

LEAF-BUD CUTTINGS, a Rapid Multiplication Technique for Potatoes



Series I: Rapid Multiplication Techniques

Guide-Book I/4



INTERNATIONAL POTATO CENTER (CIP)

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INTERNATIONAL POTATO CENTER (CIP)
DEPARTMENT OF TRAINING AND COMMUNICATIONS

Series I: Rapid Multiplication Techniques

This CIP Slide Training Series was produced by the Department of Training and Communications of the International Potato Center to guide training of those who are or will be involved in the implementation of rapid multiplication techniques for potatoes in developing countries.

The objective of CIP Series I is that each participant describe the steps involved in four rapid multiplication techniques for potatoes presently developed. The techniques are:

- Sprout Cuttings (Set 1)
- Single-Node Cuttings (Set 2)
- Stem Cuttings (Set 3)
- Leaf-Bud Cuttings (Set 4)

The CIP slide training sets are designed to be used in instructor-directed training. They may also be used for individualized learning, in which learners may study directly from the guide-book aided by the slides, or for on-site recall. In all cases, complementary practice activities are essential for effective skill development.

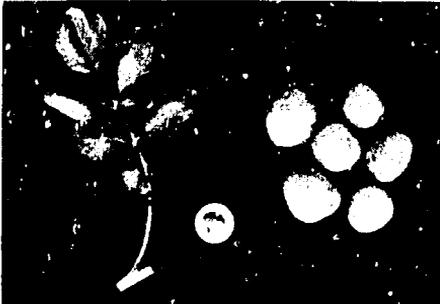
LEAF-BUD CUTTINGS, a Rapid Multiplication Technique for Potatoes

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2

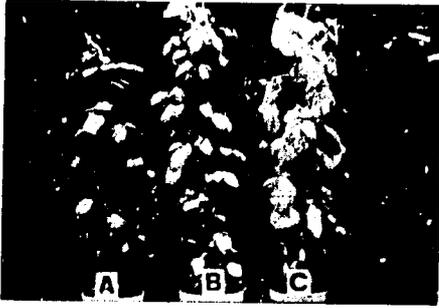


Introduction.

Leaf-bud cuttings, used as a rapid multiplication technique, eliminate non-systemic soil and tuber pathogens. Steps in leaf-bud cuttings technique are the following.

- a) Obtain leaf-bud cutting from large mother plants beginning to mature. Cuttings should contain one leaf and its bud.
- b) Place cuttings in sand to produce a tuberlet used for further multiplication. Each mother plant will produce 80 to 120 tuberlets depending on variety, climatic conditions, number of stems and plant size.
- c) Each tuberlet develops into a vigorous one-stem plant that yields about 500 g of normal tubers in the field, depending on variety, soil and climatic conditions, and crop management.

3



Procedure

The first step is selection of suitable mother plants.

- A. This plant is too young. Cuttings tend to produce small tuberlets or aerial shoots.
- B. This plant is beginning to senesce and is ready to be cut into leaf-bud cuttings. Note the maturing basal leaves. Mother plants have been grown under long day length and then held 10 to 15 days at a short day length prior to cutting to induce tuberization.
- C. This plant shows excess senescence. Cuttings from this plant will produce few or no tuberlets and those produced will be small.

4



Best yielding cuttings come from the central part of the plant (shown over the light background). Those from the lower part of the plant produce smaller tuberlets. Cuttings from the plant top produce few tuberlets and tend to produce roots and aerial shoots.

5



Follow strict sanitary procedures to prevent spread of contact viruses and other diseases. Before working with each plant:

- a) wash hands and knives in a strong soap solution (pH 8-9) or other approved chemicals that have a high pH;
- b) use other chemicals or methods depending on potential disease problems; and
- c) wear clean clothes that have not been in contact with other plants.

6



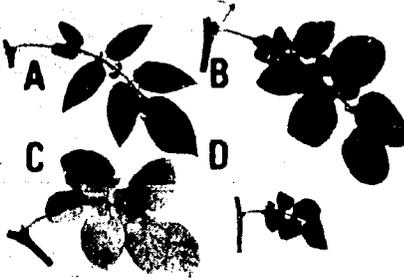
Remove the stems at the base of the plant 2 to 3 cm above the soil. Handle them carefully to avoid foliage damage. Use a disinfected board on which to cut the stems into leaf-bud cuttings that contain one leaf and its bud.

7



This is a typical leaf-bud cutting with a maximum of 3 cm of main stem. With some varieties, better results are obtained from a 1 cm long cutting of the main stem. The node should be in the center of the cutting to avoid damage to the bud. The cutting has a non-differentiated bud and leaf. Best tuberlet production comes from the larger leaves.

8



Proper selection of the leaf-bud cuttings to be used is important.

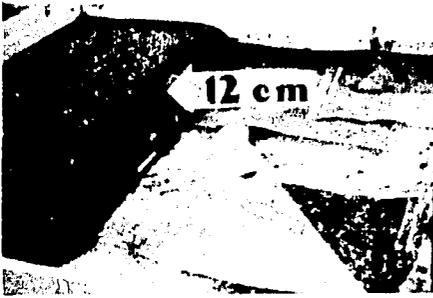
- A. An ideal leaf-bud cutting with a non-differentiated bud.
- B. Leaf-bud cutting with a differentiated bud that will produce no tuber. This is typical of cuttings taken from plants that have produced stem cuttings.
- C. Old and damaged leaf-bud cutting from basal zone of the plant. It may produce only a tiny tuber because of its short life expectancy.
- D. A small, young leaf-bud cutting from the apical portion of the plant. This cutting tends to produce roots and aerial shoots similar to single-node cuttings.

9



Cover freshly cut leaf-bud cuttings with a moist paper towel to avoid wilting. Plant as soon as possible.

10



Fine sand, of about 1 mm grain size, is used for tuberlet production and must be well drained. Tuberlets form best in a moist, but not wet, media that is aerated. Large pebbles help provide drainage and the double layer of screen separates them from the fine sand. Depth of sand should be approximately 10 to 12 cm. The table holding the frame should be slightly inclined to facilitate drainage.

11



Place the stem piece of the cutting in the fine sand with the bud below and the leaf above the surface. Completely cover the sand surface with leaves but avoid excessive overlapping of leaves. Plant in rows. Distance between cuttings will vary depending on size of leaves. Normal distance is 5 to 7 cm.

12



Apply pressure to assure contact between the cutting and the sand substrate. This supports the leaf in an upright position. Use care to insure that the bud remains below the surface, otherwise aerial shoots tend to form.

13



Irrigate lightly. Avoid heavy watering that washes the sand away from the cuttings and causes the leaves to come in contact and stick together as seen in this photo. These leaves receive insufficient light and mature rapidly, resulting in very tiny tuberlets.

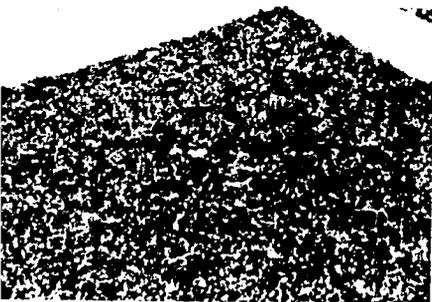
Shade should be provided on hot days to avoid excess moisture loss and prevent leaves from wilting.

14

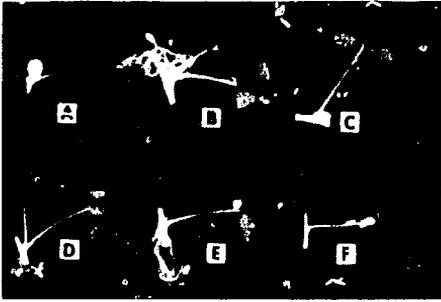


Tuberlet formation begins after one or two weeks. Sampling will help detect problems.

15

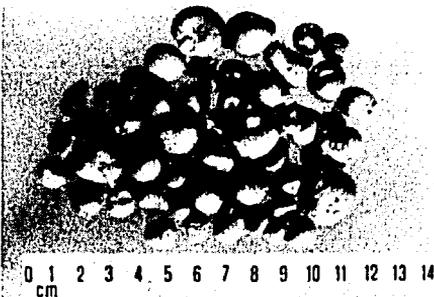


Tuberlets are harvested when all leaves are dead, usually 4 to 6 weeks after planting, depending on the variety and temperature. The longer the life of the leaf, the larger the tuberlets that form. Cool temperatures of about 20°C are best. Harvest carefully so no tuberlets are left in the sand.



Eliminate any leaf-bud cuttings not properly developed. If many tuberlets are not useable, determine why and prevent this loss.

- A. A good cutting that will have a large tuberlet.
- B. Tuberlet on stoion, apical growth and roots formed. Mother plant not completely induced for tuberization, needed a longer time at short day length or was too young.
- C. Two tuberlets forming. Both will be small and tend to dehydrate rapidly. A solution is to remove one of the buds prior to planting.
- D. Apical growth and roots. Cutting from too young a mother plant or one with too long a day length. Shorten the day length of the cuttings during tuber formation. Node may have been too close to the surface of the sand.
- E. Only roots. Cutting from a mother plant that is too young or from the apical portion of the plant.
- F. Nothing. Sand too dry or other stress. Possibly no bud at the leaf axil.



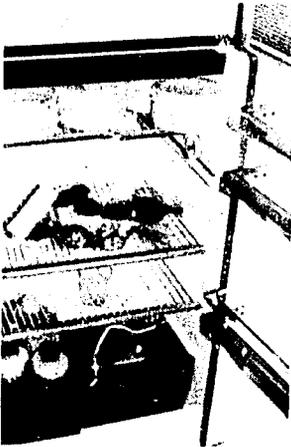
Typical size and shape of tuberlets produced 31 days after planting the cuttings. These tuberlets average 0.5 to 1.0 cm (1.0 to 1.5 g).

18



Through this technique a large number of tuberlets can be obtained rapidly using a reduced area. This example shows more than 1000 tuberlets obtained in a 3 m² area. Tuberlets larger than 2 cm in diameter can be obtained as is shown in this photograph.

19



Uniform breaking of dormancy in tiny tuberlets is difficult. Best results are obtained by producing the tuberlets 4 to 6 months prior to field planting and storing them at 4°C and 90% or higher relative humidity, letting dormancy break naturally. An ordinary refrigerator can serve this purpose. Alternative methods to accelerate the breaking of dormancy are being sought. However no chemical treatment has yet been found that breaks dormancy uniformly.

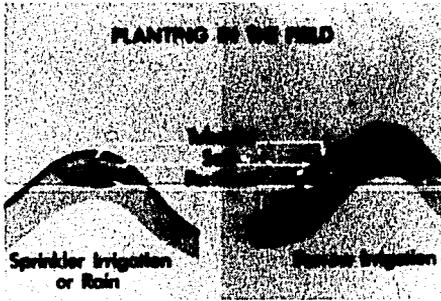
20



0 1 2 3 4 5 6 7 8 9 10 11
cm

When tuberlets sprout they are ready for field planting. Use extreme care not to break off the sprouts. New sprout formation on tubers this small is poor and rarely will more than one sprout form. Only one sprout is needed, as a tuberlet of this size will only form one strong stem.

21



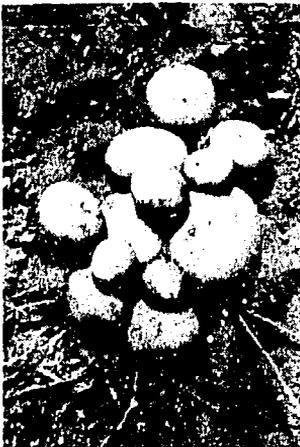
The method of planting in the field will vary depending on type of irrigation. Special care must be taken with irrigation until the plantlets are well established. Tubers are planted shallowly, near to, but not in contact with dry fertilizer.

22



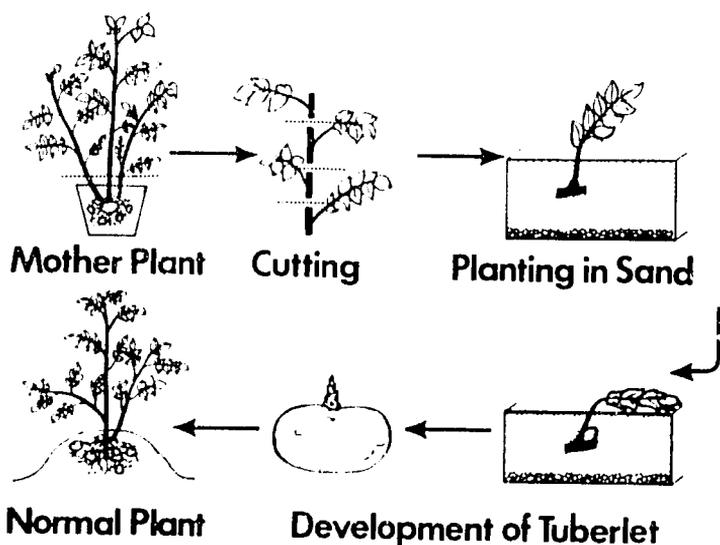
In-row spacing depends somewhat on variety and soil conditions as well as size of tubers desired, but is usually no more than 20 cm. Most varieties do well at 15 cm. These plants in Costa Rica are spaced 20 cm x 85 cm.

23



The typical yield from one leaf-bud tuberlet of plants shown in the previous photograph. Yield should average 500 g and will depend on variety, soil and climatic conditions, and crop management. Tubers produced will be normal. An important point is that this yield was from foliage of the mother plant which otherwise would have been eliminated.

LEAF-BUD CUTTINGS

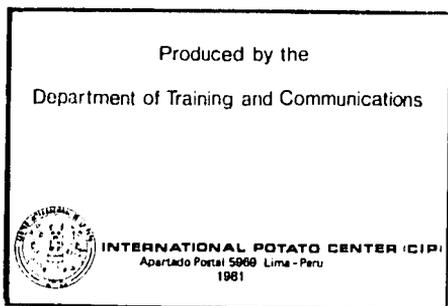


Summary.

The production of tuberlets from leaf-bud cuttings involves:

- electing appropriate mother plants;
- harvest of leaf-bud cuttings;
- planting leaf-bud cuttings in fine sand;

- tuberlet forming at the bud after one month or more;
- sprouting the tuberlet; and
- development of normal plants grown from the tuberlets.



For additional information see CIP publication: **Bryan, James E.; M.T. Jackson and N. Melendez G.** 1981. *Rapid Multiplication Techniques for Potatoes*. International Potato Center, Lima. 22 pp.

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