Development of Growth-Retarding Element of Rice in the Reduced Horizon

As seen from Fig. 3-3 sulfate radical in the reduction horizon is reduced by sulfate reducer to hydrogen sulfide, and in case where a smaller amount of active iron is deposited in the soil root-rot disease develops and causes the "Akiochi" phenomenon of soil. Other growth-retarding elements of rice also develop from various fermented organic matters, i. e. mercaptan, butyric acid, acetic acid, formic acid, lactic acid, etc. Thus too much reduction is liable to cause an unhealthy growth of rice. In order to prevent such extraordinary reduction, an artificial drain of irrigation water is intermittently practiced.

Thus the diversification of oxydation and reduction horizons of paddyfield soils is caused by functions of microorganisms living there. In each horizon of soils specific flora is found to exist, and this is a characteristic of paddy field soil shown as distinct from those of upland soil. The understanding may facilitate and promote artificial control of metabolism which goes on in the paddy field soils.

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Drill Fertilizers and Their Recent Developments

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Recent tremendous changes in the socio-economic situation in Japan have provoked so serious a labor problem that the labor force is increasingly drawn out of the agriculture sector and hence agricultural productivity should inevitably be maintained through mechanization of field operations. Seeding and fertilizing practices in paddy fields, among others, have invited our attention, and various types of machines have now come to be developed. Direct sowing drills for non-irrigated fields have been invented in a wide range of size-from small to large - and is being introduced into practical use. As to direct sowing planter for submerged fields some difficulties still remain to be solved. Manual type planters, however, are now largely used in practice.

Fertilizer drill which tillage attachment

Fertilizer drill with tillage attachment is an operating unit which performs tilling and harrowing by rotary tiller and seeding and fertilizing at the same time. Design of the seeding and fertilizing part is almost the same for various types but there are two types for harrowing parts - rotary type and plow-with-harrow-type. The rotary-type fertilizer drill consiste of rotary and seeding, fertilizing device being attached to

it. Thus, tilling and harrowing, and seeding and fertilizing are performed on the same row and at the same time. This type is in common use and there are many models. The plow-with-harrow-type fertilizer drill consistes of a plow with harrow, and seeding and fertilizing device attached to it, with both operation being performed at the same time but on the adjacent rows. Structure of the tilling and harrowing part is almost equal to that of existing rotary or plow with harrow, so its illustration is not shown here. The seeding and fertilizing part consists of power transmission, fertilizer and seed feeder, runner etc. Driving power is transmitted to the feeding shaft through chains either from the wheel shaft of the tractor or from the ground wheel. There are various models as to mechanism of seed and fertilizer feeding device. The most prevailing one being channeled roll. The hopper is mostly made from solid chloridize vinyl, and the fertilizer hopper and seed hopper are united in most models. The feeding roll is made from such materials as; ebonite, bakelite, aluminum casting, neoprene, solid chloridize vinyl, derlin, etc. Adjustment of feeding rate is mostly done through slide of roll in case of channeled roll with which a steples adjustment of the rate is feasible. Discharged fertilizer and seed are transported through the vinyl pipe down to the runner. The runner consists of a furrow opener and a press wheel which are arranged in 4 to 8 rows in most models. Working depth and row spacing are adjustable by the opener. The fertilizing pipe is attached either in front or in back of the rotary tiller. In the former type furrow openers are dismounted from the contact area so that fertilizers are broadcast on the whole tilled area. While, in the latter, the fertilizer pipe is attached for its opening to come just in the rear of the furrow opener and, thus, for fertilizers to be drilled on the row. Seeding pipes are in most cases fixed to the bar in the rear part of the rotary tiller. Distance between rows is usually 30 cm, and seed placing depth 2 to 3cm. Efficiency of operation is different by model, with 20 to 45 minutes per 10 ares the most prevalent. Most models are adjustable in regard to seeding rate (e. g. 90 to 350 grains of rice per sq meter) and fertilizing rate (30 to 120 kg per 10 ares).

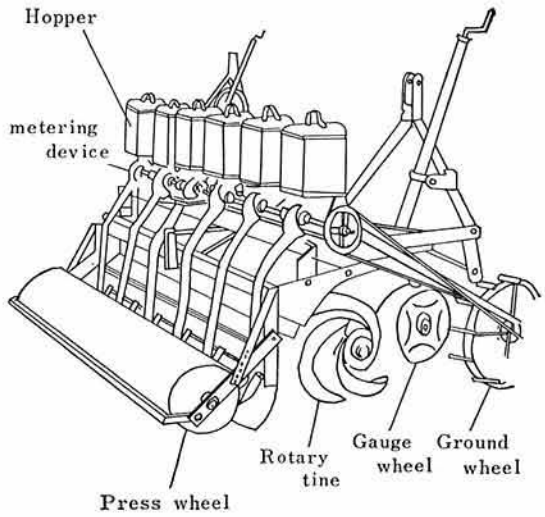

Fig. 1a Drill fertilizer with tillage attachments

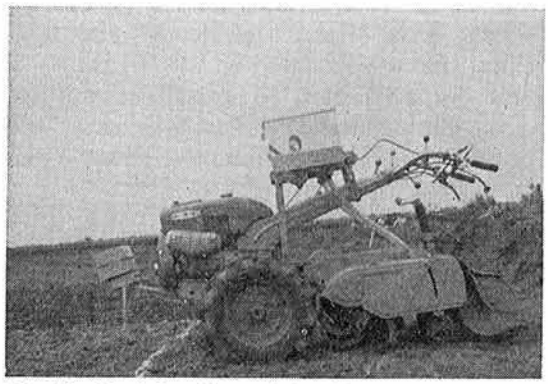

Fig. 1b Drill fertilizer with tillage attachments

Pull type fertilizer drill

Pull type fertilizer drill is used in the fields where plowing and harrowing by rotary tiller and leveling by leveler have been finished. It was no tillage device unlike the drill fertilizer with tillage attachment as previouly described. It consists of a fertilizer and seed feeder and runner. The structure of the fertilizer and seed is almost identical to that of the fertilizer

drill with tillage attachment. The contact area, however, has a furrow opener, press wheel and marker, which are mounted on the frame. In case of paddy, 2 to 11 rows can be covered by using a tractor. The work efficiency is a little greater than that of the already mentioned drill fertilizer, i. e. around 25 minutes pər 10 ares. The rates of seeding and fertilizing are the same, too.

Another type of planter is called ladle type cell wheel (Fig. 2a and b). No fertilizing device is attached to this model. The planter consists of a hopper and cell wheel, the borh parts being connected with a U-shaped pipe. The flow of seeds is adjusted by regulator to both of travelling speed of the tractor and rotating speed of seed hopper. These two speeds also regulate spacing of seeds planted in the row. As shown in Fig. 2, hopper feeds, as it rotates, a regulated amount of seeds through U-shaped pipe. In other words, seeds aɹe fed by regulator discharge hole and are ladled by U-shaped pipe. Then seeds are released through discharge holes on the ground as the wheel rotates. In this type furrow opener, press wheel, seed hopper and mulching tine are mounted on the frame as a unit for each row, thus making multiple row planting feasible. This type has a wide range of applicability to motive power, from hand labor to engine.

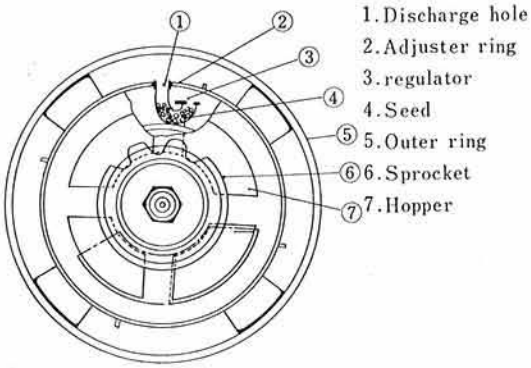

Fig. 2a Iadle type cell wheel planter

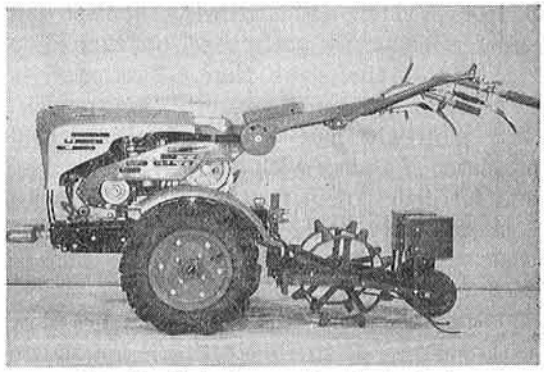

Fig. 2b Iadle type cell wheel planter

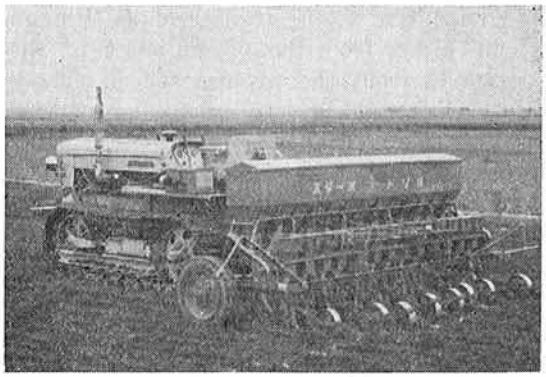

Fig. 3 Pull type drill fertilizer

Direct sowing paddy planter for submerged fields

The fertilizer drill so far illustrated are used only in the non-irrigated fields. While, direct sowing paddy planter is used for submerged field where harrowing and leveling are already practised. Fertilizer and seed feeding device is almost the same with the forerunners, but the structure of runner is substantially different in that a float is attached and furrow opener has various shapes. Most models are are driven by hand and not many motor-driven ones are developed yet. Most models of hand-driven direct sowing planter are two-furrow type and about 15 kg in weight. A four-furrow type, which is rarely produced, is almost 30 kg in weight. The planter is operated in either direction by pushing or pulling. In some models both directions are inter-

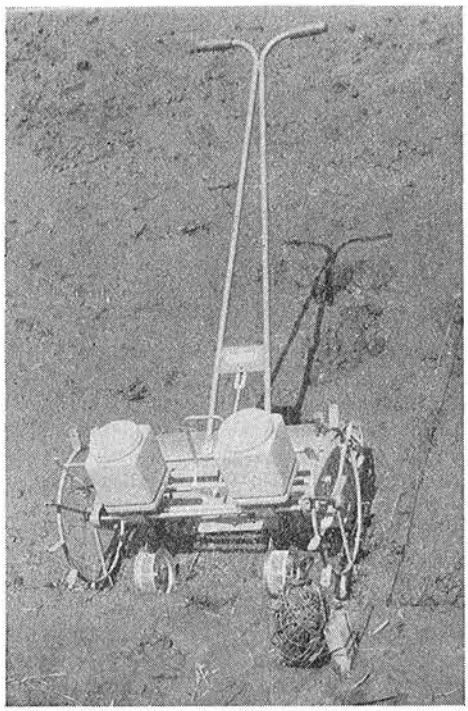

Fig. 4 Direct rowing menual paddy plantir for submerged field

changeable by adjusting the handle. Seed feeding is done in most models through a roll with hole and the rate of feeding is adjusted by an interchange of rolls. Feeding is adjustable both for dotted and continuous (or line) planting. The runner consists of a float, furrow openers, seed-bed makers and presses. The float enables the machine to afloat on the surface of the water and also keeps the surface of paddy field even for furrow openers to work on seed-beds smmoothly. Press puts seeds, which are fed through the hole, into seed-bed by own gravity or by mechanical force by spring. The rate of seeding is almost the same with those of the fertilizer drills described above.

The work efficiency is approximately 60 minutes per 10 ares, though with allowances according to conditions of field. Sometimes the machine is converted to a vegetable seeder by interchanging each rolls.

Other types of fertilizer drills

Besides the above-mentioned, feeding part is now deviced so as to be interchageable among feeding not only wheat but also soybean, corn, rape seed and beet seed. This utility-type fertilizer drill now comes into practical use.

Citrus Breeding through Nucellar Seedling Selection

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In Japan, many citrus varieties were derived from natural hybridization and spontaneous mutation throughout the citrus regions for the last two or three centuries. Among these are the two most important varieties on which the modern Japanese citrus industry has depended exclusively. One is the well-known Unshu-mikan or Satsuma mandarin, the leading citrus variety in Japan. The other is the Natsudaidai. The former is considered to have originated as a chance seedling derived from citrus fruit brought over from southern China over 300 years ago, and grown on a small island in the southern part of Kyushu. The latter was found also as a chance seedling in Yamaguchi prefecture, in the westernmost part of Honshu island, about 275 years ago. It is the most common late-maturing variety at present, but there are some defects in its quality.

The Satsuma replaced the older varieties about 100 years ago, because it is cold-hardy, early to ripen, easy to peel, seedless and has excellent quality. Through the years, many strains of Satsuma have developed