19. TESTING AND EVALUATION OF FARM MACHINERY IN JAPAN

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Introduction

As a result of the development of farm mechanization and a considerable financial investment in it, farmers themselves must have some means to evaluate the machines they use.

Although at first the machines were examined by seeing, as they have been more expensive and complicated, technical tests by highly trained specialists have been necessary.

On the other hand, the government and others concerned benefit from farm machinery testing because it helps the development and improvement of farm machinery and eventually promotes sound farm mechanization. For these reasons, national and other official tests have been carried out in Japan.

Usefulness and effect of test

Apart from the simple machines manufactured by local craftsmen, the more complex the machines became, the more difficult they were even for experienced farmers to select.

Farmers, therefore, need help in choosing their machines. The testing of farm machinery by the official agency is one of the most effective helps. If this is properly done, it enables them to take a first and important step in choosing their equipments.

Large manufacturers have their means—specialists, testing apparatus, farms, etc. —for developing, improving and assessing machines, but nevertheless they cannot always assess really the performance of machines, particularly those made in foreign countries. In contrast to large manufacturers, small and medium-sized manufacturers cannot be expected to have the sufficient facilities mentioned above because of their high cost. Farm machinery testing can help the manufacturers to develop and improve their machinery as well as to promote the fair trades on the basis of the precise data and the impartial view of experienced specialists.

The farm machinery testing develops a more reasonable selection of machinery, which results in its wider and more economic use, and consequently the reasonable mechanization. Others concerned therefore benefit from machinery testing, as the reasonable mechanization will contribute to the increase in productivity, lower production costs and the healthy development of all industries. Especially the government can gain valuable information to establish agricultural policy towards farm mechanization.

Brief history of farm machinery testing in Japan

The comparative tests of many new kinds of machinery were carried out in national and prefectural agricultural experiment stations from around 1920 to World War II and they principally aimed at the development and improvement, and had great influences on the development of processing machines. The original types of threshers and rice hullers were developed and put into practical use in this period.

After World War II, losing their market, many new manufacturers began to produce

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farm machinery and implements all at once to sell to farmers who had the purchasing power. As some of the products they manufactured proved to be of no use or showed low resistance to wear and tear, farmers suffered from such troubles. So in 1949 the Ministry of Agriculture and Forestry commenced the test to exclude machines of such poor quality and to promote the improvement of farm machinery. This testing later became the present national test service based on the Agricultural Mechanization Promotion Law (AMPL) established in 1953, and continued up to today with some changes in its character.

The actual works of the national testing carried out by national and prefectural agricultural experiment stations in the beginning were taken over by the Farm Implement and Machinery Testing Laboratory, which was established in 1954, and afterwards the Institute of Agricultural Machinery (IAM) which was established in 1962 has been entrusted with national test. In addition IAM is now carring out the IAM test as the official test.

National test

This is the test on the machine to represent the model (e.g. Int. B485), and is carried out at a manufacturer's or a dealer's request, based on the AMPL, but it is neither compulsory nor a test of individual machines produced. The manufacturers have a duty to produce the same machine as the one which passed the test, and every year the Ministry of Agriculture and Forestry inspects the production machines. The test codes are determined by the Ministry upon the consideration of the Test Division of the Farm Mechanization Council, involving the test requirements (standard). The "Pass Mark" is to be attached to the machines which passed the test. On the other hand, the makers of machines which did not pass it will fall into difficult situation even though they are not prohibited from selling them.

The Ministry of Agriculture and Forestry makes public the names and summary of test results of machinery which passed the test.

The Ministry of Agriculture and Forestry determines and makes public the kinds of machinery to be tested in the fiscal year. In other words, the national tests are carried out on some selected kinds, not on all kinds of machinery.

This is principally due to the fact that a great deal of new model machines come into market by many manufacturers and that all of them can not be tested every year.

The kinds of machinery tested in the past several years are as follows: 1) Agricultural tractors (Riding type) 2) Agricultural tractors (Walking type) 3) Fertilizer drills 4) Power sprayers 5) Power dusters 6) Power binders 7) Urine spreaders 8) Self-feeding type threshers 9) Fodder cutters 10) Grain driers 11) Rubber rolls for rice hullers.

Some 60 models are tested every year.

IAM test

In Japan, farm mechanization has been making remarkable progress and new kinds of machinery such as binders, Japanese-type combines and rice transplanting machines have appeared and have been put into practical use. So, the official test must be given to provide the proper technical information to farmers and the manufacturers. However, as these machines are developing now and there is much room left for improvement, it is difficult to test them without any sufficient preparation in the system of national test because test codes inclusive of passing standard should be strictly established.

During the preparation period the IAM test takes the place of the national test, IAM test is carried out by the IAM on the basis of its testing regulation. The testing procedures set up by the IAM do not include the test standard and the detailed test

results obtained are made public or informed of some concerned, according to the aim of tests. In the IAM test there are comparative (or group) tests of the same kind of machines and the test of individual machines. The IAM determines the kinds of machinery to be tested in the fiscal year as the national test does 20–40 models to be tested every year.

Scope of test

The testing methods even on the same machines are much different among the countries. This is due not only to the different local conditions and requirements, but also to the lack of information on the foreign countries and particularly to the line along which each testing authority first began to work.

The last matter is essential to understand the foreign country's testing methods. In the national test, the fact that many machines should be tested in a short period has greatly influenced the testing methods.

Apart from the above-mentioned, if a test is to make sure of technical value of a machine, the machine should undergo a whole series of tests related to the following three aspects; performance, durability and easiness of operation.

(1) Performance

Performance tests include measurements of input such as power and fuel consumption and output such as effective power, grain quantity harvested, and the observations of machines in operation and the work done. The object is to obtain a detailed picture of the performance of the machine.

These tests can be classified into the following two types, i.e. technical test in the laboratory and practical test under the local conditions such as soil, crop, climate, etc. These are carried out in the fields and laboratory respectively.

In the former example, the results of the tests such as an engine test and an output test of sprayers show constant figures, valied in itself and reproducible in another station and at the other time. Although specialists lay emphasis on these tests because of its repeatability and comparability, the test results are difficult for many farmers to understand because they are the basic performance tests and do not directly present the practical performance in the field. For instance, even if a tractor is approved to have some 20 horsepower in the laboratory test, the farmer can not realize how wide the tractor can operate the plow or rotary tiller. The results of technical tests therefore must be shown so that they can understand it.

The results of the performance tests in the latter, which are generally most important for farmers, depend chiefly on the local conditions, such as soil, climate and cultivating method. For example, in the rice harvesting by a combine harvester, soil conditions have the important influence on the travelling of the machine. In some cases, the harvester cannot travel but bogs down. Also the morning dew lowers the capacity of the harvester for sieving and cleaning mechanism of paddy. The ripeness and threshability of the grain also influence the working capacity of the machine, cleanness of product, and especially the quantity of the grain loss.

Those local conditions are so many in number and varied that it is physically impossible to test all of them, the number of which must be always limited. There are two possible means to be adopted. The tests are carried out under a few typical and important conditions or an artificial laboratory test is devised where the machine is placed in the constant conditions because the test results can be compared there at any time. In the former method often adopted, many machines of the same kind are tested under the several same conditions and thus the test results can be compared with each other to some extent. If the tests are carried out every year under the same conditions,

the test results obtained in the different years also can be compared with one another.

The latter artificial laboratory test is also often adopted in Japan, since it has the advantage not only of allowing the numerical comparison of one machine with another but also being capable of carring out the test at any time. Great care, however, must be paid lest the artificial conditions should be much different from the actual ones. Otherwise the test result cannot serve the actual performance of agriculture.

In addition to the quantity measured by testing apparatus, the evaluation of the quality of the work done is essential for the technical assessment of the machine. Some farmers consider it is more important than the quantitative performance. Needless to say, the objective and quantitative measurements are also desired when the quality is evaluated. Subjective opinions based on observations of the machines in operation are apt to raise some mistrust in the mind of manufacturers.

All the countries are therefore doing their endeavours to establish quantitative measurements of the quality. Many methods developed by the studies have been adopted also in Japan although they require additional measurements which are arduous and costly. There are some cases in which quantitative measurements can not be taken: for, they are not yet established or the time, staff and budget are short. In such cases the evaluation of quality must be handled by experienced and first-grade testing staffs.

(2) Durability

The durability greatly influencing on the farmers' economy, is fundamentally important to them. The more expensive the machinery becomes as mechanization advances, the more significant the durability is.

The durability test, however, has a number of difficulties. It is true that a machine showing low resistance to wear under the average condition will probably have the same defect under the other conditions.

Nevertheless durability of machines depends on local conditions such as soil, climate, crop and operating hours in a year, to a large extent, and particularly so when they are extreme. For instance the plow share is more thoroughly worn out when the soil is sandy.

Under actual conditions, the durability test takes a long period to indicate the definition, since the farm machines are used only for a short period in a year. That is the reason why the test report has often become useless when it is issued, for the machine has already been modified or replaced by a new one.

An attempt is often made to replace practical test with artificial durability test in the laboratory, in order to get a conclusion in a short time. This approach is also adopted mainly in Japan. The method now employed is to operate the machine for some hours under artificial conditions similar to actual conditions and afterwards to examine the results. This method is not always sufficient to investigate the durability thoroughly. So it is called as a running test. It is, however, very usuful in the point that the defects and weak points can be discovered.

(3) Difficulty of operation

It is very important that the machine is easy to adjust and handle. Some farmers consider these matters to be more important than performances, since the performances of machines of the same capacity usually do not so much differ with each other. This aspect belongs to new science called human engineering or ergonomics which has been developed since World War II. The further research in agriculture will lead to many ways of evaluation based on the quantitative measurements. At present, in addition to some quantitative measurements (noise, force to operate, etc.), there are more than three tests in Japan to actually operate and adjust the machine through which technicians evaluate the machine.

Principal items to be investigated in the test are: 1) exchange of parts and tools,

2) setting and adjusting of various parts, 3) handling in operation, 4) maintenance and 5) safety.

Standardization of testing methods

As mentioned above, the testing methods in various countries vary widely for some reasons and there are also confusion in the terminology. Therefore, test reports from one country are only of very limited use in other countries. The disadvantages resulted from such circumstances are as follows; testing stations are often forced to repeat the entire test already made elsewhere; the international trade becomes dull and more difficult; and finally the farmers are in danger of choosing the machines of poor quality.

There is, therefore, the necessity of international standardization of testing methods and terminology, although they are very difficult problems because the farm machinery depends on the local conditions. As to this subject, the International Organization for Standardization (ISO) has already proposed the draft of ISO recommendation of Test Code for Agricultural Tractors and others. On the other hand, the Organization for Economic Co-operation and Development (O.E.C.D.) also has been engaged in this work and two test codes and two testing procedures have been established up to the present. Especially O.E.C.D. Tractor Test Code was established in 1959 (in the period of O.E.E.C., original of the present O.E.C.D.), and rivised several times and approximately 250 models have been tested under the Code. Also in Japan one tractor has been tested under the Code, and the test report with O.E.C.D. test number has been issued.

Although tests defined in the Code are limited to technical ones and practical ones such as a plowing test are not included, the test reports are very useful because they enable one tractor in one country to be compared with the other in the other country and therefore to avoid the repetition of tests among testing stations.

As the farm mechanization advances and the international trade of farm machinery in Asia increases, this problem will become more serious, and the close international co-operation will be more needed.