A COMPARISON OF FIVE TYPES OF PLANTING MATERIAL FOR ROUGH LEAF PINEAPPLES

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ABSTRACT

A five-year trial comparing five planting materials for rough leaf pineapples (Ananas comosus (*L*). *Merr.*) *is described from New Britain. Treatments were tops, slips, butts, aerial and ground suckers. All materials except butts produced a good stand. Aerial and ground suckers were the first to bear followed by slips, tops and lastly butts. Aerial suckers clearly outyielded the other treatments throughout the trial whilst butts were inferior. Yield differences were mainly associated with differences in fruit number, but differences in average fruit weight also occurred. Treatment effects were related to maximum plant height at ten weeks after planting and average weight of* 100 *of each of four leafy types of planting material taken from another block.*

INTRODUCTION

Pineapples (*Ananas comosus* (L.) Merr.) are normally propagated by one of the following planting materials—

1. Top or crown: the short stem and leaves growing from the apex of the fruit (see *Plate* I).
2. Slips: the leafy branches attached below the fruit which are developed from axillary buds on the peduncle (fruit stalk).
3. Butt or stump: the stem of a plant which has fruited.
4. Aerial suckers: leafy branches developed from axillary buds on the above-ground portion of the stem.
5. Ground suckers: leafy branches developed from axillary buds on the underground portion of the stem.

(Definitions follow Collins (1960, p. 39) except for aerial suckers.)

The term shoot is often used to describe both aerial and ground suckers and other terms such as ratoon, base and pregnant suckers and hapas are to be found in the literature. The quoted time to fruit-bearing for the various planting materials varies from country to country but in general shoots are the earliest to bear followed by slips, then tops, with butts the slowest. The times to fruit in Hawaii (Collins 1960, p. 147) of 17 months for shoots, 20 months for slips and 22 to 24 months for crowns are typical of figures in the literature.

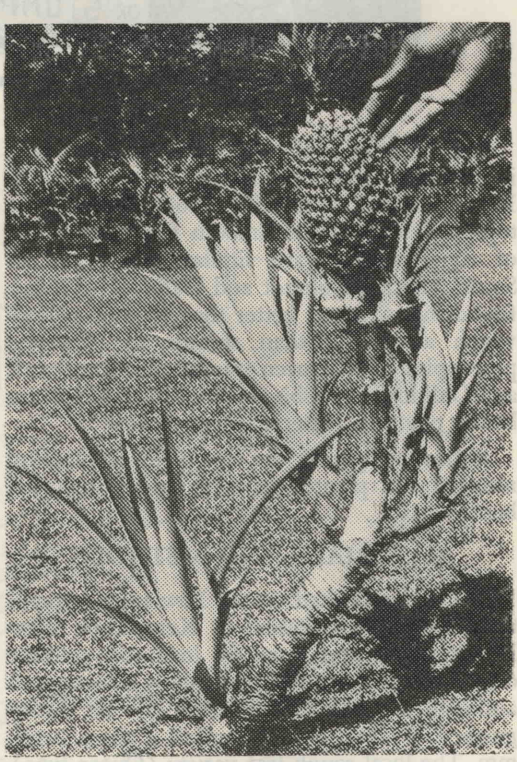

Plate I.—A rough leaf pineapple plant stripped of leaves to show the various plant parts. From the top these are top, fruit, slips, peduncle (fruit stalk), aerial suckers, butt and ground sucker

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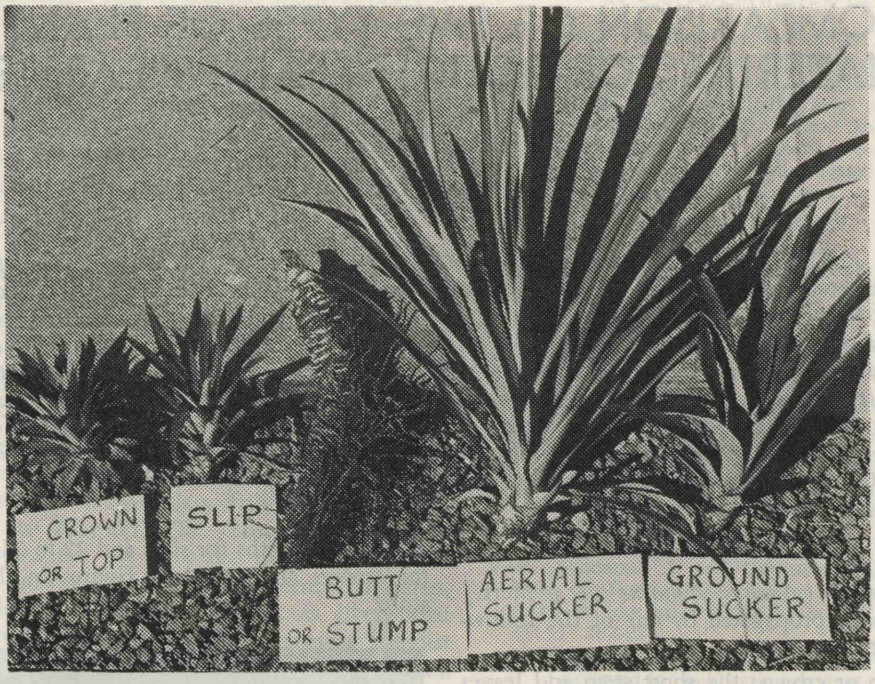

Plate II.—**The five types of planting material compared in the trial**

A number of trials comparing various planting materials have been reported from overseas. In Queensland Mitchell (1963) found that tops and slips of the Smooth Cayenne variety of equal weight gave similar results and in South Africa Reynhardt and Dalldorf (1968a) found that slips are better than tops or suckers which are better than stumps for Cayenne pineapples. For Queen pineapples Reynhardt and Dalldorf (1968b) reported that stumps are better planting material than suckers.

A trial comparing the five types of planting material was planted in 1971 and is reported here.

MATERIALS AND METHODS

The trial was sited on the Lowlands Agricultural Experiment Station at Keravat on New Britain on a fertile sandy loam of volcanic origin. Seasons are not particularly pronounced although a dry and wet season can be distinguished. Average annual rainfall is about 2 800 mm. The local rough leaf variety (Queen type) was used.

Design was a randomized block with five replicates and five treatments corresponding to the five types of planting material given above. Plots consisted of double rows 15.54 m long. Rows within the double rows were 91 cm apart and spacing between double rows was 2.74 m. Within-row spacing was 46 cm giving a planting density of 15 947 per hectare. There was a guard row at both ends of the trial but not along other edges.

Replicates 1, 2 and 3 were planted on 22nd April, 1971 and replicates 4 and 5 a fortnight later. Tops, slips, aerial and ground suckers had some of the lower leaves removed and were dried for a few days in the sun before planting. For the butts the leaves were removed from plants that had fruited and the base of the stem and peduncle were cut away. Butts were placed horizontally in shallow trenches and covered with about 5 cm of soil.

Fertilizer was applied as a side dressing three months after planting and thence every three months. Rates were 133 kg N, 24 kg P and 98 kg K per hectare per year, although there were minor deviations from this. N and K were spilt into four applications and P into two. Apart from regular weeding and slashing of leaves to keep interplot areas open, the

only other maintenance was two thinning-out operations carried out in September, 1972 and November, 1973. No artificial flower induction was performed.

Ten weeks after planting the first three replicates, the maximum plant height in each plot was recorded and observations were made on the number of plants growing per plot. Once the trial started bearing, fruit were harvested once or twice weekly. Individual fruit were weighed without tops. Some pilfering occurred but not a lot.

The average weight was obtained for 100 of each of tops, slips, aerial and ground suckers from another block of rough leaf pineapples.

RESULTS

At ten weeks after planting almost all plants in all treatments except butts were established. Plant growth from butts was uneven and there were many gaps in the rows.

Treatment effects for maximum plant height per plot at ten weeks were highly significant (*Table* 1).

Table 1.—Maximum plant height per plot (ten weeks)

Treatment	Height cm
Ground suckers	62.0 a
Aerial suckers	51.4 b
Slips	42.7 c
Tops	29.3 d
Butts	17.5 e
LSD (0.05)	6.0
LSD (0.01)	8.3

Figures followed by the same letter are not significantly different at p = 0.01.

Table 2.—Average weight of four types of planting material

Planting material	Average weight g
Aerial suckers	358
Ground suckers	250
Tops	162
Slips	125

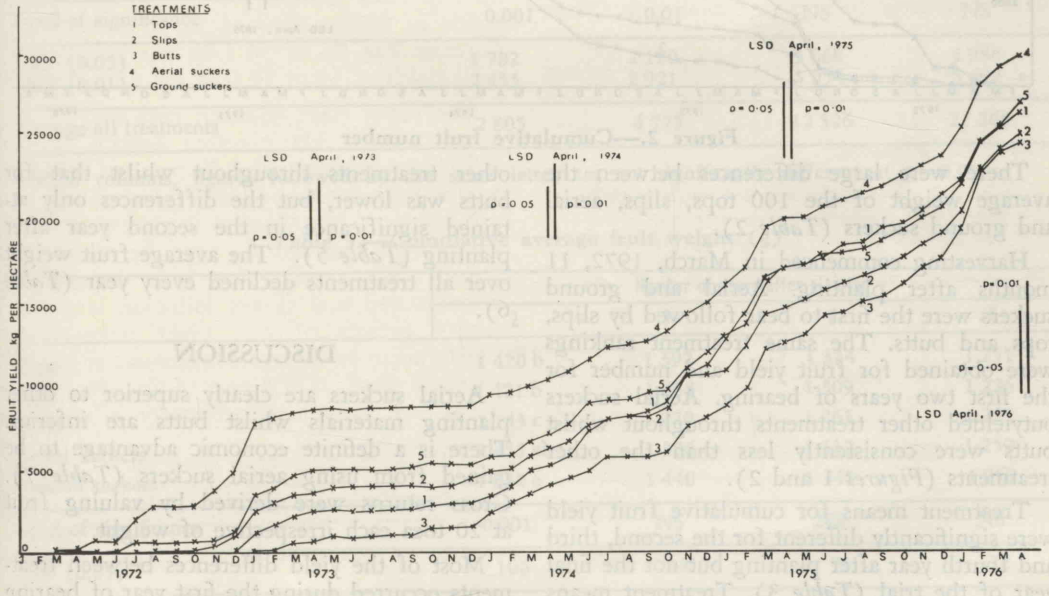

Figure 2.—Cumulative fruit yield

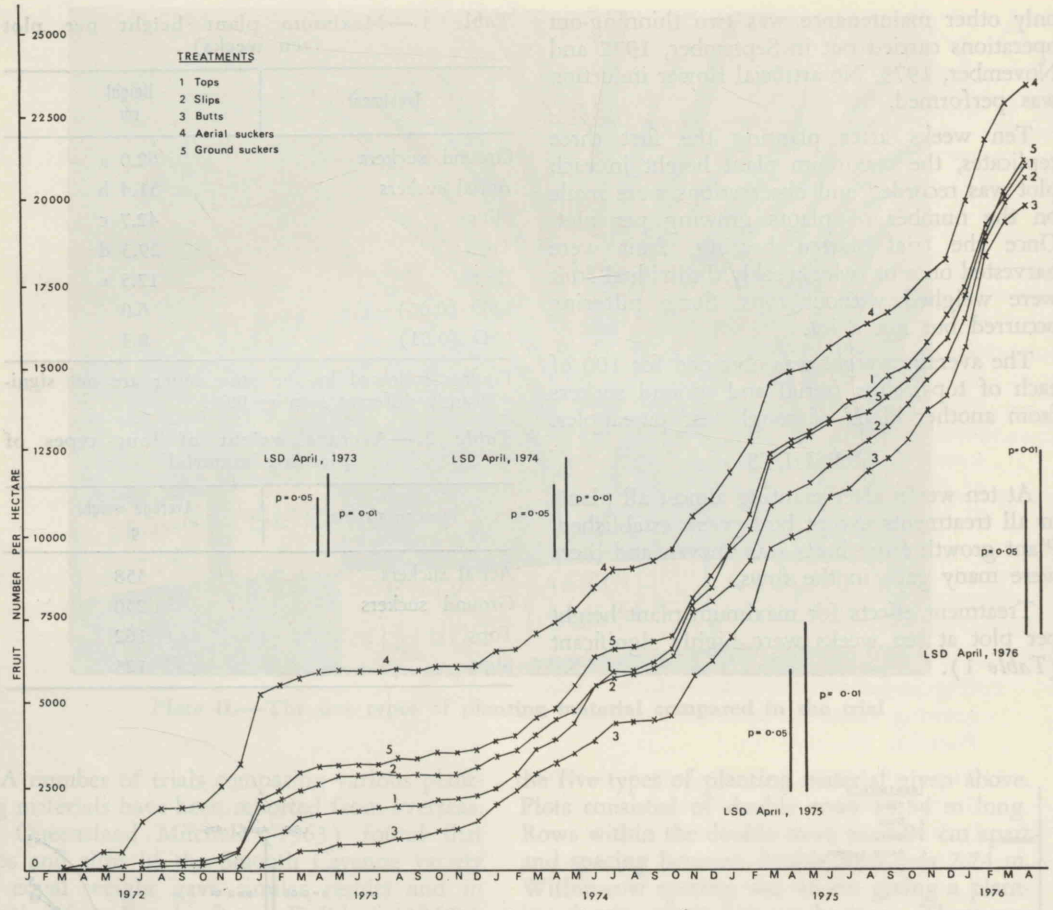

Figure 2.—**Cumulative fruit number**

There were large differences between the average weight of the 100 tops, slips, aerial and ground suckers (*Table* 2).

Harvesting commenced in March, 1972, 11 months after planting. Aerial and ground suckers were the first to bear followed by slips, tops and butts. The same treatment rankings were obtained for fruit yield and number for the first two years of bearing. Aerial suckers outyielded other treatments throughout whilst butts were consistently less than the other treatments (*Figures* 1 and 2).

Treatment means for cumulative fruit yield were significantly different for the second, third and fourth year after planting but not the final year of the trial (*Table* 3). Treatment means for cumulative fruit number were significantly different for the second and third year after planting (*Table* 4). Cumulative average fruit weight of ground suckers was greater than other treatments throughout whilst that for butts was lower, but the differences only attained significance in the second year after planting (*Table* 5). The average fruit weight over all treatments declined every year (*Table* 6).

DISCUSSION

Aerial suckers are clearly superior to other planting materials whilst butts are inferior. There is a definite economic advantage to be gained from using aerial suckers (*Table* 7). Gross returns were derived by valuing fruit at 20 toea each irrespective of weight.

Most of the yield differences between treatments occurred during the first year of bearing (*Figures* 1 and 2). This indicates that the effect of planting material is on maturity. Once the plants mature, they give similar yields whatever the planting material.

Table 3.—Cumulative fruit yield (kg/ha)

	Number of years after planting			
	2	3	4	5
Tops	2 470 bc	5 296 b	16 970 ab	26 300
Slips	3 663 b	6 306 b	14 734 b	25 333
Butts	748 c	4 169 b	12 632 b	24 444
Aerial suckers	8 576 a	10 359 a	19 889 a	29 603
Ground suckers	4 901 b	7 062 b	17 005 ab	26 836
Level of significance	0.001	0.01	0.05	NS
LSD (0.05)	2 599	3 160	4 630	4 913
LSD (0.01)	3 581	4 353	6 379	6 769
Average all treatments	4 072	6 638	16 246	26 503

Within columns, figures followed by the same letter are not significantly different at p = 0.05.

Table 4.—Cumulative fruit number per hectare

	Number of years after planting			
	2	3	4	5
Tops	1 735 bc	3 846 b	12 804	21 059
Slips	2 580 b	4 549 b	11 256	20 684
Butts	657 c	3 236 b	9 943	19 840
Aerial suckers	5 910 a	7 411 a	14 915	23 498
Ground suckers	3 142 b	4 831 b	12 710	21 247
Level of significance	0.001	0.01	NS	NS
LSD (0.05)	1 782	2 120	3 668	3 986
LSD (0.01)	2 455	2 921	5 054	5 492
Average all treatments	2 805	4 775	12 326	21 265

Within columns, figures followed by the same letter are not significantly different at p=0.05.

Table 5.—Cumulative average fruit weight (g)

	Number of years after planting			
	2	3	4	5
Tops	1 420 b	1 392	1 334	1 251
Slips	1 421 b	1 388	1 309	1 226
Butts	1 143 c	1 270	1 263	1 227
Aerial suckers	1 455 ab	1 386	1 332	1 259
Ground suckers	1 532 a	1 440	1 340	1 267
Level of significance	0.001	NS	NS	NS
LSD (0.05)	106	118	75	72
LSD (0.01)	146	162	104	100
Average all fruit	1 452	1 390	1 318	1 246

Within columns, figures followed by the same letter are not significantly different at p=0.05.

It has been confirmed that shoots (aerial and ground suckers) bear earliest followed by slips, then tops and lastly butts. However it is worthwhile to distinguish between aerial and ground suckers, at least for the rough leaf variety in PNG. This is because this variety suckers prolifically and planting material is usually plentiful. The yield results differ from those reported by Mitchell (1963) and Reynhardt and Dalldorf (1968a and b).

Treatment differences between aerial and ground suckers, slips and possibly tops may be related to the size rather than the nature of the planting material. There is a relationship between the weight of the four leafy planting materials (*Table* 2) and the time to bearing and yield. Studies in a number of countries have shown that larger planting material gives larger plants and fruit than smaller planting material. Such results have been reported for slips in Hawaii (Linford, King and Magistad 1934, cited by Collins 1960, p. 212); in Guinea by Py (1960); in Queensland by Mitchell (1963) for slips and tops; in Taiwan by Wang and Kwong (1967) for slips; and in Malaysia by Tan and Wee (1973). However Reynhardt and Dalldorf (1968b) in South Africa reported that medium suckers gave better results than smaller or large suckers in a trial with Queen pineapples.

Time to bearing and early yield are related to the maximum plant height at ten weeks (*Table* 1). Average plant height may have been more closely related.

Table 6.—Average annual fruit weight

Year after planting	Average fruit weight g
2	1 452
3	1 303
4	1 272
5	1 147

In this trial yield differences are mainly influenced by fruit numbers although there are some differences in average fruit size as well. Had flower induction been carried out, say at 12 months after planting, it is likely that fruit number from the various treatments would have been similar, but that large differences in average fruit weight would have been recorded.

Two years after planting average production was only 2 805 fruit/ha. Even the fruit number after five years (21 265 per hectare) was little better than one per mother plant (15 947 per hectare planted). It is likely that flower induction would have resulted in much greater production. Although resultant fruit would have been somewhat smaller than naturally induced ones, the practice should have been most profitable.

The overall yield level in the trial (26 503 kg/ha over five years), and that of other crops at Keravat, is low compared with reported yields overseas. In Australia average yield for a five-year cycle of one plant and two ratoon crops of the Cayenne variety is 113 t/ha (Collins 1960, p. 162). In Taiwan Wang and Kwong (1967) reported yields of 72 to 88 t/ha for a plant and one ratoon crop, depending on slip size. Collins (1960, p. 181) quotes yields in Puerto Rico of 38 to 63 t/ha for Cayenne and 25 to 50 t/ha for Red Spanish with yields of 13 to 25 t/ha for a ratoon crop.

The lower yield obtained here may be due in part to the low planting density, varietal differences between the Queen and Cayenne type and the fact that fruit weight was recorded without tops. Nevertheless it appears that environmental influences may be important. Bourke (1976) using data from this trial has demonstrated that flower initiation is greatest during periods of low night temperatures. Variations in minimum temperatures at Keravat are quite small. It is suggested that the climate is too even for a high percentage of plants to

Table 7.—Value of fruit harvested by 2, 3, 4 and 5 years after planting

	Cumulative gross returns per hectare (kina) after			
	2 years	3 years	4 years	5 years
Aerial suckers	1 182	1 482	2 983	4 700
Ground suckers	628	966	2 542	4 249
Slips	516	910	2 251	4 137
Tops	347	769	2 561	4 212
Butts	131	647	1 989	3 968

have flowers induced naturally and artificial flower induction is required to maximize production.

The decline in average annual fruit weight as the trial progressed (*Table 6*) reflects the smaller fruit that are obtained from ratoon crops. These "ratoon" fruit are generally smaller than fruit from a mother plant.

CONCLUSION

For rough leaf pineapples, aerial suckers should be used as planting material in preference to other types. Unless no other material is available, butts should not be used because of the resultant uneven growth, slowness to commence bearing and lower yield. Ground suckers, slips and tops are satisfactory planting materials although slips and tops are slower to start bearing and these three types do not yield as well as aerial suckers.

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