Turrialba Vol. 30, Nº 3, 1980, pp. 258-261

Vegetative propagation of pejibaye (**Bactris gasipaes** H.B.K.)*1/

G. BLAAK**

COMPENDIO

Un método sencillo de multiplicación vegetativa de plántulas jóvenes de pejibaye (Bactris gasipaes) *es descrito. La eliminación de la dominancia apical por eliminación de botón terminal con un barrenador de corchos resulta en la formación de vástagos laterales dentro de seis semanas. Es esencial conservar al menos una hoja de mayor edad por plántula después de la eliminación de botón terminal para suministrar los nutrimentos indispensables durante el estadio temprano de la formación de vástagos laterales. Se indican las consecuencias comerciales de la multiplicación vegetativa de palmas sin espinas sobre el tallo, en relación con la producción de los frutos y del palmito.*

Introduction

PEJIBAYE *(Bactris gasipaes H. B. K.)* is an old palm food crop from pre-Colombian times in Latin America. The palm fruit and the palm heart (palmito) are highly valued foods in Central America.

The palm grows rapidly up to 13 m in 10-15 years. Tillers are formed at the base of many palms, when the competition for light is not too intense. The slender stem is about 15 cm in diameter. The lower part of the stem shows circular leaf scars about 10 - 15 cm apart. The internodes are covered with a dense cover of long, hard and very sharp spines. The leaves on mature palms are 2.4 - 3.6 m in length. The pinnae of the leaf are irregularly orientated and covered with shorts spines. The fruit bunches are very variable in size and consist of a central rachis to which thin, fruit bearing branches (rachillae) are attached. An annual production of 3 - 5 bunches with 50 - 100 fruits per bunch is normal. The fruits may weigh from 29 - 100 grams. They contain a conical black nut of about 2 cm diameter. The oval fruits may differ per palm from yellow, green, orange, red to brown. The thick mesocarp layer of fresh fruits contains about 34.5 per cent starch, 5.6 per cent fat, 2.1 per cent protein, 1.3 per cent crude fibre and 55.8 per cent water. The orange mesocarp contains about 320 ppm carotene on fresh weight. (4) This is high as compared with carrots, which contain 50 - 60 ppm carotene on fresh weight.

The pejibaye palmito is of high quality as compared with the palmito of other palm species in respect of flavour, colour and texture. The palm produces well up to 700 m above sea level in tropical countries on young alluvial soils with a regular water supply. Pejibaye is a highly variable species in characteristics such as fruit composition, tillering behaviour density and length of stem spines and stem thikness. Fruit types differ in size, fibre content and colour. Some palms produce seedless fruits, which are much preferred in the market.

The tillering behaviour makes the palm attractive as a ratoon crop for palmito production. This may save the replanting costs after the felling for palmito recovery. However, as with many semi-domesticated crops, there are some serious set-backs that prevented pejibaye to become a crop of major importance in recent times. It is very difficult to climb pejibaye palms to harvest the fruit due to the stem spines. As a result harvesting costs are about 11 per cent of the crop value. Another problem is the prevention of fruit puncturing by the spines during harvesting. However, spineless palms do occur but are very rare (3). It is obvious that vegetative propagation of the spineless palms offers great prospects in popularizing the crop. Also vegetative propagation of seedless palms will mean a much better supply of the preferred seedless fruit. A combination of these two characteristics would greatly enhance the value of the crop.

Vegetative propagation has been attempted by numerous people (1, 2, 5, 6). However, the percentage

* Received for publication June 5, 1980.

1/ The author likes to acknowledge the assistance of Dr. Jorge Soria and Mr. Edilberto Camacho of CATIE, Turrialba, Costa Rica in providing the seed for this study. This paper has been approved for publication by Ir. G. J. Koopman, Deputy Director, Royal Tropical Institute.

** Royal Tropical Institute, 63 Mauritskade, Amsterdam-Oost, The Netherlands.

success has been low. The highest percentage survival was obtained by removal of large tillers of 1.2 - 1.8 m from older palms. The defoliated suckers were planted in the shade until roots were formed. This procedure is too slow and labour intensive to be used as a multiplication process on a large scale. The vegetative propagation method would be grealtly improved if small suckers could be used and the number of suckers obtained per palm could be increased. The multiplication of small suckers from young nursery palms has the additional advantage that the generation time from sucker to sucker producer can be much reduced. This means that a desirable palm type could be produced on a large scale in a matter of a few years. This paper describes a successful method of tiller inducement of young seedlings in the nursery.

Methods and results

Three open-pollinated seedlots were received from three different palms through the assistance of CATIE, Turrialba, Costa Rica. The seedlots were named progeny 1, 2 and 3. The 3 seed parents grew in different sites in Costa Rica. The seed was germinated and planted in polybags holding about 2 liters of peat soil each in a greenhouse of the Royal Tropical Institute in Amsterdam. The seedlings received regularly small quantities of a complete fertilizer. The seedling development was much slower than in the tropics but otherwise normal. The treatments started when leaf 12-15 was fully expanded.

Only simple treatments were studied that can be adopted easily by local farmers. All treatments except one were based on the idea that removal of a possibly existing apical dominance may stimulate tillering. Cases of such behaviour were observed when pejibaye palms were felled for palmito production. Sometimes many small suckers developed around the base of the rotten trunk that remained after felling.

In a first trial six seedlings from progeny 2 were defoliated and the growing points were removed. Four palms died but 2 developed one new shoot each within 6 weeks after cutting. This method was a wasteful method of tiller production but proved a remarkable ability of the seedling to recover.

A second series was started concurrent with the above mentioned series. All leaves except one of the older leaves were removed of five seedlings of progeny 2. A deep V-cut was made with a clean but unsterilized scalpel to remove the apical bud (growing point). All seedlings developed 1 - 5 shoots within 6 weeks after treatment. Six randomly chosen seedlings from progeny 2 served as a control. None of these control seedlings produced a single shoot.

Although the removal of the apical bud with a scalpel worked well it does not seem a rapid method for large scale operations. In a third trial all the leaves but one were removed from three seedlings of each of the progenies 1 and 3. A 5 - 6 mm plug, including the apical bud, was removed from the stem by pushing a corkborer horizontally in the stembase of the seedling. Care was taken not to damage the leaf-base of the remaining leaf with the corkborer. Two seedlings died because the apical bud was missed in the first attempt and a too big wound was created during the second attempt to remove the apical bud. The other 4 seedlings remained healthy and produced one shoot each within 5 weeks. A larger test was carried out subsequently using 33 seedlings. All 33 seedlings were left with 1 or 2 leaves. All seedlings survived the apical bud removal with the corkborer. The results of the last three trials are summarized in Tables 1, 2 and 3.

During the first experiments TMTD-dust was applied on the wounds made by the corkborer or scalpel. In the last experiments this procedure was omitted without any deleterious effects.

Table 1.—Shoot formation as a result of apical of bud removal in pejibaye seedlings of progeny 2. Seedlings retained one older leaf after bud removal.

Palm	Method of apical bud removal	Number of shoots or buds at apical bud removal time	Number of well developed shoots after 5 months
35	corkborer	2 buds	2
16	"	0	2
26	"	3 buds	4
5	"	0	2
33	"	0	2
9	"	0	3
28	scalpel, V-cut	0	2
39	"	0	3
54	"	0	2
17	"	0	1
42	"	0	1
1	no bud removal	2 buds	0
46	"	0	0
11	"	0	0
22	"	0	0
30	"	0	4
32	"	0	0
38	"	3 buds	0
8	"	0	0
20	"	0	0
34	"	0	0
19	"	1 bud	0
26	"	0	0

Another technique, pitting the bottom part of the seedling as used in bulb stimulation of hyacinths, was tried However, this did not lead to any stimulation of shoot formation

Table 2.—Shoot formation as a result of apical bud removal in pejibaye seedlings of progeny 1. Seedlings retained one or two older leaves after bud removal.

Palm	Method of apical bud removal	Number of shoots or buds at apical bud removal time	Number of well developed shoots after 5 months
64	corkborer	0	1
1	"	0	0
23	"	0	0
24	"	1 bud	1
56	"	0	1
22	"	2 buds	0
39	"	2 buds	3
69	"	2 buds	6
14	"	0	2
76	"	0	4
71	"	0	5
58	"	0	0
7	"	0	0
78	"	0	0
17	"	1	0
17	"	6 buds	6
33	"	4 buds	3
19	"	1 bud	1
30	"	0	3
45	"	0	1
44	"	1 bud	3
11	"	0	1
52	no bud removal	0	0
5	"	0	0
31	"	2 buds	0
61	"	2 shoots	2
80	"	0	0
16	"	0	1
32	"	0	2

Discussion

Apical bud removal clearly stimulates the formation of secondary shoots in seedlings However, there seems to be some difference in response between progenies All seedlings in progeny 2 reacted with shoot formation after apical bud removal (Table 1). An average of 2.5 shoots when removing the buds the corkborer and 1.8 shoots when removing the buds with a scalpel. Small dormant buds were sometimes visible at the stem base at the time of apical bud removal These buds did not develop in the untreated seedlings, but they grew out into shoots after apical bud removal Only one seedlings out of 12 control seedlings developed shoots spontaneously during the period of observation

The response to apical bud removal in progeny 1 is less convincing. Only 15 out of 21 treated seedlings developed shoots However, 2 out of 6 control seedlings also developed shoots spontaneously during the same period of observation The shoots on the control seedlings remained very small *i.e.* less than 5 cm, while the average shoot height on the treated seedlings was 20.2 cm (Table 2)

Apical bud removal in progeny 3 resulted in an average formation of 4.0 shoots per seedling. During the period of observation 2 out of 6 nontreated seedlings devoloped one shoot (Table 3).

Table 3.—Shoot formation as a result of the removal of the apical bud in pejibaye seedlings of progeny 3

Palm	Method of apical bud removal	Number of shoots or buds at apical bud removal time	Number of well developed shoots after 5 months
13	corkborer	1 bud	3
5	"	0	3
35	"	0	5
3	"	0	5
41	"	0	4
10	no bud removal	1 bud	1
20	"	1 bud, 1 shoot	1
47	"	6 buds	1
17	"	0	0
14*	"	6 shoots	6
45	"	0	0
31	"	1 bud	0
52	"	0	0

* Palm 14 in progeny 3 produced abundantly spontaneous shoots well before any other plant

It is not known whether tthe shoots resulted only from stimulated shoot primordia or dormant buds already present at the time of apical bud removal Apical bud removal may result in an annual shoot multiplication factor of 5 (Table 3). Under better growth conditions in the tropics it may be expected that this factor will be higher The results indicate that in a period of 6 years it would be possible to multiply a single plant to a stock of about 15000 clonal plants. At a planting density of 200 palms per hectare this amounts to 75 ha.

Root formation on shoots has been one of the major problems in vegetative propagation. There are two possibilities to establish shoots on their own root system. The first method is to cut the cluster of shoots so that each shoot is provided with a few roots of the motherpalm In this procedure it is essential that the shoots develop at least one fully expanded leaf to provide the required assimilates. However, the large wound may become infected. It is better to wait until the shoot forms its own adventitious roots. There are not yet sufficient data available but there is the impression that there are considerable differences in the earliness of adventitious root formation depending on the parent plant (genotype).

The practical implications of this study are a short cut in the breeding of pejibaye and the possibility to make available within 3 - 4 years improved clonal varieties as base material for commercial purposes. However, the feasibility of the method has to be confirmed by field experiments in the tropics.

The method of vegetative propagation described in this article can be taught to any horticulturist or farmer and requires only the expenditure of a good corkborer.

Summary

A simple technique of vegetative multiplication of young seedlings of pejibaye *(Bactris gasipaes)* has been described. Removal of the apical dominance by removal of the growing point with a corkborer results in adventitious shoot formation within 6 weeks. It is essencial to keep at least one older leaf on the seedlings after removal of the apical bud to provide the required assimilates needed during the early stages of shootformation. The commercial implications of vegetative propagation of spineless palms are indicated in respect of fruit and palmito production.

Literature cited

1 CAMACHO, E and SORIA, V. J. Palmito de pejibaye Proceedings of the Tropical Region American Society of Horticultural Science 14:122-132. 1970.

2 HUNTER, R. J. The lack of acceptance of the pejibaye palm and a relative comparison of its productivity to that of maize Economic Botany 23:237-244. 1969.

3 JOHANNESSEN, C. L. Pejibaye in commercial production. Turrialba 16: 181-187 1966.

4 JOHANNESSEN, C. L. Pejibaye palm: physical and chemical analysis of the fruit. Economic Botany 21:371-378. 1967.

5 JOSHI, A. C A palm suitable for cultivation in India, Bactris utilis et Hook. F Indian Farming 7: 237-239. 1946.

6 POPENOE, W. and JIMENEZ, O The pejibaye, a neglected food plant of tropical America. Journal of Heredity 12: 154-166. 1921.