

POST BUDDING TREATMENT OF CACAO SEEDLINGS

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## BIOGRAPHY

I was born on September 1, 1919 in Saint Louis du Nord (Haiti), where I started the primary school. In 1929, I went to Port-au-Prince (Haiti) where I completed the primary and secondary schools at the Collegue Saint Louis de Gonzague, in July 1939.

In October 1939, through an examination I was admitted to the "Ecole Nationale d'Agriculture" d'Haiti, at Damien, where I graduated on October 8, 1942. From October 15, 1942 to July 1946, I was employed by the Agricultural Department of Haiti as County Agent, in the Extension Service. From November 1946 to February 1948 I worked as a Director of Project of Coffee Regeneration at Cavaillon (Haiti). In April 1948, I was promoted "Chief of 5th Brigade" of the Agricultural Extension Service, of the Agricultural Department (Haiti).

In January 1949, I obtained a scholarship from the Cacao Center of the Inter-American Institute of Agricultural Sciences in Turrialba, Costa Rica.

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## INTRODUCTION

Vegetative or asexual propagation enables man to keep and perpetuate the desirable characteristics of a plant, which might be lost through sexual propagation.

In the case of cacao, the most interesting characteristics to be reproduced are the following: high productivity, resistance to diseases and pests, and superior quality. Among various methods of asexual reproduction two, up to now, have given good results; they are: a) rooting of cuttings and b) budding. A successful method of budding involves two conditions: 1) a high percentage of "set" of the buds, and 2) a quick and vigorous growth of the new plants. Attainment of these objectives has been the object of many investigations.

During the past two years, the Cacao Center of the Inter-American Institute of Agricultural Sciences at Turrialba, Costa Rica, has developed a system of budding, the inverted U, which has been very satisfactory on chupones. However, information concerning its possibilities of success, when applied to seedlings was inconclusive. This study was initiated to extend the knowledge of the advantages and limitations of the "Inverted U" method of budding upon cacao seedlings, with special reference to the post-budding treatment of the budded stocks.

LITERATURE REVIEW

The literature pertaining to the budding of cacao has been reviewed recently by Paredes (15) and Velásquez (23), however, the most outstanding investigations in that field are recorded here, especially in regard to the subsequent treatment of the stock plants.

J. T. Harris (10) in Jamaica, in 1903 described his method of budding. He recommended that the part of the stock above the bud be cut back after the union of stock and scion had been completed. According to Freeman (5), Casse in Haiti, in 1905, was successful in budding on seedling stocks; his opinion on subsequent treatment of the stock was not reported. In Trinidad, Tobago and Dominica, (11) attempts to bud on cacao seedlings were started, during this same period. In 1915, Jones (12) recommended the patch-budding system as a method of budding cacao. A new step toward the improvement of budding was done by Gerold Stahel, in Surinam. His method of budding was described by Van Hall (22). One of the most important features of his method was the posterior treatment of the budded stock. According to this author, the stock should be bent over after budding, and severed back only when the bud had sprouted. Van Hall agreed with him. This system was successfully applied in the Belgian Congo (2) in 1933. In 1934, and 1943, Pound (17 and 18), published a detailed description of the patch-budding system

as applied to cacao. As regard to the posterior treatment of the stock he said, "Generally, as soon as the bud shows signs of sprouting the stock can be topped back, leaving only a few leaves. In the plot nursery, cutting back can be done much more rapidly except, in the driest weather, when the bud is in danger of drying out. Dormant bud patches often fail to sprout at all until the stock is cut back severely, and this can be done without risk if the patch is well healed onto the stock."

An attempt to determine the effect of different post-treatments of the stock was done by Paredes (15). This investigator, using the "Inverted U" method, compared two treatments: a) cutting back the chupon stock at 10 cm. above the bud immediately after budding, and b) girdling the stock, by taking out a piece of bark in a ring form 10 cm. above the bud also immediately after budding. Paredes did not obtain any significant difference for the number of buds "set" in either group. A very marked difference in the subsequent growth was noted however, after 6 months, in favor of the first group (cutting back immediately).

Later, Velásquez (23) also working on chupones, compared three different times of severing the stock at a point approximately 10 cms. above the buds; 1) cutting back one week before budding, 2) cutting back immediately after budding, and 3) cutting back 2 weeks after budding. No important



differences were noted between these treatments, but cutting back immediately after budding resulted in a greater number of budded unions as well as in subsequent growth.

In a survey of the literature dealing with budding of either temperate or tropical fruit trees, most writers (1), (4), (12), (13), (19), have recommended the cutting back of the stock after union of the stock and scion.

### MATERIALS AND METHODS

The investigations were conducted in two locations: at the Institute and at La Lola Farm. The Institute is located about 6 Kms. from Turrialba, at an elevation of approximately 600 meters. The amount of rainfall is approximately 2,800 m/m per year and the mean annual temperature is 22.7° C. La Lola Farm is situated on the Atlantic Coast of Costa Rica about 55 Kms. from Turrialba by railroad. The elevation varies from 24 to 58 meters. The precipitation which was well distributed over the year, was 4,035 m/m in 1949; the mean maximum temperature was 32° C., and the mean minimum temperature was 22° C.

Seedlings in nursery plots were used as stock material in both locations. The budwood was obtained from "El Chino", an experimental and demonstration plot at the Institute, where selected clones of the United Fruit Co. are grown. A budding-knife, small pruning shears and wrapping tape

comprised the equipment. The wrapping material was prepared, by dipping ordinary muslin cloth in a hot solution of paraffin and beeswax (1000 g. of paraffin, 500 g. of beeswax).

The method of budding used in these experiments was the "Inverted U" which is described briefly as follows: Two parallel cuts of equal length are made in the stock approximately 10 cm. above the soil surface. The upper ends are then joined by a straight cut and the bark gently lifted, forming a rectangular flap still attached below to the stock. The flap is 2.5 to 8.0 cm. long. A piece of bark with one bud but no wood is cut to fit the space from a budstick and inserted beneath the flap. The flap is cut off immediately below the bud, so that the bud itself will not be covered. The budded area is wrapped firmly with the wrapping tape. Budwood was prepared one week before budding by cutting off the growing point and the leaves of the selected branches.

In the experiment carried out at the Institute, 500 seedlings about 14 months old were used as stocks and budwood was taken from 5 different clones namely: 221, 613, 650, 667 and 677. Five post-budding treatments of the stock were compared: (A) the stock was half-severed 10 cms. above the bud and bent over immediately after budding; (B) the stock was left untouched after budding; (C) the

stock was cut back 10 cms. above the bud 2 weeks after budding; (D) the stock was cut off 10 cms. above the bud immediately after budding, and (E) the stock was girdled by removing a ring of bark 10 cms. above the bud immediately after budding. The budding was done during five different periods in 1949: 1) August 22 to 28; 2) September 11 to 17; 3) September 26 to October 2; 4) October 10 to 16, and 5) October 17 to 20. Four buddings were made per clone - per treatment - per time period; thus 100 buddings were made during each time - period. All buds were unwrapped one week after the date of budding.

At La Lola, 270 seedlings about 18 months of age were used as stocks; these seedlings were growing in rows about 75 cms. apart and were naturally shaded by Inga trees. The plants were spaced about 20 cms. apart in the rows. Budwood was obtained only from clone #650.

The experimental design was a randomized block with 3 post-budding treatments, 5 replications, and 3 periods of time. These treatments were: (A) the stock was cut  $\frac{2}{3}$  through the stem and bent over at a joint 10 cms. above the bud immediately after budding; (B) the stock was cut off 10 cms. above the bud immediately after budding, and (C) the stock was cut off 10 cms. above the bud 14 days after budding. There were 6 plants per replication. The time-periods were: February 9, 16, and 23 of 1950. Ninety

buddings were made during each time period. The buds were unwrapped 14 days after they were made. The plants were sprayed with a 3-3-50 Bordeaux mixture at intervals of 14 days during a period of 2 months after budding, so as to prevent losses from infection of the leaves and growing points by Phytophthora. The diameter of the stock at the point where the budding was done (approximately 10 cms. above the ground) was recorded at the moment of budding, also the presence or absence of a flush on the stock. The sprouting buds were carefully maintained with only one whip, so that their heights could be used as a measure of growth.

### EXPERIMENTAL RESULTS

#### Investigations at the Institute:

The data recorded for this part of the experiment are limited to the sprouting of the buds, for several reasons such as: a relatively low number of successful unions, some mechanical injuries caused by the artificial shade falling on the plants, and infection of the new growth by a fungus, probably Phytophthora.

The results presented in table 1 indicate the number of buds sprouted by clone, post-budding treatment and the time-period of budding. These data were obtained two months after the budding period. All buds which were still green - but had not sprouted by this time were recorded as dormant buds.

Table 1. The number of successful bud-unions obtained in the experiment conducted at Turrialba in 1949. The data are obtained by clones, post-budding treatments, and time of budding.

Clone	Treatment	22-8-49	11-9-49	26-9-49	10-10-49	17-10-49	Total	$\bar{x}$
221	A	3	4	3	3	2	15	3.0
	B	1	0	0	0	0	1	0.2
	C	3	4	4	2	2	15	3.0
	D	3	3	2	3	3	13	2.6
	E	2	3	2	2	3	12	2.4
Total and Mean		12	14	11	9	10	56	2.2
613	A	3	2	3	3	2	13	2.6
	B	0	0	0	0	0	0	0.0
	C	4	4	3	3	2	16	3.2
	D	3	3	3	2	2	13	2.6
	E	2	3	1	2	3	11	2.2
Total and Mean		12	12	10	10	9	53	2.1
650	A	3	3	3	3	2	14	2.8
	B	0	1	0	0	0	1	0.2
	C	3	4	3	3	3	16	3.2
	D	3	2	2	2	3	12	2.4
	E	2	2	3	2	2	11	2.2
Total and Mean		11	12	11	10	10	54	2.2

Table 1. (Cont).

Clone	Treatment	22-8-49	11-9-49	26-9-49	10-10-49	17-10-49	Total	$\bar{x}$
667	A	2	2	2	2	2	12	2.4
	B	0	0	0	0	0	0	0.0
	C	3	3	3	2	2	13	2.6
	D	3	1	2	2	2	11	2.2
	E	2	3	2	2	3	12	2.4
Total and Mean		10	10	10	9	9	48	1.9
677	A	3	3	2	2	1	11	2.2
	B	0	0	0	0	0	0	0.0
	C	3	4	4	2	2	15	3.0
	D	3	3	3	2	3	14	2.8
	E	2	2	2	1	3	10	2.0
Total and Mean		11	12	11	7	9	50	2.0
Totals for Clones	A	14	15	13	14	9	65	2.6
	B	1	1	0	0	0	2	0.1
	C	16	19	17	12	11	75	3.0
	D	15	12	13	10	13	63	2.5
	E	10	13	10	9	14	56	2.2
Total Mean		56	60	53	45	47	1.9	
		2.2	2.4	2.1	1.8	1.9		

The data presented above were analysed by the R x 2 method of chi-square analysis (21). The results of the analysis indicated the following:

1) Cutting back of the stock 14 days after budding (Treatment C) was significantly better than ringing the stock (treatment E) and also significantly better than leaving the stock untouched (treatment B).

2) Cutting back immediately after budding (treatment D), cutting and bending over the stock immediately after budding (treatment A) and treatment E, were significantly better than treatment B; but there were no important differences between A, D, and E.

No significant differences were found between clones nor between the time periods.

#### Investigation at La Lola:

The data obtained from the preliminary experiment conducted at the Institute indicated that at least 3 of the treatments were worthy of further investigation. These 3 treatments, ( A) cutting and bending over the stock immediately after budding; C) cutting of the stock 14 days after budding, and D) cutting off the stock immediately after budding), were investigated further at La Lola under more favorable conditions.

In addition to obtaining data on the number of successful bud-unions, data was obtained concerning the effect of the presence or absence of a flush on the stock at the time

of budding, the relationship of diameter of stock to the number of bud unions and subsequent growth of sprouts, the effect of precipitation upon number of bud unions, and the effect of treatment upon the number of days required for sprouting and subsequent growth of the sprouts. All of the data were analyzed statistically by the  $R \times 2$  method of Chi-square analysis or the method of pooled variance (21).

The effect of treatment upon the number of successful bud unions: Of the 270 budded plants, 203 sprouted which gave a total of 75.18% success. By treatment the percentages were: 1) Stock cut and bent over immediately after budding (treatment A) 82.22%; 2) Stock cut back immediately after budding (treatment B) 54.44%; and 3) Stock cut off 14 days after budding (treatment C) 88.88%.

The data on the number of successful bud unions are presented in Table 2. The analysis indicated that:

For time-period I (Feb. 9) there were no significant differences between treatments A and C, but both were significantly better than treatment B. For time-period II (Feb. 16) treatments A and C were again approximately equivalent and both were significantly better than treatment B. However, for time-period III (Feb. 23), there were no significant differences between the three treatments. When the totals of the treatments for the entire experiment were compared treatments A and C were both significantly better



Table 2. The number of successful bud unions obtained in the experiment conducted at La Lola in 1950. The data are arranged according to time of budding and post-budding treatments.

Time	Treatment	Treatment Totals	Treatment Means
I (Feb. 9)	A	21	4.20
	B	11	2.20
	C	27	5.40
	Total	59	3.93
II (Feb. 16)	A	26	5.20
	B	14	2.80
	C	26	5.20
	Total	66	4.40
III (Feb. 23)	A	27	5.40
	B	24	4.20
	C	27	5.40
	Total	78	5.20
Totals	A	74	4.93
	B	49	3.27
	C	80	5.33

than treatment B, but there was no important difference between A and C.

The effect of the time-period of budding on the number of successful unions was analysed also.

Time period III (Feb. 23) was significantly better than time-period I (Feb. 9). There was no significant dif-

ference between time-periods I and II, nor between II and III.

The effect of the presence or the absence of a flush on the stock when the budding was done: The data shown in table 3 were obtained at the time the plants were budded to determine whether the presence or the absence of a flush of new leaves on the stock had an effect on the union of the stock and the scion. Analysis of the data did not reveal any significant differences that could be attributed to the presence or absence of flushes.

Table 3. The number of plants with and without flushes at the moment of budding.

Conditions of the stocks	Total N° of plants	Total N° of buds set	Percentage
Flushing	172	127	74 %
Not flushing	98	76	78 %
<b>Total</b>	<b>270</b>	<b>203</b>	

The relationship of diameter of the stock to the number of successful bud-unions: The diameter of the stocks was measured at the point where budding was done, to determine if the size of the stock had an effect upon the number of successful bud-unions. In Table 4 are presented the number of successful unions according to the different diameters recorded.

Table 4. Stock diameters in cm. of the area budded recorded at the time of budding.

Diameter of the stock (cm)	N <sup>o</sup> of Plants	Percentage of buds set
1.0	37	62.2 %
1.5	122	80.3 %
2.0	79	74.7 %
2.5	22	72.7 %
3.0	9	66.6 %
3.5	1	100.0 %
Total	270	

The result of the analysis of these data did not indicate any significant differences between the different sizes of stocks.

The effect of rainfall upon the number of successful bud-unions: The amount of rainfall for the 14 day period following each budding time was obtained. This data and the number of successful bud unions for each time-period of budding are presented in Table 5 and depicted graphically in figure 1.

Table 5. The amount of rainfall recorded during the 14 days after the budding was done, and the number of buds set per time-period of budding.

Period	Rainfall m/m	N <sup>o</sup> of buds set
Time I	307.2	59
Time II	331.5	66
Time III	95.5	78
Total	734.2	203

The results of the analysis of these data indicated that there was no significant correlation between the amount of rainfall and the number of buds set.

The effect of treatment upon the number of days for sprouting: The time of sprouting of the buds was believed to be related to the post-budding treatments, so the number days required by each bud to start its initial growth was recorded. These data are presented in Table 6.

Table 6. The number of developed buds in each treatment and the mean number of days required to start growth.

Treatment	N <sup>o</sup> of Plants	$\bar{x}$ N <sup>o</sup> of days
A	74	27.77
B	49	26.71
C	80	26.91
Total	203	

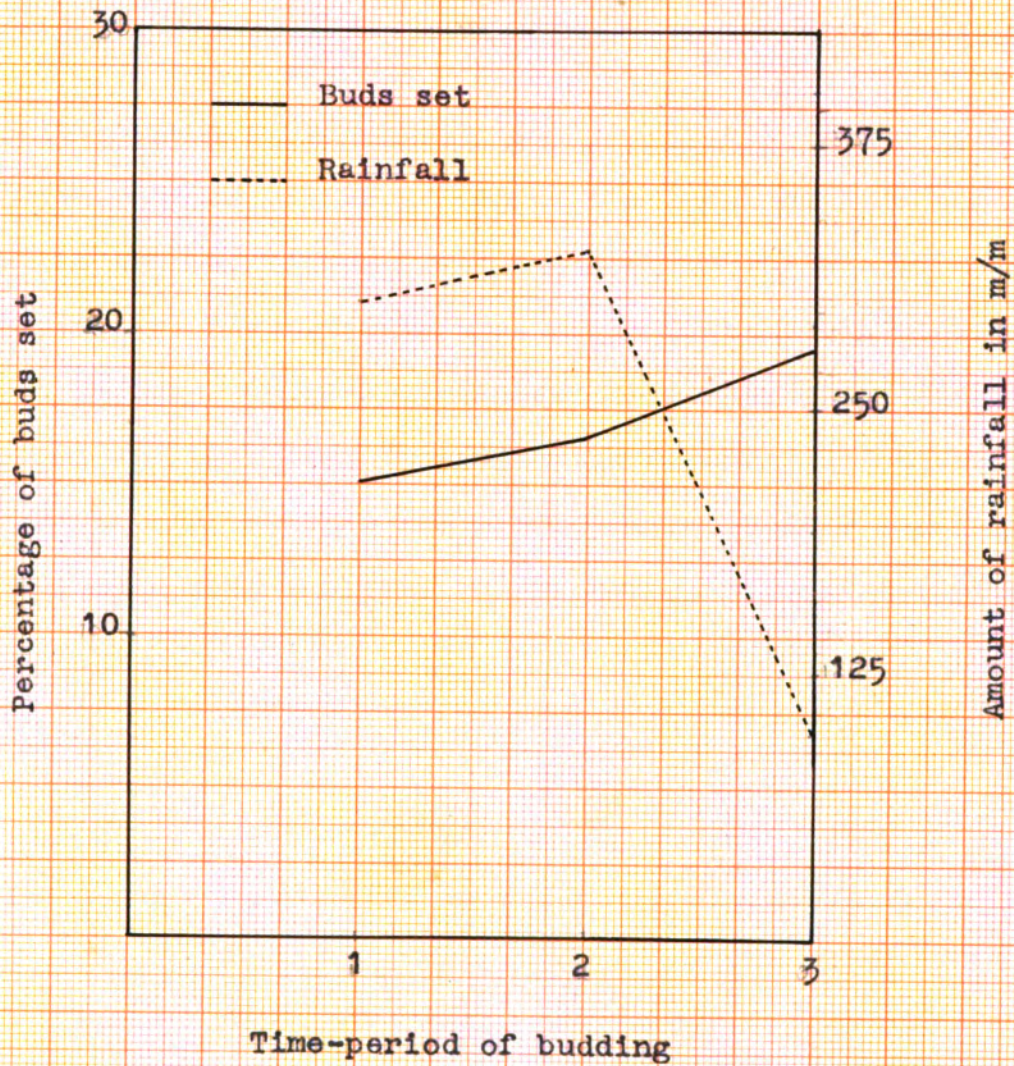


Figure 1.- The number of buds set by time-period and the amount of rainfall 14 days after budding for each period.

The analysis did not reveal any significant differences between the treatments.

The average number of days required for sprouting was practically the same for each of the post-budding treatments.

The effect of treatment upon the growth of the sprouts:

The measurements of the growth of the sprouted buds were taken at the end of the first, second and third months after their initial start. Only the length of buds was obtained. Due to injuries of several kinds, the number of growing buds measured was less than the 203 which actually sprouted. The growth measurements are presented in table 7 and figure 2. The data were analysed by the method of pooled variance (21).

Table 7. Growth measurements of the buds arranged by treatments for the three months.

Treatment	N <sup>o</sup> of plants measured	$\bar{x}$ Growth (cm)
<b>First month</b>		
A	57	12.39
B	45	10.78
C	73	13.89
<b>Second month</b>		
A	53	18.00
B	40	14.28
C	63	18.74
<b>Third month</b>		
A	51	25.96
B	40	20.17
C	60	26.06

For the first month, cutting back of the stock 14 days after budding (treatment C) was significantly better than cutting back immediately after budding (treatment B), and there was no significant difference between cutting and bending over the stock immediately after budding (treatment A) and treatment C. There was no significant difference

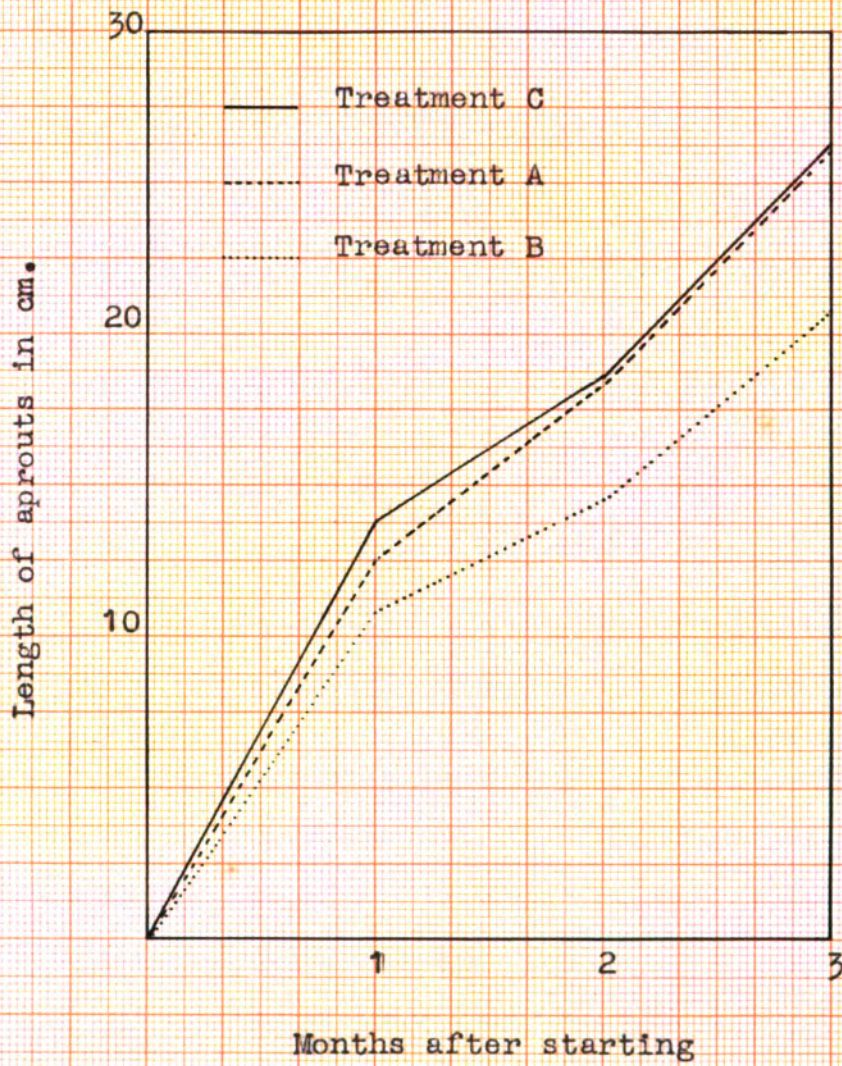


Figure 2.- The growth of the buds according to treatment for the three months measurements.



between treatments A and B. During the second and third months, the growth measurements of treatments A and C were approximately equal and both were significantly better than treatment B.

The effect of size of the stock on the growth of the sprouts: The growth measurements of the buds were recorded also according to the diameter of the stock at the time of budding.

These data are presented in Table 8.

Table 8. Growth measurements in cm. of the buds for each of the three months, in relation to the diameter of the stocks.

Dia- meter:	: First Month		: Second Month		: Third Month	
	: N <sup>o</sup> of Plants	$\bar{X}$ Growth	: N <sup>o</sup> of Plants	$\bar{X}$ Growth	: N <sup>o</sup> of Plants	$\bar{X}$ Growth
1.0	18	9.67	17	12.58	17	15.94
1.5	88	11.79	71	15.69	69	21.63
2.0	52	14.79	49	19.65	47	28.93
2.5	14	13.36	14	20.85	13	27.37
3.0	5	12.40	4	18.75	4	35.00
3.5	1	16.00	1	23.00	1	38.00

The results of the analysis of these data were as follows: During the first month the growth of the buds which sprouted on the stocks of 2.0 cms. diameter was significantly better (1 % level) than on the stocks of 1.0 and

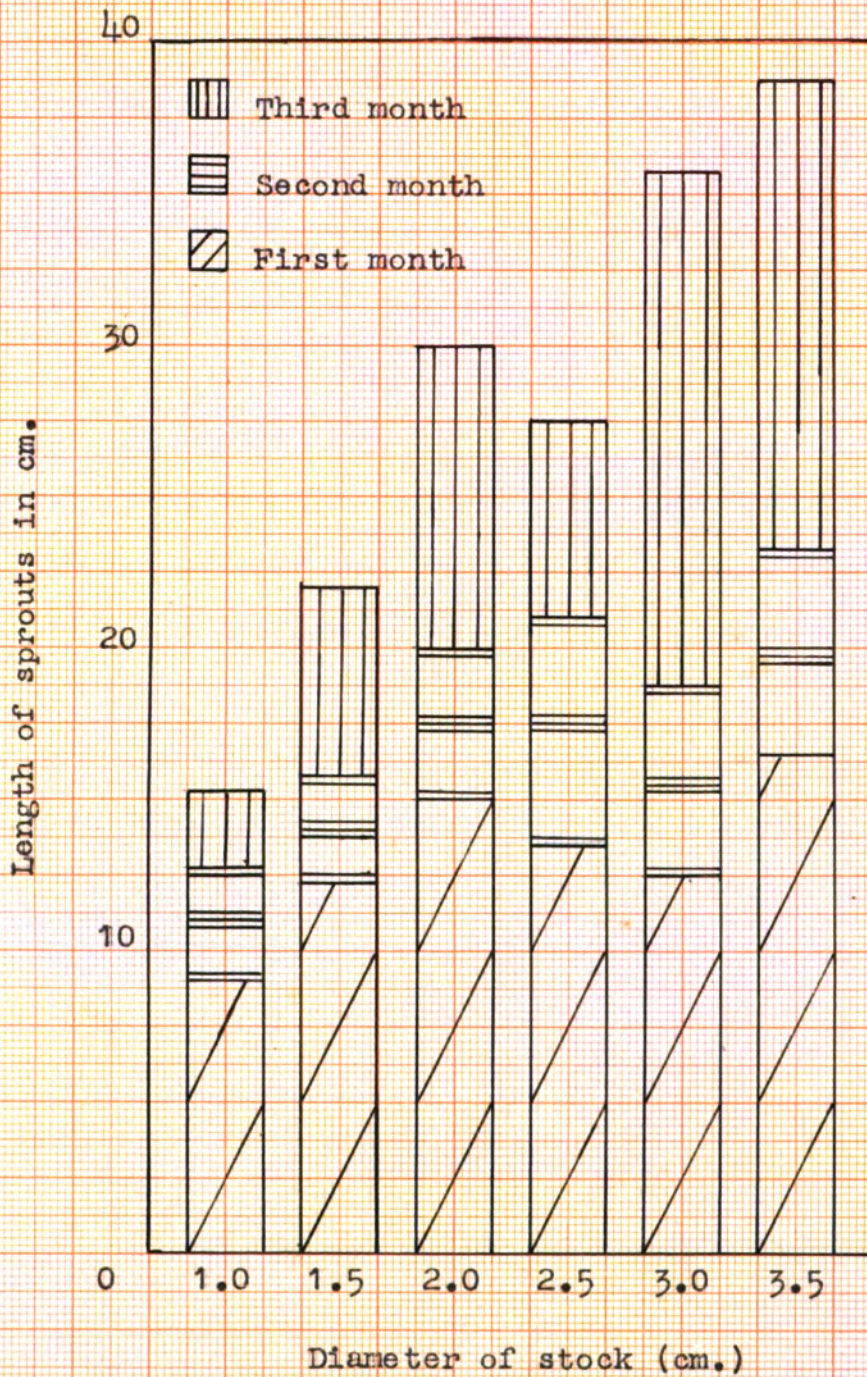


Figure 3.- The relationship between the size of the stock (diam.) and the growth of the buds for the three months observations.

and 1.5 cms. diameter. The growth on 1.5 cm. and 2.5 cm. stocks was better (5 % level) than the 1.0 cm. stock. There were no other significant differences.

During the second month, the growth of the buds on the 2.0 and 2.5 cm. stocks was approximately equal and significantly better (1% level) than the growth on the 1.0 and 1.5 cm. stocks; the growth on the 1.5 cm stock was better (5% level) than the 1.0 cm. stock.

In the third month of growth the 1.5 cm. stock was better (5% level) than the 1.0 cm. stock. The 2.0, 2.5, and 3.0 cm. stocks were approximately equal and all were significantly better (1% level) than the 1.0 and 1.5 cm. stock.

The 3.5 cm. stock measurement was not included in the analysis because there was only one plant of that size.

The preceding results are presented more clearly in figure 3 which shows the monthly growth for each diameter of stock.

### DISCUSSION

The success of any method of budding depends upon the union of the stock and scion. The exact physiological nature of this union is not well known, but the union is possible only through the activity of the cambium layer located between the bark and the wood of both stock and scion.

"The cambium produces the outgrowth of young tender callus tissues, which is so essential to the success of budding and grafting." (1)

Posterior treatments of the stocks are just attempts to force the buds into growth. This may be accomplished in several ways: cutting back the stock, bending over, or girdling; the purpose being to give to the bud a terminal position from a physiological standpoint.

The necessity of post-budding treatment of cacao appeared to be justified by the results obtained for treatment B (stock left untouched) in the experiment at the Institute, since, after two months, only 2 buds sprouted, from 77 that set;

As regards the effect of the stock on the setting of the buds the lack of constancy in the results of the experiment makes its explanation more difficult. Indeed, in the investigations at La Lola Farm, it was observed that, cutting back the stock 14 days after budding (treatment C), and cutting and bending over immediately after budding (treatment A) were approximately equal and both significantly better than cutting back immediately after budding (treatment B) for 2 time-periods: Period I (Feb. 9) and period II (Feb. 16). However, for time-period III (Feb. 23.) these three treatments (A, B, and C) were all approximately equal.

A tentative explanation of such results may be the

following: when the stock is cut back immediately after budding, a disturbance takes place in the whole system of the stock.. There is a loss of reserves (observed by a bleeding, or sap exudation as soon as cutting was achieved) and also the stock is unable to build up new reserves because of the loss of its leaves. On the other hand, it may be that such a treatment stimulates cell activity but this activity may be used in healing the wound at the upper surface of the stump, where the cut was done. It is known that callus formation depends largely on the vigor of the plant. If a plant is vigorous enough, there should be no danger of interference of the healing of the wound and the union of stock and scion. When the stock is not severed immediately after budding, such a problem does not exist, and union between stock and scion seems to be more likely.

The effect of the presence or absence of new leaves on the stock at the time of budding on the set of the buds may be explained by the fact that cacao, as most of the tropical crops, does not have a marked dormancy period; the cells are active at all seasons of the year.

The average period of time required by the buds to sprout was not affected by the treatments in the investigations conducted at La Lola Farm. It is believed that any differences obtained were due to the physiological conditions of the buds at the time of budding.

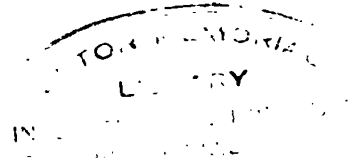
— The absence of any relationship between the amount of

rainfall in the 14 days period after budding, and the number of successful bud-unions, suggests that this rainfall in itself does not affect the budding. The results would probably have been different if the wrapping material had not been waterproof.

The size of the stock did not have any apparent effect on the setting of the buds; this indicates that the morphological conditions necessary for union of stock and scion were present in all the different sizes of stocks. Any marked influence of the size of the stock on the setting of the buds is probably due to the ability of the operator to handle the stocks of different sizes.

The post-budding treatments, cutting back 14 days after budding (treatment C) and cutting off and bending over (treatment A) showed more growth during the second and third months than cutting back immediately after budding (treatment B). The disturbance caused in stocks where treatment B was applied, as discussed above, may be responsible for such results. However, it is believed that the size of the stock also played a part in the increase of growth for these two treatments.

The effect of the size of the stocks on the subsequent growth of the sprouts is a direct effect of stock on scion. The results indicated that the greater the diameter of the stock, the greater the growth of the sprouts. It is believed



that the larger stocks had a greater capacity for supplying the sprouts with nutrient material.

### SUMMARY

1. The literature pertaining to the budding of cacao especially in regard to the post-budding treatment of the stock plants has been reviewed.
2. In the preliminary experiment conducted at the Institute cutting off the stock 14 days after budding was the best treatment. Cutting and bending over the stock immediately after budding was almost as satisfactory. Leaving the stock untouched, and ringing the stock immediately after budding was generally unsatisfactory.
3. In the experiment conducted at La Lola it was found that:
  - a. Cutting off the stock 14 days after budding, and cutting and bending the stock immediately after budding resulted in a significantly greater number of successful bud-unions than cutting off the stock immediately after budding.
  - b. The presence or absence of a flush of new leaves on the stock at the time of budding had no effect upon the number of successful bud-unions.
  - c. The diameter of the stocks had no effect upon the number of bud-unions but that stocks of from 2.0

to 3.0 cm. resulted in greater subsequent growth of the sprouts than stock of 1.0 to 1.5 cm.

- d. There was no apparent relationship between the amount of rainfall during the 14 days following budding and the number of bud-unions.
- e. There was no effect of treatment upon the number of days required for initial sprouting of the buds.
- f. The growth of the sprouts that developed in treatments C (cutting off stock 14 days after budding) and A (cutting and bending over immediately after budding) was significantly better than the growth in treatment B (cutting off immediately after budding).

4. The significance of the results are discussed and attempts made to explain the various phenomena.

### CONCLUSIONS

From the data presented and discussed herein, the following conclusions may be drawn:

1.- The "Inverted U" method of budding may be used on cacao seedlings successfully.

2.- Of the post-budding treatments investigated, cutting back the stock 14 days after budding, and cutting and bending



over the stock immediately after budding are preferable to cutting back the stock immediately after budding.

3.- Budding can be done on cacao seedlings of 1.0 to 3.5 cm. diameter at the budded area.

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## SUMARIO

1. La literatura sobre el injerto de cacao, con especial referencia al tratamiento posterior de los patrones, ha sido revisada.
2. En el experimento preliminar llevado a cabo en el Instituto se observó que al cortar el patrón 14 días después de ser injertado, resultó ser el mejor tratamiento. Cortar y doblar el patrón inmediatamente después de ser injertado resultó ser casi tan satisfactorio. En el patrón no forzado, y en el patrón anillado inmediatamente después de ser injertado, no se observaron resultados satisfactorios.
3. En el experimento llevado a cabo en "La Lola" se encontró que:
  - a. Los tratamientos de cortar 14 días después de injertar, y cortar y doblar el patrón inmediatamente después de ser injertado resultaron en un número de prendimientos significativamente más grande que en el método de cortar inmediatamente después de injertar.
  - b. La presencia o ausencia de una nueva brotación en el patrón al momento de ser injertado, no tuvo efecto sobre el prendimiento.
  - c. El diámetro de los patrones no tuvo ninguna relación con el número de prendimientos, pero patrones 2.0 cm. a 3.0 cm. resultaron en un mayor crecimiento de las yemas que los de patrones de 1.0 cm. a 1.5 cm.
  - d. No se observó ninguna relación entre la cantidad de lluvia durante los 14 días siguientes al injerto, y el número de prendimientos.
  - e. No obstante el tratamiento usado, el número de días requeridos para la primera brotación de los injertos fué aproximadamente igual.
  - f. El crecimiento de los brotes en los tratamientos C(cortar 14 días después de injertar) y A(cortar y doblar inmediatamente después de injertar) resultó significativamente mejor que en el tratamiento B(cortar inmediatamente después de injertar).
4. Se ha discutido la significación de los resultados, y se trató de explicar los diferentes fenómenos.