Choosing plus tree of Salagundi (*Roudholia teysmanii*) at Salib Kasih Tourism Area

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Abstract. Availability of qualified seed source will produce qualified trees. Initial step to achieve those targets is finding plus tree, refers to the phenotypic characteristic. This research aim was to determine plus tree of Salagundi at Salib Kasih Tourism Area. The comparison tree system method was used in this research. The result defined that 16 plus tree were found at Salib Kasih Tourism Area according to the assessment of the tree characteristic. The highest total score was found on plus tree number 15 (89 points) and the lowest was found on plus tree number 8 (65 points) while others were found on 84-86 points. There was a lack of information about the phenology of Salagundi, and then further research is needed to figure it out.

1. Introduction
Salagundi (*Roudholia teysmanii*) is a potential lesser-known species in North Sumatra. This species has a higher specific gravity than teak, which is around 0.8-0.86 [1]. Wood specific gravity is an important characteristic to determine the wood utilization. Considering the specific gravity, these species include on strength class II [2-3]. Current data shows that this species is found in the Salib Kasih Tourism Area, Tarutung. Initially, this species was planted by the surrounding community in 1995 with an area of about 23 ha. Furthermore, many people use the wood as a pillar of a house or firewood.

Salagundi propagation still occurs naturally through wildings, so its genetic quality is not well known. Efforts to improve genetically can be made in various ways. The easiest and short-term solution for the supply of quality seeds is to find a source of quality seeds through a plus tree [4]. Plus trees are individual trees that have excellent and superior phenotypes according to the desired characteristics [4-5]. Considering that this species has a relatively high specific gravity, the wood is suitable for woodworking purposes. Characteristics needed for woodworking purposes include straight rod shape, height, large diameter, cylindrical stem, narrow canopy, small branching with horizontal angles, resistance to pests and diseases, etc.

There are several methods for determining plus trees; these methods are Ocular, Comparative Tree System, Base-line System, and Absolute Standards [6]. The ocular method is the simplest method, without being based on a measurement or assessment of properties, but only based on the appearance that the tree is good and healthy. The comparison tree system method is done by comparing the potentially plus trees with their neighbours or the average tree in stands for some characteristics. This method is often combined with scores for qualitative properties. The baseline system method is based
on dependent variables and independent variables, for example, height in 10-20 of dominant and codominant trees in a stand, then a regression line is created and when they are passing the average value will be defined as a plus tree. The absolute standard method of a property such as a diameter or height is compared to the table volume of certain Bonita in certain areas. If it exceeds the specified standard value, it will be set as a plus tree. The purpose of this study is to find plus trees, as a short-term solution for seed sources, both for generative and vegetative propagation.

2. Materials and Methods
This research was carried out in the forest area in the Salib Kasih Tourism Area of Tarutung Regency. The method of selecting plus trees used was the comparison tree system method. Sampling used was systematic sampling in a total area of approximately 23 ha. The plot used was 20 m x 20 m with a distance between plots of 50 meters. A further step was selecting the 6 best order trees in the plot, seen from their appearance, including height, straight and healthy.

| Characteristics | Evaluation System | Score (Points) |
|-----------------|-------------------|----------------|
| Height          | <105%             | 4              |
|                 | 105-110%          | 5              |
|                 | 111-115%          | 12             |
|                 | 116-120%          | 16             |
|                 | >121%             | 20             |
| Diameter        | <105%             | 5              |
|                 | 105-110%          | 7              |
|                 | 111-115%          | 17             |
|                 | 116-120%          | 23             |
|                 | >121%             | 30             |
| Crown           | Healthy and balance | 10           |
|                 | Less healthy (damage 10-20%) | 5         |
|                 | Not healthy (damage >20%) | 0          |
| Straightness of the trunk | Straight | 10          |
|                 | Straight 75%      | 7              |
|                 | Straight 50%      | 5              |
|                 | Straight 25%      | 3              |
| Natural Pruning | <35%              | 3              |
|                 | 35-45%            | 6              |
|                 | 46-55%            | 9              |
|                 | 56-65%            | 12             |
|                 | ≥65%              | 15             |
| Roundness       | Round             | 5              |
|                 | Near round        | 2              |
|                 | Not round/irregular | 0         |
| Branching angle | <50°              | 0              |
|                 | 50-70°            | 5              |
|                 | >70°              | 10             |

The best trees will be used as potentially plus trees, while the other five trees will be used as comparison trees. The conditions of a comparison tree must have a quality of growth that was not much different from the potentially plus tree. The comparison tree must have a dominant or codominant crown. Then measured the parameters to be assessed from each tree. Next, scoring the properties that have been assessed, then making a register for the whole plus tree. The characteristics evaluated included: quantitative characteristics (height, diameter) and qualitative characteristics
The next step was to mark the potentially plus tree with paint and give the tree serial number and other information. Next, make a map of its location or at least sketch the site, by recording natural boundary signs, administrative boundaries of the government and so on.

3. Results and Discussion

Based on the results of the research that has been conducted, there were 16 plus tree candidates who met the desired characteristics. The coordinates of candidate plus tree points that have been recorded are then plotted into maps. The results can be seen in Figure 1.

Overall, the individual trees found in this location were relatively in small numbers, even, in some plots of a total of 75 plots made, no individuals were found in the tree phase. This is seen on the map, many blanks in certain areas. Ideally, a number of plus trees range from 10-25 trees/ha [4, 6, 8]. In addition to maintaining the continuity of seed production, maintaining the variation and also avoids inbreeding or marriage between relatives. But at the location of the study, only 16 candidates plus trees were determined for an area of 23 ha. It is necessary to immediately formulate and make actions for the conservation and tree improvement of this species. Information gathered from the study site stated that many people felled this species, some used it as firewood and also for woodworking purposes. In addition, the issue of the conversion of forests to gardens has also taken place. In accordance with Minister of Forestry Decree No. 44/Menhut-Il/2005, based on the function of forest area, this location is included in the function of limited production forest area and administratively was involved in the territory of UPT KPH Wil XII Tarutung.
plus trees can be recommended as a Salagundi plus tree [6-7]. The selection of plus trees based on avoided, cylindrical/round stems and branching angles > 70° were required to have a narrow canopy shape, straight trunks, fast natural pruning, cylindrical round good wood quality and was generally used for woodworking purposes. The woodworking purposes selection of plus tree candidates; it was given that Salagundi had the plus tree candidates did have superior performance compared to other trees around them. The selection of plus tree candidates has fulfilled the correct rules and provisions. Most of the plus tree comparison was calculated between plus tree candidates and comparison tree averages, ranging from 111.11-144.44 with a score between 12-20. The diameter characteristics of candidate plus trees ranged from 32-63 cm, and the average comparison tree ranged from 27-46.5 cm. If the percentage comparison was calculated between the plus tree candidates and the comparison tree average, it ranges between 112.21 to 141.57 with a score between 17 and 30. Based on these data, it can be explained that the plus tree candidates have fulfilled the correct rules and provisions. Most of the plus tree candidates have maximum scores, indicating that the comparison of the two characters has shown that the plus tree candidates did have superior performance compared to other trees around them.

Quantitative characters (height and diameter) were compared between candidate plus trees score with average comparison trees. The height character of the plus tree candidates found ranged from 17-35 m, and the average comparison tree ranged from 14 to 27 m. If the percentage comparison was calculated between the plus tree candidates and the comparison tree average, it ranges between 111.11-144.44 with a score between 12-20. The diameter characteristics of candidate plus trees ranged from 32-63 cm, and the average comparison tree ranged from 27-46.5 cm. If the percentage comparison was calculated between plus tree candidates and comparison tree averages, ranging from 112.21 to 141.57 with a score between 17 and 30. Based on these data, it can be explained that the selection of plus tree candidates has fulfilled the correct rules and provisions. Most of the plus tree candidates have maximum scores, indicating that the comparison of the two characters has shown that the plus tree candidates did have superior performance compared to other trees around them.

Qualitative characters (crown shape, straightness of the trunk, natural pruning, roundness, branching angle) were selected in the selection of plus tree candidates; it was given that Salagundi had good wood quality and was generally used for woodworking purposes. The woodworking purposes were required to have a narrow canopy shape, straight trunks, fast natural pruning, cylindrical round bars and a branching angle of 70°. This was related to the ease of processing and the quality of woodworking. Plus tree candidates of Salagundi as a whole had a healthy and balanced canopy shape, rod straightness of about 75%, natural pruning that was high enough so that wood eye defects can be avoided, cylindrical/round stems and branching angles > 70°.

The total score obtained by the candidate plus tree which is the sum of the characteristic scores observed ranged from 65-89. There were no characters who had a score of 0; therefore, all candidate plus trees can be recommended as a Salagundi plus tree [6-7]. The selection of plus trees based on

### Table 2. Register the results of the assessment of candidate plus trees with the comparison tree system method

| No PT | T    | D   | V    | T    | D   | P   | KLB  | PA   | KB   | SC   | Total |
|-------|------|-----|------|------|-----|-----|------|------|------|------|-------|
| 1     | 16   | 0.31| 0.87 | 20   | 30  | 10  | 5    | 9    | 5    | 5    | 84    |
| 2     | 23   | 0.38| 1.82 | 12   | 23  | 5   | 7    | 9    | 5    | 66    |
| 3     | 17   | 0.33| 1.04 | 16   | 17  | 10  | 7    | 9    | 2    | 10    | 71    |
| 4     | 22   | 0.39| 1.84 | 20   | 30  | 10  | 5    | 9    | 5    | 5    | 84    |
| 5     | 23   | 0.395| 1.98 | 12   | 23  | 10  | 7    | 9    | 5    | 7    | 71    |
| 6     | 22.5 | 0.40| 1.98 | 16   | 30  | 10  | 5    | 6    | 5    | 5    | 77    |
| 7     | 25.25| 0.445| 2.77 | 20   | 30  | 10  | 7    | 9    | 5    | 5    | 86    |
| 8     | 27   | 0.47| 3.28 | 12   | 17  | 10  | 7    | 9    | 5    | 5    | 65    |
| 9     | 14   | 0.27| 0.56 | 20   | 23  | 5   | 5    | 9    | 2    | 10    | 74    |
| 10    | 17.5 | 0.34| 1.13 | 20   | 30  | 10  | 7    | 6    | 2    | 10    | 85    |
| 11    | 18   | 0.36| 1.28 | 20   | 30  | 10  | 7    | 9    | 5    | 5    | 86    |
| 12    | 23   | 0.42| 2.24 | 20   | 30  | 10  | 5    | 9    | 5    | 5    | 84    |
| 13    | 20   | 0.37| 1.50 | 20   | 30  | 10  | 5    | 9    | 5    | 5    | 84    |
| 14    | 26   | 0.465| 3.11 | 20   | 30  | 10  | 5    | 9    | 5    | 5    | 84    |
| 15    | 26.5 | 0.445| 2.80 | 20   | 30  | 10  | 7    | 12   | 5    | 5    | 89    |
| 16    | 24.67| 0.45| 2.75 | 20   | 30  | 10  | 7    | 9    | 5    | 5    | 86    |

Remarks: PT (Plus tree), T (Total height), D (Diameter), V (Volume), P (Crown), KLB (Straightness of the trunk), PA (natural pruning), KB (roundness), SC (Branching angle).
their superior performance as a provider of short-term seeds was often overlooked, even though this was very helpful because these seeds have been phenotypically proven to produce superior individuals [5, 6, 8]. Of course, the use of these seeds was still temporary, which usually has not been able to provide a significant improvement in terms of volume, but in terms of quality, resistance to pests & diseases and their adaptability to the environment shows great improvement [4, 6, 8]. Unfortunately, information about the phenology of Salagundi has not yet been obtained, to determine the candidate plus tree to be a plus tree still required proof of the individual's ability to produce seeds [4, 8]. Regarding the small population found and considerable disturbance, it was necessary to rescue and conserve genetic Salagundi through vegetative propagation immediately. Vegetative propagation material can be taken from the plus tree candidates found because the performance has good and promising qualities [4]. The ability to sprout Salagundi was also quite high, as evidenced by the number of felling marks in the field, capable of producing large amounts of sprout and fast enough.

4. Conclusions

There have been 16 candidates plus trees of Salagundi at the Salib Kasih Tourism Area, Tarutung, which can be recommended as a source of both generative and vegetative seeds. But unfortunately, the information about the phenology cannot be obtained, so it still needs further studies, to complement the results of this study.

References

[1] Pasaribu G 2005 Physical and mechanical properties of four endemic wood species from North Sumatra Journal Penelitian Hasil Hutan 25 pp 15-27
[2] Martawijaya A, Kartasujana I, Kadir K, Prawira S A 2005 Indonesian Wood atlas volume I. (Bogor: Center for Research and Development Forestry)
[3] P3HH 2008 A Handbook of selected Indonesian wood species (Indonesia: PT. Pusaka Semesta Persada)
[4] Ministry of Environment and Forestry 2016 Guidelines standard of seed source (Jakarta: Directorate of Forest Seed)
[5] Mulawarman, James M R, Singgih M S, and Djoko I 2002 Management of tree seeds. Field guidelines for field officers and farmers (ICRAF and Winrock Internasional)
[6] Zobel B and Talbert J 1984 Applied forest tree improvement (New York: John Wiley &Sons)
[7] Ministry of Forestry 2006 Manual selection of plus tree (Sumedang: Center for Forest Seed Plants of Java and Madura)
[8] Leksono B 2017 Techniques for appointment and development of seed sources (Yogyakarta: Center for Forest Plant Breeding and Biotechnology Research)