Increasing viability of cinnamon \([Cinnamomum burmanii \text{ L.}]\) seed by soaking in rabbit urine

E Mayura\(^1\)* and H Idris\(^1\)

\(^1\)Experimental Farm of the Spice and Medicinal Plants Research Institute Laing, Kapten Bahar Hamid St, Solok, West Sumatera, Indonesia

Email: elizamayura@gmail.com

Abstract. Cinnamon is the main commodity of West Sumatra and Indonesia is the largest exporter of world markets. Cinnamon seeds are recalcitrant, so the fruit that has fallen out and is not fresh has experienced a decline in germination power. To improve the viability of cinnamon seeds, it is necessary to soak with rabbit urine. For this reason, a study was conducted to improve the quality of cinnamon seed viability through soaking in rabbit urine. This research was conducted at Balitro Laing Solok Experimental Garden from October 2017 to February 2018. The study used a completely randomized design [CRD] with 5 treatments namely rabbit urine dose: \([1]\) without urine/water, \([2]\) dose of 10 ml/l, \([3]\) dose of 15 ml/l \([4]\) dose of 20 ml/l \([5]\) Dose of 25 ml/l, 30 seeds per box/plot and repeated 7 times. Seeds were used 7 days after harvest. Variables measured included: germination, vegetative growth of seeds [seed height, leaf number, leaf length, leaf width, stem diameter, number of roots, root length and biomass], chlorophyll analysis. The results showed that the seed germination was 60% while the vegetative growth of seed height, number of leaves, leaf length, leaf width, and stem diameter were found the best at doses 25 ml/l as well as for the variable root length, number of roots, whole wet weight, stem wet weight + leaves, root wet weight, whole dry weight, dry weight of stem + leaves, and dry weight of the root

1. Introduction

Cinnamon is one type of spice plant that is widely cultivated in Indonesia, its bark is usually used as a cooking spice. The cinnamon plant can grow in areas up to a height of 1.500 m above sea level with a height of 1-12 m. the cinnamon plant has an elliptical green leaf and the young leaves are red. In Indonesia, there are several types of cinnamon including \(Cinnamomum burmanii\). This type of cinnamon is different from \(Cinnamomum zeylanicum\) and \(Cinnamomum cassia\) and several other types of cinnamon plants native to Indonesia [1].

\(Cinnamomum burmanii\) is a superior commodity, especially in the Provinces of West Sumatra and Jambi [Kerinci Regency], which is a center for Indonesian cinnamon production, with farmer income from cinnamon yields of 26.93% of the results of other farming businesses, or 16, 03% of total farmer income. Although it is not the main income, its function is very important as a reserve of funds to meet the needs of sudden and expensive costs.

The development of \(C. burmanii\) plants can be done generatively [through seeds] and vegetatively [grafts, cuttings, and root buds]. Until now cinnamon propagation technology is not yet available to obtain quality seeds, age of seed harvest, and selected seeds following the applicable laws and regulations. The optimal age of harvest of cinnamon seeds is not yet available, as are other factors that affect cinnamon seed germination such as fruit maturity, temperature, and growing media.
Cinnamon is a recalcitrant plant, so fruits that have fallen out and are not fresh may have experienced a decline in germination [2]. Recalcitrant seeds are very sensitive to drought and will experience a setback at low water levels and temperatures [3]. The storage time has a significant to a very significant effect on germination, vigor index, growth speed, and sprout growth rate [4]. In *Avicennia marina* plants which are classified as recalcitrant seeds are stored for 2 weeks, their germination is only 30% [5]. Other recalcitrant plants such as clover seed weight 0.5-0.8 g, length 1.8-3.5 cm, diameter 0.8-1.39 cm, the minimum water content of 80%, germination capacity 85%, seeds must grow within 3 weeks after seeding [6].

The seeds of *C. burmanii* have the same characteristics as *C. zeylanicum*, so the method of handling is the same. Cinnamon seeds that have been peeled [discarded flesh of the fruit] will quickly lose its growth and must be sown immediately. *C. zeylanicum* seeds that have been peeled and planted directly on the sand media can germinate in 15-20 days with an average percentage of germination of 57-99% [7]. The difference in the percentage of germination is caused by differences in seed size. The selection and characterization results of *C. zeylanicum* germplasm collection in the Laing Experimental Farm were obtained by prospective superior varieties with different fruit characteristics [shape, size, weight] [6] [7]. The germination of cinnamon seeds obtained from outside the area with a storage period before the seedlings, the success rate is unknown. Likewise, the optimal growth media for seed growth at a later stage has also not been obtained.

In certain seeds, the germination media can cause the seeds to become dormant [8], [9]. Sand growing media is more suitable to use as seed germination media because it produces the highest percentage of nutmeg seed germinate [83.88%] and a shorter seed germination period of 65 the day Rafter nursery while good growing media for nutmeg seedling growth up to 90 days after sprouting is sand + husk charcoal [1:1] [10]. Cinnamon germination power reaches an average of 86.67% in soil, sand and sawdust media [11].

The high germination capacity of seeds needs to be supported by the provision of optimal growth media to obtain seeds that are ready to channel. The medium which is widely used in hatching recalcitrant plants such as cloves and nutmeg is soil and manure [1:1 for nutmeg, 2:1 for cloves]. While the optimal growth media for *C. burmanii* cinnamon seed is not yet available. For this reason, a study was conducted to improve the viability of *C. burmanii cinnamon* through soaking in rabbit urine.

Rabbit urine is one of the liquid organic fertilizers which have abundant nitrogen [N] content where the content is important for plants. Nitrogen element is needed by plants for the formation of vegetative parts of plants, such as leaves, stems, and roots and plays a vital role when plants carry out photosynthesis, as forming chlorophyll. Rabbit urine also contains auxin growth regulators. Based on the results of a study by the livestock research center in 2005, rabbit manure and urine can be used as organic pesticides and fertilizers. That is because the nitrogen content, especially in rabbit urine, is higher than that in other herbivore animals such as cattle and goats. The content of rabbit urine is N: 2.72%, P: 1.1%, and K: 0.5% [12]. Besides being able to improve soil structure, rabbit urine is also useful for liquid organic fertilizer, increasing plant growth, pre-growth herbicides, and can control disease and pests, repel rat pests, stink bugs and other small insect pests [13].

Based on the results of studies of the livestock research center in the year 2005 that rabbit droppings and urine can be utilized as organic pesticides and fertilizers. That is because nitrogen levels in particular in rabbit urine are higher than other herbivore animals such as cows and goats. That is because rabbits only eat leaves. Content of rabbit urine are N: 2.72%, P: 1.1%, and K: 0.5% [12]. Besides being able to improve soil structure, rabbit urine is also useful for liquid organic fertilizer, pre-growth herbicides, and disease-pest control, rat pest as well as stink bugs and other small insects pest repellent [13].

2. Materials and methods
The study was conducted at the Greenhouse in Experimental Station of Balittro Laing Solok, West Sumatra, from October 2017 to February 2018. The seeds used came from the Kerinci Regency's PIT
[Selected Tree] Garden. Other materials and tools, namely: rabbit urine, sand, hoe, plastic nursery tub, sand sieve, and bucket. This study used a completely randomized design [CRD], one factor with seven replications the treatment given is in the form of rabbit urine with five doses of treatment, namely: [1] No urine/water, [2] Dose 10 ml/l, [3] Dose 15 ml/l, [4] Dose 20 ml/l, [5] A dose of 25 ml/l, each with 30 seeds per box/plot. Repeated 7 times. How it works The seeds that have been peeled are cleaned and then treated by soaking them in rabbit urine according to the treatment dose for 60 minutes, after which the seeds are sown.

The parameters observed included germination and vegetative growth of seeds [seed height, number of leaves, leaf length, leaf width, stem diameter, number of roots, root length and biomass]. Results of analysis of variance if the F count is greater than the F table at the 5% level then it is tested with Duncan's Multiple Range Test.

3. Results and Discussion
From the results of research carried out, it turns out that immersion of cinnamon seeds with rabbit urine shows a significant effect on the germination and vegetative growth of seeds, with control [without soaking] shown in Table 1.

Table 1. Immersion dose of rabbit urine effect on vegetative growth 3 months after seedling.

| Rabbit urine dose | Plant height [cm] | Number of leaves | Leaf Length [cm] | Leaf Width [cm] | Stem Diameter [cm] |
|-------------------|-------------------|------------------|------------------|-----------------|-------------------|
| Dose 10 ml        | 12.02 d           | 4.99 c           | 5.62 b           | 2.09 b          | 1.98 bc           |
| Dose 15 ml        | 12.55 c           | 5.14 bc          | 5.75 b           | 2.14 b          | 2.06 b            |
| Dose 20 ml        | 13.08 b           | 5.38 bc          | 5.83 ab          | 2.23 b          | 1.92 bc           |
| Dose 25 ml        | 13.45 a           | 5.69 a           | 6.09 a           | 2.57 a          | 2.62 a            |
| Control           | 11.17 e           | 4.41 d           | 5.04 c           | 1.75 c          | 1.80 c            |
| KK %              | 12.66             | 10.03            | 10.17            | 12.80           | 9.69              |

Note: Number followed by the same letter in one column not significantly different from the 5% DMRT test rate.

Soaking with 25 ml rabbit urine showed that the vegetative growth of seedling height, number of leaves, leaf length, and leaf width and stem diameter of cinnamon seed was better than without treatment. The number of leaves as an indicator of plant height functions as a light receiver and where the photosynthesis process is carried out. Treatment with 25 ml urine concentration produces more leaves than others; this is because the P content in rabbit urine is an ATP energy source for photosynthesis. A large number of leaves will affect the photosynthates produced because leaves are the main producer of photosynthesis [15]. From the results of research conducted by Mayura [16], the type of urine also influences seed growth where pure urine produces vegetative growth better than fermented rabbit urine. Karo [17] suggested that rabbit urine could influence the growth of potato tuber weights, by watering this as stated by Setyanto et al. [18] that the nitrogen content contained in rabbit urine can improve soil structure and play a role in increasing plant growth.

Table 2 shows that the best 25 ml dose of rabbit urine at the number of roots, root length, root fresh weight, plant dry weight, and root dry weight, while the fresh weight of the plant did not show a significant effect. The effect of soaking with various doses of rabbit urine is estimated because rabbit urine which can be as a fertilizer that contains organic material C/N: [10-12%] and pH 6.47-7.52 and can help improve soil fertility [19]. Besides, it is allegedly because, in rabbit urine which is also
commonly used as liquid organic fertilizer, there are macro and micronutrients needed by plants so that it can increase plant growth shown with good root development.

**Table 2.** Effect of rabbit urine soaking dose on vegetative growth of cinnamon seedling 3 months after seeding.

| Treatment [ml] | Number of Roots | Height of roots [cm] | Fresh weight of the plant [g] | Fresh weight of roots [g] | the dry weight of plants [g] | the dry weight of roots [g] |
|----------------|-----------------|----------------------|-------------------------------|--------------------------|-------------------------------|---------------------------|
| Dose10         | 22.90 bc        | 12.35 c              | 1.45 a                        | 0.33 d                   | 0.32 c                        | 0.07 b                    |
| Dose15         | 22.47 bc        | 15.30 b              | 1.58 a                        | 0.40 c                   | 0.34 b                        | 0.07 b                    |
| Dose20         | 23.69 ab        | 15.78 b              | 1.63 a                        | 0.42 b                   | 0.35 b                        | 0.08 b                    |
| Dose 25        | 26.91 a         | 17.39 a              | 1.94 a                        | 0.50 a                   | 0.38 a                        | 0.92 a                    |
| Control        | 19.53 c         | 10.61 d              | 1.06 a                        | 0.26 e                   | 0.27 a                        | 0.05 b                    |

KK % 11.87 8.48 9.15 8.55 8.59 14.08

Note: Number followed by the same letter in one column not significantly different from the 5% DMRT test rate.

4. Conclusion
The results of the study concluded that soaking cinnamon seed with 25 ml rabbit urine dose showed 60% seed germination and vegetative growth in seed height, the number of leaves, leaf length, leaf width, stem diameter, and cinnamon plant biomass is better than without treatment.

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Acknowledgment.
The authors would like to say thank to Zulkarnain, SP as the technician and researcher in the Green House and Experimental Farm of the Spice and Medicinal Plants Research Institute Laing, Solok, West Sumatera, Indonesia.