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Artikel

THE EFFECT OF THE STAKE STRUCTURE MODELS ON POD QUALITY OF SEVERAL YARDLONG BEAN VARIETRIES *(Vigna unguiculata* L. subsp. *Sesquipedalis)*

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ABSTRACT

Yardlong bean is one of the commodities with very high economic value. To obtain good quality pods, it requires the right cultivating techniques such as the use of stake model and the use of superior varieties. The objectives of this study were to investigate the effect of stake model and varieties on the quality of yardlong bean pods. This research was conducted on the Agrotechnology Innovation Center of Universitas Gadjah Mada at March-June 2019. This research was arranged in factorial treatment design with Randomized Complete Block Design (RCBD) using three blocks as replication. The first factor is the stake model i.e. single, double, and triangle. The second factor is varieties included Parade Tavi, Pujangga, Katrina, Wulung, and Kaloka. The observed quantitative data were analyzed using analysis of variance (ANOVA), followed by Scott-Knott with the level of credibility at 5 %. The results showed that the use of the stake models on different varieties does not indicated a significant impact on the quality of produced pod.

Keyword: pod, quality, stake model, varieties

INTRODUCTION

Future food needs will increase, so it is necessary to increase the production of yardlong beans because it has an important meaning in supporting the improvement of community nutrition, as well as the high economic opportunity. Yardlong beans are also promoted as a source of protein and minerals. Thus, this vegetable attracted consumer attention who understand the meaning of nutritional value and good quality of foods. Yardlong beans can be consumed in fresh or process form. According to Haryanto (2003), yardlong bean seeds contain carbohydrates (70.00%), protein (17.30%), fat (1.50%), and water (12.20%), so this commodity also becomes a source of vegetable protein. However, not many people like yardlong beans, especially children, because it has a bad taste. The quality of yardlong bean pod can be seen in terms of taste, pod fiber or the level of pod crunchiness, and the nutritional content.

In the cultivation of yardlong bean, several factors need an attention to improve the quality of yardlong bean pods. These factors include the use of improved varieties and staking. Yardlong bean superior varieties have certain superior properties compared to local varieties. Yardlong bean is an indeterminate crops (Suanum et al., 2016), therefore stake is requires to

have good yardlong bean yields (Suanum et al., 2016)), plants need to be given a stake as a place to a vine (Setiawan and Trisnawati, 1999). The use of stake increases the light capture and facilitates the agricultural practices such as fertilizing, spraying pesticides, and weeding (Rukmana 1994). Samadi (2003) revealed that there are several types of stake arrangement models such as isosceles triangle, equilateral triangle, triangle pyramid, and fence. In addition to these models, there are various models of spatial planning used in the practice of yardlong bean cultivation. However, studies of the effect of the spatial structuring model on the growth and yield of yardlong beans have never been reported, therefore in this opportunity, research will be conducted to evaluate the effect of stake structure model on the pod quality of several yardlong beans.

MATERIALS AND METHODS

The research was conducted at The Agrotechnology Innovation Center of Universitas Gadjah Mada (PIAT-UGM), in Kalitirto, Berbah, Sleman, Yogyakarta, and the Laboratory, Department of Agronomy, Faculty of Agriculture, Universitas Gadjah Mada between March-June 2019 by using 3 stake structure models i.e is single, double, and triangle stake model arrangement as factor which applied to 5 high yielding yardlong bean varieties.

The first factor was three cedars which, whereas the second factor is variety that consists of Parade Tavi, Pujangga, Katrina, Wulung, and Kaloka. The research arranged with Factorial Complete Randomized Block Design (RCBD) with three blocks as repetition, then both factors were combined.

This research was begun with soil processing and the basic fertilizer of manure at a dose of 1000 kg/ha. Black-silver mulch was applied before planting. The spacing used is 40 x 60 cm. The stake model arrangement was applicated when the plant was 10 weeks old after planting. The stake is made of bamboo with a length of 1.75 m and plugged in 5 cm from the plant.

The research results were analyzed with Analysis Variance (ANOVA) for the Complete Randomized Block Design (RCBD). Significantly different results on each treatment were further tested by analyzing the data using analysis of variance and further tests by Scott-Knott with the conviction level up to 5%. All data analyses were performed using R software version 3.6.1.

RESULTS AND DISCUSSION

The quantity of pods tested showed that there is no interaction between the treatment factors (table 1). The models of arrangement of the stake and the varieties used in this research the same response to the quantity of pods. Stake models not give interaction because the growth of yardlong beans upright on the three models setup stake so that the creation of pods are not obstructed, branches and models of the arrangement of the stake itself as well as the layout of the trunk and branches follow the model of arrangement while the pods will depend on the bottom (Rukmana, 2008). Kuswanto *et al.* (2007) states that the number of pods per stem ranges from 2-4 pieces depending on the amount of interest. In the stalk not all flowers can become pods. It is caused by the flowers that fall and fail to produce pods.

Table 1. The Effect of Stake Models on Quantity of Pods in Plant Several Varieties of Yardlong Beans

Factor	Quantity of Pods in Plant
Stake Models:	
Single	26.97 a
Double	24.74 a
Triangle	25.66 a
Varieties:	
Parade.Tavi	26.62 a
Pujangga	26.51 a
Katrina	26.45 a
Wulung	25.49 a
Kaloka	23.89 a
Interaction	(-)
CV (%)	14.57

Information: the values followed by the same alphabet in the same column, are not significantly difference based on the *Skott-Knott* test with $\alpha = 5\%$.
(-) indicates there is no interaction between the treatment factors

The fresh weight of pods in plant tested showed no interaction between the treatment factors (table 2). This indicates the presence of the model of the arrangement of the stake and the varieties used in this research have the same responses to the variable fresh weight of pods. In the research using *Vigna unguiculatan* species with a direction from bamboo and corn crop, the 2 m tall bamboo chase produces a fresh pod quantity of pods better than the one with

As for this research, the bamboo stake used as high as 1.75 cm. Suspected of the higher level of the given, the physiological influence on the plant, including the movement of the auksin. With the use of energy, the space by the plant becomes efficient (Janick, 1972).

Table 2. The Effect of Stake Models on the Fresh Weight of Pods in Plant Several Varieties of Yardlong Beans

Factor	The Fresh Weight of Pods in Plant (g)
Stake Models:	
Single	695.13 a
Double	647.72 a
Triangle	652.27 a
Varieties:	
Parade.Tavi	739.10 a
Pujangga	683.37 a
Katrina	675.05 a
Wulung	625.18 a
Kaloka	602.51 a
Interaction	(-)
CV (%)	15.83

Information: the values followed by the same alphabet in the same column, are not significantly difference based on the *Skott-Knott* test with α = 5%.
(-) indicates there is no interaction between the treatment factors.

The quantity of the seeds in pod and weight of the 100 seeds tested showed that there is no interaction between treatment factors (table 3). The existence of varieties treexatment factors has different responses. The varieties of Pujangga, Katrina, and Wulung provide distinct results on the amount of seeds per pod, while at of the weight of the 100 seeds the difference on the varieties of Parade Tavi, Pujangga, and Wulung.

Samadi (2003) argues that each pod contains 8 to 20 seeds. The difference in the quantity of seeds between pods is suspected because of the distance between the beans are relatively far, so that the seeds are formed a little. This results in line with the research Septeningsih (2013) explaining that the increasing position between the seeds in the pods is more and more the quantity of seeds in the pods. As for the weight of 100 seeds produced are influenced by the number of productive branches and number of plant pods (Ohorella, 2011). The weight of the plant

Table 3. The Effect of Stake Models on Quantity of the Seeds in the Pod in Plant and Weight of the 100 Seeds Several Varieties of Yardlong Beans

Factor	Quantity of seeds in the pod	Weight of the 100 seeds (g)
Stake Models:		
Single	19.07 a	19.22 a
Double	18.87 a	18.56 a
Triangle	18.98 a	19.21 a
Varieties:		
Parade.Tavi	19.63 a	18.34 b
Pujangga	18.74 b	17.76 b
Katrina	18.56 b	20.31 a
Wulung	18.63 b	18.66 b
Kaloka	19.30 a	19.90 a
Interaction	(-)	(-)
CV (%)	3.72	10.25

Information: the values followed by the same alphabet in the same column, are not significantly difference based on the *Skott-Knott* test with α = 5%.
(-) indicates there is no interaction between the treatment factors.

The harvest index indicates that there are interactions, where different varieties give different harvest index results on different stake model arrangement (table 4). The effect of the arrangement model of single interaction on the varieties of Pujangga and Katrina showed a noticeable difference in the varieties of the Parade Tavi, Wulung, and Kaloka. The arragement model of double in varieties Parade Tavi and Kaloka shows a noticeable difference to the varieties of Pujanga, Katrina, and Wulung. While in the use of the arrangement model of triangular in varieties of Wulung shows there is a difference to the varieties of the Parade Tavi, Pujangga, Katrina, and Kaloka.

The combination of the arrangement model of single on the Tavi Parade variety shows the highest harvest index of 85.20%, while the lowest one is a combination of the arragement model of double on the Kaloka variety of 78.93%. This shows that 85.20% of the weight is economically weighted and the rest is non-economical. The harvest Index shows a comparative distribution of assimilation results between economic biomass and the overall biomass. Crop harvest index can be increased by increasing the economical biomass produced as for the long beans utilized are fresh pods. Crop production is heavily influenced by its vegetative growth. If the vegetative growth is good, then the production will

be good too. When the reproductive phase is more dominant than the vegetative, the carbohydrate produced will be more stacked on its storage organs (Edmond *et al.* 1975). Production differences are influenced by the ability of a variety to adapt to the environment in which it grows (Simatupang, 1997). Egli (1999) argues that crop productivity is limited by the source photosynthesis activity or the sink ability to use source-generated asymlates. As for the assimilation distribution becomes important in determining the outcome of crops.

Table 4. The Effect of Stake Models on Harvest Index Several Varieties of Yardlong Beans

Varieties	Stake Models					
	Single		Double		Triangle	
Parade.Tavi	85.20	a	79.04	b	83.53	a
Pujangga	79.53	b	83.17	a	84.05	a
Katrina	81.22	b	81.87	a	81.99	a
Wulung	85.78	a	82.83	a	78.95	b
Kaloka	81.73	a	78.93	b	83.27	a
Mean	(+)					
CV (%)	2.55					

Information: the values followed by the same alphabet in the same column, are not significantly difference based on the *Skott-Knott* test with α = 5%.
(+) indicates there was interaction between the treatment factors.

The length of the pods indicates there is a real interaction, where the different model of the arrangement gives different length of pods in different varieties (Table 5). The influence of a single arrangement model on Kaloka varieties shows that there is a noticeable difference in the variety of the Parade Tavi, Pujangga, Katrina, and Wulung. The arrangement model of double on varieties of Parade Tavi and Wulung shows the results that there is a noticeable difference in the varieties Pujangga, Katrina, and Kaloka. Also, the influence of the interaction a triangle arrangement model to the varieties of Parade Tavi and Kaloka shows that there is a noticeable difference in the varieties of Pujangga, Katrina, and Wulung. The combination of the arrangement model of double on the Pujangga variety shows the results of the longest pods length of 67.99 cm, while the shortest is a combination of treatment of triangular marker in the kaloka varieties of 61.90 cm.

The use of varieties in this research has a noticeable interaction on the variable length of the pods (Fig 2), while the arrangement model of the stake indicates that there is no significant to the length of the resulting pods (Fig 3). Varieties of Pujangga show the length of results of the longest pods of 74.88 cm on the observation of the age of the harvest 9 WAP, while the ones that indicate the length of the shortest pods are varieties of Kaloka of 53.30 cm on the observation of the age of the harvest 11 WAP. Lakitan (2007) reveals that plant growth and development are heavily influenced by plant genetic factors. In line with the research conducted Kuswanto *et al.* (2007) that genetic differences can lead to the appearance of different strains as well as other variable power outcomes.

Consumer choice of households against the quality of beans includes a medium length of pods with a size of 40 to 60 cm (Soetiarso and Marpaung, 1996). The decrease in the length of the pods began to occur at an observation time of 10 WAP to 12 WAP. Suspected plants have entered the aging phase or also called senescence phase, in this phase is the peak phase of crop growth, consequently, the plant is no longer able to produce new plant organs, or usually marked with fruit that is bush in Small, skinny plant organs and ends on plant death.

Table 5. The Effect of Stake Models on Lenght of the Pod Several Varieties of Yardlong Beans

Varieties	Stake Models		
	Single	Double	Triangle
Parade.Tavi	67.77 a	63.41 b	63.75 b
Pujangga	66.25 a	67.99 a	67.15 a
Katrina	66.72 a	67.03 a	65.88 a
Wulung	67.76 a	60.24 b	64.86 a
Kaloka	62.38 b	65.25 a	61.90 b
Mean	(+)		
CV (%)	3.03		

Information: the values followed by the same alphabet in the same column, are not significantly difference based on the *Skott-Knott* test with α = 5%.
(+) indicates there was interaction between the treatment factors.

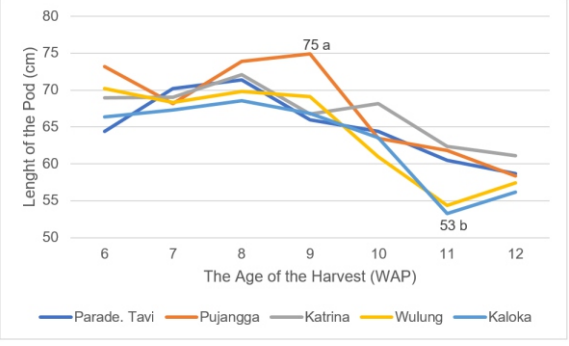

Figure 2. Length of the Pods according to the Age of the Harvest for Different varieties of yardlong beans

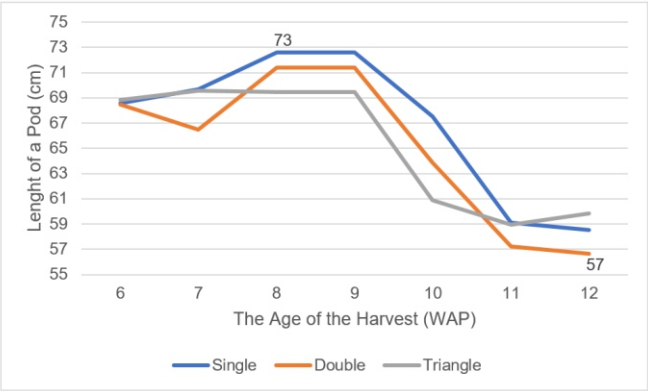

Figure 3. Length of the Pods according to the Age of the Harvest for a Stake models

The Diameter of the pods and the level of hardness of the pods tested showed no noticeable interaction between treatment factors (table 6). This indicates that there is a different stake model that gives the results of the resulting pod diameter and the same level of hardness in different varieties. The observation of the diameter and hardness of the long bean pods is done to know the size and the level of the crunch that can be consumed because the quality of pods can be seen from the size and severity of pods. Observations were conducted by observing sample pods at each treatment.

Soetiarso and Marpaung (1996) reveal that the choice of household consumers is a pod that has a round shape, medium size (0.5 to 1 cm), with a crunchy level of crispy pods and a sweet flavor. It is also expressed Talahatu (2011) that the best crunch is the fruit that has a texture is not harsh. The level of crunch is heavily influenced by the harvesting time. Therefore, harvesting should not be late because there is a positive correlation between the harvest age of young pods to the sweet and cloudy content of Pods. It explains that there is influence time harvesting of sweetness and the crunch of pods so that harvesting at the right time will increase the sweetness and crunch of pods. While the pass the harvest period will be more clay, lint, and yellow color.

Table 6. The Effect of Stake Models on Diameter of the Pods and Hardness Level of the Pods Several Varieties of Yardlong Beans

Factor	Diameter of pods (mm)	Hardness Level of pods (kgf/cm^2)
Stake Models:		
Single	6.74 a	66.58 a
Double	6.78 a	66.23 a
Triangle	6.75 a	65.08 a
Varieties:		
Parade.Tavi	6.78 a	65.23 a
Pujangga	6.85 a	66.20 a
Katrina	6.63 a	65.21 a
Wulung	6.72 a	66.53 a
Kaloka	6.80 a	66.64 a
Interaction	(-)	(-)
CV (%)	4.04	3.49

Information: the values followed by the same alphabet in the same column, are not significantly difference based on the *Skott-Knott* test with $\alpha = 5\%$.
(-) indicates there was no interaction between the treating factors.

CONCLUSION

Based on the research done, it can be concluded that:
1. The use of the three models of the arrangement of stake on different varieties does not indicated a significant effect on the growth and quality of pods produced.
2. Stake models do not affect the quality of pods.
3. Each variety produces the quality of different pods.

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