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Test 993: John Deere 2520 Power Shift

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NEBRASKA TRACTOR TEST 993 - JOHN DEERE 2520 POWER SHIFT DIESEL

POWER TAKE-OFF PERFORMANCE

Hp	Crankshaft speed rpm	Fuel Consumption		Hp-hr per gal	Temperature Degrees F			Barometer inches of Mercury
		Gal per hr	Lb per hp-hr		Cooling medium	Air wet bulb	Air dry bulb	
MAXIMUM POWER AND FUEL CONSUMPTION								
Rated Engine Speed—Two Hours								
56.28	2500	4.194	0.515	13.42	202	55	75	29.115
Standard Power Take-off Speed (1000 rpm)—One Hour								
51.98	2067	3.541	0.471	14.68	203	56	75	29.085
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
48.67	2544	3.624	0.515	13.43	198	57	76	.....
0.00	2671	1.245	.....	.....	190	56	75	.....
24.93	2606	2.313	0.641	10.78	190	56	75	.....
54.05	2501	4.127	0.528	13.10	203	57	76	.....
12.60	2631	1.771	0.971	7.11	189	56	74	.....
36.98	2575	2.899	0.542	9.48	194	56	75	.....
Av 29.54	2588	2.663	0.623	11.09	194	56	75	29.050

DRAWBAR PERFORMANCE

Hp	Drawbar pull lbs	Speed miles per hr	Crankshaft speed rpm	Slip of drivers %	Fuel Consumption		Hp-hr per gal	Temp Degrees F			Barometer inches of Mercury
					Gal per hr	Lb per hp-hr		Cooling med	Air wet bulb	Air dry bulb	

VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST

Maximum Available Power—Two Hours—4th Gear											
45.98	3807	4.53	2499	5.47	4.024	0.605	11.43	196	54	64	28.640
75% of Pull at Maximum Power—Ten Hours—4th Gear											
37.61	3013	4.68	2558	4.61	3.474	0.639	10.83	191	38	46	28.984
50% of Pull at Maximum Power—Two Hours—4th Gear											
26.97	2059	4.86	2608	2.85	2.818	0.730	9.46	188	47	56	28.740

MAXIMUM POWER WITH BALLAST

37.55	6797	2.07	2559	14.96	2nd Gear	.....	192	49	62	28.955
46.11	5118	3.38	2501	8.91	3rd Gear	.....	198	51	64	28.950
47.97	4023	4.47	2497	6.54	4th Gear	.....	200	51	64	28.950
44.69	2842	5.90	2499	4.53	5th Gear	.....	195	49	59	28.950
46.33	2238	7.76	2501	2.92	6th Gear	.....	202	43	55	28.910
45.95	1668	10.33	2500	2.42	7th Gear	.....	202	43	53	28.910

MAXIMUM PULL WITHOUT BALLAST

31.36	5627	2.09	2572	14.95	2nd Gear	190	60	80	28.530
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VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—4th Gear

Pounds pull	4023	4300	4571	4779	5080	5131	4904
Horsepower	47.97	45.98	43.00	39.12	35.34	29.64	22.78
Crankshaft speed rpm	2497	2251	1991	1741	1489	1238	991
Miles per hour	4.47	4.01	3.53	3.07	2.61	2.17	1.74
Slip of drivers, %	6.54	7.13	7.64	8.02	8.66	8.78	8.40

TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 13.6-38; 6; 20	Two 13.6-38; 6; 16
Ballast	—Liquid	370 lb each	None
	—Cast iron	420 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	18 lb each	None
Height of drawbar		18 inches	18 inches
Static weight with operator—Rear		6910 lb	5330 lb
	Front	2130 lb	2095 lb
	Total	9040 lb	7425 lb

The University of Nebraska Agricultural Experiment Station
E. F. Frolik, Dean; H. W. Ottoson, Director; Lincoln, Nebraska

Department of Agricultural Engineering

Date of Test: October 22 to October 29, 1968

Manufacturer: JOHN DEERE WATERLOO TRACTOR WORKS, WATERLOO, IOWA

FUEL, OIL and TIME Fuel No 2 Diesel Cetane No 54.3 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8303 Weight per gallon 6.913 lb Oil SAE 30 API service classification MS DM To motor 1.939 gal Drained from motor 1.264 gal Transmission and final-drive lubricant John Deere type 303 special purpose oil Total time engine was operated 48 hours.

ENGINE Make John Deere Diesel Type 4 cylidner vertical Serial No M 53 RA 109686 T Crankshaft mounted lengthwise Rated rpm 2500 Bore and stroke 4.02" x 4.33" Compression ratio 16.7 to 1 Displacement 219.8 cu in Ignition system Battery Cranking system 12 volt electric Lubrication Pressure Air cleaner dry type with replaceable pleated paper element Oil filter full flow replaceable pleated paper cartridge Oil cooler radiator for transmission and hydraulic oil Fuel filter sediment bowl, screen and filter with replaceable pleated paper element Muffler was used Cooling medium temperature control Thermostat.

CHASSIS Type standard Serial No T 713 P 017116 R Tread width rear 56" to 88" front 48½" to 82½" Wheel base 92.75" 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 25.4" Vertical distance above roadway 36.6" Horizontal distance center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive Transmission selective gear fixed ratio with operator controlled full range power shifting Advertised speeds mph first 1.67 second 2.36 third 3.64 fourth 4.75 fifth 6.12 sixth 7.92 seventh 10.49 eighth 17.49 reverse first 1.94 second 2.75 third 4.29 fourth 5.55 Clutch multiple disc wet clutches within transmission hydraulically operated Brakes wet disc hydraulically power actuated and operated by two foot pedals which can be locked together Steering hydrostatic power Turning radius (on concrete surface with brake applied) right 116¾" left 116¾" (on concrete surface without brake) right 139" left 139" Turning space diameter (on concrete surface with brak applied) right 243½" left 243½" (on concrete surface without brake) right 287" left 287" Belt pulley 976 rpm at 2100 engine rpm diam 12" face 8½" Belt speed 3063 fpm Power take-off 1016 rpm at 2100 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 fifteen miles per hour.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 993.

L. F. LARSEN

Engineer-In-Charge

G. W. STEINBRUEGGE, Chairman

W. E. SPLINTER

D. E. LANE

Board of Tractor Test Engineers

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, $\frac{1}{2}$ of 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 transmission, 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 Pull without Ballast. All added ballast is removed from the tractor. The drawbar pull is determined at slip limits of 15% for pneumatic tires or 7% for steel tracks or lugs. The tractor is operated at the fastest possible travel speed.

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.



JOHN DEERE 2520 POWER SHIFT DIESEL