

## UPSCALING OF POTENTIAL PINEAPPLE HYBRID TO SMALL AND MEDIUM-SCALE GROWER IN JOHOR, MALAYSIA

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### ABSTRACT

New pineapple hybrid developed by Malaysian Agriculture Research and Development Institute (MARDI) known as Josapine x 53 116 (6) was pre-commercialized to a grower in Pontian District, Johor. Three thousand suckers were transferred to the grower in April 2016 for large-scale field planting. This project objective is to determine the growth performance, fruit quality and fruit production in the grower's field including the upscaling plot in MARDI Pontian, Johor. This project also aimed to introduce the new pineapple hybrid with good fruit taste and quality to be marketed in the pineapple industry. The evaluation shows a positive response from the farmer in terms of the quality of the fruit and the highly favourable among consumers. On the other hand, growth performance of this hybrid found less infected by the bacteria heart rot disease (BHR) and has medium fruit size (1.3 – 1.8 kg) with production around 40-48 tons/ha with estimated revenue of RM78,000 per hectare. The fruits can be harvested after 14 months of planting and the plant has many slips as a source of planting materials (>5 slips/plant). Besides, the consumer study shows that this hybrid is comparable to MD2 pineapple in several features including the taste, texture, fruit colour and the aroma. Therefore, this hybrid has a potential impact on the pineapple industry through the expansion of pineapple cultivation areas that will help to increase the income of farmers especially the small and medium-scale farmers.

Keywords: Pineapple hybrid, upscaling, small-scale grower, medium-scale grower

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### INTRODUCTION

Pineapple (*Ananas comosus* (L.) Merr.) is one of the main commodities in Malaysia and contributed to the second highest crop production after banana (340,821.95 metric tons) in hectareage of 12,898.44 hectare in 2017 (Fruit Crops Statistic, 2017). Total pineapple production dropped from 2015 to 2017 with 452,021.00 metric tons, 391,712.40 metric tons and 340,722.00 respectively (Fruit Crops Statistic, 2017). Malaysia used to be the world market leader in pineapple production during the early 1970s. However, due to shortage and some weaknesses of the existing commercial varieties leads to Malaysia being unable to maintain the status. In addition, uneconomical land size factor causes high productivity and costs and registering about 67% of the growing area that are less than 3 acres. This low-scale and low productivity below 5 acres does not guarantee a profitable return. In addition, the level of acceptance and technology was low; about 44% of pineapple farmers do not practice proper

cultural practices. In addition, the production costs including field clearing, planting, field maintenance, fertilizer application and harvesting were very high which are around RM 6,000-7,000 per acre.

Recently, Malaysia has undergone extreme climate change that affected the local fruit sector which leads to direct losses due to low yields production. Besides, fruit yields are also dependent on soil types, supply of planting material, and crop adaptation in different environments. Therefore, MARDI has developed Josapine x 53 116 (6) pineapple hybrid, which is one of the potential pineapple hybrid through hybridization between local pineapple variety, Josapine with Australian variety, 53 116. 53 116 which is known as 'piping-leaf' variety, was introduced into MARDI in 1993 through germplasm exchange with Moroochy Horticultural Station in Australia (Chan et al., 2005). On the other hand, MARDI introduced Josapine variety in 1996 through pineapple conventional breeding program that has started since 1980's. Since then, Josapine has been marketed as fresh fruit and is widely planted all across Malaysia as well as being exported to the other Asian countries such as Singapore, Vietnam and Thailand. Josapine is the only pineapple variety that can be harvested after 12 months of planting which ultimately reduces the cost of planting and labour.

Josapine x 53 116 (6) hybrid is the result of several evaluation and selection of 7,000 F<sub>1</sub> progenies in the open field involving culling process of the off-type hybrid. The evaluation of eight (8) potential hybrids in multi-location trials were conducted in four places, which are MARDI Pontian, Kluang, Serdang and Sintok. Josapine x 53 116 (6) is the best overall selection in terms of the growth performance, total yield and their adaptability in different location. To date, this hybrid has been evaluated in the upscale plot in several locations including grower's plot and an upscaling research plot in MARDI Pontian, Johor. Therefore, this study is to evaluate the performances of Josapine x 53 116 (6) in order to determine the actual yield and fruit quality in various field plots, mainly under common growers' practice. Furthermore, this study also aim to transfer the technology to the grower that will benefit them by expanding the new hybrid cultivation areas that are currently monopolise by local pineapple varieties. The feedbacks from the grower is very important for the marketability of this new hybrid to penetrate into Malaysia's pineapple industry in the future.

The small-scale grower involved in this study was a predominant male at the age of 50 who works on 2 acres of land, which also includes cultivation of other pineapple varieties. The actual yield production and fruit quality was determined based on his standard farming practice in accordance to Malaysian Standard Agricultural Practices for pineapple cultivation. The production yield was also determined by on the grower's capability and potential from the opportunity given to him by MARDI to plant the new pineapple hybrid.

#### MATERIALS AND METHODS

Two evaluation plots were established; the first located in Mardi Pontian, Johor and the second is in a farmer's plot in Kampung Penerok, Pontian, Johor. 3000 suckers were transplanted to each plots. The hybrids were planted in a double bed row design with 300 rows in total. Each row consists of 100 plants using standard planting design of 30 cm x 60 cm x 90 cm. In term of fertilization for the 14 months of planting cycle, standard cultural practices were applied in MARDI's plot. Twice application of NPK Green 15:15:15 (20g/plant/application) on the third and sixth month, an application of NPK Blue 12:12:17 (20g/plant/application) on the eight month and twice foliar application of *Bordeux* mixture on the 1.5 and 4.5 months after planting. On the other hand, the farmer used his own fertilizer packages based on his standard practice. The flower induction were conducted nine (9) months after transplanting with 50 ml *Ethrel* and 180 g urea in 18 L water at the rate of 50 ml of the solution per plant. The parameters that were recorded and evaluated in this study are plant height, D-leaf length, peduncle length, slips number, fruit and crown weight, fruit length, core size, total soluble solid content and acidity. The data were analysed by using t-test analysis to determine the comparison of the growth performance in different experimental plots.

#### RESULTS AND DISCUSSION

The growth performance, yield and fruit quality were analysed using a t-test. Table 1 shows ten (10) parameters and the t-test results for each parameter in two different plots. No significant differences were found for D-leaf length, peduncle diameter, slip number, fruit weight and total soluble solid content. However, there are significant results between the two different plots in term of plant height, peduncle length, fruit length, core size and acidity content. Table 1 indicates that the mean values of several parameters such as fruit weight, core size and acidity shows a positive significant difference between the two plots. There is a higher mean fruit yield in MARDI's plot (1.57 kg) compared to 1.32 kg in farmer's plot. This is probably due to the accurate application of the standard agronomic practices for pineapple planting in MARDI. However, the fruit yield in farmer's plot is still acceptable within the range of medium fruit size.

Generally, this hybrid has vigorous plant vegetative growth with the height of 90.53 – 96.69 cm. One of its special characteristic is plenty of slips (5 slips/plant) as a source of planting materials compared to other varieties and this resulted in time saving and lower cost for production of new suckers. This hybrid has long and strong peduncle about 35-42 cm but it is formidable and can hold heavy fruit with many slips thus not easily broken. Furthermore, Josapine x 53 116 (6) has spineless leaf margin (piping-leaf) that is becoming the farmer preference because it facilitates work maintenance, thereby can reduces labour and production costs. This hybrid is also tolerant to bacterial heart rot disease compared to its parent, Josapine. It has cylindrical fruit shape and flat eyelets that provide high percentage of flesh recovery.

Chan & Lee (1999) stated that a balance of high total soluble solid and acidity content would impart the good taste of pineapple. In this evaluation, we found that this hybrid has a very high sugar content (15-16.71°Brix) and low to fairly high acid content (0.46-0.62 %). The acidity content of the fruits from farmer's plot is significantly lower than the MARDI's plot. However, the reading of pH 4-5 for the soil content in MARDI's plot is suitable for pineapple planting even though the acidity of the fruits is slightly high.

Based on the consumer preferences study, it is found that this hybrid is comparable to MD2 variety in terms of the fruit quality; crunchy pulp taste, juiciness and sweetness. Consumer positive acceptance toward the external and internal characteristics of the fruits indicates that this hybrid is able to satisfy the demand and interest from local consumers market (Noorlidawati et al., 2016). Josapine x 53 116 (6) has good agronomic characteristics and good fruit quality that is suitable for fresh consumption and canning industry due to its high sugar content, small core size (< 3 mm) and cylindrical fruit shape. This hybrid has 30% higher fruit production yield (47,806 kg/ha) compared to Josapine and determined on per hectare basis (43,500 plants). Generally, the farmer is satisfied with the growth performance and the fruit quality especially on the taste of the fruit and he gave positive responses on the marketing aspect for this hybrid in the pineapple industry. He managed to propagate and collect all the harvested slips/suckers for the expansion of the cultivation areas for the next planting cycle. This hybrid is also suitable to be planted and has better fruit quality in mineral soil, so that it not only limited on the peat soils.

Table 1. T-test results for growth performance, yield and fruit quality in both experimental plots

Parameters	Location	<i>n</i>	<i>m</i>	Difference	<i>t</i>	<i>p</i>
Plant height	Location 1 (MARDI)	15	90.53	-6.16	-3.260	0.0057
	Location 2 (Grower)	15	96.69			
D-leaf length	Location 1 (MARDI)	15	80.30	0.70	0.490	0.6344
	Location 2 (Grower)	15	79.60			
Peduncle length	Location 1 (MARDI)	15	35.73	-5.80	-5.370	<.0001
	Location 2 (Grower)	15	41.53			
Peduncle diameter	Location 1 (MARDI)	15	2.68	0.30	1.910	0.0768
	Location 2 (Grower)	15	2.38			
Slip	Location 1 (MARDI)	15	5.07	0.27	0.550	0.5894
	Location 2 (Grower)	15	4.80			
Fruit weight	Location 1 (MARDI)	15	1.57	0.25	3.41	0.0042
	Location 2 (Grower)	15	1.32			
Fruit length	Location 1 (MARDI)	15	11.13	-1.10	-3.450	0.0039
	Location 2 (Grower)	15	12.23			
	Location 2 (Grower)	15	12.23			
Core size	Location 1 (MARDI)	15	2.15	0.40	4.610	0.0004
	Location 2 (Grower)	15	1.75			
Total soluble solid	Location 1 (MARDI)	15	15.53	-1.18	-1.490	0.1579
	Location 2 (Grower)	15	16.71			
Acidity	Location 1 (MARDI)	15	0.62	0.16	4.380	0.0006
	Location 2 (Grower)	15	0.46			

On the other study on another grower's plot, Nurul Shamimi et al. (2018) reported that this hybrid showed good agronomic characteristics in terms of fruit quality and yield by reaching medium fruit size of 1.60 kg per plant that generated about 49 tons/ha of fruit yield. Another positive feedback received from the other grower involved in the previous study is that this hybrid were able to overcome the drawback of Maspine that has limited source of planting materials and only dependent on the crown and stem for propagation, by producing high number of slips as planting materials. This leads to reduce production cost by almost 30%, thus saving a lot of time (up to 12 months) by obtaining new pineapple suckers for the next planting cycle.

## CONCLUSION

This new hybrid developed by MARDI (Josapine x 53 116 (6)) has good agronomic characteristics and fruit quality that has promising potential for fresh consumption, minimal processing and canning industry as well as juice processing. This hybrid has high fruit production yield reaching about 40 tons/ha to 48 tons/ha with estimated revenue of RM 78,000 per hectare and the objective of the study has been achieved by determination of the actual yield and fruit quality in the upscale plot. It was also found that this hybrid is tolerant to bacterial heart rot disease and can ensure uniform fruit yields. In addition, it attracts farmers interest in term of high slips numbers as a source of planting materials that can reduce the cost of production for the second planting cycle. This study provides information about the growth performance, plant characteristics, fruit quality and yield that will be beneficial to other farmers, pineapple producers and researches. Furthermore, this hybrid also has a potential to be a superior parent for future hybridization program that may produce wider potential varieties. It is also expected to be an alternative for the existing pineapple varieties in the Malaysian pineapple industry and acceptable by the consumers for fresh market.

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