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Rice Transplanting Machine

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Rice seedliags transplanted by hand now in Japan range from those younger ones with 2.5 leaves to those with 8 leaves. And some of paddy fields where they are transplanted are so wet and muddy as a farmers body sinks as deep as to his waist while others are so dry and so hard soil as it cannot be made finer with hoe. It would be most desirable that a rice transplanting machine could work efficieiently under any of such conditions of both seedlings and soil. But it is actually impossible to produce such machine. The machine on sale therefore is limited in efficiency according to different conditions, to which it is applied. Namely, the machine does not work at all or works rather in efficiently unless it is employed under a certain condition suited to its function.

The rice transplanting machine now under study or on sale can be roughly classifled into the one for seedlings with roots washed and the other for those with soil clods or their roots.

Transplanting machine for seedlings with roots washed

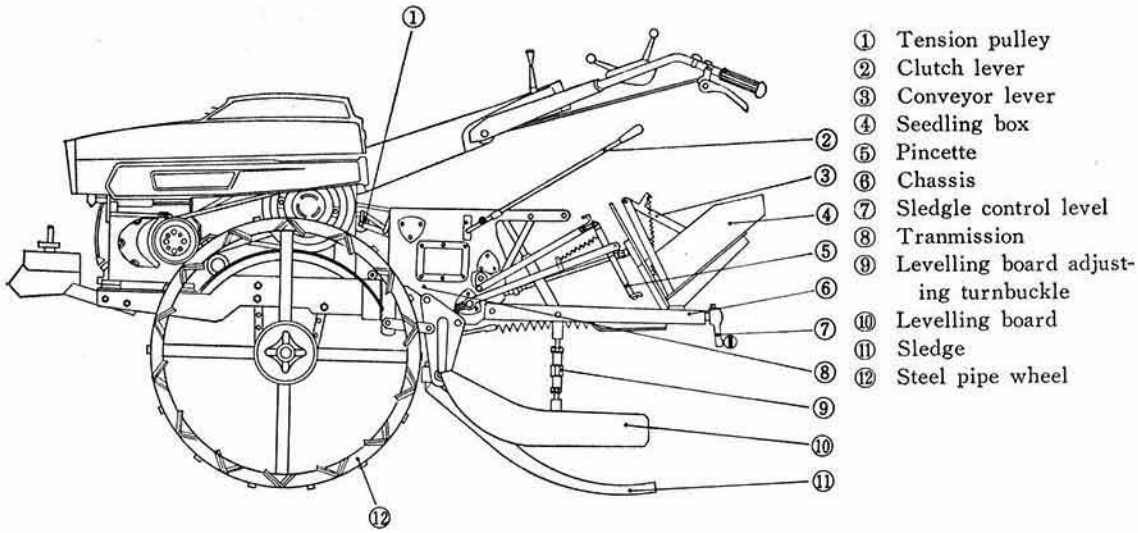
Rice seedlings with 4–6 leaves are picked out from a nursery at first. If they are picked out from a upland nursery, mud attached to their roots is struck off while those from an irrigated nursery are cleaned of mud from their roots by washing.

At any rate the seedlings are kept clean of mud from their roots in the same way as those used for traditional hand transplanting. When the machine loaded with seedlings runs, most of its working process is similar to the hand transplanting. Fig. 1 shows a upright type power machine for transplanting seedlings with their roots washed in two rows at a time. This type appeared in the market in 1965. The working process consists of the following stages: seedlings are carefully put upright in the seedling box; the clutch is on; the planting claw is opened and put into the seedling box; the claw is closed to grasp a hill of seedlings; the claw pulls out the hill and moves toward the field; it puts the hill into the surface of the field with soil levelled by a levelling board; then the claw opens again and returns to its original position,

while the seeblings planted are left on the soil. This working process is repeated. When the claw takes out a hill of seedlings from the seedling box, it is apt to pull out a few unwanted whose roots are entangled with those of seedlings belonging to another hill. Therefore the machine is equipped with a device to prevent it. If a hill is taken out always from a definite point of the box, the socalled bridging will occur to prevent the claw from pulling out a right hill. Therefore a device is made so as to move the box traversely a little and enable the claw to grasp a right hill without fail. The claw can be selected from among 6 kinds so that each can take out a hill of 3–4 seedlings according to the size of seedlings' stems. The depth to which the seedlings are put in the soil is adjusted by moving up and down the levelling board with turnbuckle. The spacing between rows is set tor 30 cm, which however is convertible to 12, 15, and 18 cm by changing the belt of the pulley.

A hand rice transplanting machine for seedlings with roots washed is also on sale. It can plant 6 hills each on two rows at the same time. The working process of this machine is, in principle, completely the same as that of the above power transplanting machine as shown in Fig. 1. While the latter

Fig 1 Rice planting machine for seedlings with roots washed.



plants two hills successively, the former does 6 hills each on two rows or 12 hills in total by operating the handbar and then moves on to a certain distance to repeat the same process. Thus that the hand machine works with an interval and its total weight is supported by 2 sledges, is different from the power machine.

In order to run well the power machine as shown in Fig. 1, it requires seedlings to have the following conditions: their height is between 18 and 35 cm; length of roots, within 50 mm; tiller, within 2; and their body is hard. And it also requires that the field where it works, has the following conditions: it is plowed to a depth less than 15 cm; the hard pan below this depth is firm and level; water is flooded to a depth less than 5 cm; unmatured compost and cut weed are not strewn on the field surface; and the soil is not so hard and compact about 24 hours after careful puddling of its surface. If the seedlings have more tillers and longer roots than as aforemenfioned, lack in hills will occur. If there is no water flooded over the surface or weeds are plowed in the soil too much, there appears the same result, that is, lack in hills. If the length of seedlings is insufficient, hills become to have annexcessive number of seedlings, while if it is too long,

seedlings may fall down. If the soil is compact and hard or the depth of flooded water is too much, the seedlings are apt to float up. If the hard pan of the field is not level, the machine becomes slanted and can hardly move on straight forward and eventually produces hills with an inadequate number of seedlings. It is very important to adjust the planting claw so as to grasp as near the roots of seedlings as possible. If it grasps far above the roots, the stem is inclined to break. If all the above reqirements are satisfied and the machine is right adjusted, it works out splendidly in transplanting seedlings in the field to a depth of 4-5 cm and at so low a rate of lack in hills of 3-6 percent or 3.5 seedlings per hill in an average. Besides, yield of rice is the same as that available from hand planting of seedlings of the same kind under same conditions of the field for transplanting. The machine can plant 100-120 hills per row per minute. Even if time for feeding seedlings to and turning the direction of the machine is taken into account, it can finish the transplanting work for 10 ares in 3-3.5 hours or 4 times higher than the efficiency of hand transplanting. But 3 men have to engage in picking up seedlings from nurseries in order to make the machine run as efficiently as mentioned above because the process of picking has not been mechanized yet.

Transplanting machine for seedlings with soil clod on their roots

This machine is to transplant seedlings

① Star wheel : to cut and plant seedlings
② Conveyor belt : to carry seedlings
③ Handle-bar controller : to adjust the angle of handle-bar to the machine body
④ Float controller for vertical direction
⑤ Seedlings flow control lever : to control seedlings flowing out from the seedling box
⑥ Wheel adjuster : to adjust sinking of the wheels so as to run machine smoothly
⑦ Seedlings guiding board
⑧ Device for carrying out seedlings
⑨ Fixer of roller
⑩ Wheel : to drive other rotating parts

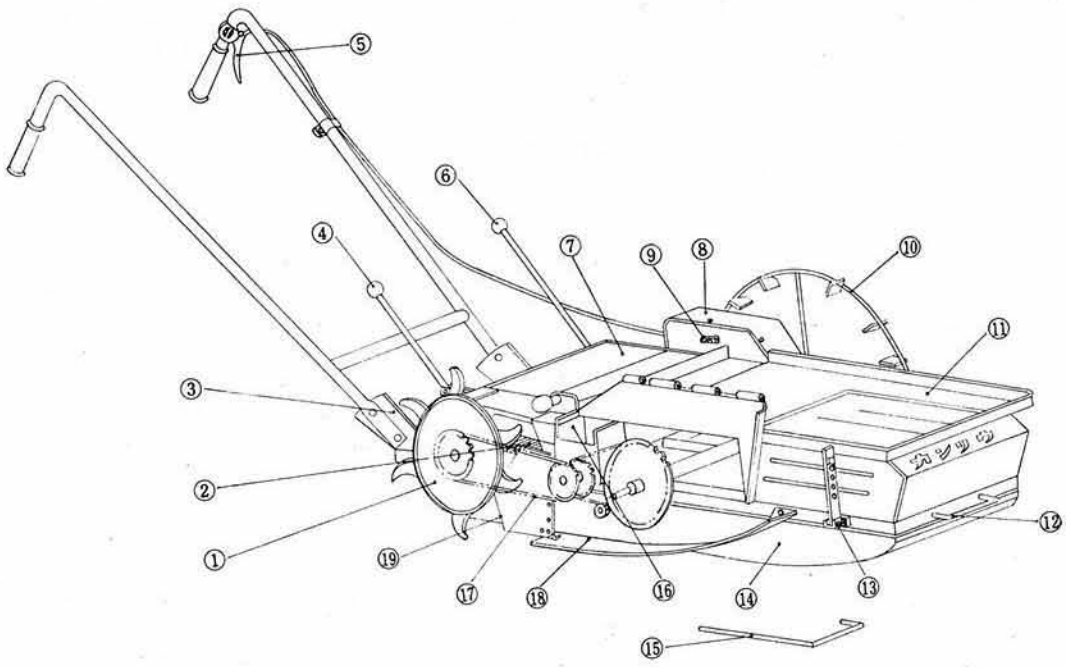


Fig. 2 Rice planting machine for seedlings with soil clods on their roots.

⑪ Seedling box holder
⑫ Handle-bar
⑬ Marker(1) : to adjust the spacing between rows on which seedlings are planted. (Holes from bottom upward on the guide board show those of marker respectively for the spacings of 24, 27, 30, 33, and 36 cm
⑭ Float
⑮ Marker(2) : to be fixed to Marker(1)
⑯ Gear-box
⑰ Chain
⑱ Levelling board : to level the surface of field where rice seedlings are to be transplanted.
⑲ Blade

with the least possible soil clod on their roots and work in a way completely different from hand transplanting. There are two kinds of the machine, the one is for seedlings with 5–6 leaves and the other for those with 2–3 leaves. The former is used less than the latter because the seedlings with more leaves are apt to have more soil clod on their roots. Fig. 2 shows a machine for transplanting seedlings with lesser leaves in one row at a time. It was put on sale in the market for the first time in 1966. Seedlings fed to this machine are those brought up in a box nursery. The pox is 280 × 590 × 30 mm in size and has a corrugated polyethyrene sheet with the spacing of 7 mm between grooves where soil is put in. On this soil, seed paddies that germinated a little are sown and buried so thinly as they barely disappear from the soil surface and then warmed by an electric heated frame at a constant temperature of 30–32℃ to grow uniformly. Then the seedlings are moved to a vinyl tunnel or quonset where they become to bear 2–3 leaves. As shown in Fig. 2, the seedling box as mentioned above is put on a holder in the machine and one of the ends of the polyethyrene sheet is fixed to a roller. Thus as an operator drives the machine, the wheels run on to spin round all the other rotary parts. The roller to which the sheet has been fixed thus begins to pull out regularly rows of seedlings with soil strips on their roots arranged laterally in a belt form on the sheet one by one onto a conveyor belt which carries them to the claw. The blade and the star wheel cut every 1cm of the soil strips and then the claw plants the seedlings with soil clod on their roots in the field by pushing them into the soil. As the wheels are driven by ratchets, they can be driven back to fill any hill lack of seedlings. When the machine turns round, a float is lowered down to make the wheels come up.

Conditions of seedlings required for this machine to work efficiently are that seedlings with soil strips are arranged laterally in a belt form without break of more than 1cm, that the roots are well developed, holding on opitmum amount of soil among themselves, and that the soil is not too wet at the time of transplanting. Conditions of the field soil, on the other hand, are that the surface of soil is fairly compact and rather hard 2–3 days after puddling, that the surface of the field is level and even and that it is flooded to a depth of 2–3cm. If there is a break in the belt of seedlings, there comes out lack of hills and if the soil on seedlings is too wet, it makes them stick to the polyethyrene sheet and hinders them to be smoothly put on the conveyor. If the field soil is too soft, the float sinks down and makes it hard for one operator alone to drive the machine. If the field is not level and even, a depth of water to 2–3cm at higher part of the field will be deeper at lower part where seedlings may submerge.

If the above conditions are satisfied, this transplanting machine can plant rice seedlings as efficiently as at so low a rate of 2–6 percent of lack of hills and accurately to a depth of 2–3cm in the field. It is capable to transplant for 10 ares in 3 hours when the operator drives it 0. 4m per second on foot. As it dispenses with the picking out of seedlings in the course of its performance, its capacity will be about 6 times as much as the hand transplanting that is carried out along with picking out seedlings. Since the machine handles younger seedlings with 2–3 leaves, it cannot be employed in some areas where the transplanting is performed comparatively late in the season because of the preceding crops in the field. The reason is that such young seedlings are not available if transplanted late. For transplanting seedlings from a nursery to the field,

it is necessary to use a shelf. Other than the one row transplanting machine as mentioned above, there are the 2 row and 4 row transplanting machines, and these latter two will be introduced to the market by two manufacturing companies in 1967. The process taken by these two machines is a little different from the one row machine although their mechanism equipped with the seedling box is constituted on the same principle as that of the one row machine. They are characterized only by their transplanting process.

The present situation of the rice seedling transplanting machines now in practical use or about to be used has been stated as above. As they can not be omnipotent to all conditions, it is essential not only to select one from among them in consideration of the condition of the field where seedlings are transplanted and of seedlings to which it is applied but also to have full knowledge of the machine itself and maintain it in perfect condition.

Rodent Control of Stored Grains

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It is well known that rodents damage all commodities everywhere in the world. Therefore, every country has been exerting efforts to control them.

A grain warehouse not only is full of food that is most attractive to rodents, but also provides them with most comfortable living quarters. Besides those warehouses also furnish a chance for them to abrade their incisors when they break through walls of the house from outside. Favored with these conditions of the warehouse, rodents have naturally a wide home range around it.

For controlling rodents in grain storages, there are measures both active and passive : the former being represented by chemicals such as rodenticide and rat repellent while the latter by rat trap to directly catch them. But most effective of all is chemical control. How and what chemicals are used in Japan and how successful is this usage ?

Selection and application of rodenticides

Rodents love to live near where human being live, and their food habits make them devour a large variety of things such as stored grains, structures of buildings, fixtures, clothing, etc., which shows distinctly their polyphagous nature. But they are so careful about any food strange in their home range and they can not be expected to readily eat strange foods. Therefore, the utmost care is required for the preparation of rodend baits.

Studies on 47 kinds of bait[1),2)] have shown that those with higher moisture content are generally effective for feeding. As a result, rodent control has been successfully performed chiefly with water soluble rodenticides in Japan. Now the coumarin-based chemicals[3)] are enjoying the highest popularity among the rodenticides[1),4),5)], which was once held by yellow phosphorus. In addition, sodium monofluoroacetate is also applied fairly widely. As rat repellents are developed, however, they are used combined with rodenticides with success.

Yellow phosphorus

This chemical has long been used for a rodenticide. It is like a paste with a peculiar smell, containing 8-10 percent of phosphor. As it is very toxic to the human body, it is important not to touch it directly when baits are produced from it.

Coumarin-based rodenticide

There are several kinds of coumarin-based rodenticide with different components and