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Evaluation of growth performance and yield potential of selected emas cotek *(Ficus deltoidea)* accessions on bris soils

[Penilaian prestasi pertumbuhan dan potensi hasil aksesi terpilih emas cotek *(Ficus deltoidea)* di tanah bris]

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Key words: emas cotek, *Ficus deltoidea*, accessions, growth, yield, morphological characters

Abstract

Emas cotek *(Ficus deltoidea)* is one of the medicinal plants that is gaining popularity among the traditional practitioners in Malaysia. Emas cotek, an epiphyte found mainly growing on the branches of higher plants for sunlight. Preliminary evaluations, however, indicated that some accessions have good growing habit and showed potential for field planting. To evaluate the growth and yield potentials of these selected accessions under open field, a trial using seven accessions (i.e. MFD 1, MFD 2, MFD 3, MFD 4, MFD 6, MFD 7 and MFD 12) was conducted at MARDI Station, Telong in 2003.

Harvestings were conducted at 20 months after planting. Results obtained showed that accession MFD 4 gave significantly highest total fresh yield of 7.3 t/ha. The highest total dry yield was obtained from MFD 6, MFD 4 and MFD 7 with a range of 1.1–1.4 t/ha. The mean of biomass yield partitioning showed that 50.8% were stems while the leaves and fruits gave 32.4% and 16.8% respectively. The leaf and fruit characteristics as well as the yield components of the seven accessions evaluated were also discussed.

Introduction

Apart from tongkat ali *(Eurycoma longifolia)*, other medicinal plant species that is gaining popularity especially among the traditional practitioners in the East Coast of Peninsular Malaysia is emas cotek *(Ficus deltoidea)*. The decoction of the leaf is used mainly by women as afterbirth treatment. It is believed that it helps to contract the uterine and the vaginal muscles, improve blood circulation and regain body strength as well as for treating disorders related to the menstrual cycle (Burkill and Haniff 1930; Fasihuddin and Din 2002). In Indonesia, the decoction of the whole plant is taken by women as medicinal tea or tonic for general health, maintain youthfulness, virility and as aphrodisiac (Sri Yuliani 2001). It is also taken for treating pneumonia, diabetes, hypertension, diarrhoea and gout. Currently, emas cotek is commercialised and marketed in the form of dried and powdered leaf, stems, roots and fruits, ingredient in bottled drinks or mixed with other beverages such as coffee.

Emas cotek or Mistletoe figs belongs to the genus *Ficus*, a cross-pollinated species with insect as the main pollinator (van Valkenberg and Bunyapraphatsara 2002). Variations in leaf characteristics have been reported in *F. deltoidea* (Musa 2005a, b).

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Emas cotek is an epiphyte and found growing mainly on the branches of taller plants for sunlight. The plants were also found growing on bris soil along the coastal areas, peat soils and most forest habitats except the mangrove swamps. With proper management, however, the plant can be easily cultivated, especially on well-drained bris soils (Musa and Wan Zaki 2004; Musa et al. 2005). To evaluate the growth and yield potentials of some of these accessions, a trial was conducted at MARDI Station, Telong in 2003.

Materials and methods

Field/Experimental procedures

A field study was conducted to evaluate the production potential of seven selected emas cotek accessions on bris Rudua series at MARDI Station, Telong in 2003. Bris is loose sandy soils developed from marine sand deposit and found mainly along the East Coast of Peninsular Malaysia. The selection of these accessions was based on their vigour and potential ability to adapt well for the ground planting. They were MFD 1, MFD 2, MFD 3, MFD 4, MFD 6, MFD 7 dan MFD 12. These are the clonal materials selected from the 20 accessions kept and maintained at the research station (Musa 2005b). The experimental design used was Randomised Complete Block with three replications. Each plot consisted of 10 plants. They were planted on raised bed measuring 60 cm high and 150 cm wide. Single row planting with 120 cm between plants in the row and 200 cm between rows were used. This gave the plant density of about 4,167 plants/ha.

Eight-week-old seedlings raised from 6 cm shoot cuttings were used as the planting materials. Organic manure (unprocessed chicken dung) at 20 t/ha was split into two equal proportions and were given as basal one week before planting and 6 months after planting. It was incorporated into the top 10 cm of the planting bed. Fortified organic fertiliser KOKEI (N:P:K = 10:10:10) at 1.0 t/ha was also given as basal together with the chicken dung as the standard treatment. Decomposed palm oil bunch was used as soil ameliorant to conserve moisture at the rate of 6 kg/planting hole or 25 t/ha. Weeds were controlled by using plastic mulching. Drip irrigation system was used to irrigate the crop.

Data collection

Three plants were sampled from each plot for the measurements of growth and agronomic characteristics of the accessions prior to harvesting. The measurements taken included plant height and canopy width. Plant height was taken from the ground level to the shoot tip. Canopy diameter was taken at the widest point of the plant.

Harvesting was done at 20 months after field planting by cutting at 8 cm above ground levels. Records on the total number of leaves, fruits and main branches per plant of three sampled plants were taken at harvest. The leaf area was taken by using Li-300 Area meter (Li-COR Inc, USA). Other agronomic parameters collected are length and width of leaves and fruits. The fresh and dry yields were also recorded. The weight of the leaf, branches and fruits were immediately recorded to indicate the fresh biomass weight of each yield component. The dry yield was obtained through drying at about 15% moisture content by using tobacco barn at 45 °C for 72 h. The ratio of fresh to dry weight was calculated to indicate the drying ratio of each yield component.

SAS Statistical package for PC (SAS Inst. 1985) was used for the analyses of ANOVA and comparison of means.

Results and discussion

Morphological characteristics

The leaf morphological characteristics of the accessions studied were as shown in *Table 1*. All the parameters evaluated were significantly different among them. The leaf length ranged from 5.18 cm (MFD 6) to 8.59 cm (MFD 2) with an average of

Table 1. The leaf characteristic of seven emas cotek accessions grown on bris soil

Accession No.	Leaf no./ plant	Leaf length (cm)	Leaf width (cm)	Leaf shape (length: width ratio)	Leaf area (cm^2)	Dry wt./ unit area (g)	Dry wt./ leaf (g)	Leaf drying ratio
MFD 1	818.6bc	6.43b	4.32c	1.49d	17.33d	2.68d	0.079cd	3.41c
MFD 2	413.4cd	8.59a	6.92b	1.24b	36.24c	4.20c	0.158b	4.76ab
MFD 3	103.9d	8.17a	8.17a	0.99f	46.59a	5.67a	0.289a	5.72a
MFD 4	1099.3b	6.98b	6.49b	1.07ef	28.54c	4.08c	0.118bc	5.2a
MFD 6	2072.7a	5.18c	3.76c	1.38c	12.63d	2.43d	0.043d	3.88bc
MFD 7	1882.3a	6.10bc	3.62c	1.68a	14.05d	2.30d	0.070cd	3.75bc
MFD 12	432.3cd	8.54a	7.30ab	1.17de	40.48b	4.71b	0.159 b	4.77ab
Mean	974.2	7.2	5.8	1.3	27.98	3.7	0.13	4.5
CV (%)	33.8	7.3	9.3	4.6	14.47	6.4	22.8	13.5
Sign. level	**	**	**	**	**	**	**	**

Values with the same letter in each column are not significantly different ($p = 0.05$)

Table 2. The fruit characteristic of seven emas cotek accessions grown on bris soil

Accession No.	Fruit length (mm)	Fruit width (mm)	Fruit shape (length: width ratio)	Dry wt./ fruit (g)	Fruit drying ratio
MFD 1	13.79ab	13.163ab	1.04c	0.154b	4.72a
MFD 2	14.72ab	11.320b	1.30ab	0.198b	6.95a
MFD 3	16.15ab	14.210a	1.13bc	0.877a	1.57b
MFD 4	16.49a	12.17ab	1.13bc	0.153b	5.73a
MFD 6	12.84b	11.30b	1.13bc	0.104b	5.60a
MFD 7	14.45ab	11.68b	1.24ab	0.126b	5.13a
MFD 12	13.14ab	9.12c	1.42a	0.123b	4.84a
Mean	14.5	11.8	1.2	0.25	4.9
CV (%)	11.8	9.3	7.9	25.7	33.6
Sign. level	*	**	**	*	*

Values with the same letter in each column are not significantly different ($p = 0.05$)

7.15 cm. The average of leaf width was 5.79 cm. The average leaf shape (length: width ratio) was 1.29. The accessions with more rounded leaves were MFD 3, MFD 4 and MFD 12. These accessions have the leaf length to width ratio of 0.99 to 1.20. Traditionally they are usually classified as 'female' type. The 'female' emas cotek showed bigger and thicker leaves as indicated by the leaf area, dry weight and dry weight per unit area. In contrast, the accessions with more slender leaves are MFD 1 and MFD 7. These accessions are normally classified as the 'male' type. The accession with the biggest and heaviest leaves was MFD 3. This particular accession was shown to have higher leaf drying ratio (5.72) as compared to other accessions.

The fruit characteristics of the accessions are presented in *Table 2.* Significant differences among the accessions studied were also observed. The mean fruit length ranged from 12.84 mm (MFD 6) to 16.49 mm (MDF 4). The fruit width ranged from 9.12 mm (MFD 12) to 14.21 mm (MFD 3). Among the accessions evaluated, MFD 3 produced the biggest fruit (0.88 g) and the lowest fruit drying ratio (1.57).

Yield components

The whole plant of emas cotek is believed to have medicinal properties. According to Kamarudin and Latif (2002), all the plant

parts which include leaf, stem and fruit are used for medicinal preparation. The leaf and fruit yield components were presented in *Table 3*. The results showed that the parameters studied for these plant parts were highly significant among the accessions evaluated. The number of leaves ranged from 103.9 to 2,072.7 per plant with the mean of 974.6. The highest number of leaves obtained from MFD 6 (2,072.7) followed by MFD 7 (1,882.3) and MFD 4 (1,099.3). Likewise, the total fresh and dry leaf weight from these accessions were higher as compared to other accessions evaluated. The total leaf dry weight per plant obtained from MFD 6, MFD 7 and MFD 4 were 90.0, 128.0 and 132.2 g respectively. Similar trends were also observed for the total fresh leaf yield. Among the accessions evaluated, MFD 3 gave the lowest number of leaves (103.9 per plant). The total fresh (152.2 g) and dry (32.2 g) leaf weight per plant was also the lowest.

The differences in fruit number obtained per plant among the accessions evaluated were very high. The highest fruit number per plant was from MFD 12 (1,000.4) and the least from MFD 3 (2.7). The mean number among them was 363 per plant. Other accessions with high fruit number per plants were MFD 7 (524.3), MFD 4 (381.7) dan MFD 6 (335.2). The mean fresh and dry weights of the fruits per plant were 189.9 and 34.5 respectively. The accession with the highest fresh fruit weight per plant was MFD 4 (324.4 g), followed by MFD 7 (313.3 g) and MFD 6 (193.1 g). The accession with the lowest fruit fresh weight was MFD 3 (3.7 g). A similar trend was observed for the fruit dry weight per plant (2.2 g).

The yield data of the branch component was presented in *Table 4*. A very high variation in branching parameter was observed among the accessions. The accession with the highest number of main branch per plant was MFD 6 (99.9), followed by MFD 7 (54.4) and MFD 1 (40.7). The accession with the lowest branch number was MFD 3 (9.67). The number of main branch did not reflect in the total branch yield. The highest branch yield was obtained from MFD 4. Eventhough the branch number per plant was relatively low, the dry weight per plant recorded for MFD 4 was highest (1,000.9 g/plant).

The contribution of these yield components to the total biomass yield of the seven accessions was presented in *Table 5*. The branches (main and lateral branches) contributed the highest component (50.8%) of the total yield followed by the leaves (32.4%) and fruits (16.8%). The accession with the highest total fresh yield per plant was MFD 4 (2,027 g) followed by MFD 7 (1,471 g), MFD 6 (1,160 g) and MFD 2 (1,017 g). MFD 3 gave the lowest total fresh

Table 3. The leaf and fruit yield components of seven emas cotek accessions grown on bris soil

Accession No.	Leaf no./ plant	Fruit no./ plant	Total leaf fresh wt./plant (g)	Total leaf dry wt./plant (g)	Total fruit fresh wt./plant (g)	Total fruit dry wt./plant (g)
MFD 1	818.6bc	181.3a	200.2c	58.8cd	136.9bc	26.2b
MFD 2	413.4cd	115.2a	313.1bc	65.1cd	171.8ab	22.9b
MFD 3	103.9d	2.7a	152.0c	32.2d	3.7c	2.3c
MFD 4	1099.3b	381.7a	702.4a	132.2a	324.4a	57.8a
MFD 6	2072.7a	335.2a	359.3bc	90.0bc	193.1ab	34.4b
MFD 7	1882.3a	524.3a	498.0ab	128.0ab	313.3 a	60.3a
MFD 12	432.3cd	1000.4a	325.4bc	68.9cd	182.0ab	37.9b
Mean	974.6	362.9	364.4	82.2	189.9	34.5
CV (%)	33.8	148.2	36.3	26.3	46.9	32.4
Sign. level	**	ns	**	**	**	**

Values bearing the same letter in each column are not significantly different from one another (p = 0.05)

Table 4. The branch yield components of seven emas cotek accessions grown on bris soil

Accession No.	No. of main branch/plant	Total branch fresh wt./plant (g)	Total branch dry wt./plant (g)	Dry wt./ branch (g)	Branch drying ratio
MFD 1	40.7bc	342.9cd	109.8bc	3.02b	3.00a
MFD 2	18.3c	531.8bc	138.7bc	7.55a	3.83a
MFD 3	9.7c	236.6d	64.7c	6.75a	3.15a
MFD 4	36.2bc	1000.9a	267.8a	7.59a	3.80a
MFD 6	99.9a	607.6bc	185.3ab	1.82b	3.64a
MFD 7	54.4b	659.6b	199.8ab	3.97b	3.34a
MFD 12	19.0c	616.9bc	163.6b	8.67a	3.73a
Mean	39.7	570.9	161.4	5.63	3.50
CV (%)	42.6	26.9	29.5	24.71	19.12
Sign. level	**	**	**	**	**

Values with the same letter in each column are not significantly different (p = 0.05)

Table 5. Yield components of emas cotek grown on bris soil

Accession No.	Fresh weight (g/plant)			
	Leaf	Fruit	Branch	Total
MFD 1	200	137	343	680
MFD 2	313	172	532	1017
MFD 3	152	4	237	393
MFD 4	702	324	1001	2027
MFD 6	359	193	608	1160
MFD 7	498	313	660	1471
MFD 12	325	182	617	1124
Total	2,549	1,325	3,998	7,872
Mean	364	189	571	1,125
Yield components (%)	32.4	16.8	50.8	100

yield (393 g/plant). Besides the relatively lower leaf and stem yields, this accession was shown to have very little fruit. The total fresh fruit weight was only 4 g per plant.

Growth and potential yield

The plant height, canopy diameter and the ratio of plant height to canopy diameter ratio ranged between 75.7–149.0 cm, 70.6–130.7 cm and 0.90–1.89 respectively *(Table 6)*. Their respective means obtained were 113.8 cm, 100.8 cm and 1.18. The highest plant height was recorded from MFD 6 (149.0 cm) followed by MFD 3 (143.9 cm). Although accession MFD 3 was relatively tall, the canopy size was however small (85.9 cm). As a result, it has a more slender and tall growth structure as compared to the more spreading growth structure obtained by other accessions such as MFD 4, MFD 12, MFD 7 and MFD 2. Generally it was observed that the accessions with shorter and more spread growth structure such as MFD 4 (height to canopy diameter ratio of 0.90) tended to produce more smaller branches *(Plates 1–2)*. This may contributed to the higher total biomass weight.

The potential yield of emas cotek grown on bris soil was as shown in *Table 6*. The highest fresh yield of 7,287 kg/ha was obtained from MFD 4 followed by MFD 7 (4,624 kg/ha) and MFD 6 (4,038 kg/ha). For dry yield, the highest yield was obtained from MFD 6 (1,394 kg/ha) followed by MFD 4 (1,231 kg/ha) and MFD 7 (1,125 kg/ha). The higher dry yield obtained from MFD 6 as compared to MFD 4 was due to lower drying ratio

Table 6. The growth performance and potential yield of seven emas cotek accessions grown on bris soil

Accession no.	Plant height (cm)	Canopy diameter (cm)	Plant height to canopy diameter ratio	Total fresh yield (kg/ha)	Total dry yield (kg/ha)	Drying ratio[1]
MFD 1	108.4ab	83.2bc	1.35ab	2411.4cd	706.7cd	3.49b
MFD 2	75.7b	70.6c	1.08b	3821.9bc	911.4bc	4.21ab
MFD 3	143.9a	85.9bc	1.88a	1322.3d	378.6d	3.82ab
MFD 4	109.7ab	122.4ab	0.90b	7287.4a	1231.9ab	5.88a
MFD 6	149.0a	130.7a	1.14b	4038.6b	1394.4a	2.91b
MFD 7	114.5ab	112.0ab	1.02b	4624.4b	1125.0abc	4.35ab
MFD 12	95.7b	100.7abc	0.95b	3418.8bc	686.5cd	5.10ab
Mean	113.8	100.8	1.18	3846.9	919.2	4.25
CV (%)	20.9	21.1	29.4	21.74	27.24	27.23
Sign. level	**	**	**	**	**	*

[1]Ratio of total fresh to total dry weight
Values with the same letter in each column are not significantly different (p = 0.05)

Plate 1. Growth characteristics of MFD 4

Plate 2. Leaf characteristics of MFD 4

observed in MFD 6 (2.91) as compared to MFD 4 (5.10).

Conclusion

Even though emas cotek is an epiphytic plant and normally grow on the branches of taller plants for sunlight; there are some accessions that can be successfully grown in the field. At 20 months after planting, the fresh and dry yield of some of these accessions (MFD 4, MFD 7 and MFD 6) were greater than 4,000 and 1,100 kg/ha respectively. The highest yield was obtained from MFD 4 with the total fresh and dry yield of 7,287 and 1,231 kg/ha respectively. This accession has a much bigger and thicker leaves compared to other accessions evaluated. The branches are the main component of the yield and contribute to about 51% of the total biomass yield while the rest are the leaves and fruits.

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Abstrak

Emas cotek ialah tumbuhan ubatan yang semakin popular di kalangan pengamal tumbuhan ubatan tradisional di Malaysia. Emas cotek merupakan tumbuhan epifit dan tumbuh di atas pokok tinggi untuk mendapatkan cahaya matahari. Kajian awal menunjukkan beberapa aksesi mempunyai sifat pertumbuhan yang baik dan seharusnya berpotensi untuk penanaman komersial. Untuk menilai potensi sebenar aksesi-aksesi ini di ladang terbuka, satu kajian dengan menggunakan tujuh aksesi (iaitu MFD 1, MFD 2, MFD 3, MFD 4, MFD 6, MFD 7 dan MFD 12) telah dijalankan di Stesen MARDI, Telong pada tahun 2003.

Pengutipan hasil dijalankan pada bulan ke-20 selepas menanam. Keputusan yang diperoleh menunjukkan aksesi MFD 4 memberikan hasil basah yang signifikan serta tertinggi iaitu 7.3 t/ha. Hasil kering yang tertinggi telah diperoleh daripada MFD 6, MFD 4 dan MFD 7 dengan julat 1.1–1.4 t/ha. Pengiraan pembahagian purata komponen hasil basah menunjukkan 50.8% ialah ranting/batang. Selebihnya ialah daun (32.4%) dan buah (16.8%). Sifat daun, buah dan komponen hasil bagi ketujuh-tujuh aksesi yang dinilai juga dibincangkan.

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