BULBS RESULTS OF FOUR KINDS OF GENOTYPE CASSAVA (*Manihot esculenta*, L) OCCULATION METHODS AND MAKED HOLE PLANT

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ABSTRACT

This research aims to find out the effect of genotype cassava using grafting technology and maked hole of plant method on the growth and yield of cassava. The study was conducted at Kuala Gumit, Langkat from April 2015 - January 2016. The research used a Randomized Block Design (RCBD) with two treatment factors and four replications. The first factor was the genotypes cassava with occulation technique consisting of 4 levels, namely the cassava genotype of malaysia batu, malaysia susu, ubi roti and mangu. The second factor is occulation method and maked hole of plant planting hole consisting of 2 levels, namely without occulation and without maked hole of plant and using the occulation method and maked hole plant.

The results showed that genotype cassava occulation method and maked hole plant had a significant effect on the variables of plant height, stem diameter, tuber diameter, tuber length, tuber weight and number of cassava plant tubers. There is an intraction of all observed variables. Malaysian batu has superior growth and yield compared to malaysian susu, ubi roti and mangu.

Keywords: Cassava, Maked A Hole Plant, Occulation

A. INTRODUCTION

Talking about the productivity of cultivated plants is certainly inseparable from the methods and problems that include the provision of seeds, suitable planting media, technical culture to the right postharvest handling. Cassava cultivation technology to increase cassava productivity is very much researched.

The results of research conducted by research institutions have resulted in cultivation technology that is very useful in increasing cassava productivity.

The problem is how to adopt the results of the study in such a way that the hope of increasing cassava cultivation results can be achieved. Equally important is the problem of varieties to the prospects of people's food and the world of cassava industry is completed.

Efforts to increase cassava production can be done by intensification and extensification. Intensification to increase cassava productivity which is still low (curently a round 20 ton/ha), is done by planting superior varieties and applying more advanced cultivation technologies. Extensification is done by increasing the area of planting/ harvesting to dry land with various types of soil, utilizing sleep land and further increasing the cropping index. The assembly of varieties to improve the quality of cassava as a food ingredient, in addition to high productivity is also directed to taste good (low HCN content), and not fibrous. As an industrial raw material (ethanol) besides productivity and high starch content also has a total sugar content and high ethanol conversion value.

The average productivity of cassava at the farmer level in North Sumatra is around 19 t/ha (Anonimous. 2016). Cassava productivity is influenced by several factors, including physical, biological, and physiological factors. The main physical factors are soil nutrition, soil hardness and water (Whyte, 1987). Ubikayu can be planted in soil conditions and climate varies, where both of these factors have a major effect on yield (Guritno and Utomo, 1988)

Various alternatives are needed in order to optimize cassava's productivity as folk food and industrial industries made from cassava, including efforts to increase tuber yield with cassava splicing techniques through occulation. Occulation techniques are commonly used in rubber plants. Compared to other vegetative propagation methods, occulation is easier and more economically practiced on a commercial scale. Plants from occulation have advantages, especially in terms of genetic uniformity, so that the potential for crop production per unit area is higher (Karyadi and Sunarwidi, 1989).

Research on cassava occulation is still not much done because at that time it did not get special attention from the government. From the observations in the field, the method of cultivating cassava is still quite diverse. In 1974 the grafting system was examined by Unibraw, which concluded that the source potential of the upper stem was able to supply sink capacity from the lower stem, so that cassava productivity could be increased to > 70 t / ha. Even with intensive maintenance and by age of planting > 1.5 years of cassava, the occulation system can reach > 100 kg / plant. The IITA International Research Institute in Ibadan Nigeria, and CIAT in Cali Columbia have also tried to implement the occulation system which concluded that the relationship sinks increased in rhythm, thereby increasing productivity > 100%.

B. METHODOLOGY

This study was arranged based on factorial randomized block design (RBD) consisting of 2 factors:

1. Cassava genotype (G) consists of 4 levels, namely:

G1 = Ubi Malaysia Batu
G2 = Ubi Malaysia susu
G3 = Ubi roti
G4 = Ubi Mangu

2. Factors of occulation method and maked a hole plant (O) consist of 2 levels, namely:

O0 =Without Grafting and without maked a hole plant
O1 = occulation method and maked a hole plant

Occulation process is making from ubi karet as above stem and the roodstock is ubi malaysia batu, susu, roti and mangu

To test each treatment a variety analysis was attempted. If the test results show a real or very real influence, a DMRT test is carried out.

Observation variables are plant height (cm), stem diameter (cm), tuber diameter (cm), tuber length (cm), tuber weight (kg), number of tubers (fruit).

C. RESULTS AND DISCUSSION

Table 1. Average Types of Cassava Genotypes with occulation methods and maked a hole plant on plant height.

Genotypes Cassava	Occulation		Average
	O_0 (without occulation and without maked hole plant)	O_1 (Occulation and maked whole plant)	
	………………………………cm……………………………….		
G1 (Malaysia Batu)	835,90 d	1108,63 a	243,07 a
G2 (Malaysia Susu)	855,85 c	964,27 b	227,52 b
G3 (Roti)	758,06 f	813,65 e	196,46 c
G4 (Mangu)	530,59 h	687,05 g	152,21 d
Average	186,28 b	223,35 a	

Description: the numbers followed by the same letter in the same row or column show no significant difference at the 5% level using the BNT test.

Table 1 shows that planting with occulation methods and maked a hole plant in the genotype of cassava malaysia batu (G1) plant height 243.07 cm, significantly different from (G2) 227.52 cm, (G3) 196.46 and (G4) 152.21 cm, so between G2, G3 and G4 shows the real differences between each other. This shows that the difference in the height of the fourth genotypic plant is caused by genetic differences in the plant it self. According to Wasonawati (2011) plant growth shows xylem formation activity and enlargement of growing cells. This activity causes the cambium to be pushed out and the formation of new cells outside the layers, causing an increase in plant height.

Plants without occulation and without maked a hole plant, the plant height is not high because the plants are left behind high under the occulation and with maked a hole plant. This is caused by plants without undergoing an occulation process so that growth does not develop optimally, in contrast to plants with occulation methods and maked a hole plant.

The response to plant height showed that the average treatment with occulation method and maked hole plant resulted in higher plant growth compared to those that did not use occulation methods and maked a hole plant. The occulation method as well as the physiology of occulation is to increase the capacity of the photosynthetic source to obtain a greater sink. Ubi karet is known as a plant that has a large posture, a lot of leaf potential. Thus the photosynthetic capacity is greater. According to the results of a study by Santoso B, et. al, 2011 examined 4 varieties of cassava occulation, where the results of the occulation method can be three times compared to the method without occulation.

Simillar with maked a hole plant method of its effect on the genotype of cassava occulation further increases plant growth (height) of plants. This is in accordance with the results of the study of Ahit and Posas (2001) that the treatment of planting hole size has a significant effect on the height and diameter of the stem.

This is because maked a hole plant gives flexibility to the development of rootstock to absorb limited nutrients in the planting hole space, so that it can be used for vegetative growth of plants to be better. According to Gardner and Mitchell (2001) the rootstock has a strong effect on plant growth and development. The interaction of cassava genotype occulation and maked hole plant method showed a significant effect on all treatment combinations. The graph of the relationship between cassava genotype occulation on plant height can be seen in Figure 1 below.

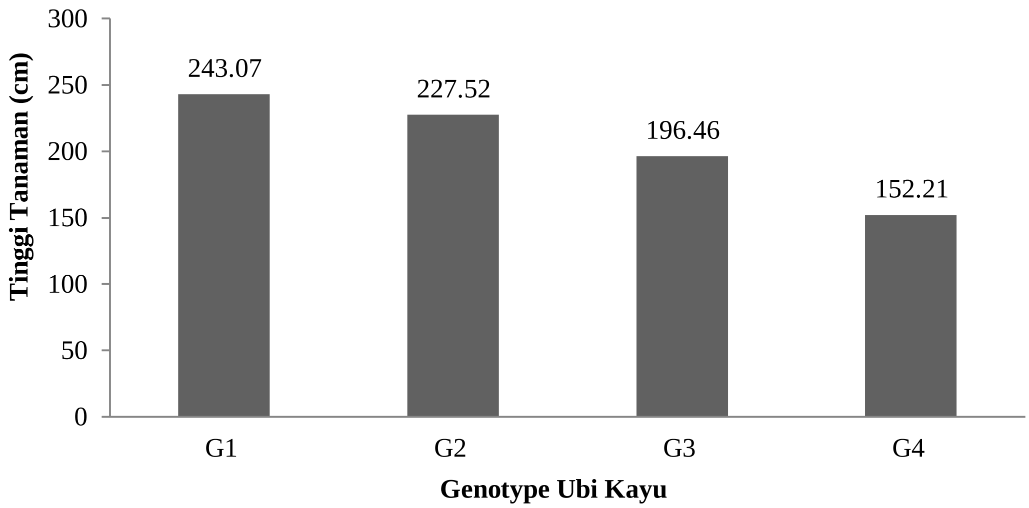

Figure 1. Graph of the Relationship of Cassava Genotypes to Plant Height

4.2 Rod Diameter

Table 2 shows Malaysian Batu (G1) cassava having a larger stem diameter than Malaysian Susu cassava (G2) = 8.31, ubi roti (G3) = 6.34 and Mangu (G4) = 4.96. This shows that all four genotypes of occulation gave different responses to the method of planting maked a hole plant. In terms of genetic of Malaysian batu genotypes has a superior response compared to other genotypes.

Similarly, genotype of malaysia batu without occulation and maked a hole plant showed Malaysian batu genotypes remains superior to the other three genotypes (Table 2).

Table 2. Average Diameter of Cassava Genotype Stems On Occulation and Maked Hole plant

Genotypes Cassava	**Occulation**		**Average**
	O_0 (without occulation and without maked hole plant)	**O_1 (Occulation and maked whole plant)**	
	………………………………	cm………………………………	
G1 (Malaysia Batu)	20,00 e	59,00 a	9,88 a
G2 (Malaysia Susu)	17,50 f	49,00 b	8,31 b
G3 (Roti)	13,50 g	37,20 c	6,34 c
G4 (Mangu)	11,20 h	28,50 d	4,96 d
Average	3,89 b	10,86 a	

Description: the numbers followed by the same letter in the same row or column show no significant difference at the 5% level using the BNT test.

The response of cassava species to stem diameter is that the making of planting holes gives room for the maximal occulation of cassava growth due to the availability of nutrients around the roots in the planting hole. The interaction of cassava genotype and maked hole plant method on diameter stem showed a significant effect on all treatment combinations.

The graph of the relationship between cassava genotype occulation on stem diameter can be seen in Figure 2 below.

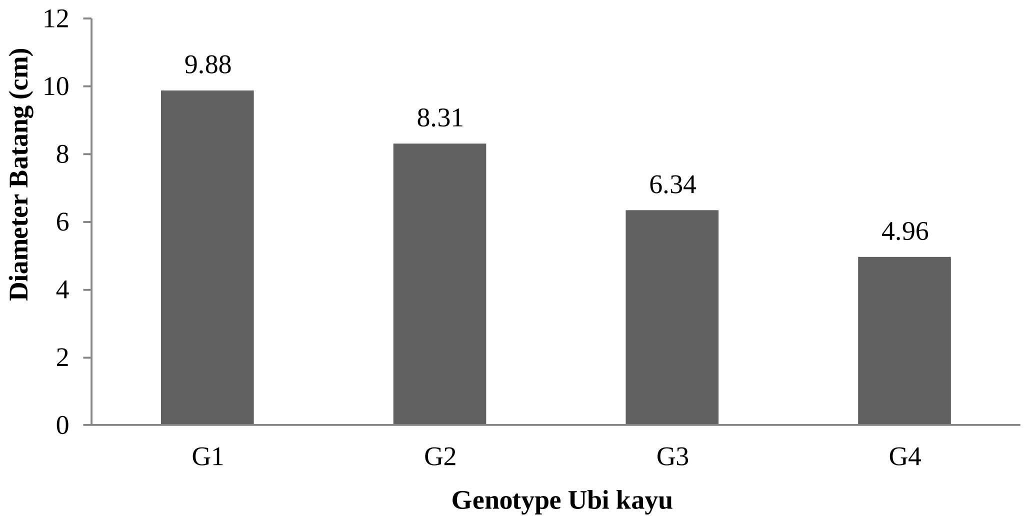

Figure 2. Graph of the Relation of Cassava Genotype to the method of grafting and planting holes on the stem diameter

4.3 Diameter of Bulbs

Table 3 shows that the cassava genotype of Malaysia Batu (G1) has a tuber diameter 12.00 cm wide, higher than Malaysian Susu (G2) 9.69 cm, Ubi roti (G3) 7.10 and mangu (G4) 5 , 59 cm, so between G2, G3 and G4 shows the real difference between each other. This is assumed that the making of planting holes gives room for the growth of grafted cassava to the maximum due to the availability of nutrients around the roots in the planting hole as well as the height of the plants.

Some research results show that cassava yield potential is influenced by clones / varieties that have large tuber size (diameter and tuber length) (Birador et al., 1998), a large number of tubers and a high harvest index as selected cassava clones / varieties (Kamalam et al., 1998).

Table 3. Average Diameter of Bulbs of Casava Genotypes Against the Occulation Method and maked a hole plant

Genotypes Cassava	**Occulation**		**Average**
	O_0 (without occulation and without maked hole plant)	**O_1 (Occulation and maked whole plant)**	
	…………………………………	cm…………………………………	
G1 (Malaysia Batu)	27,50 e	68,50 a	12,00 a
G2 (Malaysia Susu)	24,00 f	53,50 b	9,69 b
G3 (Roti)	18,30 g	38,50 c	7,10 c
G4 (Mangu)	12,70 h	32,00 d	5,59 d
Average	5,16 b	12,03 a	

Description: the numbers followed by the same letter in the same row or column show no significant difference at the 5% level using the BNT test.

The graph of the relationship between cassava genotype occulation on diameter of bulbs can be seen in Figure 3 below.

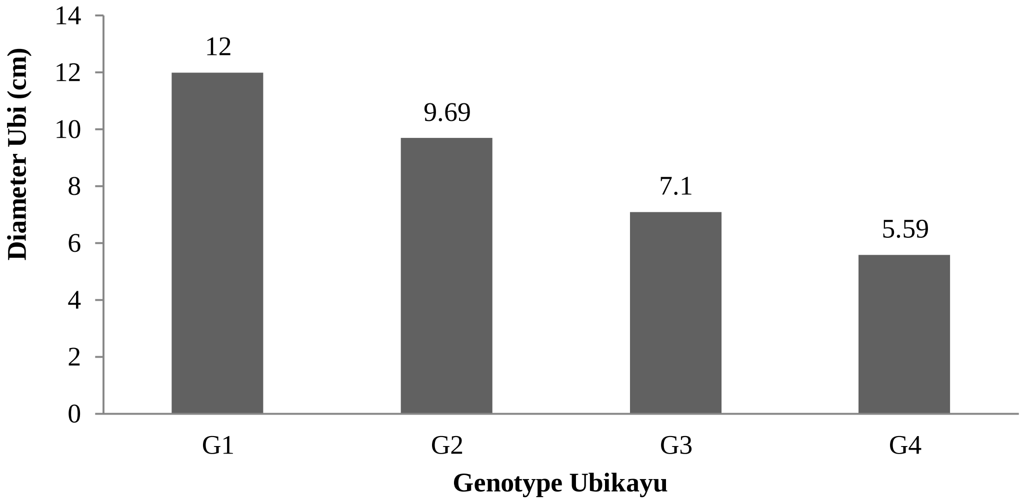

Figure 3. Graph of the Relationship of Cassava Genotype to the Diameter of Tubers

4.4 Long Bulbs

Table 4 shows that the cassava genotype of Malaysia Batu (G1) has the highest tuber length (G1) 12.00 cm, higher than Malaysian Susu (G2) 9.69 cm, Ubi Roti (G3) 7,10 and Mangu (G4) 5.59 cm, so between G2, G3 and G4 shows the real differences between each other. This is assumed that the making of planting holes gives room for the growth of grafted cassava to the maximum due to the availability of nutrients around the roots in the planting hole as well as the height of the plants. Besides that, the genotype of Malaysian batu has genetic characteristics superior to the other. As for the diameter of the tuber as well as the length of the tuber which is the growth of the tuber it self which is very much determined by genetic, plant, factors other than the environment.

Table 4. Average Length of Cassava Genotypes On Occulation Methods And Maked Hole Plant.

Genotypes Cassava	Occulation		Average
	O_0 (without occulation and without maked hole plant)	O_1 (Occulation and maked whole plant)	
	………………………………	cm………………………………	
G1 (Malaysia Batu)	289,00	397,00	85,75 a
G2 (Malaysia Susu)	251,00	369,00	77,50 b
G3 (Roti)	212,00	300,00	64,00 c
G4 (Mangu)	60,50	200,50	32,63 d
Average	50,78 b	79,16 a	

Description: the numbers followed by the same letter in the same row or column show no significant difference at the 5% level using the BNT test.

The graph of the relationship between the length of cassava tubers with genotype occulation and maked a hole plant can be seen in Figure 4 below.

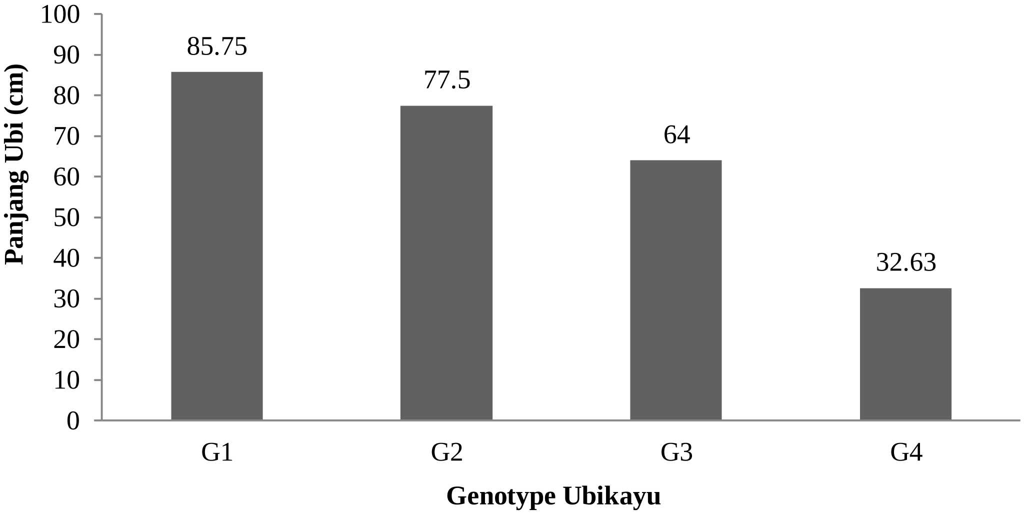

Figure 4. Graph of relationship between tuber length and cassava genotypes occulation and maked a hole plant.

4.5 Weight of Fresh Bulbs

Table 5 shows that the cassava genotype of Malaysia Batu (G1) has the highest tuber weight (G1) 33.63 kg, higher than Malaysian sweet potatoes Milk (G2) 30.39 Ubi roti (G3) 26.23 kg and mangu (G4) 16.15 cm, so between G2, G3 and G4 shows the real differences between each other. This is assumed that the making of planting holes gives room for the growth of grafted cassava to the maximum due to the availability of nutrients around the roots in the planting hole as well as the height of the plants. Besides that, the genotype of Malaysian stone cassava has genetic characteristics superior to the other three cassava genotypes. As for the weight of tubers is the growth of the tuber itself which is largely determined by genetic factors of plants other than the environment.

The growth of tubers, roots, stems and leaves, and determined by genetic and environmental factors. The genetic factors that determine one of them are genotype (Ekanayake et al., 1998) as a distinguishing feature and special characteristics with others. While environmental factors that influence growth are nutrient availability and water. The length and diameter of tubers are also the main component of tuber size, the longer and the width of the diameter, the larger the tuber size (Rahayuningsih, 2002).

Table 5. Average Weight of Cassava Genotype Bulbs on Occulation and Maked a Hole Plant

Genotypes Cassava	Occulation		Average
	O_0 (without occulation and without maked hole plant)	O_1 (Occulation and maked whole plant)	
	…………………………………	cm…………………………………	
G1 (Malaysia Batu)	26,00 e	243,00 a	33,63 a
G2 (Malaysia Susu)	20,10 f	223,00 b	30,39 b
G3 (Roti)	17,80 f	192,00 c	26,23 c
G4 (Mangu)	18,20 f	111,00 d	16,15 d
Average	5,13 b	48,06 a	

Description: the numbers followed by the same letter in the same row or column show no significant difference at the 5% level using the BNT test.

The graph of the relationship between cassava weight and cassava genotype occulation and maked a hole plant can be seen in Figure 5 below.

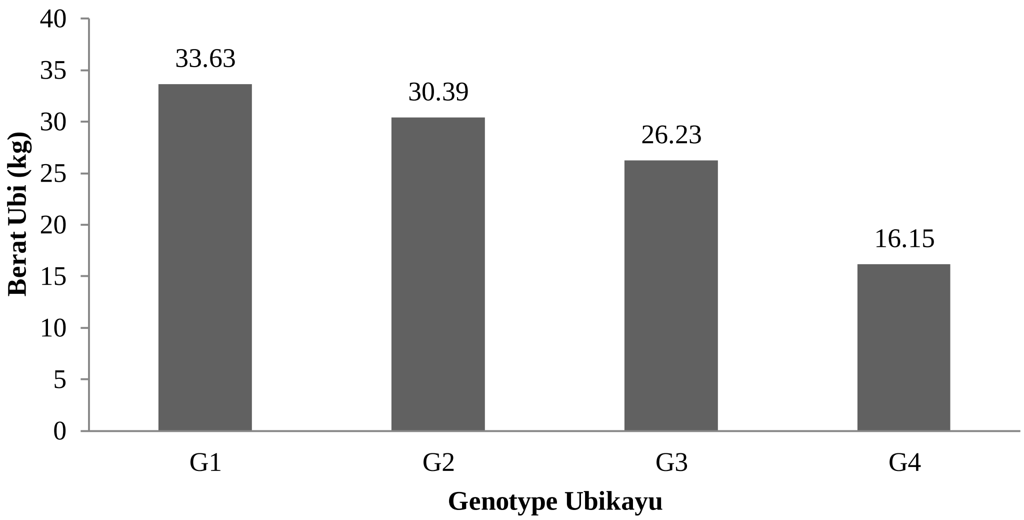

Figure 5. Graph of relationship between tuber weight and cassava genotypes of occulation and maked a hole plant.

4.6 Number of Bulbs

Table 6 shows that the cassava genotypes of Malaysia Batu (G1) has the highest number of tubers (G1) 8.25 , higher than Malaysian Susu (G2) 7.63, ubi Roti (G3) 7.13 and Mangu (G4) 6.63, so between G2, G3 and G4 shows the real differences between each other. This is assumed that the making of planting holes gives room for the growth of occulation cassava to the maximum due to the availability of nutrients around the roots in the planting hole as well as the height of the plants. Tuber enlargement is more accelerated than the number of tubers formed in its growth. Even though the number of tubers is only around 8 pieces, but the maximum tuber size and weight are an advantage. Besides that, the cassava genotype of Malaysia Batu has proven genetic properties that are superior to the three other cassava genotypes.

The growth of tubers, roots, stems, and leaves, is determined by genetic and environmental factors. The genetic factors that determine one of them are genotype (Ekanayake et al., 1998) as a distinguishing feature and special characteristics with others. While environmental factors that influence growth are nutrient availability and water. The length and diameter of tubers are also the main component of tuber size, the longer and the width of the diameter, the larger the tuber size (Rahayuningsih, 2002).

Table 6. Average Amount of Cassava Genotypes on Occulation and Maked a Hole Plant

Genotypes Cassava	**Occulation**		**Average**
	O_0 (without occulation and without maked hole plant)	**O_1 (Occulation and maked whole plant)**	
	………………………………	cm………………………………	
G1 (Malaysia Batu)	27,00 e	39,00 a	8,25 a
G2 (Malaysia Susu)	24,00 h	37,00 b	7,63 b
G3 (Roti)	26,00 f	31,00 c	7,13 c
G4 (Mangu)	25,00 g	28,00 d	6,63 d
Average	6,38 b	8,44 a	

Description: the numbers followed by the same letter in the same row or column show no significant difference at the 5% level using the BNT test.

The graph of the relationship between the amount of cassava tubers and cassava genotype occulation can be seen in Figure 6 below.

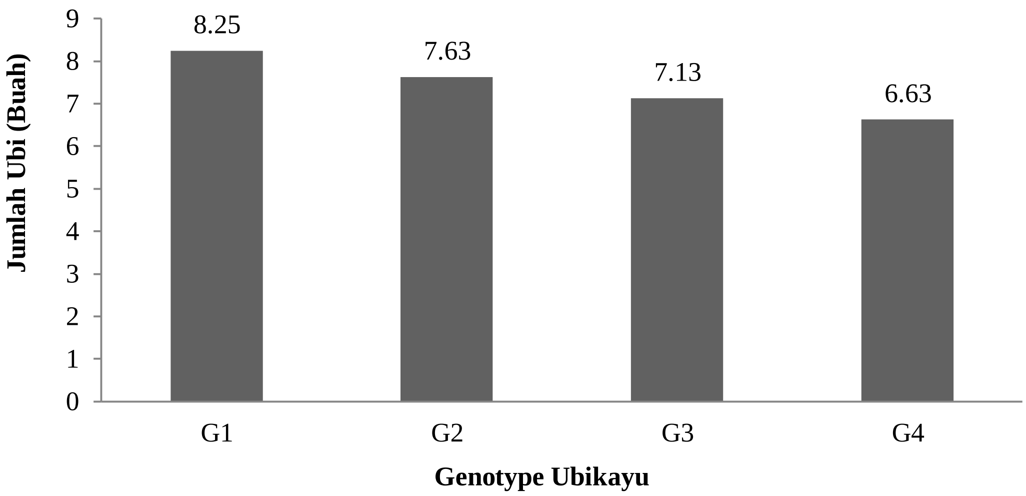

Figure 6. Graph of the number of tubers in the cassava genotype of occulation and maked a hole plant.

D. CONCLUSION

Occulation and maked a hole plant methods had a significant effect on the variables of plant height, stem diameter, tuber diameter, tuber weight and number of tubers.

The occulation and maked a hole plant method of the four cassava genotypes tested were obtained from the cassava genotype of Malaysia batu is superior to growth and yield compared to Malaysian Susu, Roti Cassava and Mangu. Cassava Genotype of Malaysia batu is the best type of genotype for use as a rootstock for cassava seedlings.

Suggestion

Further research needs to be carried out further research on the growth and yield of cassava with occulation methods and maked a hole plant of various other types of local cassava genotypes in accordance with local characters in each region.

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