: Seed moisture content (%) as affected by DAA and position on mother plant in variety NHAs 47 - 4

I LSD 5% to compare seed moisture content from different positions

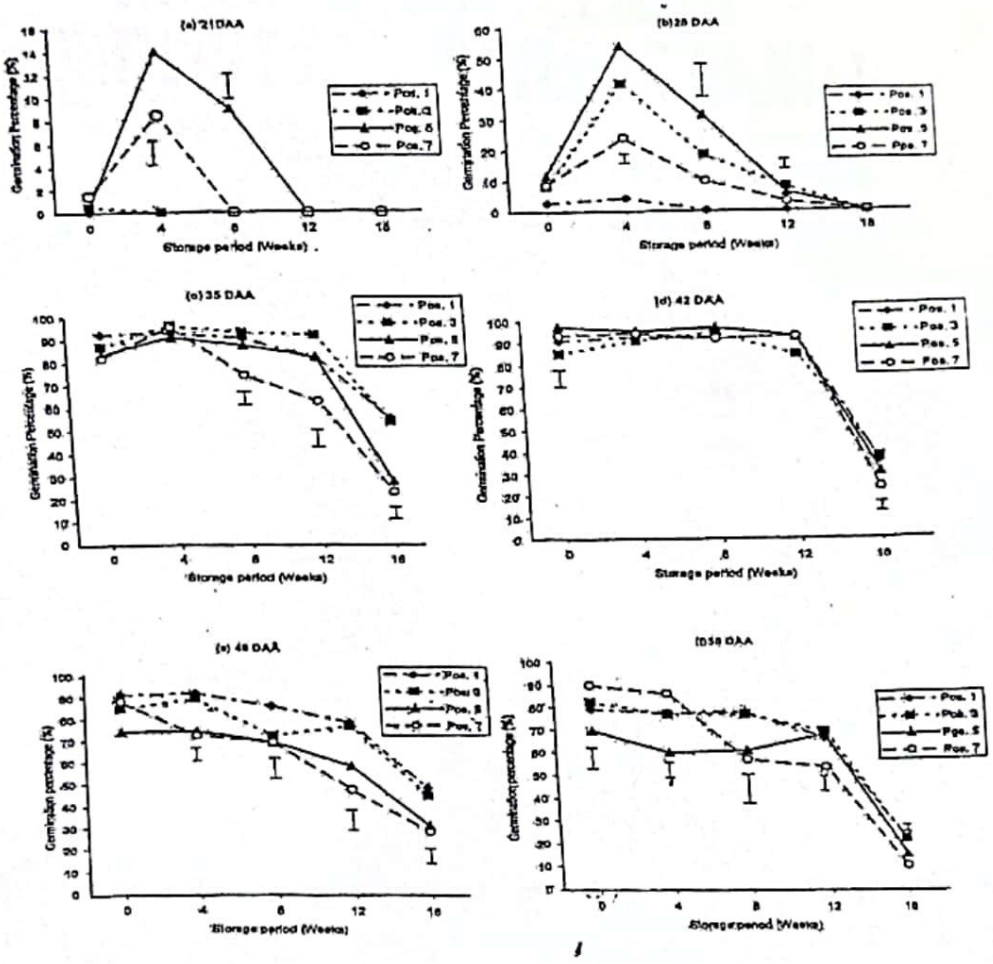

Fig. 8 (a-f): The germination percentages of aged and unaged NHAe 47-4 seeds harvested at different DAAs from different positions (1, 3, 5 & 7) on the mother plant

I LSD 5% to compare germination percentages of aged and unaged NHAe47-4 seeds from different positions and at different DAA's