Big scaled irrigation project after the war still practised the furrow irrigation until 1955. (Sagamihara Field Irrigation District).

Since then the method was altered from the furrow to the sprinkler irrigation. Why is it that such flood irrigation practices as the furrow, border, basin and corrugation which are widely practised on the field all through the world has not been adopted as the Japan's field irrigation practice?

The first reason is that she has much sloped land, i.e., twenty six percent of the land is with five to fifteen degrees steep gradient nineteen-percent, with over fifteen degrees gradient. The second is that she has shallow plowing soil which has poor water holding capacity and easily erosive from over irrigation. Thirdly poor land preparation and distribution which makes the flood irrigation unsuitable, and the technique of streaming or introducing water from the canal was immature.

The latest field irrigation practice uses sprinkler irrigation mostly, therefore pressed water is delivered through the pipe and many sprinkler methods have been developed.

At first the splinkler type of "Rainbird No. 30" which is portable was much used and recently the nozzle has become larger, pipe of which is fixed on or under the ground. Especially it is much used in the orchard.

No. 30 type sprinklers are still being used on the ordinary field and since the big sprinklers like "Furrow Gun" has been introduced, bigger types seem to be preferred.

Besides the above many sprinkler equipment as nursery bed sprinkler, "Perforain" "Ozzo", to fulfill particular purposes have been introduced. Thus the irrigation practice is making rapid progress, but Japan still has young history of field irrigation and is immature in its practice.

There are a great many kind of crops for irrigation and the effect varies.

Figure 7 shows the yield increase by irrigation in the last fifteen years in Japan, indicating that the irrigation effect differs even on the identical crop. It is one of the unique features of Japan's field irrigation agriculture that the irrigation effect remarkably differs depending on the kind of crops, soil type, meteorological conditions of that year and cultural practice, as well as the general characteristics of the humid-wet zone.

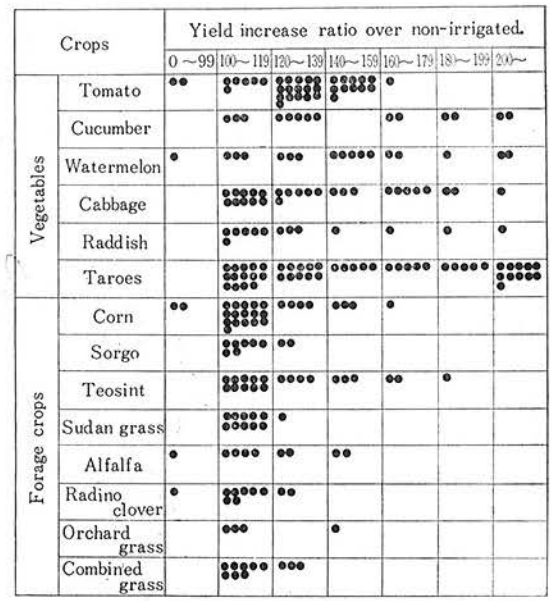

Fig. 7 Crop yield increase by the irrigation.

Performance of Reaper

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Kind of reaper

There are 4 kinds of grain harvester, windrower, dropper, binder and harvester-thresher combine. The first three are called reaper and the last called combine which is not usually classified into reaper in the limited

sense of the term and therefore omitted from this article.

When one judges performance of a machine, naturally one compares it to that of other machines. In the case of reaper, it is no exception, but it is necessary to define the performance beforehand. In a broad sense, it means rate of work, quality of work, durability, etc., while in a narrow sense it does only the first two of them.

Rate and quality of work of a reaper depend upon conditions of a crop or a field for which it is applied. As these conditions vary with different location of field and different years, the performance of the machine may change in rate and quality of work accordingly. Whenever a reaper is used for rice plants without lodging in a field where soil is adequately firm it takes one hour for 10 ares reaping with less than 2 percent of grain losses, but it may take 2 hour for 10 ares with grain losses so high as 5 percent when it is applied to rice plants standing at a standing angle of 30°. The reason why it takes as much as twice the time is that the common type reaper and binder in Japan cannot reap the crops in all directions. Then, standing conditions of crops and soil conditions of field are very important for reaping.

It is a better reaper which can work well not only under favorable conditions but also under unfavorable conditions.

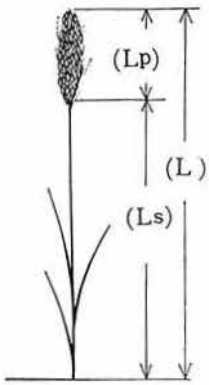

Fig. 1 Descriptions of Parts of standing rice plant

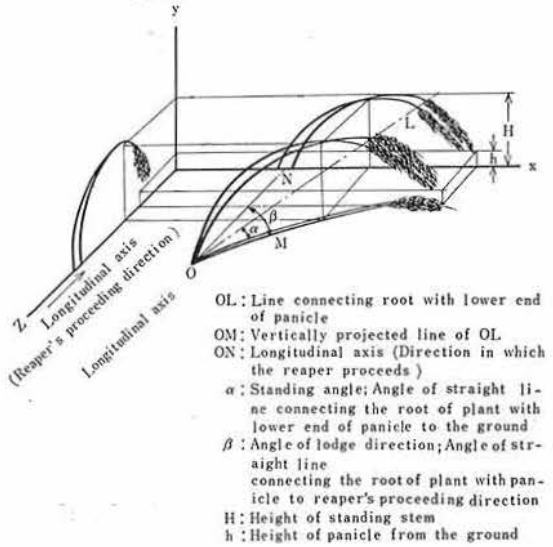

Fig. 2 Descriptions of Parts of Lodged Plant

The method of performance test for reaper

General description

The performance test for reaper is carried out according to items of survey and measurement as mentioned below. Before testing, field, crop and operating conditions are surveyed. Operating time of reaper is measured during test. Then the test is completed with a measurement of quality of work.

Items and method for survey and measurement

1) Field conditions
   a) Shape and size of field
   b) Hardness of soil
   c) Moisture contents of soil
2) Crop conditions
   a) Variety
   b) Method of cultivation
   c) Characteristics of crop (H)
      Plants' stature (L)
      Length of stem (Ls)
      Length of panicle (Lp)
      Number of panicles (m)
      Apparent height of crop
      Height of panicle from the grouud (h)
      Standing angle (α)
      Number of immature panicles
3) Operating conditions
   a) Engine speed
   b) Position of change gear
   c) Width and height for cutting

4) Rate of work
   a) Working hours and area
   b) Time for adjustment and repairing
   c) Travelling speed
5) Quality of work
   a) Width and height for cutting
   b) Angle of released bundles to longitudinal axis (r)
   c) Number of mis-binding
   d) Position of released bundles (d_1)
   e) Distance between released bundles (d_2)

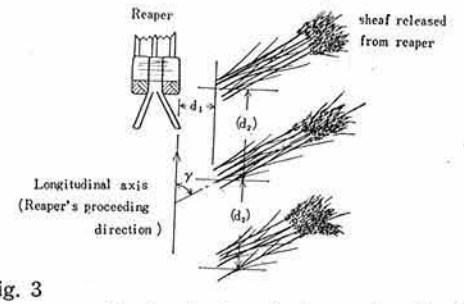

Fig. 3

r : Angle of released sheaves longitudinal axis
d_1 : Position of released sheaf
d_2 : Distance between released sheaves

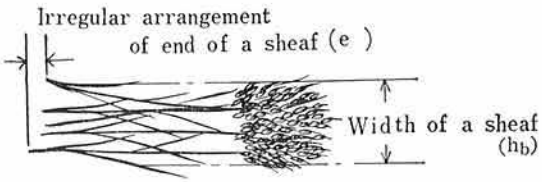

Fig. 4

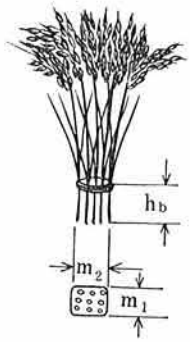

Fig. 5

h_b : Binding position
m_1 m_2 : Section of a bundle of binding position

f) Irregular arrangement of end of a bundle (e)
g) Width of a sheaf unbound (f)
h) Section of a bundle at binding position (m_1, m_2)
i) Weight of bundle
j) Binding position (h_b)
k) Firmness of binding
l) Losses of grains: amount of dropped on the field after reaping

Performance of reaper on sale

In the autumn of 1966, reapers such as windrower, dropper and binder underwent a performance test. The results of the test were as shown below.

Conclusions

The results of performance test on 6 kinds of reaper were as shown in Fig.6. The time required for reaping (including binding) is closely related to the number of bundles which is bound by hands and to the corner ares of field where the reaper is unworkable and reaping is perfomed by hands.

The future reapers must be designed taking into consideration above conditions, having binding mechanism and needing no hand reaping of corners of the field.

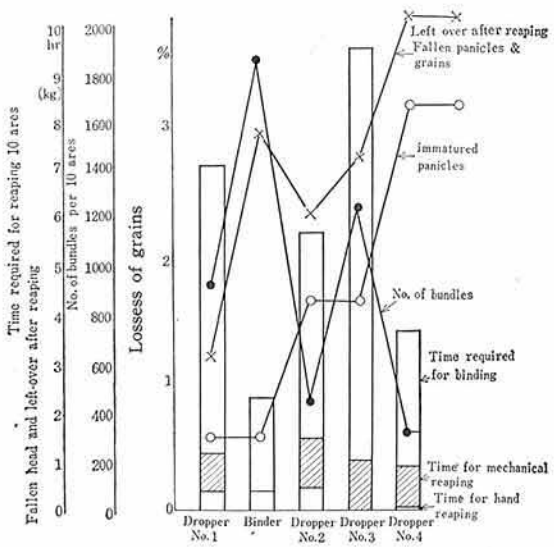

Fig. 6 The result of performance test (1966)

Testing condition & Performance of reaper			Reaper tested	Dropper A	Dropper B	Dropper C	Dropper D	Binder
Testing Conditions	Field condition		Area	10.2	8.1	10.0	9.6	8.3
			Softness	Slightly softer	Firm	Soft	Slightly softer	Soft
	Corp conditions		Variefy	Fujiminori	Fujiminori	Fujiminori	Fujiminori	Fujiminori
			Maturify	Matured	Matured	Matured	Matured	Matured
			Spacings bet. ridges and hills (*cm*)	30×16	30×15	30×16	30×16	30×13.5
			Stature of plant (*cm*)	105	100	106	109	101
			No. of stems per. hill	12	15	15	13	18
			Standing angle (°)	67	68	71	66	66
			Height of panicle from the ground (*cm*)	61	65	70	65	66
			Moisture contents Grain (%)	24.0	21.2	20.4	19.4	23.1
			Moisture contents Straw (%)	67.7	65.2	62.9	57.9	66.8
			Yield of crop *kg*/10 *a*	507	558	516	574	531
	Operating conditions		Av. speed of travelling	0.62	0.36	0.34	0.21	0.62
			Av. width of cutting	30	87	90	91	60
Performance	Rate of work	Time for reaping	(hr. min. sec) Reaping by hand	0.20.40	0.03.21	0	0.32.04	0.23.02
			(hr. min. sec) Reaping by reaper	0.50.42	0.53.55	1.09.30	1.06.45	1.53.03
			(hr. min. sec) Time of suspension	0	0	0	0	0.04.18
			(hr. min. sec) Net time for reaping	1.11.22	0.57.18	1.09.30	1.38.50	2.15.37
			(hr. min. sec) Total time reaping	1.11.22	0.57.18	1.09.30	1.38.50	2.19.55
			(hr. min. sec) Time for binding (man-hour for 10 a)	5.47.39	2.42.40	8.15.00	3.58.16	—
			Time for reaping & binding	6.98	3.67	9.41	5.62	2.33
	Qauilty of work		Height of cutting (*cm*)	6	8.6	8.8	8.9	3.5
			Angle of released bundles to longitudinal axis (°)	160	90	87	90	40
			(*kg*/10 *a*) Left-over after reaping	0.15	0.02	0	0	0.07
			Fallen panicles (*kg*/10 *a*)	1.66	8.47	6.07	5.65	5.32
			Fallen grains (*kg*/10 *a*)	1.33	1.70	1.30	0.33	2.20
			immature panicles (%)	0.56	3.31	1.74	1.71	0.56
			Weight of bundle (*kg*)	1.83	5.55	1.57	3.62	1.23
			Distance bet released bunbles (*cm*)	160	177	87.8	88.0	164
			No. of sheaves before binding	927	326	1,221	1,267	—
			No. of bundles	867	304	1,221	444	1,815