

Broadcast-planting of Rice Seedlings Raised in Paper Pots

By KEN KAWASAKI

Agricultural Physics Division, Hokkaido National Agricultural Experiment Station

In Hokkaido, the "young seedling transplanting culture" (in which seedlings younger than ordinary ones are used) is adopted only to a limited extent, because the use of "young seedlings" results in the delayed heading which apt to induce cool weather damage. On the contrary, seedlings raised in paper-pots (hereafter referred to paper-pot seedlings) give better growth after transplanting and higher stability of yield than the "young seedlings", being highly appreciated as suited to the cool area.

Paper-pot seedlings are heavy, 6-7 g/hill. When they are flinged up in the air, they fall down on the surface of paddy fields with their roots underlying and are planted in such a manner as are transplanted by hand. By applying such principle, broadcast-planting of paper-pot seedlings has come to be practiced either by hand or by machines.

As the practice is simply to scatter the seedlings up in the air, the hand-broadcasting can be done with less fatigue and with high efficiency, 8-10 a/hr, which is as high as 8 times that of hand transplanting and almost similar to that of two-row transplanting machines. Small-holders appreciate it as a labor-saving method without transplanting machine whereas highly efficient broadcasters by the use of the tractor are also devised for cooperative use among big-holders.

Characteristics of paper-pot seedlings

A paper-pot is bottomless with a dimension of 1.5×1.5 cm and 3.0 cm of height.

After filled with soil, 2-4 seeds are sown per pot. One block of paper pots is composed of 760 pots, being sticked each other with paste, arranged in 38 rows with 20 pots each. For planting to 10a, 35 blocks are required. Recently a big block composed of 12,600 hexagonal, bottomless pots with 1.9 cm of diameter and 3.0 cm of height is devised (Plate 1).

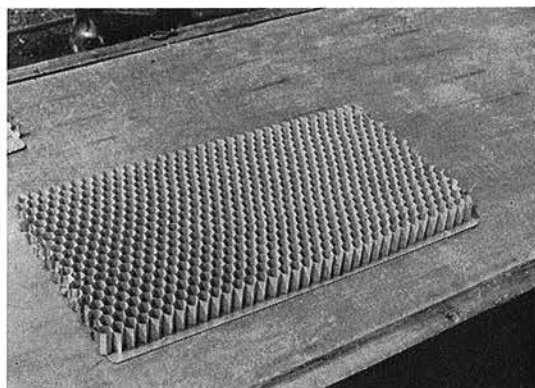


Plate 1. Paper-pots for rice seedlings

With 30-35 days of seedbed duration (in pots), seedlings of 3.0-3.5 leaf stage, with slightly shorter height and less leaves than ordinary seedlings are grown. For transplanting, each pot is separated and broadcast. Seedling establishment is better than that of "young seedlings" or ordinary seedlings, because roots are protected inside the pots.

Preparation of seedlings and broadcasting

1) *Soil packing and seeding*

Loam or clay loam soils are used for filling the pots, because extremely heavy soils inhibit seedling growth and sandy soils cause seedlings coming out from the pots during the broadcasting. Dry soil of 180 kg is needed for 10a. Soil packing is made by the following ways:

- (1) Soil packing and seeding instrument to be used by hand

It consists of vertically vibrating table and seeding device. Paper-pots placed on the table are filled with soil and then seeded. Work for 1.5 ha is done in a day with a set of 4 workers. Due to its low efficiency, it is now scarcely used, although it is of simple structure and low cost.

- (2) Power soil packing and seeding machine of small scale

Soil packing and seeding are made automatically (Plate 2). With 5-7 workers, efficiency is about 50 a/hr or about 4.0 ha/day. This machine is now used to a considerable extent by joint operation of several farmers.

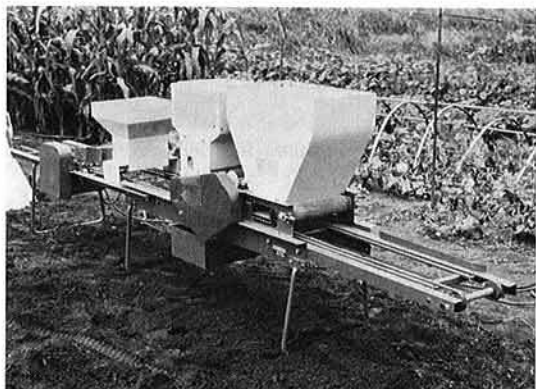


Plate 2. Soil-stuffing and seeding machine

- (3) Power soil packing and seeding machine of large scale

This machine, having the same structure as above, is used in the large scale facilities

for raising seedlings. Efficiency is about 120 a/hr, i.e., soil packing and seeding required for 9.6 ha can be done in a day.

2) *Installation of paper-pots*

Paper-pots prepared as above are placed on the levelled fields with good drainage. In Hokkaido, they are placed inside the plastic houses for keeping warm. In this case, a sheet of paper coated with a chemical which prevents root penetration is placed between paper-pots and soil surface in order to avoid the roots being entangled each other, because an additional labor is required to separate each pot.



Plate 3. Hand broadcasting of paper-pot seedlings

After 30-35 days of seedbed management, seedlings of 3-3.5 leaf stage were raised in the paper-pots thus prepared.

3) *Separating and broadcasting of pots*

- (1) Separation of pots

Paper-pots must be separated each other before scattering. This can be done by grasping about 20 hills of plants and beating soil gently. Pots to be used for 15a are separated by one worker per 1 hr.

- (2) Transportation of seedlings

Separated seedlings were placed in vessels such as used vinyl bags or wooden boxes and transported to paddy fields by trucks. A large amount of seedlings can easily be transported, an advantage of paper-pot method.

- (3) Broadcasting of seedlings

Since planting is made naturally by falling seedlings themselves, hard soil surface or deep water on the field causes seedling not properly planted or shallowly planted, resulting in uneven plant spacing. Therefore, the broadcast should be done soon after the puddling operation and with surface water as shallow as possible. Planting density is usually 25–30 hills/m². Methods of broadcasting are as follows:

- i. By hand. From a plastic bucket containing about 800 hills of seedlings, brought into paddy field by a worker, 10–15 hills are flinged up in the air at one grip. Flying height of about 2 m is adequate for reducing improper planting. Efficiency is 8–10 a/hr.
- ii. Riding on tractor. The above method is a tiresome work, because the worker, bringing a heavy container with him, has to work on muddy field for a long time. To solve this problem, a worker riding on a platform rear-mounted on a tractor broadcasts the seedlings. Efficiency is slightly higher than the above method by hand.

Another method is to use a trailer attached to a small walking tractor. A worker riding on the trailer broadcasts the seedlings transported to a paddy field by a trailer. Paddy field wheels are attached to the tractor and trailer.

- iii. Broadcast-planting machine. At first, a method of broadcasting from the levees by means of a blower and an automatic broadcaster to be used by a tractor were devised, but they were not used practically because the uniform distribution of seedlings and proper planting posture could not be attained although efficiency was high.

By overcoming these defects, a drill planter mounted on tractor was developed. Seedlings fall down to paddy field from a considerable height through the shoot, and are planted in rows (Plate 4). The machine currently being used is the drill-planter with semi-automatic



Plate 4. Drill planter with semi-automatic seedling feeder

seedling feeder for 12 rows (Plate 4). In addition, full-automatic feeder for 6 rows, semi-automatic feeder for 6 rows, full-automatic feeder for 12 rows and semi-automatic feeder for 18 rows were devised. For the semi-automatic feeder, feeding of seedlings is made by hand but not for full-automatic types.

Working efficiency of semi-automatic drill planter is 17.7 a/hr (4 workers required) with a 6-row type, 29.0 a/hr (6 workers required) with a 12-row type, and 47.8 a/hr (9 workers required) with a 18-row type. Working efficiency of full-automatic type is almost similar to the above, but it requires less persons due to automatic feeding. As the mechanized broadcasting still requires a number of workers, the joint utilization is desired.

It is generally recognized that the drill planting gives an uniform seedling distribution, but it has a disadvantage of causing seedlings lying on soil surface or buried in the soil. Sometimes 50% of seedlings are lying or buried and which apt to cause lodging. However, even the lying seedlings can survive by becoming erect within a few days after planting.

The broadcast-planting of paper-pot seedlings has high efficiency of broadcasting itself, but it requires more labor for soil

filling as compared to the transplanting of "mat-like young seedlings" (roots are entangled each other like a mat). Low accuracy of planting (occurrence of seedlings not properly planted) and high cost of input materials are also disadvantages. However, this method assures a safety for rice culture in cool area where cool weather damage of the crop frequently occurs. This is more than enough to compensate these disadvantages. As no cool year occurred recently, farmers tend to adopt "mat-like young seedling", and as a result an extension of paper-pot seedlings is very slow.

On the other hand, a substitute for paper in making pots is now under study, expecting less cost and better seedling establish-

ment. Broadcasting can be made by the same machines described above or by hand. This new method which takes places of paper-pots is now attracting wider attention.

References

- 1) Research Committee on Planting of Paper-pot Seedlings: Results of experiments on broadcast-planting of paper pot seedlings. (1973) [In Japanese].
- 2) Research Committee on Planting of Paper-pot Seedlings: Farm operations of rice culture by broadcast-planting of paper-pot seedlings and device of large scale transplanter. (1974) [In Japanese].