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EFFECTS OF PLANTING DEPTHS ON THE GERMINATION OF SIX COMMONLY CULTIVATED CROPS IN EKPOMA, EDO STATE, NIGERIA

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Abstract: Germination marks the beginning of the independent growth and existence of seeds or other organs of a plant. Planting depth has to do with the extent of seed burial in soil or other organic components which are aimed at achieving germination. Six crops studied were maize, rice, melon, beans, groundnut and okra. This experiment was carried out at the Botanical Garden of Department of Botany in Ambrose Alli University, Ekpoma, Edo State, Nigeria and seed viability tests gave; maize (95%), rice (94%), melon (90%), beans (98%), groundnut (90%) and okra (89%), respectively. Then 10 seeds were sown at each potted bag and replicated by 10 more bags for each crop type to give 100 seeds for each crop at planting depths of 0cm, 2cm, 5cm, 7cm, 10cm and 15cm respectively. At the end of the study, it was found that planting depths affected seed germination in all studied crops since germination percentages decreased with increasing planting depths with the highest germination rate at 0cm (surface) planting level. The current study has shown that planting depths do affect germination percentages of seeded crops like maize, rice, melon, beans, groundnut and okra, though at different rates. Generally, it has been found that lower planting depths favoured maximum germination in the crops studied while increasing planting depths caused reductions in the germination percentages of such crops. Recommended optimum planting depths should be 5cm for maize, rice and melon while 2cm was recommended for beans, groundnut and okra, respectively.

Keywords: Dormancy, Germination percentages, Planting depths.

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INTRODUCTION

Germination is the process of reactivation of the metabolic machinery of the seeds and the emergence of the radical (root) and the plumule (shoot), leading to the production of a seedling (Hartman and Kester, 1984). Germination is maximized in any given seed when such seeds are viable, non-dormant and the embryo quiescent (Dutta and Dutta, 2008). Germination marks the beginning of the independent growth and existence of seeds or other organs. Arousing a dry seed to commence germination entails inhibition of water, formation of enzyme system, radical emergence and seedling sprouting. The importance of varying planting depths has received lots of attention of researchers, for some time now. Milberg (1994) compared the germination ecologies of *Primula veris* and *Trellius europaeu*; both perennial polycarpic grassland plants, Milberg (1994) emphasized the effects of planting depths in the germination and emergence of Virginia Button weeds (*Diodia virginana*). Other researchers were Davis *et al.,* (1991) who worked on the effects of planting depths on Redvine (*Brunnichia ovata*); Calvino and Sandras (1999) on Maize, Sunflower, Soyabean and Wheat; Eke and Okereke (1990) on *Eleucine indica* and *Euphorbia heterophylla* while Nsoma (1986) worked on *Glycine max*. Planting depth is the

extent of seed burial in soil or other organic components (which are) aimed at achieving germination (Calvino and Sandras, 1999). Seed depth contributes to the extent of attacks by insects and rodents, especially when unprotected (Adelana, 1980). Germinating seeds find it difficult to establish, if sown at the surface of the soil (Nsowah, 1986). On the other hand, Calvino and Sandras (1999) stated that deeper soils favour establishment prior to germination, but very deep planting depths may prevent germination. Eke and Okereke (1990) observed that germination was adversely affected by surface planting of seeds since *Eleucine indica* and *Suphorbia heterophylla* sprayed with glyphosphate at 1.5kg/ha adversely affected germination of seeds sown at the surface but were both unaffected at depths ranging from 2cm and beyond. The six commonly cultivated crops under study are usually planted by most subsistence farmers in Ekpoma in Edo State, Nigeria. They constitute the staple foods of many of the people who are resident within the study area. Thus, Maize, Rice, Melon, Beans, groundnut and Okra. Farmers within the area plant most crops at almost the same planting depths and this could be responsible for low germination of seeds. This has informed the need to investigate the effects of planting depths on the germination of the afore-mentioned crops.

EXPERIMENTAL

This experiment was carried out at the Botanical Garden of Department of Botany in Ambrose Alli University, Ekpoma, Edo State, Nigeria. The Botanical Garden is located on latitude 06°42′ north and 06°08′ East and the study. This study was conducted between 3rd and 12th October, 2001. The experimental sets were set in a way that the study site was protected with a wire guaze so that the direct effects of the vagaries of weather were prevented from interfering and to prevent attacks from rodents, reptiles and insects. Temperature was roughly unaltered at 25±2°C and rainfall didn't impact the study. Seeds used for the experiment were purchased from Ekpoma market in Ekpoma, Edo State, Nigeria. Viability tests were then 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%), respectively. Seeds were then sowed within 3 days after concluding viability tests on the seeds to avoid loss of seed viabilities. 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 period of the experiment. A transparent ruler was used to measure the depths on very strong sticks for 2cm, 5cm, 7cm, 10cm and 15cm respectively. The blunted heads of the calibrated sticks were used in pushing through the soils in the potted bags to create corresponding planting depths. Then 10 seeds were sown at each potted bag and replicated by 10 more bags for each crop type to give 100 seeds for each crop at planting depths of 0cm, 2cm, 5cm, 7cm, 10cm and 15cm respectively. Sowed seeds were watered daily with 200ml distilled water throughout the experimental period. Germination of seeds is said to have taken place whenever the emergent radical measures up to 2mm in length (Upadhaya *et al.,* 2006). The number of germinated seeds was then measured in simple percentages and deductions eventually made.

RESULTS AND DISCUSSIONS

Results in this study showed that the six commonly cultivate crops in this study showed similarities and differences with respect to germination percentages as each day passed. For instance, Beans (3%) and Okra (2%) showed some level of germination on the first day at 0cm (surface) level while Maize, Rice, Melon and Groundnut didn't show any form of germination on the first day at 0cm (surface) level. At the end of the investigation, it was found that germination percentages were highest at 0cm (surface) level than any other planting depth for all studied crops; Maize (89%), Rice (93%), melon (92%), Beans (96%), Groundnut (84%) and Okra (89%) respectively (See Figure 1 below). Highest values noticed for the surface planting could be attributable to lack of disturbances from insects, reptiles and rodents in addition to not having any obstruction from soil, apart from breaking dormancy.

Table 1. Variation in Maize

	Percentage Germination in days								
Planting Depth	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0cm	0	9	57	69	78	83	86	87	89
2cm	0	1	54	62	77	81	83	85	86
5cm	0	0	49	58	71	77	81	83	84
7cm	0	0	31	39	51	60	69	72	73
10cm	0	0	22	28	37	44	50	52	53
15cm	0	0	2	5	11	19	26	28	30

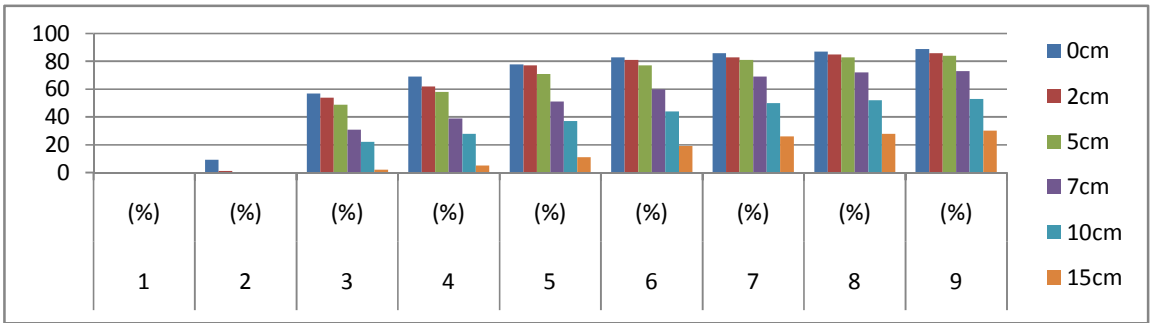

Figure 1. Variation in Maize

Table 2. Variation in Rice with planting depths

Planting Depth	1	2	3	4	5	6	7	8	9
0cm	0	7	28	58	77	81	89	91	93
2cm	0	2	16	44	73	79	85	86	87
5cm	0	0	9	31	49	71	74	75	77
7cm	0	0	2	12	43	56	60	63	64
10cm	0	0	1	5	18	26	29	34	35
15cm	0	0	1	2	7	11	17	18	20

Table 3. Variation in Melon with planting depths

Planting Depth	1	2	3	4	5	6	7	8	9
0cm	0	14	53	67	76	83	89	91	92
2cm	0	0	47	59	69	78	84	86	88
5cm	0	0	39	48	57	67	77	79	81
7cm	0	0	31	37	46	55	69	70	71
10cm	0	0	12	17	22	31	43	46	49
15cm	0	0	0	1	3	12	17	23	25

Table 4. Variation in Beans with planting depths

Planting Depth	1	2	3	4	5	6	7	8	9
0cm	3	31	63	72	89	93	95	96	96
2cm	0	23	44	65	83	89	90	91	92
5cm	0	11	19	52	78	83	85	86	86
7cm	0	0	6	29	41	49	53	54	54
10cm	0	0	2	8	28	30	31	32	32
15cm	0	0	0	2	14	18	18	18	18

Table 5. Variation in Groundnut with planting depths

Planting Depth	1	2	3	4	5	6	7	8	9
0cm	0	7	19	38	67	71	79	82	84
2cm	0	0	5	36	63	70	75	76	80
5cm	0	0	3	21	54	68	74	76	76
7cm	0	0	1	7	33	52	60	63	64
10cm	0	0	0	2	18	27	32	35	36
15cm	0	0	0	0	1	3	4	4	5

Table 6. Variation in Okra with planting depths

Planting Depth	1	2	3	4	5	6	7	8	9
0cm	2	26	41	58	67	74	83	88	89
2cm	0	23	36	47	59	67	77	80	83
5cm	0	9	14	29	38	44	53	54	55
7cm	0	0	2	7	15	21	34	39	42
10cm	0	0	0	1	3	6	11	12	13
15cm	0	0	0	0	0	0	0	0	2

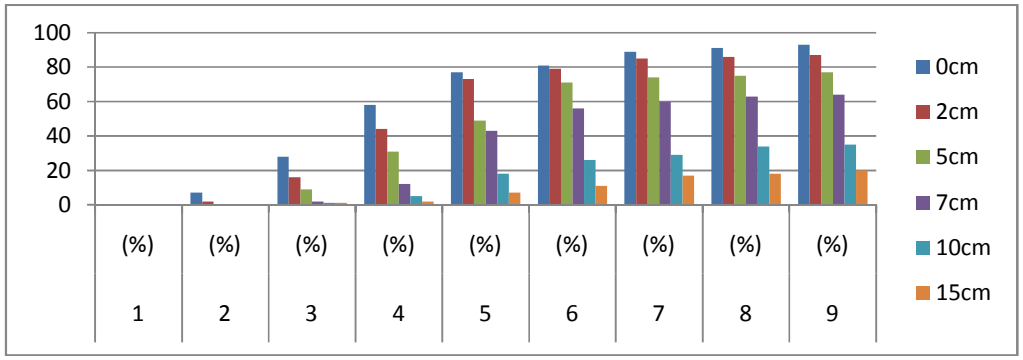

Figure 2. Variation in Rice

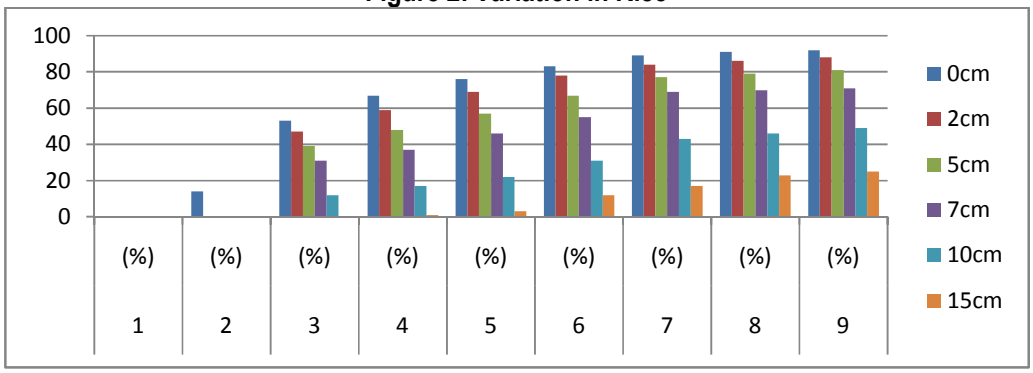

Figure 3. Variations in Melon

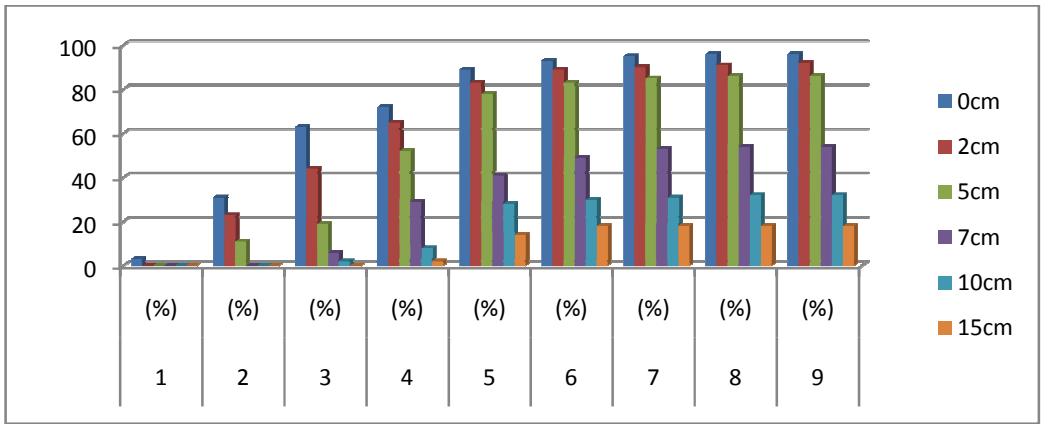

Figure 4. Variation in Beans

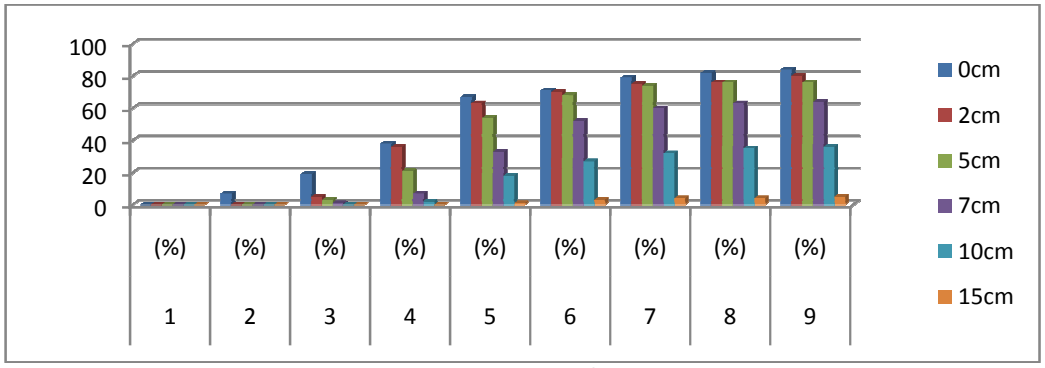

Figure 5. Variation in Groundnut

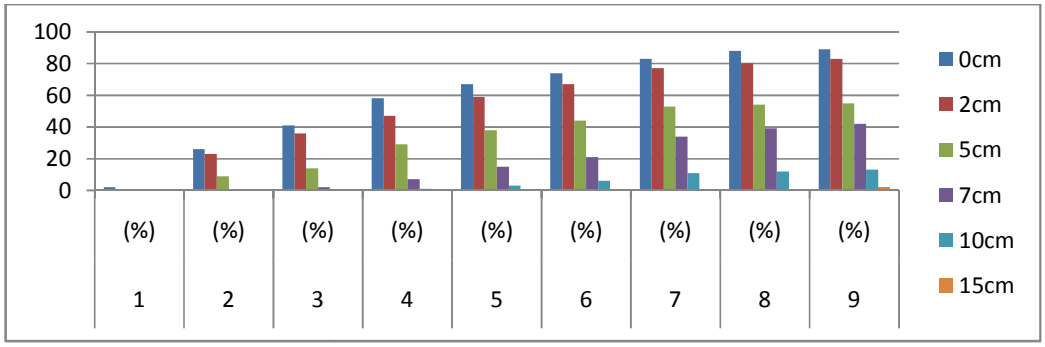

Figure 6. Variation in Okra

As could be seen in table 2, at 2cm planting depth, maize (1%), Rice (2%), Beans (23%), and Okra (23%) were observed. Germination was observed was observed to be highest at 2cm planting depth in Beans with 92% and lowest in Groundnut with 80% germination (Figure 2). This could be due to seeds of Beans sown having highest viabilities. At 5cm planting depth, Beans (11%) and Okra (9%) both emerged on the second day while Maize (49%), Rice (9%), Melon (39%) and Groundnut (3%) were all found to emerge (Table 3). Least germination at 5cm planting depth was observed in okra (55%) even though germination was recorded on the second day while the highest germination percentage was observed in Beans (86%) as seen in Figure 3. This showed that at 5cm planting depth, germination percentage was affected more by factors endogenous to the seeds rather than soil cover. At 7cm planting depth, all the investigated crops germinated on the third day with Groundnut (1%) showing least germination percentage as in table 4. At the end of the study, Okra (42%) showed least germination percentage while Maize (73%) was highest (see figure 4). As could be seen in table 5 above, at

10cm planting depth, Maize (22%), Rice (1%), Melon (12%) and Beans (2%) were all found to germinate on the third day while Groundnut (2%) and Okra (1%) both germinated on the fourth day. Highest and least germination percentages at the end of the study for 10cm planting depth were observed in Maize (53%) and Okra (13%) respectively (Figure 5). And, at 15cm planting depth, Okra (2%) didn't germinate until the last day while the highest germination percentage at the end of the study was in Maize with just 30% as seen in table 6 while germination was largely very poor at 15cm planting depth for all crops studied since none achieved up to 50% germination rate at the end of the study (see figure 6). Results in this study have shown that planting depths affected seed germination in all studied crops since germination percentages decreased with increasing planting depths with the highest germination rate at 0cm (surface) planting level. However, early researchers like Biswas *et al* (1975), Krueger and Shaner (1982) and Semenza *et al* (1978) attributed early germination on the surface (0 cm) to light sensitivity. Although germination percentages were highest at 0cm (surface) level, concerns about the safety of seeds sown at the 0cm (surface) on the field cannot be guaranteed. Also, growth and consequent establishment of such crops prior to germination is another major challenge. Also, fluctuations in moisture conditions could be responsible for differences in germination percentages between 0cm (surface) and 2cm planting depth. The findings in this study is consistent with those of Mohammad (2011), Wilson (1979) as well as Balyan and Bhan (1986) who separately established from studies from different seeds that planting depths do affect germination rates in crops. Therefore, it could be safe to state that deep soil burial of seeds inhibited germination rates in all studied crops. This is because high seed burial with soil prevents seeds access to optimum water, air, light and temperature requirements hence decrease in germination with increasing planting depths as confirmed by Mohammad (2011). Decrease in germination percentages with increasing planting depths could also be attributable to seed weights (Griffin, 1972; St. Clair and Adams, 1991; Khan and Uma Shanker, 2001 and Gross and Kromer, 1986).

CONCLUSION

The current study has been able to show that planting depths do affect germination percentages of seeded crops like Maize, rice, melon, Beans, groundnut and okra, though at different rates. Generally, it has been found that lower planting depths favored maximum germination in the crops studied while increasing planting depths caused reductions in the germination percentages of such crops. Putting attacks from reptiles, insects and rodents, growth and establishment as well as well as the effects of the vagaries of weather into consideration, it is hereby recommended that optimum planting depths should be 5cm for Maize, Rice and Melon while 2cm is being recommended for Beans, Groundnut and Okra, respectively. At the recommended planting depths, optimum germination is attained and erect-growing would not have problems during seedling growth and establishment.

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