



Effects of Seed Weight on the Germination of Six Commonly Cultivated Crops in Ekpoma, Edo State, Nigeria

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ABSTRACT

Germination involves the emergence of the plumule and radical from formally dormant seeds into viable seedlings. Seed weight and seasonal variations seem to affect seed germination. Thus, effect of seed weight on germination was investigated over wet and dry seasons in maize, rice, melon, beans, groundnut and okra. This experiment was conducted at the Botanical Garden of Ambrose Alli University, Ekpoma, Nigeria. First, viability tests were conducted following standard procedures and methods. Percentage viabilities for the seeds were tested before actual experimentation. The actual experiment was conducted with seeds sown at the soil surface on sandy-loamy soils dug and packed into polyethylene bags measuring 50cm in diameter by 40cm high and thoroughly watered. Germination percentages were least in the light-weighted seeds, followed by intermediate-weighted seeds while heavy weighted seeds showed the highest germination rates. Seed weight had tremendous influence on germination since increasing seed weight led to a corresponding increase in germination percentages. It was suggested that heavier-weighted seeds should be used in preference to lighter-weighting seeds as a production strategy for the six studied crops. Also, the vagaries of weather did not have any significant impacts on germination percentages of most crops, as long as proper irrigation was employed.

Keywords: Germination; Seed weight; Seasonal variation

INTRODUCTION

Germination has to do with the emergence of the plumule (shoot) and radical (root) from formally dormant seeds into viable seedlings. It is the phase where viable seeds were transformed into seedlings. Seed weights have been found to influence germination of certain crops. Tripathi and Khan (1990) stated that germination, survival and growth of seedlings are influenced largely by food reserves in seeds, which increases with seed weight. Upadhaya et al (2006) cited the existence of conflicting reports in interspecific variation in seed weight and germination behaviour. They cited instances of large seeds germinating at higher percentages than smaller seeds (Tripathi and Khan, 1990; Bhuyan et al, 2000 as well as Khan and Uma Shanker, 2001); smaller seeds germinating at higher percentages than larger ones (Marshall, 1986) or germination independent of size of seeds (Gross and Kromer 1986 and Perez-Garcia et al, 1995).

Khan (2003) stated that increase in seed weight of *Artocarpus heterophylla* L. from 4 – 6g to 12 – 14g increased the germination percentages of the planted seeds. Also, within species, Barik et al (1996) observed that heavier seeds may take less time for germinating than lighter seeds while Muralli (1997 or 1984) observed that lighter seeds may germinate earlier than heavier seeds where as Perez-Garcia et al (1995) conversely observed that germination time may be independent of seed weight.

This is an indication of the existence of peculiarities between seed weight and germination percentages for different crops. Thus, there is need to investigate the effects of seed weight on the germination percentages of six commonly cultivated crops; Maize, Rice, Melon, Beans, Groundnut and Okra in Ekpoma, Edo State, Nigeria. This is to help provide first hand localized information for local farmers and researchers on the six studied crops.

MATERIALS AND METHODS

Table 1: Classification of seeds of crops based on seed weights

Seed Weight	Maize	Rice	Melon	Beans	Groundnut	Okra
Light	>1.5g	>1.0g	>1.1g	>2.8g	>2.0	>1.3g
Intermediate	<1.5 –2.0g	<1.2-1.4g	<1.1-1.4g	<2.8-3.4g	<2.0-2.5g	<1.3-1.5g
Heavy	<2.0g	<1.4	<1.4g	<3.4g	<2.5g	<1.5g

This experiment was conducted at the Botanical Garden of Department of Botany in Ambrose Alli University, Ekpoma, Edo State, Nigeria. The study site is located on latitude 06°42' north and 06°08' East. The wet season study was conducted between 3rd and 12th October, 2001 when the rains were still on while that of the dry season was conducted between 8th and 17th November 2001 when the dry season had emerged. To prevent attacks from rodents, reptiles and insects, the study site was protected with a wire guaze and direct effects of the vagaries of weather were prevented from interfering. Temperature was roughly unaltered at 25±2°C and rainfall didn't impact the study.

Seeds that were used for the experiment were purchased from Ekpoma market in Ekpoma, Edo State, Nigeria. Viability tests were conducted on the seeds before the actual experiment was carried out. Percentage viabilities for the seeds were as follows; maize (95%), rice (94%), melon (90%), beans (98%), groundnut (90%) and okra (89%), for the wet season and maize (91%), rice (97%), melon (93%), beans (94%), groundnut (92%) and okra (91%) for the dry season, respectively. Seeds were then sowed within 3 days after concluding viability tests on the seeds.

Top sandy-loamy soils were dug from the Botanical Garden and packed into polyethylene bags measuring 50cm in diameter by 40cm high. The soils in the potted bags were thoroughly watered all through the periods of the experimentation. The seeds were sown only at the surface (0cm) and a total of 600 seeds each were sown for each of the crops. Germination was considered to have taken place whenever the emergent radical measures up to 2mm in length (Upadhaya et al, 2006). The number of seeds that germinated was then measured in simple percentages.

Seed weight was determined by counting and weighing 1,000 seeds, each of maize, rice, melon, beans, groundnut and okra in a weighing balance and their corresponding weights recorded. Each of the six seeds was categorized into three distinct weight classes; light, intermediate and heavy-weighted seeds and their corresponding weights recorded (see table 1).

RESULTS AND DISCUSSIONS

Results in this study showed variation of seed weight with germination percentages for all six commonly cultivated crops studied. Generally, germination percentages were observed to be least, out of the three classes, in the light-weighted seeds in all the crops investigated upon. Also, significant differences were observed at p<0.005 level of significance among the different weights in all six crops studied except rice light weight and intermediate weight as well as melon intermediate weight and heavy weight. maize was observed to show 30.34%, melon (49.22%), okra (39.49%), beans (42.62%), groundnut (26.97%) while rice showed 83.55%. This agreed with the works of Burgar (1964), Griffin (1972), Belcher et al (1984) who independently found positive relationships between seed weights and seedlings sizes in many Conifers. In addition, the works of Tripathi and Khan (1990), Khan and Uma Shanker (2001) as well as Moshatati and Gharineh (2012) also agreed with the findings in this study.

Apart from rice where seeds achieved up to 83.55% (wet) and 82.25% (dry) germination rates, it was observed that light-weighted seeds of maize melon, beans, groundnut and okra seeds generally showed below 50% germination percentages during both seasons. In addition, intermediate-weighted seeds in all six crops under study showed higher germination percentages than their light-weighted counterparts. Although, germination percentages were more pronounced in maize, rice and melon where they were found to show over 80% germination percentages during both seasons than beans, groundnut and okra. It was observed that for all studied crops, germination percentages were highest in heavy-weighted seeds than the intermediate and the light-weighted seeds during both seasons. All the crops achieved approximately 90% and over in all the crops in this present study during both seasons. This clearly shows that seed weight positively influenced germination percentages in maize, melon, okra, beans and groundnut with the exception of rice where the influence was less pronounced. This trend agrees with the findings of Barik et al (1996), Vera (1997) and Upadhaya et al (2006). The trend observed in this study could be attributable to sufficiency in energy content of heavy-weighted seeds as compared to intermediate or light-weighted seeds which could contain lesser energy content within them. Thus, breakage of dormancy is faster and easier in the heavier-weighted seeds than the lighter ones. Although, wet season influenced germination percentages better than the dry season, it could be stated that seasonal influences did not have any significant impact on the outcome of percentage germination in all crops under study. This is owing to the fact that there were no significant differences between germination percentages at $p < 0.005$ level of significance in all crops studied during both seasons. Also, germination percentages for wet season were found to be generally higher than those during dry season, except in groundnut. This shows that wet season provides better favourable environmental conditions for germination than dry season. Although, wet season did positively affect germination percentages in all crops under study, except groundnut, the difference does not have any significance.

Table 2: Variation of seed weight with germination percentages during wet season.

Seed weight	Maize		Rice		Melon		Beans		Groundnut		Okra	
	NSS	NSG	NSS	NSG	NSS	NSG	NSS	NSG	NSS	NSG	NSS	NSG
Light	94	27 (28.72%)	231	193 (83.55%)	191	94 (49.22%)	122	52 (42.62%)	89	24 (26.97%)	276	109 (39.49%)
Intermediate	203	166 (81.77%)	152	128 (84.21%)	187	166 (88.77%)	61	31 (50.82%)	113	77 (68.14%)	78	43 (55.13%)
Heavy	303	289 (95.38%)	217	206 (94.93%)	222	201 (90.54%)	417	397 (95.20%)	398	372 (93.47%)	246	237 (96.34%)

NSS= No. of seeds sown and NSG= No. of seeds that germinated.

Table 3: Variation of seed weight with germination percentages during dry season.

Seed weight	Maize		Rice		Melon		Beans		Groundnut		Okra	
	NSS	NSG	NSS	NSG	NSS	NSG	NSS	NSG	NSS	NSG	NSS	NSG
Light	278	78 (28.06%)	169	139 (82.25%)	207	99 (47.83%)	172	72 (41.86%)	66	18 (27.27%)	192	74 (38.54%)
Intermediate	172	139 (80.81%)	212	178 (83.96%)	194	171 (88.14%)	116	58 (50.00%)	208	141 (69.12%)	183	99 (54.10%)
Heavy	150	143 (95.33%)	219	204 (93.15%)	199	179 (89.95%)	312	295 (94.55%)	326	306 (93.87%)	225	214 (95.11%)

NSS= No. of seeds sown and NSG= No. of seeds that germinated.

CONCLUSION

Seed weight had tremendous influence on the rates of germination. This is owing to the fact that increasing seed weight in all the crops studied, led to a corresponding increase in germination percentages. The positive influence of seed weight was more pronounced in maize, melon, beans, okra and groundnut but less in Rice. Thus, it is being suggested that heavier-weighted seeds should be used in preference to light-weighting seeds as a production strategy for all the six studied crops.

Also, in all the six crops studied, it was observed that, provided all the conditions that favour germination are in place, that seasonal influences as reflected by the impacts of the vagaries of weather do not really have any significant impacts on germination percentages of most crops. Thus, proper irrigation during dry season could help to maximize germination in crops if they should be planted during dry seasons.

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