# CARIBBEAN FOOD CROPS SOCIETY

# 22

## Twenty Second Annual Meeting 1986

## St. Lucia

Vol. XXII

# EFFECTS OF PRE- AND POST-PLANTING TREATMENTS OF CUTTINGS ON YIELD OF THE SWEET POTATO (**Ipomoea batatas** (L.) Lam.)

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## ABSTRACT

When the sweet potato is planted from vine cuttings it passes through a difficult period of healing the wound and initiating roots. The initial treatment of the cutting is therefore, very important. The effects of four simple practices such as removal of leaves of cuttings versus non-removal, holding the cutting for two days and stimulating roots versus immediate planting, delayed versus immediate irrigation, and planting in the morning versus planting in the afternoon, were tested in small, replicated trials with four clones of sweet potato. Removal of leaves reduced respiration and water loss but delayed establishment and reduced yields. Holding cuttings two days and stimulating rooting increased the number of storage roots and thus yield. Delayed irrigation tended to reduce root size. Planting in the morning versus the afternoon did not significantly affect any yield components. Thus, leaves should be left on the cuttings, cuttings should be prerooted before planting, and immediate irrigation appears beneficial.

## INTRODUCTION

In the tropics the sweet potato is normally planted from pieces of the stem (often called the vine), which, when cut from the plant and partially buried in moist soil, will root and produce new plants. This simple and easy planting technique often causes farmers to think that all pieces of the vine are equal, and that the cuttings can survive when badly treated or when inadequately cared for.

This is far from the truth. Cuttings from old vines are slower to establish healthy plants, and the result is reduced yield (Martin, 1984). Normally, the tips of the vines are recommended for planting (Shanmugavelu, et al., 1972), although most farmers concede that when the foliage is growing rapidly, the stem section just below the tip may also be prime material. Type of planting material was considered a major source of high plant to plant variability measured in sweet potato fields (Haynes and Wholey, 1971).

It seems reasonable to postulate that the cutting, abruptly cut from the vine, will suffer, and that this shock might be related to survival in the field and to eventual yields. To test this hypothesis several variables in the handling of cuttings were studied for possible effects on subsequent yields.

## MATERIALS AND METHODS

Four clones of sweet potato were used for these experiments. These included two cultivars recommended for Puerto Rico, Gem and Miguela, and

two seedling selections, SPV 26 (Chipper) and SPV 43 (Bonara). These same materials had been used for a previous experiment (Martin, 1984). Terminal cuttings were taken from vigorous plantings between 2-3 months of age and were used in four experiments, each similar in design, consisting of four replicates of single rows 3 m long. The rows were ridges 1 m apart and the cuttings were planted in the rows at intervals of 30 cm. All treatments received overhead irrigation as needed and all received a post planting herbicide treatment of chloramben. The four experiments were: Exp. 1, leaves left on the cutting versus leaves removed from cuttings; Exp. 2, cuttings made and planted the same day versus planting two days later (meanwhile, they were kept moist); Exp. 3, cuttings planted the day they were taken and irrigated immediately versus irrigation delayed 4 hours; and Exp. 4, cuttings taken in the morning, planted, and irrigated immediately, versus cuttings taken in the afternoon, planted, and irrigated immediately.

The first two experiments were begun in January, and the second two in May. Each experiment was harvested 4 1/2 months after planting. The number of surviving plants were counted. The roots were counted and weighed. Mean root weight was calculated. The data were subjected to analysis of variance.

RESULTS

There were only minor differences among clones or treatments in survival of cuttings. Almost all cuttings survived. The yield data (roots/plant, weight/plant, and mean weight of root) were therefore calculated on the basis of surviving plants.

Exp. 1. **Effects of removing leaves.** Removing leaves from cuttings before planting significantly reduced the number of roots in each clone (Table 1). The amount of reduction was 29, 52, 38 and 30 per cent in the four cloens, with an average reduction of 33 per cent. The total weight was also reduced by 25, 32, 29 and 41 per cent with a mean reduction of 32 per cent. The mean weight of the roots was not significantly affected by the treatment except in one clone. Average weight of roots from cuttings with leaves was 0.26 kg, and from cuttings without leaves 0.34 kg. Thus, loss in weight due to removal of leaves was due to reduction in number of roots. When root number was reduced, root size tended to increase, in compensation.

Exp. 2. **Effects of holding cuttings two days to permit rooting:** Holding cuttings for two days under humid conditions stimulated rooting, so that plants were more easily established in the field. Holding cuttings for two days increased the number of storage roots by 2.6, 18, 16, and 42 per cent, an average of 20 per cent (Table 2). This resulted in yield increases of 6, 47, 13, and 22 per cent, with an average of 22 per cent. However, the mean weight of the roots was not significantly affected.

Exp. 3. **Effects of delayed irrigation:** Delayed irrigation resulted in visibly more wilting of cuttings on the day of planting. Delayed irrigation appeared to increase the number of roots in three of the four clones (Table 3) but differences were not significant. The increases were 12, 46, 13 and 24 per cent, for an average increase of 14 per cent. Delayed irrigation appeared to decrease weight of root with two clones, and

Table 1. Effects of removing leaves of cuttings on yields components of four sweet potato cloens

| Parameter | Variable | Clone | | | | |
|---|---|---|---|---|---|---|
| | | Gem | Miguela | SPV 26 | SPV 43 | Mean |
| No. of roots | Leaf removal | 4.5* | 1.2* | 2.7* | 4.6* | 3.3* |
| | Non-removal | 6.3 | 2.4 | 4.4 | 6.6 | 4.9 |
| Wt. of roots, kg | Leaf removal | 1.12 | .42* | 1.05* | .62* | .80* |
| | Non-removal | 1.50 | .62 | 1.48 | 1.06 | 1.16 |
| Mean wt., kg | Leaf removal | .25 | .35 | .62* | .13 | .34 |
| | Non-removal | .24 | .26 | .37 | .16 | .26 |

* Significant difference (P = 0.05)

Table 2. Effects of holding cuttings and stimulating rooting on yield components of four potato clones

| Parameter | Variable | Clone | | | | |
|---|---|---|---|---|---|---|
| | | Gem | Miguela | SPV 26 | SPV 43 | Mean |
| No. of roots | Root stimulation | 5.8 | 4.7* | 4.9* | 5.4* | 5.2* |
| | Non-stimulation | 5.6 | 4.0 | 4.2 | 3.8 | 4.4 |
| Wt. of roots, kg | Root stimulation | 1.51 | .91* | 1.40 | .77* | 1.19* |
| | Non-stimulation | 1.42 | .62 | 1.24 | .63 | .98 |
| Mean, wt., kg | Root stimulation | .26 | .19 | 1.28 | .14 | .22 |
| | Non-stimulation | .24 | .16 | .25 | .17 | .21 |

* Significant difference (P = 0.05)

Table 3. Effects of delayed irrigation on yield components of four sweet potato clones

| Parameter | Variable | Clone | | | | |
|---|---|---|---|---|---|---|
| | | Gem | Miguela | SPV 26 | SPV 43 | Mean |
| No. of roots | Delayed irrigation | 5.9 | 2.9 | 4.5 | 5.3 | 4.7 |
| | Non-delayed | 6.7 | 2.0 | 4.0 | 4.3 | 4.2 |
| Wt. of roots, kg | Delayed irrigation | 1.28* | .92 | 1.38 | .90 | 1.12 |
| | Non-delayed | 1.60 | .87 | 1.16 | 1.05 | 1.22 |
| Mean wt., kg. | Delayed irrigation | .22 | .32 | .31 | .17 | .26* |
| | Non-delayed | .27 | .43 | .29 | .24 | .31 |

*Significant difference (P = 0.05)

increased it in the other two. Weight was decreased significantly, however, only in the case of Gem. The average root weight/plant was 1.22 kg. for the promptly irrigated, and 1.12 for the delayed irrigated. The mean weight per root was higher for the promptly irrigated (0.31 kg) than for the late irrigated (0.26 kg), and this difference was significant.

Exp . 4. **Effects of planting in morning versus afternoon:** Cuttings that are planted in the morning are exposed to the sun all day. Cuttings planted during the afternoon have a shorter exposure to sun, and thus are less dehydrated. Planting in the afternoon instead of the morning had little or no effect on the number of roots (Table 4). Planting in the afternoon appeared to decrease weight of roots in two clones and increase in the other two. The mean root weight for morning planting was the same as for afternoon planting.

Table 4. Effects of morning versus afternoon planting on yieid components of four sweet ptoato clones

| Parameters | Variable | Clone | | | | |
|---|---|---|---|---|---|---|
| | | Gem | Miguela | SPV 26 | SPV 43 | Mean |
| No. of roots | Morning planting | 8.1 | 2.7 | 4.3 | 4.1 | 4.8 |
| | Afternoon planting | 7.7 | 2.6 | 4.0 | 4.4 | 4.7 |
| Wt. of roots, kg | Morning planting | 1.75 | .58 | 1.45* | .98 | 1.19 |
| | Afternoon planting | 1.50 | .63 | 1.08 | 1.30 | 1.13 |
| Mean wt., kg | Morning planting | .22 | .21 | .34 | .24 | .25 |
| | Afternoon planting | .19 | .24 | .27 | .30 | .25 |

*Significant difference (P = 0.05)

## DISCUSSION

The present experiments were made on a small scale, but when the data from the four experiments are considered together, a clear picture emerges. When the cutting is taken from the plant it has no roots and is subject to water stress. Treatments which reduce water stress tend to increase number of roots and thus yield, whereas treatments which increase stress tend to decrease the number of roots and thus yield. However, as a compensation, plants with less roots tend to have slightly larger roots. The magnitude of the stress given appears to be closely related to the number of roots, and, thus to yield. In all experiments yield followed this pattern, from highest to lowest, Gem, SPV 26, SPV 43, Miguela. There may have been slight interactions between treatments and clones but the data were inadequate to confirm them. Removal of leaves from cuttings seems to interfere with root formation, as had previously been observed by Fadi, et al. (1978). This most likely is due to loss of the initial photosynthetic capacity.

The delicate nature of the cutting, and loss of yield due to the aging of plantings was previously reported (Martin, 1984). Cuttings merit careful attention before removal from the plant, during the holding period, and on planting in order to maximize yields.

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