EFECT OF NITROGEN AND PHOSPHORUS FERTILIZERS APPLICATION TO MOTHER PLANT ON THE QUALITY OF EGUSI MELON (*Citrullus lanatus* Thumb) SEED

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Abstract
The experiment to determine the effect of application nitrogen and phosphorus fertilizers to mother on the quality of egusi melon seed was conducted in the Crop Production laboratory of the Federal University of Technology, Minna, Nigeria. Egusi melon seeds were obtained from egusi melon plants that were produced with nitrogen (0, 40, 60 and 80kg /ha) and phosphorus (0, 10, 20 and 30 kg/ha) fertilizer application. The seeds were spread in open plastic plates and stored at 30^{o}C and about 70% relative humidity for 16 weeks. Seed samples were drawn and tested for germination, seedling emergence, vine length and number of leaves per seedling, at 0, 2, 4, 6, 8, 10, 12, 14 and 16 weeks of storage. Increased rates of Nitrogen and Phosphorus enhanced seed longevity. There was a decline in viability of seeds with increase in storage period irrespective of the quantity of Nitrogen and Phosphorus levels applied on the field. Seedling emergence, seedling vine length and number of leaves/seedling from stored seeds increased initially and later dropped with increase in storage period. The interaction effect was not significant. The viability and storability of seeds were enhanced by application of Nitrogen and Phosphorus. Application of 80 kg N/ha and 30 kg P/ha is the optimum for 'egusi' melon.

Keywords: Nitrogen, phosphorus, mother plant

Received: 16.10.2017 Reviewed: 04.12.2017 Accepted: 13.12.2017

1. INTRODUCTION

Fertilizer is an important factor determining the quality and robustness of seeds. The soil total nitrogen has long been identified as a factor that is important to soil fertility in both managed and natural ecosystems (Gaetano, 2007). Adequate supply of nitrogen is essential for vigorous vegetative growth, seed formation and optimum yield of melon (Olaniyi, 2008). Chandler (1999) reported that the addition of nitrogen between the rates of 60 and 120 kg N/ha increased fruit and seed yield in okra. William *et al*. (2000) stated that there will be no further increase in yield if N rates increase beyond 60 – 120 kg/ha in okra plant. Lenka and Petre (2004) reported significant increases in okra and canola seed yield; yield increased with increasing N levels. After nitrogen, phosphorus is the most limiting plant nutrient in most agricultural soils (Smithson and Sanchez, 2000) Phosphorus is an important constituent of nucleoproteins involved in high energy transfer compounds such as Adenosine TriPhosphate and plays a key role in energy transfer in the metabolic processes and also helps in root growth (Rashidi and Seilsepour, (2008). Phosphorus is a critical plant growth nutrient. Among the macronutrients, phosphorus is the key element, which improves root growth, hastens seed maturity and increases fruit yield especially in combination with nitrogen (Naik and Srinivas, 1994; Paddy and Dubey, 1996). Nitrogen and phosphorus exhibit synergy in functions in crop growth and development so cannot be used as replacement for one another (Uchida, 2007). Non-availability of good seeds remains a constraint to wide cultivation of vegetables in Africa (Adeboye *et al*., 2000). The viability of most farmers' seeds is usually poor because of the low level of production techniques (Schippers, 2000). Therefore, the aim of this study is to determine the effect of application of nitrogen and phosphorus fertilizers to mother plant on the quality of egusi melon seeds. Egusi melon (*Citrullus lanatus* Thumb.) is an herbaceous annual vegetable crop with a trailing hairy, ridged vine which bears tendrils and lobed leaves on petioles. It belongs to the cucurbitaceae family (Ogbonna and Obi, 2009).

2. MATERIALS AND METHOD

Four levels of nitrogen (N) and phosphorus (P) fertilizers at the rate of 0, 40, 60 and 80kg N ha^{-1} and at 0, 10, 20 and 30 kg P ha^{-1} were applied to egusi melon (*Citrullus lanatus* Thumb.) at the Teaching and Research Farm of Federal University of Technology, Minna (9° 40'N and 6° 30'E), in the Southern Guinea Savannah region of Nigeria during the rainy seasons of 2011, 2012 and 2013. Harvesting of fruits was done when the vines were completely dry. Harvested fruits were cut into two and allowed to decompose for two weeks. Seeds were then extracted, washed in a stream of running water and dried in the sun for six days. Samples of seeds were stored at 30°C and relative humidity of about 70 %. Seeds were drawn for germination test at 0, 4, 8, 12, and 16 weeks. Germination test was conducted on both freshly produced and stored seeds. Four replicates of 25 seeds were counted from each treatment combinations and placed on water moistened absorbent paper in Petri dishes incubated at 30°C for 28 days. Germination counts were taken every-other-day and the absorbent paper was moistened as found necessary. Four replicates of 10 seeds each from all the treatment combinations were sown separately in plastic pots filled with surface the same field soil. For seedling emergence and growth test, data were collected on seedling emergence percentage, number of leaves per seedling and vine length at 14 days after sowing. Data collected on germination and seedling emergence was subjected to Analysis of variance (ANOVA) and means were separated where significant differences exist using DMRT and LSD BARS at 5% level of probability.

3. RESULTS AND DISCUSSION

Results

Figure 1 below shows that seeds produced at all N application levels germinated equally highly within the first four weeks of storage during the three years of study. As from 6 weeks after storage (WAS) significant differences were recorded among N fertilizer treatments. Germination percentages were significantly higher at 80 kg N /ha than any of the other N levels: germination was poorest at 0 kg /ha. Similar to what was recorded for nitrogen application, significant differences among seeds produced at different P levels in 2011 and 2012 only became evident as from 6 weeks of storage Figure 2. In 2013, differences among P levels only became significant as from 8 WAS. As from 6 weeks of storage in 2011 and 2012 and as from 8 weeks of storage in 2013, only the differences between 30 kg /ha and 0 kg P/ha were significant. So viability was best maintained in seeds produced with 30 kg P /h and poorest in those without P application.

The effect of nitrogen application to mother plant on seedling emergence was significant (figure 3). There were no significant differences in emergence percentages of seeds produced from the different N plots within the first two weeks of storage in 2011 and 2013 and within the first four weeks of storage in 2012 (Figure 3). As from 4 to 18 WAS in 2011 and 2013 and from 6 to 18 WAS in 2012, significantly higher seedling emergence were recorded from seeds produced at 80 kg N/ha than at all other N level. Furthermore, seedling emergence percentages were generally lower from seeds produced at 0 kg N /ha than at 40 and 60 kg /ha.

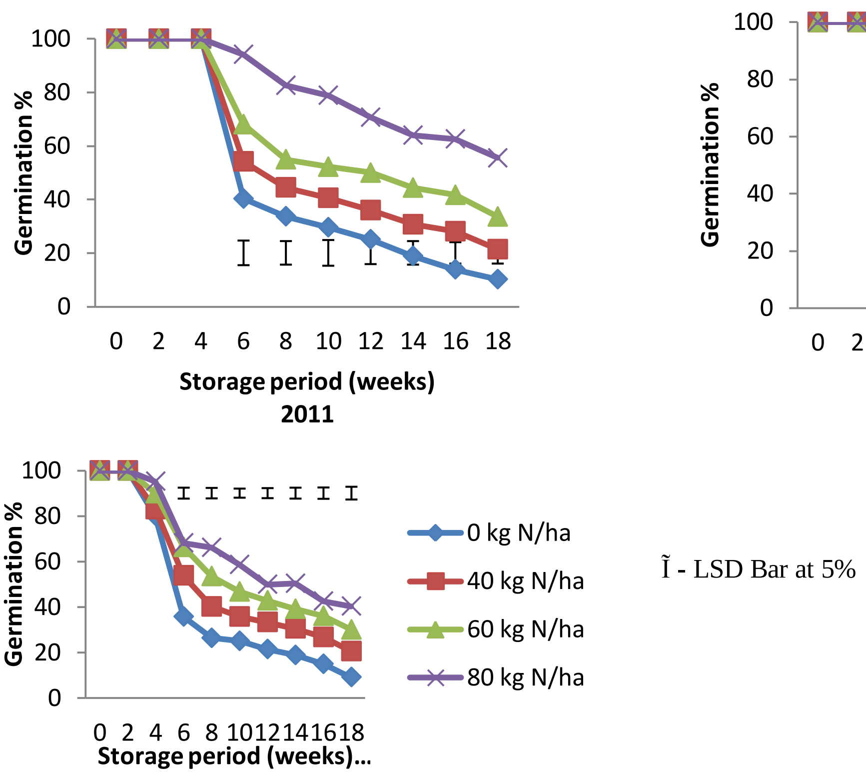
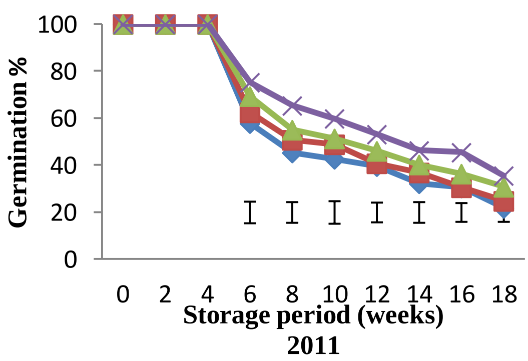


Fig. 1: Germination percentage of seeds produced under different N fertilizer levels following storage for 18 weeks



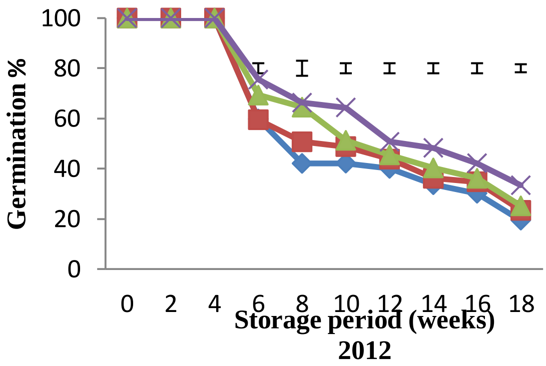
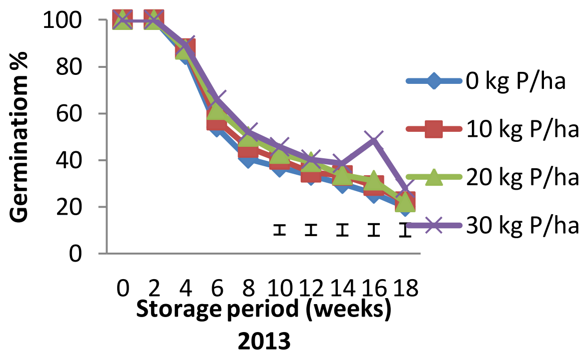


Fig. 2: Germination percentage of seeds produced under different P fertilizer levels following storage for 18 weeks

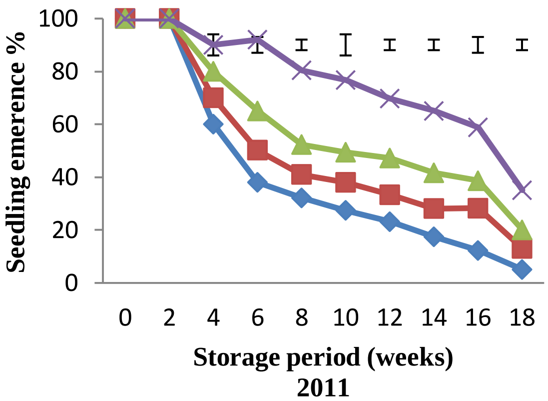
Ĩ - LSD Bar at 5%

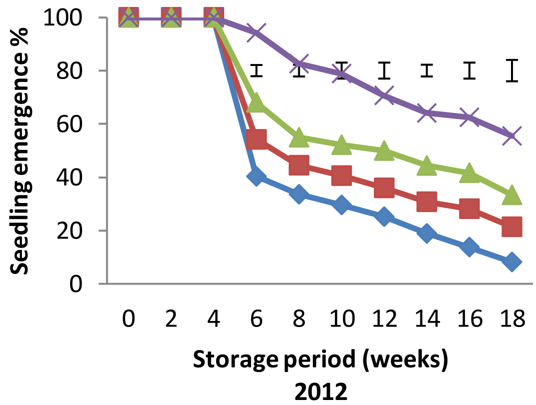


The effect of phosphorus fertilizer levels on seedling emergence percentage in 2011, 2012 and 2013 are presented in Figure 4. P applied at all the levels had no significant effect on seedling emergence within the first two weeks of storage in 2011 and within the first four weeks of storage in 2012 and 2013. As from 4 WAS in 2011 and 6 WAS in 2012 and 2013, percentage seedling emergence was significantly greater in seeds produced at 30 kg/ ha than at 0 kg/ha. In the three years of study the differences between the levels of 0 and 40 kg N/ha were not significant as from 4 and 6 weeks of storage up to 18 weeks.

Application of nitrogen at 80 kg /ha significantly enhanced melon vine length compared to what was recorded for 0 N application throughout the storage period in the three years of study (Figure 5). Furthermore, the differences between application of N at 80 and 60 kg /ha, and that between 40 and 0 kg /ha were not significant in 2012. In 2013 cropping season, application of N at 80 kg /ha was superior compared to 0 kg /ha, N applied at 60 kg /ha also significantly increased vine length when compared with 0 kg/ha. The differences in response to the application of 60 and 40 kg N/ha and 40 and 0 kg /ha were generally non-significant on vine length. Furthermore the differences in response to N application at 80 and 60 kg /ha were not significant at 14 – 16 WAS.

Figure 6 shows that the application of P at all levels had no significant effect on vine length all through the study periods; vine length declined with storage period irrespective of P application levels. There was a declining from 18 to 16 cm at 0 WAS and from 12 to 10 cm at 18 WAS in 2011. In 2012 the decline was from 16 to 15 cm at 0 WAS and from 8 to 7 cm at 18 WAS. While in 2013, the decline was from 19 to 18 cm at 0 WAS to 9 to 8 cm at 18 WAS.





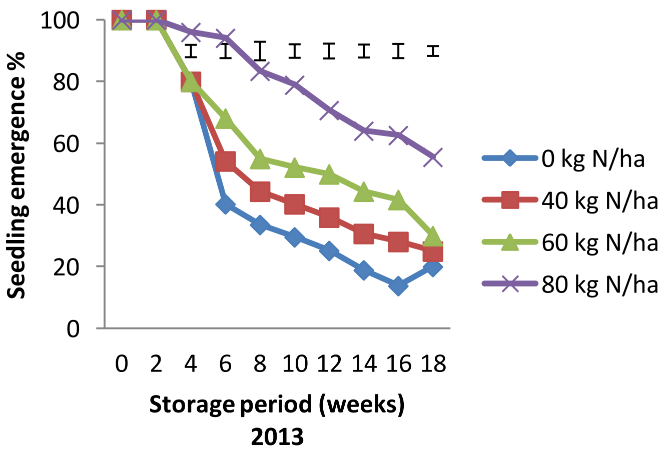


Fig. 3: Percentage seedling emergence of seeds produced from different N fertilizer levels following storage for 18 weeks

Ĩ - LSD Bar at 5 %

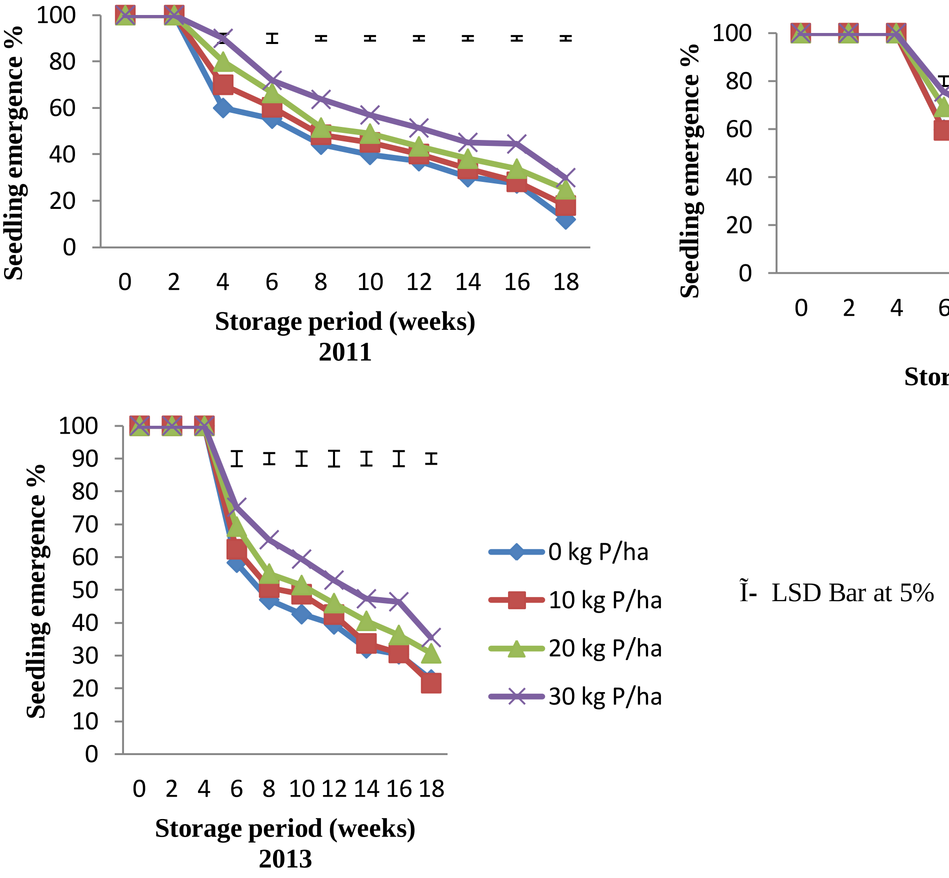
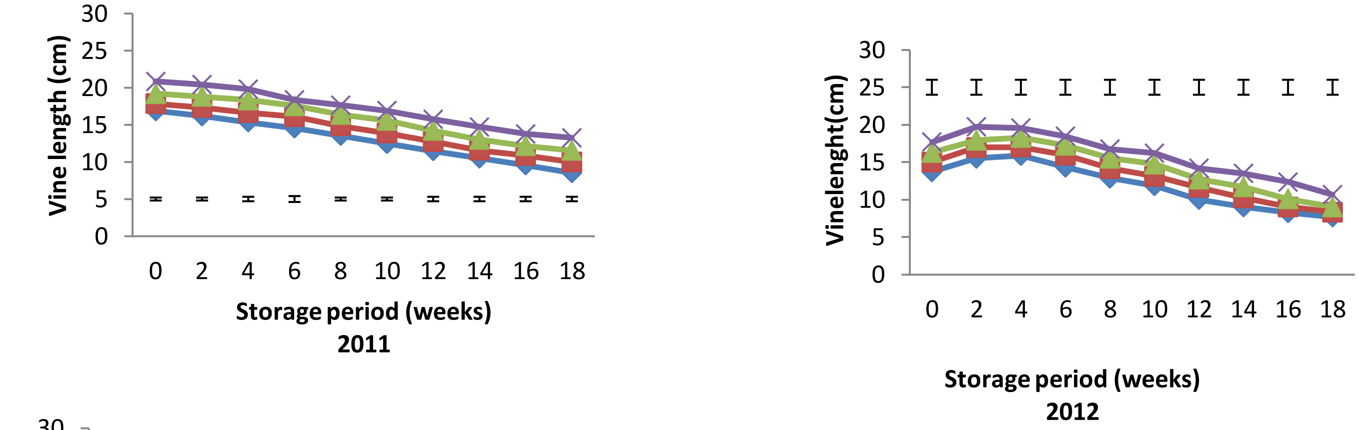


Fig. 4: Percentage seedling emergence of seeds produced under different P fertilizer levels following storage for 18 weeks



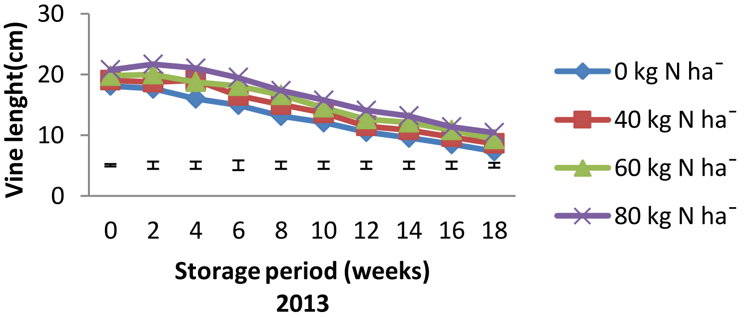
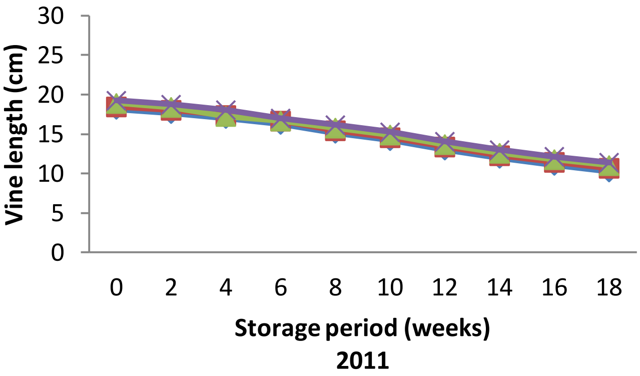


Fig. 5: Vine length of plants produced from seeds produced under different N levels following storage

Ĩ - LSD Bar at 5 %



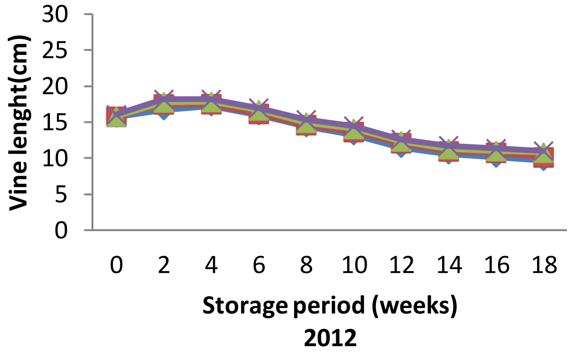


Fig. 6: Vine length of plants produced from seeds produced under different P levels following storage

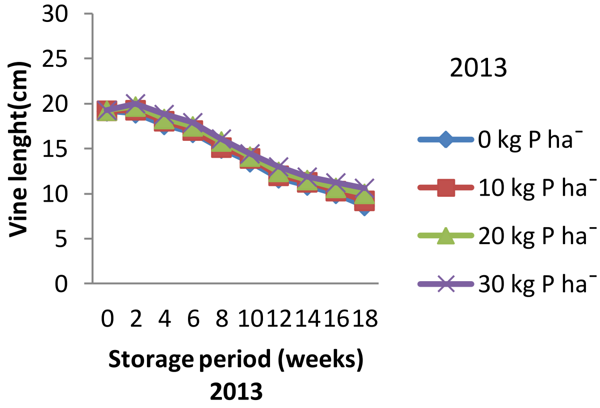
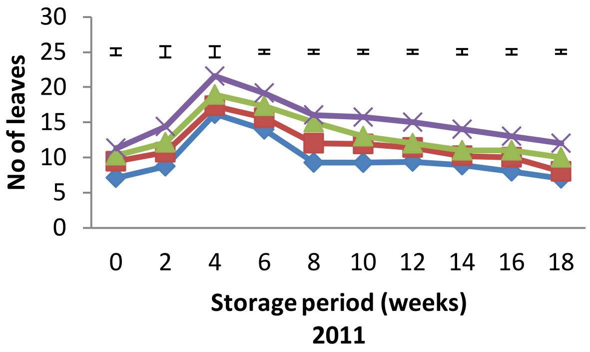
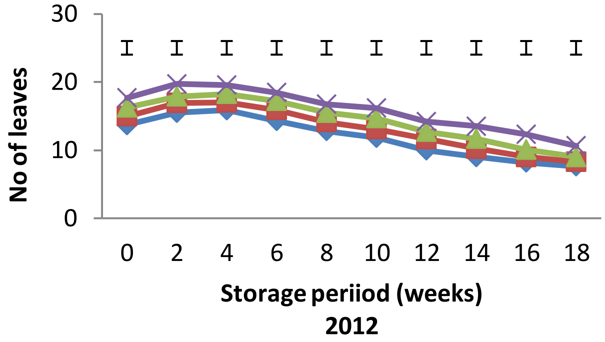


Figure 7 shows that the application of N at 80 kg/ha produced significantly greater number of leaves. Application of N at 80 kg /ha produced 22 leaves at 4 WAS and 10 leaves at 18 WAS in 2011. About 20 leaves was produced at 4 WAS and 10 leaves at 18 WAS in 2012 with application of N at 80 kg/ha. While in 2013, 22 leaves was produced at 0 WAS and 10 leaves at 18 WAS application of N at 80 kg/ha. In 2011, there were increase in number of leaves between 0 – 4 WAS, and between 0 -2 WAS in 2012. The increases were thereafter followed by decline. In 2011 and 2013, the differences between the values recorded in respect of 80 and 60 were generally significant. Also, no significant differences were recorded between 60 and 40 kg /ha. The differences in responses to the number of leaves at 80 and 60 kg /ha and that at the levels of 40 and 0 kg /ha were not significant from 2 to 18 WAS in 2012 and 4 to 18 WAS in 2013.

The effect of phosphorus application on the number of leaves in 2011, 2012 and 2013 is shown in (Figure 8). Application of P at the level 30 kg/ha resulted in the production of significantly greater number of leaves than was recorded for 0 kg /ha from 0 to 18 WAS in 2011 and 2012. In 2013, the significant effect of P started manifesting from 4 WAS. Differences in response to 30 and 20 kg P /ha were generally non – significant except at 10 – 14 WAS in 2011. Also differences in response to 0 and 10 as well as those between 10 and 20 kg P/ha were generally insignificant in all the years of study.





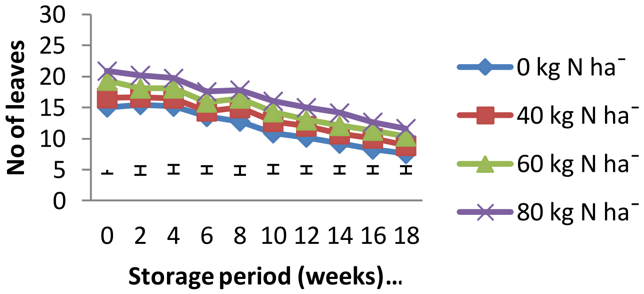
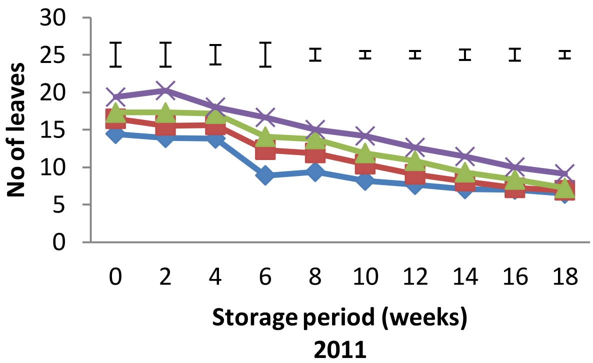


Fig. 7: Number of leaves of plants produced from seeds produced under different N levels following storage
Ĩ- LSD Bar at 5%

Fig.7. Number of leaves of plants produced from seeds produced under different N levels following storage



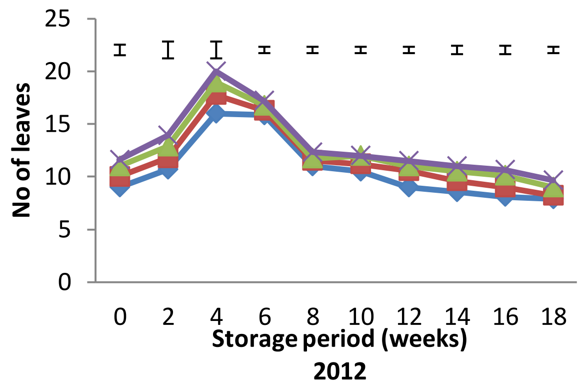
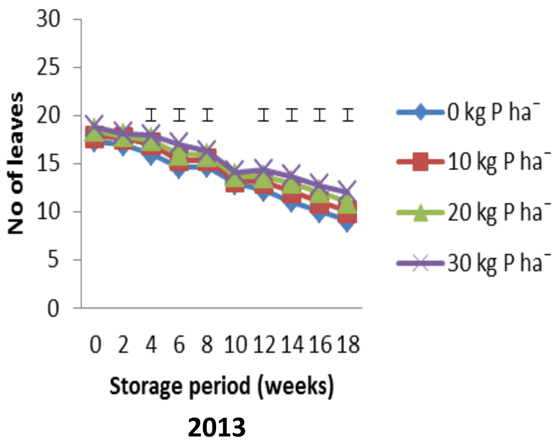


Fig. 8: Number of leaves of plants raised from seeds produced under different P levels and stored for 18 weeks

Ĩ- LSD Bar at 5 %



Discussion

Seed germination and longevity as well as seedling emergence percentages were best ensured when mother plants received application of 80 kg N/ha and 30 kg P/ha compared to lower application rates on the field throughout the study period. This is in line with the study of Adediran *et al*. (2015) on *Solanum macrocarpon* seed in which application of 80 kg N/ha resulted in best germination percentage. Provision of adequate soil nutrition will result in greater food reserve in seed (Adeniyi *et al*., 2004). The availability of seed reserves will likely influence any subsequent seedling germination and establishment (Dolan, 2004). Good seed nutrition of the mother-plant during growth is important as it has been reported by Dias *et al.* (2006) to result in rapid seedling emergence as recorded in this study. In this study, there was generally a decline in germination percentages irrespective of the quantity of N and P levels applied on the field. Seed normally deteriorate with age and 'egusi' melon seed has been reported to deteriorate fast especially if not properly handled due to its oil content (Olaniyi, 2008). This trend agrees with finding of others. Soltani *et al*. (2009), Al-Maskri *et al*. (2003) and Gungula and Tame (2006) reported that seed ageing occurs gradually with advance in time. They described it as a natural but unavoidable and a continuous process. As seeds age, they undergo changes which lower their potential vigour and performance capability (Oladiran and Mumford, 1990: Rina and Wahida, 2008). Aghabarati and Malalian (2011) described these degenerative changes that occur with time to increased seed vulnerability to external changes and decrease seed longevity. Kapoor and Jato (2007) reported that seeds generally tend to loose viability with ageing even under ideal storage conditions. Asharaf and Habib, (2011) also reported that ageing is a natural phenomena which is associated with reduction in quality and performance with time. There was initial increase in seedling emergence, seedling vine length and number of leaves/seedling from stored seeds, which may have been due to existence of dormancy in freshly harvested seeds and which were broken with time. The eventual decline in the scores of the different traits is common with ageing. And thereafter a decline was observed in this study which can be due to seed deterioration with time.

4. CONCLUSION

The viability and storability of seeds were enhanced by application of N and P fertilizers. Application of 80 kg N/ha and 30 kg P/ha is the optimum for 'egusi' melon.

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