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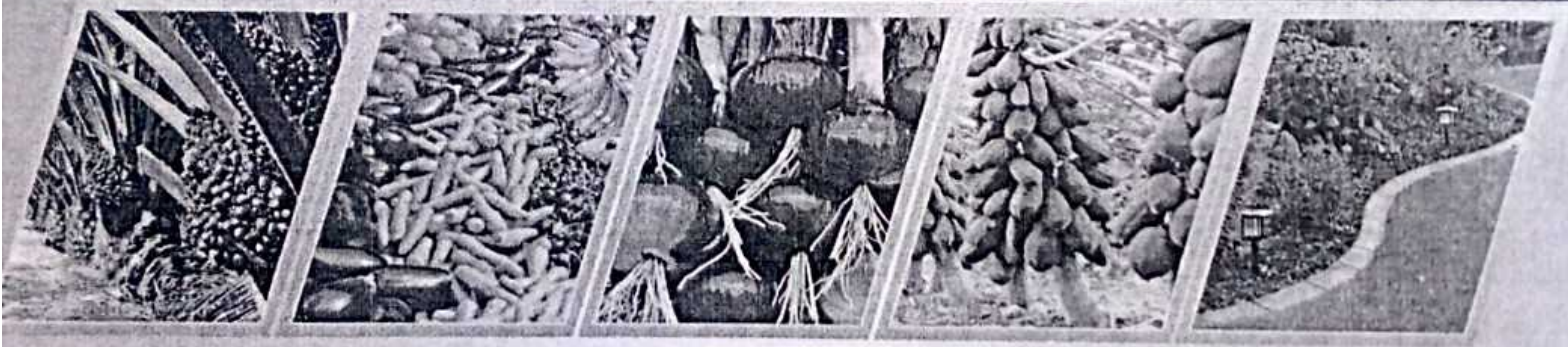

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GERMINATION AND SEEDLING GROWTH OF FLAME OF THE FOREST (*Delonix regia*) AS AFFECTED BY SCARIFICATION METHOD AND DIPPING DURATION

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ABSTRACT

A field experiment was conducted at the Horticultural nursery of Federal University of Technology, Minna to investigate the influence of scarification method and dipping duration on the germination and seedling growth of flame of the forest (Delonix regia). The treatments consisted of two factors (i) Sacrification methods used in breaking dormancy: H_2SO_4 (70%); Gibberellic acid (0.2 g/L); and untreated (control); (ii) Dipping duration of 10, 20 and 30 minutes. The treatments were arranged in a 2 x 4 factorial in a Completely Randomized Design with five replications. Data collected on germination parameters, were subjected to Analysis of Variance and treatment means were separated using Least Significant Difference (LSD) at $P \leq 0.05$. Scarification method had a significant effect on Delonix regia seeds, as seeds treated with H_2SO_4 at 30 minutes dipping had the highest germination percentages (88%) at (9 - 30 Days After Sowing) followed by seeds dipped for 20 minutes (65%) and 10 minutes (50%). Seeds of Delonix regia treated with GA_3 had the highest number of branches per plant at dipping duration of 30 minutes, while seeds treated with GA_3 had the broadest leaf area (268.4 cm^2) at dipping duration of 30 minutes. Seeds treated with GA_3 at 30 minutes dipping had the tallest plant height of (52.0 cm) followed by those dipped for 20 minutes (49.0 cm) and 10 minutes (46.0 cm). Control (untreated) seeds recorded the lowest number of branches (15), with the least plant height of (27.6 cm).

Keywords: *Delonix regia, tetraoxosulphate (vi) acid, Gibberellic acid, Dipping duration.*

INTRODUCTION

Flame of the forest (*Delonix regia*) is a deciduous tropical tree that is considered as one of the most beautiful tree in the world due to its bright orange-yellow bloom. (Rahman*et' al*, 2004). It losses all its leaves during the dry season and begins to sprout immediately as rain commences, however in climate where cold is not much dryer than hot, it is ever green tree (Rahman *et' al*, 2004). The ornamental tree is valued mainly for its shade provision, bloom beauty, wood for agricultural implements and oil processed as insecticidal and anti- bacterial material. The seed when powdered is used to purify and enriches the blood.

Delonix regia is good in controlling soil erosion in the arid and semi- arid areas because of its hardy nature and aggressive root system. It can be planted as live fence posts, grown on eroded sites for erosion control, and for soil rehabilitation and improvement through atmospheric nitrogen fixation. The objectives of this study therefore were to;

- determine the germination of *Delonix regia* using chemical method, GA3 (gibberelic acid), sulphuric acid (H_2S0_4) and control method.
- assess the effect of scarification and dipping duration on the seed
- study the effect of mechanical scarification on seed germination and seedling growth and
- investigate the effect of soaking of seeds in water or concentrations of sulphuric acid on seed germination and seedling growth.

MATERIALS AND METHODS

Experimental location

The experiment was carried out at the experimental nursery of Crop Production department, School of Agriculture and Agricultural Technology, Federal University of Technology, Minna Niger

State on a latitude 9^0 40'N and longitude 6^0 3'E

Source of seed

Seeds of flame of the forest was collected from fully grown trees at the front of the main campus Federal University of Technology, Minna Niger State.

Seed treatments

The seeds of flame of the forest were treated with tetraoxosulphate (vi) acid, (H_2SO_4) and gibberellic acid (GA_3) at different variation of dipping of 10 minutes, 20 minutes, and 30 minutes, then the seeds were rinsed with distilled water to remove the remains of the acid from the seeds before sowing the seeds in polythene bags of (25x20) cm containing 14 kg of soil at the nursery.

Data collection and Analysis

The treatments were arranged in a Completely Randomized Design (CRD) with five replications in a 3 x 3 factorial experiment resulting in nine treatment combinations. Data were collected on the days to first emergence, days to 50% germination, percentage germination, plant height, number of leave, leaf area, and stem girth. Data collected were subjected to analysis of variance (ANOVA) using SAS package and means were separated using Least Significant Difference (LSD) at 5% level of probability.

RESULTS

Effect of scarification method and dipping on seed germination of *Delonix regia* The result showed that scarification method had a significant ($p \leq 0.5$) effect on germination of *Delonix regia* at 8 and 9 DAS. At 8 and 9 DAS seed of *Delonix regia* treated with H_2SO_4 resulted in the highest germination rate (0.8 and 0.9 respectively) than the other scarification methods. Dipping duration at 30 minutes resulted in the highest germination rate (0.8) compared to the other dipping durations. The interaction between the scarification method and the dipping duration were not significant throughout the study as reported in Table 1.

At 18-30 DAS seed of *Delonix regia* treated with H_2SO_4 produce the highest germination rate (1.4) than the other significations, dipping duration had a significant effect on germination of seed of *Delonix regia,* at 18-30 DAS in the study. During this time dipping duration at 30 minutes at 18 DAS resulted in the highest germination rate compared to the other dipping duration. The interaction between the scarification method and dipping duration were not significant on *Delonix Regia* seed germination in this study.

Effect of scarification method and dipping duration on stem girth of *Delonix regia*

The result of the effect of scarification methods and dipping duration on stem girth of *Delonix regia* with 9-14 WAS shown in Table 3, scarification method had significant ($P<0.05$) effect on stem girth of *Delonix regia* at 9 and 14 WAS respectively, at 14 WAS control produce the highest stem girth (1.8 mm) and dipping duration has a significant effect on stem girth of *Delonix regia* at 14 WAS, the interaction between scarification method and the dipping duration were not significant

Effect of scarification method and dipping duration on number of leaves of *Delonix regia*

The result of the effect of scarification and dipping duration on number of leaves of *Delonix regia* at 9th week to 11th WAS shown in Table 4, scarification method had a significant ($P \leq 0.05$) effect on number of leave of *Delonix regia*, at 9, 10 and 11 WAS. At 11 WAS *Delonix regia* treated with GA_3 resulted in the highest number of

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leave (1391.2) and (944.8) which was statistically similar to *Delonix regia* treated with GA_3 and untreated (control). At 11th WAS *Delonix regia* treated with GA_3 had the highest number of leave (1391.2) which was similar to *Delonix regia* treated with H_2SO_4 and control. Dipping duration of *Delonix regia* had a significant effect on number of leave of *Delonix regia* during the period of the experiment.

Effect of scarification method and dipping duration on number of branch of *Delonix regia*

The result of the effect of scarification and dipping duration on number of leaves of *Delonix regia* at 9-17 was shown in Table 5, scarification had a significant ($p \leq 0.05$) effect on number of branches of *Delonix regia* at 9-17 WAS respectively, at 17 WAS seed of *Delonix regia* treated with GA_3 resulted in the highest number of branches (21.9) while control at 9th WAS produce the lowest number of branches (6.0). Dipping duration had a significant effect on number of branches of *Delonix regia* at 17WAS seeds that were dipper for 30 minutes resulted in the highest number of branches (21.2) compared to the other dipping duration. The interaction between effect of scarification method and dipping duration were not significant on number of branches of *Delonix regia*

Effect of scarification method and dipping duration on leave area of *Delonix regia*

The result of the effect and dipping duration on leave area of D*elonix regia* at 9-14 WAS is shown in Table 4.4 Scarification method had a significant ($p<0.05$) effect on leave area of *Delonix regia*, at 9-14 WAS at 14 WAS, seed of *Delonix regia* treated with GA_3 had the broadest leaf areas ($268.4cm^2$) and while the seed of *Delonix regia* treated with H2SO4 at 9 WAS produced the lowest leave area ($64.0cm^2$). the dipping duration had a significant effect on leave area of D*elonix regia* at 14 WAS in this study dipping duration of 30 produced the highest leave area (264.4cm) compared to other dipping duration, the interaction between effect of scarification method and dipping duration were not significant on leave area.

Effect of scarification method and dipping duration on plant height of *Delonix regia*

The result of the effect of scarification method and dipping duration on plant height of *Delonix regia* at 9-17 WAS is shown in table 4.5, scarification method had a significant ($P<0.05$) effect on plant height of *Delonix regi*a with 9-17 WAS at 17 WAS, seed of *Delonix regia* treated with Gas had the tallest plant height (50.4cm) followed by seeds treated with H_2SO_4, while control recorded the lowest plant height (47.6). Dipping duration had a significant effect on plant height of *Delonix regia* with seed dipped for 30min resulting to tallest plant height of (51.6cm) compared to the dipping duration, the interaction between scarification method and dipping duration were not significant on plant height of *Delonix regia.*

DISCUSSION

The germination of flame of the forest (*Delonix regi*a) was significantly ($p < 0.05$) influenced by Scarification method and dipping duration. The highest germination percentage was observed in combining the use of gibberellic acid, tetraoxosulphate (vi) acid for 30 minutes. This explains why pre-treating the seeds of flame of the forest at a specified dipping duration had been recommended for its quick germination. Chuanren, *et al.*,

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(2004) supported that seeds of flame of the forest are similar to those of many other hard coated legumes and that germination is enhanced if seed coats are softened or scarified.

Germination success of flame of the forest in the nursery, with GA_3 and H_2SO_4 was unique, for 30 minutes duration of dipping. It was observed that seeds treated with GA_3 for 30 minutes performed better than seeds dipped in H_2SO_4, for 10 and 20 minutes. Application of growth regulators such as GA_3 has a positive effect on germination; this was in conjunction with Seiler (1994) who reported that the use of gibberellic acid (GA_3) doubled the germination rate of dormant seeds with hard seed coat (Sunflower, golden shower). Application of exogenous compounds, such as GA or ethylene, will modify the ABA: GA; ratio removing dormancy effects, allowing seeds to germinate. This was confirmed by Borghetti *et al*. (2002), when seeds submerged in ethyl (25 ppSm) had significantly increased germination.

Conclusion

Based on the result from the experiment it could be concluded that, highest germination was recorded in seeds treated with tetraoxosulphate (vi) acid for 30 minutes, accorded by seeds treated with gibberellic acid at 30 minutes duration of dipping, it is therefore concluded that seeds of flame of the forest should be treated with tetraoxosulphate (vi) acid and gibberellic acid for 30 minutes to support maximum and optimum emergence and growth of the seed.

Recommendation

From the result obtained, it is recommended that flame of the forest seed should be treated with gibberellic acid and (GA_3), tetraoxosulphate (vi) acid (H_2SO_4) for 30 minutes, to soften the hard seed coat and thereafter enhance the quick germination.

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Table 1: Effects of scarification method and dipping duration of germination of *Delonix regia*

Field trialTreatment Germination (DAS) Method	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
H_2SO_4	0.1[a]	0.1[a]	0.1[a]	0.1[a]	0.2[a]	0.4[a]	0.7[a]	0.7[a]	0.9[a]	1.0[a]	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.2[a]
GA3	0.0[a]	0.0[a]	0.0[a]	0.0[a]	0.0[a]	0.0[a]	0.0[b]	0.0[b]	0.3[a]	0.4[a]	0.4[a]	0.7[a]	0.8[a]	0.9[a]	1.1[a]
Control	0.0[a]	0.0[a]	0.0[a]	0.0[a]	0.0[a]	0.0[a]	0.0[a]	0.0[b]	0.7[b]	0.7[a]	0.7[a]	0.7[a]	0.7[a]	0.7[a]	0.7[a]
SE+	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4
Dipping Duration (Minutes)															
10	0.0[a]	0.0[a]	0.0[a]	0.0[a]	0.0[b]	0.2[a]	0.2[a]	0.3[a]	0.5[a]	0.7[a]	0.8[a]	0.8[a]	0.8[a]	0.8[a]	1.0[a]
20	0.0[a]	0.0[a]	0.0[a]	0.0[a]	0.0[b]	0.2[a]	0.3[a]	0.3[a]	0.5[a]	0.7[a]	0.7[a]	1.0[a]	1.0[a]	1.2[a]	1.2[a]
30	0.2[a]	0.2[a]	0.2[a]	0.2[a]	0.3[a]	0.3[a]	0.3[a]	0.3[a]	0.8[a]	0.8[a]	0.8[a]	0.8[a]	1.0[a]	1.0[a]	1.3[a]
SE+	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.4	0.4	0.4	0.5	0.5	0.5	0.5
Interaction H*L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Means followed by the same Alphabet(s) in a column for the same factor are not significantly different at P < 0.05 by LSD NS= Not Significant

Table 2: Effects of scarification method and dipping duration of germination of *Delonix regia*

Treatment Germination Method	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
							(DAS)								
H_2SO_4	1.2[a]	1.2[a]	1.4[a]	1.4[a]	1.4[a]	1.4[a]	1.4[a]	1.4[a]	1.4[a]	1.4[a]	1.4[a]	1.4[a]	1.4[a]	1.4[a]	1.4[a]
GA3	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.1[a]
Control	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]
SE+	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Dipping Duration (Minutes)															
10	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]	1.0[a]
20	1.2[a]	1.2[a]	1.3[a]	1.3[a]	1.3[a]	1.3[a]	1.3[a]	1.3[a]	1.3[a]	1.3[a]	1.3[a]	1.3[a]	1.3[a]	1.3[a]	1.3[a]
30	1.3[a]	1.3[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]
SE+	1.5a	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]	1.5[a]
Interaction H*D	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Means followed by the same Alphabet(s) in a column for the same factor are not significantly different at P < 0.05 by LSD (DMRT) NS= Not Significant

Table 3: Effect of scarification method and dipping duration on stem girth of *Delonix regia*

Treatment	WEEK AFTER SOWING (WAS) (mm)					
Method	9WAS	10WAS	11WAS	12WAS	13WAS	14WAS
H_2SO_4	0.5[a]	0.9[a]	1.1[a]	1.3[a]	1.6[a]	1.8[a]
GA3	0.6[a]	0.9[a]	1.0[a]	1.3[a]	1.5[a]	1.7[a]
Control	0.4[a]	0.5[a]	0.9[a]	1.1[a]	1.5[a]	1.8[a]
SE+	0.2	0.2	0.2	0.2	0.3	0.3
Dipping Duration (Minute)						
0	0.4[a]	0.5[a]	0.9[a]	1.1[a]	1.5[a]	1.8[a]
10	0.5[a]	0.8[a]	1.0[a]	1.2[a]	1.4[a]	1.7[a]
20	0.5[a]	0.8[a]	1.0[a]	1.2[a]	1.6[a]	1.8[a]
30	0.7[a]	1.0[a]	1.2[a]	1.5[a]	1.6[a]	1.8[a]
SE+	0.2	0.3	0.3	0.3	0.3	0.3
Interaction H*D	NS	NS	NS	NS	NS	NS

Means followed by the same Alphabet(s) n a column for the same factor are not significantly different at P < 0.05 by LSD NS= Not Significant

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Table 4: Effect of scarification method and dipping duration on number of leave of *Delonix regia*

TREATMENT	NUMBERS OF LEAVES	WEEK AFTER SOWING	
Method	9WAS	10WAS	11WAS
H2SO4	666.7a	944.8a	1276.0a
GA3	538.8a	756.0a	1391.2a
Control	370.3a	508.0a	667.0a
SE-+	133.54	294.49	326.43
Dipping Duration (Minutes)			
10	489.2a	1006.3a	1480.8a
20	560.8a	698.5a	1149.5a
30	758.2a	847.7a	1370.5a
SE+	163.6	360.7	399.8
Interaction			
H*D	Ns	Ns	Ns

Means followed by the same Alphabet(s) n a column for the same factor are not significantly different at P< 0.05 by LSD NS= Not Significant

Table 5: Effect of scarification method and dipping duration on number of branches on *Delonix regia*

TREATMENT	NUMBER OF BRANCHES WEEKS AFTER SOWING								
Method	9WAS	10WAS	11WAS	12WAS	13WAS	14WAS	15WAS	16WAS	17WAS
H2SO4	6.4a	7.9a	9.0a	10.8a	12.3a	14.4a	15.6a	16.9a	18.7a
GA3	6.7a	8.7a	9.3a	11.8	13.3a	16.2a	17.4a	19.1a	21.9a
Control	6.0a	7.3a	8.0a	9.0a	10.0a	12.0a	14.3a	18.0a	21.0a
SE+	0.6	0.9	1.0	1.9	1.8	2.1	2.0	2.3	2.2
Dipping Duration (Minute)									
10	6.2a	7.3a	8.5a	12.2a	13.8a	17.5a	18.2a	19.2a	20.7a
20	6.3a	7.8a	8.5a	9.5a	10.7a	13.2a	14.2a	16.0a	19.0a
30	7.2a	9.7a	10.5a	12.2a	14.0a	15.3a	17.2a	18.8a	21.2a
SE+	0.8	1.1	1.2	2.4	2.3	2.6	2.5	2.8	2.7
Interacti on H*D	NS	NS	NS	NS	NS	NS	NS	NS	NS

Means followed by the same letter(s) in a column for the same factor are not significantly different at P < 0.05 by LSD NS= Not Significant

Table 6: Effect of scarification method and dipping duration on leaf area of *Delonix regia*

TREATMENT	LEAF AREAWAS					
METHOD	9WAS	10WAS	11WAS	12WAS	13WAS	14WAS
H_2SO_4	64.02[a]	101.7	138.7[a]	166.8[a]	194.0[a]	243.0[a]
GA3	73.5[a]	95.3[a]	133.6[a]	159.4[a]	190.8[a]	268.4[a]
Control	71.6[a]	90.7[a]	121.0[a]	139.3[a]	164.8[a]	197.7[a]
SE+	23.3	28.4	40.0	40.0	39.9	51.6
Dipping Duration (Minute)						
10	96.3[a]	113.3[a]	151.2[a]	182.4[a]	225.6[a]	261.5[a]
20	68.5[a]	90.3[a]	114.6[a]	130.5[a]	151.3[a]	241.3[a]
30	41.5[a]	92.0[a]	142.5[a]	176.4[a]	200.4[a]	264.4[a]
SE+	28.6	34.9	49.1	49.0	48.9	63.2
Interaction H*D	NS	NS	NS	NS	NS	NS

Means followed by the same letter(s) in a column for the same factor are not significantly different at P < 0.05 by LSD NS= Not Significant

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TABLE 7: Effect of scarification method and dipping duration on plant height on *Delonix regia*

TREATMENT	PLANT HEIGHT	WEEKS AFTER SOWING (WAS)						
Method	9WAS	10WAS	11WAS	12WAS	13WAS	14WAS	15WAS	16WAS	17WAS
H_2SO_4	10.6[a]	20.8[a]	25.5[a]	28.9[a]	32.9[a]	35.7[a]	39.5[a]	42.8[a]	47.6[a]
GA3	10.9[a]	23.4[a]	27.4[a]	30.6[a]	33.7[a]	37.1[a]	41.1[a]	46.4[a]	50.4[a]
Control	9.5[a]	18.5[a]	23.8[a]	28.6[a]	31.7[a]	36.4[a]	39.9[a]	43.6[a]	47.6[a]
SE+	1.4	2.2	3.2	3.4	3.8	4.0	4.2	4.4	4.2
Dipping Duration (Minute)									
10	10.0[a]	21.1[a]	25.4[a]	28.7[a]	32.1[a]	34.7[a]	38.4[a]	41.4[a]	46.1[a]
20	12.1[a]	22.3[a]	25.4[a]	28.5[a]	31.5[a]	35.2[a]	39.5[a]	45.8[a]	49.4[a]
30	10.1[a]	23.0[a]	28.7[a]	32.1[a]	36.4[a]	39.4[a]	43.0[a]	46.8[a]	51.6[a]
SE+	1.7	2.6	3.9	4.2	4.6	5.0	5.2	5.3	5.1
Interaction H*D	NS	NS	NS	NS	NS	NS	NS	NS	NS

Means followed by the same letter(s) in a column for the same factor are not significantly different at $P < 0.05$ by LSD NS= Not Significant

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