

## Percentage Fruit Set In Avocados (*Persea Americana* Mill.)

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### Introduction

The expression, percentage set, designates the percentage of fruits which set on the tree under normal conditions, when exposed to insect pollination. The percentage set may be determined at any time, from fruit-initiation up to fruit-maturity, by counting the fruits on a marked branch and comparing that number with the number of recorded flowers. In this study, attention was focused on the percentage of initial fruit set and the percentage of such fruits attaining maturity.

### Materials and Methods

The study reported here was conducted in 1972 and 1973 at the Field Station of the University of the West Indies, St. Augustine, Trinidad.

*Initial percentage fruit set:* The initial percentage fruit set was determined at the beginning, middle and end of March, 1973, on two trees of each of the cultivars "Nishikawa C.", "Kahaluu H." and "Simmonds." Three branches (a low, middle and high one) were marked on each tree. Unwanted parts of the inflorescences were removed. A number of flowers on each tree were used as controls and these unpollinated flowers were observed for shedding in order to determine the exact time of initial fruit set; the fruits initiated on the marked branches were then counted.

*Percentage set of mature fruits:* In 1972, 13 four to five-year old trees were selected and one branch was marked on each tree. Every day, from the beginning to the end of anthesis, the flowers (open for their first period) on each inflorescence were counted and the numbers recorded. This method was followed as it was impossible to count the flowers and flower buds on each inflorescence at once. Fruits were first counted a week after the opening of the last flowers on each branch and counting was continued at weekly intervals until the fruits matured. The flowering and fruiting status of each tree, as an individual, was also recorded.

### Results and Discussion

#### Initial Fruit Set

*Time of initial fruit set:* From observations on the controls un-pollinated flowers, which do not form fruits, were shed within six to seven days after their first opening (Fig. 1). Therefore, the time of initial fruit set was considered to be either the 6th or 7th day after the first period of flower opening.

*Initial percentage fruit set:* Table 1 shows the mean initial percentage fruit set of the three periods (beginning, middle and end of March) studied for each tree. It is worth

noting that in the cultivar "Simmonds" the set was much lower than in the cultivars "Nishikawa C." and "Kahaluu H." Such a difference may be attributed to pollination, in which insects play the most significant role. In addition, the size of the stigmas seems to be, at least theoretically, an important factor in pollination; it is feasible that cultivars with large stigmas would have a greater chance for pollination than those with small stigmas. Such small stigmas characterize "Simmonds" while the other two cultivars have larger stigmas.

Generally speaking the initial percentage fruit set in all the trees studied was low and the factor responsible for this was, most probably, inadequate pollination.

### **Fruits Attaining Maturity**

*Abscission of the fruits:* There was fruit-formation in all the trees studied (Table 2), but most of these fruits drop at an early stage of development. It is essential that this drop takes place, as the tree, under normal circumstances, would not be able to carry so many fruits through to maturity. Later in the season, up to about seven weeks before maturity, a low percentage of the total number of initiated fruits drop. From that time up to maturity none of the fruits abscised.

*Percentage set of mature fruits:* According to Cameron, Mueller and Wallace (1952), the percentage of fruit set on "Fuerte" trees studied was 0.031, 0.023, 0.001 and 0.008. Chandler (1958) stated that a "Fuerte" tree usually sets less than 0.02 per cent mature fruits. Bergh (1967) has mentioned that the avocado tree can mature fruits to a maximum of about 0.1 per cent of the flowers when bloom is heavy.

In this study, the percentage set of mature fruits varied from zero (0) to 0.66 between trees of different cultivars (Table 2). It is worth noting that in certain cultivars the percentage of mature fruits was zero, despite initial fruit set. The cultivars studied can, therefore, be distinguished according to their ability to hold and mature fruits; that is, those which set fruit but carry none to maturity, and those which set and mature fruit. In the "Monroe" cultivar, none of the fruits on the marked branch attained maturity, but there were a few mature fruits on other branches of the tree. However, despite the exceedingly low percentage set in the cultivars which set and mature fruits, a satisfactory crop is not excluded, if there is no other limiting factors, because of the enormous number of flowers borne by an avocado tree.

Table 3 is related to flowering and fruiting status. More specifically, this Table gives the percentage set of mature fruits for the year 1972, together with the amount of bloom and the numbers of mature fruits for the years 1972 and 1973.

*Unfruitfulness of avocado cultivars:* As previously mentioned, the percentage set of certain cultivars was zero on the marked branches. Furthermore, none of the fruits on other branches of these trees attained maturity. The amount of bloom was heavy during the two flowering seasons and although there was high initial fruit set, all the young fruits abscised. This abscission usually occurred within a period of one month after fruit-formation.

All these cultivars were brought to Trinidad from the United States of America, where they are believed to be fruitful and, therefore, the change in their fruiting status may be due to intolerance of the Tropical-Lowland climatic conditions existing in Trinidad. High

temperatures prevailing during the flowering and fruiting periods may lead to embryo abortion and result in abscission of the fruit. However, the critical temperature for each cultivar, above which conditions are increasingly unfavorable for fruit setting, has not yet been determined. Experiments with two of these trees, in which more than 80 per cent of the flowers were removed, failed to give mature fruits. This suggested that abscission was not due to competition between the flowers or young fruits.

It would be of interest, if these cultivars were the subject of further experimental work to determine the causes of unfruitfulness. Such work could include a complete program of fertilization, hormone treatments, girdling, cooling the trees by sprinkler irrigation and/or planting these cultivars on cooler hilly areas and embryo abortion studies.

### **Summary**

Under Trinidad conditions, the percentage of fruit set in certain avocado cultivars was studied. The initial percentage fruit set on six trees (three different cultivars), exposed to insect pollination varied from 5.1 to 6.8. The percentage set of mature fruits on trees exposed to insect pollination varied from 0.04 to 0.66 between different cultivars which carried matured fruits. Although the cultivars "HAES 6836," "Kahaluu C.," "Kahaluu H.," "Nishikawa C." and "CRC 3-4" set fruits these cultivars carried none to maturity. The unfruitfulness of these cultivars is worthy of investigation.

### **Acknowledgments**

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### **References**

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2. Cameron, S. H., R. T. Mueller and A. Wallace. 1952. Nutrient composition and seasonal losses of avocado trees. Cal. Avoc. Soc. Ybk. pp. 201-209.
3. Chandler, W. H. 1958. Evergreen Orchards. Lea and Febiger, Philadelphia.

FIGURE 1: PERIOD OF SHEDDING OF UNPOLLINATED FLOWERS WHICH DID NOT FORM FRUIT

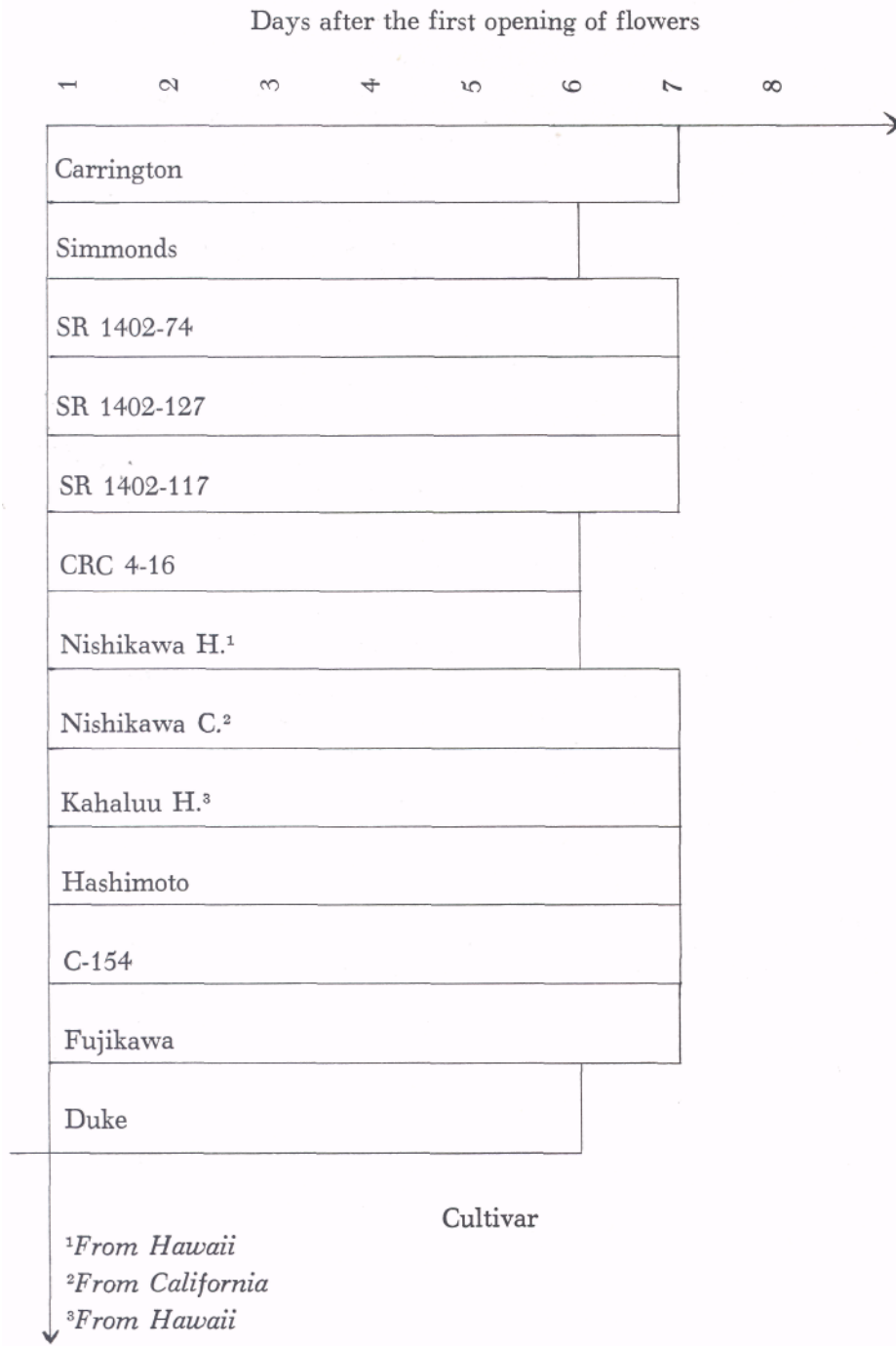


TABLE 1: INITIAL FRUIT SET DURING MARCH, 1973

Cultivar	Simmonds			Nishikawa C. <sup>1</sup>			Kahaluu H. <sup>2</sup>			
	R <sub>1</sub> T <sub>13</sub>	R <sub>1</sub> T <sub>14</sub>	R <sub>7</sub> T <sub>19</sub>	R <sub>7</sub> T <sub>20</sub>	R <sub>7</sub> T <sub>27</sub>	R <sub>7</sub> T <sub>28</sub>	Open Pollination	Control	Open Pollination	Control
No. of Row and Tree on the Row										
No. of flowers	661	746	976	986	1003	1024				
Initial fruit set	51	38	130	166	101	108				1
Initial percentage set	7.7	5.1	13.3	16.8	10.1	10.5				0.8

<sup>1</sup>From California

<sup>2</sup>From Hawaii

TABLE 2: PERCENTAGE SET OF MATURE FRUITS

Row and Tree	R <sub>1</sub> T <sub>11</sub>	R <sub>1</sub> T <sub>13</sub>	R <sub>1</sub> T <sub>16</sub>	R <sub>6</sub> T <sub>1</sub>	R <sub>6</sub> T <sub>7</sub>	R <sub>6</sub> T <sub>22</sub>	R <sub>6</sub> T <sub>24</sub>
Cultivar	Carrington	Simmonds	Simmonds	HAES 6836	Kahaluu C <sup>1</sup>	CRC.3-4	CRC 3-4
No. of flowers counted on the marked branch.	3,096	2,776	2,517	5,718	8,364	8,352	5,290
Fruit set 1 week after the last open bloom on the marked branch.	102	26	32	139	83	192	129
2 weeks after	54	8	14	58	63	48	111
3 weeks after	33	7	8	13	6	4	11
4 weeks after	31	7	6	0	1	0	2
5 weeks after	17	7	6	0	0	0	0
6 weeks after	10	7	6	0	0	0	0
7 weeks after	7	5	5	0	0	0	0
8 weeks after	4	5	5	0	0	0	0
9 weeks after	3	5	5	0	0	0	0
10 weeks after	2	5	5	0	0	0	0
11 weeks after	2	5	5	0	0	0	0
12 weeks after	2	4	5	0	0	0	0
13 weeks after	2	4	5	0	0	0	0
14 weeks after	2	4	5	0	0	0	0
15 weeks after	2	4	5	0	0	0	0
16 weeks after	2	4	5	0	0	0	0
17 weeks after	2	4	5	0	0	0	0
18 weeks after	2	4	5	0	0	0	0
19 weeks after	2	4	5	0	0	0	0
No. of mature fruits	2	4	5	0	0	0	0
Percentage set of mature fruits				0	0	0	0

<sup>1</sup>From California

Row and Tree	R <sub>6</sub> T <sub>29</sub>	R <sub>7</sub> T <sub>9</sub>	R <sub>7</sub> T <sub>20</sub>	R <sub>7</sub> T <sub>26</sub>	R <sub>3</sub> T <sub>14</sub>	R <sub>10</sub> T <sub>17</sub>
Cultivar	CRC 4-16	Murrieta	Nishi-kawa C <sup>1</sup>	Kahaluu H <sup>2</sup>	C-154	Monroe
No. of flowers counted on the marked branch.	2,426	2,341	7,112	7,574	2,792	2,158
Fruit set 1 week after the last open bloom on the marked branch	36	12	159	153	48	46
2 weeks after	28	6	63	54	28	34
3 weeks after	25	2	3	4	13	22
4 weeks after	22	2	0	0	11	20
5 weeks after	19	2			10	8
6 weeks after	19	2			10	2
7 weeks after	19	2			9	0
8 weeks after	17	2			9	
9 weeks after	17	1			9	
10 weeks after	16	1			9	
11 weeks after	16	1			9	
12 weeks after	16	1			8	
13 weeks after	16	1			8	
14 weeks after	16	1			8	
15 weeks after	16	1			8	
16 weeks after	16				8	
17 weeks after	16				8	
18 weeks after	16				8	
19 weeks after	16				8	
No. of mature fruits	16	1	0	0	8	0
Percentage set of mature fruits	0.66	0.04	0	0	0.29	-*

\*There were mature fruits on other branches of the tree (See Table 3).

<sup>1</sup>From California

<sup>2</sup>From Hawaii

TABLE 3: FLOWERING AND FRUITING STATUS OF AVOCADO TREES (PERCENTAGE SET, AMOUNT OF BLOOM AND YIELD RATING)

Row & Tree	Cultivar	Percentage set of mature fruits 1972	Amount of bloom		No. of mature fruits	
			1972	1973	1972	1973
R <sub>1</sub> T <sub>11</sub>	Carrington	0.06	Heavy	Heavy	129	155
R <sub>1</sub> T <sub>13</sub>	Simmonds	0.14	Heavy	Heavy	116	128
R <sub>1</sub> T <sub>16</sub>	Simmonds	0.20	Heavy	Light-Medium	237	96
R <sub>6</sub> T <sub>1</sub>	HAES 6836	0	Heavy	Heavy	0	0
R <sub>6</sub> T <sub>7</sub>	Kahaluu C. <sup>1</sup>	0	Heavy	Heavy	0	0
R <sub>6</sub> T <sub>22</sub>	CRC 3-4	0	Heavy	Heavy	0	0
R <sub>6</sub> T <sub>24</sub>	CRC 3-4	0	Heavy	Heavy	0	0
R <sub>6</sub> T <sub>29</sub>	CRC 4-16	0.66	Light-Medium	Medium	47	81
R <sub>7</sub> T <sub>9</sub>	Murrieta	0.04	Medium	Medium	34	58
R <sub>7</sub> T <sub>20</sub>	Nishikawa C. <sup>2</sup>	0	Heavy	Heavy	0	0
R <sub>7</sub> T <sub>26</sub>	Kahaluu H. <sup>3</sup>	0	Heavy	Heavy	0	0
R <sub>8</sub> T <sub>14</sub>	C-154	0.29	Medium	Medium-Heavy	82	274
R <sub>10</sub> T <sub>17</sub>	Monroe	-	Light	Medium-Heavy	17	149

<sup>1</sup>From California

<sup>2</sup>From California

<sup>3</sup>From Hawaii