Honolulu, T. H. May 1941

HAWAII AGRICULTURAL EXPERIMENT STATION

of the

University of Hawaii

PROGRESS NOTES NO. 21

PROPAGATING TARO BY THE NORMALLY DORMANT BUDS PRESENT ON HULI AND CORM

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Taro is usually propagated vegetatively by huli (the uppermost one-eighth to one-fourth inch of the mother corm, or kalo, plus 6 to 12 inches of the basal portion of the petioles with the leaves removed), or by oha (secondary corms). Plant multiplication by these methods is a slow process, for only two to five plants can be obtained from a single individual in 6 to 10 months' time. A method of more rapid multiplication would be particularly valuable in times of emergency or food shortage, or if a new and desirable variety were developed by plant breeding methods.

It has been found that taro can be multiplied rapidly by utilizing the buds, borne in the axils of the leaves on the surface of the taro corm. Forty to 60 buds may be present on a mature kalo, 15 to 20 on a developing kalo or on an oha, and 2 to 6 on a huli. Only two commercial varieties of wetland taro, Piialii and Piko Uliuli (Haehae), were tested, but undoubtedly the method can be applied equally well to other varieties.

MATERIALS AND METHODS

In order for the normally dormant buds to develop, the controlling influence of the growing point of the corm or huli must be eliminated. This can be brought about in any one of several ways: (a) By cutting the kalo horizontally into slices, 1 to 2 inches in thickness; (b) by cutting out individual buds together with approximately 1 cubic centimeter of corm tissue; or (c) by destroying the growing point of the kalo or huli, leaving the buds attached.

In preliminary studies, buds on the lower parts of a mature kalo failed to develop. The tissues of a mature corm are of different physiological ages. The base is the portion first formed by the plant, while the youngest portion is at the apex of the corm where the current leaves have their origin. The same age relationships apply to the buds on the kalo. In order to make comparable observations on bud development, particularly when working with a number of corms, the surfaces of the corms were arbitrarily divided into four regions, A, B, C, and D. A and B constituted the upper half of a kalo, C and D the lower half, with A and D the apical and basal quarters respectively.

Most of the plant material was planted in sterilized soil, but some was kept continuously in running tap water. Differences in growth were estimated by counting the buds that developed and the leaves and oha on the resulting plants, and by measuring the height of the plants at various stages during the investigations.

RESULTS AND DISCUSSION

Effect of position of buds on surface of taro corm

Nine healthy and mature corms, six of the variety Piko Uliuli and three of the variety Piialii, were cut into quarters, corresponding to the previously described regions A, B, C, and D. The individual quarters were planted in soil on November 23, 1936, and the experiment terminated on January 10, 1937. The data obtained are presented in table 1.

Results show that in order to obtain most rapid plant multiplication, slices of corm from regions A or B should be used. Buds on region A, the uppermost quarter of a corm, are more vigorous than buds on the remainder of a corm.

Comparison of growth from buds and from huli

Individual buds were cut out of regions A and B of taro corms (variety Piko Uliuli) and planted in soil side by side with huli taken from the same corms. Data were collected at intervals from September 28, 1936, the date of planting, until the plants were harvested on June 26, 1937. All data are presented in table 2.

The results indicate that plants developed from buds make as good growth as plants developed from huli. It should be noted, however, that there is greater uniformity of growth of plants from huli than of plants from buds.

Stimulation of normally dormant buds by destruction of growing point

1. Huli. Four huli, variety Piko Uliuli, were split longitudinally to give 8 "half-huli"; four additional huli were left uninjured. The lower ends of all material were submerged

Table 1. Growth and development of buds on various parts of mature taro corms.

Variety	Number of corms	Region of corm 1/	Number of buds present when planted		Number of buds that developed		Height per plant	
			Range	Average	Range	Average	Range	Average
							Cm.	Cm.
Piko Uliuli	6	A	10-15	13.3	8-13	11.0	7-18	14.5
		B	3-14	8.5	0-13	3.5	0-11	2.8
		C	2-10	6.0	0-4	1.3	0-5	2.0
		D	2-7	4.5	0-0	0.0	0-0	0.0
Piialii	3	A	10-14	12.3	10-12	11.0	7-15	12.3
		B	8-10	8.6	7-9	8.0	5-10	7.0
		C	7-10	8.3	6-10	7.6	3-5	4.0
		D	4-9	6.3	0-4	2.3	0-3	2.0

1/ A, B, C, and D are slices taken from uppermost, uppermost-median, lowermost-median, and lowermost quarters of a corm, respectively.

Table 2. Growth and yield of plants developed from excised corm buds and from huli of taro, variety Piko Uliuli.

Type of plant material	Number of plants	Growth and yield data		Date of observation			
				10/30/36	1/10/37	3/31/37	6/26/37
Excised buds	14	Height (cm.)	Range	4-23	12-57	24-72	15-60
			Average	13.3	34.5	42.7	35.0
Huli	5	Height (cm.)	Range	27-33	35-39	37-42	27-38
			Average	29.2	36.6	38.4	33.6
Excised buds	14	Number of leaves	Range	3-6	3-6	2-5	2-5
			Average	4.6	4.6	3.6	3.6
Huli	5	Number of leaves	Range	3-4	3-4	2-4	2-4
			Average	3.2	3.6	3.2	3.2
Excised buds	14	Number of oha	Range	0-2	0-8	1-10	2-18
			Average	0.3	2.8	4.6	6.5
Huli	5	Number of oha	Range	0-2	0-4	1-4	3-5
			Average	0.6	1.4	2.6	3.6
Excised buds	14	Yield (gm.)	Range				50-1260
			Average				379.1
Huli	5	Yield (gm.)	Range				155-208
			Average				181.8

in running tap water, to a depth of 2 or 3 inches for 3 weeks, when the buds that had developed were counted. Results are found in table 3.

2. Kalo. Thirteen corms, variety Piialii, approximately 3½ months old, were collected and 8 were split longitudinally. The leaves of the remainder were removed and the growing points left exposed but uninjured. All corms were completely submerged in running tap water for 3 weeks, when the buds that had developed were counted. These results are also in table 3.

The data given in table 3 show clearly that destruction of the growing point will stimulate development of the buds on the huli or kalo. After the buds have formed root systems, they should be cut out and planted individually, in pots at first and later in the field.

Stimulation of buds by chemicals

Attempts were made to stimulate the development of buds on huli by subjecting the plant material to treatment with each of the following chemicals: thiourea, sodium thiocyanate, and acetylene. The first two substances were used as dips; in each case the huli were submerged in a 2-percent solution for 1 hour, rinsed in tap water, and planted in sterilized soil. No differences in bud development were noted between treated huli and the check huli, which had been submerged in tap water for a comparable length of time.

There was some evidence to indicate that exposure of huli to acetylene gas (90-95 percent concentration) in a closed container stimulated bud development. In practice, huli were treated

Table 3. Effect of destruction of the growing point of huli and of kalo on the development of attached buds, normally dormant. Data taken 3 weeks after start of experiment.

Type of plant material	Treatment of material	Number of huli or kalo	Average number of buds developed
Huli	Split longitudinally to destroy growing point	4	3.5
	Uninjured	4	0
Kalo	Split longitudinally	8	5.4
	Uninjured	5	0

for 48 hours, removed and held in the laboratory for 24 hours, replaced in the acetylene chamber for a second 48 hours, and again removed to the open. Tests showed that stimulation occurred only after three consecutive treatments (48 hours each) with acetylene. Increasing the number of treatments to four and to five produced proportionately greater stimulation. Root development by treated huli was slower than root development by untreated huli.

Stimulation by acetylene never equalled that obtained by destruction of the growing points.

SUMMARY

1. Buds, normally dormant, present on the taro kalo or huli can be stimulated to develop by any one of the following methods: (a) By cutting the kalo horizontally into slices; (b) by cutting out individual buds together with approximately one cubic centimeter of corm tissue; and (c) by destroying the growing point of the kalo or huli, leaving the buds attached.

2. Most rapid plant multiplication and most vigorous bud development is obtained by using slices of mature corm taken from the youngest portion of the kalo (the apex).

3. Plants developed from buds make as good growth as plants developed from huli, although there is greater uniformity of growth of plants from huli than of plants from buds.

4. Thiourea and sodium thiocyanate (2-percent solution, 1 hour immersion) failed to stimulate development of buds on huli. Three successive 48-hour treatments with acetylene (90-95

percent concentration), with 24-hour intervals in the open, gave evidence of bud stimulation. Subsequent root development indicated some injury by the treatment. Stimulation by acetylene never equalled that obtained by mechanical methods.