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WAKING THE SEED FROM SLUMBER: RECIPE FOR SUCCESSFUL GERMINABILITY

By

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Waking the Seed from Slumber: Recipe for Successful Germinability

The Vice-Chancellor,
Deputy Vice-Chancellor (Academic)
Deputy Vice-Chancellor (Development)
Principal Officers of the University,
Deans and Directors,
Heads of Departments,
My Academic and Professional Colleagues,
Members of My Immediate and Extended Family,
Gentlemen of the Print and Electronic Media,
Distinguished Ladies and Gentlemen,
Great UNAABITES

1.0 PROLOGUE

I am extremely glad to be honoured and called upon to give the 28th Inaugural Lecture of this great University. This is the 5th from the College of Natural Sciences, with the likes of Professors Adamson, Solarin, Eromosele and Bamiro setting the pace. This is also the 1st from the Department of Biological Sciences since the inception of UNAAB. I am grateful to God Almighty for being the 1st Professor to present an inaugural lecture from the Department of Biological Sciences. I wish to inform this great audience that the College had, about

4 years ago, prepared me for this purpose in the series of Leadership Lectures of the College of Natural Sciences. It is the tradition of Universities to organize inaugural lectures, showcasing the summary of academic contributions university Dons at the professorial levels to knowledge and Development through research and various write ups. I am compelled by the rule of the game to present a 1 hour lecture of my work of 27 years of sojourn in tertiary level of education, 16 of which were at UNAAB.

2.0 INTRODUCTION

Today's lecture titled "Waking the seed from slumber: Recipe for successful germinability" is based on the importance of seeds, what comes out of the seeds and the problems associated with their germination. I have concentrated on using seeds from timber producing trees of the rain forest and those of some multipurpose trees of the savanna biomes as well as those of the tropical weeds. Most of these seeds do not readily germinate even when exposed to favourable conditions despite the fact that they are still living. This therefore, mean that they are dormant or physiologically quiescent. These seeds have gone into slumber and, hence, need to be awakened.

Seed dormancy may be due to immaturity of the embryo (Mayer and Mayer 1975), mechanical resistance of the seed coat, presence of germination inhibitors in the seed structure, after ripening needs, etc.

The biological seed is a product of sexual reproduction involving double fertilization in the Angiospermic flower. The ovule and the integuments within the former ovary become the seed. The structural components of the seed at maturity include the covering i.e. the testa or seed coat, the cotyledon, embryo and the endosperm (which may degenerate before seed maturity). Some seeds cannot be separated from the former ovary structures even after development. These are used for planting as non-biological seeds e.g. maize, rice, barley, oats, etc. They are actually biological fruits (caryopsis).

2.1 The forest

The tropical forests provides a wide range of trees which are important both for local use and exportation. Both hard and soft woods have been important items of trade in Nigeria for several years and have thus served as major stimuli for industrialization. The tropical forest also served as a large source of wood for fuel, pulp and paper as typified by the rate of consumption of *Gmelina arborea, Tectona grandis* and *Leucaena leucocephala* (Ajiboye and Agboola, 2008, 2009).

Intensive research efforts have also focused attention on the use of *Leucaena* and related species in agroforestry practices and as natural sources of Nitrogen in alley cropping (Benge, 1976; Kang et al., 1986; 1987). This implies a drastic reduction on the dependence on inorganic nitrogen fertilizers.

For forest to continue to provide these valuable resources, concerted efforts and well co-ordinated programmes of re-afforestation must be carried out. This is in view of the fact that the continued growth of human population has constantly increased the pressure on the forest such that most of the tree species are continuously being harvested with reckless abandon and total disregard for afforestation (Beets, 1989).

One of the major problems associated with afforestation programmes in the tropics is the fact that most tropical forest tree seeds exhibit one form of dormancy or the other (Olofintoba, 1979). Another problem is the inability of the collected seeds to retain their viability while in storage (Olatoye, 1968).

The tropical rainforest is exceptionally rich supporting more than a hundred different species per hectare compared to 10-15 in many temperate countries. As the seeds of these trees awake and resume germination the next set of problem have been discovered to be the establishment and survival of the seedling (Spore-CTA 1991; Onoche 1990). Various nursery practices have been geared towards successful seedling establishment of some species in plantation. These are still faced with some handicaps, mainly loss of leaves by the young seedlings. Leaf can be lost through diseases, insect and animal feeding and infestation and by natural disasters. For example, the heavy winds that accompany tropical rainstorms are a common source of leaf loss (Remison 1978). Leaf loss interferes with the metabolic processes of the plant in general and hence growth. This can be critical during the early vegetative phase especially when young seedlings have limited surfaces of photosynthesis (Darling, 1969).

The demand for nutrients by trees is very high and response to lack of it, is probably the most common form of mineral deficiencies in trees (Kozhoswski, 1971). The easiest and fastest methods of correcting nutrient deficiencies are through the use of fertilizers which are mostly applied directly to the soil or indirectly to the plant foliage in liquid form (FDDP 1989).

My research activities have verified the extent to which leaf removal and application of five inorganic fertilizers affect early vegetative growth of the seedlings of some economically important tropical trees including *Terminalia ivorensis, Terminalia superba, Ceiba petandra* which are inhabitants of the rain forest and sources of quality timbers. Fertilizer trials on some extotic tree species including *Gmelina arborea, Tectona grandis* and *Leucaena leucocephala* have yielded good results.

3.0 SEED GERMINATION AND CROPS

A lot of research efforts have also been geared towards good germinability in non tree plants such as soya beans (*Glycine max*) varieties and *Occimum gratissimum* and some noxious weeds such as *Tithonia diversifolia*, common open land weed in agroforestry practices.

Soybean was introduced into Nigeria mainly 90 years ago and the production attained commercial recognition during the late Nineteen forties. It can produce the highest yield of protein per weight than any of the plants or annual feed source (IITA, 1990). With the counting increase in the cost of living, soybeans have become important as a source of protein, valuable oil, fertilizers and soaps, etc (Anon 1950). In Nigeria, planting times vary according to the different ecological zones. So many varieties of soybean have been known in Nigeria. Some older ones include TGX 293-63E, TGX 995-

22E, TGX 536-02D, TGX 943-1E, TGX 1072-E, TGX 849-313D, SAMSOY-2, TGX 1025-8E, TGX 536-02D, TGX 996-2E, TGX 1063-2E and TGX-940.

Various germination responses have been observed among the varieties of soybean introduced to the local farmers. These are often noticeable in the varying rate of and total percentage germination. So many seeds from some varieties introduced fail to germinate when planted. It appears that the germination problems confronting the seeds have not been totally overcome in some varieties introduced to our farmers. Seeds of some soyabeans have hard and tough seed coats that may retard or prevent inhibition of water and exchange of gases thus slowing down initiation of germination processes.

Some of the pretreatments used for the seeds of eight of the varieties gave highest total percentage germination of 90% and rapid rate of germination. Immersing seeds in hot water may have enhanced germination by providing a stimulating effect on the germination process and by causing the tough testa to rupture. This pretreatment, therefore, creates passages on the seed coats through which water can enter the seed (Cavanah, 1987; Mermuda, 1989). Concentrated sulphuric acid or exposure to high temperature rendered the seed coats soft causing uniform inflow of water and unrestricted expansion of the embryo. The difference in the germinability response of the soybean seed varieties shows the variability in the seed coat structure. Those seeds with less hard coats need a little period of soaking than those with hard coats.

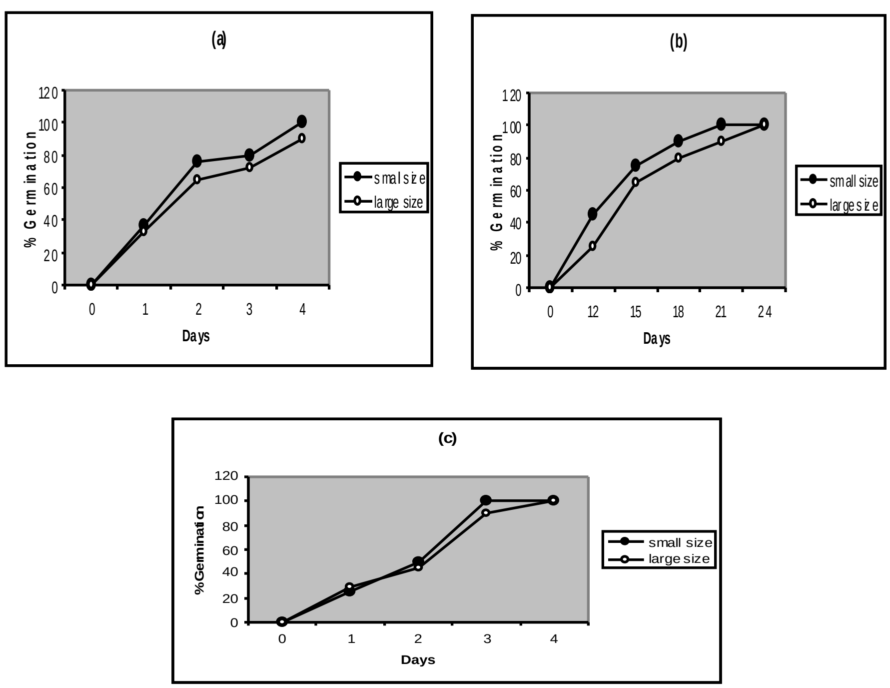


Fig 1: Percentage germination in large and small- size seeds of (a) *Leucaena Leucocephala* (b) *Tectona grandis* and (c) *Ceiba pentandra*

3.1 Seed germination and weeds

Tithonia diversifolia (Hemsl.) A. Gray the wild sunflower or Mexican sunflower is a perennial noxious weed of field crops, wasteland and road sides. This weed is now prominent and fast growing in Nigeria, inhabiting the rain belt of the southern part of Nigeria. The weed also grows in the wet part of the Guinea savanna especially along the fringes of the rain belt (Latitude 6-9°N). It was introduced into West Africa as an ornamental plant (Akobundu and Agyakwa, 1987). The heavy deposits of seeds from the previous years population which have remained dormant in the dry season (November-March) germinate at the onset of the early rain in April-May. The seedlings grow fast and attain maturity during the second rainfall, peak of July-August when the flower and seed heavily. The plant dries up before January of the following year yielding a lot of litter, which is often destroyed through bush burning in December to January yearly (Agboola 1998). The weed makes an incursion into the farmland and, thus, becoming a nuisance to farmers.

The vigour and luxuriance of the growth of *T. diversifolia* has stimulated my research on the aspects of its biology, and the problems posed by the weed in the environment (Agboola, 2004). My studies also focused on dormancy and germination of viable seeds, growth performance and chemical control of young seedlings of this weed and four others. I have been able to contribute my modest quota on the ecology and physiology of this weed for effective control.

The general survey of Nigeria for *T. diversifolia* infestation showed that almost one third of the country has been inhabited by this weed starting from the Southwest coast. These areas enjoy moderate to heavy annual rainfall with bimodal peak in June and September. Initial germination test of fresh seeds show a low germination percentage. The seed exhibits dormancy and required pretreatment for best germination result. This is also the case with *Rotboella cochinchinensis, Calapogonium mucunoides, Cassia huisuta* and *Cassia obtusifolia* some of which are serious weeds of wasteland, corn, cowpea and sorghum farms in Nigeria. Combination of heat, light and storage terminated dormancy in seeds of *T. diversifolia*. This shows that this weed seeds suffer from physiological dormancy. Most weeds propagate by means of seeds and in the dry season they shed many seeds from their pods. Some of them may germinate sporadically in the field (Etejere and Ajibola, 1990). Most of the seeds remain dormant within the soil for many years, thus, making the eradication or control of these plants difficult. Weed control in the field can be achieved by the stimulatory or inhibitory effect of herbicide on the germination of seeds. The increased field emergence of seedlings obtained by stimulated germination makes it possible to reduce the content of soil-boring viable weed seeds (Kolk, 1979). The emerged seedlings can subsequently be destroyed by mechanical or chemical weed control measures. Soil-borne viable seeds can also be destroyed directly by using herbicides of suitable concentration and dosage.

The inhibitory or eliminating effect of herbicide 2,4-dichlorophenoxy Acetic Acid, 2,4-trichlorophenoxy Acetic Acid (2,4,5-T), DNOC MCPA, Galeic, Atrazine, Primextra have been used to control *C. obsutifolia, C. hirtusa, C. occidentalis* and *Calapogonium occidentalis* through destruction of soil-borne seeds (Harle, 1974, Agboola, 2003). This is achieved through the distruption of one or more of the stages of energy production.

4.0 DORMANCY AND TREATMENTS

The Vice-Chancellor sir, ladies and gentlemen the tropical region is in trouble. We are talking of the depletion of ozone layer and the green house effect. The whole surface of the earth is being heated up, cyclones, typhoon of different names, here and there. I am adding desertification through human negligence. The beautiful tropical forest with its rich flora and fauna, a sanctuary of rich biodiversity is being destroyed. Timber trees are felled without replanting because of the difficulties involved in getting the seeds to germinate. It is not possible to have the seeds of these trees planted and achieve germination it is with maize and beans grains.

The tropical forest provides a wide range of trees which are important both for local use and exportation. Both hard and soft woods have been important items of trade in Nigeria for several years and have thus served as major stimuli for industrialization.

Table 1:Effect of different osmotic pressures on imbibition of water by seeds of some tropical high forest tree species. The temperature of the medium was 29 ± 1°C. Data are mean values ± S.E of five replicates

Molar Concentration (M) of NaCl	Osmotic pressure (ATM)	Water Imbibed after 48h (% of dry wt.)		
		C. pentandra	T. superba	T. ivorensis
0.0(H2O)	0.0	54.2 ± 0.15	51.2 ± 0.07	50.4 ± 0.12
0.1	3.8	44.6 ± 0.11	50.0 ± 0.07	49.0 ± 0.08
0.2	7.6	43.0 ± 0.07	47.1 ± 0.10	45.8 ± 0.35
0.3	11.4	42.0 ± 0.09	46.0 ± 0.06	41.9 ± 0.08
0.4	15.2	40.0 ± 0.08	43.1 ± 0.05	40.0 ± 0.10
0.5	19.2	38.8 ± 0.22	40.8 ± 0.08	37.1 ± 0.10
0.6	22.4	38.4 ± 0.10	35.9 ± 0.19	36.2 ± 0.08
0.7	26.6	36.0 ± 0.09	33.9 ± 0.13	32.0 ± 0.07
0.8	30.4	34.3 ± 0.07	30.1 ± 0.05	30.3 ± 0.06
0.9	34.2	30.8 ± 0.12	29.2 ± 0.45	28.1 ± 0.04
1.0	38.0	28.0 ± 0.18	27.0 ± 0.07	27.4 ± 0.10
2.0	72.0	18.2 ± 0.06	22.1 ± 0.14	26.0 ± 0.08
4.0	30.0	16.1 ± 0.13	13.0 ± 0.14	20.2 ± 0.20

Plate 1: (a) Germinating and non germinating seeds (b) Seedlings of *Dialium guineensis*.

The tropical forest also serves as a large source of wood for fuel, pulp and paper as typified by the rate of consumption of *Gmelina arborea* and *Leucaena leucocephala*. One of the major problems associated with afforestation programmes in the tropics is the fact that most tropical forest trees seeds exhibit one form of dormancy or another (Olofinbola 1979; Ajiboye and Agboola 2008). Another problem is the inability of the seeds to retain their viability while in storage (Olatoye 1968).

The efforts of my research have brought out some useful seed pretreatments including heat, chemical and mechanical scarification, leaching, often ripening treatment. These pretreatments have shown that the dormancy problems are in most cases that of hard seededness, immature embryo and chemical inhibitors with in the fruit and seed structures.

4.1 Germination, Seed Orientation and Soil Types

Failure of the seeds to germinate or seedlings to emerge has also been correlated with orientation of the seeds in nursery. This is despite the fact that the seed has been pretreated for dormancy release. The series of work carried out had shown that germination could be slowed down when the hilium - micrypyle end is inverted as seen in seeds of *T. grandis*.

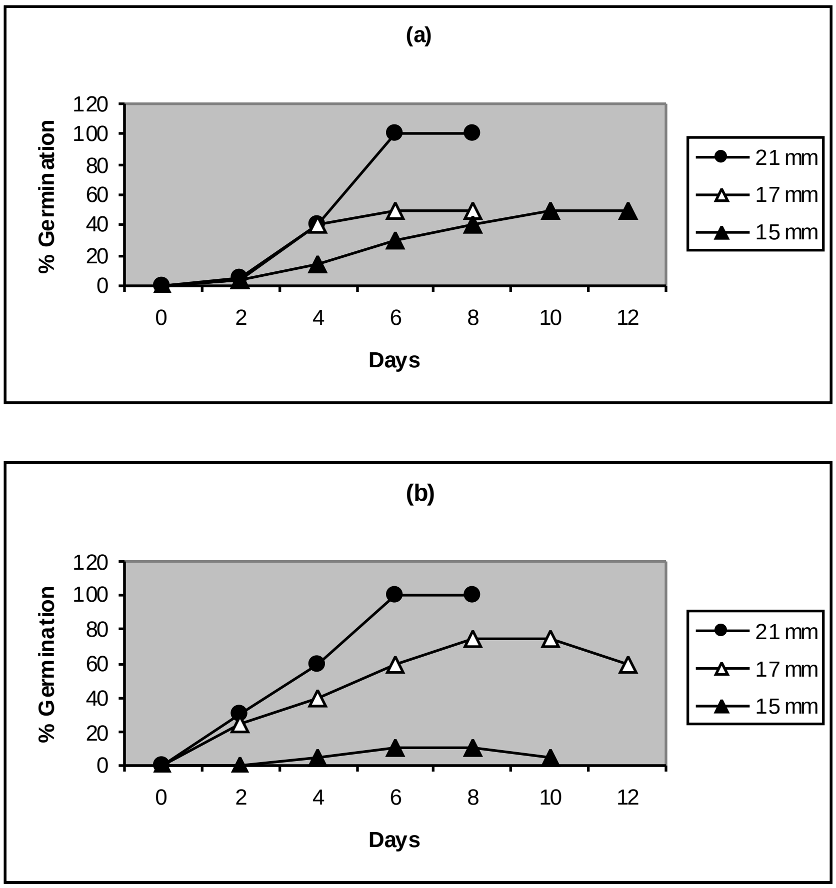
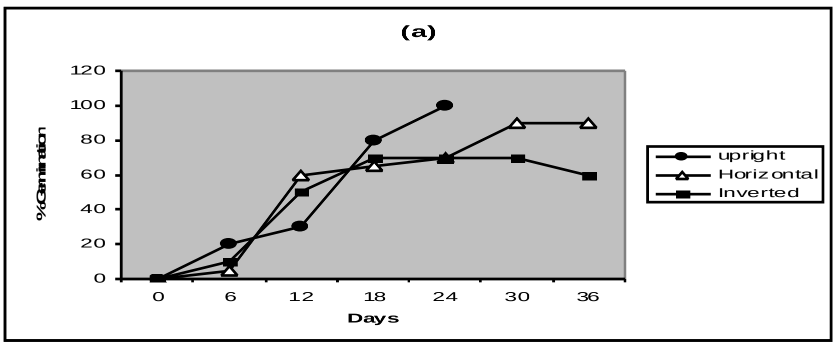


**Fig. 2:Pertcentage germination of stored seeds of (a*) Ceiba pentandra*
and (b*) Leucaeus lencocephals* prepared with conc H_2SO_4**

It has been proved that unequal distribution of hormones such as the auxin and Gibberrellic acid (GA_3) in the embryo could cause this. Luckily enough most seeds fall sideways during planting i.e. horizontal to the soil surface. The hormone distribution in this way encourages the growth and establishment of the radicle before the plumule. Hence the most accepted sign of successful germination is when the radicle has emerged even to about 2cm (ISTA, 1976). The effect of seed orientation during planting could be an additive to that of the soil types and depth. Seed planted too deep may fail to germinate despite the fact that it is not dormant.

This work, though looking so simple has been revalidated by some Scholars/researchers, while the paper was adjudged the best by the Indian Academy of Science in 1993 (Agboola, Etejere and Fawole, 1993). Some seeds have been found to germinate in sandy soils because of the low water-retaining capacity, hence, too much water may impose dormancy on such seeds. However, most seeds in the forest germinate well in deep loamy soil heavily laden with humus. The forest floor with this type of soil contains various soil bacteria and fungi which have been known to play a lot of role in the formation of humus and in general cycling of nutrient materials. It is also probable that the microbial digestion of the coat of the fruit stones of *T. grandis* on loamy soil, and the effect of soil nutrient, pH on the seed covers of seeds of other tree species used as supportive, especially in germination rather than major mechanism of releasing dormancy.



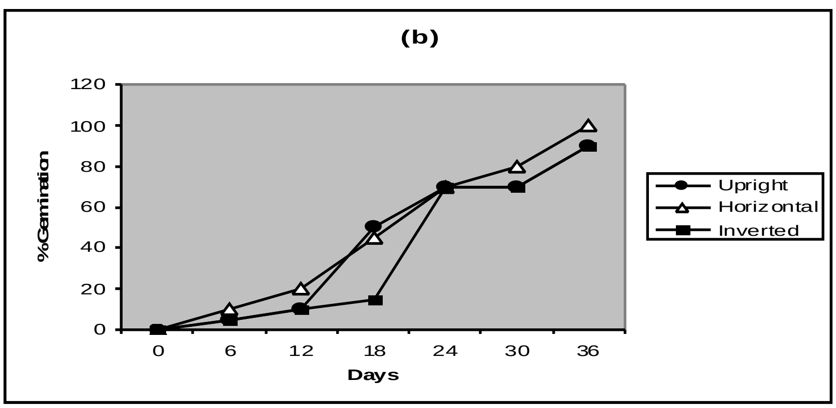


Fig.3: The effect of orientation on germination of seeds of (a) *Tectona grandis* and (b) *Terminalia superba*

5.0 My Focus

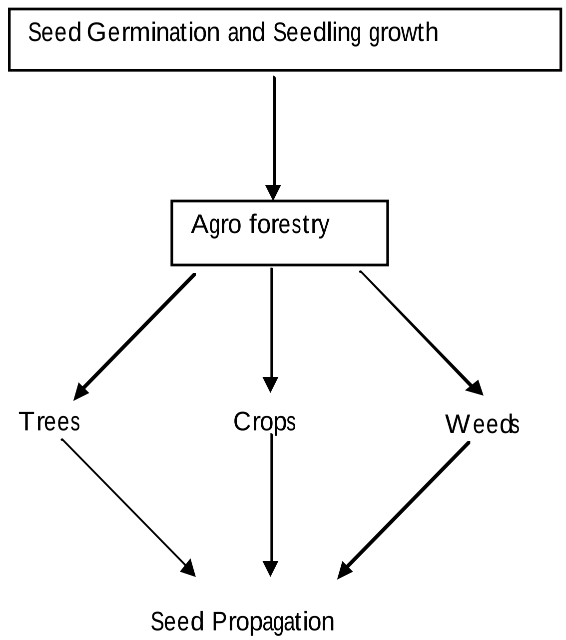


Fig. 4: The Profile of Research Focus of this Inaugural Lecturer

Vice-Chancellor sir, I have all along been sounding as if I am a Professor of Tree Physiology or Silviculturist or a Forester to be precise. However, I wish to categorically say I am a Professor of Botany in the area of Plant Physiology. At times sir, the foresters take Botany in the modern day as a forest science. However, my tool, the seed has been sourced from the agro-forest in Agroforestry, a farming practice. As Figure 4 shows within the agroforest are three components, i.e., the tree, the crop and the weed component which the unwanted component. For better understanding and improvement, I, as a plant physiologist, have worked on the germinability problems of the seed with a view to improving the lots of seeds and seedlings of the tree and crop components and at the same time to profer solution to the control of the menace of the weed. All the three mentioned components propagate by means of seeds. The botanist and the foresters are therefore partners in progress.

6.0 DORMANCY AND FRUIT FERMENTATION

A new dimension has been added to complement the standard pretreatments often used to overcome dormancy. This biotechnological approach involves subjecting the pulpy fruits and seeds to fermentation by microbes actually in the open and in enclosure. Seeds in washed and sundried fruits of hog plum, *Spondias mombin* germinated better when such pulpy fruits were fermented in the open or enclosure before washing in more water and then sundried. The methods used in achieving higher percentage germination in seeds of *S. mombin* corroborate the presence of germination inhibiting substances in fruits of this tree species (Aramide, 1977; Fasidi et al., 1979; Agboola and Etejere 1991, 2000). These problems are alleviated by leaching and fermentation of fruits in some cases (Agboola 1991b; Okoro, 1983).

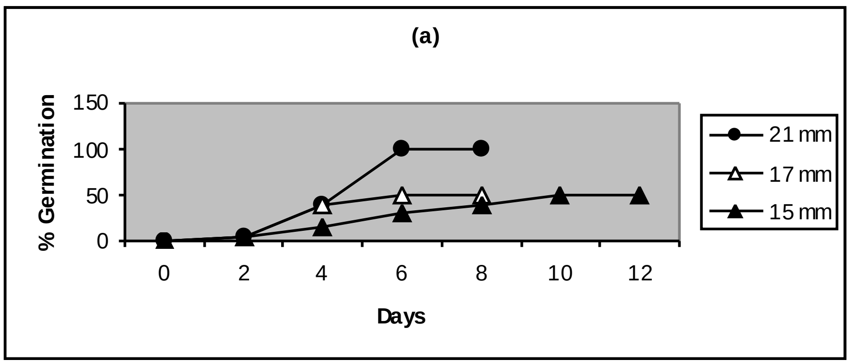
Many studies on the inhibitory effect of pulp of fleshy fruits on germination of seeds also indicated that inhibitors might be involved in the control of seed dormancy. In nature, animals and especially micro-organisms are important in the breakdown of seed coat to remove the unpermeability.

Plate 2 : (a) and (b) Fruits and seeds of *Spondias mombin* before fermentation and after fermentation and germination respectively.

There is every possibility of degradation of inhibitors and other chemicals including sugars present in the fruit by the micro-organisms including the yeast and other bacterial fermenters. Therefore, the amount of inhibitions in the remaining part of the fruit and seed after fermentation can be easily leached out by water. This is the likely complementary roles of fermenters in alleviation of dormancy in problematic seeds of *S. mombin*.

6.1 Seed Sizes and Germination

There is increasing evidence that the distribution and abundance of adults in a plant community are often mediated by events that occur during seedling stages. Large seed size is generally assumed to provide individuals with a competitive advantage (Gross and Werner 1982). However my research using both the seeds of the Savanna and forest tree species have shown that seed size may affect initial seedling growth, but not final yield (Gross and Soule 1981). The rate of germination was faster in small seeds of *T. grandis*. Seedlings from large seeds had higher Leaf Area Ration (LAR) and Net Assimilation Rate (NAR) as seen directly from the total leaf area and dry weights of seedlings. However, in terms of relative performance, seedlings raised from small sized seeds and with higher RGR were better. My studies on the effect of seed sizes on seedling and survival favour the use of both seed sizes. Sometimes larger seedlings from large seed size have higher survival and sometimes they do not.



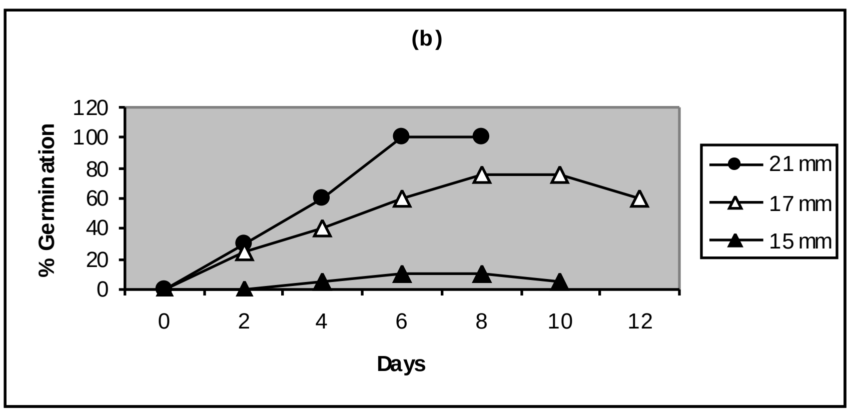


Fig. 5:Pertcentage germination of stored seeds of (a*) Ceiba pentandra* and (b*) Leucaeus lencocephals* prepared with conc H_2SO_4

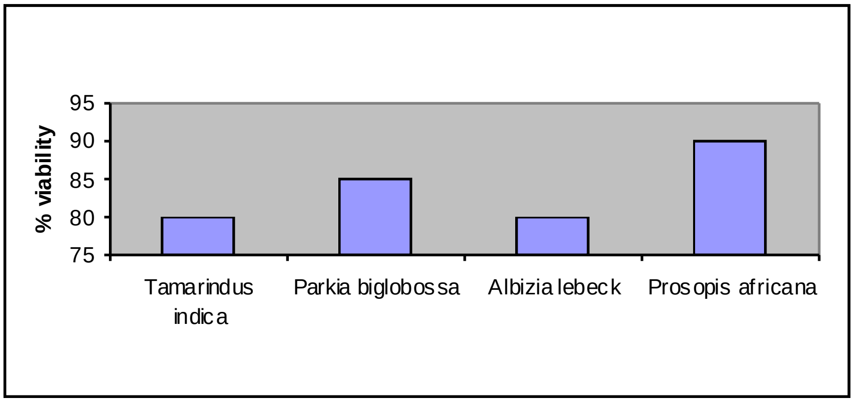


Fig. 6: Percentage Viability of some Tree seeds

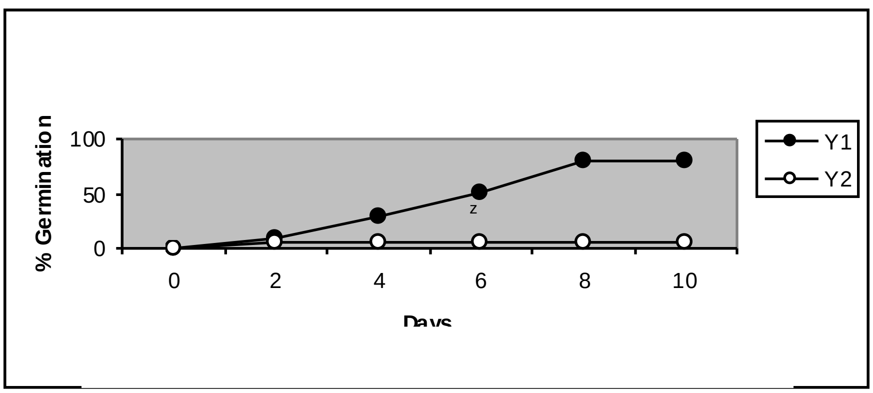


Fig. 7: Percentage germination of Scarified (Y1) and unscarified (Y2) seeds of Parkia biglobosa

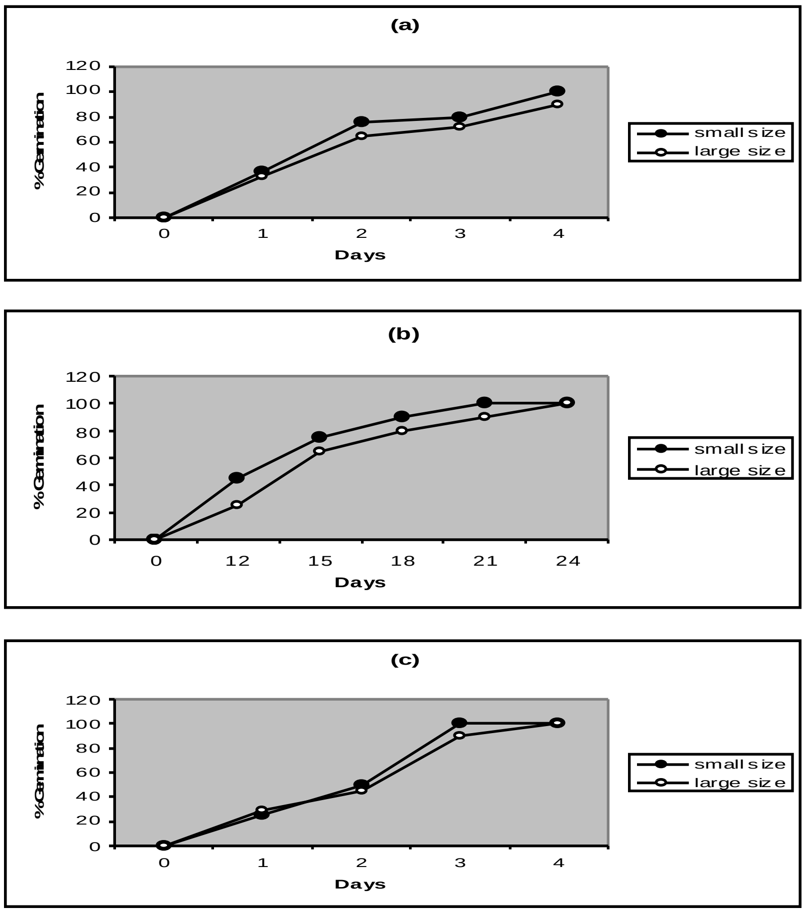


Fig. 8: Percentage germination in large and small- size seeds of (a) *Leucaena Leucocephala* (b) *Tectona grandis* and (c) *Ceiba pentandra*

6.2 Seeds Storage, Longevity and Viability

Another problem often encountered is the inability of collected seeds to retain their viability while in storage (Agboola, 1991a & b). Temperatures and relative humidities have been attributed to these problems. Ambient relative humidities during storage can lead to increase in seed moisture content and resultant deterioration. Higher moisture content do not favour the proper mobilization of the food materials in the seed by the embryo for germination. In our series of work, the viability of most of the seed was maintained for 24 months when stored under RH of 52.5-62% at room temperature, most especially those on the effect of relative humidity on storage and viability of *T. superba*, *T. ivorensis, Ceisa pentandra* and *P. africana* (Agboola, 1991; Agboola and Etejere, 1991; Agboola 2006). Viability was easily lost within 12-15 months when seeds were stored between 0-22% and 91-100%. The viability of most seeds of trees of the savannah including *Prosopis africana* and *Parkia biglobossa* was maintained for 24 months when seeds were stored under RH values of 47-52.5% at room temperature. Viability was easily lost under RH values of 22% and 72.5-100%.

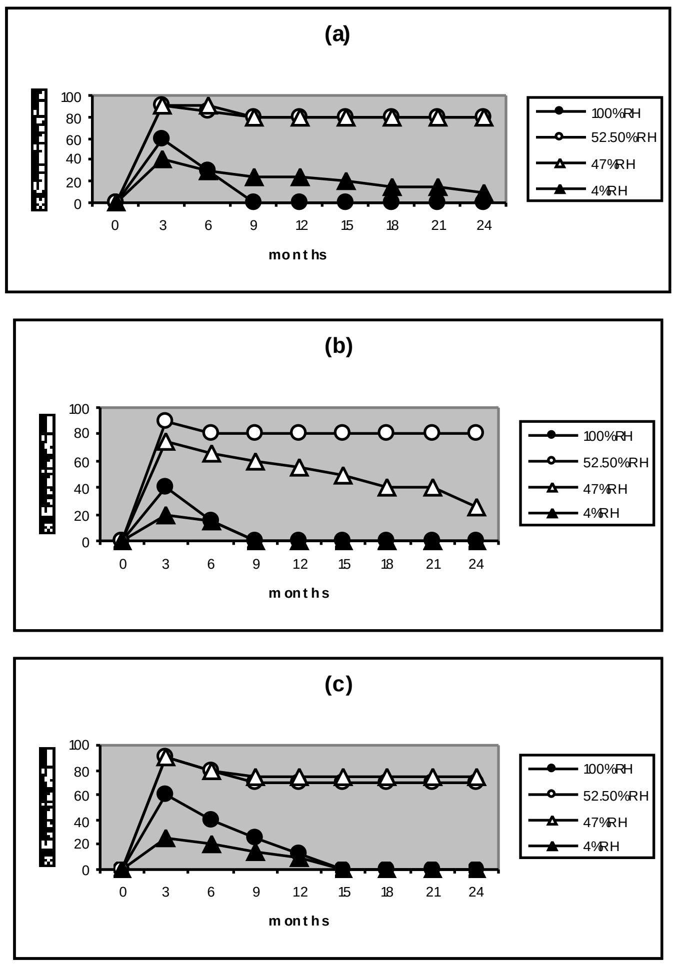


Fig. 9: Percentage germination of seeds of (a) ***Leucaena leucocephala***
(b) ***terminalia superba*** **(c)** ***Gmelina arborea***

6.3 Seeds and plant growth regulators

My works have shown recently, stimulatory effect of growth regulators in seed germination and vegetative growth of seedling of trees most especially in the forest and savannah bromes. Seed germination of tree seeds was enhanced by gibberrelic acid 3000 mg/L (Agboola, 2002). Germination rate was faster with a combination of kinetin and gibberrellic acid. This process of complementing other treatments with hormonal treatment has been used to terminate dormancy and raise more seedlings for successful establishment of their stands in various afforestation programmes (Agboola and Adedire 1998). Gibberrellic acid (GA_3) is one of the major plant hormones involved in the control of processes of mobilization of food reserves from endosperm or cotyledon. Absorbed GA_3 complemented the inherent hormone on the seed.

Trees whose seeds have benefited from my work include *Milicia exelsa, Milletia throningii, Enterolobium cylocarpum, Ceiba pentandria, Gmelina arborea, Leucaena leucocephala, Terminalia superba, Terminalia ivorensis, Parkia biglobossa, Dialium guineensis, Prosopis africana, Albizia lebbeck, Tamarindus indica* to mention a few.

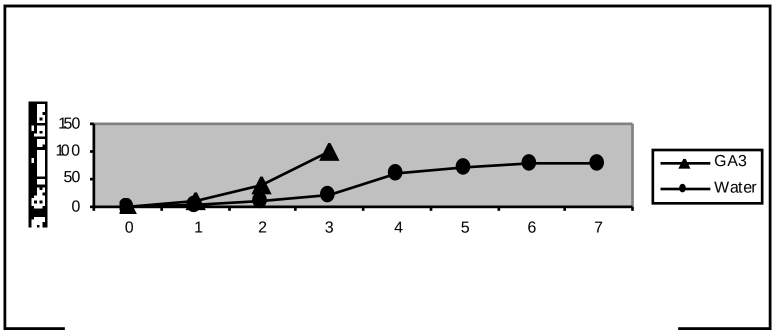


Fig.10: Effect of giberrellic acid (GA_3) on the germination of seeds of Cassia *obtusifolia*

Table 2: Effect of defoliation on the root dry weight of 3-month old seedlings of six tropical tree species. Data are mean values ± s.e of five replicates

Defoliation treatment	Dry weight of root (x102g)					
	Ts	Tv	Tg	Cb	Ga	Leu
D0	7.9 ± 0.5	5.0 ± 1.2	130.0 ± 1.7	15.0 ± 1.3	33.4 ± 0	23.0 ± 0.2
D1	9.7 ± 0.3	4.8 ± 1.2	127.3 ± 0.6	14.7 ± 0.2	33.6 ± 0.1	22.8 ± 1.6
D2	7.2 ± 0.4	4.6 ± 1.0	128.4 ± 0.3	14.2 ± 0.5	33.7 ± 0	22.7 ± 1.2
D3	5.1 ± 0.1	2.5 ± 0.61*	102.3 ± 0.2	9.3 ± 0.3*	26.3 ± 1.2*	15.2 ± 1*
D4	7.3 ± 0.3	4.7 ± 0.1	126.8 ± 0.1	14.8 ± 1.5	34.0 ± 0.6	22.6 ± 0.3
D5	4.6 ± 0.4*	2.0 ± 0.1*	94.2 ± 1.0	10.4 ± 2.4*	22.3 ± 0.1*	13.3 ± 1.1*
D6	7.1 ± 0.4	4.4 ± 1.2	126.2 ± 0.7	14.6 ± 2.2	32.9 ± 0.1	22.8 ± 3.9

* Significantly different from control (p = 0.05)

D_0 = no leaf removed (control) D_1 - one whole leaf removed
D_2 = one half leaf removed D_3 = two whole leaves removed
D_4 = two half leaves removed D_5 = three whole leaves removed
D_6 = three half leaves removed

Ts = *Terminalia superba* Tv = *Terminalia ivorensis* Tg = *Tectona grandis*
Cb = *Ceiba pentandra* Ga = *Gmelina arborea* Leu = *Leucaena leucocephala*

Table 3: Effect of defoliation on the shoot dry weight of 3-month old seedlings of six tropical tree species. Data are mean values ± s.e of five replicates

Defoliation Treatment	Dry weight of root (x10²g)					
	Ts+	Tv	Tg	Cb	Ga	Leu
D0+	12.6 ± 0.4	9.0 ± 0.4	60.0	99.0 ± 4.0	89.0 ± 0.3	48.0 ± 1.6
D1	12.4 ± 0.7	8.8 ± 0.6	57.3 ± 0.1	94.0 ± 2.6	86.3 ± 0.2	47.3 ± 0.2
D2	12.5 ± 0.2	8.7 ± 0.3	58.0	96.0 ± 6.3	87.2 ± 0.3	47.6 ± 1.2
D3	8.4 ± 0.7	5.2 ± 0.1	46.4 ± 1.2	64.6 ± 2.4*	63.4 ± 1.7*	31.3 ± 1.1*
D4	12.2 ± 1.3	8.6 ± 0.4	57.2 ± 1.3	96.2 ± 4.2	87.2 ± 0.5	47.7 ± 1.3
D5	6.7 ± 0.1*	4.3*	39.6 ± 0.4	70.1 ± 1.6*	56.7 ± 1.3*	27.2 V 1.4*
D6	12.2 ± 0.1	8.2 ± 0.2	57.1 ± 0.3	97.3 ± 3.4	87.6 ± 0.3	47.3 ± 2.4

Table 4: Effect of defoliation on root length of 3-month old seed lings of six tropical tree species. Data are mean values ± s.e of five replicates

Defoliation treatment	Root length (cm)					
	Ts+	Tv	Tg	Cb	Ga	Leu
D0+	20.0 ± 0.3	16.4 ± 0.3	18.0 ± 2.0	20.4 ± 1.8	19.4 ± 1.3	18.2 ± 0.5
D1	19.7 ± 0.2	16.2 ± 0.2	17.3 ± 0.1	18.9 ± 0.3	19.0 ± 0.1	16.4 ± 0.4
D2	19.4 ± 0.3	16.0 ± 0.1	17.0 ± 0.1	18.8 ± 0.3	19.2 ± 0.2	18.0 ± 0.3
D3	13.0 ± 0.1	10.0 ± 1.2*	12.3 ± 0.1	13.3 ± 0.6*	19.3 ± 1.2	13.9 ± 0.8*
D4	19.8 ± 0.4	16.3 ± 0.4	17.4 ± 0.1	19.4 ± 0.7	18.8 ± 1.3	16.9 ± 1.3
D5	12.3 ± 0.5*	8.0 ± 1.2*	9.6 ± 0.3	11.1 ± 0.3*	19.2 ± 0.7	12.0 ± 0.5*
D6	18.3 ± 0.4	16.0 ± 0.2	17.0 ± 0.1	18.6 ± 0.4	18.7 ± 1.1	18.0 ± 0.5

*Significantly different from control (p = 0.05)
+as in Table 2

Table 5: Effect of defoliation on the shoot length of 3-month old seedlings of six tropical tree species. Data are mean values ± s.e of five replicates

Defoliation treatment	Shoot length (cm)					
	Ts+	Tv	Tg	Cb	Ga	Leu
D0+	16.4 ± 0.1	11.4 ± 0.1	10.9 ± 0.4	16.4 ± 0.5	23.0 ± 0.1	20.0 ± 1.6
D1	16.0 ± 1.3	11.4 ± 0.1	11.3 ± 0.1	17.5 ± 0.2	22.9 ± 0.3	18.9 ± 1.3
D2	16.2 ± 0.9	11.2 ± 0.2	10.8 ± 0.1	16.8 ± 0.1	22.8 ± 0.1	19.4 ± 0.6
D3	16.3 ± 0.6	11.3 ± 0.1	8.9 ± 0.2	16.0 ± 0.2	15.0 ± 1.2*	12.6 ± 0.5
D4	16.2 ± 0.7	11.0 ± 0.1	10.2 ± 0.4	16.3 ± 0.1	22.9 ± 0.1	20.7 ± 1.2
D5	15.9 ± 0.4	10.9 ± 0.3	7.8 ± 0.1	16.4 ± 0.2	13.3 ± 0.9*	12.5 ± 0.6*
D6	15.6 ± 0.1	11.2 ± 0.4	10.4 ± 0.1	16.3 ± 0.4	21.5 ± 1.3	20.1 ± 0.2

*Significantly different from control (p = 0.05)
+as in Table 2

Table 6: Effect of inorganic fertilizers on the leaf area of 3-month old seedlings of six tropical tree species. Data are mean values ± s.e of five replicates

Fertilizer treatment	Leaf area of seedling (cm2)					
	Ts+	Tv	Tg	Cb	Ga	Leu
Control	1435.0 ± 4.6	350.0 ± 2.7	6550.0 ± 7.3	1175 ± 9.1	4611.0 ± 18.1	788.0 ± 3.0
NaNO3	1610.0 ± 11..3	412.0± 1.5	6730.0 ± 6.2	1360.0 ± 6.4	4764.0 ± 9.2	920.0 ± 7.4
Mg(No3)2	1620.0 ± 11.2*	476.0 ± 2.5*	6947.0 ± 7.3*	1642.0 ± 3.5*	5102.0 ± 4.1*	1020.0 ± 8.1*
NH4NO3	1536.0 ± 9.7	436.0 ± 1.7	6714.0 ± 3.9	1260.0 ± 2.7	4821.0 ± 10.1	640.0 ± 4.1
Al(NO3)3	1497.0 ± 11.7	410.0 ± 6.4	6614.0 ± 11.2	1210.0 ± 4.2	4721.0 ± 8.7	360.0 ± 3.5
NH4Cl	1560.0 ± 5.4	386.0 ± 5.1	6783.0 ± 8.4	1320.0 ± 6.1	4801.0 ± 7.2	802.0 ± 5.6

Table 7: Effect of inorganic fertilizers on the total dry weights of 3-month old seedlings of six tropical tree species. Data are me an values ± s.e of five replicates

Fertilizer treatment	Total dry weight of seedling (g)					
	Ts+	Tv	Tg	Cb	Ga	Leu
Control	1.62 ± 0. 01	1.65 ± 0. 02	8.84 ± 0. 14	12.65 ± 0.09	18.46 ± 0.19	7.47 ± 0. 18
NaNO3	3.01 ± 0. 02	1.97 ± 0. 03	8.77 ± 0. 14	12.94 ± 0.14	18.76 ± 0.87	7.86 ± 0. 18
Mg(No3)2	5.24 ± 0. 04**	4.87 ± 0. 06**	16.29 ± 0.17**	34.64 ± 0.11**	30.0 ± 0. 76**	28.92 ± 0.14**
NH4NO3	4.6 ± 0.06	3.70 ± 0. 22	8.93 ± 0. 03	13.01 ± 0.46	18.6 ± 1. 24	8.01 ± 0. 26
Al(NO3)3	1.72 ± 0. 04	1.75 ± 0. 01	8.19 ± 0. 39	12.12 ± 0.01	18.77 ± 1.26	7.48 ± 0. 27
NH4Cl	2.46 ± 0. 03	1.74 ± 0. 01	8.74 ± 0. 01	13.53 ± 0.4	18.73 ± 0.06	9.75 ± 0. 36

Table 8:Effect of different concentration of thiourea, potassiumni trate and potassium cyanide

Treatment	Mean Percentage Germination Scarified Seeds		
	Thiourea	Potassium nitrate	Potassium cyanide
500 ppm	50b	48b	42c
1000 ppm	80a	50b	50b
1500 ppm	40c	56b	42c
2000 ppm	38d	44c	36d
	Unscarified seeds		
500 ppm	0.0e	0.0e	0.0e
1000 ppm	0.0e	0.0e	0.0e
1500 ppm	0.0e	0.0e	0.0e
2000 ppm	0.0e	0.0e	0.0e

Data are means of 5 replicates obtained 20 days after incubation at 30 ± 2°C
Data with the same letter indicates no significant difference between means at P = 0.05 (DMRT)

Table 9:Percentage germination of untreated and herbicide treated seeds of *Cassia occidentalis* after 7 days

	Percentage germination Concentration (ppm)			
Treatment	0 (water)	10	50	100
2-4D	75 ± 3a	70 ± 7a	45 ± 3c	0 ± 0c
GALEX	75 ± 3A	65 ± 5*b	35 ± 5*c	0 ± 0c
GRAMOXONE	75 ± 3a	75 ± 3*b	60 ± 4*b	0 ± 0c
ATRAZINE	75 ± 3a	65 ± 14b	25 ± 5*c	0 ± 0c
SIMAZINE	75 ± 3a	60 ± 6b	45 ± 3c	0 ± 0c
ROUND D-UP	75 ± 3a	55 ± 3*b	0 ± 0*c	0 ± 0c
PRIMEXTRA	75 ± 3a	45 ± 2*c	0 ± 0*c	0 ± 0c

*Significantly different from control at 95% probability level
Data with same letter are not significantly different at 95% probability level, LSD = 0.3277

Table 10: Percentage germination of untreated and herbicide treated seeds of *Cassia obtusfolia*

	Percentage germination Concentration (ppm)			
Treatment	0 (water)	10	50	100
2-4D	90 ± 4a	75 ± 3a	75 ± 2b	0 ± 0c
GALEX	90 ± 3a	65 ± 5*b	35 ± 5*c	0 ± 0c
GRAMOXONE	90 ± 14a	70 ± 3*b	55 ± 5*b	0 ± 0c
ATRAZINE	90 ± 14a	65 ± 7*b	45 ± 6*b	0 ± 0c
SIMAZINE	90 ± 14a	80 ± 10a	60 ± 2*b	0 ± 0c
ROUND D-UP	90 ± 14a	70 ± 5b	65 ± 3b	0 ± 0c
PRIMEXTRA	90 ± 14a	80 ± 3a	45 ± 7*c	0 ± 0c

*Significantly different from control at 95% probability level
Data with same letter are not significantly different at 95% probability level, LSD = 0.12209

Table 11: Percentage germination of untreated and herbicide treated seeds of *Calapogonium mucunoides*

	Percentage germination Concentration (ppm)			
Treatment	0 (water)	10	50	100
2-4D	80 ± 6a	0 ± 3*c	0 ± 0c	0 ± 0c
GALEX	80 ± 6a	5 ± 7b	45 ± 4*b	0 ± 0c
GRAMOXONE	80 ± 6a	0 ± 3a	55 ± 3b	0 ± 0c
ATRAZINE	80 ± 6a	5 ± 2*c	0 ± 0c	0 ± 0c
SIMAZINE	80 ± 6a	5 ± 3b	40 ± 7c	0 ± 0c
ROUND D-UP	80 ± 6a	0 ± 12*b	4 ± 5*c	0 ± 0c
PRIMEXTRA	80 ± 6a	5 ± 3*c	0 ± 0*c	0 ± 0c

*Significantly different from control at 95% probability level
Data with same letter are not significantly different at 95% probability level, LSD = 0.2832

Table 12: Percentage germination of untreated and herbicide treated seeds of *Cassia hirtusa*

	Percentage germination Concentration (ppm)			
Treatment	0 (water)	10	50	100
2-4D	86 ± 4a	72 ± 6*a	43 ± 2c	31 ± 3c
GALEX	86 ± 4a	64 ± 7b	22 ± 3*c	0 ± 0c
GRAMOXONE	86 ± 4a	56 ± 2*b	25 ± 3*c	25 ± 2*c
ATRAZINE	86 ± 4a	60 ± 5b	42 ± 4c	0 ± 0c
SIMAZINE	86 ± 4a	74 ± 5a	35 ± 1c	24 ± 7*c
ROUND D-UP	86 ± 4a	66 ± 1b	45 ± 2c	15 ± 6*c
PRIMEXTRA	86 ± 4a	70 ± 1a	36 ± *c	16 ± 4*c

*Significantly different from control at 95% probability level
Data with same letter are not significantly different at 95% probability level, LSD = 0.1970

The Savanna: seed trees and their economy

The savanna vegetation in Nigeria occupies a land expanse between latitudes 7°N and 10°N (Agboola, 1995). The vegetation is well known for its combination of open woodland and grasses. Some of the tree species are the general utility types helping in nutrient recycling as well as providing medicine, food, fodder, charcoal, utensils and timber (Ola-Adams and Oneyachusim 1993). Such tree species include those of *Vitellaria, Khaya* (dry zone Mahogany) *Daniell, Prosopis, Parkia, Afzelia, Vitex, Terminalia*. They are referred to as general utility or multipurpose trees (Ebofin *et al*., 2003).

All these propagate by means of seeds apart from very few that do so vegetatively through the roots. Some attributes which affect germination of seeds and growth of seedlings are also encountered in many of the tree species most especially the tree-legumes such as *P. africana* and *P. biglobossa*. This include hard seed coats, seed types and sizes in addition to problems of seed dormancy and longevity (Agboola 1996). Trees are of great value to many communities scattered all over the savanna in Nigeria where more than two thirds of the country is the savanna (Fig. 11). These trees are not cultivated and are often referred to as wild, endangered, lost crops or lesser crops but useful. In Nigeria the seeds of such trees as *P. biglobossa* and *P. africana* are very important to the Idoma, Ighala, Ebira, Tiv and Yoruba people (mostly of the Guinea Savanna). Seeds from the two trees are used for preparing fermented soup condiments, called 'Ukpehe' and 'iru' or 'dawadawa'. This is apart from the medical preparation from plant parts and kitchen utensils such as spoons, axe, hoe, handles, club, mortar, pestles etc fashioned from their wood.

The flow charts (Fig. 12) explain the traditional method of preparing ukpehe and charcoal as well as carving of hoe and axe handles, pestles and mortar (Figures 14 and 15).

The Vice-Chancellor sir, ladies and gentlemen, all these aspects of money yielding part of the economy will be adversely affected if the seeds of these valuable plants are not carefully managed to yield their seedlings which later grow into matured plants.

This is the motive behind my focus of research as a plant physiologist (Agboola, 2004) working strictly on seeds and seedling physiology especially as it relates to agroforestry.

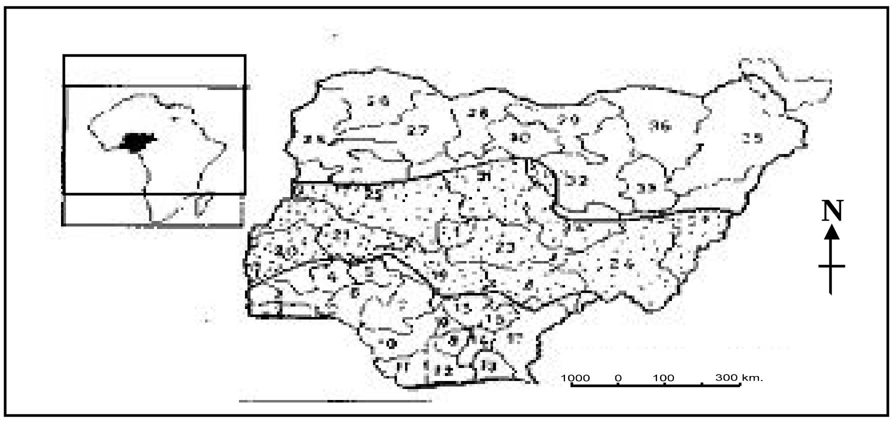


Fig.11: Study area in the Guinea Savanna of Nigeria, States with Guinea Savanna:

1 - ABUJA (FEDERAL CAPITAL TERRITORY); 18 – BENUE, 19 – KOGI, 20 – OYO, 21 – KWARA,
22 – NIGER, 23 – NASARAWA, 24 – TARABA, 30 – KANO, 31 – KADUNA, 32 – BAUCHI,
34 – PLATEAU, 37 – ADAMAWA.

Seeds

Boiling in earthen ware or iron pots for 24 hours until very soft

⇩

Dehulling with palm

⇩

Separation of seed coats and cotyledon

⇩

Cotyledons are washed and boiled for 5 hours

⇩

Reboiled cotyledons are put in calabashes or earthen ware pots prelined with pawpaw or banana leaves

⇩

Covering of calabashes with jute bags for 5 days

⇩

Ukpehe

Fig 12: Flow chart for the traditional preparation of ukpehe

Felling of trees

⇓

Pruning of trees to have main bole and separated branches

⇓

Sun-drying of boles and main branches

⇓

Digging of linear pits and trenches

⇓

Pruned boles and branches are buried in trenches with covers of dry grasses

⇓

These are left to smoke/combust slowly for about 2-3 weeks until no more smoke is observed

⇓

Sand cover is removed and charcoal formed is excavated

⇓

Charcoal is stacked in poly or jute bags for the market

Fig.13: Flowchart for the traditional production of charcoal

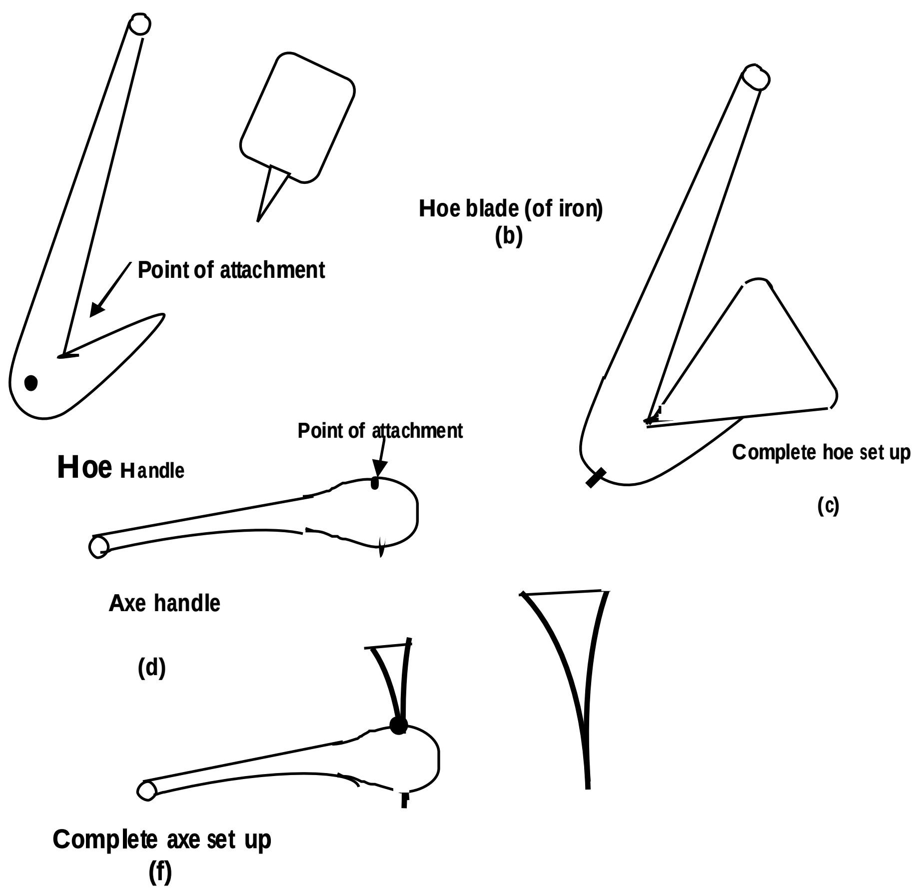


Fig.14: Hoe and axe parts from the wood of *P. africana* (a) wooden hoe handle, with point of for blade; (b) iron blade for hoe; (c) complete hoe; (d) axe handle with point of fix for the blade; (e) axe iron mouth or blade; (f) complete axe set-up.

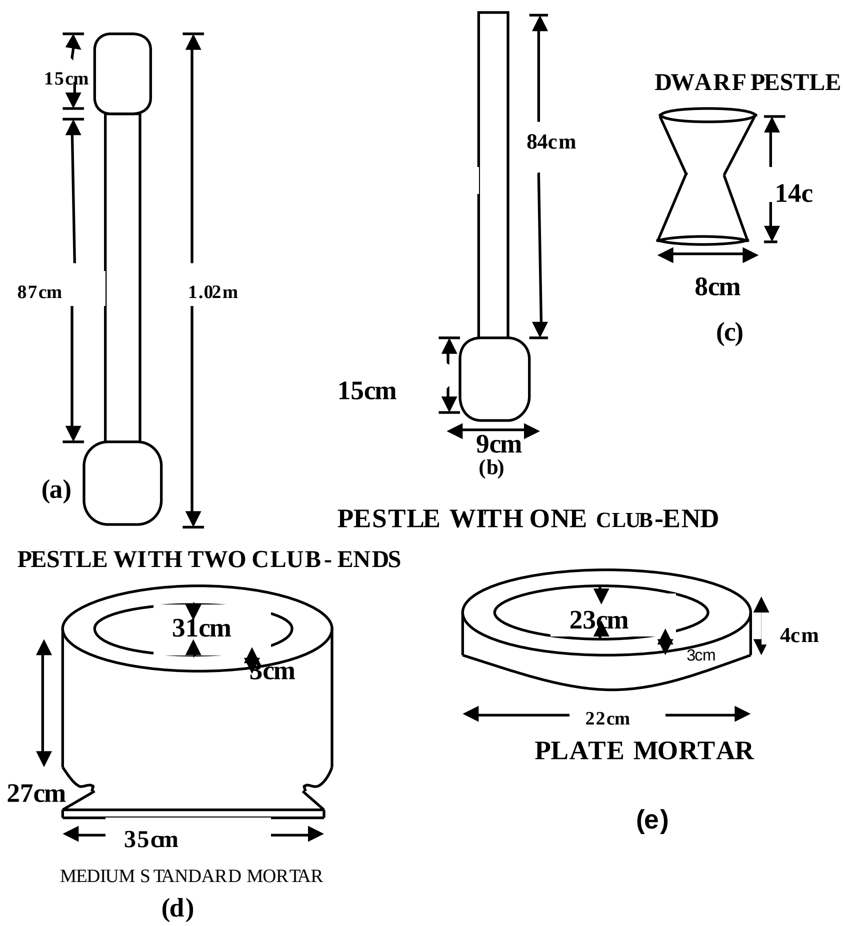


Fig.15: Types of wooden pestle and motars from the wood of *P. africana* (a) standard pestle with two club like ends; (b) Pestle with one club- like end; (c) Dwarf pestle for table mortar; (d) Medium size standard mortar (e) Plate mortar.

Table 13: *Prosopis* Tree Species in Different Countries

SOUTH AMERICA	USA	NORTH AMERICA	MEXICO	CHILE	PERU
P. AFFINIS	P. VELUTINA	P. JULIFLORA	P. JULIFLORA	P. TAMARUGO	P. CHILENSIS
P. ALBA	P. GLANDULOSA	P. ARTICULATA	P. PUBESCENS	P. CHILENSIS	P. PALLIDA
P. CHILENSIS	P. ALBA	P. VULETINA	P. PALMERI	P. BURKATII	P. JULIFLORA
P. CALDENIA	P. PUBESCENS	P. PUBESCENS	P. ARTICULATA	*P. ALBA	P. STROMBULIFERA
P. ELATA	*P. JULIFLORA	P. REPTANS	P. TAMAULIPANA	P. FLEXULOSA	P. REPTANS
P. FEROX			P. LAEVIGATA	P. SILIQUASTRUM	P. LAEVIGATA
P. FLEXULOSA			P. GLANDULESA	P. ATACAMENSIS	*P. ALBA
P. HUMILIS			P. VELUTINA	P. LIMENSIS	
P. NIGRA			P. TORREYANA		
P. TORQUATA					
P. KUNTZEI					
P. ALPATARO					
		NIGERIA	***SENEGAL***	***MAURITANIA***	
P. NIGRA		P. AFRICANA	P. AFRICANA	**P. JULIFLORA	
P. STRUMBULIFERA			**P. ALBA		
P. ALPATACO			**P. CHILENSIS		
P. NIGRA			**P. JULIFLORA		
P. STROMBULIFERA			**P. CINERARIA		
P. SERICANTHA					
P. ARGENTINA					
P. TAMARUGO					
P. RUSCIFLORA					
P. HASSLERI					

* species with one to two varieties
** introduced

Source: Ffolliot and Thames (1986) as modified by Agboola (2001).

Table 14 : The Economic Potential of *Prosopis Africana* in the Guinea Savanna Regions Of Nigeria

Soil improvement	Environ-mental	Socio economic	Nutritional and food	Miscellaneous products
- Agro-silvo-pastoral systems	- Alternative source of fuel	- Job opportunities	- Food for man and animals	- timber
- Nutrient recycling	- Positive modification of micro climate	- Source of food for man and animals	- Source of forage	- furniture wood
- Nodulation and fixing of Nitrogen	- For wild life	- Cool shades for man and animals		- honey production
- Check soil erosion	- for aesthetic value	- Source of fire wood		- charcoal
				- Wooden implement
				- medicinal products
				- gums and rasins

7.0 MY CONTRIBUTIONS TO KNOWLEDGE

It is my joy that I have in my little way contributed to knowledge. My contributions to knowledge have been along the following:

* Fermentation of fresh fruits and seeds using natural fermenters as a type of dormancy releasing method in pulpy fruits as a new dimension in Biotechnology.

* Terminating dormancy ("seed slumber") in seeds of some forest and savanna trees species Including *C.pentandra, T.ivorensis, T.superba, T.grandis, G.arborea, T.indica, P.africana* and *P.biglobossa*. which play substantial role in the economy of our great country Nigeria.
* The seed sizes – types and effect on seedling growth.
* Dormancy treatment in some herbs and spices.
* Effect of nutrient requirements using different sources of nitrogen and inorganic fertilizers on young seedlings
* Seed germination and plant hormone effect for enhancing germination of seeds.
* Germination responses of some noxious weeds of tropical wastelands within the agroforest.
- Germination inhibitors and promoters – types and their Rf values in fruits and seeds of some forest tree species.

8.0 RECOMMENDATIONS

Vice-Chancellor sir, UNAAB has come of age. It has been a meteoric rise to stardom. New departments and colleges are springing up. Departments such as Forestry and Wildlife, Plant Breeding and Seed Technology and Biological Sciences are well established. To boost our research, teaching and extension service, I wish to submit as follows:

- Farmers should be encouraged to learn how to propagate and cultivate these several utility tree species.
- Additional research is needed to explore more of the potentials of these valuable tree species.
- A good approach to the problems of the noxious weed is to find useful application to which these can be put as done in Kenya either for green manuring or medicinal purpose.
- There is the need for a construction of modern silos for the University.
- The establishment of a seed centre in UNAAB is long overdue. This should include the

(i) Seed store with the refrigerators and driers

(ii) Seed testing centre

(iii) Seed packaging centre

(iv) Seed sale unit

(v) Seed procurement unit

(vi) Giant Power generator- 250 KVA above

All these are capital intensive and, hence, government should increase funding of the Universities of Agriculture.

Reminiscences

Vice-Chancellor sir, it has been wonderful being a partner in progress with this great university. I have had the opportunity of working under four Vice-Chancellors. Each tenure has opened my vision to different scenario of human endeavours. The tenure of Professor Olufemi Olaiya Balogun has been the most challenging, fruitful and rewarding. I have learnt and imbibed steadfastness, prudence, managerial skills, mercy, fatherliness and Godliness. Members of the Senate especially the Deans and Heads of Departments who are working with him will agree with me. We have been kept on our toes for information and data that must be supplied within the next 24 hours, inaugural lectures notwithstanding.

This University portrays the best cream of students in terms of discipline, morals and intelligence. I have enjoyed my stay in UNAAB with them. I have been so close to them to an extent that the likes of colleagues such as Professors Arowolo, Adedire, Drs. Adeofun and Alegbeleye, Dr. Ola-tunde, etc, often call me "Baba Omo", i.e., the father of the children. I can not do otherwise afterall my children went through this university. Sir, I have been the chairman at many Unaabite marriages, I am still expecting more. This University can boast of sound administrators hence this university has given birth to Registrars in other universities. Be-

cause UNAAB is still the best university in Nigeria.
The cream of chartered accountants in UNAAB may suffer the same fate, i.e., more of them will go to other universities as Bursars. Lest I forget sir, the department of Biological Sciences has come of age and should be split into two departments after the accreditation exercise this year. So help us, Vice-Chancellor.

9.0 ACKNOWLEDGEMENTS

Vice-Chancellor sir, those of us from very humble beginning must be at the forefront of thank givers to God Almighty for answering our prayers. Papa God, I honour you and give thanks and adoration to your holy name with this stanza I say I am grateful sir.

"You are the Lord
that is your name
You will never share your glory with anyone
You will never share your glory with anybody
Almighty God
That is your name"

I was the only son of an illiterate mother who was schemed out of the love of my father by aunties simply for being an illiterate. Her agony, vicissitude and prayers produced a Professor son who is standing before you today. I therefore

sincerely appreciate the efforts of my late parents Mrs. Dorcas Aina Okewunmi and Most Special Senior Apostle, Benjamin Adebayo Agboola and my step father, late Papa James Okewunmi for the care, prayers, efforts and expenses incurred on me.

I pay special tributes to my late uncle James Ademola Agboola for his advice that piloted me through the University days. The same goes to my late wife Mrs. Tawa Agboola (Nee Gbenle) who worked assiduously to see me through my Ph.D programme at the University of Ilorin. Your memory and versatility remains indelible in my mind, Adieu. To the Gbenle and Omonbenle family, take heart, God is in control and thank you for everything.

I sincerely appreciate the family of my in-laws, the Adewuyis for their wonderful support. To my late father in- law Alhaji Raimi Adewuyi , I pay a glowing tribute.

I sincerely thank my mentors in academics Professor S.N.C. Okonkwo (formerly of the University of Nigeria Nsukka, now late), Professor M. O. Olofinboba (now late), Who was my major supervisor for the M.Sc programme in Ilorin, Professors M. O. Fawole and E. O. Etejere of Bowen University, Iwo and the University of Ilorin respectively, my supervisors for the Ph.D programme.

I am immensely grateful to my classmates from the secondary school and the Higher school, Professor Musibau Akanji and Olufemi Durosaro for their encouragement. To my half brothers and sisters Ajayi, Toro, Nike, Segun, Sunday, Dunni Okewunmi I say a big thank you for the respect and brotherliness. I owe a lot of gratitude to the Inspector General of Police Mr. Ogbonaya Ikechukwu Onovo, my colleague at Nsukka for his benevolence, and also Professor Okezie and other Lions at the Department of Botany Nsukka still holding forth at the Den. Great Lions and Lionesses here present, Ndewo nu, keep the flag flying and thank you for gracing this occasion.

I owe a lot of gratitude to the University of Agriculture, Abeokuta for developing me up to the Professorial level. I have never regretted my stay in this institution. To cap it all I highly appreciate all the efforts of Prof. Olufemi Olaiya Balogun for giving everybody a free hand to participate in his government. To the past Vice-Chancellors UNAAB I am very grateful. I shall never forget the role played by Professor Amioba Okojie in the life of one of my sons when it became difficult to send him to the best secondary school of my choice. He came to the rescue of the family. The Almighty

God will reward your benevolence.

I wish to express my gratitude to members of staff in the Biological Sciences Department especially Professors Mafiana, Kadiri, Ayodele and Idowu, Drs. Ademolu, Sam-Wobo, Ekpo, Oke, Drs. (Mrs.) Idowu and Kehinde. Messrs Aworinde, Bankole and Felix. This list also includes Mrs. Lanloye and my indefatigable secretary of the department Mrs. Magbagbeade and Office Assistant Mrs. Owoseni. The cohesion in the family relationship existing in the department has led to the peace and well being of the department. May the blessing of the Almighty God continue to reign in your lives.

I wish to thank the Dean of COLNAS Prof. Asiribo and the entire College Board for presenting me for this 28th Inaugural Lecture. I wish to thank colleagues and Heads of the Departments in COLNAS including Professors Yemisi Eromosele, Ademuyiwa, Drs. Adeniran, Oyebanji and others. I am highly indebted to my senior colleagues in COLNAS most especially Professors Ighodalo Eromosele and Bamiro for the wonderful encouragement and leadership. To them I say a big thank you. I pay a glowing tribute to my friend, brother, colleague, late Prof. Waidi Lasunkanmi Biobaku. Adieu. To his darling wife Alhaja Iyabode Biobaku, I say thank you for the support always.

I also appreciate my wonderful students in the Department of Biological Sciences, they have been hardworking and obedient. I admonish you to work harder to have the first class grade for the first time this session, so shall it be in Jesus name.

The CAC Student Fellowship (CACSA) UNAAB and Cherubim and Seraphim unification student fellowship UNAAB, I appreciate your love and support in prayers. I wish you a successful sojourn in UNAAB. You will all come out in flying colours in Jesus Name.

I wish to extend my gratitude to my church members of the Agbala Itura Christ Apostolic Church, Agbala Itura, Abeokuta. These include the District Superintendent Pastor Diran Adeleke, Lady Evangelist (Mrs.) Adeleke, Reverend Ojo, and my assembly pastor at Eleweran, Rev. Oyetoran. Thank you for standing by me all the time. Deacon and Deaconess Olalotiti Lawal, Dr. Toyin Afolabi and Azeez, you are appreciated.

The Vice-Chancellor sir, behind every successful man there is a woman. Moreover sir, when King David was old the Israelites found for him Abishag the Shunemite to be his companion and give him warmth.

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Thank you all and God bless.

A

B

Plate 3: Fresh seeds of *Prosopis africana* (A) and *Parkia biglobosa* (B)

A

B

Plate 4: *Parkia biglobosa* tree (A) and Charcoal for sale (B)

A

B C

Plate 5: Axes (A) ,Fire wood (B) and Hoes (C) For sale in the market

A B

C D

Plate 6: Motar (A), Pestles with two club-ends (B) , Planks (C) and Logs of wood (D) at the saw mill

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