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Breaking Seed Dormancy: Effect of Heat and *Vimpel*® on Oil Palm Seed Germination (*EIaeis guineensis* Jacq)

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ABSTRACT: Oil palm (*E. guineensis*) is native to Africa and among highest oilseeds crop in the world, having a dormant seeds which require pre-treatments to quicken the germination process. The objective of this experiment is to evaluate the effects of Vimpel growth regulator on germination of Oil palm seedlings. The viable seeds of oil palm were treated with vimpel solution at different stages of the germination process tagged as A (+ Vimpel before heat), B (+Vimpel after heat), C (+Vimpel without heat) D (0 vimpel) E (+ Vimpel prior and after heat) and F (Water prior and after heating/Control) and then subjected to six different temperature regime i.e. 2,4,6,8, 10 and 12 weeks in the germination chamber. The result indicates that group A had the highest germination percentage at 10 weeks of heat treatment followed by B at 8 weeks of temperature while group F (control) had the lowest percentage. Conclusively, the vimpel growth regulator has significant effects in facilitating the germination process by 40 days against 80 days of heat treatment currently use in the oil palm seed germination.

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The oil palm (*Elaeis guineensis* Jacq.) is native to Africa and among oilseeds, it is the highest producing oil seed crop in the world (Jalani *et al.,* 1997) (Rajanadu*et.al*. 1997), ranking first in the world in oil production. The oil palm produces oil from the fruit mesocarp (crude palm oil) and palm kernel oil from the seed. Like most seeds with very thick seed-coat (testa), the oil palm seeds pose difficulties in seed germination because of a long dormancy (1 to 3 years) after it is harvested (Herrera *et al*. 1999) which is attributed to restrictions of embryo growth due to mechanical constraints and the oxygen uptake by the compact "stony" endospermous tissue of the oil palm seeds (Hussey 1958). As such oil palm seeds have to undergo a period of increased temperature under sufficient seed moisture for rapid and maximum germination (Monk, 1982). To ensure the reproduction of plants species, seeds or vegetative organs must germinate; that will begin metabolism activities to give a new plant (Côme and Corbineau, 1998). This process starts with seed imbibition which lead to the embryo development (Bewley and Black, 1994). Seed germination, however, differs widely from one species to another, depending on the type of dormancy caused by various factors (Bewley 1997; Bewley and Black, 1994; Koomneef *et al*., 2002). Dormancy may be due to the embryo immaturity (Berjak *et al.*, 1984, Yang *et al.,* 2007; Baskin et al., 1998), the impermeability to the seed coat (Robertson and Small, 1977; Daquinta *et al.*, 1996) or some physiological events that occurred in the seed during its storage (Yuri, 1987; Baskin *et al.,* 2000; Leubner-Metzger, 2005; Bove *et al*., 2006; Oracz *et al.*, 2007). As part of a comprehensive study to develop our knowledge base on the biology of oil palm seeds and in preparation for genomic investigations, we determined the effect of various

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chemicals and plant growth substances on dormancy and germination of oil palm seeds. Attempts to stimulate germination with plant growth regulators to avoid the need for heat treatment have been made Wan and Hor (1983), Herrera *et al* (1998). Due to the problem of seed dormancy and high demand for oil palm seeds there is need to continuously work on how to further reduce the dormancy period and increase the availability of sprouted seeds to farmers. The objective of this experiment is to evaluate the breaking of seed dormancy by investigating the effects of heat treatment and vimpel growth regulator solution on germination of Oil palm seedlings.

MATERIALS AND METHODS

Sample Collection and treatment: Freshly depulped oil palm seeds with known moisture content were collected from seed production division of the Nigeria Institute for Oil Palm Research. The seeds were subjected to pre-treatment measurements (viability test) viability test was carried out. The seeds collected were shared into six groups (A-F) of 135 seeds per lot. The different groups were subjected to different heat treatment regime as follows 2wks, 4wks, 6wks, 8wks, 10wks and 12wks.

GRP A- seeds were treated with vimpel prior to heat treatment

GRP B- seeds were treated with vimpel after heat treatment

GRP C-seeds were treated with vimpel without heat application

GRP D-seeds were soaked in water before and after 80 days of heat treatment (control)

GRP E-seeds were treated with vimpel prior and after heat treatment

GRP F-seeds were soaked with water prior and after heat treatment.

Seed Germination: While bringing the seeds out from the germinator the seeds were soaked for another 3 days in either water or vimpel solution respectively as stated above. On the third day, the seeds were air-dried, bagged in transparent polythene sealed with rubber band and arranged in the laboratory at room temperature to receive sunlight. A seed was considered germinated when there was protrusion of the hypocotyl-radicle axis, characterized by the resumption of the growth of the embryo or by the visible emission of the radicle (Hussey, 1958; Bewley and Black, 1994). Percentage germination was calculated as follows:

Percentage germination was calculated as follows:

$$Germination\ percentage = \frac{nsp}{nss} x\ 100$$

While: Nsp=number of seeds packed, nss=number of seeds sprouted.

The data obtained were represented in simple statistics (bar chart and pie chart) for the duration of treatment, concentration and germination percentage.

RESULTS AND DISCUSSION

The chemical properties of vimpelis presented in Table 1. The data showed that nitrogen, phosphorus and potassium (NPK) are absent. Vimpel contains 8% zinc, 8% iron 8% Magnesium and 8% calcium oxide. The germination percentages of the oil palm seeds after heat-treatment for 2wks, 4wks, 6wks 8wks, 10wks and 12wks in the germination chamber at 39±1°C as shown in the Table 1. The results indicates that group A (+ Vimpel prior to heat treatment) had the highest germination percentage especially at 10 weeks of heating interval as shown above (Table 1), this could be attributed to the activation enzymes by the used growth regulators (Vimpel) during germination of oil palm seeds.

Table 1 Chemical properties of Vimpel.

Element	%
N	-
P	-
K	-
Mg	8
Fe	8
CaO	8
Zn	8

The result obtained conform with the findings of Sokolowski and Cicero, (2011), application of plant growth regulators helped to overcome dormancy in X. aromatica, with the greatest percentage of seedling emergence being observed in seeds treated with Promalin.

Also the study of Mesger (1988) stated GA biosynthesis observed in imbibing non dormant seeds is not a necessary prerequisite for germination. It is therefore possible that GA biosynthesis in imbibing non dormant seeds is one of many coordinated biochemical events that occur during germination rather than an initiator of the processes leading to germination.

According to Bewley *et al.*, (2013). The pre-soaking of seeds in plant growth regulators and biostimulants solutions can influence seed germination by accelerating the whole processes, which starts with the absorption of water, ending with the embryonic axis elongation. Studies performed in order to increase the germination of seeds. Hormones also regulate germination and dormancy-breaking via the control of metabolism. Additionally, mitochondrial reactivation during seed imbibition has been shown to be stimulated by gibberellins and inhibited by abscissic acid in Arabidopsis. Still, specific mechanisms involving hormones in the control of metabolism in oil palm germination remain to be elucidated.

Table**2.** Treatment distribution and weekly heating variations

Trt/weeks	**2 wks**	**4 wks**	**6 wks**	**8 wks**	**10 wks**	**12 wks**
A	15	22	31	37	42	51
B	4	7	12	15	17	20
C	-	3	5	10	12	15
D	-	3	6	7	9	10
E	-	-	-	2	3	3
F	-	-	-	-	1	1

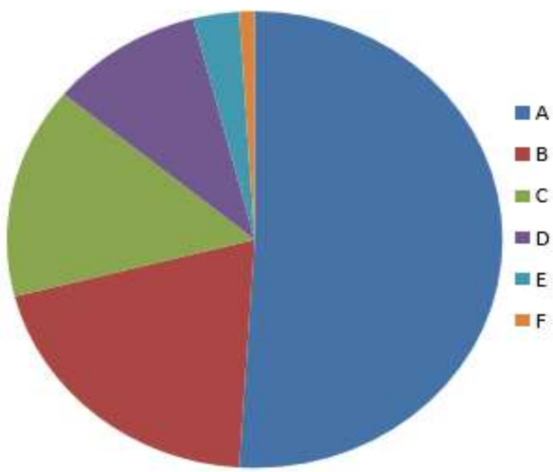

Fig. 1: Percent germination of oil palm (*Elaeis guineensis* Jacq.)

The nutritional composition of the vimpel as indicated (Table 2) enhances the germinability of Oil palm seeds by quickening the metabolic processes (Bewerly, 2013), followed by B as shown figure 1 (+Vimpel after heating) while the F (control) had the lowest percentage germination. Growth regulators generally play important role in increasing germination rate of oil palm seeds, they are mostly used for improving the productivity and seed germination of some crops, however, vimpel was found to be highly effective in inducing fast germination in dormant oil palm seeds

Conclusion: From the above result it may be concluded that the seeds treated with vimpel gave better response over control. This study therefore, suggests that the use of vimpel growth regulator in oil palm seed germination can further reduced the 80 days heat treatment. Seed dormancy period has become an important and vital issue hence, the need for this work. From this analysis the rate of germination of oil palm seeds varied according to the duration of heat treatment. It could be recommended that presoaking of Oil palm seeds in growth regulators or prior to heat treatment will help in accelerating the germination by reducing the level of dormancy and increase the absorption rate thereby activating the enzymes.

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