

The performance of growth and yield component of soybean varieties in Margodadi village, Ambarawa sub-district, Pringsewu regency, Lampung province, Indonesia

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Abstract. Efforts to increase soybean production require superior varieties which are stable in every agroecology production center. Therefore, it is necessary to perform field evaluation of several new released soybean varieties. The aim of this study was to evaluate the growth and yield potential of soybean varieties developed by Indonesian Legume and Tuber Crops Research Institute (ILETRI) Malang in a field experiment. Four soybean varieties (Devon 1, Dering 1, Gema and Gepak Kuning) were sown in Margodadi Village, Ambarawa Sub-district, Pringsewu Regency, Lampung Province, Indonesia from May to August 2017. Plots were arranged in randomized complete block design with six replicates. The variables observed were crop emergence at 7 DAS sowing, plant height and number of pods at harvest, pest attack on 1-month-old plants and at harvest, and seed yield. The results showed that Gepak Kuning gave the highest yield (2.13 t/ha), which indicated that this variety is suitable to be planted and developed in the location of the study.

Keywords: soybean, varieties, evaluation, agroecosystem.

1. Introduction

One of the successful targets of agricultural development is to achieve self-sufficiency in five basic food crops including soybean. Soybean (*Glycine max*) has long been an important source of protein, fat, mineral and vitamin in the Indonesian diet because it is affordable by most people. In Indonesia, soybean is processed into various food products such as fermented soybean (“tempe” or fermented soybean in blocks, “tauco” or soybean paste and soy sauce), tofu, soybean milk, and other products [1]. At the international level, soybean commodity is repositioned as healthy foodstuff and a highly prospective source of functional food [2].

The demand for soybean increases every year proportionally to population growth [1], while current soybean productivity at the farmers is only 1.3 t/ha [3]. Since the domestic capacity of soybean production could not meet the consumption, the import of soybean is inevitable. Therefore, in efforts to achieve soybean self-sufficiency, support from various aspects, including improved technologies is needed to increase national production. Superior variety is one of the technologies that can contribute significantly to increase the production of soybean. Generally, breeding of superior soybean varieties has been directed to develop cultivars with high potential of seed yield, resistant to pests and diseases, early maturity and seed quality of crops according to consumers wishes [4].



Several improved varieties have been released, mostly by Indonesian Legume and Tuber Crops Research Institute (ILETRI) Malang, which has the mandate to develop new soybean varieties. Among those varieties, Gepak Kuning, Gema, Dering and Devon 1 are soybean with several superior characteristics. Gepak Kuning, released in 2008, is a selection from local varieties with the same name [5]. This variety has high tofu rendement content and can adapt well in paddy field and dryland, both in the rainy season and dry season. The yield potential of Gepak Kuning is 2.86 t/ha. Gema was released on 9 December 2011 [6]. This variety is a selection of breeding lines derived from the cross of an introduced cultivar Shirome to a national variety Wilis [5]. Gema is an early maturing cultivar with harvesting age of less than 75 days and has an average production of 2.47 t/ha. Early maturing type is important for areas with limited rainfall or for cultivation in the second planting time during the dry season when irrigation water decreases [6]. Dering 1 was released in September 2012 [5]. This variety is drought tolerant at the reproductive phase and has a high yield potential up to 2.8 t/ha [7]. In 2015, a new high yielding variety Devon 1 was released [5]. Devon 1 is a selection from the cross of Kawi variety to IAC 100. With the yield potential of 3.09 t/ha and an average of 2.75 t/ha, this variety is expected to be popular among farmers and thus can accelerate the increase of soybean production [3].

Efforts to increase soybean production require superior varieties which can perform well in different agroecological zones. In addition, the selection of a variety is also based on the farmers/users preferences. Therefore, it is necessary to evaluate the growth and yield potential of the soybean varieties above in a field location.

2. Materials and methods

The study was conducted in Margodadi Village, Ambarawa Sub-district, Pringsewu Regency, Lampung Province, Indonesia from May to August 2017. Four varieties (Devon 1, Dering 1, Gema and Gepak Kuning) developed by ILETRI were tested in this study. Two seeds of each variety were sown in 2 m × 2 m plots at 20 cm × 40 cm planting space. The experiments occupied a total area of 2,500 m². Plants were fertilized with NPK at a rate of 200 kg/ha and liquid organic fertilizer at a rate of 8 l/ha. NPK was applied near the plant hole at 7 days after sowing (DAS), whereas liquid organic fertilizer was sprayed when plants were 1-month-old. Variables observed were crop emergence at 7 DAS, plant height and pod number at harvest, pest incidence on 1-month-old plants and at harvest, grain weight and yield. Experiments were arranged in a randomized completely block design with six replications for each variety. Mean separation test was done using DMRT at 5% significant level.

3. Results and discussion

3.1. Plant growth and productivity

Among the four varieties, Devon 1 had the lowest growth rate (70%; Figure 1), indicating that seeds of this variety may have declined physiologically. Storing space temperature plays a role in maintaining seed viability during storage, which is influenced by seed moisture content, room temperature and relative humidity. At low temperatures, respiration runs slowly compared to high temperatures. Generally, seeds with low vigor also show poor growth in the field [8,9]. Freshly harvested soybean seeds that are stored for a period of time must have a germination capacity above 85% [9,10]. It has been known that the growth of soybean plants is influenced by the interaction between genetic and environment [11].

Plant height at harvest ranged from 38.58–51.32 cm, which was not significant different from each other (Table 1). These figures were lower than the original description. Agroclimate condition during the growing season may not be conducive for optimal soybean growth because experiments were done at the second planting season but slightly later (May) than the common practice by local farmers (April).

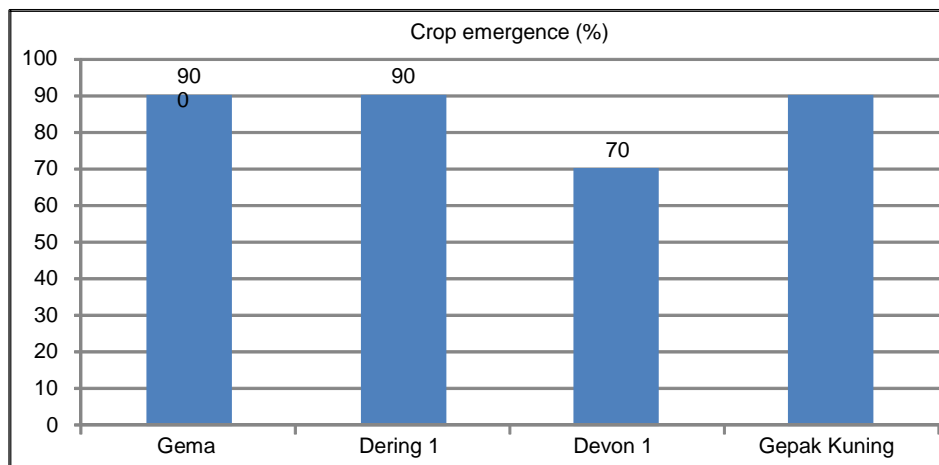


Figure 1. Rate of crop emergence of four soybean varieties at 7 days after sowing in a field in Margodadi Village, Lampung Province, Indonesia from May to August 2017.

The number of pods in soybean plants is strongly influenced by genetic factors [12]. In this study, the highest number of pods was obtained from Gepak Kuning, which was significantly differed from the other three varieties (Table 1). The percentage of empty pods was also the lowest on Gepak Kuning, although it did not differ significantly from the other varieties. The total yield ranged from 1.27 to 2.13 t/ha and was significant different among the four varieties (Table 1). The order of varieties from the highest to the lowest yield was Gepak Kuning, Dering 1, Devon 1 and Gema. The weight of 100 grains of the four varieties was close to the description (Table 1).

Table 1. Growth and yield of four soybean varieties planted in a field in Margodadi Village, Lampung Province, Indonesia from May to August 2017.

Varieties	Plant height (cm) ^a	Number of pod per plant ^a	Empty pods (%) ^a	Yield (t/ha) ^a	Weight of 100 grains (g) ^a
Gema	38.58 a	24.10 b	14.16 ab	1.27 d	11.67 b
Dering 1	47.89 a	32.97 b	10.25 ab	1.87 b	11.00 b
Devon 1	51.32 a	44.20 b	24.42 a	1.47 c	13.67 a
Gepak Kuning	41.80 a	103.80 a	4.92 b	2.13 a	8.00 c

^a Values followed by the same letter(s) within the same column are not different significantly at 5% level according to DMRT.



Figure 2. Variation in the seed color of Gepak Kuning (A), Dering 1 (B), Devon 1 (C) and Gema (D) soybean varieties released by Indonesian Legumes and Tuber Research Institute (ILETRI).

All those varieties have yellow seed coat color with a varying degree of intensity (Figure 2). The seed coat of Gepak Kuning is greenish yellow, Dering 1 and Devon 1 are yellow, and the seed color of Gema is light yellow [5].

3.2. Leaf and pod damage by insect pests

Insect pests prevailing during the vegetative stage were armyworm (*Spodoptera litura*), whereas at the harvest time were pod borer (*Etiella zinckenella*) and pod sucker (*Riptortus linearis*). Percentage of leaf damage on 1-month-old plants by armyworm was 12 to 18% (Table 2). The highest percentage of leaf damage was observed on Gepak Kuning, but was not statistically significant different from that on Gema and Dering 1. In contrast, the lowest percentage of leaf damage was observed on Devon 1 which did not differ significantly from that on Dering 1. Because the level of leaf damage exceeded the economic threshold (12.5%) [13], insecticide sprays were applied.

Table 2. Percentage of leaf damage by armyworm and pod damage by pod borer and pod sucker on four soybean varieties planted in a field in Margodadi Village, Lampung Province, Indonesia from May to August 2017.

Varieties	Leaf damage by armyworm (%) ^a	Pod damage by pod borer (%) ^a	Pod damage by pod sucker (%) ^a
Gema	16.14 a	6.97 ab	3.73 b
Dering 1	13.08 ab	9.58 a	9.97 a
Devon 1	12.01 b	3.75 b	3.99 b
Gepak Kuning	18.27 a	5.19 b	5.61 b

^a Values followed by the same letter(s) within the same column are not different significantly at 5% level according to DMRT.

The level of pod damage caused by pod borer and pod sucker reached 3.8 to >9.0%, which were significantly different among varieties (Table 2). Dering 1 was released as pod borer resistant variety [7], but in this study it suffered the most compared to the other varieties. Climatic factors may favor insect prevalence and induced instability of resistance in this variety. Devon 1 was more resistant to three insects, but had low crop growth (Figure 1), high empty pods and low productivity (Table 1).

Although Gepak Kuning was less resistant to insect pests compared to the other varieties, its yield potential was the highest among the four varieties and was close to the description. It is known that variety with high production capacity is due to well adaptability to the environment [14]. Gepak Kuning is a small seed variety, a characteristic that is favored by farmers in the experimental location. Therefore, Gepak Kuning is recommended to be developed in this region.

4. Conclusions

Of the four varieties studied, Gepak Kuning gave the highest yield (2.13 t/ha). Gepak Kuning can be developed in the region of study because it has small seed grain, which is favored by local farmers.

5. References

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