

UDC 633

THE RELATIONSHIP OF THE NUMBER AND SHAPE OF SEED WITH THE GENDER OF SALAK SUWARU

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ABSTRACT

Salak Suwaru is one of excellent fruits of East Java, Indonesia, promoted as superior fruit. Generally, salak Suwaru is cultivated vegetatively through bud grafting of the female plant. This condition causes the expansion of planting area focusing only on the female plant without balancing the male plant. Supposedly, salak cultivation in the development area should be planted with both female and male plant. Male plant should be planted at least 10% of the population. The issue is that male plant of salak produces a few buds. On the other hand, the seed is the only material for salak propagation. However, there is no certainty which seed will grow as a male plant. A research conducted in Experimental Farm of East Java Assessment Institute for Agricultural Technology, from October 2011 to April 2014 aims to determine if the number and shape of the seed can be used as the characteristics of the male plant of salak Suwaru. The research result shows that salak Suwaru consisting of one seed with rounded shape will likely grow as a male plant with the chance of 96.67%. In addition, the dusk color and the leaf hardness can also be used as the characteristics of male plant of Salak Suwaru.

KEY WORDS

Leaf morphology, Salak, suwaru, male, seed shape.

Salak is a native fruit of Indonesia (Mogea, 1984) and salak is superior fruit in several regions with a very large national and international market opportunity (Sumarno, 2004). Salak belongs to Palmae family, first cultivated in Java and the fruit was marketed in Singapore (Ridley, 1925). Salak is not only spread throughout the archipelago but also to Malaysia, Philippines, Brunei and Thailand (Widyastuti and Paimin, 1993). Therefore, Java as the center of salak cultivation encourages various regions in Java to be the main production center of salak. One of the regions in East Java known as the main production center of Salak is Malang. Malang is a well-known producer of salak Suwaru.

Salak Suwaru is one of excellence fruits in East Java promoted as superior variety through Ministry of Agriculture Decree No: 120/Kpts/TP/240/3/1991. One of the Suwaru's superiority is thick meat, similar to grains (masir), sweet taste, strong fragrance with the weight per fruit ranging from 70 – 120 g (Widyastuti and Paiman, 1993; Department of Agriculture of Food Crop Level II Malang Regency, 1997).

Salak (*Salacca edulis* Reinw) syn *Salacca zalacca* (Gaertner) Voss (Mogea 1984; Schuiling and Mogea, 1992) belongs to Palmae family growing in a cluster. Salak belongs to dioecious plant based on the gender of the plant. Male and female flower are in the different plant (Mogea, 1978). Based on the nature of such flower, salak is generally cross-pollinated (Frankel and Galun, 1977; Fisher and Mogea, 1980).

Based on its cross-pollination nature of salak, the presence of male salak as a source of the pollen is very important. The limited male plant of salak as the source of the pollen is associated with the today's plant propagation. Salak Suwaru is cultivated vegetatively through bud grafting of the female plant. This condition causes the expansion of planting area focusing only on the female plant without balancing the male plant. Rosmahani et al. (2001) suggested that on the salak cultivation, other than female plant, the male plant should also be planted in the new development area with about 10% of the population from female

plant. Reproducing the male plant of salak can be used to overcome the limited source of pollen. The issue is that male plant of salak produces a few buds (Ashari, 2002).

On the other hand, the large source for the propagation of salak is in the seed. However, there is no certainty which seed will grow as a male plant. Therefore, there should be a research on how to determine male plant of salak based on the seed form. On the salak cultivation, it is very important to find the appropriate method in order to determine male and female plant of salak plantlet grown from the seed ("Sinkronisasi Pelaksanaan Program", 2003).

The research aims to determine if the number and shape of the seed can be used as the characteristics of the male plant of salak.

METHODS OF RESEARCH

The research started from October 2011 to April 2014 at the Experimental Farm of East Java Assessment Institute for Agricultural Technology, Malang, Indonesia at an altitude of \pm 550 m above sea level.

The seeds come from salak Suwaru. They are taken from one-seeded salak that has rounded shape. The criteria of round seeds are that the seed has the ratio of length and width of about 1:1. A total of 200 seeds is collected and seeded in black polybags with the size of 15 cm x 20 cm containing a mixture of the medium of soil and barnyard manure with the ratio of 1:1. Before seeding the seeds they have to be germinated (Figure 1). The plantlet is cultivated on the field at the age of 4 months after the seedling. A total of 150 plantlets is cultivated on the field in 3 blocks with each block consisting of 25 plants.

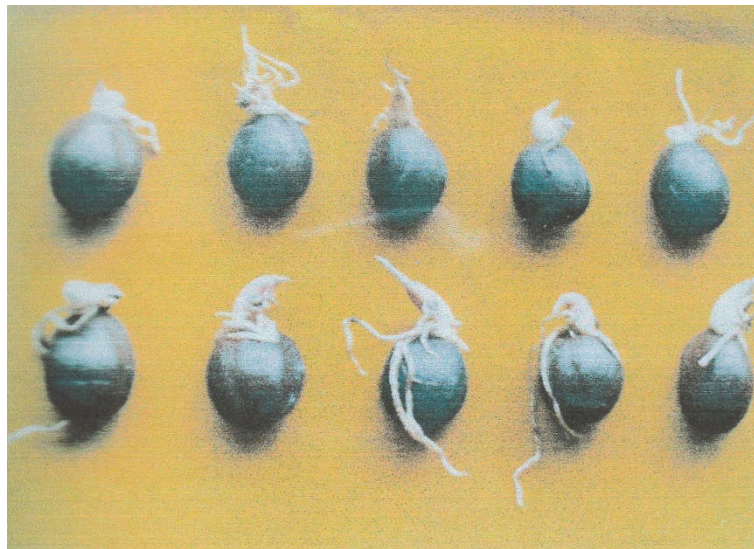


Figure 1 – Germ from rounded shape seed of salak Suwaru

The cultivation on the field with a plant spacing of 2 m x 2 m and plant management based on Sudaryono (1992). 20 plants are randomly selected in each block for observation. The observation includes the morphology of the plant, which is the character of the leaf such as the dusk color and the leaf stiffness. The same observation is conducted on the adult male of salak. The observation of the dusk color of the leaf uses color chart and the observation of the stiffness is conducted using penetrometer. Correlation analysis is conducted in order to understand if there is a relationship between the leaf characteristic of the adult salak with the younger salak. Therefore, the characteristic of dusk color and the stiffness of the leaf are generally used by the farmer to differentiate male and female plant of salak in the plantlet phase. Thus, the observation on the younger salak is continued until the flowering phase of the plant to ensure that the concerned plant is a male plant. Data analysis uses t-test.

RESULTS AND DISCUSSION

Proportion of Rounded and Non-Rounded Salak Seeds of Any Fruit Bunch of Salak Suwaru. Rounded shape seeds are produced from salak with only one seed. Non-rounded seeds are produced from salak with 2 or 3 seeds. The shape of the seed produced from every fruit bunch of salak Suwaru is not affected by the environment. Research result shows that the proportion of rounded and non-rounded seed, whether from fertile and infertile salak Suwaru, are different. The chance to obtain rounded shape seed is around 13%. The criteria of fertile and infertile salak Suwaru is based on the number of fruit and seeds. The fertile salak Suwaru produces a lot more fruit and seed per fruit bunch comparing to infertile salak Suwaru (Table 1). The chance to obtain rounded shape seed of salak from every fruit bunch is about 13%. In order to obtain male plant from the seed, 5 – 10 of plants will be obtained from each fruit bunch. Assuming that every fruit bunch of salak Suwaru consists of 42 – 69 seeds. This amount is more than propagation of male plant using bud grafting. According to Ashari (2002), every parent of the male plant of salak Suwaru on average only has 1 tiller every year. Thus, propagation of salak plantlet in a massive scale can be reached using the seeds. In addition, to obtain the plantlet in large quantity, this method can be easily implemented by the farmers.

Table 1. Proportion of rounded and non-rounded seeds of salak between fertile and infertile Salak Suwaru

The condition of the plant	The number of seed per bunch	The number of seed per bunch	Rounded Seed		Non-Rounded Seed	
			Total	Percentage (%)	Total	Percentage (%)
Fertile	34 a	68 a	9 a	13.24 a	59 a	86.76 a
Infertile	11 b	23 b	3 a	13.04 a	20 b	86.96 a

Note: The numbers in the same column that are accompanied by different letters show a real difference based on t-test at the level of 1%.

Leaf Morphology. The observation of the leaf morphology on 1-year-old salak cultivated from the rounded seed show that dusk color ranged from brownish green to yellowish brown with an average score of 3.55. Meanwhile, the dusk color on the adult male of salak ranged from brownish green to yellow with an average score of 3.65 (Table 2). The dusk color of the younger salak leaf is positively correlated with the dusk color on the adult male of salak with the value of closeness relationship (r) of 0.843.

Table 2 – Comparison of mean score of dusk color and leaf hardness between younger salak aged 1 year with adult male of salak aged > 5 years old

Leaf Characters	Young salak derived from rounded seeds (age of 1 year)	Adult male of salak (age > 5 years))
Dusk color	3.55 a	3.65 a
Stiffness	1.68 a	1.75 a

Note: The numbers on the same line followed by the same letter indicate no difference based on t-test at the level of 5%.

The observation of other leaf morphology on 1-year-old salak cultivated from rounded seed show that around 75% of the plant show the characteristic of leaf hardness or stiffness with an average score of 1.75 (Table 2). Leaf hardness characteristic in young salak is positively correlated with the leaf hardness of male adult of salak with closeness relationship (r) of 0.823.

The dusk color and the leaf hardness of young salak is positively correlated with the dusk color and the leaf hardness of male adult of salak. Indicating that leaf morphology of the leaf can be used to differentiate or characterize the gender of salak. The reality on the field shows that the leaf character of salak being observed grows into a male plant. This fact is contrary to what has been proposed by Ashari (2002) and Nazaruddin and Kristiawati (1992). Research result conducted by Ashari (2002) concludes that female and male salak show

same morphology. Nazaruddin and Kristiawati (1992) suggested that salak from the seed, since the beginning of the growth until the flowering phase, shows same morphology characteristics between female and male plant.

The relationship of Seed Shape and the Gender of Salak Suwaru. The observation on 150 salak from rounded seeds until the age of 31 months shows that the number of male plant (Figure 2) in the block I, II and III is 49, 48 and 48 plants consecutively. Meanwhile, the number of female plant in the same block is 1, 2 and 2 (Table 3) consecutively.



Figure 2 – Male plant of Suwaru cultivated from rounded seeds, age 31 months

Table 3 – Proportion of male and female salak cultivated from rounded seeds

The gender of the plant	Number of Plant		
	Block I	Block II	Block III
Male	49 (98.0%) a	48 (96.0%) a	48 (96.0%) a
Female	1 (2.0%) b	2 (4.0%) b	2 (4.0%) b

Note: The numbers in the same column followed by different letters show real difference based on t-test at the level of 1%.

In Table 3, it can be seen that from 150 rounded seeds of salak Suwaru being cultivated, 145 seeds (96.67%) grow into a male plant. Meanwhile, 5 seeds (3.33%) grow into a female plant. The research result shows that the number and shape of the seed are related to the gender of salak Suwaru. Salak Suwaru with one rounded seed will grow into a male plant.

CONCLUSION

Based on the results of the research, there are two points of conclusion that can be made as follows. Firstly, the dusk color and leaf hardness can be used as the differentiation of male and female plant of salak Suwaru. Secondly, Salak Suwaru consisting of one seed with rounded shape will likely grow as male plant with the chance of 96.67%.

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