

# **Breeding of Sweet Potato Adapted to Direct Planting and Method of Direct Planting Culture**

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According to historical records, direct planting culture was practiced in the age soon after sweet potato was first introduced to Japan. Afterwards, the transplanting culture same as that of present time has been popularized owing to improvements of seedling raising techniques and introduction and breeding of varieties adapted to transplanting. In recent years, the direct planting by which small tuberous roots are planted directly to fields was taken up to meet the labor shortage and the demand for farm mechanization, but the method has not been widely used, mainly because varieties adaptable to that culture were not available. However, a new variety suitable for direct planting was developed recently and it will possibly make the direct planting culture practicable.

## **Advantages of direct planting culture**

In the direct planting culture, small tuberous roots (20-50 g each) are directly planted to fields, like the case of Irish potato. Major benefit of this method is labor-saving. Traditional transplanting culture requires much labor in seedling raising, pulling out of seedlings, and transplanting whereas the direct planting culture requires only preparation of seed sweet potato and its planting (sowing). Remarkable labor-saving can be achieved by the use of potato-planter which performs furrowing for fertilization, fertilizer application, planting and soil covering at one stroke, whereas transplanting culture is difficult to be mechanized and each operation has

to be done separately.

Advantages of direct planting culture over transplanting one are as follows.

1) Materials, cost and labor for raising seedlings are eliminated, because no seedling bed is necessary.

2) Delayed planting can be avoided in contrast to transplanting culture in which planting is apt to be delayed because seedlings are taken successively.

3) Rooting and initial growth after transplanting are frequently retarded due to dry weather, but there is no such fear with direct planting (sowing).

4) Trash tuberous roots can be utilized as seed sweet potato.

5) Productivity is high.

6) Mechanization can be done easily.

On the other hand, there are following disadvantages:

1) Seed tuberous roots enlarge with irregular shape.

2) Diseases such as scurf are apted to be brought into fields.

3) Seed tuberous roots are apt to be damaged by birds or field rodents after planting.

4) Seed tuberous root production culture is necessary depending on varieties.

5) More seed tuberous roots have to be stored as compared to transplanting culture.

## **Characteristics of varieties adaptable to direct planting**

Plants grown from seed tuberous roots, directly planted, produce three kinds of roots

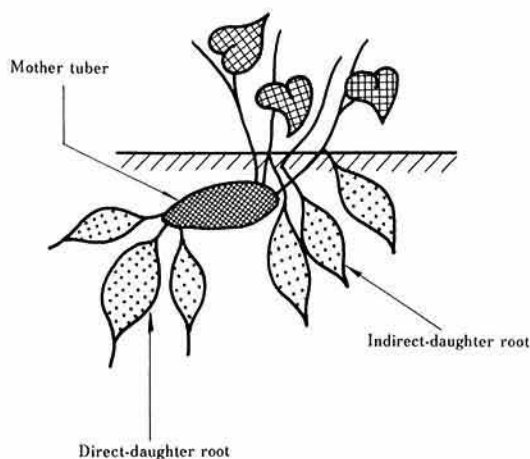


Fig. 1. Kinds of roots produced by directly planted sweet potato

as shown in Fig. 1: 1) an enlarged seed tuberous root (so-called mother tuberous root), 2) roots developed from a seed tuberous root (direct-daughter root), and 3) roots developed from vines (indirect-daughter root). According to the proportion of these three kinds of roots, tuberous root production can be classified into four types: 1) mother root type (mostly mother root thickening with few daughter roots), 2) direct-daughter root type (bearing mostly direct-daughter roots), 3) indirect-daughter root type (bearing mostly indirect-daughter roots), and 4) intermediate type (consisted of direct and indirect-daughter roots).

When the varieties for transplanting use are directly planted, most of them show the mother root type as shown in Plate 1, i.e., seed tuberous

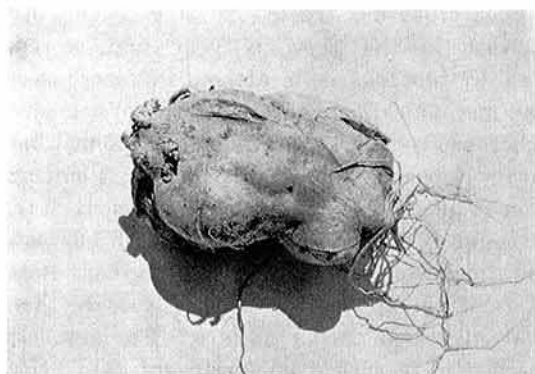


Plate 1. Mother root type

root grow with irregular shape and they can be used only for feedstuff because of poor appearance and poor quality. Varieties producing a large number of daughter roots without thickening of a mother root are required for direct planting.

Varieties for direct planting require the following characteristics:

1) Weight of mother root should be as small as possible, at least 2-3 times its original weight.

2) Yield of daughter roots should be equal or more than that of transplanting varieties, and of high starch content.

3) More than 1-2 small tuberous roots of 20-50 g should be produced to be used for seed tuberous roots in the following year.

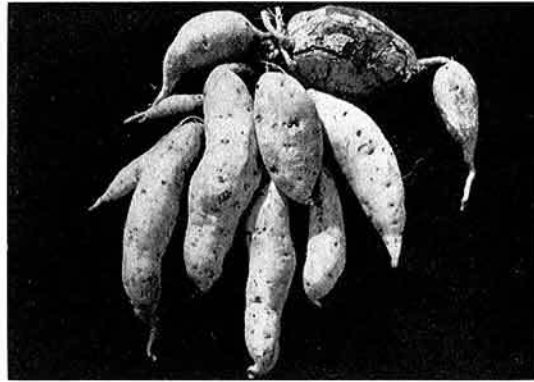
4) Good germination and shoot elongation under low temperature, good initial thickening of tuberous roots, adaptability to late planting and resistance to diseases and insect pests are required.

### Development of a new variety, Naeshirazu, for direct planting

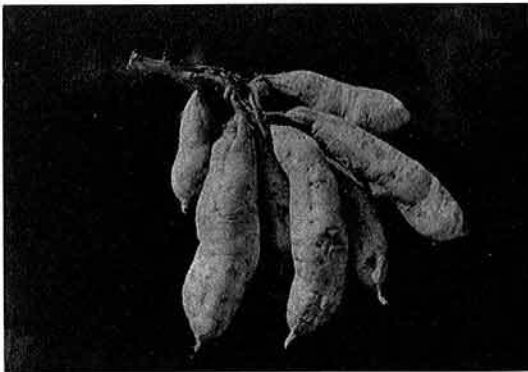
In July 1974, a variety was developed for the first time for direct planting in the Chugoku National Agricultural Experiment Station. The variety was named Naeshirazu (sweet potato Norin No. 32, formerly called by the strain name sweet potato Chugoku No. 33), and released for commercial use. It can be said that with the development of this variety the direct planting culture of sweet potato is made practicable.

For breeding this variety, Koganengan (female parent) which has the greatest cultivated area with main distribution in southern Kyushu was crossed by Chugoku No. 25 (male parent) showing an adaptability to direct planting, and selection was made for the adaptability to direct planting, high-yielding and high starch content. Tuberous roots of the parents and Naeshirazu are shown in Plate 2.

The variety, Naeshirazu, resembles its female parent in shape and color of leaf and



Female parent ↗ Naeshirazu ↖ Male parent



Koganesengan



Chugoku 25

Plate 2. Naeshirazu and its parents

stem, and tuberous root shape, but it is an indirect-daughter root type with yellowish white skin color. The variety is characterized with a large number of daughter roots, a small mother root, and moderate number of small tuberous roots to be used as seed tuberous roots for the subsequent cropping as well as stable adaptability to direct planting, high yielding and high starch potential. However, it is not highly resistant to black rot and nematoda.

Furthermore, as the variety suffers from scurf, the transplanting culture is better than the direct planting one for fields with excessive soil moisture or with abundant soil organic matter. It is used mainly as industrial materials and feedstuffs, but it suitable for food because the taste is as good as that of Koganesengan.

## Direct planting culture of sweet potato

Standards of direct planting culture are as follows:

Seed tuberous roots, 20–50 g each, are harvest in the previous year and stored. Healthy tuberous roots without disease, insect and mechanical damages are used. When seed tuberous roots are in shortage, somewhat larger tuberous roots can be used. Planting time is generally from mid-April to early May, although it varies to some extent with harvesting time of preceding crops and regions. Rate of fertilizer application is slightly more than that in transplanting culture. The simplest method is to spread all fertilizers onto fields as basal dressing by hand or using drill seeder

or broadcaster, and then plowing, harrowing and ridging are practiced. Row application is also made. Deep placement of fertilizers results in higher yields than shallow placement as is the case of transplanting culture. Kinds of fertilizers to be used are the same as those for transplanting culture (more potassium is desirable).

Distance between rows and intra-row spacing have a strong influence on yield and also relate to the quantity of seed tuberous roots needed. In general it is better to increase intra-row spacing than to increase the distance between rows. Slightly wider spacing is allowable for direct planting culture, and the spacing of about 3,000 hills/10 a is regarded as appropriate.

As to the depth of soil cover, the thinner the cover the less is seed tuberous root regrowth, but drought and bird damages often occur under too thin covers. The regrowth is less even under somewhat thick covers with Naeshirazu, and about 5 cm of depth is most appropriate.

In direct planting culture more or less longer time is required for emergence and initial growth is rather slow as compared to transplanting culture. Therefore weed control during the early stage of growth is important.

Healthy seed tuberous roots should be used because diseases such as black rot and scurf spread from infected seed tuberous roots. It is safe to avoid direct planting on ill-drained fields or fields with too much organic matter because scurf often occurs in such fields.

Harvesting is made at right time according to the methods employed in transplanting culture. As tuberous roots are oriented closely each other, the harvesting can easily be mechanized. For producing a large quantity

of seed tuberous roots to be used in the subsequent year, seedlings are grown and transplanted densely.

## Conclusion

Direct planting culture of sweet potato has many advantages such as elimination of seedling raising, pulling out of seedlings and transplanting operations as well as easiness of mechanization of cultivation, using for example potato planter. However the direct planting culture has not been popularized because there were no suitable varieties adapted to the culture. Recent development of a new variety, Naeshirazu, gives a promising prospect for the culture. For the future development of sweet potato production, it is most important to save labor and increase productivity by establishing labor-saving, high-yielding cultural technology. For that purpose, the direct planting culture is expected to play an important role.

## References

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