Zagazig J. Agric. Res., Vol. 45 No. (2) 2018 465-476

Plant Production Science

http:/www.journals.zu.edu.eg/journalDisplay.aspx?Journalld=1&queryType=Master

INFLUENCE OF PRE GERMINATION TREATMENTS ON OVERCOMING SEED DORMANCY AND SEEDLING GROWTH OF BAOBAB *(Adansonia digitata* L.)

Samia M.Z. El-Bably[1*] and Nahed M. Rashed[2]

1. Ornamental Plants and Landscape Gard. Res. Dept., Hort. Res. Inst., Agric. Res. Cent., Giza, Egypt
2. Vegetable and Ornamental Dept., Fac. Agric., Damietta Univ., Egypt

Received: 17/01/2018 ; Accepted: 15/02/2018

ABSTRACT: There is an urgent need to overcome seed dormancy especially in some multi-benefit tree like baobab, which can be successfully cultivated in Southern Egypt, in order to improve their regeneration. Therefore, this study was carried out to investigate the effects of some pre-germination treatments *i.e.,* soaking in tap water, boiling water or sulphuric acid at 98.5% for either 30 or 60 min, mechanical scarification with sandpaper alone or combined with soaking in sulphuric acid 98.5% for either 30 or 60 min, on germination characters and seedling traits of *Adansonia digitata* L. Results revealed that all pre-germination treatments significantly increased all germination parameters, growth performance and some chemical traits compared to the untreated seeds, except for soaking seeds in tap water. The descending order of pre-sowing treatments was scratching baobab seeds then soaking in sulphuric acid 98.5% for 60 or 30 min > soaking in sulphuric acid 98.5% for 60 or 30 min> mechanical scarification with sandpaper > boiling water. In the same order was minimized number of days from sowing until the emergence of the plumule from 68 to 6 days and increasing germination (%) from 9 to 94% for untreated and soaking in tap water without significant differences in between and scratching seeds then soaking in sulphuric acid 98.5% for 60 min, respectively. There were increments in seedling height (from 4.27 to 57.58%) and in stem diameter (from 21.67 to 61.48%) for seeds soaked in tap water, and scratching seeds then soaking in sulphuric acid 98.5% for 60 min, respectively. Generally, all previous treatments except soaking in tap water led to breaking baobab seed dormancy. The best treatment was scratching seeds before soaking in sulphuric acid 98.5% for 30 mints.

Key words: *Adansonia digitata* L, Germination, Dormancy, Seedling quality.

INTRODUCTION

Adansonia digitata. L. (baobab) known as the tree of life, belongs to Fam: Malvaceae and native Africa. It is a massive deciduous tree, up to 20-30 m tall with a diameter up to 2-10 m at adult age. Baobab is a very long-lived tree (1000 years old) with multipurpose uses as bonsai, clothing, medicine, and food because every part of the tree (seeds, leaves, sap, bark, roots, *etc.*,) is useful **(Sidibe and Williams, 2002; Rahul *et al.*, 2015)**. The tree can store hundreds of liters (120000) of water, which is an adaptation to the harsh drought conditions of its environment. Baobab is resistant to forest fires and absorbs large quantities of CO_2 from the atmosphere (**Assogbadjo, *et al.*, 2011).** Baobab leaves have a high content of iron compared to numerous

*** Corresponding author: Tel. :** +201010596979
E-mail address: sa_elbably@yahoo.com

other wild-gathered foods. The leaves contain nutritional components that are useful for human health and maintenance **(Abiona *et al*., 2015).** The seeds called "monkey bread" is edible, and rich in amino acids and minerals **(Glew *et al.*, 1997)**. Baobab fruits are rich in calcium, potassium, phosphorus, vitamin C, carbohydrates, fibers, proteins and lipids **(Assogbadjo *et al.*, 2011; Rahul *et al*., 2015**).

Natural reproduction and free germination of *Adansonia digitata* is poor. The seeds are known to stay quiescent in the soil for a long time before germination. The limiting factor in germination is due to the fact that the seed coat is impermeable to water. This type of dormancy in baobab seeds is known as physical dormancy. These impermeable layers were developed during maturation and during seed drying. As a result, the seeds are impermeable to both gases and don't germinate until quiescence is broken. Naturally, this type of dormancy is broken by several methods including ordinary water, hot water, mechanical and acid scarification and combination between two methods may help in removing, softening the seed coat and stimulation of germination in some cases as comparing to untreated seeds **(Baskin *et al.*, 2000; Sidibe and Williams, 2002; Kumar *et al*., 2015 a,b)**. Baobab seeds pre-treated enhanced the accessibility of water and oxygen into the seeds before planting, in order to break dormancy and to obtain optimum germination and improve performance for plantation establishment **(Gebauer *et al.*, 2002).** Seed dormancy is an instinctive seed property that determines the environmental conditions in which case, the seed is able to germinate. Seeds are viable sometimes that have no primary dormancy lapse into a state of secondary dormancy as a modification when exposed to unfavorable environmental system **(Mayer and Poljakoff-Mayber, 1989**). Various researchers have been working on the chemical dormancy breaking and seed germination of baobab which reported that soaking baobab seeds in sulphuric acid enhanced germination (%) and growth performance (**Niang *et al.,* 2015; Yisau *et al*., 2015; Usman and Asan, 2017).**

For enhancement of *Adansonia digitata* L. seedling production and for producing a large number of good quality seedlings with minimum cost and labor, it is necessary to determine the variation in seed pre-treatments and need to know the fundamental of requirements for improving baobab seeds germination and more specifically from different growth traits, which require less sophistication with reliable outcomes. Many research works were performed on breaking the *Adansonia digitata* seeds dormancy, but few or none were extent have a research into the combinative effect of various pre-treatments methods on seed quiescence and germination of *Adansonia digitata* seeds and identified seedling response as the results of pre-treatments. Therefore, the objective of this study was to investigate the effects of some pre-treatment techniques to overcome dormancy of *Adansonia digitata* L. and achieving rapid germination, uniform, high germination traits, seedling performance and increase the production capacity in local environmental conditions.

MATERIALS AND METHODS

Planting Materials

Mature seeds of *Adansonia digitata* L. were collected from Sudan during autumn months and the experiment was carried out during the two seasons of 2014 and 2015 at Sakha Agricultural Research Station, Kafr El-Sheikh Governorate, Egypt, located at $31^{o}07^{-}$ latitude, $30^{o}57^{-}$ longitude with an elevation of about 6 meters above mean sea level in the North Middle Nile Delta region to study the effect of some pre- germination treatments techniques to overcome dormancy of *Adensonia digitata* L. and achieving rapid germination, uniform, high germination traits, seedling performance and increase the production capacity in the local environmental conditions. .

Seed Treatments

Mature seeds of *Adansonia digitata* L. were treated by mechanical scarification and soaking. Seeds were subjected to 8 different treatments as shown in Table A.

Experimental Description and Statistical Design

The seeds were sown in foam trays filled with a mixture of Peat moss, vermiculite and

Table A. Seed treatments and description

Seed treatment	Description
T1 control,	Untreated seeds
T2 Soaking in tap water, T3 Soaking in boiling water,	Seeds were soaked in tap or boiling water (100° C) in glass bowl and kept in a cool dry place at 25°C. The soaking periods were 24 hr., for tap water and 1 hr., for boiling water. Seeds were sown after the soaking period.
T4 Mechanical scarification,	The seeds coat were alleviated with sandpaper
T5 Soaking in sulphuric acid for 30min, T6 Soaking in sulphuric acid for 60min,	Seeds were soaked for 30 or 60min in H_2SO_4(98.5%) in a glass bowl and kept in a cool dry place at 25°C. Seeds were washed before sowing after soaking period.
T7 Scratching seeds then soaking them for 30 min in sulphuric acid and T8 Scratching seeds then soaking them for 60 min in sulphuric acid.	The seeds coat were alleviated with sandpaper then soaked for either 30 or 60 min in H_2SO_4(98.5%) in a glass bowl and kept in a cool dry place at 25°C. Seeds were washed before sowing after soaking period.

perlite (3:2:1 *V:V:V*) on March 17th in the two seasons inside saran house and after 4-months, seedlings were transplanted into pots filled with sand and clay (2:1 *V:V*). All seedlings, were fertilized with kirstallon (19:19:19) at 3g/ l every month. The statistical design used was completely randomized block. There were 8 treatments consisting of 3 replications, each replication was represented by 30 seeds. The following data were recorded:

Germination traits

Data on germination were recorded daily from the fourth day; 2 mm radicle protrusion seed were considered as germinated. The number of germinated seeds was counted every day to evaluate germination rates until seeds germination was over in each treatment.

1- Germination percentage (G %) was computed as the **ISTA (2011)** using the following equation:

$$G\ (\%) = \frac{\text{No. of germinated seeds}}{\text{Total seed number}} \times 100$$

2- Germination velocity (G.V) = Number of days from sowing until the emergence of the plumule.

3- Mean germination rate (M.G.R) = Number of days to attain 50% of total germination **(Odetola, 1987).**

4- Germination rate index (GRI) the germination rate index was calculated according to battled equation **(Hartmann and Kester, 1983)** as follow:

$$GRI = \frac{A\ (A+B) + (A+B+C)}{N\ (A+B+C)}$$

Where:

A, B and C =number of germinated seeds counted at different times.

N=number of times at which the germinated seeds were counted.

5- Plumule length of the germinated seeds (cm).

6- Vigour index (VI) = G (%) x mean length of plumule **(Selvaraju and Selvaraj, 1994).**

Growth performance

After 7 months at the end of each season (middle of October) seedlings from the different treatments were gently lifted to measure the following data: plant height (cm), leaf area/plant (cm^2), leaf number /plant, fresh and dry weights of aerial part (g), stem diameter (cm), root length (cm), fresh and dry weight of roots/plant (g), total carbohydrates mg/g D.W in leaves according **Herbert *et al.* (1971)** and total green color in fresh leaves (SAPD units) values were performed using the SPAD-502 meter (Minolta Co. LTD, Japan). The instrument measures

transmission of red light at 650 nm, at which chlorophyll absorbs light, and transmission of infrared light at 940 nm, at which no absorption occurs **(Hoel and Solhaug, 1998).**, Elemental determination: The extraction was made of a known weight of the dried leaves sample (0.5 g). The wet digestion procedure was performed according to **Jackson (1973)** to determine the following minerals: nitrogen percentage was determined by using the semi-micro-Kjeldahll method according to **Black *et al.* (1982)**, phosphorus percentage was colorimetrically determined according to **Jackson (1973)**. The developed blue color was measured at the wavelength of 660 nm using a spectrophotometer, and potassium percentage was determined using a flame photometer as described by **Jackson (1973)**.

Statistical Analysis

Data were computed and subjected to analysis of variance (ANOVA) by adopting the randomized completely block design (RCBD). Means of all data were compared using Duncan's multiple range tests according to **Snedecor and Cochran (1980).**

RESULTS

Germination Parameters

Germination percentage

All pre-germination treatments were found to have a significant influence on germination (%) comparing to the untreated seeds (Table 1). The treatments could be arranged descending in the order T8 >T7>T6>T5>T4>T3>T2>T1. Scratching seeds then soaking in H_2SO_4 for either 30min or 60 min without significant differences were the most effective methods to enhance germination (%)(G%). Furthermore, these methods increased G% by 90.23 and 90.1% for T8 and T7, respectively in the first season. Soaking seeds in H_2SO_4 for either 30 min or 60 min increased G% by 89.05 and 87.14% and 88.33 and 85.07% in the two seasons, respectively. Mechanical scarification enhanced (G%) by 78.92 and 81.49% in the two seasons, respectively. Likewise, soaking seeds in tap water and boiling water promoting (G%) by 45.18 and 8.16% and 54.67 and 5.56% in the two seasons, respectively comparing with the untreated seeds. Generally, increasing with soaking time in the $H_2SO_4$from 30 to 60 min was not significant for baobab seeds whether with or without scratching.

Germination velocity

It appears from results presented in Table 1 and illustrated in Fig. 1. that the significantly lowest days' number from sowing seeds until emergence of the plumule were obtained from T8 treatments (combination of scratching seed then soaking in H_2SO_4 for either 60 or 30 min) without significant differences in both seasons followed by the treatment of soaking seeds in H_2SO_4 for either 30 min or 60 min. It is noteworthy, that T_8 and T_7 gave the earlier seed germination comparing to the untreated one by 90.21 and 88.83% and 91.41 and 91.10% in the two seasons, respectively. Otherwise, there was a highly negative correlation between (G%) and GV. A significant correlation coefficient R_2= 0.918 and 0.969 in the two seasons, respectively. With increasing G% thereby, the day's number for germination decreased (Fig. 2).

Mean germination rate (MGR) and germination rate index (GRI)

The significantly less number of days to attain 50% of total germination (MGR) was noticed for the seeds scratched then soaked in H_2SO_4 for 60 min as compared to the control (Table 1 and Fig. 2). The longest time to attain the corresponding percentage was observed from untreated seeds and soaking seeds in tap water without significant differences among then in both seasons. The other treatments gave an intermediate values with significant differences in all cases. There is no doubt that, the germination rate index (GRI) will increase for this reason. It is evident from results that the significant high germination rate index values were also obtained from the treatments of scratching seeds then soaking them in H_2SO_4 for either 30 or 60 min without significant differences in between during both seasons.

Plumule length and vigour index

Most treatments significantly increased plumule length and vigour index over the untreated seeds. There were insignificant differences between soaking in tap water and control on plumule length and vigour index of

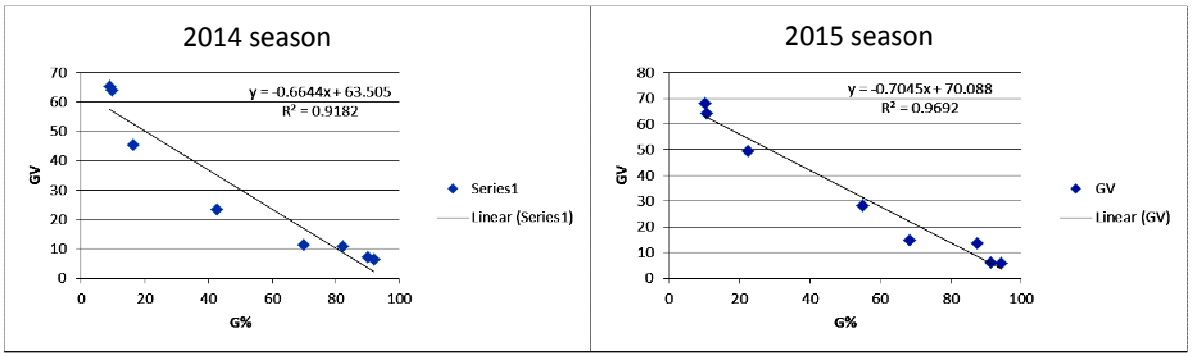

Fig. 1. Correlation between germination percentage (G%) and germination velocity (GV) affected by seed treatments in the two seasons

Table 1. Effect of some pre-germination treatments on germination percentage (G%), germination velocity (GV) day, mean germination rate (MGR), germination rate index (GRI), plumule length and vigour index (VI) of *Adansonia digitata* L. seeds during 2014 and 2015 seasons

Trait / Treatment	G (%)	GV (day)	MGR	GRI	Plumule length (cm)	Vigour index (VI)
			2014 season			
T_1	9.0 f	65.37 a	48.6 a	0.33e	1.31 e	11.79 f
T_2	9.8 f	63.90 a	47.7 a	0.36 e	1.33 e	13.03 f
T_3	16.4 e	45.44 b	29.8 b	0.45 d	1.62 d	26.57 e
T_4	42.7 d	23.37 c	21.2 c	0.48 d	1.67d	76.01 d
T_5	70.0 c	11.38 d	11.9 d	0.61 c	1.78 d	124.60 c
T_6	82.2 b	10.94 d	10. 8 d	0.75 b	2.34 c	189.06 b
T_7	90.1 a	7.30 e	9.8 de	0.87 a	2.88 b	259.49 b
T_8	92.1 a	6.40 e	7.9 e	0.89 a	3.45 a	317.75 a
			2015 season			
T_1	10.2 f	68.23 a	41.9 a	0.38e	1.65 d	16.83 f
T_2	10.8 f	64.27 a	40.0 a	0.38 e	1.68 d	18.14 f
T_3	22.5 e	49.60 b	34.6 b	0.47 d	1.94 c	43.65 e
T_4	55.1d	28.33 c	19.4 c	0.47 d	1.95 c	107.45 d
T_5	68.3 c	14.84 d	15.5 d	0.58 c	2.74 b	187.14 c
T_6	87.4 b	13.60 d	13.8 d	0.66 b	3.17 b	277.06 b
T_7	91.3 a	6.07 e	11.0de	0.79 a	3.63 a	331.42 a
T_8	94.3 a	5.86 e	9.5 e	0.84 a	3.68 a	347.02 a

Means within a column having the same letters are not significantly different according to Duncan's multiple range test. T_1 control, T_2 soaking in tap water, T_3 soaking in boiling water, T_4 mechanical scarification, T_5 soaking for 30 min in sulphuric acid (98.5%), T_6 soaking seeds for 60 min in sulphuric acid 98.5%), T_7 scratching seeds then soaking for 30 min in sulphuric acid (98.5%) and T_8 scratching seeds then soaking for 60 min in sulphuric acid (98.5%).

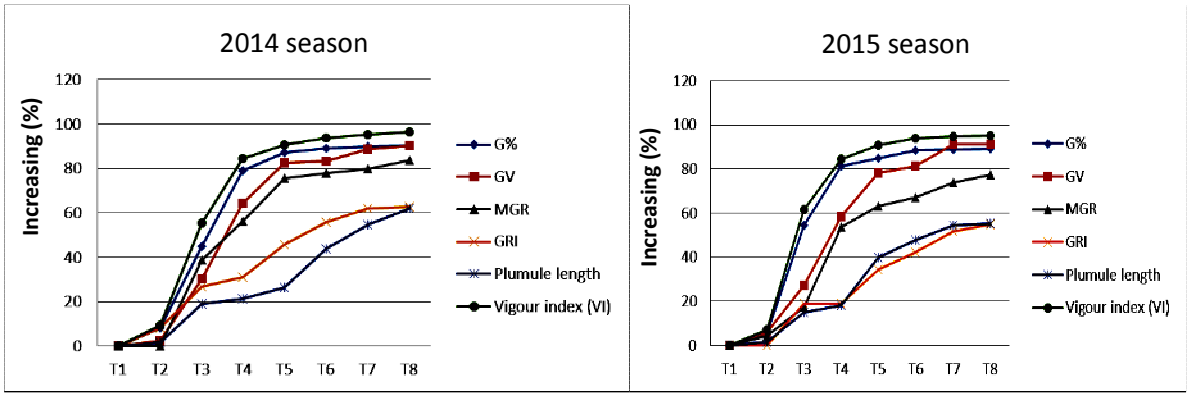

Fig. 2. Increasing percentage of the germination parameters as influenced by seed treatments during the two seasons

T_1 control, T_2 soaking in tap water, T_3 soaking in boiling water, T_4 mechanical scarification, T_5 soaking for 30 min in sulphuric acid (98.5%), T_6 soaking seeds for 60 min in sulphuric acid, T_7 scratching seeds then soaking seeds for 30 min in sulphuric acid (98.5%) and T_8scratching seeds then soaking seeds for 60 min in sulphuric acid (98.5%).

seed during the two seasons. On the other hand, scratching seeds then soaking in H_2SO_4 for either 30 or 60 min were without significant differences between the duration of sulphuric acid immersion in the second season, while caused increased plumule length and vigour index for about 62.03 and 96.29%, respectively Fig. 2.

Seedling Performance

Growth parameter

All pre-germination treatments significantly affected on seedling performance as shown in Table 2 and Fig. 3. Scratching baobab seeds then immersing them in H_2SO_4 for either 30 or 60 min recorded the highest plant height, leaf number/plant, leaf area, stem diameter, fresh and dry weights of aerial parts, root length, roots fresh and dry weights without significant differences between soaking duration in most cases. The promotion in plant height, leaf number/plant, leaf area, stem diameter, fresh and dry weights of aerial parts, roots length, root fresh and dry weights reached 57.58, 70.12, 75.99, 61.48, 57.97, 69.78, 62.63, 66.79 and 59.49%, respectively for T_8, (Fig. 2). Moreover, soaking seeds for 60 min in sulphuric acid was the third treatment which enhanced all seedling characteristics for about 46.67, 65.97, 72.34, 27.69, 51.51, 50.30, 60.92, 54.29 and 49.32%, respectively without significant differences between soaking duration in most cases. T_4 and T_3 gave intermediate effect on seedling parameters. In addition, there were insignificant differences between soaking seeds in tap water and the control in most cases.

Chemical characters

The application of different pre-treatments recorded significant increase in each of total carbohydrates contents, total green color, N, P and K (%) of *Adansonia digitata* L seedling as compared with untreated seeds in both seasons (Table 3). The best treatment that led to earlier germination (scratching seeds then soaking in H_2SO_4 for either 30 or 60 min without significant differences in between in most cases) recorded the highest values of this trait during the two seasons. Additionally, there were no significant differences between soaking seeds in H_2SO_4 for 30 or 60 min (T_5 and T_6) and scratching seeds then soaking in H_2SO_4 for either 30 or 60 min (T_7 and T_8).

DISCUSSION

An important factor that affect on germination is seed coat hardness. The major objective of pre-treatments seeds is to promote fast germination, but conversely the worthiness of various treatments differ greatly with the degree and the kind of dormancy. Many authors suggested different approaches to interrupt seed dormancy in order to enhance germination percentage and increase the germination rate. The results of this study showed that, although untreated *Adansonia digitata* seeds didn't achieve

Table 2. Effect of some pre-germination treatments on plant height, leaf number/plant, leaf area (cm^2), stem diameter (cm), aerial part fresh weight (g), aerial part dry weight (g), root length(cm), roots fresh and dry weights (g) of *Adansonia digitata* L. seedling during 2014 and 2015 seasons

Trait / Treatment	Plant height (cm)	Leaf number /plant	Leaf area cm^2/ plant	Stem diameter (cm)	Aerial part FW/ plant (g)	Aerial part DW/ plant (g)	Root length (cm)	Roots FW (g)	Roots DW (g)
				2014 season					
T1	11.2 d	4.9 d	118.4 g	0.47 d	85.2 f	8.4 d	11.1 c	95.4 e	11.1 d
T2	11.7 d	5.2 d	149.3 f	0.60 c	86.8 f	8.0 d	11.5 c	101.0 e	11.8 d
T3	15.3 c	9.0 c	179.4 e	0.64 c	119.4e	12.7 c	12.3 c	160.7 d	17.6 c
T4	16.8 c	9.3 c	391.4 d	0.66 c	131.1d	15.8 bc	18.6 b	163.3 d	17.0 c
T5	20.6 b	13.8 b	344.3 c	0.65 c	169.6 c	16.6 bc	22.4 b	196.5 c	18.8 bc
T6	21.0 b	14.4 ab	428.2 b	0.65 c	175.7 c	16.9 bc	28.4 a	208.7 c	21.9 b
T7	25.8 a	15.7a	488.2 a	0.82 b	190.4 b	19.8 b	29.1a	240.3 b	25.0 a
T8	26.4 a	16.4 a	493.1a	1.22 a	202.7 a	27.8 a	29.7a	287.3 a	27.4a
				2015 season					
T1	11.8 d	5.8 c	107.3 g	0.49 d	89.4 f	10.0 c	12.3 d	87.9 e	9.0 e
T2	12.0 d	6.0 c	132.2 f	0.50 d	112.5 e	11.1 c	12.2 d	91.8 e	9.3 e
T3	16.8 c	10.9 b	165.1 e	0.60 c	117.7 e	11.6 c	12.5 d	138.5 d	14.0 d
T4	25.0 b	11.7 b	377.2 d	0.61 c	145.3 d	11.6 c	16.0 c	143.4d	15.7 cd
T5	26.1ab	11.9 b	321.5 c	0.61 c	160.7 c	14.0 bc	21.8 b	180.4 c	17.0 c
T6	27.3 a	12.2 ab	410.8 b	0.66 c	164.7 c	14.8 bc	23.0 b	241.0 b	22.7 b
T7	27.7 a	13.2 a	475.8 a	0.73 b	186.9 b	17.0 b	30.8 a	245.7 b	23.8 b
T8	28.1a	13.2 a	477.5a	1.04 a	193.8 a	25.4 a	31.1a	291.5 a	30.1a

Means within a column having the same letters are not significantly different according to Duncan's multiple range test. T_1 control, T_2 soaking in tap water, T_3 soaking in boiling water, T_4 mechanical scarification, T_5 soaking for 30 min in sulphuric acid (98.5%), T_6 soaking seeds for 60 min in sulphuric acid, T_7 scratching seeds then soaking seeds for 30 min in sulphuric acid (98.5%) and T_8scratching seeds then soaking seeds for 60 min in sulphuric acid (98.5%).

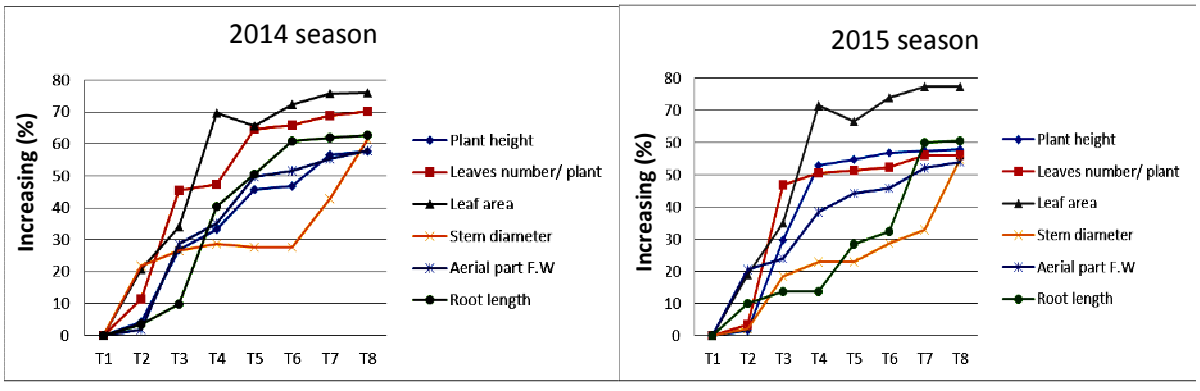

Fig. 3. Increasing percentage of the growth seedling parameters as influenced by seed treatments in the two seasons

T_1 control, T_2 soaking in tap water, T_3 soaking in boiling water, T_4 mechanical scarification, T_5 soaking for 30 min in sulphuric acid (98.5%), T_6 soaking seeds for 60 min in sulphuric acid, T_7 scratching seeds then soaking seeds for 30 min in sulphuric acid (98.5%) and T_8scratching seeds then soaking seeds for 60 min in sulphuric acid (98.5%).

Table 3. Effect of some pre-germination treatments on total carbohydrates contents (mg/g DW), total green color (SAPD unit), nitrogen, phosphorus and potassium (%) of *Adansonia digitata* L. during 2014 and 2015 seasons.

Treatment / Trait	Total carbohydrates (mg/g DW)	Total green color (SAPD)	N (%)	P (%)	K (%)
		2014 season			
T1	21.08 c	20.42 c	1.066f	0.043d	1.007c
T2	21.33 c	22.05 c	1.121f	0.055d	1.018c
T3	21.42 c	26.63 b	1.878e	0.066d	1.464b
T4	28.78 b	27.04 b	2.008d	0.199c	1.641b
T5	29.09 b	38.07 a	2.121d	0.553b	1.877a
T6	31.31 b	38.66 a	2.584c	0.871a	1.880a
T7	37.03 a	38.75 a	2.866b	0.878a	1.888a
T8	37.55a	38.11a	3.111a	0.888 a	1.888a
		2015 season			
T1	20.12d	21.04 c	1.084f	0.055e	1.053e
T2	20.26 d	21.69 c	1.654 e	0.061e	1.059e
T3	20.41 d	27.07 b	1.905 d	0.088e	1.266d
T4	25.65 c	28.02 b	2.073 cd	0.399d	1.488c
T5	25.74 c	27.03 a	2.374 c	0.670c	1.491c
T6	30.04 b	37.80 a	2.719b	0.777b	1.505b
T7	31.31 b	38.84 a	3.068a	0.839a	1.573b
T8	36.88 a	38.87 a	3.306a	0.844a	1.747a

Means within a column having the same letters are not significantly different according to Duncan's multiple range test. T_1 control, T_2 soaking in tap water, T_3 soaking in boiling water, T_4 mechanical scarification, T_5 soaking for 30 min in sulphuric acid (98.5%), T_6 soaking seeds for 60 min in sulphuric acid, T_7 scratching seeds then soaking seeds for 30 min in sulphuric acid (98.5%) and T_8scratching seeds then soaking seeds for 60 min in sulphuric acid (98.5%).

any germination for 65 days of different soaked seeds and the mechanically scarified impressive gave earlier germination than the control treatment. The influence of tap water on seed germination has obtained a result contrary to what would be expected as it disturbs germination. There was no significant difference between untreated seeds and the tap water seeds either in the germination percentage or the growth traits looked. This recorded that tap water pre-treatment is not a suitable technology for baobab. These results may be due to reducing germination as over-soaking seeds in waters because of oxygen deficiency. The *Adansonia digitata* seeds might contain some chemicals that prevent germination which couldn't be leached out by soaking 24 hr. In addition, this may be due to the fact that the seed coat might have contained some deposition of fat or oil which delayed or prevented the water penetrating, so affecting the germination technique (**Amoakoh *et al*., 2017**). The result was, however contrary to the findings by **Shahin *et al*. (2015), Kumar (2016)** and **Shahin and El-Tayeb (2016)** showed that the highest germination percentage and mean daily

germination were observed for soaking seeds in water for 24 hr. This revealed that different plant species have varying rates at which their seed coat is permeable to water and gases **(Owonubi *et al.*, 2005).**

Various experiments on seed pretreatments implied that time is an important factor for the induction of promoting germination ability. Indeed, the assessment of the germination capacity depends not only on the reached percentage of germination but also its velocity as well as its evolution in time. The correlation of these two factors is often used to decide the success of a pretreatment on embryonic and physical dormancy **(Nonogaki *et al*., 2010)**. On the opposite site, results showed that soaking baobab seeds in boiling water gave earlier germination to about 20 days. This means that the use of boiling water could be break-down dormancy as this could be attributed to the ability of this treatment for dissolving of fat or oil which delayed or prevented the water from penetrating, so affecting the germination. Likewise, **(Missanjo *et al*., 2014; Yisau *et al*., 2015; Abdulazeez, 2016**) pointed out that hot water treatment was the best for higher germination percentage of seeds and significantly increased growth traits of the seedlings.

The findings of the present study showed also that seed germination of baobab was under mechanical scarification as this may be due to that it was effective on allow only promoted water and air to enter into the seeds that ended up with the elongation of the embryonic axis **(Holdsworth *et al*., 2008 a,b; Azad *et al*., 2012).** Similarly, **Missanjo *et al*. (2014), Yisau *et al*. (2015) and Amoakoh *et al*. (2017)** found that nicking seeds gave the highest germination percentages.

Moreover, seed dormancy whether it is of embryonic or physical nature is determined by several factors such as the content of oxygen, dehydration and extreme temperatures. These conditions are necessary for a good production of seedling by seeds. The internal qualities of the seeds themselves among which the metabolism the content of certain growth regulators as well as the presence of certain inhibitory substances of germination in the integument preventing and delaying the imbibition which is the first stage of the germination induction, the acidity of the culture medium **(Kaydan and Yagmur, 2008; Phartyal *et al*., 2009; Ribeiro *et al.,* 2011)**. This is tandem with the observation of seeds scratched then soaked in H_2SO_4 for 60 min which gave the lowest MGR. This may be due to that H_2SO_4 combined with scratching seeds quickly overcome the seed coat, besides the stimulatory and feeding effects, which help in enhancing the germination, the concentrated sulphuric acid acts to oxidize, degrade and often the coat to permit water uptake and gaseous exchange and remove the constraint imposed by the covering layers **(Mensah and Ekeke, 2016)**. Earlier germination from 68 to 6 days may be the reason to increment in all growth seedling parameters and chemical characters **(Falemara *et al*., 2014; Yisau *et al*., 2015; Kumar, 2016)**. Acid treatment is an indication of the more rapidly seed coat ruptured the fastest rate of germination **(Amusa, 2011; Falemara *et al*., 2013; Kumar, 2016)**. Improving growth in the treatments of scratching seeds then soaked in sulphuric acid for either 30 or 60 min may be attributed to that these two treatments accelerate seed germination before the other treatments and consequently caused saving enough time for the newly formed seedlings to grow better than those formed lately. Besides, soaking in H_2O_4 for a suitable time helps to absorb more water necessary for hydrolysis of the complex food reserves to absorbable forms. These results are in accordance with those of **(Afshar *et al*., 2014; Sadat *et al.,* 2014; Niang *et al.,* 2015; Yisau *et al*., 2015; Arast *et al*., 2016; Mensah and Ekeke, 2016; Usman and Asan, 2017)** indicated that concentrated sulphuric acid significantly enhanced seed germination.

Conclusion

According to our study, all pre-treatments gave earlier germination and enhance of germination and seedling characters compared with the control except for soaking seeds in tap water. Therefore, the present study suggested that the descending order of pre-sowing treatments were scratching baobab seeds then soaking them in sulphuric acid 98.5% for 60 min > soaking in sulphuric acid 98.5% for 60 min >

mechanical scarification with sandpaper > boiling water, disrupts the seed coat and facilitates improved germination parameters, and attained good characteristics of seedling production.

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تأثير معاملات ماقبل الانبات على كسرسكون البذور ونمو شتلات الباوباب (الادنسونيا)

سامية محمد زهير البابلى[١] - ناهد مصطفى راشد [٢]

١- قسم بحوث نباتات الزينة وتنسيق الحدائق- معهد بحوث البساتين – مركز البحوث الزراعية- الجيزة – مصر

٢- قسم الخضر والزينة – كلية الزراعة – جامعة دمياط – دمياط - مصر

هناك حاجة ملحة للتغلب على سكون البذور وخاصة بعض أنواع الأشجار التى يمكن نجاح زراعتها فى جنوب مصر مثل الادنسونيا متعددة الفوائد من أجل تحسين تكاثرها، لذلك تم إجراء هذه الدراسة لدراسة تأثير معاملات ما قبل الإنبات (نقع في مياه الصنبور، نقع في الماء المغلي، نقع فى حامض الكبريتيك ٩٨,٥% لمدة ٣٠ أو ٦٠ دقيقة)، الخدش الميكانيكي بالصنفرة و خدش البذور ثم النقع في حمض الكبريتيك ٩٨,٥% لمدة ٣٠ أو ٦٠ دقيقة) وذلك على صفات الإنبات وصفات شتلات الأدانسونيا، أوضحت النتائج أن جميع معاملات ما قبل الإنبات (ماعدا نقع البذور في ماء الصنبور) أدت إلى زيادة معنوية في جميع صفات الإنبات و النمو وبعض الصفات الكيميائية بالمقارنة بغير المعاملة (الكنترول).وكان الترتيب التنازلي لمعاملات ما قبل الإنبات هى خدش البذور ثم نقع في حامض الكبريتيك ٩٨,٥% لمدة ٣٠ أو ٦٠ دقيقة > نقع في حامض الكبريتيك ٩٨,٥% لمدة ٣٠ أو ٦٠ دقيقة > الخدش الميكانيكى بالصنفرة > النقع فى الماء المغلي، وبنفس الترتيب قل عدد الأيام من الزراعة حتى ظهور الريشة من ٦٨ يوم إلى ٦ أيام وزيادة نسبة الإنبات من ٩% إلى ٩٤% فى البذور غير المعالجة أو التى نقعت فى ماء الصنبور والبذور التى خدشت ثم نقعت في حامض الكبريتيك ٩٨,٥% لمدة ٦٠ دقيقة على التوالي، علاوة على ذلك كانت هناك زيادة في ارتفاع الشتلات من ٤,٢٧ إلى ٥٧,٥٨% وفي قطر الساق من ٢١,٦٧ إلى ٦١,٤٨% للبذور التى نقعت في مياه الصنبور والبذور التى خدشت ثم نقعت في حامض الكبريتيك ٩٨,٥% لمدة ٦٠ دقيقة على التوالي، عامة يمكن إجراء كل هذه المعاملات لكسر سكون بذور الباوباب بنجاح (ماعدا النقع فى ماء الصنبور)، وكانت أفضل معاملة هى الخدش ثم النقع فى حامض الكبريتيك ٩٨,٥% لمدة ٣٠ دقيقة.

المحكمون :

١- أ.د. أميمة محمد عبدالكافي أستاذ الزينة المتفرغ – كلية الزراعة – جامعة المنصورة.

٢- أ.د. علي عبدالحميد معوض أستاذ الزينة المتفرغ – كلية الزراعة – جامعة الزقازيق.