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A new cassava table clone, SM 1542-19

(SM 1542-19, klon ubi kayu baru untuk dimakan)

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Key words: cassava, table variety, evaluation and selection, root yield, root cyanogen content, morphological characteristics

Abstrak

Penilaian dan pemilihan telah dilakukan secara berjadual dalam tempoh 1992–2000 terhadap klon anak benih daripada biji benih pendebungaan terbuka yang dibawa masuk dari luar negara. Hasilnya, satu klon ubi kayu baru untuk dimakan telah dikenal pasti berdasarkan hasil ubinya (melebihi 30 t/ha) dan kandungan sianogen di dalam ubinya (kurang daripada 100 µg/g). Dalam ujikaji hasil yang terakhir, selepas 10 bulan, SM 1542-19 memberi hasil ubi yang melebihi hasil Medan dan Ubi Putih, dua varieti makan tempatan yang popular, manakala hasilnya setanding dengan varieti Ubi Kuning. Seperti Ubi Kuning, SM 1542-19 didapati sesuai untuk diproses menjadi kerepek.

Abstract

Evaluation and selection of seedling clones from an open-pollinated seed batch introduced from abroad has been carried out in a scheduled manner over the period 1992–2000. This has resulted in the identification of a promising new cassava table clone, based on its root yield (of more than 30 t/ha) and root cyanogen content (less than 100 µg/g). In a final yield trial, after 10 months, SM 1542-19 outyielded Medan and Ubi Putih, two popular local table varieties and was equivalent to Ubi Kuning in yield productivity. Similar to Ubi Kuning, SM 1542-19 has been found to be suitable for processing into *kerepek* or oil-fried crisps.

Introduction

While cassava (*Manihot esculenta* Crantz) has long been planted in Malaysia, the more prominent industry connected with this crop is starch processing. By contrast, the use of cassava for human food and for processing into food products in this country has been negligible. However, there has been a decline in the cassava starch processing industry in recent years due mainly to the lack of sizeable tracts of land, especially in Peninsular Malaysia, to keep a starch factory in supply, and the lack of cassava varieties with high starch content. It has been estimated that between 1 500 ha and 2 000 ha is the minimum size for a starch cassava plantation. Furthermore, the farm price for cassava roots destined for starch extraction has been too unprofitable at 15 sen/kg or less for farmers to sustain an interest in planting the crop.

On the other hand, there has been increasing interest in growing edible varieties of cassava. Farm prices for edible

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cassava are typically higher than the starch cassava at 30–35 sen/kg. Smaller plantings of edible varieties are also feasible. While the market demand for edible cassava at present is somewhat limited, this situation can be improved with processing of cassava into food products such as *kerepek* (oil-fried crisps), *keropok* (crackers) and *tapai*, a fermented dessert preparation.

With this switch in trend from planting starch cassava to edible cassava, it is timely that MARDI has developed a table clone which will provide farmers with a wider choice when planting cassava for food purposes.

Materials and methods

Various batches of seed introductions were made from CIAT* Headquarters in Cali, Colombia as well as the CIAT-Thai Programme in Rayong, Thailand over the years 1976 to 1994. These, of both hybrid as well as open-pollinated origin, went through a series of step-wise testing (Tan and Mohsin 1984) for yield performance, including harvest index (root weight divided by total plant weight including root weight), starch content (estimated from the specific gravity of the roots – see Noor Auni and Tan 1980) and, at a later stage of evaluation, cyanogen content in the roots. Those with a low cyanogen content of less than 100 µg/g were selected for separate evaluation as possible table varieties.

The scheme of selection starts with seedling selection, where single seedlings were evaluated at a wide plant spacing of 2 m x 2 m. Those showing high harvest index as well as high fresh root yield and root starch content were cloned, and advanced to unreplicated single-row trials. These comprised 10 plants per clone, tested in blocks against single rows of the check variety, Black Twig. The plants were spaced at 1 m apart within the row, and the rows are 1.5 m apart. Only the middle eight plants per row were harvested, and clones were selected for root starch content, fresh root yield and harvest index, and advanced into preliminary yield trials.

Preliminary yield trials consisted of 25-plant plots (5 m x 5 m plot size with plants at 1 m x 1 m spacing) replicated twice per clone evaluated against Black Twig as the check. Only the central nine plants per plot (3 x 3) were harvested for data collection. A randomized complete block design with two replications was used. Clones with higher fresh root yields than Black Twig were selected.

For seedling, single-row and preliminary yield trials, harvests were carried out after 12 months. Those clones qualifying for advanced yield trials were tested and harvested after 6 and after 12 months. Advanced yield trials comprised 5 m x 9 m plots, allowing half of the plot (central nine plants) to be harvested at 6 months and leaving another nine surrounded by a border row all round for harvest at 12 months. The same check was used. A randomized complete block design with four replications was used. Cyanogen contents of the roots of each clone were estimated using the method developed by Tan and Noor Auni (1981).

The usual agronomic and fertilizer practices for cassava on mineral soils (Chan et al. 1983) were adopted for the seedling evaluation, and the practices on drained peat (Tan and Chan 1992, 1994) were adopted in all the other trials.

From a batch of seed introduced from CIAT Headquarters in 1992, a clone SM 1542-19 which showed promise in terms of fresh root yield and low root cyanogen content was identified.

In a final yield trial carried out in the year 2000, SM 1542-19 was evaluated against the current popular table varieties, Medan, Ubi Putih and Ubi Kuning. A randomized complete block design was adopted with four replications. Plot size was

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7 m x 7 m. At a planting distance of 1 m x 1 m, there were 49 plants per plot.

The trial was carried out at the Department of Agriculture Peat Station in Pontian. The usual agronomic and fertilizer practices for cassava on peat were followed (Tan and Chan 1992, 1994). Edible varieties are usually harvested after 10 months to avoid the roots getting fibrous which affects eating quality. At harvest, only the central 25 plants were harvested from each plot, and data were collected on total fresh root yield, number of marketable roots (>15 cm length), harvest index, starch content and cyanogen content.

Root samples were also sent twice to an established *kerepek* processor – once after the advanced yield trial, and again after the final yield trial, to gauge the acceptability of the new clone for this product.

Results and discussion

The performance of SM 1542-19 compared to Black Twig, a moderate yielding starch variety over the various stages of testing is summarized in *Table 1*. As a seedling, SM 1542-19 showed the potential of high root yield (16.9 kg from a single plant) in an environment with minimum plant-to-plant competition, i.e. at the wide spacing of 2.0 m x 2.0 m. This was not so apparent in the single-row trial, but its superior harvest index was still maintained. In the replicated trials (preliminary and advanced), SM 1542-19 produced root yields which were higher or on par with those of Black Twig, the check variety in these cases. Data on root cyanogen content in the yield trials also show that SM 1542-19 generally produced less cyanogen and at those levels considered safe for eating (less than 100 µg/g fresh weight). According to Bolhuis (1954), for an adult weighing 50 kg, cassava with a cyanogen content of >50 to <100 µg/g is considered moderately poisonous, but with processing and cooking this level will be reduced.

The performance of SM 1542-19 in a final yield trial with edible varieties, Ubi Kuning, Ubi Putih and Medan, may be seen in *Table 2*. Currently, the most popular table variety, also recommended by MARDI (Anon. 1990), is Medan – usually eaten after boiling. SM 1542-19 outperformed Medan by more than 30% in yield after 10 months' growth, and Ubi Putih by about 22%. Marketable root number of SM 1542-19 was also significantly higher than those of Medan and Ubi Putih. However, its root yield and marketable root number were not significantly different from those of Ubi Kuning.

The root starch content of the new clone is marginally higher than those of Ubi Kuning and Ubi Putih, but significantly higher than that of Medan. SM 1542-19 has a much higher harvest index than all three local varieties, i.e. it produces less non-economic top growth in relation to root growth implying a better partitioning ability. In this particular trial, the root cyanogen content of all four genotypes was higher than is normal (<100 µg/g for edible varieties). This happens occasionally under as yet not clearly established circumstances (Tan 1995). Nevertheless, the cyanogen content of SM 1542-19 was not significantly different from the other edible varieties.

Ubi Kuning and Ubi Putih are the preferred varieties for making *kerepek*. SM 1562-19 when tested each time by an established processor was found to be suitable for making *kerepek*. This processor is well-acquainted with the preferences of his customers.

Further notes on SM 1542-19

SM 1542-19 originated from an open-pollinated seed batch, coming from the maternal parent CG 1139-2 in the CIAT germplasm collection of more than 6 000 accessions.

To help farmers identify the new clone SM 1542-19, its major morphological characteristics as compared to the popular edible varieties are given in *Table 3. Plate 1* shows some of these characteristics.

Table 1. Performance of clone SM 1542-19 compared to variety Black Twig at various stages of testing

Year	Stage of testing	No. of replications/no. plants per plot	Location/soil type	Clone/variety	Fresh root yield	Harvest index	Starch content (%)	Root cyanogen content (µg/g)
1992/93	Seedling	Single plant	Serdang/ mineral soil	SM 1542-19	16.9 kg	0.60	25.6	na
1993/94	Single-row trial	Unreplicated/ 8 plants	Jalan Kebun/ drained peat	SM 1542-19	12.9 kg	0.66	20.8	na
1994/95	Preliminary yield trial	2 replications/ 25 plants	Jalan Kebun/ drained peat	SM 1542-19	22.4 t/ha	0.68	23.3	na
				Black Twig	14.1 t/ha	0.52	21.3	
				Mean (23)*	19.5 t/ha	0.58	22.2	
1995/96	Advanced yield trial (6 months)	4 replications/ 25 plants	Pontian/ drained peat	SM 1542-19	23.6 t/ha a	0.41a	24.2a	56a
				Black Twig	11.4 t/ha b	0.16b	21.6a	102b
				Mean (15)*	16.4 t/ha	0.33	23.9	78
1995/96	Advanced yield trial (12 months)	4 replications/ 25 plants	Pontian/ drained peat	SM 1542-19	36.8 t/ha c	0.55c	26.2b	60c
				Black Twig	38.1 t/ha c	0.42d	23.7b	81d
				Mean (15)*	36.2 t/ha	0.48	24.9	55

*Number in brackets refers to number of entries in the yield trial

For the advanced yield trials, values in the same column bearing the same letter are not significantly different from one another according to the new Duncan multiple range test ($p = 0.01$), na = not available

Table 2. Final yield trial comparing the performance of clone SM 1542-19 with popular edible varieties, Ubi Kuning, Ubi Putih and Medan (on drained peat at DOA Station Pontian, over 10 months)

Clone/Variety	Fresh root yield (t/ha)	Marketable root number/plot	Starch content (%)	Harvest index	Root cyanogen content (µg/g)
SM 1542-19	31.6a	99a	26.4a	0.68a	221a
Ubi Kuning	29.3ab	82ab	25.9ab	0.51b	167a
Ubi Putih	26.0bc	67b	25.3ab	0.51b	220a
Medan	23.6c	68b	24.8b	0.53b	154a

Values in the same column bearing the same letter are not significantly different from one another according to the new Duncan multiple range test ($p = 0.01$)

Table 3. Morphological characteristics of clone SM 1542-19 compared to those of edible varieties: Medan, Ubi Putih and Ubi Kuning

Plant part	SM 1542-19	Medan	Ubi Putih	Ubi Kuning
Leaves				
Young shoot colour	Green	Light green to pale brown	Apple green to pale brown	Purplish brown
Petiole colour	Reddish tinge at both ends	Entirely dark red	Yellowish green	Pinkish
Lobe shape	Obovate	Obovate	Obovate	Narrow obovate
Stems				
Plant habit	Mostly unbranched or late branching	Mostly unbranched to intermediate branching	Unbranched	Late branching
Mature stem colour	Reddish brown with silvery patches	Brown with silvery bloom	White to very light brown	Silvery white stems
Roots				
Root shape	Cylindrical	Cylindrical	Cylindrical	Cylindrical but long
Root skin colour	Dark reddish brown	Reddish brown	Brown	Light brown
Root skin condition	Rough	Rough	Rough	Slightly rough
Colour under skin	Cream	Pink	Pale brown to pinkish	Cream
Flesh colour	Creamy white	Creamy white	Creamy white	Yellow core with outer white ring
Flowering and fruiting	None	None	None	Profuse

Shoot and leaves

Roots

Mature stems

Plate 1. Characteristics of new cassava table clone, SM 1542-19

Conclusion

SM 1542-19 offers an alternative to growers of edible cassava varieties, besides Medan, Ubi Putih and Ubi Kuning. Not only can it be considered for a table variety, but it is also suitable for use in the processing of *kerepek*, a popular local snack.

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