

INFLUENCE OF CERTAIN PHYSICAL AND CHEMICAL TREATMENTS ON THE GERMINATION AND SUBSEQUENT GROWTH OF COCONUT *Cocos nucifera* L. SEEDLINGS, A PRELIMINARY STUDY*

K. M. THOMAS

Coconut Research Centre
P. O. Box 5016
Tanga, Tanzania

SUMMARY

The effect of certain physical and chemical treatments on the germination and subsequent growth of coconut seedlings was tested. The treatments consisted of soaking the seed coconuts for 48 hours in 0.01 and 0.02 molar potassium nitrate and sodium carbonate solutions, soaking in water for one week and two weeks durations and a physical treatment of chopping the husk from both ends of the nut. A control was also provided for comparison. The results indicated that all the treatments except the chopping of the ends significantly reduced the germination period, gave a higher percentage germination and greater growth of seedlings when compared with the control. Amongst the treatments, simply soaking in water for two weeks is recommended as it ranked first in all characters and at the same time is simple and easy to follow by farmers.

Coconut, *Cocos nucifera* L. is propagated by seeds only, but seed coconuts take 3-5 months to germinate under normal conditions. This is a long period compared to many other seeds and the reasons for this dormancy are still obscure. Cutter and Wilson (1954) studied the effect of endosperm and other growth stimulants on the development *in vitro* of coconut embryos. They found that, the factors inhibiting to the growth develop in the milk and solid endosperm of coconut as the fruit matures and function in initiating and maintaining the dormancy.

Nanda *et al.* (1959) found that the germination of coconut seeds would be affected by water relations that exist both before and during imbibition, the specific effect of water probably being due to the leaching of water soluble inhibitors. Deshpande and Kulkarni (1962) found that germination was accelerated by 2, 4-D treatment, the best results being obtained with a 150 ppm solution applied to the eyes plus a 10 cc injection of 3 ppm solution into the nut. Whitehead (1965) working on the germination of seed coconut found that the speed of germination varied with the varieties. Cassidy (1961) observed no relationship between the manner in which unhusked nuts floated in water and their speed of germination. But Marar and Shambu (1961) found that the vigour of the seedlings was greatest when seednuts floated vertically in water and least when it floated horizontally.

Fremont *et al.* (1966) reported that trimming the seed coconuts (removing some of the husk at the germ end) would help the shoot to get through the pericarp and also let moisture reach the pericarp more easily.

Menon and Pandalai (1960) reported that soaking of seednuts in water for periods up to 15 days resulted in quicker and better germination. However, they observed that soaking for more than 15 days would adversely affect the germination and quality of seedlings.

Liyanage (1952) did not get any beneficial effects on germination of coconut seeds by injecting six kinds of hormones into the husk. Injection of major nutrients like N, P and K into the husk was also found to have adverse effects on the germination of seed coconuts (Menon and Pandalai 1960).

Nitrates were long been shown as powerful agents in germination, particularly during after ripening and in light sensitive seeds. (Steinbauer and Grigsby, 1957). Hesse (1924) found that a treatment with 0, OIM potassium nitrate could promote the germination of several freshly harvested seeds. Schwendiman and Shands (1943) reported that a 0.2 percent solution (0.02-M) of potassium nitrate was as efficient as prechilling in overcoming delayed germination of freshly harvested seeds of Vicland oats. Ogawara and Ono (1955) found that nitrates and nitrites were effective promoters of germination of seeds of certain varieties of tobacco.

Sodium carbonate is a chemical used by farmers of Tanzania to promote early germination of maize seeds for Preparation of certain crude alcoholic drinks (Masseri 1971).

In the propagation of Coconut, seednuts are first planted in a nursery and when the seedlings attain sufficient growth i.e. about 9—12 months after planting they are transplanted in the permanent field. So if the seeds could be germinated quickly, the nursery period can be shortened and thereby the cost of production of seedlings reduced. Therefore to study the effect of certain physical and chemical treatments on the germination of coconut seeds and the subsequent growth of seedlings, this experiment was carried out at the Coconut Research Centre, Tanga (Tanzania) during the years 1971—72.

MATERIAL AND METHODS

The experiment was laid down in a randomised block design with eight treatments replicated four times. The treatments consisted of the following:—

- (T₁) Soaking the seeds in 0.01 molar potassium nitrate solution for 48 hours before planting.
- (T₂) Soaking the seeds in 0.02 molar potassium nitrate solution for 48 hours before planting.
- (T₃) Soaking the seeds in 0.01 molar sodium carbonate solution for 48 hours before planting.
- (T₄) Soaking the seeds in 0.02 molar sodium carbonate solution for 48 hours before planting.
- (T₅) Soaking the seeds in water for one week before planting.
- (T₆) Soaking the seeds in water for two weeks before planting.
- (T₇) Chopping about one inch of husk from both the apical and basal ends of the nut before planting.
- (T₈) Control. (i.e. planting in the usual way without any treatment.)

20 seednuts of uniform size and maturity selected from the tall variety of coconut were planted on raised beds (450cm x 120cm x 25 cm) at a spacing of 45cm between seeds and 90cm between rows. Each bed represented one plot. A pathway of 60 cm. separated each bed to facilitate irrigation and drainage. The beds were irrigated twice weekly when there was no rain. The number of days taken by each nut for germination after planting was recorded and the average for each plot calculated. A seednut was reckoned as germinated when the plumule emerged 1 cm out of the husk.

Table 1 Effect of certain physical and chemical treatments on the germination and growth of coconut seedlings

<i>Treatment</i>	Mean of 4 replications				
	<i>No. of days taken for germination</i>	<i>Percentage germination obtained</i> *	<i>Mean height obtained</i> Cms	<i>Mean no. of leaves produced</i>	<i>Mean girth at the collar</i> Cms
T1) Soaking 48 hours in 0.01M KNO ₃ solution	100.0	70.8	75.3	5.0	10.3
T ₂) " " " " 0.02M " solution	94.8	71.4	73.1	4.7	10.2
T ₃) " " " " 0.01M Na ₂ CO ₃ "	95.7	73.2	71.5	4.6	9.7
T4) " " " " 0.02M " "	96.4	73.6	75.1	4.8	10.1
T5) Soaking in water for 1 week	93.5	64.8	77.6	4.8	10.3
T6) " " " " 2 weeks	81.1	75.7	80.4	5.1	10.5
T7) Chopping $\frac{1}{2}$ inch from ends	140.1	57.7	56.9	3.8	9.1
T8) Control	142.9	66.5	51.5	3.7	8.3
LSD, P = 0.05	19.4	7.9	11.3	0.8	1.4
P = 0.01	26.4	—	16.6	—	2.1

* Data subjected to arcsine transformation prior to analysis.

The measurable characters of seedlings viz. the height, the total number of leaves produced and the girth at the collar were observed exactly 10 months after planting of the seednuts as at that time the seedlings attained sufficient growth for transplantation in the permanent field.

RESULTS AND DISCUSSION

Summary of the data gathered on the time taken for germination of seednuts, the percentage germination and the growth (Viz. the height, the total number of leaves produced and the girth at the collar) obtained 10 months after planting are furnished in Table 1.

The rate of germination obtained according to time is shown graphically in figure 1.

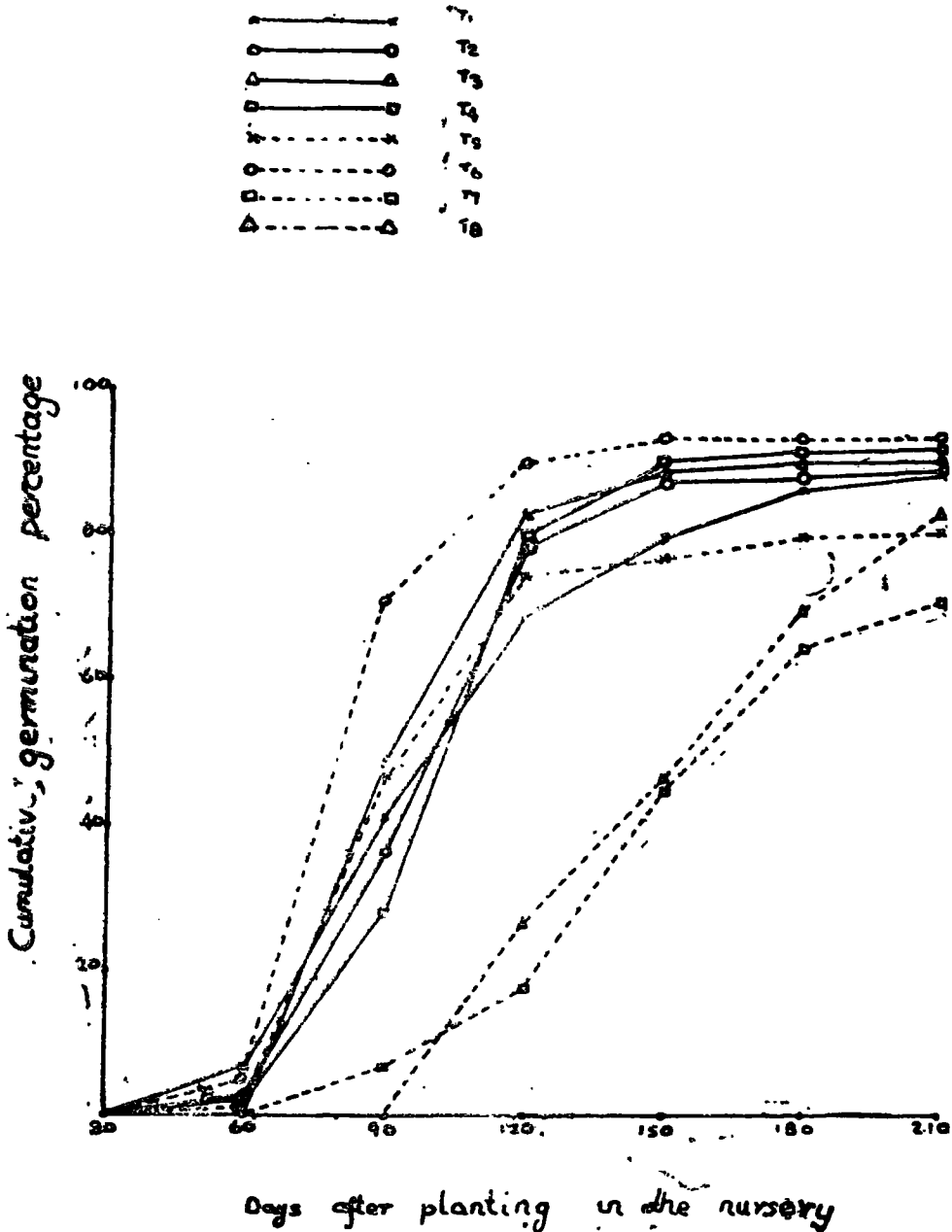


FIGURE 1. Influence of certain physical and chemical treatments on the rapidity of germination in coconut Seeds.

The results show that all the treatments except T₇ significantly reduced the time taken for germination when compared with the control. Simply soaking the seeds in water for two weeks (T₆) recorded the lowest period for germination (81.1 days), a reduction of 61.8 days (43%) from the control (142.9 days). The result is in agreement with the observation of Menon and Pandalai (1960).

The reason for the beneficial effects of soaking in water on the germination of seeds may be attributed to the dilutionary effect of the growth inhibitors or due to the leaching of water soluble inhibitors. The structure of the coconut seed is such that imbibition of water is very difficult under natural conditions. So it is also possible that the promotory effects of soaking might simply be due to a stimulation of the embryo caused by the additional imbibition of water. However, further exploratory tests are needed to confirm any of these views.

The results also showed that in addition to the water treatments, potassium nitrate and sodium carbonate also considerably reduced the period for germination. This conforms with the observations of Hesse (1924), Schwendiman and Shands (1943) and Vegis (1964) who also found that nitrates are capable of promoting germination of non-after ripened seeds. In the present investigation no significant difference was observed between the two molarities of solutions either in the time taken for germination or the ultimate germination percentage recorded. This indicated that 0.01 molar solutions were probably sufficient to get the desired effect. The study however was not complete as two levels of concentration and one soaking time alone were tested. So a trial to examine the effect of varying molarities of the chemicals and longer periods of soaking is in progress at the centre.

Apart from the quickness in germination, the percentage germination secured has also to be looked into to evaluate the success of any treatments. The results in this factor also showed that soaking the seeds in water for two weeks (T₆) gave the greatest germination percentage of nuts and was superior to T₈, T₅ and T₇. The treatment No.7 viz. chopping the lower and upper ends of husk had given a lower germination percentage than even the control. When the ends were chopped, the embryo was more exposed to temperature and desiccation which probably adversely affected the germination.

Figure 1, showing the rates of germination reveals that T₆ produced 71.3 percent germination within 90 days whereas the control did not record any germination during that period. Within 120 days, T₆ almost completed its germination, but the control registered only 26.3 percent. It is only within 210 days that the control reached its maximum germination percentage showing thereby a time lag of 90 days between T₆ and the control for reaching the maximum germination.

The earliness in germination had its promotory effect on the subsequent growth of seedlings in the treatments concerned. The growth measurements (Table 1) showed significant differences between treatments with regard to the heights attained, total number of leaves produced and also the girth at the collar (neck). These are the three characters generally looked for in assessing the vigour of coconut seedlings. (Menon and Pandalai, 1960).

In all the three characters, T₁ to T₆ were found superior to T₇ and T₈. Among T₁ to T₆ even though there were no significant differences, still T₆ ranked first in all the growth measurements.

This Preliminary study therefore concluded that subjecting the coconut seeds to treatments 1 to 6 had beneficial effects. Even though there was no significant difference, between T₁ to T₆, still T₆, the treatment of simply soaking in water for two weeks ranked first in all respects. This being a very simple and easy treatment, can be well recommended to be followed when coconut seedlings are to be raised. The practice if adopted would considerably reduce the nursery period resulting in a lower cost of production of seedlings in Tanzania.

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