# TESTING OF DRAWBAR POWER FOR TILLAGE IMPLEMENTS

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## Introduction

**Agricultural Research Council** – Institute for Agricultural Engineering (ARC – IAE) in partnership with Grain SA and NWK tested tillage implements over the period September 2010 to March 2011 with financial assistance from The Maize Trust. The tests were done in Lichtenburg, Koster and Mareetsane on sandy, sand loamy and clay loamy soils. The whole purpose of the field tests was to update a manual called "Guide to Machinery Costs" updated annually by the Department of Agriculture, hence only new machinery not in the old manual was tested. The implements include, offset disc harrow, rippers, paraplough, chisel plough and rolling stalk chopper (rolmoer). Over the years, the manual has proved very useful in farm machinery management hence contributing to the economic viability of farm operations. The manual will be readily available on the Department of Agriculture website: http://www.daff.gov.za.

## Testing methodology

Engine power tests at 540 rpm and 1000 rpm were done using a fixed electrical dynamometer in the laboratory to determine the relationship between fuel consumption and engine power output through regression analysis. The fuel consumption recorded during field tests was then correlated to the engine power results from laboratory tests.

In the field, the implements were hitched to the 3 point linkage dynamometer for recording the drawbar power of the implement through radio communication to the mobile testing unit (Fig. 1). The mobile testing unit includes a computer with a TCE software for processing all data from the data logger installed on the tractor (Fig. 2). Finally, ncode software installed with Glyphworks was used for producing a report of the test results (Fig. 3)

## Results and discussion

On average, 50 % of the engine power was used for draw bar power and Super 25 ripper (1.5 meter width, 3 tine with 19° full "hamerkop" shares) gave the highest engine power requirements of 100 kW. The trailed 2 meter rolling stalk chopper (rolmoer) had the least power requirements of 24 kW.

For same implements tested in sandy soils and clay loamy soils, the latter always gave higher engine power requirements (14 % higher) even though the soil moisture content was 2 % (wet basis) higher in the clay loamy soils.

**Fig 1. Dynamometer linked to implement.**

The results from sandy loam soils did not show any clear relationship to the other 2 soils. Engine power output is very important in determining the size of tractor for pulling the implements.

The following factors are crucial in influencing drawbar power results: speed, soil type, moisture content, wheel slip, working depth, working width and size of implement hence a simple comparison of all the implements is not possible. The implements were tested under normal farm operating conditions hence parameters like speed, width and depth differed making any simple comparison for different implements difficult.

## Conclusion

The information obtained from the tests will be very important for the "Guide to Machinery Costs" updated annually by the Department of Agriculture. Such information on performance of the new machinery in terms of field capacity, fuel consumption, drawbar power requirements is very important in helping the farmer make an informed decision on selection of machinery suitable to particular circumstances. For farming to be sustainable, the farming enterprise has to be economically viable.

Further tests are also important to establish the effect of speed, soil type, moisture content, wheel slip, working depth and working width on draw bar power for each implement under different conditions.

**Fig 2: Mobile testing unit**

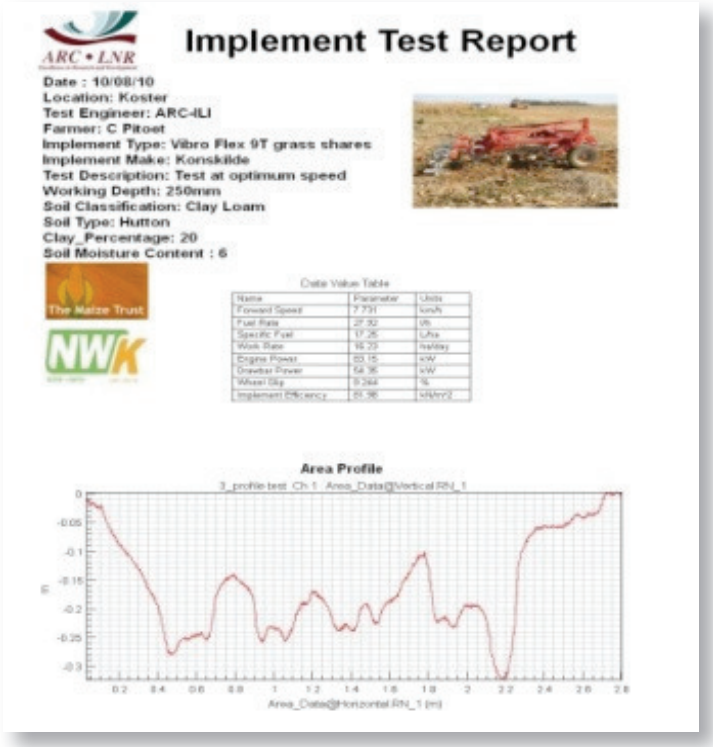


**Fig 3: Test report from n code software**