Agro Bali : Agricultural Journal
Vol. 6 No. 2: 385-394, July 2023
e-ISSN 2655-853X
https://doi.org/10.37637/ab.v6i2.1159

Potential Seed Source for the Preservation of Bitti (*Vitex cofassus*) in the Community Forest of Burau District, South Sulawesi, Indonesia

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Article history: submitted: December 27, 2022; accepted: July 25, 2023; available online: July 31, 2023

Abstract. Bitti (*Vitex cofassus*) is one of the most important tree species in Sulawesi, or in some areas, it is also known as gofasa. Bitti wood is also widely used for other uses, such as building timber and carpentry wood. This study aimed to determine the potential source of beetroot (Vitex cofassus) seeds in the Community Forest of Burau Village. This study used the exploratory method by making plots using purposive sampling on a 100m x 100m plot with 38 sampling plots.. Data analysis of potential beetroot seed sources includes measuring diameter, tree height, tillering potential, and determining scoring based on the presence of seeds to determine the possibility of Bitti tree seeds. The results of this study showed that the phenotypic characteristics of the 18 plots that had been selected were a total diameter of 524.44, an entire tree height of 272 m, and a branch-free height of 50.5 m of the 18 parent trees that have been identified, then selected with the criteria of having fruit and saplings. Bitti trees have the most significant tillering potential, found in plot 21 with 0.005% of tillers and 0.0097% of the fruit. Other results obtained the highest value in the parent tree with a score of 73 with a potential class of 5. Genetic and environmental factors can affect plant growth, so the selection of seed source trees to get Bitti mother plants with good phenotypic quality will produce quality seeds.
Keywords: fruit; phenotype; potential plant; sampling

INTRODUCTION

Currently, in the development of human life, forest areas are increasingly being used to meet the needs of life. The use of forests has been carried out in varying ways and intensities. Utilizing the forest is not limited to local communities around the forest. However, currently, the forest has also been used by the community nationally. Forest resource management aims to provide community welfare while maintaining a forest area's main characteristics and functions. One of the functions of forest areas that support economic development is the production of timber and non-timber forest products. (Alviya, 2011) states that the timber industry was once a parameter for increasing state revenues of the forestry sector during the period 1967-1999. Industrial plantation forests are assumed to have higher productivity and efficiency than plantation forests grown by smallholder farmers (Pirard et al., 2016).

Community plantation forests are recognized as one of Indonesia's solutions to forestry problems (Widarti, 2015) . Sulawesi has several community forest areas with the potential for local timber with high economic value, especially East Luwu. One of Sulawesi's typical and endemic plants is Bitti, whose family is the same as teak, *Verbenaceae*. This local Bitti tree (*Vitex cofassus*) is one of South Sulawesi's mainstays and superior wood species (Langga et al., 2012). The spread of Bitti wood plants in South Sulawesi is found in several regencies: Pangkep, Pinrang, Bantaeng, Enrekang, Bulukumba, Sidrap, and Selayar (Darmojo, 2013). The people of South Sulawesi generally only use Bitti wood as a building material. Bitti, in the world of forestry, is one of the plants widely used by the community, especially in carpentry. Bitti is a prima donna because its quality is a type of solid class II wood (Darmojo, 2013). Another potential use for Bitti wood is to use it as a plant that has a toxic effect on cancer cells by utilizing the bark (Ilyas et al., 2015).

The habitat of this tree is in lowland forests up to an altitude of 2000 meters above sea level. Bitti plants can reach 40 m in Height and 130 cm in diameter and begin to

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v6i2.1159

bear fruit at the age of five years (Widarti, 2015) . Bitti can grow on dry, rocky soils with clay to sandy soil texture and in rainfall-type areas A, B, and C (Darmojo, 2013). This tree is easy to grow, does not require high growing requirements, and is included in plants with moderate growth speed. This type is resistant to fire. When burned, it will immediately sprout back. Therefore, this breed has the potential to be developed because of its easy-to-grow nature. The wood has numerous branches and leaves that are wide enough that even the trunk of the Bitti tree is tall, straight, white in color, and firm (Sejati et al., 2022).

Bitti is essential to cultivate because the benefits of Bitti are so great that the demand for Bitti from year to year continues to increase. However, the availability of Bitti wood is becoming scarce due to the lack of rejuvenation or replanting (Alam et al., 2021). This also indicates that Bitti crop production in community forests cannot meet market needs, resulting in overexploitation in natural woods. Plant propagation generally uses wild saplings pulled out from under the stand so that the quality is less guaranteed. This condition causes a decrease in the rate of bits plants (Gusmiaty et al., 2012), so it will also impact the production of potential seeds from the community and natural forests.

In general, the frequency of fruiting of Bitti trees in one year is one time a year, and fruiting varies in each location depending on the conditions of the place and climate (Rambakila, 2018). Fruiting frequencies are closely related to the potential source of seeds. Collecting data on the physical character of Bitti trees by sampling is one technique for producing Bitti plant seeds. According to Wahyuni et al., (2021), A seed harvested when it is physiologically ripe will show optimal growth and production. Growth and development will not be optimal if the seeds are harvested before and after physiological maturity. In this study, a new thing that needs to be studied is the determination of seed source trees in good categories with phenotypic factors related to improving seed quality. So this study aims to examine the potential related to the number of saplings and the number of fruits related to the probable source of Bitti seeds in the community forest of Burau Village. This research provides benefits as databased and information on the preservation of Bitti plants and the management of seed sources for seed breeders in South Sulawesi.

METHODS

Time and Location of Research

This research was conducted in April 2021 in Cendana Village, Burau District, East Luwu Regency. The tools used in this study were a compass, GPS, Roll meter, Tape meter, Stationery, Machete, Camera, wooden stakes, soil thermometer, and hagameter materials used in this study of Tally sheets and rapia ropes.

Data Collection

Data collection in the field begins with observations to determine the state of the environment around the People's Forest. Observation and survey activities include regional comments to identify potential sources of Bitti seeds. Data collection using the purposive sampling technique by creating one plot measuring 100 m x 100 m consisting of 38 sampling plots (Figure 1). The data collected are obtained directly from the field, such as Bitti stands, tree diameter, tree height, the total number of fruit saplings, and coordinate points. At the same time, secondary data includes data obtained from related literature such as journals, books, physical field conditions, rainfall, temperature, and humidity.

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v6i2.1159

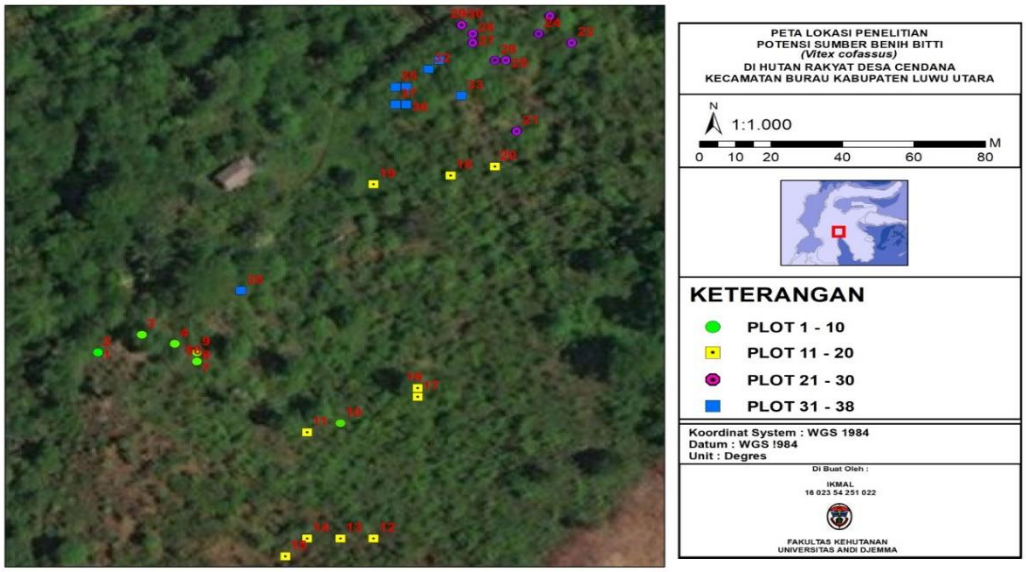


Figure 1. Research location map

Research Design

The placement of subplots of 5 m x 5 m is adjusted to the presence of Bitti trees. Likewise, with a subplot measuring 1 m x 1 m (Figure 2).

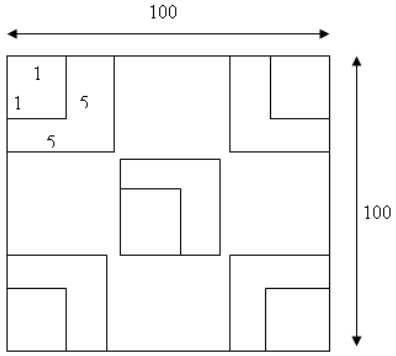


Figure 2. Observation plot

Description:
a. Plot 5m x 5m to retrieve data on the number of saplings.
b. Plot 1m x 1m to retrieve data on the number of fruits and soil samples using sample rings.

The determination of plants is carried out by purposive sampling based on the presence of Bitti plants and taking the coordinates of each sample by observing, researching, and measuring.

Data Analysis

Several analyses were carried out to determine the potential source of Bitti seeds. The formula for each of these analyses is:

1. Tree Diameter (Suparyanto dan Rosad, 2020):

$D = K/\pi$

Description:
D : Tree diameter (cm)
K : Circumference of the tree
Π : 3.14

2. Plant Height

The Height of a tree is the shortest distance between a point and its projection point on a flat plane (Suparyanto dan Rosad, 2020) using the following formula :

$$\text{Tree Height} = \text{branch free height} - \text{base height}$$

3. Potential of Tillers and Fruits

To calculate the potential of saplings and fruits using the following formula:

$$\text{Potential Tillers (PT)} = \frac{\text{Number of saplings}}{\text{Area}} \text{ x } 100\%$$

$$\text{Potential of Fruits (PF)} = \frac{\text{Number of fruits}}{\text{Area}} \text{ x } 100\%$$

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v6i2.1159

4. Scoring

The reference to scoring (Benchmarking or Score making), from observations (Tally sheet) cutting on trees that correspond to the scoring table (Table 1) on trees that have the potential to be seed stands (Hidayat, 2010).

Table 1. Scoring

No	Character	Scoring system	Score
1	Plant height	< 105%	4
		105-110%	12
		111-115%	16
		116-120%	18
		>121%	20
2	Branch free height	<35%	3
		35-45%	6
		46-55%	9
		56-65%	12
		>66%	15
3	Characteristic bar straightness	Straight from the bottom to the top	10
		Straight from bottom to 75%	7
		Straight from bottom to 50%	5
		Straight from bottom to 25%	3
4	Surface	Fine	5
		Slightly smooth	2
5	Diameter	<105%	5
		105-110%	7
		111-115%	17
		116-120%	25
		>121%	30
6	Health condition	Healthy (area of signs of pest attack <20%)	5
		Unhealthy (extensive signs of pest attack> 20%)	0

Percentage comparison of the assessment of the phenotype character of the tree and the comparison tree using the following formula (Hasibuan et al., 2019):

- Total Plant Height = $\frac{\text{Tree Trunk Height}}{\text{Average full Height of the comparison tree}}$ x 100%
- Branch free Height = $\frac{\text{Tree Branch Free Height}}{\text{Comparator tree branch-free Height}} x\ 100\%$
- Trunk diameter = $\frac{\text{Tree trunk diameter}}{\text{The average diameter of the shadow of the comparison tree}} x\ 100\%$

5. Determination of Potential

The potential of Bitti stands as a seed source is determined by the scoring method against a parameter. The scoring method ranges from lowest (1) to highest (5) with five classes, namely (1) 1 – 15 Not good categories, (2) 16 – 31 Not good categories, (3) 32 – 47 Fairly good categories, (4) 48 – 63 Good category, and (5) 64 – 79 Very good category (Sugiyono, 2013). The score value is seen from the number of saplings, fruit, diameter, total Height, free Height of branches, and volume. According to

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v6i2.1159

(Kurniawati Purwaka & Pande Gede, 2013), before determining the potential class, the Bitti tree with the best character is first selected, namely the nature of the Bitti stand, age, diameter, number of saplings, and number of fruits.

RESULT AND DISCUSSION

Characteristics of Bitti Tree Phenotypes

Based on the results of research and data analysis regarding the phenotype characteristics of Bitti Stands (*Vitex cofassus*) in People's Forests in Cendana Village, Burau District, East Luwu Regency, which became parameters in the tree assessment, namely diameter, total Height, and branch-free Height, results were obtained as stated in Table 2.

Table 2. Characteristics of Bitti Tree Phenotypes

No	Plot	Diameter (cm)	Total Height (m)	Branch Free Height (m)
1	4	37.26	16	1
2	5	47.77	15	6
3	6	28.66	16	3
4	8	25.79	12	1.5
5	9	45.22	16	1
6	11	35.03	15	2
7	20	28.34	9	1
8	21	25.47	15	1
9	22	26.11	12	2
10	23	20.7	7	1
11	27	22.92	11	5
12	29	29.29	21	2
13	32	23.56	21	8
14	33	23.56	13	2
15	34	30.25	14	1
16	35	24.84	21	6
17	36	21.97	20	5
18	37	27.7	18	2
	Total	524.44	272	50.5

Source: primary data

The implementation of the search for the mother tree in the observation path as a candidate for the seed source tree is carried out by choosing a good seed source tree by determining the comparison tree in the observation plot. Then measurements are made, including the tree's total Height, diameter, branch-free Height, stem straightness, trunk surface, and tree health condition on a tree that is feasible or meets the criteria as a seed source tree. Assessment of the phenotype character of a tree is carried out to determine the form of growth contained in a tree (Robiyati et al., 2015).

The existence of differences in environmental conditions can cause discrepancies and ecological influences on the growth of total Height and diameter between each sampled tree. Trees are chosen for seed source purposes that phenotypically have superior characteristics to the average similar tree around them. Based on the results of the survey of 38 plots of phenotype characteristics of potential stands in Table 2 above, it is known that the phenotype characteristics of the standing potential of the 18 plots that have been selected are a total diameter of 524.44, an entire tree height of

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v6i2.1159

272 m and a branch-free height of 50.5 m. According to Awaludin et al., (2018), the growth of the tree's height is generally influenced by the difference in the speed of formation of foliage that is very sensitive to the place of growth. The diameter and Height of the tree can be one of the essential phenotype characteristics in the assessment of the parent tree as a source of seed.

Percentage of Bitti saplings and Fruits

Based on the research and data analysis results regarding the percentage of Bitti seed stands (*Vitex copasssus*) in the People's Forest in Cendana Village, Burau District, East Luwu Regency, the results were obtained as stated in figure 3.

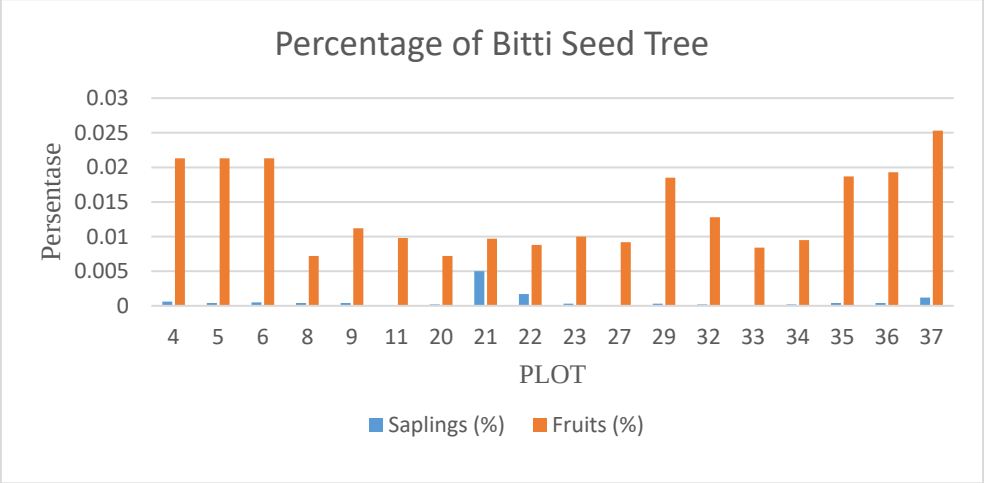
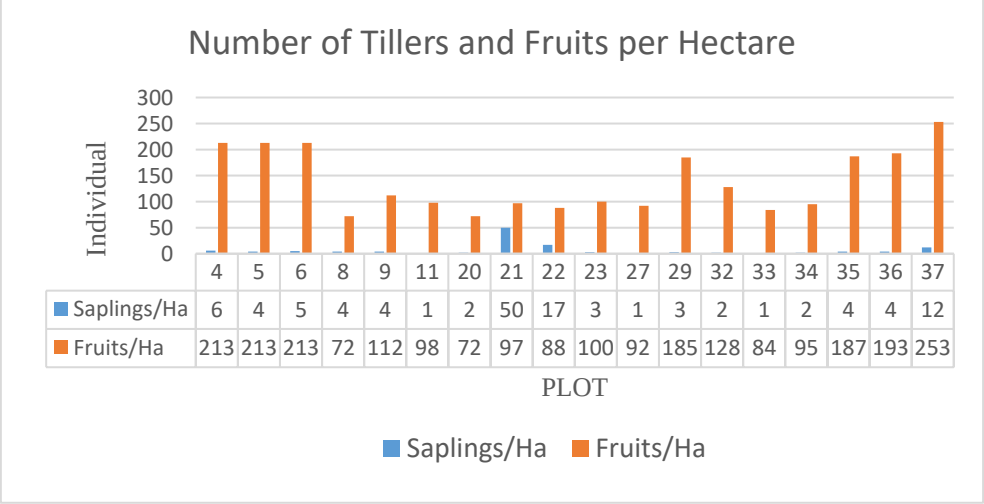


Figure 3. Percentage of saplings and fruits of Bitti tree



	4	5	6	8	9	11	20	21	22	23	27	29	32	33	34	35	36	37
Saplings/Ha	6	4	5	4	4	1	2	50	17	3	1	3	2	1	2	4	4	12
Fruits/Ha	213	213	213	72	112	98	72	97	88	100	92	185	128	84	95	187	193	253

Figure 4. The number of individual saplings and fruits of the Bitti tree

Based on the results of the survey of 38 plots of percent of the potential number of saplings in Figure 2, it is known that the potential for saplings from the 18 plots that have been selected is 0.125% of saplings. The most significant potential for saplings is found in plot 21, with the number of saplings as much as 0.005% saplings, and the percentage of the number of fruits 0.0097%, with a diameter of 25.47 cm, a total height of 15 m, and tuberculosis of 1 m, this is due to the absence of maintenance of stands, so it needs care in the form of pruning. At the same time, the smallest potential saplings are found in plots 11, 27, and 33, with the number of saplings as much as 0.0001%. This is because the Bitti seeds that fall from the Bitti stand are blocked by grass that grows around the Bitti

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v6i2.1159

stand. As for the highest number of saplings is influenced by topography, whereas in plot 21, the topography is flat. This is in line with research (Iffa, 2017), saying that the slope level affects the number of saplings growing around the stands of Bitti trees.

Based on figure 3, it is known that the Fruit Potential of the 18 plots that have been selected is 0.2495% fruit. The highest fruit potential is found in plot 37, with a total of 0.0253% fruits, a diameter of 27.7 cm, a total height of 18 m, and tuberculosis of 2 m. At the same time, the lowest fruit potential is found in plots eight and 20, with the number of fruits at 0.0072%. In plot eight, the diameter is 25.79 cm, with a total height of 12 m, and tuberculosis is as much as 1.5 m and plot 20, the diameter is 28.34 cm, with a full size of 9 m, and tuberculosis is 1 m. The magnitude of the diameter and Height of the Bitti tree stands affects the large number. According to Kurniawati Purwaka & Pande Gede, (2013), it was stating that the correlation of the number of peas with the diameter of the trunk and the Height of the tree is positive, which means that in the fruit production phase, the greater the diameter of the box and the Height of the tree, the more the number of peas produced.

Based on figure 4 above, 18 mother trees have been identified. For this reason, the selection of mother trees selected with the criteria of having fruits and saplings is carried out, and this is done to get above-average broodstock that can produce seeds (Iriyanto et al., 2013). Figure 4 above, which has saplings and fruits, namely plots 4, 5, 6, 8, 9, 11, 20, 21, 22, 23, 27, 29, 32, 33, 34, 35, 36, 37, are found to have fruits and saplings of Bitti plants. It is challenging to determine saplings based on topographic conditions with a 40–50% slope. In addition, identifying saplings is very difficult because the presence of saplings is not under the floor of their parent tree. The way that can be done to see the tree that will be used as a mother tree is to see the presence of fruit on the mother tree when the tree bears fruit.

Seed Source Tree Potential Class

Results were based on research and data analysis regarding the potential class of bitti seed source stands (*Vitex copassus*) in community forests in Cendana Village, Burau District, East Luwu Regency, obtained as stated in table 3.

Based on scoring, the study results are in Table 9 (Hidayat, 2010). From the assessment of the results of the difference in scores between seed source trees which are included in the criteria with comparison trees that do not enter the criteria between 27-73. The highest score on the parent tree with a score of 73 and a potential class of 5 is included in the very good category, is found on the fifth plot, namely the total Height of the tree with a score of 16, the Height of the tree branch with a score of 15, the diameter of the trunk with a score of 30, the surface of the trunk with a score of 2, the straightness of the trunk with a score of 5, as well as the state of health of the tree with a score of 5.

The tree with the lowest score of 27 is included in the not good category in plots 20 and 23, Namely the total Height with a score of 4, the branch-free Height with a score of 6, the diameter with a score of 5, the surface of the trunk at 2, the straightness of the trunk at 5, and the health condition of the trunk 5.

According to Awaludin et al., (2018), Genetic and environmental factors can affect tree growth. In addition, variations between trees are also caused by differences in geographical variations (between provenances), local variations (between places of growth), variations between trees in a place of growth, and variations within trees.

Differences influence differences in the appearance of a tree in genotypes, differences in the environment in which they grow and interactions between genotypes and the environment, genetic potential and environmental factors (Juanda et al., 2017), environmental variations and genetic variations cannot be drawn a clear line of difference because they affect each other.

However, such variations can be changed through silvicultural actions and differences in genetic makeup (which can be

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v6i2.1159

changed by selection). The selection of seed source trees to obtain a mother tree with good phenotype quality will also produce good quality seeds. Proper use of seeds derived from superior mother trees will increase the productivity of the tree.

Table 3. The scoring potential of Bitti seed trees

No.	Plot	SCORE						TOTAL SCORE	POTENTIAL CLASS
		D (cm)	TT (m)	TBC (m)	PB	KB	KK		
1	4	30	18	6	2	5	5	66	5
2	5	30	16	15	2	5	5	73	5
3	6	5	18	15	2	5	5	50	4
4	8	5	4	12	2	5	5	33	3
5	9	30	18	6	2	5	5	66	5
6	11	25	16	15	2	5	5	68	5
7	20	5	4	6	2	5	5	27	2
8	21	5	16	6	2	5	5	39	3
9	22	5	4	15	2	5	5	36	3
10	23	5	4	6	2	5	5	27	2
11	27	5	4	15	2	5	5	36	3
12	29	5	20	15	2	5	5	52	4
13	32	5	20	15	2	5	5	52	4
14	33	5	4	15	2	5	5	36	3
15	34	5	12	6	2	5	5	35	3
16	35	5	20	15	2	5	5	52	4
17	36	5	20	15	2	5	5	52	4
18	37	5	20	15	2	5	5	52	4

Notes: Diameter (D), Total Height (TT), Branch free height (TBC), Stem surface (PB), Stem straightness (KB), Health condition (KK).

CONCLUSION

Based on the research results conducted in the Cendana Village People's Forest, Burau District. The village has the potential to be overgrown by bitti trees (*Vitex copassus*) in producing seed sources seen from the number of broodstock, saplings, and fruits through scoring. The highest number of scoring is in plot 5 with a total score of 73 potential class 5 (Very good category), while the lowest number of scores recorded in plots 20 and 23 potential class 2 (Not good category). It is hoped that in the future, it is necessary to research to find out the best quality of seeds contained between one plot and another plot, and in sampling, the mother tree should be about 50 meters away. In the future, research is needed regarding the best seed quality available between each plot, and when sampling the main trees should be about 50 meters apart.

ACKNOWLEDGMENT

We would like to thank the Faculty of Forestry, Andi Djemma University. We would also like to express our gratitude to the entire implementation team for their time and efforts in collecting data and information in the field so that this research can be carried out properly.

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v6i2.1159

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