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Test 743: Case 731 (Diesel)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 743 - CASE 731 DIESEL

The University of Nebraska Agricultural Experiment Station

W. V. Lambert, Director, Lincoln, Nebraska

POWER TAKE-OFF PERFORMANCE

| Hp | Crank shaft speed rpm | Fuel Consumption Gal per hr | Lb per hp-hr | Hp-hr per gal | Temp Cool- ing med | Degrees F Air wet bulb | Air dry bulb | Barometer inches of mercury |
|--|--------------------------------|--------------------------------------|--------------------|---------------------|-----------------------------|---------------------------------|--------------------|-----------------------------------|
| MAXIMUM POWER AND FUEL CONSUMPTION | | | | | | | | |
| Rated Engine Speed—Two Hours | | | | | | | | |
| 56.43 | 1700 | 3.793 | 0.471 | 14.88 | 183 | 60 | 75 | 28.943 |
| VARYING POWER AND FUEL CONSUMPTION—TWO HOURS | | | | | | | | |
| 49.42 | 1751 | 3.235 | 0.459 | 15.28 | 168 | 60 | 74 | ..... |
| 0.00 | 1880 | 0.899 | ..... | ..... | 156 | 60 | 72 | ..... |
| 25.65 | 1818 | 2.033 | 0.556 | 12.62 | 161 | 60 | 75 | ..... |
| 56.55 | 1701 | 3.817 | 0.473 | 14.82 | 186 | 61 | 76 | ..... |
| 12.95 | 1839 | 1.506 | 0.815 | 8.60 | 160 | 61 | 76 | ..... |
| 37.71 | 1784 | 2.606 | 0.484 | 14.47 | 167 | 62 | 79 | ..... |
| Av 30.38 | 1795 | 2.350 | 0.542 | 12.93 | 166 | 60 | 75 | 28.945 |

DRAWBAR PERFORMANCE

| Hp | Draw- bar pull lbs | Speed miles per hr | Crank shaft speed rpm | Slip of drivers % | Fuel Consumption | | Hp-hr per gal | Temperature Cooling medium | Degrees F Air wet bulb | Air dry bulb | Barometer inches of mercury |
|---|-----------------------------|-----------------------------|--------------------------------|----------------------------|------------------|-------|------------------|----------------------------------|---------------------------------|--------------------|-----------------------------------|
| VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST | | | | | | | | | | | |
| Maximum Available Power—Two Hours—4th Gear | | | | | | | | | | | |
| 48.33 | 4459 | 4.06 | 1704 | 6.37 | 3.782 | 0.549 | 12.78 | 198 | 60 | 80 | 28.560 |
| 75% of Pull at Maximum Power—Ten Hours—4th Gear | | | | | | | | | | | |
| 38.97 | 3371 | 4.34 | 1771 | 3.90 | 2.929 | 0.527 | 13.30 | 175 | 62 | 70 | 28.704 |
| 50% of Pull at Maximum Power—Two Hours—4th Gear | | | | | | | | | | | |
| 27.31 | 2294 | 4.46 | 1805 | 2.94 | 2.441 | 0.627 | 11.19 | 159 | 54 | 55 | 28.748 |
| MAXIMUM POWER WITH BALLAST | | | | | | | | | | | |
| 38.86 | 7531 | 1.94 | 1752 | 14.11 | 2nd Gear | ..... | 194 | 60 | 77 | 28.610 | |
| 46.68 | 6583 | 2.66 | 1700 | 11.23 | 3rd Gear | ..... | 196 | 59 | 79 | 28.610 | |
| 48.69 | 4496 | 4.06 | 1699 | 6.27 | 4th Gear | ..... | 198 | 60 | 80 | 28.555 | |
| 48.35 | 3380 | 5.36 | 1703 | 4.85 | 5th Gear | ..... | 198 | 58 | 79 | 28.560 | |
| 47.86 | 2306 | 7.78 | 1704 | 3.33 | 6th Gear | ..... | 196 | 58 | 79 | 28.560 | |
| 46.38 | 1607 | 10.82 | 1710 | 2.11 | 7th Gear | ..... | 193 | 58 | 79 | 28.560 | |
| MAXIMUM POWER WITHOUT BALLAST | | | | | | | | | | | |
| 51.38 | 4811 | 4.00 | 1705 | 8.16 | 4th Gear | ..... | 160 | 43 | 48 | 28.790 | |
| VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—4th Gear | | | | | | | | | | | |
| Pounds pull | | | 4500 | 4700 | 4800 | 4850 | 4750 | 4650 | | | |
| Horsepower | | | 48.7 | 45.1 | 41.0 | 36.2 | 30.4 | 24.8 | | | |
| Miles per hour | | | 4.1 | 3.6 | 3.2 | 2.8 | 2.4 | 2.0 | | | |

Department of Agricultural Engineering

Dates of Test: April 21 to May 6, 1960

Manufacturer: J. I. CASE COMPANY, RACINE, WISCONSIN

Manufacturer's Power Rating: Not Rated

FUEL, OIL and TIME Fuel No 2 Diesel Cetane No 50 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8419 Weight per gallon 7.010 lb Oil SAE 10W API service classification MS, DG To motor 1.957 gal Drained from motor 1.716 gal Transmission and final-drive lubricant SAE 10W Type engine oil Total time engine was operated 40 hours.

ENGINE Make Case Diesel Type 4 cylinder vertical Serial No 8161048 Crankshaft mounted length-wise Rated rpm 1700 Bore and stroke 4½" x 5" Compression ratio 15.2 to 1 Displacement 267 cu in Cranking system 12 volt electrical (two 6 volt batteries) Lubrication pressure Air cleaner oil washed wire mesh Oil filter replaceable pleated paper element Fuel filter two replaceable cotton thread elements one replaceable sealed cartridge Muffler was used Cooling medium temperature control thermostat.

CHASSIS Type standard Serial No 8161048 Tread width rear 52" to 88" front 53" to 82" Wheel base 101¾" Center of gravity (without operator or ballast, with minimum tread, with fuel tank filled and tractor serviced for operation) Horizontal distance forward from center-line of rear wheels 31¾" Vertical distance above roadway 35¾" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive Transmission selective gear fixed-ratio Advertised speeds mph first 1.5 second 2.1 third 2.9 fourth 4.3 fifth 5.6 sixth 8.0 seventh 10.7 eighth 15.7 reverse 2.0 and 7.2 Clutch single plate operated by foot pedal Brakes double disc operated independently by foot pedals which can be locked together Steering power assisted Turning radius (on concrete surface with brake applied) right 143" left 124" (on concrete surface without brake) right 200" left 196" Turning space diameter (on concrete surface with brake applied) right 298" left 260" (on concrete surface without brake) right 412" left 403" Belt pulley 1322 rpm at 1700 engine rpm diam 10½" face 7¼" Belt speed 2624 fpm Power take-off 545 rpm at 1700 engine rpm.

REPAIRS AND ADJUSTMENTS No repairs or adjustments.

REMARKS All test results were determined from observed data obtained in accordance with the SAE and ASAE test code.

First gear was not run as it was necessary to limit the pull in second gear to avoid excessive wheel slippage. Eighth gear was not run as it exceeded 15 mph.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 743.

L. F. LARSEN
Engineer-in-Charge

L. W. HURLBUT, Chairman
G. W. STEINBRUEGGE
J. J. SULEK
Board of Tractor
Test Engineers

TIRES, BALLAST and WEIGHT

| | | With Ballast | Without Ballast |
|----------------------------|----------------------|------------------|------------------|
| Rear tires | —No, size, ply & psi | Two 15.5-38;8;20 | Two 15.5-38;8;14 |
| Ballast | —Liquid | 470 lb each | None |
| | —Cast iron | 995 lb each | None |
| Front tires | —No, size, ply & psi | Two 6.00-16;6;36 | Two 6.00-16;6;36 |
| Ballast | —Liquid | None | None |
| | —Cast iron | None | None |
| Height of drawbar | | 19½ inches | 19½ inches |
| Static weight | —Rear | 7610 lb | 4680 lb |
| | —Front | 2080 lb | 2100 lb |
| Total weight with operator | | 9865 lb | 6955 lb |

EXPLANATION OF TEST REPORT

GENERAL CONDITIONS

Each tractor is a production model equipped for common usage. Power consuming accessories can be disconnected only when it is convenient for the operator to do so in practice. Additional weight can be added as ballast if the manufacturer regularly supplies it for sale. The static tire loads and the inflation pressures must conform to recommendations in the Tire Standards published by the Society of Automotive Engineers.

PREPARATION FOR PERFORMANCE RUNS

The engine crankcase is drained and refilled with a measured amount of new oil conforming to specifications in the operators manual. The fuel used and the maintenance operations must also conform to the published information delivered with the tractor. The tractor is then limbered-up for 12 hours on drawbar work in accordance with the manufacturer's published recommendations. The manufacturer's representative is present to make appropriate decisions regarding mechanical adjustments.

The tractor is equipped with approximately the amount of added ballast that is used during maximum drawbar tests. The tire tread-bar height must be at least 65% of new tread height prior to the maximum power run.

BELT OR POWER TAKE-OFF PERFORMANCE

Maximum Power and Fuel Consumption. The manufacturer's representative makes carburetor, fuel pump, ignition and governor control settings which remain unchanged throughout all subsequent runs. The governor and the manually operated governor control lever is set to provide the high-idle speed specified by the manufacturer for maximum power. Maximum power is measured by connecting the belt pulley or the power take-off to a dynamometer. The dynamometer load is then gradually increased until the engine is operating at the rated speed specified by the manufacturer for maximum power. The corresponding fuel consumption is measured.

Varying Power and Fuel Consumption. Six different horsepower levels are used to show corresponding fuel consumption rates and how the governor causes the engine to react to the following changes in dynamometer load: 85% of the dynamometer torque at maximum power; minimum dynamometer torque, $\frac{1}{2}$ the 85% torque; maximum power; $\frac{1}{4}$ and $\frac{3}{4}$ of the 85% torque. Since a tractor is generally subjected to varying loads the average of the results in this test serve well for predicting the fuel consumption of a tractor in general usage.

DRAWBAR PERFORMANCE

All engine adjustments are the same as those used in the belt or power take-off tests. If the manufacturer specifies a different rated crankshaft speed for drawbar operations, then the position of the manually operated governor control is changed to provide the high-idle speed specified by the manufacturer in the operating instructions.

Varying Power and Fuel Consumption With Ballast. The varying power runs are made to show the effect of speed-control devices (engine governor, automatic transmissions, etc.) on horsepower, speed and fuel consumption. These runs are made around the entire test course which has two 180 degree

turns with a minimum radius of 50 feet. The drawbar pull is set at 3 different levels as follows: (1) as near to the pull at maximum power as possible and still have the tractor maintain the travel speed at maximum horsepower on the straight sections of the test course; (2) 75% of the pull at maximum power; and (3) 50% of the pull at maximum power. Prior to 1958, fuel consumption data (10 hour test) were shown only for the pull obtained at maximum power for tractors having torque converters and at 75% of the pull obtained at maximum power for gear-type tractors.

Maximum Power with Ballast. Maximum power is measured on straight level sections of the test course. Data are shown for not more than 12 different gears or travel speeds. Some gears or travel speeds may be omitted because of high slippage of the traction members or because the travel speed may exceed the safe-limit for the test course. The maximum safe speed for the Nebraska Test Course has been set at 15 miles per hour. The slippage limits have been set at 15% and 7% for pneumatic tires and steel tracks or lugs, respectively. Higher slippage gives widely varying results.

Maximum Power Without Ballast. All added ballast is removed from the tractor. The maximum drawbar power of the tractor is determined by the same procedure used for getting maximum power with ballast. The gear (or travel speed) is the same as that used in the 10-hour test.

Varying Power and Travel Speed with Ballast. Travel speeds corresponding to drawbar pulls beyond the maximum power range are obtained to show the "lugging ability" of the tractor. The run starts with the pull at maximum power; then additional drawbar pull is applied to cause decreasing speeds. The run is ended by one of three conditions; (1) maximum pull is obtained, (2) the maximum slippage limit is reached, or (3) some other operating limit is reached.

For additional information about the **Nebraska Tractor Tests** write to the Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska.



Case 731 Diesel