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January 1971

Test 1063: John Deere 7020

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 1063 – JOHN DEERE 7020 DIESEL

POWER TAKE-OFF PERFORMANCE

Hp	Crankshaft speed rpm	Fuel Consumption Gal per hr	Lb per hp-hr	Hp-hr per gal	Temperature Degrees F			Barometer inches of Mercury
					Cooling medium	Air wet bulb	Air dry bulb	
MAXIMUM POWER AND FUEL CONSUMPTION								
Rated Engine Speed—Two Hours (PTO Speed—1011 rpm)								
146.17	2200	10.236	0.482	14.28	184	58	75	28.780
VARYING POWER AND FUEL CONSUMPTION—Two Hours								
127.59	2260	9.270	0.500	13.76	178	60	76	.....
0.00	2412	3.027	.....	.....	176	57	73	.....
66.04	2340	6.256	0.651	10.56	180	58	75	.....
145.87	2200	10.221	0.482	14.27	180	60	78	.....
33.62	2382	4.720	0.965	7.12	178	58	75	.....
97.81	2309	7.800	0.548	12.54	182	59	76	.....
Av 78.49	2317	6.882	0.603	11.41	179	59	75	28.743

DRAWBAR PERFORMANCE

Hp	Drawbar pull lbs	Speed miles per hr	Crankshaft speed rpm	Slip of drivers %	Fuel Consumption			Temp Degrees F			Barometer inches of Mercury
					Gal per hr	Lb per hp-hr	Hp-hr per gal	Cooling med	Air wet bulb	Air dry bulb	
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST											
Maximum Available Power—Two Hours—7th Gear (4 Lo)											
127.72	8969	5.34	2196	3.98	9.960	0.536	12.82	180	49	60	28.600
75% of Pull at Maximum Power—Ten Hours—7th Gear (4 Lo)											
105.32	6962	5.67	2309	2.92	8.921	0.582	11.81	179	45	55	28.822
50% of Pull at Maximum Power Two Hours—7th Gear (4 Lo)											
70.98	4594	5.79	2334	2.00	7.466	0.723	9.51	180	40	46	28.945
50% of Pull at Reduced Engine Speed—Two Hours—10th Gear (5 Hi)											
72.30	4677	5.80	1628	1.77	5.601	0.532	12.91	179	51	65	28.920

MAXIMUM POWER WITH BALLAST

108.79	18726	2.08	2276	14.91	2nd Gear (1 Hi)	183	57	73	28.650
128.97	11794	4.10	2201	5.36	5th Gear (3 Lo)	181	44	52	28.600
129.56	10214	4.76	2197	4.42	6th Gear (3 Hi)	180	47	56	28.590
131.50	9234	5.34	2198	4.06	7th Gear (4 Lo)	180	47	58	28.590
129.63	7837	6.20	2203	3.39	8th Gear (4 Hi)	179	48	59	28.590
130.22	7280	6.71	2198	3.02	9th Gear (5 Lo)	181	48	59	28.590

MAXIMUM PULL WITHOUT BALLAST

97.55	17629	2.08	2270	14.68	2nd Gear (1 Hi) ...	186	54	68	28.900
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VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—7th Gear (4 Lo)

Pounds Pull	9234	9939	10663	10928	10458	9374
Horsepower	131.50	126.35	120.75	108.15	89.11	67.55
Crankshaft Speed rpm	2198	1971	1762	1542	1326	1116
Miles Per Hour	5.34	4.77	4.25	3.71	3.20	2.70
Slip of Drivers %	4.06	4.28	4.86	4.86	4.71	4.13

TRACTOR SOUND LEVEL

	dB(A)
Maximum Available Power 2 Hours	97.0
75% of Pull at Max. Power 10 Hours	96.0
50% of Pull at Max. Power 2 Hours	96.5
50% of Pull at Reduced Engine Speed 2 Hours	92.5
Bystander 16th gear—(8 Hi)	87.0

TIRES, BALLAST and WEIGHT

	With Ballast	Without Ballast
Rear tires	—No. size, ply & psi	Four 18.4-34; 8; 12
Ballast	—Liquid	None
	Cast iron	23 lb each
Front tires	—No. size, ply & psi	Four 18.4-34; 8; 12
Ballast	—Liquid	246 lb each
	Cast iron	None
Height of drawbar	14 inches	14 inches
Static weight with operator—Rear	8930 lb	8840 lb
	10640 lb	9655 lb
	Total	19570 lb

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

Department of Agricultural Engineering

Dates of Test: April 20 to May 4, 1971

Manufacturer: John Deere Waterloo Tractor Works, Waterloo, Iowa

FUEL, OIL and TIME Fuel No 2 Diesel Cetane No 53.5 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8261 Weight per gallon 6.878 lb Oil SAE 30 API service classification MS, DG, DM, DS to motor 4.381 gal Drained from motor 3.925 gal Transmission and final drive lubricant SAE John Deere Special 303 oil Total time engine was operated 47½ hours.

ENGINE Make John Deere Diesel Type 6 cylinder vertical with turbo-charger and inter-cooler Serial No 6404AR-01-297215R Crankshaft Mounted lengthwise Rated rpm 2200 Bore and stroke 4.25" x 4.75" Compression ratio 15.7 to 1 Displacement 404 cu in Cranking system 12 volt electric (two 6 volt batteries) Lubrication pressure Air cleaner precleaner and two dry type in series with replaceable treated paper elements Oil filter full flow with replaceable paper cartridge Oil Cooler engine coolant heat exchanger for crankcase oil and radiator for transmission and hydraulic system Fuel filter sediment bowl with screen and replaceable paper primary and secondary filter elements Muffler was used Cooling medium temperature control thermostat.

CHASSIS Type four-wheel drive Serial No T773R001431R Tread width rear 72" to 89" front 72" to 89" Wheel base 120" 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 62.7" Vertical distance above roadway 52.0" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive Transmission selective gear fixed ratio with partial range synchro-mesh Advertised speeds mph first 1.99 second 2.29 third 3.18 fourth 3.66 fifth 4.20 sixth 4.83 seventh 5.40 eighth 6.21 ninth 6.72 tenth 7.73 eleventh 8.80 twelfth 10.13 thirteenth 11.40 fourteenth 13.11 fifteenth 18.59 sixteenth 21.40 reverse 4.09, 5.70, 6.54 and 7.53 Clutch single plate dry disc operated by foot pedal Brakes wet disc hydraulically power actuated by a foot pedal Steering hydrostatic power Turning radius (on concrete surface without brake) right 206" left 206" Turning space diameter (on concrete surface without brake) right 435" left 435" Power take-off 1011 rpm at 2200 engine rpm.

REPAIRS and ADJUSTMENTS: No repairs or adjustments.

REMARKS: All test results were determined from observed data obtained in accordance with SAE and ASAE test code or official Nebraska test procedure. First gear was not run as it was necessary to limit the pull in second gear to avoid excessive wheel slippage. Third, fourth, eleventh, twelfth, thirteenth, fourteenth, fifteenth, and sixteenth gears were not run as test procedure requires only six gears.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 1063.

F. L. 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. Prior to the maximum power run the tire tread-bar height must be at least 65% of new tread height.

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 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.

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 4 different runs 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; (3) 50% of the pull at maximum power; and (4) maintaining the same load and travel speed as in (3) by shifting to a higher gear and reducing the engine rpm.

Maximum Power with Ballast. Maximum power is measured on straight level sections of the test course. Data are shown for not more than 6 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 manufacturer's representative has the option of selecting one gear or speed over eight miles per hour. 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 Drawbar Pull 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.

SOUND MEASUREMENT

Sound is recorded during each of the Varying Power and Fuel Consumption runs as the tractor travels on a straight section of the test course. The dB(A) sound level is obtained with the microphone located near the right ear of the operator. Bystander sound readings are taken with the microphone placed 25 feet from the line of travel of the tractor.

An increase of 10 dB(A) will approximately double the loudness to the human ear.

For additional information about the Nebraska Tractor Tests write to the Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska 68503.



JOHN DEERE 7020 DIESEL