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F. R. Stanley

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THE IMPORTANCE OF TRACTOR TESTS TO THE PRACTICAL FARMER

By F. R. STANLEY, W.A. District Tractor and Implement Sales Manager, Ford Motor Co.

With the rapid growth of farm mechanisation over the last two decades, it naturally follows that there has been a great increase in mechanical knowledge among farmers and a greater demand for further knowledge. In many overseas countries and in at least one Australian State, there are now Institutes of Agricultural Engineering which, apart from training graduates, carry out research work and, in some cases, report on tractor and implement performances and thus provide sound practical guidance for farmers contemplating the purchase of new equipment.

No such move has yet been made in Western Australia despite the fact that this State's prosperity is still basically dependent upon its agricultural production. Some of the leading tractor and implement organisations conduct schools for farmers to disseminate knowledge of the maintenance and operation of their own machines and, in conjunction with the Department of Agriculture, they have organised a number of highly educational field days.

An important feature of the Institutes of Agricultural Engineering has been the published tractor tests. From 1946 to 1954, these tests were conducted by the Aeronaughtical Research Laboratories, Department of Supply, Fisherman's Bend Melbourne.

Since 1954, the tests have been conducted for the Australian Tractor Testing Committee set up by the Australian Agricultural Council. The A.T.T.C. is a joint body established by agreement between the Commonwealth, the States and the University of Melbourne. The tests are carried out by the University at the testing-ground at the State Research Farm, Werribee, Victoria.

How Tractor Tests Originated

Most farmers have heard of the 'Nebraska test' but may not be familiar with its origin. In 1919, the State of Nebraska introduced a law to protect farmers by insisting that tractor manufacturers could only sell their products in that State after submitting a stock model to the University to undergo a series of tests, the results of which would be made public.

A permit for sale in Nebraska was only issued subject to the actual test performance comparing favourably with the maker's claims concerning horse-power, fuel consumption and other important features. A further requirement was that adequate supplies of spare parts should be reasonably available within the State.

Although the law only applied to the State of Nebraska the tests carried out by the University of Nebraska came to be accepted as a measure of tractor efficiency throughout the U.S.A. and in many other parts of the world.

The Australian tests differ only in a few details from those established at the University of Nebraska and the following brief summary indicates their scope:

Tests on Stock Models.

Tests are conducted at the request of the manufacturer, the importer or the State distributor. It is assumed that the request is made in the knowledge that test covers both the tractor's performance and its mechanical condition at the end of the test, and that a report will be prepared and published by the Committee.

The tractor submitted must be a stock model as regularly sold in Australia, complete with all standard accessories. The right is reserved to reject any tractor.
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* Part Throttle due to Wheel Slip. † Part Throttle due to Front Wheels Lifting. Tests 1 and 18 replaced by Tests 21 and 23.
which for any reason is not considered to be representative of tractors being sold, and to select for test in its place any machine which has been prepared for delivery.

A representative of the firm must be present during the test. Under supervision, an officer of the company is required to drive and service the tractor throughout the test, and make such changes to wheel equipment etc., as are required. In addition, the representative must convey all decisions involving permissible choices or company policy relative to the test.

The fuel used in the test must be the lowest recommended grade; for instance, if the tractor is sold to run on distillate or diesel oil, diesel oil must be supplied for the test. The lubricating oil used must be chosen from the brands and grades recommended for use in the tractor and readily available in Australia.

The Tests—Main Features.

Before any test measurements are taken, the tractor is run in for approximately 12 hours under the supervision of the Testing Officer.

Two main types of test are then carried out.

(a) Belt Tests.—The belt tests are carried out by driving a brake dynamometer through a flat belt from the tractor belt pulley. The results from these tests are used to obtain an indication of the performance of the tractor engine, and the tractor as a stationary unit. The test setup includes suitable instruments to enable all the necessary information such as engine speed, belt pulley torque, fuel consumption, to be extracted from the tests.

(b) Drawbar Tests.—In the drawbar tests, the tractor pulls a combined loading and instrument car which is itself a variable load and carries all the instruments necessary to obtain information required from the tests; road speed, wheel slip, drawbar pull, drawbar horsepower.

Between the tractor and the load is a drawbar dynamometer which gives direct readings of the pull exerted by the tractor on a gauge in the instrument car. Tests are normally carried out over a measured level strip 500ft. long.

By means of wheel counters, wheel revolutions are measured; from these readings, wheel or track slip may be calculated.

Rubber tyred tractors are tested on a bitumen road so that surface conditions do not change during a test or between tests. Track tractors are tested on soil when soil conditions are favourable to the tractor.

INTERPRETING THE TEST RESULTS

In pre-war days, the publication of test data often evoked the reply that only an engineer could understand the results. Today, far more people can interpret the figures, but they are still apt to be puzzling to the layman. Possibly these brief notes may be of some assistance.

Actually, if one has the knowledge of test procedure and some acquaintance with the meaning of such terms as horsepower pull, power and speed, the reading of a report is quite simple.

With tractors, three different h.p. ratings are generally used:

These are:—(a) Brake Horsepower; (b) Belt Horsepower and (c) Drawbar Horsepower.

Brake horsepower is the power developed by the tractor engine, but the power available for stationary work is obtained through the belt pulley. This is the belt horsepower and is a little less than the brake horsepower. All tractor tests use belt horsepower.

What every practical farmer wants to know however, is the horsepower available at the drawbar—because this is the working horsepower of the tractor.

It can be seen therefore, that in choosing a tractor one must check two important horsepower ratings—belt and rated drawbar.

Provided a tractor motor is in good condition, the belt horsepower will remain constant, but drawbar horsepower will vary according to soil conditions, the overall weight of the tractor in comparison to its horsepower and the resultant wheel slippage. Drawbar horsepower ratings are vitally important, because they give you the actual useable horsepower of the
tractor. For instance, irrespective of what brake horsepower a tractor may be, there are limits to what power can be transmitted to the drawbar effectively, due to the loss of traction through wheel slippage. Once a tractor rises above the 45 h.p. maximum belt h.p. grouping, wheel slippage increases and the economic driving power of the unit is decreased unless dual tyres are used, but here again cost increases. What the practical farmer must bear in mind is to avoid over capitalisation of plant and try to achieve economy of operation, which in many cases is most effectively done by the units with a top belt horsepower of no more than 45, and a low wheel slippage in working gear.

Drawbar horsepower consists essentially of the two factors pull and speed, which together result in power. Pull therefore is not the same as power and should not be confused with it. A tractor is often described as having plenty of power when in fact what is meant is that it has a big pull.

In six speed tractors, the greatest horsepower is usually found in the third and fourth gear, except in the case of crawlers where it is generally found in second gear.

Belt and drawbar performance tests are vitally important and so of course is fuel consumption.

Tests for fuel consumption can be shown by:

A—The total hourly consumption in gallons.
B—The specific fuel consumption in lb. or pints per horsepower per hour.

The first test is self-explanatory. The second relates to the consumption over a period of one hour to the horsepower developed. If an engine while developing 28 h.p. used 14 lb. of fuel in one hour, then it will use 14/28ths lb. or 0.5 lb. per hour for each horsepower developed.

If an engine while developing this 28 h.p. only uses 12 lb. of fuel in one hour, then it will use 12/28ths lb. or 0.43 lb. per hour for each h.p. developed. The second engine is therefore more efficient.

Under this method, engines of any horsepower while using the same fuel, and running under identical conditions can be compared with one another.

Test reports of a number of tractors already tested may be obtained by writing to the Tractor Testing Committee, c/o Department of Commerce and Agriculture, 301 Flinders Lane, Melbourne, Victoria.

A brief summary of the reports is given in the table accompanying this article.

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**A TRACTOR DIRECTORY**

The Food and Agriculture Organisation of the United Nations has recently produced a directory of the wheeled and crawler tractors manufactured throughout the world.

The book is a weighty volume of cyclostyled sheets giving the name, address and country of origin of all the leading manufacturers, with details of the various models.

Overall length, width, weight, ground clearance, turning radius, size of tyres and tyre pressures, make and type of engine, type of fuel used, fuel consumption, horsepower, maximum drawbar pull, speeds in various gears and other details are given in columns.

The book is printed in English, French and Spanish, and may be obtained from the Food and Agriculture Organisation of the United Nations, Rome, Italy, at a cost of 15s.
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