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Identification of local garlic potential and development of Garlic *(Allium sativum* L.) resources in Indonesia

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ABSTRACT

The objectives of this study are to identify the potential of 4 types of local garlic (*Allium sativum* L.) namely variety of Saigon, Layur, Sembalun from Indonesia and Atsabe from Timor Lesteat 2 different altitudes, Wiyurejo village, Pujonsub district, Batu city with an altitude of 1200 meter above sea level (masl), and Cangar research station with the altitude of 1600 masl. The experimental design used was a Nested Completely Randomized design, with parameters observed were : the shoots and roots appearing age, number of leaves, Relative, crop production yields and agronomic characteristics. The results show that V1 variety has better growth, and yield in 1200 (T1) and 1600 (T2)masl, followed by V3, V2 and V4 consecutively. Special information for biomass production, T1V1 in 1200 masl is 5.15 g/plant followed by T1V1, T1V4 and T1V2 in 4.60 g/plant, 4.39 g/plant and 1.42 g/plant respectively. In 1600 masl T2V1 has also the best biomass in 8.08 g/plant followed by T2V3, T2V4 and T2V2 in 5.51 g/plant, 5.20 and 0.60 g/plant respectively.

Keywords : *Identification, Altitude, Garlic varieties, Local cultivars and characteristics.*

Introduction

Garlic is included in the *Liliaceae* family and is the clumped plants which had cloved. Garlic (*Allium sativum* Linn.) plant is a horticultural plant that has many benefits, especially its tuber is useful as a spice and can be used to treat several diseases such as respiratory infections and to increase body vitality (Pratimi, 1995). Wijaya *et al.* (2014) stated that the production of garlic in Indonesia has not been able to meet the demand for communities food needs, causing a considerable gap and emptiness between domestic consumption and production. This event caused a production deficit that required the government to import to meet the consumption of these commodities (Wibowo, 2006). In 2012 Indonesian garlic production was 296.500 tons, while national garlic demand was 400.000 tons. To meet national garlic requirements, the Indonesian government imported 320,000 tons of garlic in 2013, mainly imported garlic from China. The increase in the volume of imports was caused by several obstacles such as the narrow land area, high costs, the low quality of the seeds of the garlic used and the dependence of Indonesian people on the consumption of garlic (Central Bureau of Statistics, 2012). The development of garlic plants in Indonesia today has experienced a very sharp decline. Some local garlic cultivars are very difficult to find both in the farmer land and domestic markets. One of the main causes is the presence of imported garlic which tuber quality is better than local garlic tuber at affordable prices to consumers. The advantages of local garlic are; has a better taste and a sharp aroma compared

to other imported onions, but this garlic requires a fairly long planting time with a harvest time of 4-5 months. In addition, garlic has also been stated as one of the richest sources of total phenolic compounds among commonly consumed vegetables, where garlic has a high ranking related to consumption of phenolic per capita in human food intake (Lanzotti *et al*., 2014). To overcome these problems, it is necessary to identify plants that hope to produce superior garlic cultivars in Indonesia.

This study is important to note because both of these heights have not been conducted studies to explore and characterize local Garlic plants by studying the morphological and agronomic aspects of plants to describe plants and specifically this study is intended to identify patterns of growth and potential crop yields from 4 types of local garlic at altitudes of 1200 and 1600 meters above sea level.

Research Methods

This research was conducted in 2 different altitude of altitude and carried out in January 2018 until May 2018, and the height of the different site are altitude of 1200 meters above sea level, in the garlic farmer garden of Borah, Wiyurejo village, Pujonsub district, administrative city of Batu with a daily temperature of 15 - 20 ^{o}C and an average rainfall of 21.40 mm/year and at altitude of 1600 masl, conducted in the pilot garden of UB Cangar, Tulungre jourban village, Bumiajisub dstrict, city of Batu with an altitude of 1600 meters above sea level where the daily temperature of 17.5 °C - 22.8 ^{o}C and an average rainfall of 27.33 mm/year.

Tools and Materials

The tools used in this study namely; Horticulture books on garlic cultivation and other materials used include; oven, analytical scales and planting tools (*garden tools*) and the planting material used in the study was a local garlic genotype from 4 genotypes (Layur, Saigon, Sembalun and Atsabe), chicken manure, NPK Phonska and PGPR basic fertilizers.

Research Methods

This study was carried out by direct observation on 4 local garlic cultivars and carrying out planting tests to see the phenotype and production resilience of each local cultivar. And the design used is; Nestead randomized design with 4 treatments, each treatment with 4 replications. The first factor is the altitude (T) namely; T1 = 1200 m asl and T2 = 1600 m asl and the second factor is genotype (V) with 4 level namely; V1 = Saigon and V2 = Layur, V3 = Atsabe and genotype of V4 = Sembalun. The combination of each altitude with the genotype has 16 combinations of unit experiments.

Observation Variable

Observation variables were carried out by observing agronomic and morphological characteristics. Plant observations include; the age of shoots and roots appear, plant height, number of leaves, and crop yields and agronomic characteristics.

Results and Discussion

Results

Characterization appearance of 4 cultivars in 2 different altitudes

Garlic plant is a clumped seasonal herbaceous plant, green stem, had cloves at bottom parts, joining to white large tubers, ribbon-shaped leaves (flat elongated), flat leaf edges, pointy leaf tips, grooved, ± 60-70 cm length, 1.5-2.0 cm leaf width, fiber-rooted, white and long-stemmed flowers. According to the results and observations directly observed. The characteristics of local garlic from the 4 types of genotypes can be seen in Table 1.

According to Baghalian *et al.*, 2005; Bradley *et al*., 1996; and Avato *et al*., 1998, states that although garlic is a plant that is bred asexually, and reproduces only in a vegetative manner, a large number of different ecotypes diversity have evolved over time in various cultivation areas. Different ecotypes show large morphological diversity in tuber and leaf size, color and shape, presence of scales, and height, as well as flower color, fertility and development of bulbil (topset) during inflorescence (Pooler and Simon 1993). Thus, evaluating the genetic resources of garlic through morphological and molecular markers will enable us to better understand variations between accessions and choose accessions that are in accordance with the desired character for the identification and breeding program. The qualitative and quantitative nature of garlic accession shows wide variation, especially in a number of quantitative properties involved in plant growth and development of tubers. Tuber yields are the most important properties for garlic and have been

Table 1. The agronomic characteristics of 4 types of local garlic in the two different altitudes.

Characteristics	Local garlic (*Allium sativum* L.) cultivars			
	V1	V2	V3	V4
Age of roots grow	4 days	6 days	5 days	4 days
Age of shoots appear	7 days	5 days	9 days	8 days
Root shape	Fibers	Fibers	Fibers	Fibers
Plant height	21.76cm	19.01cm	26.79cm	32.51cm
Stem color	Light green	yellowish green and red spots	Light green	Green and yellowish stripes
Stem shape	Large	Small	Large	Large
Stem diameter	5.5-6.0cm	3-3.5cm	5.5cm	4-5.5cm
Stem stalk	60-80cm length	70-85cm length	75-80cm length	75-80cm length
Leaf length	30-60	30-35cm	60cm	50-60cm
Number of leaves	7-8 strands	4-5 strands	6-7 strands	8-9 strands
Leaf width		0.5-0.7cm	1.5-1.7cm	1.5-2.3
Leaf bottom	2.5-3.0cm	2-3cm	3.5-4.5cm	6-6.5cm
Leaf shape	Wide and rather thin	Rather small (cylindrical)	Ribbon-shaped	Width and thick
Leaf color	Light green	Dark green slightly thin yellow	Dark green	Yellow-green and thick
Number of cloves	4-12	15-20	10-15	12-13
Cloves length	2.5cm	3-3.5cm	2.5cm	2.0cm
Shape of bulbs/ cloves	Round and big	Rather long and small	Round and big	Small rather oval
cloves weight	0.6g	0.1g	0.7g	0.2g
Color of bulbs and cloves	Purplish white white	Yellowish/cream	White	Brownish white
Tuber weight	0.20g	0.6g	0.20g	0.18g
Tuber diameter	60-70mm	33-62mm	60-75mm	20-27mm
Aroma	More fragrant	More fragrant	More fragrant	Fragrant
Taste	More spicy	More spicy	More spicy	Spicy
Harvest age	120 days	135 days	125 days	120 days

Source: Personal documents (results of direct observations observed).

evaluated by a number of previous studies. (Jabbes *et al*., 2012; Baghalian *et al*., 2006; Jabbes *et al*., 2012) found that tuber yields were strongly influenced by the following characteristics: clove weight, tuber weight and diameter, number of leaves per plant and stem length. Baghalian *et al*. (2005) found a significant positive correlation between the mean weights of cloves and tubers, a negative correlation between mean weights of cloves and the number of cloves. Raju *et al.* (2013) got similar results based on the garlic genotype. Along with the opinion of Mishra *et al*. (2013) found that garlic genotype also had a significant difference in terms of its morphological character.

Growth patterns of 4 cultivars in 2 different altitudes

The results of this research experiment obtained the growth pattern of garlic plants in Pujon and Cangar, Observation of growth patterns begins in plants aged 2, 4, 6, 8 and 10 weeks after planting. As for the growth pattern of the age of shoots and roots appears, the number of roots, root length, crop production yields and appearance of agronomic characteristics at the Pujon and Cangar locations can be presented in the following figure :

Age of the shoots grows

Based on the results of variance analysis showed that genotypes at various heights/altitude were not significantly different on the age of garlic shoot grow. As for the effect of treatment on the shoots of garlic plants can be seen in Table 2 below :

Table 2, The results of the analysis of variance showed that the average age of shoot growth of genotypes treatment T1V1, T1V2, T1V3 and T1V4 were not significantly different from the height of 1200 meters above sea level and genotypes treatment T2V1, T2V2, T2V3 and T2V4 at an altitude of

1600 meters above sea level.

Plant Height

Based on the results of variance analysis showed that the treatment of varieties at various heights was significantly different on the height of the garlic plants aged of 2,4,6,8 and 10 weeks after planting the plant height increased from 2 weeks after planting until 10 weeks after planting. The response of plant height was started on plants aged 2 weeks after planting where the T2V4 genotype at 1600 masl with an average plant height higher (9.53cm) but not significantly different from the T2V3 genotype treatment (8.51cm) at an altitude of 1600 masl and T1V4 varieties (7.81cm) at an altitude of 1200 meters above sea level. In the plant aged 4 weeks after planting, the T2V4 varieties at an altitude of 1600 masl has the highest average plant height (16.74cm) compared to varieties at various other heights but not significantly different from the T2V3 genotype (15.37cm) at an altitude of 1600 masl. In plants aged 6, 8 and 10 weeks after planting, the T2V4 varieties at an altitude of 1600 masl shows the highest plant height (23.00 cm, 27.99 cm and 41.80 cm) compared to varieties at other heights (Table 2). As for the treatment effect on the height of garlic plants in the age of 2,4,6,8 and 10 weeks after planting can be seen in Table 3.

Table 2. The Average Age of Shoots Grow of 4 garlic types towards the altitude

Altitude (masl)	Genotype	Shoots Grow (day)
T1	V1	3.75
	V2	6.25
	V3	4.75
	V4	4.25
T2	V1	5.50
	V2	5.50
	V3	5.75
	V4	6.75
	LSD 5%	Ns

Information : Numbers accompanied by the same letter on the same row and column are not significantly different from the 5% LSD test, T1=1200 and T2=1600masl; V1=saigon, V2=layur, V3=Atsabe and V4=Sembalun.

Number of Leaves

Based on the results of variance analysis, it was shown that the treatment was significantly different towards the number of leaves on the plant aged 2,4,6,8 and 10 weeks after planting The number of leaves increased starting from 2 weeks after planting to 10 weeks after planting. The response of the number of leaves began in plants aged 2 weeks after planting where the T1V3 varieties at an altitude of 1200 masl showed a higher number of leaves (2.70 leaves) and significantly different from the T2V1 (1.53 leaves) at an altitude of 1600 masl. In plants aged 4 weeks after planting, the T2V4 at an altitude of 1600 masl shows the highest number of leaves (3.53) but not significantly different from the varieties of T2V3 (3.43 leaves) at an altitude of 1600 masl and the variety of T1V4 (3.35 leaves) and T1V3 (3.23leaves) at an altitude of 1200 masl. In plants aged 6 weeks after planting, the T2V4 genotype at an altitude of 1600 meters above sea level shows the highest number of leaves (4.60 leaves) but not sig-

Table 3. The average of plant height at various ages of local garlic growth towards the place height (altitude)

Altitude	Genotype	Plant height (cm) at the age of WAP				
		2	4	6	8	10
T1	V1	4.56 a	9.24 a	14.65 a	17.85 a	21.76 b
	V2	5.74 abc	9.62 ab	14.46 a	16.44 a	19.01 a
	V3	7.00 bcd	13.17 cd	17.82 b	21.70 bc	26.79 c
	V4	7.81 de	13.90 de	20.52 c	23.76 cd	32.51 d
T2	V1	5.30 ab	11.10 ab	17.75 b	20.75 b	27.82 c
	V2	7.15 cd	11.64 bc	14.39 a	18.39 a	20.80 ab
	V3	8.51 de	15.37 ef	20.36 c	25.12 d	31.21 d
	V4	9.53 e	16.74 f	23.00 d	27.99 e	41.80 e
	LSD (%)	*	*	*	*	*

Information: Numbers accompanied by the same letter on the same row and column are not significantly different at the 5% LSD test, WAP = Weeks after planting, T1=1200 and T2=1600 masl; V1=saigon,V2=layur, V3 = Atsabe and V4=Sembalun.

nificantly different from the varieties of T2V3 (4.23 leaves) at an altitude of 1600 masl and varieties of T1V4 (4.40 leaves) and not significantly different from T1V3 (4.05 leaves) at an altitude of 1200 meters above sea level. In plants aged 8 weeks after planting, the T1V4 variety shows the highest number of leaves (6.33 leaves) compared to other genotypes at an altitude of T1 and T2. In plants aged 10 weeks after planting, the T1V4 at an altitude of 1200 meters above sea level shows the highest number of leaves (7.50) and but not significantly different from theT2V4 (7.25 leaves) at an altitude of 1600 masl. As for the effect of treatment towards the number of leaves of garlic plants on the age of 2,4,6,8 and 10 weeks after planting can be seen in Table 4 below:

Plant production biomass

Based on the results of variance analysis showed that genotypes were significantly different towards root fresh weight, root dry weight, Stem fresh weight, Stem dry weight, Leaf wet weight, Leaf dry weight, Wet weight of bulbs and dry weight of bulb, the effect of treatment can be seen in Table 5-6 below :

Based on Tables 5 and 6, it shows that the highest average root fresh weight is in the T2V4 genotype at an altitude of 1600 masl amounted to (21.23 g plant^{-1}) but not significantly different from the genotypes of T2V4 (1.77g plant^{-1}) and T2V3 (1.71g plant^{-1}) at an altitude of 1600 meters above sea level. The highest average root dry weight was found in the T1V1 genotype treatment at an altitude of 1200 meters above sea level equal to 0.78g plant^{-1}) and but not significantly different from T2V4 (0.7g plant^{-1}) and T2V1 (0.75g plant^{-1}) genotypes at an altitude of 1600 masl.

The highest average weight of stem was found in the T2V3 genotype at an altitude of 1600 masl but

Table 4. The average number of leaves at various ages of plants

Altitude (masl)	Genotype	Number of Leaves (strands) at the age of (WAP)				
		2	4	6	8	10
T1	V1	2.03 ab	2.33 a	3.20 ab	4.00 bc	4.83 c
	V2	2.20 bc	2.75 b	2.85 a	3.25 a	3.28 a
	V3	2.70 c	3.23 c	4.05 c	5.43 d	6.63 e
	V4	2.55 bc	3.35 c	4.40 cd	5.43 d	7.50 f
T2	V1	1.53 a	2.60 ab	3.35 b	4.20 c	5.63 d
	V2	2.20 bc	2.70 ab	3.03 ab	3.55 ab	3.98 b
	V3	2.40 bc	3.43 c	4.23 cd	5.60 d	6.58 e
	V4	2.35 bc	3.53 c	4.60 d	6.33 e	7.25 f
	LSD 5%	*	*	*	*	*

Information: Numbers accompanied by the same letter on the same row and column are not significantly different at the 5% LSD test; WAP= Weeks after planting, Masl = meters above sea level,T1=1200 and T2=1600masl; V1=saigon, V2=layur, V3=Atsabe and V4=Sembalun.

Table 5. The average of plant production yields from 4 types of garlic towards different altitudes

Altitude (masl)	Genotype	Root fersh weight (g plant^{-1})	Root dry weight (g plant^{-1})	Stem wet weight(g plant^{-1})	Stem dry weight (g plant^{-1})
T1	V1	1.34 b	0.78 d	3.45 c	1.13 c
	V2	0.45 a	0.33 a	0.69 a	0.35 a
	V3	1.34 b	0.57 c	5.19 d	1.24 d
	V4	0.54 a	0.44 b	2.36 b	0.84 b
T2	V1	2.14d	0.75 d	12.68 f	2.13 f
	V2	1.22 b	0.33 a	9.47 e	1.38 e
	V3	1.71 c	0.47 bc	6.21 h	3.26 h
	V4	1.77 c	0.74 d	15.71 g	2.39 g
	LSD 5%	*	*	*	*

Information: Numbers accompanied by the same letter on the same row and column are not significantly different from the 5% LSD test, masl = meters above sea level,T1=1200 and T2=1600masl;V1=saigon,V2=layur,V3=Atsabe and V4=Sembalun.

not significantly different from the T2V4 genotype at an altitude of 1600 masl. The highest average fresh weight of the stem was found in the T2V3 genotype at an altitude of 1600 masl but not significantly different from T2V4 at an altitude of 1600 masl. The highest average leaf fresh weight was found in the T2V3 genotype at an altitude of 1600 meters above sea level amounted to (9.77g plant^{-1}) significantly different from the T1V1,T1V2, T1V3 and T1V4 genotype at an altitude of 1200 masl. The highest average leaf fresh weight was found in the T2V3 genotype at an altitude of 1600 masl significantly different from the T2V4 genotype at an altitude of 1600 meters above sea level and the T1V1 and T1V3 genotype at an altitude of 1200 masl.

The highest average wet weight of the bulbs was found in the T1V1 genotype (27.31g.plant^{-1}) at an altitude of 1200 masl and significantly different from otheratitude. While the highest average weight of bulb is found in the T2V1 genotype (8.08gplant^{-1}) at an altitude of 1600 meters above sea level but not significantly different from the T1V1 genotype (5.15 g plant^{-1}) at an altitude of 1200 masl. The smallest average dry weight of the bulbs was found in the T2V2 genotype (0.60 g plant^{-1}).

Discussion

Apparently, based on the table presented above, starting from age of plant roots appears, the number of roots, root length, plant height, number of leaves, leaves area index, stem diameter, tuber diameter per plant, number of cloves per bulbs, bulb fresh weight, bulb dry weight, both types of land are both increasing but there are big differences. At an altitude of 1600 meters above sea level, observations of all the variables that have been produced are much higher than those on the ground at an altitude of 1200 meters above sea level, where this occurs because of the variety of soil characteristics. Differences in soil quality as plant media influence plant growth and development. Plant growth and development are life processes and propagation where it depends on the results of assimilation, hormones, and growth of substances and environments that support and produce growth patterns (Gardner *et al.*, 1991).

The pattern of plant growth from 4 types of garlic at different heights showed that the Sembalun varieties with the response of the number of leaves, leaf length, leaf width, leaves area index, plant height and garlic biomass is the highest compared to other genotypes planted in two different places. Growth in the number of leaves on local garlic plants planted at an altitude of 1200 meters above sea level is less than the garlic plants planted at an altitude of 1600 meters above sea level and show stunted growth. This is related to the characteristics of the soil in Pujon which has a high acidity level, namely; pH 5.3 (H_2O), 4.6 (KCl) with C-organic 1.12%, N total 0.13%, C/N 9, P. Bray 36.57 mg kg^{-1}, CEC 26.97 me/100g, Wet saturation 51%, containing 41% sand, 33% dust, 26% clay with loam texture (Results of analysis of the Laboratory of Soil Chemistry at Universitas Brawijaya, 2018). The low pH content causes a high level of soil acidity which will

Table 6. The average of production yield Biomass of 4 types of garlic plants towards the different altitude

Altitude (masl)	Genotype	LFW (g plant^{-1})	LDW (g plant^{-1})	BWF (g plant^{-1})	BDW (g plant^{-1})
T1	V1	4.45 d	1.27 cd	27.31 g	5.15 e
	V2	0.65 a	0.35 a	4.83 b	1.42 b
	V3	7.03 g	1.78 e	15.96 d	4.60 d
	V4	3.06 b	0.94 b	13.97 c	4.39 c
T2	V1	4.21 c	1.35 d	26.99 f	8.08 g
	V2	4.65 e	1.14 c	3.93 a	0.60 a
	V3	9.77 h	2.29 f	16.19 d	5.51 f
	V4	5.72 f	1.73 e	19.61 e	5.20 e
	LSD 5%	*	*	*	*

Information: Numbers accompanied by the same letter on the same row and column are not significantly different from the 5% LSD test; LFW= leaves fresh weight and LDW = leaves dry weight, BFW =bulbs wet weight, BDW= bulbdry weight, masl = meters above sea level. T1=1200 and T2=1600masl; V1=saigon, V2=layur, V3=Atsabe and V4=Sembalun.

cause low soil fertility and become an obstacle in its utilization(McCormack, 2012, Goronski *et al*., 2010).High soil acidity also results in delays in the availability of nutrients both macro and micro nutrients and poor drainage as well as hydrolysis of organic acids (McCormack, 2012; Goronski *et al*., 2010). Added by Limin *et al*., 2000; Siqueira *at el*., 2019) that the high cation exchange capacity (CEC) and low wet saturation will also be obstacles so that the plants are unable to grow and develop better, this can be seen from plants that grow languish and the number of leaves is relatively small. Conversely, the pattern of growth in the number of leaves at an altitude of 1600 masl tends to be more than the height of 1200 masl. Because at that height it has a fairly good aeration, drainage and organic matter content. Soil characteristics in Cangar have a pH content of 5.7 (H_2O), 4.9 (KCl) with C-organic 4.00%, N total 0.47%, C/N 8, P. Bray 21.45 mg kg^{-1}, CEC 33.90 me/100g, Wet saturation 50%, containing 41% sand, 46% dust, 13% clay with loam texture (*sandy loam*).

This type of soil is predominantly sandy so it has porous soil pores but with sufficient C-organic (4.00%), C/N 8 and CEC 33.90 me/100g make the land able to withstand the availability of water in the soil and provide a better growing environment to support the growth and development of local garlic plants. Soils with high organic matter content will be preferred because they have higher moisture and nutrient-retaining capacity, and are less susceptible to cracking and compaction. (Bodnar *et al*., 1998 and Ruto *et al*., 2019). The use of organic fertilizers helps in structuring loam soils to open and enter water penetration to root and drainage, both of which are needed for satisfying plant growth (Eimhoit *et al*., 2005; Siqueira *et el*., 2019). Although garlic is a plant that is bred asexually, and reproduces only in a vegetative manner, a large number of different ecotypes diversity have evolved over time in various areas of cultivation (Baghalian *et al*., 2005; Bradley *et al*. 1996; Avato *et al*. 1998). Different ecotypes show large morphological diversity in tuber and leaf size, color and shape, presence of scales, and height, as well as flower color, fertility and development of tubers (topset) during inflorescence (Pooler and Simon, 1993; Azangue *et al*., 2019). Thus, evaluation on the genetic resources of garlic through morphological properties and molecular markers will enable us to better understand variations between accessions and choose accessions that are in accordance with the desired character for breeding programs. The difference in soil quality as a growing medium will affect plant growth and development.

The growth and development of the plant is a process in life and propagation which depends on the results of assimilation, hormones, substances of environmental growth that support and produce a pattern of growth (Gardner *et al*., 1991 and Ruto *et al*., 2019). The availability of nitrogen is very important for plant growth because these compounds are the main proetin constituents and the main and irreplaceable amino acid molecules. This compound is also an integral part of the chlorophyll molecule, which is responsible for photosynthesis. Adequate nitrogen supply will be associated with strong vegetative growth and more efficient use of inputs available which leads to higher productivity. The findings of this study are close to the results found by Naruka and Dhaka (2001); Yadav (2003); Banafar *et al*. (2005); Sharma *et al.* (2008) and Naruka *et al*. (2005). The diversity of the morphological properties of plant germplasm resources plays a significant role for breeding programs. Variations found in qualitative properties are very useful in identifying germplasm and in developing new varieties and quantitative properties direct the results of production (Panthee *et al*. 2006).

The qualitative and quantitative nature of garlic accession shows wide variation, especially in a number of quantitative properties involved in plant growth and development of tubers. In addition, a number of properties which are connected to the bolt, bolt length, basal bolt diameter, tuber diameter, tuber weight, spathe length, and spathe width, because the tuber is the most commonly consumed garlic organ. Tuber yield is the most important properties for garlic and has been evaluated by a number of researchers in previous studies (Baghalian *et al*. 2006; Jabbes *et al*., 2012; Jabbes *et al*., 2012) found that the yield was strongly influenced by the following properties: clove weight, tuber weight and diameter, number of leaves per plant and stem length. According to Baghalian *et al*. (2005) found a significant positive correlation between the average weights of cloves and tubers, the negative correlation between the average weights of cloves and number of cloves. Raju *et al.* (2013) get similar results based on the garlic genotype. Along with the opinions of *Mishra et al*. (2013) found that the garlic genotype also had a significant difference in terms

of its morphological character.

Conclusion

1) The results of the identification of 4 local garlic cultivars, namely Saigon (V1), Layur(V2), Atsabe (V3) and Sembalun (V4). Almost all tested clones can grow and develop well, besides the morphological character of each garlic clone in general does not show a significant difference, especially seen from the shape of the bulbs, the color of the bulb and cloves, the color of the leaves. Based on harvest age, garlic clones from the exploration result can be grouped into 3 categories, namely short harvest age (120 Day After Planting) includes V1 and V4, medium harvest age (125 Day After Planting) namely V3 and deep harvesting age (above 135 Day After Planting) only V2. 2) Based on the potential results, V1, V3 and V4 clones can be used as superior clones of local garlic whose quality is not inferior to imported garlic. These three superior garlic clones need to be tested further in several garlic production centers in Indonesia to see adaptability in the hope that they can provide hope for farmers in developing local garlic agribusiness and at the same time can be a substitute for imported garlic.

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