Effect of Priming and Scarification Techniques on Seed Germination of Red Maeso (*Maesobotrya barteri*) (Bush cherry) in the Nursery

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Abstract

Poor seed germination has drastically constrained wide spread of Red Maeso (*M*aesobotrya *barteri* /Bush cherry) coupled with rapid industrialization and deforestation. Clonal propagation is the alternative but slow. A seed germination experiment was conducted in the screen house, Federal University of Technology, Owerri. The pre-sowing seed treatments were soaking the seeds of *M. barteri* in cold water (hydropriming) and Potassium chloride solution (halopriming) for 6,12,24 hours respectively, soaking in concentrated sulphuric acid for 1,30, 60 seconds, sand scarification involving seed-sand mixture in a shaker for 30 minutes and control (no treatment applied). All treated seeds were sowed in sawdust as a growth medium. A total of 11 treatments replicated three (3) times was used in the experiment. The experiment lasted for 4 weeks after emergence, during which data were collected to calculate percentage seed emergence (PSE), emergence index (EI), mean emergence time (MET), coefficient velocity of emergence (CVE), root and shoot lengths, seedling fresh and dry weight of Red Maeso. Data collected were analysed using general ANOVA at 5% significance level. Sand scarification, cold water (6 h) and potassium chloride solution (24hs) improved *M. barteri* percentage seed emergence (95%, 95% and 70%), coefficient velocity of emergence (3.46, 3.27 and 3.57), emergence index (549. 0, 581.0 and 392. 0) and mean emergence time (28.8, 30.6 and 28.0 days) and seedling growth parameters respectively.

Keyword: Seed, emergence, priming, *Maesobotrya barteri*, scarification, seedlots, nursery.

Introduction

Tropical forests are an important reservoir of crop and animal biodiversity that play a fundamental role in giving satisfaction to many needs of the people. Nowadays, the non timber forest products, exploited and consumed by Nigeria are becoming very scarce due to high human pressure, over exploitation, non sufficient silvicultural data, climate change highlighted by the recurrent dry and rainy seasons. The situation compromises most local people food security and income (Ouinsavi, 2011). Most edible fruits are commonly collected from in the wild and often protected systems and widely consumed. Some have excellent flavour, attractive fragrance and delicious taste (Pantastico, 1975).

Fruits often form a vital part of human nutrition. Some are eaten as a refreshing delicacy, others make up a meal. In whatever way they are consumed they are valuable because of the minerals and vitamins they contribute to the diet.

Campbell (1986) noted that women and children know many wild fruits which can be used for food and medicine. They know how to gather, prepare and use different kinds of wild fruits. The harvesting, utilization and marketing of indigenous fruit and nuts have been central to the livelihoods of majority of rural communities throughout Africa (Akinnifesi *et al.*, 2007; Leakey *et al.*, 2005) and can make a difference during period of famine and food scarcity (Mithofer and Waibel, 2003, Akinnifesi *et al.*, 2006). Wild harvesting of fruits from forests and semidomesticated trees growing on-farm and homesteads can substantially boost rural income and employment opportunities in Africa (Leakey *et al.*, 2005; Ruiz-Perez *et al.*, 2004). In Nigeria, the species Red Maeso (Plate 1) is under-exploited although the tree is of both medicinal and nutritional importance. It bears edible succulent black-purple berries usually marketed and hawked by women and children, male and female alike.

Rapid and uniform seed emergence is an essential prerequisite to natural volunteer expansion, increased yield, quality and ultimately profits to marketer. This scenario of volunteer seed germination is very rare in Red Maeso and so suggests very serious seed dormancy implication. Several studies on seed dormancy break, germination and emergence revealed the beneficial effects of seed priming by several ways including heat, smoke, soaking leaching, temperature, scarification and including NaCl salinity (Hassanein, 2010). Poor seed germination has drastically constrain wide spread of *M. barteri*. Thus, different scarification techniques were tried to facilitate seed germination in Red Maeso. This study investigated the effect of priming and scarification on the germination behaviour of *M. barteri* seeds and to highlight the effects of scarification techniques on seed emergence of *M.*

barteri in sawdust growth medium in the screen house nursery.

Materials and Methods

The experiment of presowing treatments of *Mesobotrya barteri* was conducted in the Screen house of Federal University of Technology, Owerri, Imo state. The treatments were six seed soaking regimes in cold water and potassium chloride solution for 6, 12 and 24 hours, respectively, three seed soaking regimes in 5% of concentrated sulphuric acid (quick dip, 30 and 60 seconds), sand scarification for 30 minutes and control (unsoaked) seeds. The treatments were 11 replicated 3 times with a total number of 330 fruit seeds and sown in sawdust growth medium.

The fresh fruits were harvested from healthy stands of protected Red Maeso trees University farms, Owerri in Imo state, Nigeria. A total number of three hundred and thirty seeds (330) seedlot was subdivided into 10 seedlot per treatment of three replicates. Each seedlot was introduced into a 500cc beaker containing appropriate solution for specific periods using stop clock and decanted into disposal sink. Sand scarification involved 1:1 seed: sand mixture in a shaker held beaker for 30 minutes. The untreated seedlot was the control. Seeds treated with chemicals were rinsed clean in a running tap. All seeds were spread out dry over night before seeding in sawdust. The experiment lasted for 4 weeks after seed emergence. Data were collected for percentage seed emergence, emergence index, mean emergence time, coefficient velocity of emergence, root length, seedling height, seedling fresh weight and seedling dry weight. All data were analysed using general ANOVA at 5% significance level Genestat 2004 discovery model. The means were separated for significance using Least Significance Difference.

A. Unripped B. Ripped fruits C. loose fruits

Plate 1: Fruits of *Maesobotrya barteri* (Red Maeso/ bush cherry).

Results and Discussion

The results (Table 1) on germination indices suggested that various levels of hydropriming (cold water) and halopriming (Potassium chloride) of various levels 6,12 and 24 hours respectively ; sand scarification, sulphuric scarification and control (unprimed) significantly ($P<0.05$) affected seed percentage emergence, coefficient velocity of emergence, emergence index and mean emergence time of *M. barteri* seeds.

Emergence percentage

Hydroprimed (6h) and sand scarified seeds had 95% emergence respectively and was significantly ($P<0.05$) higher, followed by haloprimed (24h) seeds. Primed KCl (12h) seeds were significantly higher than unprimed (35%).

The results suggested that the highest coefficient velocity of emergence of 3.57 was observed on haloprimed (24h) followed by sand scarification (3.46) and hydroprimed (6h) seeds. Sulpuric acid scarification seeds had the least coefficient velocity of emergence of 2.94.

Emergence index

Emergence index (EI) showed that the highest of 581 was found in the presence of hydroprimed (6h) followed by 549 (sand scarification) and 424(KCl 12h). H_2SO_4 Quick dip) had the least emergence index of 67.

The shortest emergence time of 28.0 and 28.8 days were observed in KCl (24h) and sand scarification respectively and followed by 30.6 of 6h (hydroprimed).

H_2SO_4 Quick dip and control (unprimed) had 34.0 and 33.5 days respectively.

The growth indices of *M. barteri*

Table (2) showed that root length of 6h (8.07) hydroprimed seeds were significantly ($P<0.05$) longer than those of KCl, sulphuric acid treatments and unprimed. The shoot heights of sand scarification (3.53cm) is significantly ($P<0.05$) taller than those haloprimed (12 and 24h; H_2SO_4 and control respectively.

Fresh weight of *M. barteri* seedling from hydoprimed (24h) was 0.33g and significantly ($P<0.05$) bulkier than those of KCl 12h (0.22g) and control (0.24g) respectively.

Dry matter weight from 24h water priming and sand scarification were significantly heavier than those of 12h water and 12h KCl treatments. Furthermore, hydroprimed (6h) seedlings were significantly heavier than those 6hrs of KCl.

Discussion

Poor seed germination naturally exists in *M. barteri.* It is therefore necessary to improve its seed germination and growth. Priming induces a range of biochemical changes in the seed that required initiating the germination process through breaking of dormancy, hydrolysis or metabolism of inhibitors, imbibitions and enzymes activation (Ajouri *et al.,*2004).

Priming is an effective technique that improves germination of several crop species (Singh 1995).

M.barteri seed emergence was improved by several priming methods and duration. These findings are in line with the work of Mubshar *et al*., (2006) which stated that Improvement in priming is affected by some factors such as plant species, priming media type and concentration and priming duration. Potassium chloride improved *M. barteri* emergence, as already reported in Misra and Dwibedi (1980) who found that seed soaking in 2.5% potassium chloride (KCl) for 12 h before sowing increased wheat yield by 15%.

The probable reason for early germination of primed seed maybe due to the completion of pre-germination metabolic activities making the seed ready for radicle protrusion and the primed seed germinated soon after planting compared with untreated dry seed (Arif, 2005).Priming improved the coefficient velocity of emergence of *M. barteri.* Early germination of primed seeds over other treatments is probably due to water and gases entering the embryo early through the cracks and causing a series of enzymatic breakdown and resulted in the transformation of the embryo into a seedling early enough than other seed treatments (Odunfa, 1989).

Primed seeds had lower mean emergence time (MET) compared with unprimed seeds. These positive effects are probably due to the stimulatory effects of priming on the early stages of germination process by mediation of cell division in germinating seeds (Sivritepe *et al*., 2003).

Coefficient of velocity of germination increases as more seeds germinate and with shorter emergence time (Busso *et al.,* 2005) and decreases as less seeds germinate and with a higher germination time (Isfahan and Shariati, 2007). The lower the coefficient velocity of emergence value the lower the germination capacity and the longer it takes for seeds to germinate. Haloprimed (24h) and sand scarification which had the highest coefficient velocity of germination, are considered superior seed germination improvement technique for the nature of seed dormancy in *M. barteri* (RedMaeso). *M. barteri* seeds that were primed had higher shoot height and radicle length than unprimed seeds.

Significant improvement in the growth of the emerging seedlings (root and shoot) may be attributed to early germination induced by primed over unprimed seeds (Farooq *et al*. 2005), which resulted in vigorous seedlings with more root and shoot length than the seedlings from un-primed seeds. Stofella *et al*. (1992) reported also that priming of pepper seeds significantly improved radicle length. It is clear from these results that priming improves germination and growth of M. barteri (Red Maeso).

Conclusion

M. barteri seeds showed improved germination responses to priming techniques over the control. Sand scarification, hydroprimed (6h) and KCl (24h) seed priming significantly increased germination of *M. barteri* seeds. Thus, the priming is an effective method to meet the demands of farmers during the installation of the culture in the field. The technology is simple, cheap and affordable by growers of red maeso (*Maesobotrya barteri*).

Table 1: Emergence indices of *M. barteri*

Treatments	E %	CVE	GI	MET (Days)
H_2O				
6h	95.00	3.27	581.00	30.60
12h	65.00	3.08	424.00	32.50
24h	45.00	3.10	283.00	32.80
KCl				
6h	45.00	3.02	216.00	34.20
12h	65.00	3.01	380.00	32.40
24h	70.00	3.57	392.00	28.00
H_2SO_4				
Quick dip	10.00	2.94	67.00	34.00
30 Sec.	0.00	0.00	0.00	0.00
60 Sec.	0.00	0.00	0.00	0.00
scarification	95.00	3.46	549.00	28.80
Control	35.00	3.01	202.00	33.50
$LSD_{(0.05)}$	15.32	0.10	107.70	2.31

LSD=Least Significant Difference, CVE= Coefficient Velocity of Emergence, EI=Emergence Index, E%=**Emergence percentage,** MET=Mean Emergence Time

Table 2: Growth Parameters of *M. barteri* Seedlings.

Treatment	Shoot Ht (cm)	Root Lt (cm)	Fresh wt (g)	Dry matter wt (g)
H_2O				
6h	3.23	8.07	0.31	0.07
12h	3.00	7.30	0.30	0.05
24h	2.90	5.70	0.33	0.08
KCl				
6h	3.00.	5.57	0.29	0.04
12h	2.60	6.16	0.22	0.05
24h	2.77	6.03	0.27	0.06
H_2S0_4				
Quick dip	2.50	3.23	0.14	0.05
30	0.00	0.00	0.00	0.00
60	0.00	0.00	0.00	0.00
Sand sacrification				
	3.53	7.77	0.31	0.08
Control	2.40	5.57	0.24	0.05
$LSD_{(0.05)}$	O.70	1.86	0.06	0.02

LSD=Least Significant Difference, Ht=Height, Lt=Length, Wt=Weight

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