Transplantation of Half-Cut Tuber Seedlings Provides Enhanced Yields Over Conventional Sprouted-Vine Planting in Sweet Potato Cultivar “Murasakimasari”

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Abstract: Seed tubers of sweet potato cultivar “Murasakimasari”, the weights of which range from 30 to 100 g, were cut in half at a right angle to the long axis of the tuber, and planted in cell trays (cell size: 55 mm × 55 mm × height 62.5 mm, 50 cells in a 30 cm × 60 cm tray) with commercial soil mixes. The planted half-cut tubers in cell trays were incubated at 25 ºC under natural sunlight conditions in a glasshouse for 3 to 4 wk to raise half-cut tuber seedlings. Half-cut tuber seedlings were transplanted on 28 March (TST1) or on 24 April (TST2), whole seed tubers were directly planted on 26 March (DP), conventional sprouted vines were planted on 30 April (VP) in an experimental field. The highest tuber yield was obtained from TST1, followed by TST2 and VP, and DP in this order. Deformed tubers emerged from the TST1 and TST2 groups, at a rate of 3.0% and 6.7% of daughter tubers, respectively. A regional trial in a farmer’s field revealed that the tuber yields and numbers of tubers per plant were higher in TST (tuber seedling transplanting) than those in VP (vine planting). The statistical analysis of the 2 field experiments suggests that transplantation of half-cut tuber seedlings provides enhanced yields over conventional sprouted-vine planting.

Key words: Cell-raised seedling, Cell tray, Direct planting of seed tuber, Half-cut tuber seedling, Murasakimasari, Sweet potato, Transplant, Yield.

Sweet potato (Ipomoea batatas (L.) Lam.) in Japan is cultivated by a labor-intensive sprouted-vine planting method. In early spring, farmers plant seed tubers in nursery beds in warmed plastic houses; sprouts emerge from the tubers, and suitably grown sprouts (vines) are cut and planted in the field. The direct tuber-planting method, a labor-saving method developed in the 1950s and 1960s, uses whole tuber roots (seed tubers) (Kodama, 1962; Akita et al., 1962b). Kodama et al. (1957a, 1957b) studied the growth of sweet potato plants grown directly from seed tubers and showed that, during the early stage of growth, both top shoots and underground parts (roots and tubers) in direct tuber-planting method grew more rapidly than those in vine-planting one, and that the directly planted seed tubers thickened into anomalous tubers. Akita and Kobayashi (1962) and Akita et al. (1962a) studied the inhibition of the setting-tuber growth in direct planting of seed tubers by exposing them to light after their sprouting. Ikemoto and Akita (1968) and Higashi et al. (1998) directly planted cut-seed tubers, and examined the effect of this method on sprouting and yield or thickening of directly planted mother tubers. Akita et al. (1968), Kobayashi et al. (1969), and Kobayashi and Akita (1969) bred sweet potato varieties adapted to direct planting; and in 1974, the cultivar “Naeshirazu” for direct tuber planting was registered. Direct tuber planting has several advantages over conventional vine planting, including energetic growth of plants, high yield from widely spaced planting, and resistance to environmental stresses (Sakai, 1999), but has not been widely adopted. Yamashita (2000) and Arima et al. (2002) studied a new method using cut pieces of tubers. New cultivars suitable for direct planting, “Murasakimasari” and “Tamaakane”, were released in 2004 and 2009, respectively (Sakai et al., 2007; Sakai et al., 2008; Sakai et al., 2009).

In this study, we used “Murasakimasari” to prepare seedlings from half-cut tubers planted in cell trays, referred to as cell-raised half-cut tuber seedlings hereafter. The
Tubers of approximately 30 to 50 g in fresh weight (Table 1). To remove excessive tissue from the cut surface, preparing cut right angle to the long axis of the tuber. Seed tubers ranging from 30 to 100 g in weight, were cut in half at a right angle to the long axis of the tuber. Seed tubers cut in half is referred to as "half-cut" and adjusted tubers). In order to prepare cell-raised seedlings from the half-cut tubers under warmed conditions and to observe the sprouting rate (emergence of seedlings) within one month, we conducted four incubation experiments, two in 2008 (incubation experiments 1 and 2, IE-1 and IE-2) and two in 2009 (incubation experiments 3 and 4, IE-3 and IE-4); only in IE-1 half-cut and adjusted tubers were prepared and planted. Table 1 shows the range of seed tuber fresh weights, average fresh weights, standard deviations, fresh weights maxima and minima, numbers of half-cut tubers (or half-cut and adjusted tubers), the date of cutting and planting, and the date of transplanting in fields under natural sunlit conditions for 3 to 4 wk to generate cell-raised seedlings with half-cut tubers (one half-cut tuber per seedling). Plants were watered daily or on alternate days, depending on the weather and age of the seedlings.

### Materials and Methods

#### 1. Preparation of Cell-Raised Seedlings from Half-Cut Tubers of Sweet Potato

Fresh seed tubers of sweet potato cultivar "Murasakimasari", ranging from 30 to 100 g in weight, were cut in half at a right angle to the long axis of the tuber. Seed tubers weighing 100–180 g were cut in half, and again cut to remove excessive tissue from the cut surface, preparing cut tubers of approximately 30 to 50 g in fresh weight (Table 1). The seed tuber cut in half is referred to as "half-cut" and that cut again as "half-cut and adjusted". In order to prepare cell-raised seedlings from the half-cut tubers under warmed conditions and to observe the sprouting rate (emergence of seedlings) within one month, we conducted four incubation experiments, two in 2008 (incubation experiments 1 and 2, IE-1 and IE-2) and two in 2009 (incubation experiments 3 and 4, IE-3 and IE-4); only in IE-1 half-cut and adjusted tubers were prepared and planted. Table 1 shows the range of seed tuber fresh weights, average fresh weights, standard deviations, fresh weights maxima and minima, numbers of half-cut tubers (or half-cut and adjusted tubers), the date of cutting and planting, and the date of seedling transplantation in IE-1, IE-2, IE-3, and IE-4. Cut tubers were planted in plastic cell trays (cell size: 55 mm × 55 mm × height 62.5 mm, 50 cells in a 30 cm × 60 cm tray, Model 50AP-D, Tokan Kosan Co., Ltd.) with commercial soil mixes (Napura Soil Mixes, Yannmar Co., Ltd.). The planted half-cut tubers were incubated at 25°C in a glasshouse under naturally sunlit conditions for 3 to 4 wk to generate cell-raised seedlings with half-cut tubers (one half-cut tuber per seedling). Plants were watered daily or on alternate days, depending on the weather and age of the seedlings.

### 2. Sweet Potato Cultivation by Transplantation of Cell-Raised Seedlings from Half-Cut Tubers in 2008

Sweet potato cultivation was conducted in 2008 in an experimental field (latitude 31°45'N, longitude 131°01'E) at Miyakonojo Research Station, National Agricultural Research Center for Kyushu Okinawa Region (KONARC), Miyakonojo, Miyazaki Prefecture. The soil in the field was Andosol, and the texture was Loam (coarse sand 27.4%, fine sand 35.1%, silt 27.3%, and clay 11.2%). Cattle manure and lime were applied at a rate of 20 t ha⁻¹ and 500 kg ha⁻¹, respectively; and chemical fertilizer was applied: N 48 kg ha⁻¹, P₂O₅ 72 kg ha⁻¹, and K₂O 120 kg ha⁻¹. High ridges were set up with plastic film mulch. Ridge distance was 90 cm, and hill distance was 50 cm, hence the planting density was 22,222 hills ha⁻¹. Two kinds of tuber seedlings, whole seed tubers, and sprouted vines were cultivated: tuber seedlings transplanted on 28 March (TST1), tuber seedlings transplanted on 24 April (TST2), whole seed tubers directly planted on 26 March (DP), and conventional sprouted vines planted on 30 April (VP). Well-grown cell-raised seedlings of TST1 and TST2 were selected (approximately half of the seedlings in each tray), removed from the trays, and transplanted at a depth of 15 cm (Fig. 1). At this depth, the roots to form daughter tubers were expected to emerge from the stem nodes above the cell balls. Whole seed tubers (fresh weight 40 to 60 g) of DP were planted at a depth of approximately 5 cm (Fig. 1). The sprouted vines in VP were 36.0 ± 2.6 cm in vine length, 22.0 ± 2.8 cm in stem length, and 1.21 ± 0.44 g in vine dry weight (sampled number n = 20), and the prepared vines were obliquely planted. Each plot was 4.5 m × 4 m (five ridges × 4 m); and subregions of 1.8 m × 2 m (two ridges × 2 m, eight plants) in each plot were harvested to examine the yield. Each group was planted under film mulch conditions in replicates of 4. Harvest dates were 21

### Table 1. Characteristics of tubers in IE−1, −2, −3, and −4.

| Incubation experiment | Range of seed tubers' fresh weights (g) | Half-cut tubers (or half-cut and adjusted tubers) | The date of cutting and planting in cell-trays (days of incubation) | The date of transplanting in fields |
|-----------------------|----------------------------------------|-----------------------------------------------|---------------------------------------------------------------|-----------------------------------|
| IE−1                  | 100 − 180                              | 36.8 ± 2.8 (half-cut tubers)                   | 6 March 2008                                                  | 28 March 2008 (22 d)              |
| IE−2                  | 60 − 100                               | 36.3 ± 3.8 (half-cut and adjusted tubers)     | 31 March 2008                                                  | 24 April 2008 (24 d)              |
| IE−3                  | 40 − 70                                | 24.8 ± 3.6                                    | 23 March 2009                                                  | nu¹                                |
| IE−4                  | 30 − 70                                | nm²                                          | 20 April 2009                                                  | 7 May 2009 (17 d)                 |

¹ nm, not measured.
² nu, not used in this study.

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Footnotes:

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October, 23 October, 27 October, and 29 October for each group with 4 replicates; the duration of cultivation was therefore 209−215 d in TST1, 182−188 d in TST2, 211−217 d in DP, and 176−182 d in VP. Conventional weed and pest controls were applied.

At harvest, we conducted a yield survey to examine the yielding properties, (1) fresh tuber yield (tubers more than 50 g fresh weight including and excluding deformed tubers); (2) number of tubers per plant (tubers >50 g fresh weight); (3) percentage of deformed tubers; (4) percentage of enlarged mother tubers; (5) dry matter weight of mother tubers; and (6) dry matter yield of shoots (leaves and stems) at harvest.

3. Farmer’s Field Experiment in 2009

We conducted a regional trial in a farmer’s field in 2009 to compare the yielding properties of TST (tuber seedling transplanting) with those of VP (vine planting). The field was located at 31º41’ N, 131º04’ E, Miyakonojo, Miyazaki Prefecture, over an area of approximately 6 a. To prepare cell-raised seedlings, seed tubers of 30 to 70 g fresh weight were used; half-cut seed tubers were planted in cell trays on 20 April and incubated for 17 d as described in section 1 above. The transplanting date and the vine planting date
were 7 May and 8 May, respectively, and plants were harvested on 8 October. In the VP group, the sprouted vines were 41.1 ± 3.4 cm in vine length, 29.5 ± 2.6 cm in stem length, and 1.97 ± 0.48 g in vine dry weight (sampled n = 30), and the prepared vines were obliquely planted. The soil in the farmer’s field was also Andosol. Manure was not applied. Chemical fertilizers were applied at a rate of N 64 kg ha⁻¹, P₂O₅ 176 kg ha⁻¹, and K₂O 256 kg ha⁻¹. High ridges were set up with transparent film mulch. Ridge distance was approximately 1 m (ranging irregularly from 95 cm to 112 cm, but measured accurately to properly calculate the planting densities in each plot). Hill distances and planting densities were set up as an experimental factor. Four treatments were designed in this experiment: TST1, transplanting tuber seedlings with a hill distance of 50 cm (planting density; 20,400 hills ha⁻¹); TST2, with hill distance of 60 cm (23,400 hills ha⁻¹); VP1, vine planting with hill distance of 40 cm (24,400 hills ha⁻¹); and VP2, with hill distance of 50 cm (18,700 hills ha⁻¹). The groups of TST1 and TST2 were planted in replicates of 3, and the groups of VP1 and VP2 were planted in replicates of 2. The duration of cultivation was 154 d (TST1 and TST2) and 153 d (VP1 and VP2).

Weed and pest controls were conventionally applied during cultivation in the 2009 field experiment. The yielding properties described in section 2 were surveyed at harvest.

Results

1. Preparation of Cell-Raised Seedlings from Half-cut Tubers

In IE-2, IE-3, and IE-4, seed tubers of 30–100 g fresh weight were cut in half on the same day, the half-cut tubers were planted in cell trays with commercial soil mixes. In IE-1, the half-cut and adjusted tubers were planted in the trays. The surveyed half-cut tubers were an equal mixture of top and bottom halves. After around 5 days of incubation, first emergence of seedlings above the tray surface was observed. The percentages of emerged seedlings are shown in Fig. 2. After 10 days of incubation, seedling emergence was around 40%, increasing to 60% to 70% after 15 d, and to around 95% after 23 d. Cell-raised seedlings from half-cut tubers of cultivar “Murasakimasari” were therefore prepared after 3–4 wk, as shown in Fig. 3 and 4.

2. Cultivation by Transplanting Cell-Raised Seedlings from Half-Cut Tubers in 2008

When we transplanted the cell-raised seedlings from half-cut tubers, there were no missing plants (vacant hills) during cultivation in any of the plots (2.5 m × 4 m × 8 plots). Table 2 shows the shoot dry matter yield, fresh tuber yield of daughter tubers more than 50 g fresh weight including deformed tubers, and number of daughter tubers more than 50 g fresh weight per plant.

The highest fresh tuber yield (including deformed daughter tubers) was obtained in TST1, followed by TST2 and VP, with the lowest yield in DP. The number of daughter tubers per plant in TST1 was statistically higher than in VP. The shoot dry matter yield in TST1 was higher than those in TST2, DP, and VP.

3. Farmer’s Field Experiment in 2009

In the regional trial conducted in a farmer’s field in 2009, we observed no missing plants (vacant hills) in the TST1 and TST2 groups during cultivation. In contrast, VP1 and VP2 planting was not completed in the early growth stage because of wilting or stem rot of planted vines, so the percentage of missing plants was 13.3% at harvest (in the areas for yield survey). Table 3 shows shoot dry matter yield, daughter tuber yield per plant (including deformed tubers), and the number of daughter tubers more than 50 g fresh weight per area (including deformed tubers) in the 4 groups at harvest. At first, the daughter tuber yields per area in TST1 and TST2 were clearly higher than those in VP1 and VP2. In contrast, shoot dry matter yields in VP1 and VP2 were higher than those in TST1 and TST2, but the effect of planting densities (hill spacing) was not clear.

The daughter tuber yields (including deformed tubers) per plant in TST2 (60 cm hill-spacing, 17,000 hills ha⁻¹) was significantly higher than in TST1 (50 cm hill-spacing, 20,400 hills ha⁻¹) (Table 3). The tuber yield per plant in VP2 (50 cm hill-spacing, 18,700 hills ha⁻¹) tended to be higher than in VP1 (40 cm hill-spacing, 29,400 hills ha⁻¹).

Table 2. Yields of Cell-Raised Seedlings from Half-cut Tubers in 2008

| Treatment | Date of transplanting | Shoot dry matter yield (g m⁻²) | Fresh daughter tuber yield (kg m⁻²) | Number of tubers per plant (no., plant⁻¹) |
|-----------|-----------------------|---------------------------------|-------------------------------------|------------------------------------------|
| TST1      | 28 March 2008         | 295 ± 26                        | 5.30 ± 0.26                        | 12.6 ± 1.4                               |
| TST2      | 24 April 2008         | 246 ± 14                        | 4.70 ± 0.26                        | 9.8 ± 0.5                                |
| DP        | 26 March 2008         | 255 ± 21                        | 4.13 ± 0.18                        | 9.8 ± 1.3                                |
| VP        | 30 April 2008         | 238 ± 7                         | 4.44 ± 0.27                        | 8.5 ± 1.0                                |
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The daughter tuber yields per area in the farmer’s field experiment ranged from 2.34 kg m\(^{-2}\) to 3.62 kg m\(^{-2}\), which were rather low, probably because of the shorter cultivation period. The daughter tuber yields per area in TST1 and TST2 were nearly identical, meaning that the conditions of TST2 with a lower planting density are advantageous in lowering seedling cost and reducing the labor of transplanting as compared with TST1 which has a higher planting density (Table 3). On the other hand, the tuber yield tended to be higher in VP1 with a higher planting density than in VP2 with a lower planting density, meaning that in vine planting it is rather difficult to lower the planting density to sustain a suitable tuber yield. Missing plants, which occurred at 13.3% in the conventional vine planting plots and at 0% in the transplanted tuber seedling plots, may affect the yield. Thus lower-density planting conditions could accentuate the merits of energetic growth and 100% plant survival (no missing plants in TST). The number of tubers per plant (including deformed tubers) was significantly higher in TST1 and TST2 than in VP1 and VP2.

4. Emergence Percentages of Deformed Daughter Tubers and Characteristics of Enlarged Mother Tubers in 2008 and 2009 Field Experiments

The proposed TST method caused typical deformed daughter tubers, which were coil-shaped and surrounded the mother tuber. We observed deformed daughter tubers in the TST1 and TST2 groups in 2008 and 2009. These deformed tubers could be originated from the roots in cell-balls of tuber seedlings. Table 4 shows the emergence percentages of deformed tubers over total daughter tubers in number and weight in the 2008 and 2009 field experiments.

Table 3. Yield characteristics in the 2009 farmer’s field experiment.

| Treatment | The date of transplanting / vine-planting | Hill-spacing (cm) | Planting density (hill ha\(^{-1}\)) | Shoot dry matter yield per area (g m\(^{-2}\)) | Fresh daughter tuber yield per area (kg m\(^{-2}\)) | Fresh daughter tuber yield per plant (g plant\(^{-1}\)) | Number of daughter tubers per plant (no. plant\(^{-1}\)) |
|-----------|----------------------------------------|-------------------|-------------------------------------|-----------------------------------------------|-----------------------------------|--------------------------|--------------------------|
| TST1      | 7 May 2009                             | 50                | 20400                               | 146±11                                        | 3.59±0.12                         | 1758±57                  | 11.2±1.0                 |
| TST2      | 7 May 2009                             | 60                | 17000                               | 151±7                                         | 3.62±0.15                         | 2131±90                  | 11.2±0.8                 |
| VP1       | 8 May 2009                             | 40                | 23400                               | 189±3                                         | 2.58±0.12                         | 1101±52                  | 6.2±0.2                  |
| VP2       | 8 May 2009                             | 50                | 18700                               | 180±42                                        | 2.34±0.19                         | 1251±103                 | 6.3±0.9                  |

Values are average ± standard deviation of 3 replicates in TST1 and TST2, and 2 replicates in VP1 and VP2.

Daughter tubers more than 50 g fresh weight including deformed tubers are estimated.

Table 4. Emergence percentages of deformed tubers over total daughter tubers in number and weight in the 2008 and 2009 field experiments.

| Cultivation year | Treatment | Emergence percentages of deformed tubers over total number of daughter tubers (%) | Emergence percentages of deformed tubers over total fresh weight of daughter tubers (%) |
|------------------|-----------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 2008             | TST1      | 3.0±1.9                                                                         | 2.3±1.7                                                                              |
|                  | TST2      | 6.7±1.6                                                                         | 6.6±2.5                                                                              |
|                  | DP        | 0±0                                                                              | 0±0                                                                                  |
|                  | VP        | 0±0                                                                              | 0±0                                                                                  |
| 2009             | TST1      | 3.7±1.7                                                                         | 3.8±2.4                                                                              |
|                  | TST2      | 18±0.7                                                                          | 2.5±0.8                                                                              |
|                  | VP1       | 0±0                                                                              | 0±0                                                                                  |
|                  | VP2       | 0±0                                                                              | 0±0                                                                                  |

Values are average ± standard deviation of 4 replicates in 2008, and 3 or 2 replicates in 2009.

Table 5. Characteristics of enlarged mother tubers in the 2008 and 2009 field experiments.

| Cultivation year | Treatment | Emergence percentage of enlargement of mother tubers (%) | Dry matter weight of mother tubers at harvest (g plant\(^{-1}\)) |
|------------------|-----------|----------------------------------------------------------|---------------------------------------------------------------|
| 2008             | TST1      | 15.6±10.4                                                | 10.9±2.4                                                     |
|                  | TST2      | 37.5±15.3                                                | 19.5±7.5                                                     |
|                  | DP        | 87.5±8.8                                                 | 58.8±25.2                                                    |
| 2009             | TST1      | 20.0±8.2                                                 | 5.7±1.2                                                      |
|                  | TST2      | 10.0±0                                                   | 4.5±0.6                                                      |

Values are average ± standard deviation of 4 replicates in TST1, TST2, and DP in 2008, and 3 replicates in TST1 and TST2 in 2009.
percentages of deformed tubers over total daughter tubers in number and weight. The average percentages of the deformed daughter tubers in TST1 and TST2 were 4.9% in number and 4.4% in fresh weight in the 2008 field experiment, and 2.8% in number and 3.1% in weight in the 2009 field experiment. There were no deformed daughter tubers in either the DP or VP group.

Table 5 shows the characteristics of enlarged mother tubers in the 2008 and 2009 field experiments. In the 2008 field experiment, enlarged mother tubers were observed in TST1, TST2, and DP, in which the shape of each mother tuber was used to determine whether enlargement had occurred. The percentage of enlarged mother tubers in DP was much higher than in TST1 and TST2. The dry weights of mother tubers at harvest were highest in DP, followed by TST2 and TST1.

In the 2009 field experiment, the average percentage of enlarged mother tubers in TST1 and TST2 was 15%, and the average dry matter weight of mother tubers was 5.0 g plant\(^{-1}\) (Table 5).

5. Statistical Analysis of Tuber Yield Results in 2008 and 2009 Field Experiments

Table 6 shows the fresh daughter tuber yields including deformed tubers in TST (tuber seedling transplanting) and VP (vine planting) methods in the 2008 and 2009 field experiments. The suitable vine-planting time in the Miyakonojo Basin, Southern Kyushu Region, is late April to early May because the average temperature is above about 18ºC and there is no risk of late frost. However, earlier transplanting even in late March to early April would be possible by the proposed TST method because tuber seedlings, which contain half-cut tubers and roots in cell-balls, are stronger than conventional vines against the lower temperatures or other stresses. Consequently, transplanting dates in TST method can be set earlier than vine-planting dates. We combined the data of TST1 and TST2 as the same group of TST in 2008 and 2009, and those of VP1 and VP2 as the group of VP in 2009, and analyzed the data by Analysis of Variance (ANOVA) with 2 factors of cultivation year (2008/2009) and cultivation mode (TST/VP). Table 7 shows the ANOVA table, indicating that the main effects of year and cultivation mode are statistically significant (at less than the 0.1% level). Interaction effect between the year and cultivation mode is not significant. On the other hand, TST1 in 2008 has an advantage of longer cultivation duration than VP in 2008, while TST1, TST2, VP1, and VP2 in 2009 had almost the same cultivation duration. Hence we can also analyze the data of TST2 and VP in 2008 and those of TST1, TST2, VP1, and VP2 in 2009 by ANOVA (eliminating the data of TST1, 2008). This ANOVA similarly shows that both factors of year and cultivation mode are significant (at less than the 0.1% level). These results of ANOVA indicated that the TST cultivation method produced higher tuber yields than the conventional VP method in sweet potato cultivar “Murasakimasari”.

Discussion

Direct tuber planting is a simple and effective method that has been expected to replace the labor-intensive conventional cultivation method for sweet potato. However, to make this method more practical, procedures must ensure smooth and uniform above-ground sprouting from the seed tubers, and suppress the enlargement of mother tubers as much as possible.
We developed a simple method of preparing cell-raised seedlings from half-cut tubers that are transplanted directly to the field. This method ensures 100% above-ground sprouting on the day of transplant, because the seedlings from half-cut tubers already have well-grown stems and leaves before transplanting.

In general, the direct tuber planting method has several advantages over conventional vine planting, including energetic growth of each plant connected to a seed tuber, high yield even with wide hill spacing, and higher resistance to environmental stresses. Transplanting the half-cut tuber seedlings proposed here provides these advantages.

In contrast, the proposed TST method has some disadvantages. Thus far, only the cultivar “Murasakimasari” has been adopted to this cultivation method. The laborious procedures of tuber-planting in cell trays and incubating these seedlings must be compared with conventional VP method in the cost and labor-intensity. In addition, mother tuber enlargement must be minimized for efficient allocation of photosynthates to the daughter tubers.

In the present study, TST produced significantly higher tuber yields than the VP. Although the effect of TST would vary with the year, soil nutritional condition, climate condition, etc., the results obtained in the 2-year field experiments suggest that the transplanation of half-cut tuber seedlings provides enhanced yields over conventional sprouted-vine planting in sweet potato cultivar “Murasakimasari”. In addition, the obtained results suggest that the proposed TST method increases the number of daughter tubers per plant, and produces about 5% (average in 2008) or less (in 2009) of deformed daughter tubers in both number and weight.

This TST method increased daughter tuber yields in cultivar “Murasakimasari”; however in cultivar “Koganesengan”, which is most popular for production of alcohol (sweet-potato spirit), the same method resulted in thickening of directly planted mother tubers of sweet potato. Kusuhara, M., Akita, S., Ikemoto, S. and Kobayashi, M. 1969. Studies on breeding of sweetpotato varieties adapted to direct planting. 2. Variability of daughter roots yield in different root types. *Jpn. J. Breed.* 19:1922.

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* In Japanese with English summary.
** In Japanese with English title.
*** In Japanese, and the title is translated by the present authors.