

# Direct Seeding of Rice by Seed Tape

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Direct seeding of rice is the best method for rice culture by employing less labor. However, there are many problems facing direct seeding of rice. Seeding operation is influenced strongly by the weather and soil condition, and it is not always conducted on schedule. Rice seeds do not always germinate uniformly and therefore it is difficult to grow them uniformly. More weeds grow and the yields decrease in direct seeding culture than in transplanting culture.

In a word, direct seeding of rice is unstable, so this method is not popular at present. Therefore, it is most important to make direct seeding stable to spread its popularity.

The author studied the direct seeding method of rice by using the seed tape in paddy fields. In this method of using seed tape, the seeds are enclosed between two paper tapes or a water-soluble vinyl tape and the tapes set in the paddy fields. Paper tape is more suitable for direct seeding of rice in paddy field than vinyl tape.

For direct rice seeding using the seed tape, two machines are employed. One is the seed tape-making machine for enclosing seeds into two layers of paper tapes and the other is the tape seeder machine for setting of the seed tape in paddy fields.

## Seed tape making-machine

The outline of the seed tape-making machine is shown in Fig. 1. It consists of a seed tank, paste tank, two paper reels, seed tape reel,

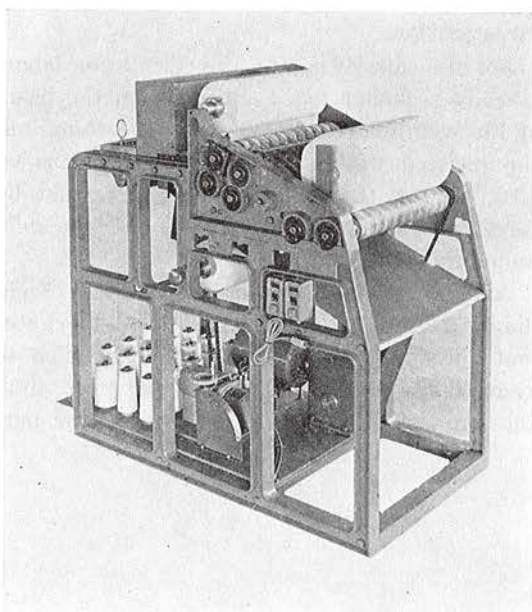


Fig. 1. Seed tape-making machine.

cotton thread reels and two motors of 200 and 400 watts.

As shown in Fig. 2, the seeds are put on a paper tape and another paper tape covers the

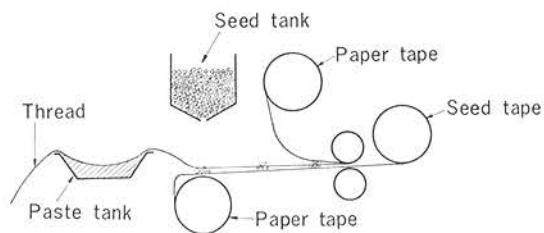


Fig. 2. Scheme of seed tape-making machine.

seed lots, and then two papers are pasted together at both sides of the seed lots with two cotton threads passed through a paste tank that is made by glutinous rice and not involving an antiseptic.

Two cotton threads act to increase the strength for pulling the seed tape and it is free from causing damage to the seed tape setting in paddy fields. The papers must be ventilative and permeable to water needed for germination of the seeds. The threads must dissolve lest the operation of other various farm machines should be obstructed.

The reel is divided into ten tapes, which are 3.4 cm wide and 120 m long. The operating efficiency of this machine is 0.15 m per sec. It takes 40 min. to make 3,300 m of seed tapes covering 10 ares.

The distance between each seed spots and number of seeds enclosed per spot are adjustable at will and accurately as shown in Table 1.

**Table 1. Enclosing of seeds by seed tape-making machine**

Varieties	Sachikaze	Kinmaze
Distance of spots	15.4±1.9 cm	15.0±0.8 cm
Number of seeds per spot	5.6±1.5 grains	6.6±1.5 grains
Length of a spot	2.1±0.6 cm	2.4±0.6 cm
Width of a spot	1.4±0.2 cm	1.6±0.6 cm

It is one of the good points that seeds are enclosed accurately as a spot. By using this seed tape, seeds are seeded as a spot or group with a proper spacing in the row like roadside tree's style.

This seeding system is very convenient for the growth of rice plant and for various cultural managements as compared with a broadcast and drill planting and also it is possible to break up the labor peak in rice culture by preparing the seed tape 60 days before setting in paddy fields.

### Tape seeder machine

The tape seeder machine consists of a float, shoes, rollers and tape reels as shown Fig. 3.

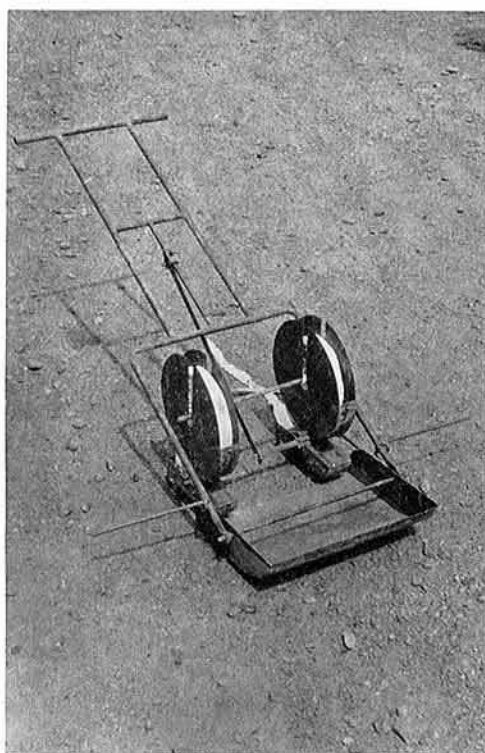


Fig. 3. Tape seeder machine.

The weight of this machine is 5 kg and hand-typed, and this machine is suitable even in bad condition and in small fields. The shoes make two furrows, 6 cm wide, 1~2 cm deep and each tape is set into two furrows at the same time. Consequently, seeds are seeded in the bottom of the furrow and the tape will be pressed down and both sides of the furrow will fall down, but it is not desirable that the seeds are covered with soil before germination. After germination, the basal part of the stem is covered sufficiently with soil so that it will be of great advantage to prevent the lodging of rice plants.

### Conditions of paddy field and setting of the seed tape

The field is tilled, submerged and puddled. After puddling, water is removed and then the soil condition becomes like a jelly. This condition is the most important factor for

good establishment. If the soil is too soft, the tape which is set, will be buried into the paddy soil; consequently, the germination of seeds will be obstructed. If the soil is too hard, the setting operation of the seed tape is difficult and the rows will not be straight. The best soil condition is when the body of 0.04 kg per cm<sup>2</sup> sinks into the soil in depth of 0.8~2.0 cm. The setting operation of the seed tape is forward style as shown in Fig. 4 and the draft force to drive this machine needs 3.5~7.0 kg of manpower.

Row spacing is adjustable, but the suitable row spacing for seeding operation and for rice growth is 30 cm. Operative accuracy is shown in Table 2. In the case of ordinary

**Table 2. Operative accuracy of the tape seeder machine**

Varieties	Sachikaze	Kinmaze
Number of seeds per spot	5.6±1.5 grains	6.6±1.5 grains
Number of seedlings obtained per spot	5.5±1.2	5.7±1.5
Germination percentage	98%	86%
Row spacing	30.0 cm	30.0 cm
Individual spacing	14.4 cm	14.6 cm

direct seeding of rice in non-flooded paddy field, the depth of seeds is not always constant and then the germination percentage is low. However, in the case of seeding by the tape seeder machine, the depth is constant and the seeds are practically not buried in the soil. Therefore, the germination percentage of seeds is high such as 86~98%. (Fig. 5) This high percentage is the best merit of the seeding method. The field efficiency of this machine is 6.8~9.0 ares per hour.

## Management and yield

### 1) Variety

The important factors in the choice of a variety are strong resistance for lodging, high germination, vigorous growth, large panicle, little tiller and high quality of rice.



Fig. 4. Setting of seed tape by tape seeder machine in paddy field.



Fig. 5. Seedling germinated on seed tape set by tape seeder machine.

### 2) Weed control

Weed control is one of the most important practices in direct seeding culture of rice because the yield of rice is influenced greatly by weeds. There are two methods to control weeds. One is cultural control by water and the other is the use of herbicides. Generally, the following chemical herbicides are used; 3 kg of "NIP" (TOK) after puddling; 450 g of "DCPA" (propanil) at 3 leaves stage of barnyard millet; 3 kg of "Saturn-S" (benthiocarb symetryn) of 5 leaves stage of rice plant and 50 g of "2.4-PA" at the maximum tiller stage of rice plant. The above mentioned quantity of herbicides applied are all standard amount per 10 ares of paddy fields.

### 3) Fertilization

It is common to apply each 14~18 kg per 10 ares of N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O as total quantity

and 6~8 kg of N and K<sub>2</sub>O at the first half stage of rice growth. Phosphatic fertilizer is applied usually as basic fertilizer or only at the early stage of rice growth.

#### 4) Irrigation

There are many functions of water in rice culture as follows; uniform germination and seedling growth by maintaining a more uniform temperature, weed control and supply of nutritious elements. Water management is the most important until the seeds germi-

seedling and also 18 kg more than the transplanting culture.

### Economical survey of rice seeding by seed tape culture

The seed tape-making machine is expensive, but its efficiency is very high. If the machine makes the seed tapes for 2,000 ares per year, the cost of seeding per 10 ares by using the seed tape is ¥2,633 as shown in Table 3 and it is inexpensive.

Table 3. Costs of direct seeding by seed tape culture as compared with ordinary manual transplanting

	Making of seed tape	Setting of seed tape	Total	Ordinary manual transplanting
Price of machine	¥380,000	¥5,000	—	—
Fixed expense	542	35	577	
Paper	900		900	
Cotton thread	350		350	
Paste	50		50	
Labor cost	300	450	750	6,000
Electricity cost	6		6	
Total	¥2,148	¥485	¥2,633	¥6,000

Notes: 1) Expense per 10 are.

2) Labor cost is estimated at ¥300 per hour.

3) Durable years of seed tape-making machine and tape seeder machine are estimated at 5 years, and operative area is estimated at 2,000 ares and 400 ares per year.

nate. After seeding, the field is irrigated slowly to make the tape adhere to the soil and supply the moisture to seeds. As soon as the seeds germinate, water has to be drained and the surface of the soil should be dried until it cracks in order to make the seeds buried in the soil germinate. Afterwards water should be kept shallow so long as the soil does not appear on the water in order that rice plants grow vigorously.

#### 5) Yield

The yields of rice in seed tape culture were 581~592 kg per 10 ares. These yields are 14~16 kg more than the ordinary direct

In addition to this, the direct seeding of rice by the seed tape releases men from heavy works such as transplanting of rice seedling by hand.

This method is most effective to the modernization of agriculture.

### References

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