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Test 1012: John Deere 4020 Power Shift

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NEBRASKA TRACTOR TEST 1012 - JOHN DEERE 4020 POWER SHIFT GASOLINE

POWER TAKE-OFF PERFORMANCE

Hp	Crankshaft speed rpm	Fuel Consumption			Temperature Degrees F			
		Gal per hr	Lb per hp-hr	Hp-hr per gal	Cooling medium	Air wet bulb	Air dry bulb	Barometer inches of Mercury
MAXIMUM POWER AND FUEL CONSUMPTION								
Rated Engine Speed—Two Hours								
95.66	2200	9.283	0.589	10.30	189	68	75	29.043
Standard Power Take-off Speed (1000 rpm)—One Hour								
87.52	1894	8.137	0.564	10.76	191	69	75	29.055
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
84.18	2279	8.703	0.627	9.67	184	70	75	.....
0.00	2406	3.832	.....	.....	170	69	74	.....
43.03	2329	5.721	0.807	7.52	177	69	75	.....
94.68	2200	9.118	0.584	10.38	181	69	74	.....
22.04	2370	4.862	1.334	4.53	173	70	74	.....
63.30	2290	6.977	0.669	9.07	179	70	75	.....
Av 51.21	2312	6.533	0.774	7.84	177	69	74	29.030

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—4th Gear											
82.57	6443	4.81	2197	6.86	9.282	0.682	8.90	182	61	69	28.995
75% of Pull at Maximum Power—Ten Hours—4th Gear											
68.71	4939	5.22	2328	4.61	8.612	0.760	7.98	192	72	82	28.906
50% of Pull at Maximum Power—Two Hours—4th Gear											
46.87	3226	5.45	2404	3.43	6.664	0.863	7.03	170	56	61	29.010

MAXIMUM POWER WITH BALLAST

64.38	10665	2.26	2278	14.89	2nd Gear	.....	171	58	60	28.720
82.62	8531	3.63	2201	9.05	3rd Gear	.....	180	61	69	28.980
84.80	6591	4.83	2201	6.65	4th Gear	.....	180	61	69	28.980
81.17	4803	6.34	2200	4.70	5th Gear	.....	180	62	71	28.980
82.03	3703	8.31	2202	3.69	6th Gear	.....	180	64	74	28.980
81.12	2744	11.09	2199	2.95	7th Gear	.....	180	64	76	28.980

MAXIMUM PULL WITHOUT BALLAST

47.89	7716	2.33	2329	14.97	2nd Gear	180	54	72	28.790
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VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—4th Gear

Pounds Pull	6591	6895	7144	7222	7198	7176
Horsepower	84.80	78.37	72.85	64.10	54.75	45.58
Crankshaft speed rpm	2201	1953	1759	1531	1313	1093
Miles per hour	4.83	4.26	3.82	3.33	2.85	2.38
Slip of drivers, %	6.65	7.20	7.47	7.47	7.60	7.47

TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No. size, ply & psi	Two 18.4-34; 8; 20	Two 18.4-34; 8; 16
Ballast	—Liquid	828 lb each	None
	—Cast iron	1450 lb each	None
Front tires	—No. size, ply & psi	Two 7.50-15; 6; 28	Two 7.50-15; 6; 28
Ballast	—Liquid	None	None
	—Cast iron	12 lb each	None
Height of drawbar		18½ inches	19½ inches
Static weight with operator	—Rear	11290 lb	6735 lb
	—Front	2530 lb	2505 lb
	—Total	13820 lb	9240 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: May 13 to June 4, 1969

Manufacturer: JOHN DEERE WATERLOO TRACTOR WORKS, WATERLOO, IOWA

FUEL, OIL and TIME Fuel regular gasoline Octane No Motor 85.0 Research 93.0 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.7288 Weight per gallon 6.067 lb Oil SAE 30 API service classification MS-DM To motor 2.170 gal Drained from motor 1.412 gal Transmission and final-drive lubricant John Deere special 303 oil Total time engine was operated 54½ hours.

ENGINE Make John Deere gasoline Type 6 cylinder vertical Serial No M21R0230567R Crankshaft mounted lengthwise Rated rpm 2200 Bore and stroke 4¼" x 4¼" Compression ratio 7.5 to 1 Displacement 362 cu in Carburetor size 1½/16" Ignition system battery Cranking system 12 volt electric Lubrication pressure Air cleaner dry type with replaceable treated paper element Oil filter full flow replaceable paper element Oil cooler engine coolant heat exchanger for crankcase oil and radiator for transmission and hydraulic system Fuel filter sediment bowl and screen Muffler was used Cooling medium temperature control thermostat.

CHASSIS Type standard Serial No T211-P210949R Tread width rear 60" to 91" front 50.75" to 79.88" Wheel base 100.25" 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 26.75" Vertical distance above roadway 36.8" Horizontal distance from center of rear wheel tread 0.1" to the right Hydraulic control system direct engine drive Transmission fixed ratio operator controlled full range power shifting Advertised speeds mph first 1.8 second 2.5 third 3.9 fourth 5.1 fifth 6.6 sixth 8.5 seventh 11.2 eighth 18.7 reverse 2.1, 3.0, 4.6 and 5.9 Clutch multiple disc wet clutches within transmission hydraulically operated Brakes wet disc hydraulically power actuated operated by two foot pedals which can be locked together Steering hydrostatic power Turning radius (on concrete surface with brake applied) right 128" left 128" (on concrete surface without brake) right 150" left 150" Turning space diameter (on concrete surface with brake applied) right 256" left 256" (on concrete surface without brake) right 335" left 335" Belt pulley 966 rpm at 1900 engine rpm diam 12" face 8.5" Belt speed 3035 fpm Power take-off 1003 rpm at 1900 engine rpm.

REPAIRS and ADJUSTMENTS: Hydraulic tee fitting at power steering housing broke during break-in run and was replaced. Following PTO runs it was necessary to make a correction on foot throttle to maintain high idle.

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 because it exceeded 15 mph.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 1012.

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 4020 POWER SHIFT GASOLINE