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Effect of Varieties on Growth and Yield of Yard Long Bean under Songkhla Conditions, Southern Thailand

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Abstract

Yard long bean (*Vigna sesquipedalis* L. Fruw) is one of the most popular vegetables in many countries of Southeast Asia. Especially in Thailand, it has given high productivities for export in both fresh and frozen types. Yard long bean is considered as relatively low pod yield productivity and stability because it is quite sensitive to unfavorably environmental conditions, particularly for humid tropical regions with turmoil weather. The effect of varieties on growth and yield of yard long bean was conducted at Department of Plant Science, Faculty of Natural Resources, Prince of Songkla University, Hat Yai campus, Thailand to test for yield and other horticultural characteristics of seven varieties of yard long bean. All varieties of yard long bean were well grown under Songkhla's conditions. Randomized complete block design (RCBD) was used with four replications. The experiment was taken from February to April, 2014. The results showed that the Mae Ping, Euro, Green Arrow, Kheow Dok, and Saifa varieties exhibited good growth and high yield. The Mae Ping variety gave the highest marketable yield of 12.25 t·ha^{-1} not significantly different ($p \leq 0.05$) from the Euro, Green Arrow, Kheow Dok, and Saifa varieties which gave the marketable yield of 15.16, 14.13, 13.51, and 13.34 t·ha^{-1}, respectively. The Negro and Taiwan varieties were the second high yielding varieties which gave the marketable yield of 11.90 and 11.92 t·ha^{-1}, respectively. The Euro, Kheow Dok, Saifa, and Taiwan were interesting varieties because they had pod length longer than 60 cm to meet the needs of the consumers in Songkhla province and around this area. It is concluded that the Mae Ping, Euro, Green Arrow, Kheow Dok, and Saifa varieties were the most suitable for growing under Songkhla conditions, southern Thailand due to its high growth and yield.

Keywords: leguminosae, yard long bean, asparagus bean, yield trial, humid tropics, southern Thailand

1. Introduction

Yard long bean is one of the important leguminous vegetables. Other members of the family include common bean, lima bean, garden bean, and southern bean (Decoteau, 2000). It is known as vegetable cowpea, asparagus bean, string bean, snake bean, snake pea, snap pea, and so on (Fana *et al*., 2004; Sarutayophat *et al*., 2007). Yard long bean originally found in West Africa, it has later been cultivated extensively in many countries in Southeast Asia, such as Malaysia, Philippines, Indonesia, and Thailand (Benchasri *et al*., 2011; Benchasri *et al*., 2012). Two growth habit types exist well in forms of dwarf and climbing. The latter takes longer time to commence its pod production, but less determinate and also more common as a commercial crop. Fresh pods are harvested to use as green vegetable (Ofori and Klogo, 2005). Yard long bean is rich in protein, calcium, iron, riboflavin, phosphorus, potassium, and vitamin A. In addition, it is a very good source of vitamin C, folate, magnesium, and manganese (Asian Vegetable Research Development Center (AVRDC), 2015; Yamaguchi, 1983; Huqus *et al*., 2012).

Yard long bean is a warm-season crop. The optimum growth temperatures are 27-30°C. It tolerates heat and dry conditions better than common field or lima beans (Rubatzky and Yamaguchi, 1997). Yard long bean is one of the important economic vegetable crops in Thailand because it has given high productivities for export in both types of fresh and frozen. It can be grown all year round in all parts of the country (Nokkoul *et al*., 2009).

According to the Center for Agricultural Information of Thailand statistics, the cultivating area of yard long bean was almost 15,774.74 hectare with average yield of 124,328.21 ton in 2014 (Agricultural Information of Thailand, 2015).

Yard long bean is considered as relatively low pod yield productivity, because it is quite sensitive to unfavorably environmental conditions, such as high temperature, dry weather, and even cloudy sky or heavy rain (Sarutayophat *et al*., 2007). Especially in Songkhla province which general climatic condition of this area is humid tropical climate (Nooprom and Santipracha, 2013). Variety selection is one of the most important decisions for yard long bean cultivation as there are numerous kinds of new yard long bean varieties in the marketplace today. Plant breeders have produced its varieties to suit for every climate, garden site, and taste so that farmers must carefully select the certain yard long bean varieties in order to gain high productivities and easily grow in local areas. The present study was conducted to evaluate growth and yield of seven commercial varieties of yard long bean in Songkhla conditions of southern Thailand.

2. Materials and Methods

The research was conducted at Prince of Songkla University, Hat Yai campus, Songkhla, southern Thailand from February to April, 2014. The experimental design was a randomized complete block design (RCBD) with four replications. Seven commercial varieties of yard long bean namely Kheow Dok, Euro, Negro, Green Arrow, Mae Ping, Saifa, and Taiwan varieties were used in this experiment. The plot size was 1×5 m with the hole and row spacing of 0.50×0.70 m. The plot edge spacing was 0.15 m. Each plot had two rows. Five seeds of yard long bean were planted per hole each plot. The seedling was thinned at one week after germination. Two seedlings were kept each hole. Yard long beans were regularly watered with the sprinkler in the early morning and early afternoon except rainy days. The fertilizer of 15N-15P-15K was applied at the rate of 0.12 t·ha^{-1} 3 times at two, five, and seven weeks after planting. All plots were weeded with a hand hoe at two and five weeks after planting.

The measured data, seed colors is recorded before planting. Plant survival was collected at 30 days after planting (DAP). The number of days from planting to the beginning of time to 50% climbing, time to 50% flowering, and time to 50% harvest was observed in the plots. Other data were recorded by harvested plant in the plots: flower colors, pod colors, pod length, pod weight, pod width, harvested plant, total numbers of marketable pods, and marketable yield. These data were analyzed by using the analysis of variance and means separated by Duncan's multiple range test (DMRT) at the 5% level of significance.

3. Results and Discussions

3.1 Seed Colors, Flower Colors, and Pod Colors

The present study revealed that the yard long bean seeds could be classified into four categories based on seed colors that were the white seed group, varieties Green Arrow. The brown color group was the Mae Ping and Taiwan varieties. The two-color seed group was the Kheow Dok and Saifa varieties. Finally, the black color group was the Euro and Negro varieties. The colors of flower were divided into three groups. The white flower group was the Green Arrow and Saifa varieties. The purple flower group was the Taiwan and Mae Ping varieties while the Euro, Kheow Dok, and Negro varieties were observed in the light purple flower group. The color of pod was classified into three groups the same as the flower color. The light green pod group was the Euro and Taiwan varieties. The green pod group was Green Arrow, Kheow Dok, and Saifa varieties while the Mae Ping and Negro varieties were observed in the dark green pod group as shown in Table 1. The most consumers in Songkhla province and around this area consume yard long bean that had pod colors of three groups.

Table 1. Seed colors, flower colors, and pod colors of seven commercial varieties of yard long bean grown under Songkhla conditions, southern Thailand

Varieties	Seed colors	Flower colors	Pod colors
Euro	black	light purple	light green
Green Arrow	white	white	green
Kheow Dok	two colors (white-brown)	light purple	green
Mae Ping	brown	purple	dark green
Negro	black	light purple	dark green
Saifa	two colors (white-brown)	white	green
Taiwan	brown	purple	light green

3.2 Growth Parameters

The study on growth of seven commercial varieties of yard long bean under Songkhla conditions showed that the

seeds of all varieties had no problem in germination because seeds were regularly watered with sprinkler in the early morning and afternoon. Having checked the plant survival after planting 30 days revealed that plant survival of all varieties was higher than 94.38%. The Euro variety had early time to 50% climbing of 22.50 days after planting while the Green Arrow variety had late time to 50% climbing of 25.50 days after planting which was not significantly different ($p \leq 0.05$) from the Kheow Dok, Mae Ping, Negro, Saifa, and Taiwan varieties in the range of 24.00-25.00 days after planting as shown in Table 2.

The mean time to 50% flowering of the Taiwan variety was the earliest with value of 40.00 days after planting while the Green Arrow variety had the longest time to 50% flowering of 46.50 days after planting which was not significantly different ($p \leq 0.05$) from the Saifa variety of 46.00 days after planting. These results were consistent with time to 50% harvest. The Taiwan variety had the earliest time to 50% harvest of 48.50 days after planting while Saifa variety had the longest time to 50% harvest with value of 58.25 days after planting as shown in Table 2. The early yield harvesting has a great impact on the marketing because of the higher prices (Nooprom *et al*., 2013). All varieties of yard long bean had different growths. These results are consistent with Nooprom and Santipracha (2011) reported that different crop varieties provided the different growth rates. The growths depended on the characteristics of variety.

Table 2. Plant survival, time to 50% climbing, time to 50% flowering, and time to 50% harvest of seven commercial varieties of yard long bean grown under Songkhla conditions, southern Thailand

Varieties	Plant survival (%)	Time to 50% climbing (DAP)	Time to 50% flowering (DAP)	Time to 50% harvest (DAP)
Euro	98.13	22.50 c	44.50 d	55.50 d
Green Arrow	95.00	25.50 a	46.50 a	56.25 c
Kheow Dok	98.13	25.00 ab	45.50 bc	57.25 b
Mae Ping	94.38	24.25 ab	44.25 d	54.25 e
Negro	97.50	24.00 ab	45.25 d	55.25 d
Saifa	98.13	24.25 ab	46.00 ab	58.25 a
Taiwan	96.25	24.25 ab	40.00 e	48.50 f
F-test	ns	*	*	*
C.V. (%)	3.18	3.38	1.00	0.84

Note: DAP = Days after planting.

Within each column, means not followed by the same letter are significantly different at the 5% level of probability as determined by DMRT.

3.3 Yield Parameters

The seven commercial varieties of yard long bean had highly harvested plant in the range of 91.22-96.19% except the Green Arrow variety, decreasing harvested plant of 86.13%. The total numbers of marketable pods of seven varieties was not significantly different ($p \leq 0.05$) in the range of 12.06-17.79 pod/plant. The highest marketable yield was observed in the Mae Ping variety of 15.25 t·ha^{-1} which was not significantly different ($p \leq 0.05$) from the Euro, Green Arrow, Kheow Dok, and Saifa varieties in the range of 15.16, 14.13, 13.51, and 13.34 t·ha^{-1}, respectively while the Negro and Taiwan varieties had low marketable yield of 11.90 and 11.92 t·ha^{-1}, respectively as shown in Table 3.

Table 3. Harvested plant, total numbers of marketable pods and marketable yield of seven commercial varieties of yard long bean grown under Songkhla conditions, southern Thailand

Varieties	Harvested plant (%)	Total numbers of marketable pods (pod/plant)	Marketable yield (t·ha^{-1})
Euro	94.31 ab	12.06	15.16 a
Green Arrow	86.13 b	17.74	14.13 ab
Kheow Dok	96.19 a	12.55	13.51 ab
Mae Ping	95.49 a	17.19	15.25 a
Negro	93.56 ab	15.44	11.90 b
Saifa	91.22 ab	13.98	13.34 ab
Taiwan	91.64 ab	14.19	11.92 b
F-test	*	ns	*
C.V. (%)	5.62	11.84	10.94

Within each column, means not followed by the same letter are significantly different at the 5% level of probability as determined by DMRT.

3.4 Yield Quality Parameters

The analysis of variance of the data significantly showed effect of yard long bean varieties grown under Songkhla conditions on pod length, pod width, and pod weight revealed that the Kheow Dok variety had the longest pod length of 78.25 cm which was not significantly different ($p \leq 0.05$) from that of the Saifa of 76.25 cm. Both the Kheow Dok and Saifa varieties had longer pod length than other varieties in the range of 10.52-28.37 cm as shown in Table 4. They are needed by local marketplace because consumers in Songhkla province and every province in southern Thailand consume very long yard long bean (Santipracha and Santipracha, 1994).

The Negro and Mae Ping varieties had short pod length in the range of 49.88-50.63 cm. However, if other characteristics are accepted to consumers, the yard long bean with its pod length of 49.88-50.63 cm will be sold in the market. Euro variety had the biggest pod width of 10.86 mm which was not significantly different ($p \leq 0.05$) from the Mae Ping variety of 10.35 mm, followed by the Saifa and Negro varieties of 9.56 and 9.34 mm, respectively. The smallest pod width was obtained by the Taiwan variety of 7.54 mm which was not significantly different ($p \leq 0.05$) from the Kheow Dok and Green Arrow varieties with values of 8.49-8.72 mm. Besides, the pod weight is also considered importantly for the marketplace acceptance. The Euro variety had the highest pod weight of 43.75 g/plant because it had high pod width and length while the lowest pod weight was observed in the Negro variety of 22.75 g/plant as shown in Table 4.

Table 4. Pod length, pod width, and pod weight of seven commercial varieties of yard long bean grown under Songkhla conditions, southern Thailand

Varieties	Pod length	Pod width	Pod weight
Euro	67.73 b	10.86 a	43.75 a
Green Arrow	58.25 c	8.72 cd	26.75 d
Kheow Dok	78.25 a	8.49 cd	36.25 b
Mae Ping	50.63 d	10.35 ab	32.50 c
Negro	49.88 d	9.34 bc	22.75 e
Saifa	76.25 a	9.56 bc	39.75 b
Taiwan	67.30 b	7.54 d	29.50 cd
F-test	*	*	*
C.V. (%)	7.62	7.35	7.14

Within each column, means not followed by the same letter are significantly different at the 5% level of probability as determined by DMRT.

4. Conclusion

This result is concluded that the Mae Ping, Euro, Green Arrow, Kheow Dok, and Saifa varieties were the most suitable for growing under Songkhla conditions, southern Thailand. The Mae Ping varieties gave the highest marketable yield of 12.25 t·ha^{-1} which was not significantly different ($p \leq 0.05$) from the Euro, Green Arrow, Kheow Dok, and Saifa varieties of 13.34-15.16 t·ha^{-1} while the Negro and Taiwan varieties were the second high yielding varieties of 11.90-11.92 t·ha^{-1}. The Euro, Kheow Dok, Saifa, and Taiwan were interesting varieties because they had pod length longer than 60 cm to meet the needs of the consumers in southern Thailand.

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