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Effect of Some Presowing Treatments on Germination of *Bauhinia rufescens* Seeds

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ABSTRACT

The study aimed at investigating the effect of chemical pre-sowing treatments on the germination of *Bauhinia rufescens* seeds. The pre-sowing treatments were made up of five different dilutions of concentrated sulphuric acid (10, 30, 50, 70, 90%), gibberellic acid (0.01, 0.03, 0.05, 0.07, 0.09) and potassium nitrate (0.1, 0.3, 0.5, 0.7, 0.9) and a control treated with distilled water. Pure seeds of *Bauhinia rufescens* were soaked in the various dilutions of sulphuric acid for 30 min while that of gibberellic acid and potassium nitrate were soaked for 24 h. The control was soaked in distilled water for all the respective treatments. The study lasted for 12 days during which data was collected daily on germination which was used to calculate germination capacity, germination value, germination rate, germination energy and coefficient of velocity of germination. Data was analysed using general analysis of variance at 5% significance level. There were significant differences between the treatments and interactions between the treatments and sub-treatments including the control were also significant. Sub-treatment 5 of treatment 1 (sulphuric acid) produced the highest germination capacity of 93.8% and had the highest germination energy at 7, 10 and 12 days after sowing. It produced the lowest germination rate at 25, 50 and 75% and had the highest coefficient of velocity of 69. Other sub-treatments which also had high germination capacity were sub-treatment 4 of treatment 1 (89.0%), sub-treatment 5 of treatment 2 (88.5%), sub-treatment 4 of treatment 2 (76.5). Germination capacity increased with increasing concentration for all treatments. Only sub-treatments 5 and 4 of treatments 1 and 2 attained 75% germination rate. The results showed that Sulphuric acid at 90% concentration was the most effective pre-sowing treatment for the germination of *Bauhinia rufescens* seeds followed by 70% concentration and that potassium nitrate was the least effective.

Key words: Germination, daily germination, cumulative germination percentage

INTRODUCTION

Bauhinia rufescens Lam. is a popular ornamental plant in Ghana used for the establishment of hedges, edges and to a less extent as small trees in ornamental gardens (Asiedu *et al*., 2011). The plant is propagated by seed (Connor, 2008; Le-Houerou, 2005). It is a hard seeded fabaceae which produces seeds with tough and hard seed coat (Connor, 2009). This condition does not encourage even germination but rather results in erratic germination of seeds (Alderete-Chavez *et al*., 2011). To achieve rapid and synchronous germination artificially, therefore, the seeds must be subjected to some physical or chemical treatment (Islam *et al*., 2009) thus the need to investigate pre-sowing treatments which can best enhance germination (Butola and Bedola, 2004). Studies by Anonymous

(1998), Connor (2008) and Asiedu *et al.* (2011) suggested treatment of seeds with boiling water and scarification with 97% sulphuric acid to enhance germination.

Several other pre-sowing treatments have been suggested to enhance germination in hard seeded seeds. These include gibberellic acid, potassium nitrate (Alves *et al.*, 2000), succinic acid (Ghadiri and Torshiz, 2000); HCl, nitric acid, boric acid, acetic acid, ethanol, methanol, benzene, xylene (Idu *et al.*, 2007); thiourea, benzyl adenine (Schmidt, 2000), among others.

As has been noted by Orwa *et al.* (2009) and Asiedu *et al.* (2011) very little work has been done on the plant thus the need to conduct further study to determine the maximum number of seeds which can germinate under optimum conditions (Willan, 1987). This experiment was thus conducted to investigate the effect of some pre-sowing treatments on the germination of seeds of *Bauhinia rufescens*.

MATERIALS AND METHODS

Location of project: The experiment was conducted at the Department of Crop Science laboratory in the Technology Village, a teaching and research facility of the School of Agriculture, University of Cape Coast from February to May, 2011.

Preparation of pre-sowing treatments: Pure seeds of *Bauhinia rufescens* were subjected to a total of 16 treatments using various dilutions of Sulphuric acid, Potassium nitrate and gibberellic acid and distilled water as the control. Seeds and other materials used were sterilized as recommended by Keshtkar *et al.* (2008) and ISTA (1999).

Five different concentrations of sulphuric acid, potassium nitrate and gibberellic acid (GA_3) were prepared. The sulphuric acid concentrations were prepared from a 97% conc. Sulphuric acid by diluting 9.8, 29.4, 49, 68.6 and 88.2 mL of the acid in 100 mL of distilled water to obtain 10, 20, 50, 70 and 90% dilutions, respectively. The potassium nitrate concentrations were prepared by dissolving 1, 2, 3, 4 and 5 g in 1 L of distilled water to produce 0.1, 0.2, 0.3, 0.4 and 0.5% dilutions, respectively.

The GA_3 concentrations were also prepared by dissolving 0.1, 0.3, 0.5, 0.7 and 0.9 g of Gibberellic acid in 1 L distilled water to yield 0.01, 0.03, 0.05, 0.07 and 0.09% dilutions, respectively (Table 1).

Treatment of seeds: Each treatment consisted of one hundred pure seeds of *Bauhinia rufescens* repeated four times. Seeds were laid in petri-dishes; 25 seeds per petri-dish. For sulphuric acid treatment, seeds were immersed in each of the respective concentrations (10, 20, 50, 70, 90%) and shaken with a mechanical shaker for 30 min. The seeds were decanted and rinsed several times under running tap water followed by distilled water after which they were laid on moistened tissue paper in petri-dishes. Potassium nitrate treatments had seeds soaked in each of the 5 dilutions (0.1,

Table 1: Summary of treatments

Treatments H_2SO_4 (T1)	GA_3 (T2)	KNO_3 (T3)
10% (Subtrt. 1)	0.01% (Subtrt. 1)	0.1% Subtrt. 1)
30% (Subtrt. 2)	0.03% (Subtrt. 2)	0.3% (Subtrt. 2)
50% (Subtrt. 3)	0.05% (Subtrt. 3)	0.5% (Subtrt. 3)
70% (Subtrt. 4)	0.07% (Subtrt. 4)	0.7% (Subtrt. 4)
90% (Subtrt. 5)	0.09% (Subtrt. 5)	0.9% (Subtrt. 5)
0.0% (Subtrt. 6/control)	0.00% (Subtrt. 6/control)	0.0% (Subtrt. 6/control)

0.2, 0.3, 0.4, 0.5%) for 24 h (Keshtkar *et al*., 2008) at room temperature. The treated seeds were then rinsed with distilled water, laid on a moistened tissue paper in petri-dishes. For the GA_3 treatments, pure seeds were soaked in each of the respective concentrations (0.01, 0.03, 0.05, 0.07, 0.09%) for 24 h at room temperature (Chuanren *et al*., 2004) after which the treated seeds were washed with distilled water before they were laid on moistened tissue paper in petri-dishes. The control had pure seeds of *Bauhinia rufescens* soaked in clean distilled water for all the respective treatments (Table 1). The seeds were decanted and put in sterilized petri dishes lined with moistened tissue paper. The control also had 100 seeds and was repeated four times.

Experimental design: The experiment was laid out in a completely randomized design and was carried out in series; repeated four times. A total of 400 seeds was allocated to each treatment (ISTA, 1999).

Data taken: Data was taken on days to first germination; Number to first germinate; Daily germination; cumulative germination percentage.

Germination assessment: The effects of pre-sowing treatment were assessed by daily counting of number of germinated seeds. Germinated seeds were counted and removed from the date of sowing until there was no more germination. A seed was considered to have germinated when the tip of the radicle emerged free of the seed coat (Wiese and Bining, 1987; Auld *et al*., 1988). Daily germination percentage was summed up to obtain cumulative germination on each assessment.

Germination period was determined as the number of days from first observed germination to where there was no more germination but energy period was arbitrarily defined in 12 days (Willan, 1987, 1993). Germination pattern was also determined by number of seeds that germinate at the different days after sowing (Viswanath *et al*., 2002).

Germination energy defined as the percentage by number of seeds in a given sample which germinate within a definite period such as 7-14 days under optimum or stated condition (Willan, 1987) was determined. Germination energy is also a measure of the speed of germination and hence, a measure of the vigour of seedlings (Willan, 1993). In addition, germination value which is a composite value that combines both germination speed and total germination was also determined. Germination value is an objective means of evaluating results of a germination test and is calculated using the formula proposed by Hartmann *et al*. (1997) as follows:

$$Gv = \text{(final) MDG} \times \text{PV (MDG)}$$

Where:

Gv	=	Germination value
Final (MDG)	=	(Final) Mean daily germination
PV (MDG)	=	Peak value mean daily germination

Total germination is expressed as (final) Mean Daily Germination (MDG), calculated as the cumulative percentage of full seed germination at the end of the test divided by the number of days from sowing to the end of test period. Speed of germination was determined and expressed as peak Value, which is the maximum mean germination reached at any time during the period of the test (Willan, 1993).

The germination rate was calculated according to Wiese and Bining (1987) as follows:

$$Gr = \frac{\text{(Number germination since n-1)}}{n}$$

Where:
Gr = Germination rate
n = Days after sowing

Coefficient of velocity of germination was also determined using the formulae (Hartmann *et al.*, 1997):

$$Gv \frac{1}{\text{Mean days}} \times 100$$

where:

$$\text{Mean days} = \frac{\text{(N1T1+N2T2+...NXTX)}}{\text{Total No. of seeds germination}} \times 100$$

RESULTS

Germination pattern: Generally germination started early; most treatments took 4 days to germinate. The only exceptions were in the sulphuric acid treatments where sub-treatments 4, 5 and 6 which started germinating 3 days after sowing (Fig. 1). Sub-treatments with higher concentrations (such as sub-treatments 3, 4, 5) showed quick and spontaneous germination after an initial delay. Lower concentration sub-treatments (sub-treatments 1, 2, 6) were more gradual but slow. Although, there was no clear pattern between concentration and number of days it took seeds to start germinating, germination increased with increasing concentration for all sub-treatments (Table 2). Also most sub-treatments reached their peak germination between 8-10 days after sowing.

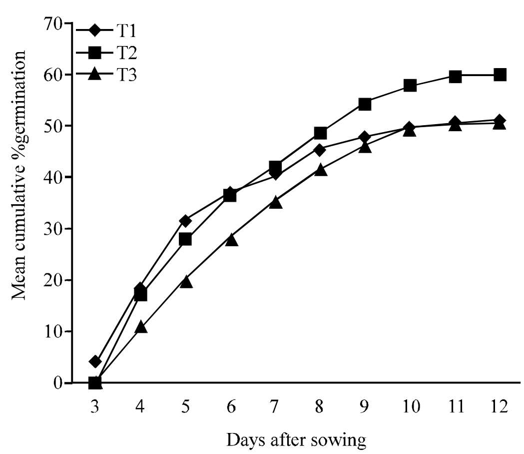

Fig. 1: Germination pattern showing relationship between treatments

Table 2: Cumulative mean germination of sub-treatments and their significance level

	Trt. 1					Trt. 2					Trt. 3				
	(Subtrt.)														
DAS	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
B	0.0^{a}	0	0	4.3	16.5	0.0^{a}	0.0^{a}	0	0	0.0^{a}	0.0^{a}	0.0^{a}	0.0^{a}	0.0^{a}	0.0^{a}
6	0.0^{a}	2.3^{a}	8.3^{b}	23.0^{b}	59.0^{b}	6.0^{ab}	11.8^{b}	17.3^{b}	23.5^{b}	29.0^{b}	3.0^{a}	7.3^{b}	6.8^{b}	16.0^{b}	22.8^{b}
4	3.5^{ab}	8.3^{ac}	12.3^{bc}	56.0^{c}	77.0^{c}	12.0^{b}	18.8^{c}	28.5^{c}	37.3^{c}	44.8^{c}	5.8^{ab}	15.5^{c}	14.8^{c}	28.8^{c}	34.5^{c}
5	6.0^{abc}	11.8^{bcd}	16.5^{c}	66.5^{d}	83.8^{cd}	19.0^{c}	22.8^{cd}	36.8^{d}	44.5^{d}	59.5^{d}	10.5^{b}	23.5^{d}	23.5^{d}	39.3^{d}	43.8^{d}
6	7.3^{bcd}	14.8^{cde}	19.8^{cd}	73.0^{e}	89.5^{de}	24.3^{cd}	26.5^{de}	40.3^{de}	48.3^{d}	70.8^{e}	18.5^{c}	29.8^{de}	32.3^{e}	47.3^{e}	50.0^{d}
7	11.0^{cde}	18.3^{def}	24.8^{de}	79.8^{ef}	92.5^{e}	28.3^{de}	32.0^{ef}	46.5^{ef}	55.8^{e}	81.0^{f}	26.0^{de}	33.5^{ef}	39.3^{fg}	52.8^{ef}	57.3^{ef}
8	11.0^{cde}	20.0^{ef}	29.0^{e}	85.5^{fg}	93.5^{e}	33.3^{ef}	36.5^{fg}	52.0^{fg}	64.8^{f}	85.0^{fg}	31.8^{ef}	36.8^{f}	45.5^{gh}	56.0^{fh}	62.0^{fg}
9	13.0^{de}	22.3^{f}	30.0^{e}	88.5^{g}	93.5^{e}	35.8^{f}	39.8^{g}	54.0^{g}	72.3^{g}	88.0^{g}	35.3^{f}	39.8^{f}	49.3^{h}	58.0^{fh}	65.0^{g}
10	15.3^{e}	23.8^{f}	30.5^{e}	89.0^{g}	93.8^{e}	37.3^{f}	40.3^{g}	55.8^{g}	76.0^{g}	88.5^{g}	35.8^{f}	39.8^{f}	51.0^{h}	60.3^{h}	66.0^{g}
11	16.0^{e}	24.5^{f}	30.8^{e}	89.0^{g}	93.8^{e}	37.8^{f}	41.3^{g}	55.8^{g}	76.5^{g}	88.5^{g}	36.5^{f}	39.8^{f}	51.3^{h}	60.5^{h}	67.3^{g}

DAS	Trt. 1	Trt. 2	Trt. 3
	(Subtrt.)		
3	0.0^{a}	0.5^{a}	0.3^{a}
4	0.5^{a}	1.8^{a}	1.5^{ab}
5	1.3^{ab}	2.0^{ab}	3.0^{ab}
6	1.3^{ab}	2.0^{ab}	3.3^{abc}
7	2.8^{abc}	4.5^{abc}	3.8^{abc}
8	5.0^{abcd}	6.0^{abcd}	5.0^{abc}
9	6.0^{abcd}	6.3^{abcd}	6.5^{abc}
10	7.5^{bcd}	8.5^{bcd}	8.0^{bc}
11	8.5^{cd}	10.5^{c}	8.8^{bc}
12	10.80^{d}	11.5^{d}	9.8^{c}
SED	3.390	3.390	3.390
LSD	6.659	6.659	6.659

Trt. 1, 2, 3: Sulphuric acid, potassium nitrate and gibberellic acid treatments, respectively. Subtrt. 1, 2, 3, 4, 5: Five sub-treatment levels for each of the treatments, DAS: Days after sowing

Germination and energy period: Ranged between 8-10 days with most treatments taking 9 days after sowing to complete germination. Almost half of the sub-treatments completed their germination period within the arbitrarily chosen 12 day test period (Table 2). Those which could not attain like sub-treatments 1, 2 and 6 were assessed based on their energy period. Generally, the higher concentrated sub-treatments (sub-treatments 4, 5) took a shorter period to attain germination period than the lower concentration sub-treatments (sub-treatments 1, 2).

Germination capacity/percentage (GC): Cumulative germination percentage for the sub-treatments ranged between 9.8 and 93.8. Sub-treatments 6 of T3 and sub-treatment 5 of T1 produced the lowest and the highest, respectively (9.8, 93.8%). Germination capacity for sub-treatments with higher concentration (sub-treatments 4, 5) was far higher than those with lower concentration (ranging between 9.8-39.8%). Sub-treatments 4 and 5 of T1 had the highest value (89.0, 93.8%) followed by T2 (76.5, 88.5) and T3 (60.5, 67.3), respectively (Table 2). Generally the interactions between means of treatments and their sub-treatments including the control showed significant differences at 5% (Table 3). Treatment two (T2) produced the highest combined mean germination of 34.67% while T3 produced the lowest of 28.7% at a co-efficient of variation of 1.7% (Least significant difference = 0.860).

Table 3: ANOVA showing relationship between treatments, sub-treatments, days after sowing (DAS) and interactions @5%

Source of variation	DF	SS	MS	VR	F pr.
Reps stratum	3	159.60	53.20	2.32	
Reps units stratum Trt	2	4297.20	2148.60	93.50	p<0.001
Subtrt.	5	291757.80	58351.55	2539.15	p<0.001
DAS	9	153753.40	17083.71	743.38	p<0.001
Trt. Subtrt.	10	44270.25	4427.02	192.64	p<0.001
Trt. DAS	18	2489.38	138.30	6.02	p<0.001
Subtrt. DAS	45	42417.12	942.60	41.02	p<0.001
Trt. Subtrt. DAS	90	7264.00	80.71	3.51	p<0.001
Residual	537	12340.65	22.98		

Trt: Treatment, pr: Probability, DAS: Days after sowing

Table 4: Germination energy at 7, 10 and 12 days after sowing (DAS)

	Trt. 1						Trt. 2						Trt. 3					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
DAS	(Subtrt.)																	
7	7.3	14.8	19.8	73.0	89.5	2.8	24.3	26.5	40.3	48.3	70.8	4.5	18.5	29.8	32.3	47.3	50.0	3.8
10	13.0	22.3	30.0	88.3	93.5	7.5	35.8	39.8	54.0	72.3	88.0	8.5	35.3	39.8	49.3	58.0	65.0	8.0
12	16.0	24.5	30.0	89.0	93.8	10.8	37.3	41.3	55.8	76.5	88.51	1.5	36.5	39.8	51.3	60.3	67.3	9.8

Germination energy: Germination energy was determined at 7, 10 and 12 days after sowing and ranged between 2.8-89.5, 7.5-93.5 and 9.8-93.8%, respectively. At all the germination energy levels the sub-treatment 6 produced the lowest while sub-treatment 5 of T1 produced the highest values (Table 4). Generally germination energy values increased with increasing concentration for all treatments but sub-treatments 4 and 5 of T1 showed the most dramatic increase followed by T2.

Rate of germination: This was calculated at 25, 50 and 75%. The results ranged between 3 and 12 days for 25%. With the exception of sub-treatment one of T1 and sub-treatment 6, of T_1, T_2 and T_3, all treatments achieved 25% germination. The earliest was sub-treatment 5 of T1 which achieved 25% germination less than 3 days after sowing while sub-treatment 2 was the last at more than 12 days after sowing. For 50%, the results ranged between 3.4 and 10.8 days after sowing and more than half of the sub-treatments did not achieve 50% germination (Table 5). The first to achieve was sub-treatment 5 of T1 at 3.4 days while sub-treatment 3 of T3 was the last at 10.8 days after sowing. Only a few sub-treatments; 4 and 5 of T1 and sub-treatment 4 and 5 of T2 achieved 75% germination. The first to achieve was sub-treatment 5 of T1 while the last was 4 of T2.

Germination value: The germination values were small and ranged between 1.1292 for T3 and 1.3090 for T2. This corresponded with a reverse but higher mean daily germination of 4.167 and 4.258 for T2 and T3, respectively (Table 6).

Coefficient of velocity: Ranged between 35.7 and 69.02. Sub-treatments 6 (control) and 5 of T1 had the lowest and highest values, respectively and showed a regular pattern with increasing concentration. The trend did not follow in the other treatments. Although sub-treatments 6 and 5 of T2 had the lowest and highest values, respectively, sub-treatment 3 had a higher value than 4. Also sub-treatment 1 of T3 had the lowest value within T3 but the highest was sub-treatment 4 (Table 7, 8).

Table 5: Germination rate for treatments

	Treatment 1 (H_2SO_4)						Treatment 2 (GA_3)						Treatment 3 (KNO_3)					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Germination (%)	(Subtrt.)																	
25	0	>12	8.1	4.3	>3	0	7.2	6.6	4.4	4.3	<4	0	7.7	6.4	6.4	4.3	4.4	0
50	0	0	0	4.5	3.4	0	0	0	8.7	7.2	5.6	0	0	0	10.8	7.6	7.0	0
75	0	0	0	7.5	4.9	0	0	0	0	10.9	7.4	0	0	0	0	0	0	0

Table 6: Germination value for treatments

Treatment	Peak value	MDG	Germination value
1	5.000	4.233	1.1812
2	5.455	4.167	1.3090
3	4.808	4.258	1.1292

Table 7: Determination of coefficient of velocity (CV)

	Treatment 1 (H_2SO_4)					Treatment 2 (GA_3)					Treatment 3 (KNO_3)				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
DAS	(Subtrt.)														
3	0.0	0.0	0.0	12.9	49.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	9.2	33.2	62.0	236.0	24.0	47.2	69.2	94.0	116.0	12.0	29.2	27.2	64.0	91.2
5	17.5	41.5	61.5	280.0	385.0	60.0	94.0	142.5	186.5	224.0	29.0	77.5	74.0	144.0	172.5
6	36.0	70.8	99.0	399.0	502.8	95.0	136.8	220.8	267.0	357.0	63.0	141.0	171.0	262.8	262.8
7	51.1	103.6	138.6	511.0	626.5	170.0	185.5	282.1	338.1	495.6	129.5	208.6	223.1	331.1	350.0
8	88.0	146.4	198.4	638.4	740.0	226.4	256.0	372.0	446.4	648.0	208.0	268.0	314.4	422.4	458.4
9	99.0	180.0	261.0	769.5	841.5	299.7	328.5	468.0	583.2	765.0	286.2	331.2	409.5	504.0	558.0
10	130	223.0	300.0	855.0	935.0	358.0	398.0	540.0	723.0	880.0	353.0	398.0	493.0	580.0	650.0
11	168.3	261.8	335.5	979.0	1031.8	410.3	443.3	613.8	836	973.5	393.8	437.8	561.0	663.3	726.0
12	192	294	369.6	1068.0	1125.6	447.6	495.6	669.6	918	1062	438	477.6	615.6	807.6	807.6
Total	781.9	1330.3	1796.8	5604.8	6473.7	2091.1	2091.1	3378	4392.2	5521.1	1912.5	2368.9	2888.8	3697.6	4076.5
	48.87	54.3	58.34	62.98	69.02	56.06	57.75	60.53	57.41	62.38	52.4	59.52	56.31	61.12	60.57

Table 8: Determination of coefficient of velocity

	T1	T2	T3
Sub-treatment DAS	6	6	6
3	0	1.5	0.9
4	2	7.2	6
5	6.5	10	15
6	7.8	12	19.8
7	19.8	31.5	26.6
8	40	48	40
9	54	56.7	58.5
10	75	85	80
11	93.5	115.5	96.8
12	129.6	138	117.6
Total	428.2	505.4	461.2
CV	35.7	42.1	38.4

DISCUSSION

Willan (1987) had suggested the use of energy period as an alternative to germination period in situations where allowing all germinable seeds to germinate could unduly prolong the test period resulting in poor vigour seedlings. The early germination and the short period it took treatments to attain germination period shows a significant improvement over earlier works by Asiedu *et al.* (2011), who reported 6-8 days in a work where hot water was used and Anonymous (2011) who reported a germination period of 21-42 days. A high germination capacity is indicative of high vigour and high field emergence compared with a low germination capacity seen in delayed germination. Treatments with lower germination capacity have lower competitive ability than early emerging once (Pourhadian and Khajehpour, 2010). High germination capacity seen in sub-treatments 4 and 5 of T1 and T2 resulted in rapid and synchronous germination, suggesting that their pre-sowing treatments were more effective (Islam *et al.*, 2009). The high germination capacity observed in the sub-treatments with increasing concentration is also supported by Rahnama-Ghahfarokhi and Tarakkol-Afshari (2007) and Muhammad and Amusa (2003) who worked on GA_3 and sulphuric acid, respectively and observed increased germination capacity with increasing concentration. Schmidt (2000) adds that sulphuric acid is the most effective pre-sowing treatment for a hard seeded fabaceae like *Bauhinia rufescens* and that its ability to increase germination capacity at higher concentrations is because it is able to rupture the seed coat sufficiently to allow imbibitions. Effect at lower concentrations though is the reverse (Keshtkar *et al.*, 2008; Muhammad and Amusa, 2003). Germination energy is a measure of speed of germination with a lower value indicative of vigorous seedlings. Sub-treatments of T1 which attained the highest germination capacity within few days of sowing had lower germination energy and have better chances of survival compared with those which had lower germination capacity (Willan, 1987). Also sub-treatment 5 of T1 which took fewer days to attain 25, 50 and 75% germination rate exhibited greater energy period. Coefficient of velocity of germination increases as more seeds germinate and with shorter germination time (Busso *et al.*, 2005) and decreases as less seeds germinate and with a higher germination time (Isfahan and Shariati, 2007). The lower the value the lower the germination capacity and the longer it takes for seeds to germinate as seen in sub-treatments 1 and 6. Thus, sub-treatment 5 of T1 which had the highest coefficient of velocity of germination, is considered to be a better treatment with a better effect on germination than the other sub-treatments.

CONCLUSION

There were significant differences between the three main treatment types T1 (sulphuric acid), T2 (gibberellic acid) and T3 (potassium nitrate) and within treatments. The interactions between sub-treatments and treatments were also significant. Sub-treatment 5 of T1 out-performed all the other treatments by attaining the highest germination capacity of 93.8%, the highest germination energy at 7, 10 and 12 days after sowing, the lowest germination rate at 25, 50 and 75% as well as the highest coefficient of velocity of germination of 69. Other sub-treatments which also performed well were sub-treatment 4 of T1 (89.0% germination capacity) and sub-treatment 5 of T2 (88.5% germination capacity). The results confirmed earlier observations that germination capacity and other germination assessment parameters improves with increasing concentration where chemical pre-sowing treatments are used and that high concentrations of sulphuric acid provide the most effective pre-sowing treatment in hard seeded seeds. Finally the results showed that potassium nitrate was the least effective chemical pre-sowing treatment compared with sulphuric acid and gibberellic acid in the germination of *Bauhinia rufescens* seeds.

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