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Using Tractor Test Data for Selecting Farm Tractors

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Introduction

The Nebraska Tractor Test Laboratory (NTTL) at the University of Nebraska is the official U.S. tractor-testing station for the Organization for Economic Cooperation and Development (OECD). This laboratory is responsible for testing a representative tractor of each model sold in the state of Nebraska. It also tests tractors manufactured in the United States and sold in international markets. The laboratory publishes the results of all tests conducted. The test reports published by NTTL can be extremely useful for selecting tractors or for comparing the performance of different makes and models of tractors. For example, when farmers are in the market for a tractor, the performance data in the test reports can be used to select a tractor that will meet their needs. Similarly, these reports can serve as an effective tool for making tractor sales. Dealership personnel can use the performance data to compare their products to those of their competitors.

For either application, familiarity with the content of the test reports and the know-how to use the information effectively are essential. Therefore, this fact sheet was developed with the following two specific objectives:

1. To familiarize farmers and other users with tractor testing and the Nebraska test reports.
2. To demonstrate the use of tractor-test reports for the selection and performance comparison of farm tractors.

Nebraska Tractor Test Laboratory

The Nebraska Tractor Test Laboratory is a member of the Organization for Economic Cooperation and Development, along with testing laboratories in 27 other countries. The organization recommends that all tractors manufactured in member countries be tested in the country where they are manufactured, following its guidelines. Based on an established agreement between member countries, test reports approved by OECD are accepted by all participating countries.

Tractor Test

The purpose of the tests is to collect data that can be used to assess the performance of tractors of different makes and models. For this reason, all tests are conducted under the same or similar test conditions and procedures. Tractor tests are generally conducted to assess the power-takeoff (PTO) performance, drawbar performance, hydraulic-lift capacity, and hydraulic-system pressure and flow. In addition, sound-level measurements are taken at operator and bystander locations.

PTO-performance tests are conducted with a dynamometer attached to the tractor PTO. The purpose of the dynamometer is to apply varying loads through the PTO and to measure the power generated by the tractor. These tests (figure 1) are conducted at an ambient temperature of 75 degrees and a barometer reading above 28.5 inches of mercury. During tests, when the tractor performance has stabilized, the data is recorded at predetermined intervals.

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Figure 1. A tractor being tested on the PTO dynamometer. The test apparatus in the foreground is measuring fuel flow.

The load applied by the dynamometer follows the operating curve of the engine at full throttle. Data collected include torque, rpm, power, and fuel consumption. A series of PTO tests are conducted at rated engine speed, standard PTO speed (either 1000 rpm or 540 rpm), engine speed where maximum power is produced, varying load, and maximum torque.

Drawbar-performance tests (figures 2 and 3) are conducted in all gears between a lower gear below the one which provided maximum drawbar force (without exceeding a wheel slip of 15 percent) and a maximum speed of 10 miles per hour. In each gear, at full throttle, the load is increased until maximum drawbar power is achieved. Engine-speed, wheel-slip, and fuel-consumption data are recorded when test conditions are stabilized.

Drawbar tests are also conducted with partial loads at 75 percent and 50 percent of the maximum drawbar load (at rated engine speed). These partial-load tests are also conducted at reduced engine speeds (selected by the manufacturer).

Hydraulic-lift capacity and flow tests are conducted to determine the maximum lift capacity of a hydraulic system through the full lift range. The lift capacity in the report is 90 percent of the maximum load carried through the full lift range.

Additional tests are also conducted to determine the pressure-flow relationship of the hydraulic system for supplying power to external actuators (such as motors or cylinders). Reports include data on delivery rate, pressure, and available power.

Sound-level measurements during performance tests are taken at operator and bystander locations. For the bystander measurement, readings are taken by locating the microphone 25 feet from the centerline of the tractor. Sound levels are recorded using the "A" scale in the sound-level meter and are expressed in terms of decibels (A) or dB(A). The A scale is a filter that responds like a human ear.

Nebraska Test Reports

Nebraska law mandates that NTTL publish the test results on all tractors sold in the state of Nebraska – which may include tractors tested by NTTL or by one of the other OECD partners. A full OECD report is gen-

Figure 2. The lead tractor is being tested on the track during drawbar-performance tests. The two vehicles in tow are load units.

Figure 3. A tractor running on the test course. The drawbar-performance test is being performed.

erally 30 pages long. The Nebraska Tractor Test Laboratory summarizes and publishes the test results in two formats (to order, see contact information before the acknowledgments section).

1. The first format is a booklet (4 inches by 6.5 inches) published annually with limited performance data on all tractors available for sale in Nebraska that year. The summary booklet includes approximately 400 tractor models from different manufacturers.

2. The second format is a more detailed report (typically two pages to six pages in length), covering individual tractor test results.

Samples of both reports are included in appendixes A and B, respectively, and they are discussed in the following paragraphs.

The cover page and a typical page from the summary booklet are exhibited in appendix A. The cover page (app. A.1) provides the year in which the tractors were tested and the name and address of the manufacturer. A typical page in the summary booklet (app. A.2) provides the summary of test results of two or three tractors from a manufacturer (in this case, from New Holland). The summary includes information on tractor model, limited engine and chassis specifications, PTO- and drawbar-performance data, sound level, three-point lift capacity, and hydraulic-system parameters. The summary booklets are particularly useful for an initial review of the performance of tractors of different sizes, produced by different manufacturers.

When the initial review generates interest in a particular tractor model, such as New Holland's model TS135A (app. A.2, col. 3), the user can obtain a summary report specific to that model tractor (the second report format). A copy of this detailed report specific to model TS135A is shown in appendix B.

The first page of the summary report (app. B.1) provides information on test number, make and model of tractor tested, and transmission. It also includes results of PTO- and drawbar-performance tests, in addition to tractor specifications in a column located on the right side of the page. Fuel consumption is reported in three different ways: gal./hr., lb./hp-hr., and hp-hr./gal. Fuel consumption expressed in terms of hp-hr./gal. is useful for comparing fuel consumption of tractors of different sizes. PTO tests at varying power levels simulate a wide range of field operations using the tractor.

The drawbar-performance data at the bottom of the first page of appendix B often continues to the next page. This data includes drawbar power and pull, forward speed, wheel slip, engine speed, fuel consumption, temperature, and relative humidity conditions at maximum, 75-percent, and 50-percent pull at maximum power. The tests at reduced engine speed also include similar data at various travel speeds.

Power measured at 75 percent of pull at maximum power may represent a typical operation with heavy loads, such as primary tillage. At 75-percent pull, the tractor may still have some reserve power to overcome unexpected overload situations. The average fuel consumption at 75-percent and 50-percent pull may represent tillage and seeding operations, respectively, on small-grain farms. Similarly, the average fuel consumption at the 50-percent pull tests can serve as a good estimate of fuel consumption when tractors are used in row-crop farming. This distinction between small-grain and row-crop production is made because more efficient tractor-implement matching is possible for small-grain production. For small-grain applications, selection of implements to utilize the available tractor power can be accomplished more easily. However, the same conclusion may not be true in the case of row-crop implements.

Tractor tests are conducted on hard surfaces – concrete or asphalt tracks – for consistency between tests. Therefore, the performance data recorded during these tests can be significantly better than what can be expected under normal field conditions. At the bottom of appendix B.2, sound level, tire, and weight information are provided. Tractor sound level at the operator's ear location is critical because the Occupational Safety & Health Administration has strict sound level and exposure-time regulations. For example, OSHA permits an eight-hour exposure period if the sound level in the work area is 90 dB(A). A 3-dB(A) increase in sound level doubles the sound-pressure level. Therefore, for every 5-dB(A) increase in sound level, the permissible exposure time is cut in half. In other words, at 95 dB(A), the allowable exposure time is only four hours. It is not uncommon to have tractor sound-level reaching 95 dB(A).

If the tractor tested has front-wheel assist, additional drawbar tests with the front-wheel assist disengaged may follow. The last page of the report (app. B.3) is devoted to three-point hitch performance data, hydraulic-system parameters, and hitch dimensions.

Published tractor-test results can also be used for estimating annual fuel consumption by knowing how the tractors are used during the year (see *Predicting Tractor Fuel Use*, Virginia Cooperative Extension publication 442-073, for more details). This information is particularly useful for budgeting and management purposes.

Fuel savings are possible with practices such as "gear-up and throttle-down." The drawbar-performance data (app. B.1) documents the fuel savings possible with the practice of gear-up and throttle-down for light-load conditions (for more details of using this technique, see *Gear Up and Throttle Down – Saving Fuel*, Virginia Cooperative Extension publication 442-450). The drawbar-performance categories that include the phrase "at reduced engine speed" can be compared with the tests conducted at full throttle at the same load level. The specific fuel consumption (hp-hr./gal.) for the at-reduced-engine-speed tests will always be more efficient than the values for the full throttle with the difference being expected fuel savings.

Depending on the engine design and other controlling factors, the gear-up and throttle-down technique can provide fuel savings in the range of 15 percent to 30 percent. For the tractor operating at 50-percent load (app. B.1), the potential savings is about 16 percent (11.67 hp-hr./gal. from the reduced throttle versus 10.05 hp-hr./gal. at full throttle). The annual fuel savings from the use of this technique can be estimated by multiplying the total number of hours the tractor is used annually for light-load operations, by the fuel consumption difference.

Using the Test Reports for Tractor Selection

Many factors are taken into consideration in the selection and purchase of a new tractor. These may include factors such as: types of jobs to be performed, price, proximity and reputation of the dealership, desired power output at the drawbar and PTO, hydraulic-system capacity, and fuel efficiency. The tractor-test reports can play an important role in the decision-making process. Both summary booklets and summary reports on individual tractors are useful in selecting tractor models or for evaluating and comparing performance of different tractor models.

The first step in the tractor selection process is to evaluate the need that exists. Depending upon the needs identified, the purchaser should estimate the power requirements at the PTO and drawbar. Knowing the power requirements, the next step is to identify tractor models that are capable of providing the required output power. This list may include tractors from different manufacturers if more than one dealership is located nearby.

Once the tractor models that meet the power requirements are identified, the next step in the selection process is to compare their performance data. This comparison can be accomplished by preparing a table similar to appendix A.2. The first column of this table may include the performance variables listed in appendix A.2, plus any other variables that are pertinent to the selection process. The number of additional columns will depend on the number of tractor models identified during initial screening. The data for each column can be extracted from the test reports. This table allows easy comparison among several tractor models.

The tractor information available in the summary reports may be used for the final selection. Factors such as stability, tire size, tractor configuration (two-wheel drive, front-wheel assist, four-wheel drive), repair frequency, proximity and reputation of dealership, and price may be considered in the final selection.

To illustrate the step-by-step procedure for selecting a tractor using the Nebraska tractor-test data, consider the following hypothetical example. Assume farmer Jeff Smith from southwest Virginia is interested in selecting a new tractor for his orchard/vegetable opera-

tion. To select the tractor for this operation, follow the step-by-step procedure established earlier.

Step 1. Evaluate the need and estimate the power requirement. Jeff considered all the different operations that need to be carried out using the new tractor during the year. He estimated that the new tractor should have a minimum-rated PTO power of 70 horsepower.

Step 2. Identify all tractor models meeting the power requirement. A review of Nebraska and OECD Tractor Test Data for 2007 summary booklet (MP-37) showed that 17 different tractor models meet the power requirement.

Step 3. Prepare a table to compare the performance data of tractors identified. Table 1 summarizes the performance data of the 17 tractor models identified from the summary booklet.

Table 1. Summary of tractors in the 70 hp to 80 hp (rated PTO-power) range.

Manufacturer	Model	Test #	2WD FWA[1]	Trans[2]	E N G[3]	Rated power (hp)	Fuel use[4]	Draw test[5]	Sound test dB(A)[6]		HYDR test[7]
AGCO	GT75A	1850	FWA	16-M	T	76.31	15.67	NA	77.3	NA	11.7
	LT75A	1883	FWA	16-PS	T	78.41	15.48	NA	74.9	81.0	25.1
Case–IH	JX1085	571	2WD FWA	16-M	A	71.7	15.08	PART	77.9	82.1	12.7
	JX1080	529	2WD FWA	12-M	A	71.6	14.71	PART	79.3 79.1	86.0 85.5	16.4
	JX85	462	2WD FWA	12-M	T	78.4	17.11	FULL	88.2* 88.4*	NA NA	15.6
Challenger	MT445B	515	2WD FWA	16-PS	T	70.7	14.16	FULL	77.3 77.3	88.2 NA	15.6
	MT455B	516	2WD FWA	16-PS	T	80.2	15.37	FULL	75.2 75.3	88.3 NA	15.6
John Deere	5652	1869	FWA	9-M	T	76.01	14.13	NA	85.8	83.3	18.6
	6215	481	FWA	16-M	TI	74.5	14.73	FULL	70.5	NA	17.8
	6220	385	FWA	24-PQ	T	75.8	15.63	FULL	71.0	NA	31.1
Massey Ferguson	583	1865	2WD	8-M	A	73.61	15.06	NA	94.4*	NA	11.0
	593	1851	FWA	12-M	T	78.81	15.92	NA	94.7*	87.6	10.0
	5445	511	2WD FWA	16-PS	T	70.7	14.16	FULL	77.3 77.3	88.2 NA	15.6
	5455	512	2WD FWA	16-PS	T	80.2	15.37	FULL	75.2 75.2	88.3 NA	15.6
McCormick	CX85	327	FWA	16-PS	T	71.3	15.18	FULL	78.0	NA	16.5
	CX95	328	FWA	16-PS	T	79.7	16.04	FULL	77.0	NA	17.0
New Holland	TL80A	524	2WD FWA	12-M	A	71.4	14.65	PART	79.0 79.0	85.5 85.5	16.5

Source: Data taken from the Nebraska and OECD Tractor Test Data for 2007 summary booklet (MP-37).

[1] Chassis type: 2WD = two-wheel drive, FWA = front-wheel assist

[2] Transmission–number of gears: M = manual, PS = power shift, PQ = power quad

[3] Engine accessories: A = naturally aspirated, T = turbocharged, I = intercooled

[4] Specific fuel consumption, hp-hr./gal.

[5] Drawbar test completed? NA = no data, PART = incomplete data, FULL = all data

[6] Sound test: first column is sound at operator's ear, second column is 25 feet away (bystander)

[7] Hydraulic flow in GPM, may be max flow from a single outlet; others may be from all ports

* Without a cab; otherwise the tractor is equipped with a cab

Final selection of a tractor model depends on many other factors such as cost, personal preference, dealership location, safety features, fuel consumption, sound-level readings, and hydraulic-system capacity. For example, two service centers/dealerships (Case-IH and John Deere) are located within 20 miles of Jeff's farm. If proximity of dealership is important to Jeff, the list is reduced to six models from Case-IH and John Deere. With the list narrowed to six tractor models, the final selection may be made taking the factors listed earlier into consideration. Free summary reports for tractors tested since 1999 can be found at: *http://tractortestlab.unl.edu/testreports.htm*; in this example, all summary reports are available at this website in Adobe format.

Conclusions

The proper selection and sizing of a tractor is important to the economic viability and sustainability of farms in Virginia. This fact sheet introduces users to the Nebraska tractor tests and test reports. A step-by-step procedure for selecting a farm tractor using published tractor-test reports has been developed and demonstrated.

Additional Reading Materials

Grisso, R., and R. Pitman. *Gear Up and Throttle Down – Saving Fuel*. Virginia Cooperative Extension Publication 442-450, posted October 2001 *http://pubs.ext.vt.edu/442-450/442-450.html*

Grisso, R., and R. Pitman. *Five Strategies for Extending Machinery Life*. Virginia Cooperative Extension Publication 442-451, posted January 2002 *http://pubs.ext.vt.edu/442-451/442-451.html*

Grisso, R., D. Vaughan, R. Pitman, and G.T. Roberson. *Predicting Tractor Fuel Use*. Virginia Cooperative Extension Publication 442-073 (In review)

For tractor-test information, contact:

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Appendix A.1. Nebraska Tractor Test Summary Booklet Cover

MP 37

TTL 2-07

Nebraska and OECD Tractor Test Data for 2007

containing test data through December 2006

Nebraska Tractor Test Laboratory
Roger M. Hoy, Director

Institute of Agriculture
& Natural Resources
Agricultural Research Division

University of Nebraska–Lincoln

Appendix A.2. Nebraska Tractor Test Summary Booklet Sample Page

NEW HOLLAND

TRACTOR MODEL	TS 125A Dsl (FWA)	TS 135A Dsl (2WD)	TS 135A Dsl (FWA)
Transmission	24 speed Pwrshift	16 speed Pwrshift	16 speed Pwrshift
NEBR SUM NO (Yr tested)	499 (2005)	500 (2004)	500 (2004)
ENGINE	Turbo-Intr	Turbo-Intr	Turbo-Intr
Bore and Stroke ... in.	4.094x5.196	4.094x5.196	4.094x5.196
" " " ... *(mm)*	*(104.0x132.0)*	*(104.0x132.0)*	*(104.0x132.0)*
No. of Cylinders	6	6	6
Displacement ... cu in *(ml)*	410 *(6728)*	410 *(6728)*	410 *(6728)*
Rated RPM	2200	2200	2200
Compression Ratio	17.0 to 1	17.0 to 1	17.0 to 1
CHASSIS	Front	Front	Front
Type	Whl Assist	Whl Assist	Whl Assist
Tires: No., Size, Ply ... front	2; 480/65R28;**	2; 480/65R28;**	2; 480/65R28;**
rear	2; 600/65R38;**	2; 600/65R38;**	2; 600/65R38;**
Weight as tested ... lbs *(kg)*	12230 *(5548)*	12185 *(5527)*	12185 *(5527)*
PTO PERFORMANCE			
Max Pwr @ Rated Eng RPM .... HP	109.4@2200	114.5@2199	114.5@2199
" " " " " " ... *(kW)*	*(81.6)*@2200	*(85.4)*@2199	*(85.4)*@2199
PTO RPM	1036	1037	1037
Fuel: Gal/hr *(l/h)*	6.65 *(25.17)*	7.19 *(27.22)*	7.19 *(27.22)*
Hp. hr/gal *(kWh/l)*	16.45 *(3.24)*	15.93 *(3.14)*	15.93 *(3.14)*
Max Pwr @ Std PTO RPM ... HP	113.6@1000	120.1@1000	120.1@1000
" " " " " " .... *(kW)*	*(84.7)*@1000	*(89.6)*@1000	*(89.6)*@1000
Eng RPM	2123	2120	2120
Fuel: Gal/hr *(l/h)*	6.64 *(25.14)*	7.21 *(27.29)*	7.21 *(27.29)*
Hp. hr/gal *(kWh/l)*	17.11 *(3.37)*	16.65 *(3.28)*	16.65 *(3.28)*
Maximum Torque rise % @ Engine RPM	49@1406	49@1398	49@1398
DRAWBAR PERFORMANCE			
Max HP (Short Term) ... @mph	100.7@6.36	106.5@8.74	106.6@4.49
" *kW* " " ... *(km/h)*	*(75.1@10.23)*	*(79.4@14.06)*	*(79.5@7.23)*
100% Load ... HP@mph	88.5@4.48	91.3@4.10	94.4@4.28
" " ... *(kW@km/h)*	*(66.0@7.21)*	*(68.1@6.60)*	*(70.4@6.88)*
Fuel: ... HP hr/gal *(kWh/l)*	13.20 *(2.60)*	12.89 *(2.54)*	13.50 *(2.66)*
75% Load ... HP@mph	68.9@4.65	73.4@4.40	74.0@4.47
" " ... *(kW@km/h)*	*(51.4@7.49)*	*(54.7@7.08)*	*(55.2@7.20)*
Fuel: ... HP hr/gal *(kWh/l)*	12.39 *(2.44)*	11.93 *(2.35)*	12.14 *(2.39)*
50% Load ... HP@mph	47.1@4.76	50.5@4.52	50.7@4.58
" " ... *(kW@km/h)*	*(35.1@7.66)*	*(37.7@7.27)*	*(37.8@7.37)*
Fuel: ... HP hr/gal *(kWh/l)*	9.44 *(1.86)*	9.90 *(1.95)*	10.05 *(1.98)*
50% Load ... HP@mph	47.1@4.78	50.6@4.53	50.7@4.60
" " ... *(kW@km/h)*	*(35.1@7.69)*	*(37.7@7.29)*	*(37.8@7.40)*
Reduced Eng RPM	1980	2055	2052
Fuel: ... HP hr/gal*(kWh/l)*	11.98 *(2.36)*	12.03 *(2.37)*	11.67 *(2.30)*
Max Pull: ... lbs@mph	12770@1.17	8565@1.32	11755@2.00
" " ... *(kN@km/h)*	*(56.8@1.89)*	*(38.1@2.12)*	*(52.3@3.21)*
MAXIMUM SOUND LEVEL	w/o cab w/cab	w/cab	w/cab
At Operator's Ear ... dB(A)	84.0 69.0	72.0	73.0
Bystander ... dB(A)	....	....	....
THREE POINT LIFT			
Force available @ 24" *(610 mm)* ... lbs *(kN)*	5485 *(24.4)*	9530 *(42.4)*	9530 *(42.4)*
HYDRAULIC FLOW			
Gal/min *(l/min)*	21.8 *(82.5)*	26.2 *(99.0)*	26.2 *(99.0)*

Note: This summary shows three tractors from manufacturer New Holland.

Appendix B.1. Sample First Page From a Summary Tractor-Test Report

SUMMARY OF OECD TEST 2203–NEBRASKA SUMMARY 500
NEW HOLLAND TS135A DIESEL
16 SPEED

POWER TAKE-OFF PERFORMANCE

Power HP (kW)	Crank shaft speed rpm	Gal/hr (l/h)	lb/hp.hr (kg/kW.h)	Hp.hr/gal (kW.h/l)	Mean Atmospheric Conditions
MAXIMUM POWER AND FUEL CONSUMPTION					
Rated Engine Speed—(PTO speed—1037 rpm)					
114.5 (85.4)	2199	7.19 (27.22)	0.443 (0.269)	15.93 (3.14)	
Standard Power Take-off Speed (1000 rpm)					
120.1 (89.6)	2120	7.21 (27.29)	0.424 (0.258)	16.65 (3.28)	
Maximum Power (2 hours)					
127.4 (95.0)	1900	7.17 (27.13)	0.397 (0.241)	17.77 (3.50)	
VARYING POWER AND FUEL CONSUMPTION					
114.5 (85.4)	2199	7.19 (27.22)	0.443 (0.269)	15.93 (3.14)	Air temperature
100.0 (74.6)	2257	6.58 (24.92)	0.464 (0.282)	15.19 (2.99)	73°F (23°C)
76.4 (57.0)	2298	5.49 (20.78)	0.507 (0.308)	13.92 (2.74)	Relative humidity
51.6 (38.5)	2326	4.41 (16.68)	0.602 (0.366)	11.72 (2.31)	56%
26.0 (19.4)	2358	3.28 (12.42)	0.888 (0.540)	7.94 (1.57)	Barometer
-- --	2372	2.31 (8.74)	-- --	-- --	29.8" Hg (101.0 kPa)

Maximum Torque - 408.2 lb.-ft. (553.4 Nm) at 1398 rpm
Maximum Torque Rise - 49.1%
Torque rise at 1800 engine rpm - 34%

DRAWBAR PERFORMANCE
(Unballasted - Front Drive Engaged)
FUEL CONSUMPTION CHARACTERISTICS

Power Hp (kW)	Drawbar pull lbs (kN)	Speed mph (km/h)	Crank-shaft speed rpm	Slip %	Fuel Consumption lb/hp.hr (kg/kW.h)	Fuel Consumption Hp.hr/gal (kW.h/l)	Temp.°F (°C) cool-ing	Temp.°F (°C) Air dry bulb	Barom. inch Hg (kPa)
Maximum Power—7th (1C) Gear									
94.4 (70.4)	8275 (36.8)	4.28 (6.88)	2199	4.5	0.523 (0.318)	13.50 (2.66)	180 (82)	66 (19)	30.1 (101.9)
75% of Pull at Maximum Power—7th(1C) Gear									
74.0 (55.2)	6205 (27.6)	4.47 (7.20)	2279	3.5	0.581 (0.353)	12.14 (2.39)	180 (82)	66 (19)	30.1 (101.9)
50% of Pull at Maximum Power—7th(1C) Gear									
50.7 (37.8)	4145 (18.4)	4.58 (7.37)	2310	2.8	0.702 (0.427)	10.05 (1.98)	180 (82)	66 (19)	30.1 (101.9)
75% of Pull at Reduced Engine Speed—8th(3B) Gear									
74.3 (55.4)	6215 (27.6)	4.48 (7.21)	2020	3.6	0.551 (0.335)	12.79 (2.52)	178 (81)	72 (22)	30.1 (101.9)
50% of Pull at Reduced Engine Speed—8th(3B) Gear									
50.7 (37.8)	4135 (18.4)	4.60 (7.40)	2052	2.5	0.604 (0.368)	11.67 (2.30)	178 (81)	72 (22)	30.1 (101.9)

Location of Test: Silsoe Research Institute, Wrest Park, Silsoe, MK45 4HS, United Kingdom

Dates of Test: June to August, 2004.

Manufacturer: CNH U.K. Ltd., Basildon, Essex, SS14 3AD, England

FUEL and OIL: Fuel No. 2 Diesel **Specific gravity converted to 60°/60°F *(15°/15°C)*** 0.847 **Fuel weight** 7.04 lbs/gal *(0.8453 kg/l)* **Oil SAE** 10W30 **API service classification** CH-4 **Transmission and hydraulic lubricant** New Holland 410B fluid **Front axle lubricant** New Holland 410B fluid

ENGINE: Make CNH Diesel **Type** six cylinder vertical with turbocharger and air to air intercooler **Serial No.** 00066631 **Crankshaft** lengthwise **Rated engine speed** 2200 **Bore and stroke** 4.094" x 5.196" *(104.0 mm x 132.0 mm)* **Compression ratio** 17.0 to 1 **Displacement** 410 cu in *(6728 ml)* **Starting system** 12 volt **Lubrication** pressure **Air cleaner** two paper elements and aspirator **Oil filter** one full flow cartridge **Oil cooler** engine coolant heat exchanger for crankcase oil, radiator for hydraulic and transmission oil **Fuel filter** one paper element **Muffler** vertical **Cooling medium temperature control** thermostat and variable speed fan

CHASSIS: Type front wheel assist **Serial No.** 209584 **Tread width** rear 68.1" *(1730 mm)* to 83.9" *(2130 mm)* front 64.2" *(1630 mm)* to 81.9" *(2080 mm)* **Wheelbase** 104.4" *(2652 mm)* **Hydraulic control system** direct engine drive **Transmission** selective gear fixed ratio with partial (4) range operator controlled powershift **Nominal travel speeds mph *(km/h)*** first 1.42 *(2.28)* second 1.73 *(2.78)* third 2.11 *(3.40)* fourth 2.58 *(4.15)* fifth 3.32 *(5.35)* sixth 4.06 *(6.53)* seventh 4.39 *(7.07)* eighth 4.96 *(7.98)* ninth 5.36 *(8.63)* tenth 6.06 *(9.75)* eleventh 6.56 *(10.56)* twelfth 8.02 *(12.90)* thirteenth 10.32 *(16.60)* fourteenth 12.60 *(20.28)* fifteenth 15.41 *(24.80)* sixteenth 18.83 *(30.30)* reverse 1.40 *(2.25)*, 1.71 *(2.75)*, 2.09 *(3.37)*, 2.55 *(4.10)*, 3.28 *(5.28)*, 4.01 *(6.45)*, 4.34 *(6.98)*, 4.90 *(7.89)*, 5.30 *(8.53)*, 5.99 *(9.64)* 6.48 *(10.43)*, 7.92 *(12.75)*, 10.20 *(16.41)*, 12.46 *(20.05)*, 15.23 *(24.51)*, 18.60 *(29.94)* **Clutch** multiple wet disc electro-hydraulically operated by foot pedal **Brakes** wet disc hydraulically operated by two foot pedals that can be locked together **Steering** hydrostatic **Power take-off** 540 rpm at 1969 engine rpm or 1000 rpm at 2120 engine rpm **Unladen tractor mass** 12020 lb *(5452 kg)*

Source: From the report of Nebraska OECD Tractor Test 2203 – Summary 500 for New Holland model TS135A.

Note: The top section shows the title box, the left-hand side shows the PTO-performance tests (top), the varying-power tests (center), and the drawbar-performance test (bottom) results. The column on the right has test conditions and tractor specifications.

Appendix B.2. Sample Second Page From a Summary Tractor Test Report

DRAWBAR PERFORMANCE

(Unballasted - Front Drive Engaged)
MAXIMUM POWER IN SELECTED GEARS

Power Hp *(kW)*	Drawbar pull lbs *(kN)*	Speed mph *(km/h)*	Crank-shaft speed rpm	Slip %	Fuel Consumption lb/hp.hr *(kg/kW.h)*	Hp.hr/gal *(kW.h/l)*	Temp.°F(°C) cool-ing med	Air dry bulb	Barom. inch Hg *(kPa)*
				3rd(3A) Gear					
62.6 *(46.7)*	11755 *(52.3)*	2.00 *(3.21)*	2292	10.9	0.637 *(0.388)*	11.07 *(2.18)*	181 *(83)*	70 *(21)*	30.1 *(101.9)*
				4th(4A) Gear					
73.9 *(55.1)*	11400 *(50.7)*	2.43 *(3.91)*	2277	10.8	0.577 *(0.351)*	12.23 *(2.41)*	181 *(83)*	70 *(21)*	30.1 *(101.9)*
				5th(1B) Gear					
92.7 *(69.1)*	11285 *(50.2)*	3.08 *(4.95)*	2203	9.2	0.538 *(0.327)*	13.11 *(2.58)*	180 *(82)*	70 *(21)*	30.1 *(101.9)*
				6th(2B) Gear					
103.7 *(77.3)*	11175 *(49.7)*	3.48 *(5.60)*	2034	8.9	0.483 *(0.294)*	14.62 *(2.88)*	178 *(81)*	70 *(21)*	30.1 *(101.9)*
				7th(1C) Gear					
104.3 *(77.8)*	10880 *(48.4)*	3.60 *(5.79)*	1902	7.0	0.486 *(0.295)*	14.53 *(2.86)*	178 *(81)*	66 *(19)*	30.1 *(101.9)*
				8th(3B) Gear					
104.6 *(78.0)*	9420 *(41.9)*	4.16 *(6.70)*	1911	5.2	0.471 *(0.286)*	14.99 *(2.95)*	176 *(80)*	68 *(20)*	30.1 *(101.9)*
				9th(2C) Gear					
106.6 *(79.5)*	8900 *(39.6)*	4.49 *(7.23)*	1900	4.7	0.459 *(0.279)*	15.38 *(3.03)*	178 *(81)*	68 *(20)*	30.1 *(101.9)*
				10th(4B) Gear					
106.2 *(79.2)*	7710 *(34.3)*	5.17 *(8.31)*	1920	4.3	0.479 *(0.291)*	14.72 *(2.90)*	176 *(80)*	72 *(22)*	30.1 *(101.9)*
				11th(3C) Gear					
104.2 *(77.7)*	6955 *(30.9)*	5.62 *(9.04)*	1921	3.8	0.493 *(0.300)*	14.31 *(2.82)*	178 *(81)*	68 *(20)*	30.1 *(101.9)*
				12th(4C) Gear					
102.7 *(76.6)*	5590 *(24.9)*	6.89 *(11.09)*	1915	3.2	0.506 *(0.308)*	13.95 *(2.75)*	176 *(80)*	68 *(20)*	30.1 *(101.9)*
				13th(1D) Gear					
102.9 *(76.7)*	4310 *(19.2)*	8.95 *(14.41)*	1923	2.7	0.498 *(0.303)*	14.16 *(2.79)*	176 *(80)*	68 *(20)*	30.1 *(101.9)*

REPAIRS AND ADJUSTMENTS: No repairs or adjustments.

NOTE: The manufacturer's claim of 115 PTO hp *(85.8 kW)* was met during the standard PTO speed test.

REMARKS: All test results were determined from observed data obtained in accordance with official OECD test procedures. This tractor did not meet the manufacturer's claims of: 62% PTO torque rise, 26.5 gpm *(100 lpm)* remote hydraulic flow nor 3 point lift capacity of 12185 lbs *(5527 kg)*. The performance figures on this summary were taken from a test conducted under the OECD Code II test procedure.

We, the undersigned, certify that this is a true summary of data from OECD Report No. **2203** Nebraska Summary 500, December 15, 2005.

Leonard L. Bashford
Director

M.F. Kocher
V.I. Adamchuk
J.A. Smith
Board of Tractor Test Engineers

TRACTOR SOUND LEVEL WITH CAB	Front Wheel Drive Disengaged dB(A)	Front Wheel Drive Engaged dB(A)
At no load in 7th (1C) gear	72.0	73.0
Bystander	--	--

TIRES AND WEIGHT	Tested Without Ballast
Rear tires - No.,size, ply & psi*(kPa)*	Two 600/65R38; **;10 *(70)*
Front tires - No.,size, ply & psi*(kPa)*	Two 480/65R28; **;10 *(70)*
Height of Drawbar	20.3 in *(515 mm)*
Static Weight with operator- Rear	7445 lb *(3378 kg)*
- Front	4740 lb *(2149 kg)*
- Total	12185 lb *(5527 kg)*

Source: From the report of Nebraska OECD Tractor Test 2203 – Summary 500 for New Holland model TS135A.

Note: Includes extended drawbar-performance tests, sound-test results, and the tires and weight sections.

Appendix B-3. Sample Third Page From a Summary Tractor Test Report

THREE POINT HITCH PERFORMANCE (OECD Static Test)

CATEGORY: II	
Quick Attach: No	
Maximum Force Exerted Through Whole Range:	9530 lbs *(42.4 kN)*
i) Opening pressure of relief valve:	NA
	variable disp. pump
Sustained pressure at compensator cutoff:	3105 psi *(214 bar)*
ii) Pump delivery rate at minimum pressure:	26.2 GPM *(99.0 l/min)*
iii) Pump delivery rate at maximum hydraulic power:	25.0 GPM *(94.5 l/min)*
Delivery pressure:	2610 psi *(180 bar)*
Power:	38.0 HP *(28.3 kW)*

THREE POINT HITCH PERFORMANCE

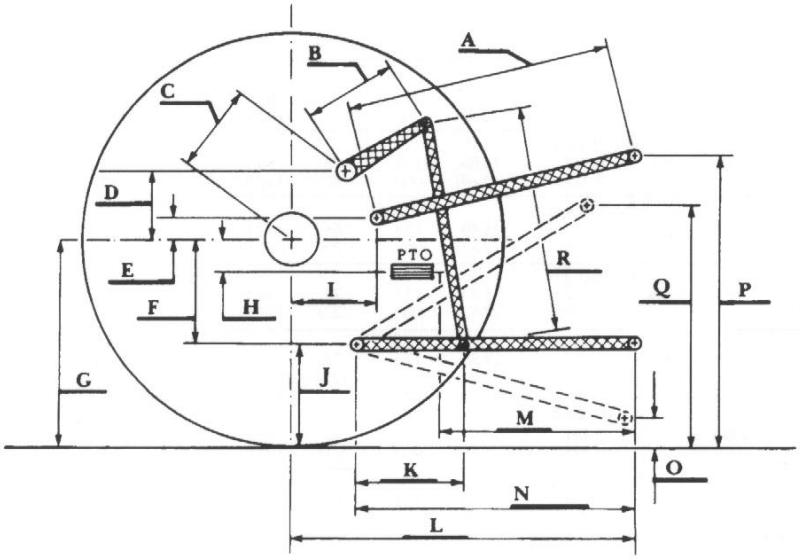
Observed Maximum Pressure psi. *(bar)*	3105 *(214)*
Location:	lift cylinder
Hydraulic oil temperature: °F *(°C)*	150 *(65)*
Location:	hydraulic sump
Category:	II
Quick attach:	none

SAE Static Test—System pressure 2685 psi *(185 Bar)* (two 90 mm cylinders)

Hitch point distance to ground level in. *(mm)*	7.7 *(195)*	15.6 *(395)*	23.0 *(585)*	30.3 *(770)*	36.2 *(920)*
Lift force on frame lb	14500	13510	12970	12455	11240
" " " " " " *(kN)*	*(64.5)*	*(60.1)*	*(57.7)*	*(55.4)*	*(50.0)*

HITCH DIMENSIONS AS TESTED—NO LOAD

	OECD test		SAE test	
	inch	*mm*	inch	*mm*
A	29.9	*760*	30.3	*770*
B	12.2	*310*	12.2	*310*
C	15.6	*395*	15.6	*395*
D	14.6	*370*	14.6	*370*
E	8.2	*208*	10.8	*275*
F	9.3	*235*	9.3	*235*
G	32.3	*820*	32.3	*820*
H	1.1	*28*	1.1	*28*
I	17.9	*455*	16.9	*430*
J	23.0	*585*	23.0	*585*
K	19.8	*502*	22.8	*580*
L	46.5	*1180*	46.5	*1180*
M	24.6	*625*	24.6	*625*
N	39.8	*1012*	39.8	*1012*
O	7.7	*195*	7.7	*195*
P	47.0	*1195*	42.0	*1068*
Q	35.4	*900*	33.1	*840*
R	32.3	*820*	35.0	*888*



Source: From the report of Nebraska OECD Tractor Test 2203 – Summary 500 for New Holland model TS135A.

Note: Includes the three-point hitch performance section and hitch dimensions section.