

Multi-Sprouts in Avocado Seeds (*Persea americana* Mill.)

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Introduction

When avocado seeds germinate, they sometimes present more than one sprout (*Fig. 1*). This phenomenon was observed for the first time in 1933 by Traub and Auchter (5). It is necessary to distinguish the multi-sprout phenomenon (sprout formation in the embryo's bud) from the presence of more than one seedling, which is determined by polyembryony. Garcia (2) found a greater quantity of polyembryonic seeds in the West Indian types (25%) than those found in the Mexican race, and he reports no polyembryonic seeds in the Guatemalan race.

When *P. americana* Mill, and *P. schiedeana* Nees avocado seeds germinate, we have observed that, in some cases, more than one sprout emerges — sometimes up to 40 sprouts per seed.

When the multi-sprout phenomenon occurs with a high frequency, it may be a disadvantage for the nursery practice, for it may give many sprouts when the rootstocks are grafted or when they are regrafted. This can also happen when a rejuvenation pruning is made. This phenomenon may be useful in the clonal propagation of the rootstocks as Traub and Auchter have pointed out, or as it has been used with the purpose of having a cheaper production of plants. Searching for a practical solution in order to propagate the outstanding selections of rootstocks, we have to consider the alternative offered by the multi-sprout phenomenon.

Materials and Methods

This research was carried out during 1981-1982. The seeds of *P. americana* from four native trees of the West Indian race from Santa Maria del Oro, Nayarit; seeds of the Guatemalan race from a tree located in Atlixco, Puebla; and seeds from five different trees of the Mexican race obtained from Tochimilco, Puebla, were included.

The avocado seeds, previously disinfected, were sown in black plastic containers filled with light textured soil. The germination began approximately 45 days after the seeding; observations began when the seedlings were 15 cm high.

Figure 1



Figure 2

Results

Phenomenon description. In some cases, we have found that the sprouts come out from the union point of the cotyledons and the new seedlings (Fig. 2). In this case, this part always presents a thickening and the sprout can be easily separated. The other case presents sprout formation lengthwise of the stem (Figs. 3 and 3a). In both cases, the sprouts come out from the area covered by the cotyledons — cotyledonal area. When quantifying this phenomenon, we have not distinguished the different types of sprout formation. It would be necessary to make a thorough study of the origin of the two different types of sprout formation.

Adventitious root formation. Adventitious root formation has sometimes been noticed

in the *P. americana* main stem seedlings (*Fig. 4*); this observation indicates the possibility of adventitious root formation at the juvenile phase. A high concentration of lateral buds in the etiolated stem within the cotyledonal zone, together with the ability to form adventitious roots, might be useful in avocado propagation through conventional methods or through tissue culture.



Figure 3



Figure 3a

Multi-sprout appearance frequency. Regardless of the limitation set by the fact that the Guatemalan race seed was from only one tree, the results are interesting.

Among the seeds obtained from the different trees of the West Indian race, a high variability in the multi-sprout phenomenon was found. The seeds which produced only one sprout had a percentage which varied from 25 to 84, depending on the tree where

the seeds came from. In the Mexican* race, the results were very stable: a percentage of 90 to 98 of the seeds had only one sprout; and this percentage in the Guatemalan race was 16 (Table 1).

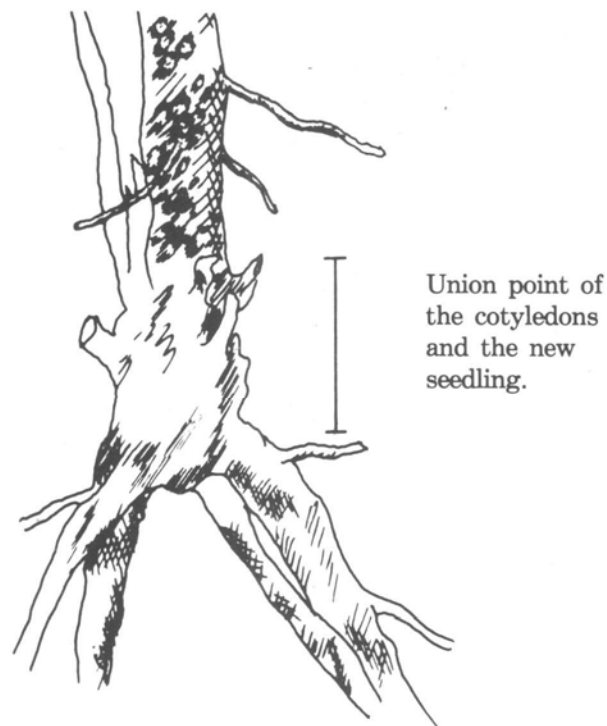


Figure 4

Discussion

Multi-sprout formation at the moment of seedling emergence is a phenomenon little known. It was possibly first mentioned by Traub and Auchter (1933), who observed seeds having up to eight sprouts within *P. americana* and *P. drymifolia*.

The formation of more than one sprout per avocado seed has been attributed to the presence of polyembryons (Garcia, 1975). In the present case, we have not found seedlings with polyembryonic origin; or did Traub and Auchter attribute multi-sprout formation to the presence of polyembryons.

Due to the different implications in vegetative multiplication with this species, and to the difficulties sometimes found, the natural or stimulated formation of a greater number of juvenile character sprouts might be an advantage for this practice. This has been sought through a special treatment to stimulate sprouting in avocado seedlings having, through pruning, a satisfactory sprout formation in the lateral buds of the stem, but of a very restricted growth in length (4). The actual data indicate a new possibility, making use of the natural tendency to form juvenile sprouts directly in the cotyledonal zone, in propagation by marcotts or cuttings. Traub and Auchter discovered a new embryo partition technique to obtain a greater number of seedlings, from two to four per seed.

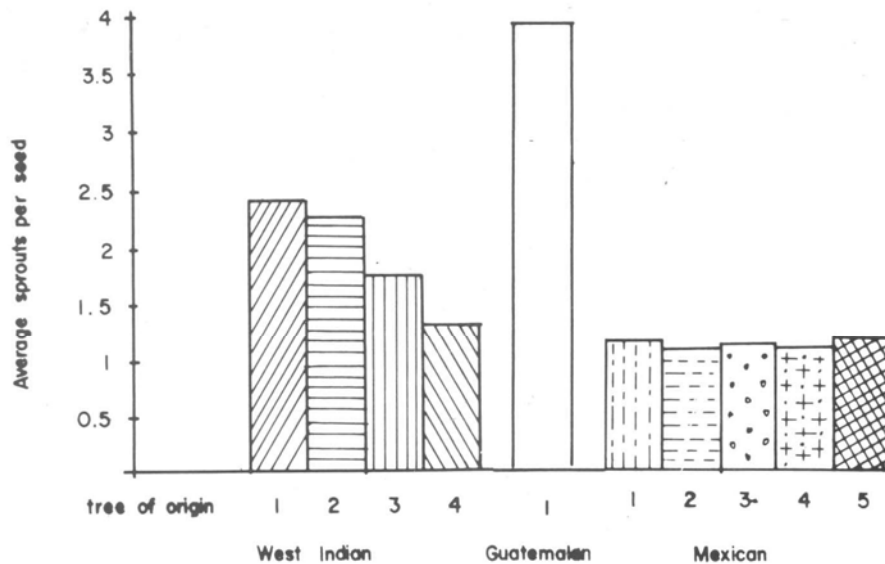


Figure 5. Average sprouts produced in seeds from various trees and races of avocado.

Even though multi-sprout formation at plant nurseries does not occur in a high number, it presents the necessity of eliminating all the sprouts that appear at the moment of germination or after grafting is made.

We know little about terminal bud damage or elimination (decapitation) and about the elimination of just part of the sprout in the sprouting of the lateral buds located in the cotyledonal area at the moment of sprout emergence, but we have previously noticed a high “sprout resistance” of the lateral buds forced through pruning (4). It was interesting to find a high natural tendency to multi-sprout formation in the case of the Guatemalan race representative, and differences in the races as well as in the different trees of origin when evaluating this phenomenon. The poor expression of this phenomenon in the case of the Mexican race might be an indicator of an accelerated process of natural selection compared with the representatives of the other two races.

It might be possible to provoke a high sprout formation in the emergence stage of the seedlings, cutting off in this way the effects related to the tip dominance or the main sprout dominance in the avocado, which is a limitation to the plant reproduction through marcotts. The sprout lengthening suppression caused by the main sprout did not* appear in the initial stage — sprouting stage and first phase of lengthening — in many of the cases.

The formation of a large number of sprouts in the neck region is an indicator of a juvenile stage; within this region the stems sometimes form adventitious roots. It has been noted that there is a tendency to form adventitious roots in the grafted plant when grafting in the emergence stage of the seedlings (5). All the information indicates new but not explored possibilities of vegetative propagation of the avocado.

Table 1. Distribution (%) of sprouts produced per avocado seed.

Race and trees	Quantity of sprouts produced per seed																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
West Indian																				
1	30.7	28.2	25.8	8.6	4.5	1.2	0.0	0.6												
2	28.2	31.4	37.2	5.1	1.5															
3	53.3	26.0	17.4	3.3																
4	84.5	11.5	4.0																	
Guatemalan																				
	16.1	16.3	17.9	17.2	11.7	7.0	4.9	3.0	2.1	1.8	0.6	0.5	0.17	0.25	0.08	0.04	0.04	0.08	0.08	0.04
Mexican																				
1	89.9	9.1	1.0																	
2	96.6	3.4																		
3	95.3	3.5	1.2																	
4	98.0	1.7	0.3																	
5	93.8	3.7	2.5																	

Table 2. Frequency of the multi-sprout presentation.

Race and trees		Quantity of sprouts produced per seed																				Total of sprouts and seeds
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
West Indian																						
1	B	50	92	126	56	40	12	0	8												384	
	S	50	46	42	14	8	2	0	1													163
2	B	34	86	153	28	10															311	
	S	34	43	51	7	2																137
3	B	49	48	48	12																157	
	S	49	24	16	3																	92
4	B	125	34	18																	177	
	S	125	17	6																		148
Totals	B	258	260	345	96	50	12	0	8												1029	
	S	258	130	115	24	10	2	0	1													540
Guatemalan																						
	B	383	776	1272	1632	1390	996	819	568	441	420	165	144	52	84	30	16	17	36	38	20	9299
	S	383	388	424	408	278	166	117	71	49	42	15	12	4	6	2	1	1	2	2	1	2372
Mexican																						
1	B	89	18	3																		110
	S	89	9	1																		99
2	B	86	6																			92
	S	86	3																			89
3	B	81	6	3																		90
	S	81	3	1																		85
4	B	393	14	3																		410
	S	393	7	1																		401
5	B	152	12	12																		176
	S	152	6	4																		162
Totals	B	801	56	21																		878
	S	801	28	7																		836

(B) Quantity of Sprouts
(S) Quantity of Seeds

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