Germination of Palm Seeds Using A Method Developed For The Oil Palm

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There is still a grave shortage of information on techniques which have proved successful for germinating palm seeds, despite excellent general advice by Loomis (1958) and Yocum (1961) and specific information for some, usually economically important, species, for example Kitzke (1958) and Rees (1959, 1962b).

Although, as Loomis pointed out, palm seeds germinate under a variety of conditions in nature, it is often possible to apply a method worked out for one species to many others, as has been done with Kitzke's method developed for *Copernicia.*

Work on the germination of oil palm seed over the past ten years or so has resulted in the development of a technique which produces 90-100 per cent germination within 100 days, and a further refinement ensures that all seeds germinate within 20 days — a factor very important for the production of uniform nurseries for establishing plantations — although this involves a further 20 days before germination is completed. The method is described below, but the refinement (a dry heat-treatment) is omitted as it has been used only for oil palm seed.

Procedure

The seeds are first soaked with a daily change of water. After seven days the seeds are surface-dried with an absorbent cloth and placed in either a polythene bag of fairly heavy gauge (0.005 in., 500 gauge) or in a suitable glass jar with a polythene cover held on by an elastic band. It will be necessary to examine the seeds every two or three days to ensure that the seed moisture content is maintained at this level which is best defined by "as wet as possible with no superficial moisture." This may be checked from the appearance of the seed which is usually dark but without the shine which results from a water film on the seed surface. If there is any doubt about moisture content, the seed may be soaked (or overwatered) and left for a few days and re-dried as described above.

The above treatment would probably apply to all palm seed as it is an improvement on the normally used moist but well-drained soil. With regard to temperature for germination there is some diversity of opinion as to what is a general optimum. For the oil palm, critical experiments have indicated an effective range of 38-42°C. (100-108°F.), and advice on supplying at least some heat is given for a number of palm seeds. Johnston (quoted by Loomis, 1958) recommends heat treatment for a number of species and a simple incubator was recently described by Yocum, 1961. About half of the seed shown in the tables were germinated at 35°C. (95°F.), somewhat lower than the recommended level for oil palm seed to avoid possible lethal effects in any temperature-sensitive species, the remainder (Code numbers M 59 onwards) were kept at 39.5°C. (103°F.). After 80 days at high temperature, the oil palm seed is normally removed to ambient temperature (about 27°C., 81°F.). This procedure is successful with some, but not all, palm seed. No harm results from the cooling, and if unsuccessful, heating can be resumed.

Results

Application of this method to the seed of a number of palm species has given the results shown in the accompanying tables. A list of "failures" is included; these may or may not be due to the method — in some cases seed was certainly of low viability.

A comparison of these results with other reported successes is difficult, because in the only comprehensive list (that of Loomis) the figures given are for "days to start of germination" with no indication of percentage germination finally achieved or of mean time to germinate. It is more useful to quote percentage germination and an indication of speed of germination such as the one used here — "days to 50 per cent of final germination", although it is frequently difficult to decide when germination is complete. For oil palm seed the criterion selected is 10 consecutive days with no germination following cooling.

Seeds of *Copernicia cerifera* germinated at about half the rate quoted by Kitzke, and fairly rapid germination was obtained with *Thrinax argentea, Pinanga Kuhlii* and *Phoenix acaulis* which are known to germinate readily (McCurrach, 1960). Particularly successful results were obtained with *Borassus flabellifer* (described by McCurrach as a species which does not germinate very well) which gave 65 per cent with half the seed germinating within 35 days. Seeds of *Allagoptera arenaria* germinated more rapidly than quoted by Loomis (73 days to start of germination) and achieved the very reasonable figure of 80 per cent, whilst *Caryota mitis* did better than expected from McCurrach's expectation of three to four months before germination starts. Reasonably high percentages without too long a wait were obtained with *Aiphanes erosa* and *Areca* sp. but no comparative data are available for estimating the efficiency of the method in these cases.

The lowest rate of germination was obtained with *Elaeis "madagascariensis"*, particularly the M4 material for which over 300 days were required to produce 2 per cent germination, under conditions which would have given approximately 95 per cent in 100 days with the closely allied oil palm, *Elaeis guineensis.*

Little can be said about the list of failures except that it is not necessarily the method which is at fault, especially in the case of seeds which normally germinate readily but here were found to be dead after comparatively short periods.

It is probably worth recording recent experiences on the preparation and storage of oil palm seeds which might apply to other palm seed. Oil palm seed stores best after very little very careful drying under ambient temperatures, or, better still, no drying at all, and storage at a somewhat reduced temperature (22°C., 72°F.) to prevent germination during storage. Germination of 98 per cent has been obtained after 15 months storage under these conditions, compared with a loss of viability of 1.2 per cent per week with methods in use until very recently. (Rees, 1962a). This is considerably better than suggested by De Leon (1958) who estimated two to three months as the maximum viability period for *Elaeis.*

Literature Cited

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TABLE 1. List of species germinated successfully, with percentages obtained and speed of germination

Code	Material		Quantity	No. Germinated	%	Speed[4]
M4	*Elaeis "madagascariensis"*	36 x 17	350	13	4	305
M5	,, ,,	43 x 17	350	95	27	96
M8	*Thrinax argentea*		30	19	63	30[5]
M14	*Copernicia cerifera*		9	7	78	28
M31	*Aiphanes erosa*[1]		55	37	67	4
M40	*Caryota mitis*		46	21	46	28
M59	*Allagoptera arenaria*[2]		10	8	80	31[6]
M60	*Pinanga Kuhlii*		197	159	81	13[5]
M62	*Areca* sp.		162	47	29	22
M64	*Phoenix acaulis*		158	58	37	59[5]
M65	*Arenga Wightii*		12	1	8	3
M66	*Chrysalidocarpus lutescens*		195	17	9	20
M69	*Arenga pinnata*[3]		23	1	4	27[5]
M96	*Borassus flabellifer*		20	13	65	35[7]

[1] Synonym under which material received: *Martinezia erosa*
[2] Received as *Diplothemium maritimum*
[3] Received as *Arenga saccharifera*
[4] Defined as days to 50% of final germination
[5] Said to germinate readily (Mc Currach, 1960)
[6] Germination starts in 73 days (Loomis)
[7] Said not to germinate readily (Mc Currach)

TABLE 2. List of species which failed to germinate

Code	Material	Quantity	Time kept
M7	*Areca triandra*	1	3 months[6]
M9	*Roystonea oleracea*[1]	30	3 months
M10	*Arecastrum Romanzoffianum*[2]	8	3 months[5]
M11	*Ptychoraphis augusta*	10	3 months[5]
M12	*Areca madagascariensis*	10	3 months
M13	*Arecastrum Romanzoffianum*[3]	6	3 months[5]
M24	*Acrocomia aculeata*	6	2.5 months[4,7]
M61	*Phoenix sylvestris*	10	22 days[4,5]
M63	*Acrocomia aculeata*	4	9 months[7]
M67	*Livistona* sp.	86	9 months[5]
M68	*Livistona chinensis*	13	9 months[5]

[1] Received as *Oreodoxa oleracea*
[2] Received as *Cocos Romanzoffianum*
[3] Received as *Cocos plumosa*
[4] All seed found dead after this period
[5] Germinate easily (Mc Currach)
[6] Seed loses viability rapidly
[7] Difficult to germinate (Mc Currach)

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A Note on Spines in the Oil Palm

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Tomlinson (1962) has recently described the types of spines found in palms, which has prompted closer observations on the oil palm. Although the oil palm is not regarded as a spiny palm in the same way as, say, *Aiphanes* or some scandent palms, it does possess three quite distinct types of spines, described below and illustrated by Figure 27.

Inflorescence spines

The tips of the branches of the female inflorescences are prolonged into spines, which persist in the fruit bunch. The growth of the fruit bunch causes the spines to separate and produce an effective armour. The inflorescence axis itself does not have a terminal spine, but is blunt-ended.

Fiber spines

As stated by Tomlinson, many cocoid palms, including *Elaeis,* have petioles armed with marginal teeth formed from the base of the fibers of the leaf sheath. In *Elaeis,* these are fairly regular, Fig. 27D, and their origin is interesting. The leaf sheath encloses two sets of fibers (with a more poorly developed third set, of no consequence here) each set comprising parallel strands of fibers, with the strands in the separate sets running roughly at right angles. When the softer tissues rot away, it is seen that the adaxial fiber layer is attached a short distance away from the abaxial. The bases of the abaxial fibers form the spines which are comparatively blunt-ended. No spines are formed at the adaxial fiber insertions. The point at which the fibers break off from the spines is well-demarcated (Fig. 27D) so that the spines are nearly all of the same length. The regular spacing of the fibers also ensures that the spines are uniformly distributed along the length of the 'petiole.'

These fiber spines occur along the basal part of the leaf up to about a fifth of the length of the leaf, and terminate at the level at which the leaflets occur.

Midrib spines

The lowermost leaflets on the oil palm leaf are poorly developed, although they still have the large basal swellings similar to those of the fully developed leaflets and from which arise the leaflet midribs. The 'lamina' of the lowermost leaflets frequently becomes broken away leaving a spine some 2 cm. long which was originally the leaflet midrib.

As the leaflets of the oil palm are arranged irregularly along the rachis in groups of one to five or more, and not all in the same plane, these spines appear (unlike the "fiber" spines) most irregular.

There is little doubt that these three types of spines in the oil palm form a very efficient means of protecting both the apex and the fruit bunches from predators. In West Africa, the original