Official Test of Walking Tractors in Japan

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In Japan the official test of agricultural machines has been carried out since 1954 as an aid to the promotion of agricultural mechanization. And the test is an important duty of the Institute of Agricultural Machinery.

The test which had been conducted by the Ministry of Agriculture and Forestry was put under our institute's charge in 1962 when it was founded. The machines tested since then are of more than 10 kinds including straw rope twisting machines, walking tractors, pest control machines, threshers and so on.

Machines are judged by three steps of tests, that is performance, durability and handling. And the machines which made better records than the standard are announced in the official Gazette as qualified ones, submitting summaries of the test results to the public.

The test of walking tractors started in 1955, and more than 400 of them have been put to the test so far. This number appears to correspond to the greater part of the walking tractors now used in the farms in this country.

Testing methods for walking tractors

Application and classification of walking tractors

This test is applied to walking tractors (mentioned as tractors hereinafter) including the ones which can temporarily be used as riding. The tractors in this range are equipped with engines of about 2-10 PS and classified into three types. The testing methods differ to some extent according to the type of tractors.

1) Pull type: This type is used for pulling various kinds of implements, being classified as follows:
   Mainly for ploughing work
   For ploughing and inter-cultivating work
   For inter-cultivating work
2) Power-tilling type: This is the type which drives tillage device (rotary, crank, screw blades and other types).
3) Dual purpose type: This is the type used for both pull and power-tilling type.

Field performance test

This test is carried out in the field to find the actual field performance of tractors. The pulling type with a plough shall be put to test ploughing work in a cropped paddy field and a powertilling type shall be tilling in similar field. Dual type shall be put to test ploughing work and tilling.

The fields are medium natured mechanical structure of soil and moisture. The tractors which are applied for the test as the type for both ploughing and inter-cultivating works, or exclusively for inter-cultivating work shall be put to test in a wheat field.

The tractor on test shall be equipped with the implements selected by the applicant (usually the maker), and wheels, additional weights equipped with tractor shall be commercially available. Accordingly the working conditions are the same as practised by the farmers, and the equipment used in the test furnish farmers with useful information.

The applicant regulates his tractor himself

Fig. 1. Ploughing test

Fig. 2. Inter-cultivating test

so that it would give the maximum performance of 50 passes for ploughing and 15 passes for tilling on the straight 50 meters marked off with white lines. Headland ploughing and tilling shall be omitted. Under the work, depth of working, width, travelling speed, turning time are measured and after the work, fuel consumption, exposure of stumps etc. are measured or observed. The evaluation of the performance is made on the basis of all those data. The performance level at present is shown in Table 1.

The mechanical efficiency test and the drawbar test were conducted with in the past, but those are omitted at present.

Table 1. The performance of walking tractors

	Pull type	Power-tilling type	Dual purpose type
Mounted engine	2~5 PS	5~10 PS	4~6 PS
Tractor weight	40~200 kg	300~600 kg	140~250 kg
Rate of work (min/10 ares)	Ploughing 70~110	Rotary tilling 60~110	Ploughing 60~110
			Rotary tilling 80~110

Continuous running test on bench

This test originally aims to find the durability of tractors. The durability, however, cannot be discerned within a short time. And some one says that it needs 500 or 1,000 hours to test the durability, though it is nearly impossible to spend such a long time in the testing. A continuous running for five hours (6 hrs. for the dual type) on bench is adopted as the testing methods at present, because the data show that if a tractor has any trouble it will be out of order within several hours of running. In this test a tractor bare of wheels is set up on the bench and operated applying the brake by a Prony Brake on the axles in case of the pull type and on the tilling shaft in the power-tilling type.

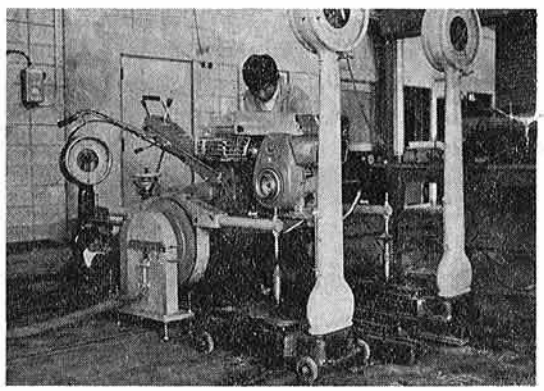

Fig. 3. Continuous running test on bench

The engine shall be run at rated speed and the brake load is 80 per cent of the rated engine horse power. In case of the pull type ratio of loads on the left and right axles individually shall correspond to that of alloted

on each axle when the tractor is at a standstill at average ploughing depth.

The hours of continuous running brake load and the unbalanced loads on the left and right axles have been changed many times on the basis of the data accumulated by experiments and tests since 1955 when the test started, and are now very rational in comparison with those in the early days.

After a continuous running test, the tractor is disassembled and any abnormality of the machine is tested. The shafts and the toothed wheels are also measured by a precision gauge, if necessary. Though disorders of tractors were sometimes found formerly during the test, nearly no such case has been met with in the last five to six years.

Handling test

The object of this test is intended to ascertain the ease of handling of the tractor and its implements. The tractor with the same implements as in the case of the field performance test is handled by inspectors to see whether it has such defects as they will be causes of the danger and fatigue of workers or not.

Fig. 4. Handling test (measurement of noise)

This test has an important meaning in the point that tractors are evaluated by their comfortability to human factor. The applicant takes the result of the test as the response of farmers to the machine sold. The improvement of tractors is now remarkable in handiness and safety as compared with those tested in the early days, being continued to meet human factors. The tractor which made a better record than the standard in the test is announced in the official Gazette as the one qualified by the official test and allowed to carry the certification mark.

The testing methods have been changed several times in the past, for example, an elimination of engineering performance test and waterproof test, and a change in loading of the continuous running test on bench, etc. and further improvements are now under investigation to furnish farmers with useful data.

The test of tractors has done great work for benefitting farmers materially and morally. It may be said that the test has served as an aid for the popularization of tractors in Japan where 3,000,000 tractors are being used now.