International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2015): 6.391

Effect of Breaking Seed Dormancy Treatments on Germination and Vegetative Growth of Some Legumes Plant

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Abstract: ***This study tried to break of seed dormancy of some legumes included Albizia lebbeck, Cassia nodosa, Cassia margenita and Cassia javanica. Different methods to breaking seed dormancy were used. Include water, GA3, H2SO4 50%, H2SO4 98% and scarification. Several treatments such as: soaking in water, scarification by sand paper, growth regulator (GA3) and acid scarification by H2SO4 in two concentration, 50% for 30 min and 98% for 5 min were used to breaking hard seed coat of legume plant. In this experiment H2SO4 (98%) gave best result in all genotypes. It needed 20.31days germination period and 68.02 % in germination percentage compare with 27.43 days and 56.22 % by water only. Albizia lebbeck showed the best result especially when it treated by H2SO4 in concentration of 98%. It decrease germination period from 22.28 days to 15.32 days and increase germination percentage from 66.01 % to 70.07 % compared with water. This study showed that break of seed dormancy to enhance seed germination and growth of legume tree, by using H2SO4 in concentration of 98%. For five minute. Albizia lebbeck was the best species in all vegetative and growth parameters.***

Keywords: *Albizialebbeck, Cassia nodosa, Cassia margenita, Cassia javanica,* GA_3, H_2SO_4, Scarification, seed dormancy.

1. Introduction

Seed dormancy is a block to the completion of germination of an intact viable seed under favorable conditions (Bewley, 1997). This block to germination has evolved differently across species through adaptation to the prevailing environment. Therefore germination occurs when conditions for establishing a new plant generation are likely to be suitable(Baskin & Baskin, 2004, Thompson *et al.*, 2003).

Mature seeds of many plant species, particularly legumes, do not germinate readily under natural environmental conditions, because they are impermeable to water and/or gases or they have a seed-coat that mechanically constrains embryo. This attribute has been called hard seed-coat dormancy. Hard coatedness, hard seededness, dormancy imposed by the seed-coat, seed-coat been found in exogenous dormancy. Hardseededness is heritable and may be not in all commercial legume species.(Argel & Paton, 1999). Other type of dormancy was morphological dormancy, germination is prevented because of morphological characteristics of the embryo(Aiken & Springer, 1995). There are several methods of seed scarifications such as heat, freezing, mechanical and acid scarification. Acid scarification by H_2SO_4 for different periods was the most effective method in softening the seed coat of Cassia seeds (Kandya, 1990). Treatment of some chemicals material include (KNI_3 or $NaHCIO_2$) or some growth regulators (GA_3 or BA) to improve germination and breaking seed dormancy (Butola & Badola, 2004). Heat scarification is the method that uses high temperature to break seed coat(Tomer & Maguire, 1989). Mechanical scarification is a technique to physically made scars on seed surface to increase water imbibition of the seed(Fernando, 2012, Olisa *et al.*, 2010).

Cassia seeds which belong to the family Leguminosae usually have seed coat cause dormancy which may be due to impermeability of test a to water (Rolston, 1978). The one of the common cause of delay in germination of seed is the blocking of water entry into the seed (Cavanagh, 1980). The treatment of cassia seeds was very necessary for breaking seed dormancy (Ramamoorthy *et al.*, 2005)

Albizialebbeck is one of the important species in Iraq and the region, its wood has subjected to investigation through the assessment of differences in its element dimensions and specific gravity under Baghdad conditions(Ali, 2014). *Albizialebbeck* is a tree belong to legume family that have a seed dormancy (Missanjo *et al.*, 2013)

The objective of this study was to use the methods of breaking seed dormancy to overcome the hard seed coat of some important legume plant, which increase the seed coat permeability, enhance the seed germination and growth

2. Methods and Material

The experiment was carried out during January to March 2017 at department of biology, college of Science, university of Baghdad, Iraq. In this experiment used different treatment for breaking seed dormancy of four legume tree, *Albizialebbeck, Cassia nodosa*, *Cassia margenita* and *Cassia javanica*.

The experiment was conducted as a factorial experiment according to completely randomize design at three replication. The treatments of seed including: soaking in water for 12h at room temperature. Second method was mechanical scarification by sand paper to scratch the seed coat. Third method was GA_3 it is one of regulator hormone in concentration of 250 Mg m^{-1} for 24h. The forth method was acid scarification by H_2SO_4in two concentration 50% for 30min and 98% for 5 min.

In this experiment the seeds were grown in pots(20cm) contain peat moss media and it is spray with ethanol 10% for sterilization. These seeds before planting wash by tap water

for several time to remove remaining material. Then cultured in pots, where each pot contain five seeds for each treatments. The final germination tests were recorded daily for a period of two months. Germination percentage calculated according to equation of ISTA (Association, 1999).

Germination percentage=No. of germinated seeds/Total No. of seeds *100

Statistical analysis
The data was analyzed according to the completely randomize design (CRD) used in this experiment and the means was compared using the LSD test at the potential 0.05 level.

3. Result and Discussions

1- Germination period:
The results of table (1) indicate that there are significant differences between the treatments on breaking of seed dormancy. H_2SO_4 98% gave minimum number of days require for germination (20.31) days compared with other treatments, while water gave (27.43) days.GA_3extended the germination perioduntil (29.95) days. H_2SO_4 50% treatment needed (28.59) and Scarification needed (23.17) to germinate.

Table (1) showed that there are significant differences between the genotypes in the average number of days of germination. *Albizialebbeck* gave the lowest average number of days require for germination (19.98) days, then followed by *Cassia nodosa* gave 26.06days compared with the other genotypes.

The results of table (1) indicate that there is significant interaction between the treatments of breaking dormancy in germination period. *Albizialebbeck* soaked with H_2SO_4 98% gave the lowest number of days needed for germination (15.32). *Cassia margenita* with GA_3 gave maximum days for germination (35.58) days compared with other interactions.

Sulfuric acid has the ability to scratch the hard seed coat and allowing the passage of water, oxygen and nutrients to the embryo. Hard seed coat is the main hindrance in improving germination. H_2SO_4removed the exogenous dormancy and hard seed coat.(Rai *et al.*, 1986).

(Gupta *et al.*, 1997) improved the seed germination when reported that pre-treated of the Glycyrrhizaglabra seeds with concentrated $H_2SO_4$for 5 min improved the germination.

Albizialebbeck (L.). It is fast growing tree with feathery foliage. They have spreading crown and can grew in Many habitats are characterized by extremes of climate such as long, hot, and dry summers and cold winters with mean temperatures (Bislig & Zabala).

Table 1: Effect of seed treatments on the germination period days of some legume plants

Treatment	Genotype				Mean
	Albizialebbeck	*Cassia nodosa*	*Cassia roxburghii*	*Cassia marginata*	
Water	22.28	27.37	29.60	30.49	27.43
GA_3	17.03	32.51	34.69	35.58	29.95
H_2SO_4 50%	26.09	27.80	29.61	30.87	28.59
H_2SO_4 98%	15.32	20.30	21.89	23.74	20.31
Scarification	19.20	22.30	24.57	26.63	23.17
L.S.D 0.05	**2.034**				**1.017**
Mean	19.98	26.06	28.07	29.46	
L.S.D 0.05	**0.910**				

2- Roots length:
The result of table (2) indicated that there are significant differences between the treatments on breaking of seed dormancy. H_2SO_4 98% gave top root length (7.77) cmcompare with other treatments, while H_2SO_4 50% gavelowest root length (5.46) cmby compared with other treatments. The result of genotypes showed in table (2) that there are significant differences between the genotypes in theroot length. *Albizialebbeck* gave the top number of root length (7.61) cm, while *Cassia marginata* gave lowest root length (4.82) days compared with other genotypes.

The results of table (2) indicate that there are significant interactions between the treatments of breaking dormancy and genotypes in roots length. *Albizialebbeck* with H_2SO_4 98% gave high number of root length (8.58) cm, while *Cassia marginata* with GA_3 gave lowest root length (3.70) compared with other interactions.

These results are in agreement with other who found that root length significantly affected by treatments and the longest root was recorded in seeds of Albiziazygia scarified by H SO for 5 minutes.(Anim-Kwapong & Teklehaimanot, 2001).

Table 2: Effect of seed treatments on the roots length cm of some legume plants

Treatment	Genotype				mean
	Albizialebbeck	*Cassia nodosa*	*Cassia roxburghii*	*Cassia marginata*	
Water	7.35	6.74	6.33	4.63	6.26
GA_3	8.23	5.28	4.90	3.70	5.52
H_2SO_4 50%	6.42	5.93	5.38	4.11	5.46
H_2SO_4 98%	8.58	8.37	7.84	6.29	7.77
Scarification	7.45	7.14	6.71	5.37	6.67
L.S.D 0.05	**0.49**				**0.25**
Mean	7.61	6.69	6.23	4.82	
L.S.D 0.05	**0.22**				

3- Shoots length

The result of table (3) indicated that there are significant differences between the treatments on breaking of seed dormancy. H_2SO_4 98% gave high number of shoots length (18.80) cm compare with other treatments, while H_2SO_4 50% gave the lowest shoots length (13.21) cm compare with other treatments.

The result in table (3) showed that there are significant differences between the genotypes in the shoots length. *Albizialebbeck* gave the top shoot length (18.41) cm. the lowest length of shoots was in *Cassia marginata* (11.66) cm compare with genotypes.

Table (3) indicated that there are significantinteractions between the treatments of breaking dormancy and genotypes in shoots length. *Albizialebbeck* with $H_2SO_4$98% gave the top number of shoot length (20.76) cm, while *Cassia margiata* with H_2SO_4 50% gave a minimum shoots length (8.94) cm compare with other interactions.

The Sulfuric acid effect on root and shoot and gave a high result this agree with other who reported that After sowing was observed that seedling root and shoot were prominent in those who were treated with acid .(Siddique & Ahmed, 2015).

Table 3: Effect of seed treatments on the shoots length cm of some legume plants

Treatment	Genotype				mean
	Albizialebbeck	*Cassia nodosa*	*Cassia roxburghii*	*Cassia marginata*	
Water	17.79	16.30	15.32	11.20	15.15
GA_3	19.90	12.77	11.85	8.94	13.37
H_2SO_4 50%	15.55	14.34	13.01	9.94	13.21
H_2SO_4 98%	20.76	20.25	18.97	15.22	18.80
Scarification	18.02	17.28	16.23	13.01	16.13
L.S.D 0.05	**1.18**				**0.60**
Mean	18.41	16.19	15.08	11.66	
L.S.D 0.05	**0.53**				

4- Germination percentage

The result of table (4) showed that there are significant differences between the treatments on breaking of seed dormancy. H_2SO_4 98% gave high number of germination percentage (68.02) %, while GA_3 gave the minimum percentage of germination (44.60)% compare with other treatments.

The genotypes in the table (4) showed that there are significant differences between the genotypes in the average number of germination percentage. *Albizialebbeck* gave the high germination percentage (62.90)%, while *Cassia marginata* gave lowest germination percentage (43.27)% compare with the other genotypes.

The results of table (4) indicate that there are significant interactions between the treatments of breaking dormancy and genotypes in germination percentage. *Cassia nodosa* gave high percent of germination (75.14)% when it is treated by $H_2SO_4$98%, while *Cassia marginata* with GA_3 gave the minimum germination percentage (33.18)% compare with other interactions.

H_2SO_4 with concentration of 98%gave the best result. This agree with (de Morais *et al.*, 2014), It was observed that for archer and perennial soybeans, using H2SO4 with concentration of 98% immersion for five minutes in was the method that had the highest percentage of germination.

Some papers indicated that the mechanical scarification is the good treatment for *Cassia nodosa*germination and breaking of it is dormancy(Al-Menaie *et al.*, 2010)

Table 4: Effect of seed treatments on the germination percentage % of some legume plants

Treatment	Genotype				mean
	Albizialebbeck	*Cassia nodosa*	*Cassia roxburghii*	*Cassia marginata*	
Water	66.01	60.49	56.84	41.55	56.22
GA_3	53.86	47.40	43.98	33.18	44.60
H_2SO_4 50%	57.71	53.22	48.28	36.89	49.02
H_2SO_4 98%	70.05	75.14	70.41	56.48	68.02
Scarification	66.87	64.12	60.22	48.27	59.87
L.S.D 0.05	**4.39**				**2.19**
Mean	62.90	60.07	55.95	43.27	
L.S.D 0.05	**1.96**				

5- Leaves number:

Table (5) show that there are a significant differences between the treatments on breaking of seed dormancy H_2SO_4 with concentration of 98%gave the high number of leaves (7.89) compare with other treatments, while H_2SO_4 50% gave the lowest number of leaves (5.55)

The genotypes in the table (5) showed that there are significant differences between the genotypes in the average number of leaves *Albizialebbeck* gave the high leaves number (7.73), while *Cassia marginata* gave minimum leaves number (4.90) compare with the other genotypes.

The results of table (5) indicate that there are significant interactions between the treatments of breaking dormancy

and genotypes in leaves number. *Albizialebbeck* with $H_2SO_4$98% gave the high leaves number (8.72), while *Cassia marginata* gave lowest number of leaves (3.76) when treated by $H_2SO_4$50%.

(Mabundza *et al.*, 2010)Supporting the results were indicated that scarification of seeds of *Tamarindusindica L.* with H2SO4 in concentration of 95% for 5 minutes enhanced number of leaves, germination of the seeds and seedlings height.

Table 5: Effect of seed treatments on the leaves number of some legume plants

Treatment	Genotype				mean
	Albizialebbeck	*Cassia nodosa*	*Cassia roxburghii*	*Cassia marginata*	
Water	7.47	6.84	6.43	4.70	6.36
GA_3	8.35	5.36	4.98	3.76	5.61
H_2SO_4 50%	6.53	6.02	5.46	4.17	5.55
H_2SO_4 98%	8.72	8.50	7.96	6.39	7.89
Scarification	7.57	7.25	6.81	5.46	6.77
L.S.D 0.05	**0.73**				**0.36**
Mean	7.73	6.80	6.33	4.90	
L.S.D 0.05	**0.33**				

6- Fresh weight

The result of table (6) showed that there are significant differences between the treatments on breaking of seed dormancy. H_2SO_4 with concentration of 98% gave a high fresh weight (14.34)gm, whileH_2SO_4 50% gave lowest fresh weight (13.04) gm. Compare with other treatments.

Table (6) showed that there are significant differences between the genotypes in the average number of fresh weight. *Albizialebbeck* gave the high fresh weight (14.24) gm, while *Cassia marginata* gave minimum number of fresh weight (12.69) gm compare with the other genotypes.

The results of table (6) indicate that there are significant interactions between the treatments of breaking dormancy and genotypes in number of fresh weight. *Albizialebbeck* when they treated by H_2SO_4 98% gave the top number of fresh weight (14.78)gm, while *Cassia marginata* with GA3 gave the lowest fresh weight (12.06) gm compare with other interactions.

Water impermeability of the testa is a physical exogenous dormancy according to (Nikolaeva, 1969). Concentrated sulphuric acid has been used for many years for softening of hard seed coats.(Hopkins, 1923)

Table 6: Effect of seed treatments on the fresh weight of some legume plants

Treatment	Genotype				mean
	Albizialebbeck	***Cassia nodosa***	***Cassia roxburghii***	***Cassia marginata***	
Water	14.09	13.75	13.53	12.58	13.49
GA_3	14.58	12.94	12.73	12.06	13.08
H_2SO_4 50%	13.58	13.30	13.00	12.29	13.04
H_2SO_4 98%	14.78	14.70	14.37	13.51	14.34
Scarification	14.15	13.98	13.74	12.99	13.71
L.S.D 0.05	**0.40**				**0.20**
Mean	14.24	13.74	13.47	12.69	
L.S.D 0.05	**0.18**				

Hard seed coat was responsible for no penetration of water, oxygen and nutrients to the embryo. However, when dormancy breaking treatments of hot water, acid scarification and mechanical scarification for different time which improved seed germination. (Siddique & Ahmed, 2015). Depending on the kind of dormancy, dormancy can be broken by gibberllic acid treatment, stratification, chilling treatment, hot water treatment,soaking in water and acid treatment. Presence of a hard seedcoat is one of the reasons for dormancy in legumes plant (Argel & Paton, 1999).

The results showed that the scarification treatment gave a less effective result, this disagree with (Nasir *et al.*, 2001), explain that mechanical scarification was a better treatment of breaking dormancy in some seeds for use as forage. Also (Hassanein Anber, 2010) showed that mechanical scarification gave good results compare with other treatments.

4. Conclusion

The species of *Cassia* and *Albizialebbeck* had hard seed coat which was impervious to water.In this study, seeds of all the species gave the best results when they treated by H_2SO_4 with concentration of 98%.H_2SO_4 98% decrease germination period, increase germination percentage, roots length, shoots length, leave number and fresh weight. The treatments were used for softening the hard seed coat. This suggested that low germination may be due to the dormancy, which retarded penetration of water to inside the seed.

The results showed that *Albizialebbeck* gave the best result in the most of the vegetative growth characteristics.Importance of this species is coming from its suitability to most of Iraqi lands and can tolerance the environment condition

The results showed that *Cassia nodosa* gave good results after Albizialebbeck when treated by H_2SO_4 with concentration of 98%.This may be due to that tree well

known mainly for their landscaping attributes, tolerance to drought conditions and low maintenance requirements, so it is suitable for growth in Iraq and tolerant climate.

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