



**UNIVERSITI PUTRA MALAYSIA**

**THE EFFECTS OF PLANT SPACING AND PRUNING SYSTEM ON  
PLANT PERFORMANCE, YIELD AND QUALITY OF BANANAS  
'MAS' (AA) AND 'BERANGAN' (AAA)**

**ZABEDAH BT. MAHMOOD**

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PLANT PERFORMANCE, YIELD AND QUALITY OF BANANAS  
'MAS' (AA) AND 'BERANGAN' (AAA)

By

ZABEDAH BT. MAHMOOD

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Abstrak Tesis yang Dikemukakan kepada Senat  
Universiti Pertanian Malaysia Sebagai Memenuhi  
Sebahagian daripada Keperluan untuk Ijazah  
Master Sains Pertanian

**KESAN JARAK TANAMAN DAN SISTEM PEMANGKASAN KE ATAS  
PERTUMBUHAN, HASIL DAN KUALITI PISANG MAS (AA) DAN  
BERANGAN (AAA)**

Oleh

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Mac 1991

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Md. Ali

Fakulti : Pertanian.

Tujuan kajian ini ialah untuk mengenalpasti kesan jarak tanaman dan sistem pemangkasan pada dua jenis pisang iaitu pisang Mas dan pisang Berangan. Kajian tersebut telah dijalankan pada dua lokasi, iaitu stesen MARDI di Jerangau, Terengganu dan di Serdang, Selangor.

Pada kedua-dua lokasi, hasil pokok pertama yang tertinggi bagi kedua-dua jenis diperolehi dari jarak 1.5 m x 1.5 m, diikuti dengan jarak 3 m x 1.5 m dan 3 m x 3 m. Hasil pisang Mas di Jerangau ialah 9 tan metrik (tm)/ha pada jarak 3 m x 3 m, 17 tm/ha pada jarak 3 m x 1.5 m dan 31 tm/ha pada jarak 1.5 m x 1.5 m. Arah aliran hasil pokok ratun didapati berbeza





dari hasil pokok utama. Hasil pisang Mas di Jerangau didapati tinggi dan stabil pada jarak 3 m x 1.5 m, sementara pisang Berangan mempunyai hasil yang stabil pada jarak 3 m x 3 m. Di Serdang pada jarak tanaman 1.5 m x 1.5 m kejatuhan hasil pokok ratun bagi kedua-dua jenis adalah ketara.

Apabila jarak tanaman dirapatkan bilangan hari untuk berjantung dan memungut hasil bertambah dan pokok-pokok pada jarak tanaman terdekat mengambil masa paling lama untuk berbuah dan berjantung. Sistem pemangkasan tidak mempengaruhi bilangan hari untuk berjantung dan mengeluarkan hasil pokok utama. Bagi pokok ratun terdapat interaksi yang berkesan di antara jarak tanaman x sistem pemangkasan di mana kesan sistem pemangkasan terhadap bilangan hari untuk berjantung dan mengeluarkan hasil adalah lebih ketara pada jarak tanaman yang paling rapat berbanding dengan yang 1.5 m x 1.5 m. Disebabkan perbezaan masa yang diambil untuk mengeluarkan hasil, pengiraan hasil dalam unit tm/ha/tahun telah juga dilakukan. Di Jerangau apabila dibandingkan dengan jarak 3 m x 3 m, hasil (tm/ha/tahun) telah bertambah sebanyak 41% dan 25% pada jarak 1.5 m x 1.5 m dan 3 m x 1.5 m satu persatunya. Di Serdang hasil bertambah sebanyak 50% pada jarak 1.5 m x 1.5 m dan 3 m x 1.5 m bila dibandingkan dengan jarak 3 m x 3 m. Walau.

bagaimanapun hasil kedua-dua jenis pisang adalah lebih rendah di Serdang berbanding dengan Jerangau.

Bagi pokok utama di Jerangau, peratus sikat gred A bagi kedua-dua jenis pisang Mas dan pisang Berangan adalah tinggi pada kombinasi rawatan yang diberikan. Perbezaan didapati di Serdang di mana peratus sikat gred A adalah rendah pada jarak tanaman yang paling rapat. Pada jarak 3 m x 1.5 m dan sistem pemangkasan 1 G, pisang Mas di Jerangau dapat mengeluarkan hasil yang stabil dengan kualiti buah yang baik pada ketiga-tiga pusingan. Di Serdang hasil dan kualiti buah pada ketiga-tiga jarak tanaman adalah rendah. Kesan jarak tanaman pada kualiti buah adalah lebih ketara pada pisang Berangan berbanding dengan pisang Mas. Cuma pada jarak 3 m x 3 m kualiti buah pisang Berangan dapat dikekalkan bagi ketiga-tiga penuaian. Pada jarak 1.5 m x 1.5 m dan 3 m x 1.5 m, hasil dan kualiti pokok ratun adalah rendah.

Kawasan di Jerangau didapati lebih sesuai untuk tanaman kedua-dua jenis pisang Mas dan Berangan berbanding dengan Serdang.

Abstract of Thesis Submitted to the Senate of  
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March 1991

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Md. Ali

Faculty : Agriculture.

The study was conducted to find out the effects of spacing and pruning system on the performance of 2 cultivars of bananas, namely, 'Mas' and 'Berangan'. The trial was conducted at 2 locations: MARDI Jerangau, Terengganu and MARDI Serdang, Selangor.

For both locations the highest yield of the first crop of both cultivars was obtained at 1.5 m x 1.5 m spacing, followed by 3 m x 1.5 m and 3 m x 3 m spacings. In Jerangau, the yield of 'Mas' at 3 m x 3 m was 9 metric tons (mt)/ha; increased to 17 mt/ha at 3 m x 1.5 m and further increased to 31 mt/ha at 1.5 m x 1.5 m. For the ratoon crops, the yield trend was



quite different from the plant crop. For 'Mas' in Jerangau the yield was quite high and stable at the intermediate spacing of 3 m x 1.5 m, while for 'Berangan' the most stable yield was found at the widest spacing. For the second location, Serdang, the yield drop of both cultivars was more prominent for the 1.5 m x 1.5 m and 3 m x 1.5 m spacings.

As the spacing was reduced the number of days to shooting and harvesting increased and plants at the closest spacing took the longest time to come to shooting and harvesting. Pruning practice did not influence the number of days to shooting and harvesting of the plant crop. For the ratoon crops the significant interaction between spacing x pruning system showed that the effect of pruning system on the number of days to shooting and harvesting was greater at the closest spacing compared to the wider spacing. Due to this difference in time to maturity, the average yield was expressed in mt/ha/yr. The yield in mt/ha/yr in Jerangau increased by 41% and 25% at 1.5 m x 1.5 m and 3 m x 1.5 m respectively, compared to the conventional spacing of 3 m x 3 m. In Serdang, the yield increased by 50% at 1.5 m x 1.5 m and 3 m x 1.5 m. However the yield of both cultivars was lower in Serdang compared to Jerangau.



For the plant crop in Jerangau the percentage of grade A hands of 'Mas' and 'Berangan' was high at the various treatment combinations but in Serdang the percentage of grade A hands was rather low at the closest spacing. For 'Mas' in Jerangau high yield and good quality fruit was maintained at 3 m x 1.5 m and 1 G pruning system for the 3 crop cycles. In Serdang yield and quality of ratoon crops was low at all the spacing treatments. The effects of plant spacing on fruit quality of the ratoon crops of 'Berangan' was more drastic than 'Mas'. Only at 3 m x 3 m the quality was maintained for the 3 harvests recorded. At the other two spacings the yield and quality of the ratoon crops were rather poor.

The experimental area in Jerangau was found to be more suitable for cultivation of both cultivars compared to Serdang.

**CHAPTER 1**  
**INTRODUCTION**

Banana is a popular local fruit species. It is non-seasonal and thus available throughout the year. Banana is mostly planted by smallholders either as a monocrop or interplanted into perennials or plantation crops such as fruit trees, rubber and oil palm. It also offers substantial shade cover to shade-needed crops such as cocoa. Besides generating early income, another attractive feature in this aspect of intercropping is that the economic life of banana, which is about 4 ~ 5 years, coincides with the period which the main crop takes to mature, and beyond that time shade from the main crop would render production of any secondary crop impossible.

The estimated area under bananas has increased from 15,384 hectares in 1982 to 23,351 hectares in 1985 (Anon. 1982, Anon. 1985). The cultivation of 'Mas' alone has increased from 943.65 hectares in 1985 to 2,741.13 hectares in 1986 (Anon. 1987). The increase may be due to the increase in local demand and also the recent interest to export bananas, especially 'Mas', to Hong Kong and Japan.



The main banana growing states in the country are Pahang, Perak, Johor, Negeri Sembilan, Selangor and Malacca (Anon. 1985).

Bananas can be divided into two main types, namely, cooking and dessert bananas. Some of the cooking bananas are 'Tandok', 'Nangka', 'Awak' and 'Raja', while some of the popular dessert bananas include 'Mas', 'Berangan', 'Rastali' and 'Embun'.

Household consumption surveys conducted by the Federal Agricultural Marketing Authority (FAMA) in 1982 and 1985 showed that banana (especially the dessert type) was the second most highly consumed fruit (second to durian) and its consumption had doubled from 1982 to 1985 (Table 1). Bananas are also being exported mainly to Singapore and a small quantity to Hong Kong and Japan. Table 2 shows that bananas make up 38.3% of the export tonnage of fresh fruits from Peninsular Malaysia valued at 5.487 million ringgit (Wong, 1986). Export of 'Mas' to Hong Kong had increased from 4 metric tons (mt) in 1982 to 1,089 mt in 1985. Malaysia controls about 3.1% of the banana market in Hong Kong. Japan imported about 680,000 mt of bananas in 1985. Even a one percent success in penetrating the market would mean 6,800 mt which may be difficult for Malaysia to fulfill with the present area and management quality of our banana growers.



Table 1

Monthly per capita household consumption  
of fruits in Malaysia (kg)

Fruit types	Peninsular Malaysia		Sabah		Sarawak	
	1982	1985	1982	1985	1982	1985
1. Banana cv. Dabun	0.031	0.0451	0.078	0.0688	0.028	0.3024
2. Banana cv. Rastali	0.100	0.1507	0.209	0.1002	0.597	0.0474
3. Banana cv. Mas	0.108	0.2560	0.336	0.2290	0.008	0.1727
4. Banana cv. Nangka	0.051	0.1371	0.021	0.1796	0.001	0.0294
5. Banana cv. Raja	0.022	0.0329	0.048	0.0493	0.181	0.0258
6. Banana cv. Berangan	0.028	0.0504	0.032	0.0116	0.005	0.0059
7. Pineapple cv. Sarawak	0.020	0.0634	0.042	0.0439	0.003	0.2034
8. Pineapple cv. Mauritius	0.154	0.2151	0.112	0.1107	0.000	0.0359
9. Orange (Limau Bali)	0.012	0.0235	0.022	0.0332	-	0.0362
10. Watermelon	0.296	0.2512	0.765	0.2795	0.406	0.4597
11. Jackfruit	0.041	0.0632	0.039	0.0917	0.017	0.0206
12. Carambola	0.020	0.0173	0.011	-	0.155	0.0020
13. Papaya	0.141	0.2729	0.228	0.1505	0.959	0.1660
14. Sapodilla (Ciku)	0.009	0.0364	0.019	0.0034	0.026	0.0294
15. Mangoes	0.047	0.1029	0.034	0.1552	-	0.0147
16. Cempedak	0.002	0.0049	0.010	0.0058	-	0.0308
17. Apple	0.090	0.1749	1.855	0.1559	0.383	0.1326
18. Oranges	0.069	0.1453	1.524	0.671	0.012	0.1268
19. Grape	0.020	0.0676	0.045	0.0057	0.031	0.0215
20. Pear	0.011	0.0298	1.186	0.0024	0.155	0.0147
21. Duku Langsat	0.604	0.0077	0.023	0.0010	-	0.0006
22. Duku	0.062	0.0161	0.001	-	0.026	-
23. Langsat	0.115	0.0358	0.259	0.0838	-	0.0473
24. Sweet Oranges	0.111	0.1601	0.116	0.1926	0.383	0.4773
25. Mangosteen	0.084	0.0452	0.040	0.0019	0.012	0.0163
26. Rambutan	0.240	0.1492	0.228	0.1544	-	0.1389
27. Durian	0.722	2.8106	7.412	2.2502	3.419	2.576

Source: Household Consumption Surveys 1982 & 1985, FAMA



Table 2  
 Export of major types of fresh fruits from  
 Peninsular Malaysia, 1985  
 (January - November, 1985)

Fruit type	Quantity (mt)	%	Value (M\$ FOB)	%
Bananas	38,423	38.3	5,487,590	16.1
Pineapple	13,751	13.7	1,113,620	6.2
Mangoes	737	0.7	257,660	0.8
Guava	421	0.4	64,520	0.2
Mangosteen	72	*neg	88,300	0.3
Rambutan	475	0.5	180,800	0.5
Durian	15,282	15.2	16,611,690	48.9
Langsat	42	neg	14,930	0
Watermelon	13,076	13.0	3,060,690	9.0
Papaya	15,134	15.1	3,435,920	10.1
Cempedak	73	neg	316,210	0.9
Mata Kucing	492	0.5	629,880	1.9
Other Tropical Fruits	2,318	1.3	1,726,080	5.1
	100,296	100	33,987,890	100

Source: Permintaan buah-buahan tempatan berdasarkan unjuran keperluan tempatan dan eksport. Proceedings of the National Fruit Symposium 1986.

\*neg : negligible