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RESEARCH PAPER

Effect of Soil-Pit Pretreatment on Germination and Seedling Quality of Oil Palm (*Elaeis guineensis*, Jacq)

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ABSTRACT

Fresh oil palm (*Elaeis guineensis*, Jacq) *dura* seeds were subjected to soil-pit pre-treatment during summer and compared with usual dry heat technique under standard laboratory germination condition. The duration of 40 d and 50d exposure under soil-pit resulted in high (88 percentage) germination. Usual dry heat treatment took 50 days to reach 68 percentage of germination. Extended pit exposure (60-70 d) gave no advantage; instead it has resulted in etiolation of germinated seeds. Simple Soil-Pre treatment for 40 d under pit can be recommended to produce quality planting material at a low cost. The study has implications in quality planting material & seed production programme in oil palm.

INTRODUCTION

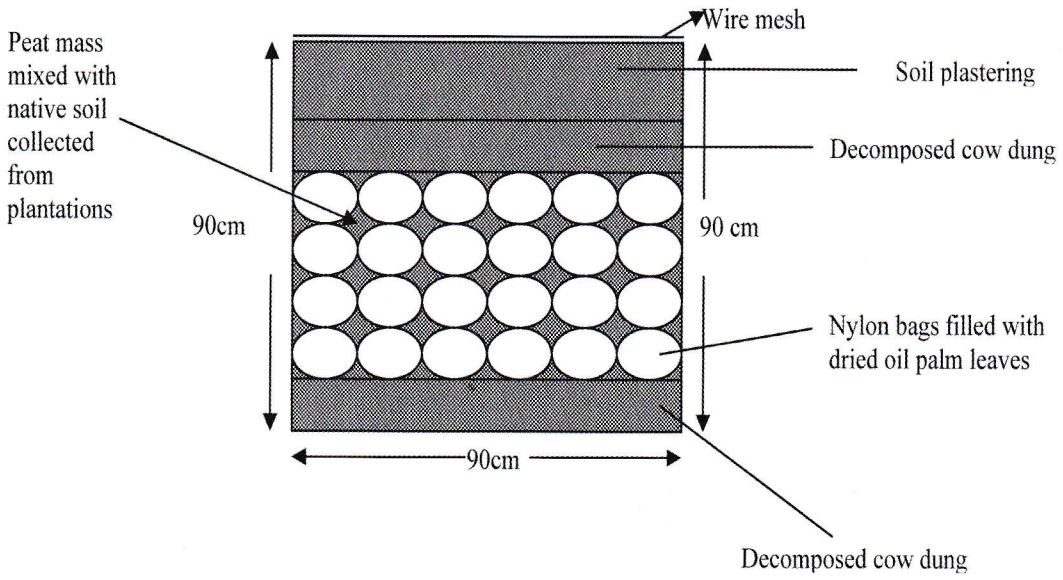
The slow and erratic germination of oil palm seed has been recognized as a serious practical problem due to strong physical seed dormancy (Addae-Kagyah, *et al.*, 1988). Some form of seed pretreatment is essential in artificial regeneration, in order to obtain a reasonably high germination rate in a short time. In these circumstances, rapid and controlled germination is highly desirable in place of dry heat treatment which is time consuming and cumbersome. Moreover, dry heat treatment requires continuous availability of power supply for the electric heaters. The rhizosphere may have either a positive or a negative influence on seed germination and subsequent seedling growth and development and the most direct approach to establish the significance of rhizosphere microorganisms is by comparing the plant growth in sterile and non-sterile environments (Alexander, 1961). In order to reduce the duration and cost required for breaking dormancy, soil-pit treatment was attempted as a part of pilot study to freshly harvested *dura* seeds with an objective to evaluate the effect of exposure of soil-pit treatment on germination and seedling quality.

MATERIALS AND METHODS

This study was conducted during March to May 2004 and repeated during 2005 at National Research Centre for Oil Palm, Pedavegi, Andhra Pradesh. Ripe fresh fruit bunch from dura mother palm (Palm no.89) was harvested and kept for three days at room temperature (32-35° C) for loosening of fruits. The loose fruits were de-pericarped, cleaned and kept in water for three days and treated with 0.2 % Bavistin. The cleaned and surface dried seeds were subjected to modified soil pit treatment adopted from technique developed for teak seeds by Forest Department, Government of Kerala. Seeds were mixed with peat mass and native soil collected from the oil palm plantations and put in nylon bags (cover tied with packing rope) (Fig 1) and kept in 90 cm^3 sized pits

Fig. 1 : Dry oil palm seeds with leaf biomass packed in nylon bags

Fig. 2: Sketch of Soil- Pit pre-treatment for oil palm *dura* seeds



during peak summer months. The bottom of the pit was filled with digested cow dung as one layer and nylon bags were arranged depending upon the duration of treatment so as to draw samples at regular intervals. Top of the nylon bags also again filled with a layer of cow dung plastered with soil and watered twice a day (Fig 2). Simultaneously, a part of same batch of seeds was subjected to dry heat treatment as a control. All the treatments were replicated 3 times with 100 seeds of each replication in a completely Randomized Design. Samples were drawn once in ten days and assessed for percentage germination and seedling growth. After completion of prescribed duration of exposure, samples were taken out and incubated under room temperature (28-30° C) in the polythene bags and the day of initiation of germination was recorded. For the estimation of dry matter production, ten random seedlings were taken and dried in an oven maintained at 85° C for 24 h after measuring their root and shoot length. The Vigour Index (VI) was calculated from the formula of Abdul Baki and Anderson (1973) as Percentage germination × Total seedling length and expressed as whole number.

RESULTS AND DISCUSSION

In the present experiment, it was observed that no germination occurred when seeds were kept in pits for 10, 20 days and 88 percentage germination was recorded in seeds kept for 40 days duration. Total germination was high when seeds were kept in pits for 40 and 50 days durations which were significantly superior to other treatments on specific day of observation. Usual technique of dry heat treatment has took total duration of 71 days to complete 68 percentage germination whereas maximum 88% germination attained when seeds kept for 40 days in pit (Table 1 and Fig 3). Seed in the pits gets warm during day and cool rapidly during night (Table 3) thereby increasing the rate of change of soil temperature in the pit with time and thus cause dormancy breaking. This is because of the fact that wet soil has higher thermal conductivity and diffusivity in comparison to dry soil (Nakeshabandi and Kohnke, 1965). Anitha Pandey *et al.*, (2002) obtained improved germination in Himalayan yew utilizing simple non forest soil treatment. In the present case, since, seeds are bundled with leaf bio mass, they provided sufficient aeration for germination and subsequent seedling growth. The seedlings evaluation for growth parameters inferred that maximum shoot and root weight and optimum Vigour Index were recorded in the seeds exposed for 40 days in pit (Table 2). The high values of Vigour Index recorded in the 60d and above were contributed by increased length of the seedlings due to etiolation. The results revealed that 40 day pre-heating under pit method resulted in high germination with good seedling growth. Early initiation of germination was also recorded in 40 days pre-heating; whereas seeds subjected to normal pre-heat treatment took 50 days to reach 68 %. Extended exposure of pre-heat under pit has resulted in etiolation of sprouted seeds and gave raise to poor quality germinated seeds as it was revealed in the higher value of Vigour Index. Pre heating for 40 days under pit produce quality planting material at a lower cost.

Table 1 : Effect of pit pre heat-treatment during summer period on initiation and total germination of *dura* seeds

Pit pre-treatment durations (days)	Germination % on specific days	Final germination(%)	Total duration of germination(days)
10 days	0	61.3	71
20 days	0	65.3	63
30 days	33.3	52.0	45
40 days	88.0	88.0	40
50 days	82.6	88.0	51
60days	82.6	86.6	80
70days	76.0	86.6	80
Control	0.0	68.0	71
CD (0.05%)	9.68	15.08	

Table 2 : Effect of pit pre heat-treatment during summer period on seedling growth and quality of *dura* germinated seeds

Pit pre-treatment durations(days)	Root length (cm)	Shoot length (cm)	Vigour Index(Total seedling length × Germination %)
Dry heat treatment	10.95	8.90	1217
Pit 10d	14.62	10.65	1650
Pit 20d	13.40	10.60	1248
Pit 30d	11.80	8.90	1822
Pit 40d	12.55	10.95	2156
Pit 50d	12.01	11.15	2006
Pit 60d	14.65	12.05	2312
Pit 70d	12.40	13.25	1744
Mean	12.80	10.70	1769
SEd	0.47	0.44	
CD (0.05%)	1.05	0.98	

Table 3 : Average soil and atmospheric minimum and maximum temperature during experimental period at NRC Oil Palm, Pedavegi, Andhra Pradesh

Month	Atmospheric temperature(°C)		Soil temperature (°C)	
	Min	Max	Min	Max
March	21.70	36.77	18.2	35.2
April	25.78	36.01	22.1	35.0
May	26.45	35.01	20.1	33.9
June	26.14	32.00	19.1	30.2

However, this technique was tested only during summer period of Andhra Pradesh and need confirmation for other conditions.

CONCLUSION

On the basis of observation in this study, it is concluded that soil- pit treatment for 40 days under pit gives faster and uniform germination by which we can produce quality planting material at a lower cost. However, this technique was tested only during summer period of Andhra Pradesh and need confirmation for other conditions. Extended exposure of pre-heat under pit has resulted in etiolation of germinated seeds which may be prone for mechanical damage during packing and transport. In developing

strategies towards acceleration of germination in oil palm, large scale seed treatment through soil-pit treatment will have significant role in the changing scenario of substantial energy requirement.

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REFERENCES

Alexander, 1961. Introduction to soil microbiology, Wiley Eastern Limited, New Delhi

Anitha Pandey, M. Nadeem and Palni, Lok Man S. 2002. Improvement in seed germination of Himalayan yew through simple soil treatments, *Indian Journal of forestry* **25(2)** : 109-113.

Abdul-Baki, A.A, and Anderson, J.D, 1973. Vigour determination in soybean seed by multiple criteria. *Crop Sci.*, **13** : 630-633

Addae-Kagyah, K.A., Osafo, D.M. S.N. Olympio and Atubra, O.K. 1988. Effect of seed storage, heat pretreatment and its duration on germination and growth of nursery stock of the *idolatrica* palm, *Elaeis guineensis* var. *idolatrica* (Chevalier) *Tropical Agriculture* (Trinidad) **65(1)**: 76 -83

Ehara, H., Komada, C. and Morita, O.1998. Germination characteristics of Sago palm seeds and spine emergence in seedling produced from spineless palm seeds. *Principes* **42** : 212-217.

Nakeshabandi, G.A and Kohnke, H. 1965. Thermal conductivity and diffusivity of soils and related to moisture tension and other physical properties. *Agr. Meteorology*, **2** : 271-279

Rees, A.R. 1962. High temperature pre-treatment and germination of seed of the oil palm *Eleais guineensis* (Jacq), *Ann.Bot.* **26** : 569- 581

Rees A.R. 1963. Some factors affecting the germination of oil palm seeds under natural conditions, *J.W.Afr. Inst. Oil pal Res.* **4** : 207 - 301

Seng. T.K. 1983. The botany of Oil Palm, Casual papers on Oil Palm, Kuala Lumpur: Incorporated Society of Planters. Wisma ISP, 29,31& 33 Jalan Taman U Thant, Malaysia p. 5.