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Estimation of The Potential of Superior Teak (JUN) Copiesin The Nusa Bangsa University Experiment Garden, Cogreg

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Abstract. *JUN copies at the University of Nusa Bangsa Experimental Garden has an area of 11 hectares, with 7 years. The potential for copies in the garden is very important information because it becomes a reference for calculating harvesting costs and the income that can be obtained from the garden. To make it easier and closer to the truth, the estimation of the potential for JUN growth is if the local volume table is known, so that regardless of the diameter growth it will be easy to calculate the volume of stands. The JUN-copies local volume equation is calculated using the Berkhout equation regression analysis (Loetsh, Zohrer and Haller, 1973). This equation is used to estimate the volume of JUN impulses by collecting stand diameter data. As a sample, 100 stands were taken (Loetsh, 1973) by systematically random start. The result obtained is the potential for JUN copies when calculated using the formula V = LBDS x t x f (Anonymous, 1997) obtained 50.26 m^3 / ha. The local volume table equation obtained in this study: V = 7,345 dbh ^{2,337}. Estimation of potential JUN copies using Volume Table obtained 44.34 m^3 / ha. From the tightness correlation test between diameter and volume in the local volume table equation, the result is 0.952, which means a close relationship.*

Keywords: *C*opies, Volume, JUN, Estimation, Potential

1. INTRODUCTION

Jati Unggul Nusantara (JUN) is a type of teak plant that is produced vegetatively from Teak Plus Perhutani (JPP) stands by inducing its roots to produce multiple taproots. JUN is expected to accelerate the teak cycle so that teak production will increase and meet the national demand for teak. The growth of the first rotation of JUN at the age of 2 years is known to be 3.89 cm / year (Setyaningsih et al., 2009). The second rotation of JUN plants in the UNB Experimental Garden at the age of 7 years has a diameter increment of 2.8 cm / year according to Meiganati (2017). So that to reach a diameter of 30 cm it takes a cycle of 10.7 years (Meiganati, 2017). It is very important to know the volume estimation during the harvesting period so that the estimated income can be calculated so that the investment fund for timber harvesting can be estimated.

The preparation of local volume tables is the simplest volume table because it only uses one data, namely diameter data only. Volume estimation is very important to have accuracy so that there is no over estimate or under estimate in calculating wood production costs (Mahmudin, 2003). The accuracy of calculating the volume of wood can be seen by the close relationship between volume and diameter. If a close relationship between volume and diameter can be found, then

a local volume table can be used to calculate the potential volume of JUN stands in Cogreg. Only using the diameter information can we directly determine the stand volume. For this reason, it is necessary to make local volume tables for JUN hundredths in the UNB Experimental Garden in estimating the potential of existing stands.

According to Putra et al (2016), there is a relationship between diameter at breast height and the volume of standing trees with an R2 value of 0.944, which means that 94.4% of the volume variable can be affected by diameter, while 5.6% can be caused by other factors. The comparison of stand volume calculated manually and using local volume tables proved to be not significantly different, the volume calculated manually was 47.669 m3, while the stand volume using the local volume table was 39.804 m3. From the t test it is known that t count is smaller than t table (Putra et al, 2016).

The above studies show that in compiling a local volume table using diameter data and by using the logarithmic allometric method, the volume estimation equation model will be obtained in a more practical way. Local volume tables will be very helpful in forest inventory activities in order to obtain forest potential that is accurate and more practical.

2. LITERATURE REVIEW

2.1. Forest Inventory

Malamassam (2009) provides an understanding of forest inventory science as a branch of forestry that discusses methods of estimating forest potential. The method of estimation referred to here is a method of measuring part or all of the elements of an object which is the target of observation to determine the properties of the object in question. By paying attention to this definition, it can be understood that forest inventory is an activity to assess the potential of a forest which is carried out by means of a sample (sample) of the potential forest to be estimated. According to Simon (1993), the definition of forest inventory is an activity in the forest management system to determine the wealth contained in a forest at a certain time.

The data required in a forest inventory are:

1. Tree Height

Height is the shortest distance between a point on a tree and its projection point on a flat plane, as a component of determining the volume of tree height there are two types, namely (Suharlan, et all, 1977)

a). The total tree height is the distance between the top of the tree and its projection on the ground or horizontal plane

b). Branch height or canopy height or branch free height, namely the distance between the point of release of the branch or the border of the canopy and its projection on a flat or horizontal plane

2. Tree Diameter

Diameter is the length of the line between two points on a circle passing through the center and is obtained from the conversion of the circumference using the formula:

$$d = (k) / \pi$$

Information : d = diameter
k = circumference

π = 3.14

2.2. Tree Volume Estimator Model

The tree volume estimator model is a mathematical equation in the form of a regression equation between the independent variables of tree diameter at breast height and tree height with volume dependent variables. This model is useful in estimating the volume of standing trees. The regression equation used in constructing the tree volume estimator model consists of six equations, equations 1-3 use one independent variable of diameter, while equations 4- 6 use two independent variables of tree diameter and height. Based on the R value and the bias value and the Root Mean Square of Error (RMSE) from other tree data obtained by cutting trees (Siran, 2007).

2.3. Teak (*Tectona grandis* L.f) Superior Nusantara (JUN)

Teak Superior Nusantara is teak derived from superior clones selected from teak trees using DNA technology, through vegetative propagation (cloning) with shoot cuttings, with biotechnology modification of the root system to produce multiple supporting roots. The characteristics of JUN teak seeds:

a) Derived from genetic material (superior clones) whose origin is clear.
b) Has a multiple supporting root system.
c) Produces teak plants that are fast growing, sturdy and can be harvested from the age of 5 years with a yield of 0.2 m3 / tree logs.

The benefits of JUN teak include 3 things, namely the ecological, economic and social benefits of the community.

a) Ecologically, JUN teak with copies will more stabilize the land / soil because during several rotations, the soil is not physically disturbed.
b) Economically, it is very profitable because the price of teak wood is on average higher than other wood, especially with very profitable copies. A big investment is only at the beginning, then just maintenance and wood can be cut in several rotations.
c) Socially, it will mobilize the community around the forest in planting, maintenance and harvesting activities.

JUN teak planted in the Cogreg Experimental Garden is a collaboration with the Wana Nusantara Housing Cooperative (KPWN) in 2007 covering 11 hectares. In 2012, an area of 4 hectares was cut down, leaving it in arrears to be cared for into copies.

According to Hamilton, et all (2000), copies is the regrowth of shoots on tree stumps (stump). Meanwhile, according to Pramono et all (2010), singling (sigling) is the activity of cutting several teak trunks that have a poor trunk shape so that the remaining 1 teak tree is expected to be able to grow into 1 straight teak tree with free high branches and a larger diameter big.

According to Nyland (2001), the capacity of the copies will decrease after 3-5 generations. For example in Eucalyptus globulus in India with a rotation length of 15 years, the production of copies was reduced by 9% in the 2nd rotation and further reduced to 20% in the 4th rotation.

Copies growth has faster growth than seedlings planted from the start, and has a wider and stronger root structure than the stakes. Copies is a plant / shoot that grows from a tree that has been felled. Thus, the copies from the stake will obtain a supply of water and nutrients that are more than the newly planted seed

(Davish et all, 1987). In addition, the copies technique is carried out because it can reduce planting costs because it does not require the cost of purchasing seeds, transportation costs of seeds, land processing, making planting holes, and planting (Wibowo, 2014).

3. RESEARCH METHODS/METHODOLOGY

This research was conducted in the experimental garden of the University of Nusa Bangsa, precisely in the area of Cogreg Village, Bogor. This research activity was carried out from May to July 2018. UNB's experimental garden area in the Cogreg area has an area of 11 hectares with around 7000 main plants of Jati Unggul Nusantara (JUN). This plant is a trial plant conducted in 2012 between UNB and KPWN (Wanabakti Nusantara Housing Cooperative). Cogreg land in government administration is included in the area of Parung District, Bogor Regency, West Java, Cogreg Village. Cogreg Village has an area of 511,499 hectares for land available in UNB's plantations, almost 60% of the land is planted by JUN, 10% of the land is planted with intercropping, including: Papaya, Chili Peppers, and Sweet Potatoes

The method in this research is using quantitative descriptive method. Data collection in the field was carried out by systematic sampling with random start with a sampling intensity of 10% of the 6 year old Jati Unggul Nusantara (JUN) copies in the area of the Experimental Garden at the University of Nusa Bangsa. According to Husch (1972), to create a local volume table, you can take 50 to 100 trees.

Data taken from the field, namely:

1. Measure the circumference of the tree trunk at breast height to get the tree's diameter, with the formula: d = k / π
   Note: d: diameter at breast height
   K: circumference of the stem at chest level
   π: 3.14
2. Measure tree height with hagameter (t).
3. Calculating the volume of the tree with the formula:
   V = LBDS x t x f
   Description: V : Volume (m3)
   LBDS : Base Area (¼ πd²)
   t : Tree height (m)
   f : Number form factor (0.7 according to Simon 2007)

From the results of the sampling of 100 trees, a regression analysis was performed using the Berkhout equation (Loetsch 1973) in the form of a volume-to-diameter relationship:

$$V = a\ dbh^b$$

Information : dbh : diameter at breast height

a and b: the regression coefficients to look for

The form of this equation if transformed into a logarithmic form is as follows:

$$\log V = \log \dot{a} + b\ log\ dbh$$

So that the regression equation model:

$$\widehat{Y} = a + b\widehat{X}$$

Information : Y = log V X = log dbh

a and b are regression coefficients that can be found by the formula:

$$b = \frac{n \sum x_i, y_i - (\sum x_i)(\sum y_i)}{n \sum x_i^2 - (\sum x_i)^2}$$

and

$$a = \bar{y} - b\,\bar{x}$$

The validity of the equation model obtained is tested by looking at the values of the determination coefficient (r^2).

4. RESULTS AND DISCUSSION

Estimating the potential for stands can be done directly by measuring the diameter and height of the stands. Local volume tables provide accuracy in calculating potential forest stands, especially in plantation forests (Simon 1993). The local volume table refers to the measurement of tree diameter and height from 100 sample trees taken by purposive sampling with random start. The following data were obtained:

Table 1. Tree Diameter and Height

No	dbh (cm)	Tinggi (m)	No	dbh (cm)	Tinggi (m)	No	dbh (cm)	Tinggi (m)	No	dbh (cm)	Tinggi (m)
1	20,7	8	26	24,8	11,5	51	14,3	6	76	14,3	7,5
2	14,9	7,5	27	11,1	6	52	12,7	6	77	11,1	6
3	21,3	9	28	14,3	6	53	11,7	6	78	11,7	7
4	21,6	10,5	29	15,2	6	54	12,4	6	79	12,7	7,5
5	24,2	10,5	30	15,9	7	55	12,7	7	80	12,1	6
6	15,9	7	31	15,9	6	56	17,5	7	81	22,2	8
7	14,3	6,5	32	14,3	6	57	15,2	6	82	21,3	6
8	15,9	7,5	33	14,9	6,5	58	15,9	8	83	21,9	7
9	21,9	8	34	12,4	6	59	15,9	6	84	15,9	6,5
10	20,7	9	35	11,1	7	60	14,9	6	85	17,5	8
11	15,9	7	36	10,1	6,5	61	14,3	7	86	16,8	7
12	15,2	6	37	11,7	7	62	15,9	7,5	87	18,7	7
13	20,7	8	38	12,7	6	63	16,5	8	88	16,5	6
14	14,3	6	39	11,1	6,5	64	11,1	7	89	14,9	7
15	16,8	7,5	40	15,2	7	65	10,1	6,5	90	15,9	6
16	23,5	8	41	14,3	6	66	11,7	6,5	91	14,9	5,5
17	18,1	9,5	42	14,9	7,5	67	11,7	6,5	92	12,7	7
18	13,6	11	43	12,7	6,5	68	12,7	7	93	19,1	7
19	16,2	7,5	44	15,9	8	69	12,4	6	94	20,7	8
20	10,8	8	45	14,9	7,5	70	13,3	7	95	17,5	5
21	13,3	11,5	46	19,1	8	71	12,1	6	96	16,8	7
22	13,3	11,5	47	14,9	7	72	12,7	6	97	15,2	6
23	21,6	12	48	14,6	6,5	73	13,3	7	98	14,9	6,5
24	11,1	7,5	49	15,9	6	74	14,9	8	99	17,5	7
25	10,1	8	50	14,9	7	75	12,7	6	100	18,1	7

Source: 2018 Research Results

From the data obtained, it is calculated by the following formula for the volume of wood:

V = LBDS x T x f

LBDS = ¼ πd² = 10,194 m^2

Or the average volume = 0.102 m^3 / tree. The number of trees in the UNB Experimental Garden = 5,420 trees (Meiganati et al, 2017), the total volume = 552.84 m^3. UNB Experimental Garden area = 11 ha, then manual volume estimation = 50.26 m^3 / ha.

Meanwhile, the estimation of the potential volume of JUN copies at that location using the volume table is:

1. The volume table formula is based on the Berkhout equation (Simon, 1993):

$$V = a \times dbh^b$$

Note: $b = \frac{n \sum x_i y_i - (\sum x_i)(\sum y_i)}{n \sum x_i^2 - (\sum x_i)^2}$; $a = \bar{y} - b\,\bar{x}$

2. The above equation can be mathematically described as follows:

$$\sum \boldsymbol{x} = -\mathbf{82,2857} \qquad \sum \boldsymbol{y} = -\mathbf{105,6524}$$
$$\sum \boldsymbol{x^2} = \mathbf{68,5491} \qquad \sum \boldsymbol{y^2} = 116{,}6769$$
$$\left(\sum \boldsymbol{x}\right)^2 = \mathbf{6770,936} \qquad \left(\sum \boldsymbol{y}\right)^2 = \mathbf{11162,429}$$
$$\bar{\boldsymbol{x}} = -\mathbf{0,6840} \qquad \bar{\boldsymbol{y}} = -\mathbf{1,057}$$
$$\sum \boldsymbol{x,y} = \mathbf{88,8997} \qquad \sum \boldsymbol{x} \sum \boldsymbol{y} = \mathbf{0693,681}$$
$$\boldsymbol{n} = \mathbf{100}$$

3. The above calculation is substituted into the regression equation as follows:

$Y = a + b.x\ y$

$$b = \frac{n \sum x_i y_i - (\sum x_i)(\sum y_i)}{n \sum x_i^2 - (\sum x_i)^2}$$
$$= \frac{(100)\,(88{,}8997) - (-82{,}2857)\,(-105{,}6524)}{(100)(68{,}5491) - (-82{,}2857)^2} = 2{,}337$$

$a = \bar{y} - b\,\bar{x}$

a = (-1,057) – (2,337)(-0,823)

= 0,866 → antilog 0,866 = 7,345

$\bar{y} = a + b\,\bar{x}$ → Y = 7,345 + 2,337 X

4. Table of local volumes of JUN copies at UNB Experimental Garden =

$V = a\ dbh^b$ that is, a = 7,345 ; b = 2,337

$V = 7{,}345\ dbh^{2,337}$

Table of JUN Copies Local Volume at UNB Experimental Garden, Cogreg compiled based on the equation presented in table 2.

Table 2. Table of JUN Copies Local Volume

Circumference of the stem (Cm)	Diameter of Tree (M)	Volume (M^3)	Circumference of the stem (Cm)	Diameter of Tree (Cm)	Volume (M^3)
1	2	3	1	2	3
21	0,067	0,0132036	86	0,274	0,356115
22	0,070	0,01472	87	0,277	0,365867
23	0,073	0,0163315	88	0,280	0,375771
24	0,076	0,0180393	89	0,283	0,385826
25	0,080	0,0198451	90	0,287	0,396034
26	0,083	0,02175	91	0,290	0,406394
27	0,086	0,0237555	92	0,293	0,416907
28	0,089	0,0258628	93	0,296	0,427575
29	0,092	0,0280732	94	0,299	0,438396
30	0,096	0,0303878	95	0,303	0,449373
31	0,099	0,032808	96	0,306	0,460506
1	2	3	1	2	3
32	0,102	0,0353348	97	0,309	0,471794
33	0,105	0,0379694	98	0,312	0,48324
34	0,108	0,040713	99	0,315	0,494842
35	0,111	0,0435667	100	0,318	0,506602
36	0,115	0,0465314	101	0,322	0,518521
37	0,118	0,0496083	102	0,325	0,530598
38	0,121	0,0527985	103	0,328	0,542835
39	0,124	0,0561029	104	0,331	0,555232
40	0,127	0,0595225	105	0,334	0,567789
41	0,131	0,0630584	106	0,338	0,580506
42	0,134	0,0667115	107	0,341	0,593386
43	0,137	0,0704828	108	0,344	0,606427
44	0,140	0,0743731	109	0,347	0,619631
45	0,143	0,0783835	110	0,350	0,632997
46	0,146	0,0825149	111	0,354	0,646528
47	0,150	0,0867681	112	0,357	0,660222
48	0,153	0,091144	113	0,360	0,67408
49	0,156	0,0956435	114	0,363	0,688104
50	0,159	0,1002675	115	0,366	0,702293
51	0,162	0,1050168	116	0,369	0,716647
52	0,166	0,1098922	117	0,373	0,731169
53	0,169	0,1148947	118	0,376	0,745857
54	0,172	0,1200249	119	0,379	0,760712
55	0,175	0,1252838	120	0,382	0,775736
56	0,178	0,130672	121	0,385	0,790927
57	0,182	0,1361905	122	0,389	0,806288
58	0,185	0,1418399	123	0,392	0,821818
59	0,188	0,1476211	124	0,395	0,837517

60	0,191	0,1535347	125	0,398	0,853387
61	0,194	0,1595817	126	0,401	0,869427
62	0,197	0,1657626	127	0,404	0,885639
63	0,201	0,1720783	128	0,408	0,902022
64	0,204	0,1785294	129	0,411	0,918577
65	0,207	0,1851168	130	0,414	0,935304
66	0,210	0,191841	131	0,417	0,952205
67	0,213	0,1987028	132	0,420	0,969278
68	0,217	0,205703	133	0,424	0,986526
69	0,220	0,2128421	134	0,427	1,003948
70	0,223	0,2201209	135	0,430	1,021544
71	0,226	0,2275401	136	0,433	1,039316
72	0,229	0,2351003	137	0,436	1,057263
73	0,232	0,2428023	138	0,439	1,075387
74	0,236	0,2506466	139	0,443	1,093686
75	0,239	0,2586339	140	0,446	1,112163
76	0,242	0,2667648	141	0,449	1,130817
77	0,245	0,2750401	142	0,452	1,149648
78	0,248	0,2834603	143	0,455	1,168658
79	0,252	0,2920261	144	0,459	1,187847
80	0,255	0,3007381	145	0,462	1,207214
1	2	3	1	2	3
81	0,258	0,309597	146	0,465	1,226761
82	0,261	0,3186032	147	0,468	1,246487
83	0,264	0,3277576	148	0,471	1,266394
84	0,268	0,3370605	149	0,475	1,286481
85	0,271	0,3465128	150	0,478	1,30675

Source: 2018 Research Results

5. Analysis of Diversity (ANOVA)

Diversity analysis is shown in table 3.

Table 3.Analysis of Variance (ANOVA)

Sources of diversity	Degrees of freedom	Sum of squares	Squares of Middle	F-count	F-table
Regression Error	1 98	4,589 6,566	4,589 0,066	69,530	3,96
Total	99	11,155			

Source: 2018 Research Results

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$$= \frac{(100)(88{,}8997) - (-82{,}2857)\,(-105{,}6524)}{\sqrt{[(100)(68{,}5491) - (-82{,}2857)^2]\left[(100)(116{,}6769) - (11162{,}429)\right]}}$$

$$= \frac{8889{,}97 - 8693{,}681}{\sqrt{[83{,}973][505{,}461]}} = \frac{196{,}289}{206{,}022} = 0{,}952$$

Table 4. Tree Volume Estimation Based on the Local Volume Table Equation

No.	Diameter Pohon (M)	Volume (M^3)	No.	Diameter Pohon (M)	Volume (M^3)
1	0,102	0,0353348	51	0,146	0,0825149
2	0,102	0,0353348	52	0,146	0,0825149
3	0,102	0,0353348	53	0,146	0,0825149
4	0,108	0,040713	54	0,146	0,0825149
5	0,111	0,0435667	55	0,153	0,091144
6	0,111	0,0435667	56	0,153	0,091144
7	0,111	0,0435667	57	0,153	0,091144
8	0,111	0,0435667	58	0,153	0,091144
9	0,111	0,0435667	59	0,153	0,091144
10	0,111	0,0435667	60	0,159	0,1002675
11	0,118	0,0496083	61	0,159	0,1002675
12	0,118	0,0496083	62	0,159	0,1002675
13	0,118	0,0496083	63	0,159	0,1002675
14	0,118	0,0496083	64	0,159	0,1002675
15	0,118	0,0496083	65	0,159	0,1002675
16	0,121	0,0527985	66	0,159	0,1002675
17	0,121	0,0527985	67	0,159	0,1002675
18	0,124	0,0561029	68	0,159	0,1002675
19	0,124	0,0561029	69	0,159	0,1002675
20	0,124	0,0561029	70	0,159	0,1002675
21	0,127	0,0595225	71	0,159	0,1002675
No.	Diameter Pohon (M)	Volume (M^3)	No.	Diameter Pohon (M)	Volume (M^3)
22	0,127	0,0595225	72	0,162	0,1050168
23	0,127	0,0595225	73	0,166	0,1098922
24	0,127	0,0595225	74	0,166	0,1098922
25	0,127	0,0595225	75	0,169	0,1148947
26	0,127	0,0595225	76	0,169	0,1148947
27	0,127	0,0595225	77	0,169	0,1148947
28	0,127	0,0595225	78	0,175	0,1252838
29	0,127	0,0595225	79	0,175	0,1252838
30	0,134	0,0667115	80	0,175	0,1252838
31	0,134	0,0667115	81	0,175	0,1252838
32	0,134	0,0667115	82	0,182	0,1361905
33	0,134	0,0667115	83	0,182	0,1361905
34	0,137	0,0704828	84	0,188	0,1476211
35	0,143	0,0783835	85	0,191	0,1535347
36	0,143	0,0783835	86	0,191	0,1535347
37	0,143	0,0783835	87	0,207	0,1851168
38	0,143	0,0783835	88	0,207	0,1851168
39	0,143	0,0783835	89	0,207	0,1851168
40	0,143	0,0783835	90	0,207	0,1851168
41	0,143	0,0783835	91	0,213	0,1987028

42	0,143	0,0783835	92	0,213	0,1987028
43	0,146	0,0825149	93	0,217	0,205703
44	0,146	0,0825149	94	0,217	0,205703
45	0,146	0,0825149	95	0,217	0,205703
46	0,146	0,0825149	96	0,217	0,205703
47	0,146	0,0825149	97	0,223	0,2201209
48	0,146	0,0825149	98	0,236	0,2506466
49	0,146	0,0825149	99	0,242	0,2667648
50	0,146	0,0825149	100	0,248	0,2834603
JUMLAH		3,0902833	JUMLAH		6,868359
T O T A L			9,9586423		

Estimation of tree volume from the above equation is 9,9586423 m^3, if the average tree count is 0.09 m^3 / tree, with a total number of trees of 5,420 trees (Meiganati et al, 2017), the total estimate is 487.8 m^3, in forest area is 11 ha, then the estimated volume per hectare is 44.34 m^3.

Research on teak tree increment has been carried out in many different places and provides important information for comparison. In Takari Kupang, the teak diameter increment is 1.4 cm / year. In Polen Timor Tengah Selatan, the teak diameter increment is 1.0 cm / year. The diameter increment of JUN teak in Cogreg is 3.93 cm / year (Setyaningsih et al, 2014).

The average annual increment each tree, including diameter increments, height increments and volume increments of 4 year old fast-growing teak copies in the experimental garden of the University of Nusa Bangsa increment in diameter is 2.86 cm / year Height increments are 2.17 m / year Volume increments 0, 02 m^3 / year (Meiganati et al 2017).

Stand volume depends on stand condition, especially tree diameter and tree height. Apart from diameter and height, other variables are the main determinants volume per hectare is the number of trees growing in the measurement plot. Stand volume was highly correlated with site quality and stand age (Simon 1993).

Local Volume Table preparation is a compensation between practicality in the field with the desired accuracy. The volume estimation variable that is easy to measure in the field is the diameter at breast height, which is a more accurate value, because it is measured directly tree by tree so this variable is often used to estimate the volume of a tree.

Volume estimation by circumference or diameter at breast height can be carried out on the assumption that trees of the same diameter will give the same volume under the same growing conditions in which the trees were taken. This assumption is justified if there is a significant relationship between tree diameter and volume.

The existence of a close relationship between tree volume and tree diameter can also indicate a close relationship between tree height and tree diameter, so that volume variations caused by tree height can be covered by variations in tree diameter. Thus trees with the same diameter will give the same volume.

The validation test is carried out to see the validity of the model that has been made in estimating the volume in the real world. According to Simon (2007), valid research results are if there is a similarity between the collected data and the data that actually occurs on the object under study. In making volume tables, validation is needed to determine whether or not the volume is compatible with free volume data. The parameters used in the validation test in this study include the chi-square

value (x ^ 2) standard error (SE), and the correlation coefficient which states the closeness of the relationship between tree diameter and volume.

In the standard error calculation, for the regression equation with the free variable diameter (d) the value is 0.06. The standard error is still within tolerance limits. And these results can be seen that the regression equation with the diameter variable (d) meets the standards for the preparation of volume tables, which is not more than 10%. The determination of these criteria is based on standards according to Spurr (1951) and Husch (1972). The relation coefficient is obtained 0.952, which means that there is a close relationship between tree diameter and volume from the obtained local volume table equation.

Using local volume tables for tree volume estimation is a preferable approach. This is due to the fact that the local volume tables are prepared according to the local situation and conditions, so that the estimation will be close to the actual volume. From the equation of the local volume table that has been obtained, it can be seen that the estimated forest volume in the Cogreg Experimental Garden is 44.34 m^3 / ha.

CONCLUSION

Estimation of potential JUN copies at the Experimental Garden of the University of Nusa Bangsa by using the Local Volume Table obtained a volume of 44.34 m^3 / ha, while the estimation of volume manually obtained was 50.26 m^3 / hectare.

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