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Influence of Scarification on Seeds Quality of *Indigofera* sp.

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ABSTRACT

The objective of this research was to determinate effect of various scarification treatments on seed quality and seed germination rate of *Indigofera* sp. This study used a Completely Randomized Design (CRD) with 5 treatments and 3 replications, and continued with Least Significant Difference Test (LSD). The treatments in this study were: R0 (without scarification treatment), R1 (soaked in water for 24 hours), R2 (soaked in 60°C hot water for 10 minutes), R3 (the seed hull was scraped using sandpaper), R4 (soaked in 1% H_2SO_4 solution for 30 minutes). The results showed that soaking the seeds in water for 24 hours gave a significant effect ($P<0.05$) on germination. It was the best treatment for seed germination rate with an average value of 74% germination rate. Treatment of scrapping the seed hull using sandpaper caused the highest number of abnormal sprouts, germination failed seed, and seed pests.

Key Words: Germination Rate, *Indigofera* sp, Scarification

INTRODUCTION

The difficulty of providing large amounts of forage, especially those with high protein content, easy to cultivate, high adaptability, is a common problem in the tropics especially in long dry seasons. To cope with the shortage of forage feed, it is necessary to find alternative feed that available daily and not compete with humans.

The strategy to overcome the problem of animal feed shortage is to cultivate forage crops that are able to adapt to any environmental conditions. Legume is an alternative that can be cultivated as forage that is well adaptable to adverse environmental conditions (Sajimin *et al.* 2006). One example of leguminous trees that can produce forage throughout the year is tarum (*Indigofera* sp.). In supporting the success of planting *Indigofera* sp, seed is one of the important factors. Seed treatment before planting is an important step considering the seed of *Indigofera* sp has a hard outer shell (coat) that becomes a limiting factor against the ingress of water and oxygen into the seed. Hard seeds coat will block an oxygen that is essential in the germination process. So if it is planted without a treatment, the germination viability will be low. Seeds that are ripe and ready to germinate require climatic conditions and a suitable place to grow to break dormancy and begin the germination process. Scarification as a pretreatment is used to break the dormancy of the seed shell, while stratification is used to overcome embryo dormancy (Lakitan 2007). Provision of pre-planted seed treatment enhances the cleavage of seed dormancy in most Indigofera tested. More effective scarification solves dormancy of seeds (Hassen *et al.* 2004).

The objective of this study was to determine the best scarification treatment of indigofera seeds. The best treatment will make indigofera multiplication easier. The ease of indigofera seed multiplication makes the problem of fulfilling the need for forage can be overcome, hence livestock have optimal growth and production.

MATERIAL AND METHODS

This research was conducted in August 2016 in Kalisari Village, Kalirejo Sub-district, Central Lampung District. The seeds of *Indigofera* sp were obtained from Bengkulu. Seedings have been treated on a media that has been covered with paper as a growing medium, given 2 ml of water per day. Observation was done for 7 days and every day data of the number of seeds germinated was taken. This study used a Completely Randomized Design (RAL) with 5 treatments and 3 replications (each unit used 50 indigofera seeds of the same weight, size and color), followed by the Smallest Different Test (BNT). The treatments in this study were: (1) R0 (without treatment); (2) R1 (soaked in water for 24 hours); (3) R2 (soaked in 60°C hot water for 10 minutes); (4) R3 (scraped off the seed hull by abrasive paper); and (5) R4 (soaked in H_2SO_4 1% solution for 30 minutes). The observed variables were growing sprout, abnormal sprouts, hard seeds, dead seeds and seed pests.

RESULTS AND DISCUSSION

Sprouts of *Indigofera* sp.

Sprout capacity is the percentage of the number of seeds germinated normal on a given day divided by the total number of seeds tested multiplied by 100%. The germination rate of a seed can be interpreted as blooming and the development of important parts of an embryo of a seed showing its ability to grow normally in the appropriate environment. (Danuarti 2005).

Table 1. Average germination viability, abnormal sprouts, hard seeds, dead seeds, seeds attacked by pest of *Indigofera* sp.

Variables (%)	Treatment				
	R0	R1	R2	R3	R4
Germination viability	0.00^{a}±0.00	74.00^{d}±8.71	42.67^{c}±6.42	20.67^{b}±4.16	36.67^{b}±5.00
Abnormal germination	0.00±0.00	2.00±1.00	5.33±1.52	6.66±2.08	3.34±1.53
Hard seeds	00.00^{b}±0.00	12.00^{a}±3.46	15.33^{a}±5.03	20.00^{a}±7,21	14.00^{a}±4.00
Dead seeds	0.00^{a}±0.00	1.33^{a}±1.15	14.68^{bc}±5.03	15.33^{b}±3.05	11.33^{b}±4.16
Seed attacked by pest	0.00^{a}±0.00	0.67^{a}±1.15	2.00^{a}±3.46	32.67^{b}±14.18	4.67^{a}±2.03

Different superscript show that the result is significantly different (P<0.05) based on the Least Significance Different (LSD)
R0 = Without treatment
R1 = Soaked in water for 24 hours
R2 = Soaked in 60°C hot water for 10 minutes
R3 = Scraped off seed hull using sandpaper
R4 = Soaked in H_2SO_4 1% solution for 30 minutes

Table 1 shows that the treatment difference causing various quality of *Indigofera* sp. seed. Based on the analysis of variance, soaking the seeds for 24 hours gave a significantly effect (P>0.05) on germination viability of *Indigofera* sp. The average germination viability of *Indigofera* sp. ranged from 0.00 to 74.00%. The lowest germination or no germination was obtained at R0, which seeds were not given

scarification treatment. This suggests that the more effective scarification treatment increases the germination rate. This is in accordance with Hassen *et al.* (2004), the more effective scarification solved the dormancy of the seed, thereby increasing the germination rate.

According to Sutopo (2004), soaking the seed in water can facilitate the absorption of water by seed, so that the seed shell that prevents water absorption becomes soft and weakens. It also can be used for cleaning the seed so that the seeds are free from pathogens that inhibit the germination of seed. According to Schmidt (2002), soaked with stagnant or flowing water is called a leaching method of germination inhibitors in fruits and seeds. Soaking in cold water aims to soften the hard seed skin and may be able to remove the inhibiting substance that lines the outer part of the skin, while immersion with hot water, the seed shell becomes soft and the inhibition occurs after the water cools down (Bonner *et al.* 1994). Water plays a role in softening the seed coat, facilitate the entry of O_2, dilution of protoplasm for function activities, and transportation of food. O_2 is needed in the oxidation process to form germination energy, so that with the ingress of water into the seed will start a germination process (Kusmiyati 2007). Hot water breaks the physical dormancy of the legume seed through the voltage that causes the breakage of the macrosclereids layer. This method is most effective when the seeds are soaked in hot water. Immediate immersion is also better for preventing damage to the embryo because with the longest immersion, the heat is passed into the embryo so that it can cause damage. High temperatures can damage seeds with thin skin, so the sensitivity to the temperature varies by type depending on the type of seed itself. Generally dry, ripe or leathery seeds are relatively thick tolerant to immersion in boiling water (Schmidt 2000). This research used hot water with temperature of 60°C immerse for 10 minute and at room temperature (27°C) used water with temperature 8°C immerse for 24 hour.

The immersion treatment with H_2SO_4 also gave a fairly good response, according to Sutopo (2004), the treatment by using chemicals is often used to break the dormancy of the seeds. The goal is to make the seed or seed skin becomes easier to enter the water in the process imbibisi. Strongly acidic solutions such as H_2SO_4 are often used with varying concentrations until concentrated depending on the type of seed being treated, so the seed shell becomes soft. Besides, the chemical solution used can also kill the fungus or bacteria that can make dormant seeds. Sadjad *et al.* (1975) stated that the chemical treatments used can liberate the hydrophilic colloid so that the inhibition pressure increases and will increase the metabolism of the seed. Rozi (2003) said that treatment using H_2SO_4 in seeds aimed to damage the seed shell, but if the concentration is too high or duration of treatment is long, it can cause damage to the embryo. In this case the seeds will be damaged and can not grow.

Abnormal sprouts

An abnormal germination is a sprout that does not show any potency to develop into a normal sprout. Characteristics of abnormal germination include broken sprouts without cotyledon, embryo rupture, and short primary roots, form of defective sprouts, development of important parts weak and less balanced. Plumula twisted, hypocotyl, epicotyl, bent cotyledons, short roots, pygmy sprouts, sprouts do not form chlorophyll, soft sprouts (Elam & Land 2000).

Table 1 shows that the different treatment of *Indigofera* sp.caused variations in abnormal germination values. The abnormal germination rate ranged from 0.00 to 6.66%. Based on the analysis of variance, the scarification treatment gave no significant effect

(P<0.05) to the abnormal sprouts of *Indigofera* sp. The highest abnormal germination occurred at the treatment of R3 when the hull was removed using sandpaper, while the lowest abnormal germination obtained at treatment R0 (without treatment). This suggests that scraping is less effective to increase seedling germination, scraping is thought to cause damage to the seed structure. This corresponds to Hassen *et al.* (2008) report that damage to the region microphylar where a radicle may damage the seed, whereas damage to the cotyledons will not affect germination.

Hard seed coat

Hard seeds are seeds that remain hard until the end of the testing period. The seed is not able to absorb the visible water from the size of the seed is not expanding, and when compared with the fresh seed does not grow the size of the smaller hard seed. This is because the skin of the seed is impermeable to gas and water.

Table 1 shows that the difference in treatment offseeds *Indigofera* sp.causes the variation of hard seed values. The average of hard seeds ranged from 12.00 to 100.00%. Based on analysis result of variety, scarification treatment gave a significantly effect (P>0.01) to hard seed of *Indigofera* sp., highest hard seed obtained at treatment of R0 that is without treatment, while lowest hard seed obtained at treatment of R1 that is soaking treatment using water for 24 hour. This suggests that soaking before seeding can reduce the number of hard seeds. The results showed that the number of hard seeds in treatment R0 is 100%. This is because seed treatment before planting is an important step considering the seeds of *Indigofera* sp. have a hard outer shell. Kartasapoetra (2003) stated that the hardness of the seed shell can cause mechanical resistance, and cause the embryo can not tear the skin which means it also can not get out to grow properly. A hard seed coat is a limiting factor against the ingress of water and oxygen into the seed. Hard seeds are hard to be penetrated and oxygen is essential in the germination process. If planted without treatment then the germination will be low. This is consistent with Hassen *et al.* (2006) giving pre-planted seed treatment increased the split of seed dormancy in most *Indigofera* sp. tested. Scarification is more effective at solving seed dormancy. Low germination may be due to dormancy of legume seeds, hard seeds, poor storage conditions, and seed quality (seed).

Failed germination seed

Table 1 shows that the different treatment of *Indigofera* sp. result the variation in the value of dead seeds. The average of dead seeds ranged from 0.00 to 15.33%. Based on analysis result of variety, scarification treatment gave a significant effect (P>0.05) to dead seed of Indigofera sp. Highest dead seed was obtained at treatment of R3 that was scraped skin using sandpaper, while seed of lowest dead seed was obtained at treatment R0 i.e. without treatment. Sanding can cause excess water absorption in watering, which will cause decay and death of seeds. The number of dead seeds also indicates damage to the seed structure, thus affecting germination. This is consistent with Schmidt's (2002) statement, that damage microphylar where there is a radicle at the time of sanding will damage the seed.

Seeds pest

Seeds infested by pests are seeds containing insect larvae, fungi or indicate the presence of insect attacks that affect germination. Table 1 shows that the different treatment of *Indigofera* sp.caused variations in the pest attack. The average seedlings of pests ranged from 0.00 to 15.33%. Based on the analysis of variety, the treatment of scarification gave no significant effect (P>0.05) to the seeds attacked by pests. The highest pest infestation seeds obtained in R3 treatment were scraped off the hull using sandpaper, with an average of 32.47% indicating less effective method to increase germination viability in *Indigofera* sp. As the treatment caused a high number of seeds attacked by pests or fungi, thus causing the seeds to not grow. The growth of fungi in the seeds can lead to decreased germination, discoloration, temperature and humidity increase in seeds, chemical changes in seeds and production and accumulation of mycotoxins in seeds (Sutjiati & Saenong 2002 in Budiarti *et al.* 2013). According to Hassen *et al.* (2007), open seed conditions cause fungal attacks on seeds, resulting in damaged seeds and the fungal spores can be contagious on other seeds.

CONCLUSION

It can be concluded that scarification on *Indigofera* sp.seeds significantly affected the percentage of germination, hard seeds, dead seeds but did not significantly affect abnormal germination and number of seeds that attacked by pests. The highest germination was found in *Indigofera* at R1 treatment that was soaked in water for 24 hours, with average germination rate of 74.00%. The treatment which gave the highest percentage to abnormal germination, dead seed and seed attacked by pest was R4 treatment that was scraped off the seed hull using sandpaper, with an average of 6.66% abnormal sprouts, 15.33% dead seed average, and average seed pests of 32.47%. The treatment which gave the highest response to hard seed was at R0 (without treatment), with an average of 100.00% hard seed.

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DISCUSSION

Question

In your research, the seeds were soaked for 24 hours, in Lolitkapo, the seeds were soaked for six hours; why did you soak the seed for twenty four hours?

Answer

This is different research; we used chemical H_2SO_4 and mechanical treatment.