SOCIALISTIC REPUBLIC OF CROATIA

INSTITUTE FOR MECHANIZATION IN AGRICULTURE

AGRICULTURAL FACULTY OF THE ZAGREB UNIVERSITY

TEST BULLETIN: O.E.C.D. No. 105

Date of approval: 19th January 1966

REPORT ON TEST IN ACCORDANCE WITH O. E. C. D. TEST CODE FOR AGRICULTURAL TRACTORS



IMR — DIESEL TRACTOR

ZADRUGAR 50-Special

(Equipped with 14—30 rear tyres)

Manufactured by: IMR — Rakovica Engine Factory, Belgrade, Yugoslavia

Date of Tests: August/December 1965

TABLE OF CONTENTS

Part I	Specification of tractor	3, 4, 5 and 6
Part II	Laboratory tests	
	Compulsory tests: At the power take-off	7
Part III	Drawbar tests on concrete track	8, 9, 10 and 11
Part IV	Location of centre of gravity	
	Turning space and turning radius	12
Part V	Repairs and adjustments, remarks	12

APPENDIX

Performance Curves

	FIG. NO.
POWER TAKE - OFF TEST	
Curves of power take-off horsepower, equivalent crankshaft torque, fuel consumption and specific fuel consumption/engine speed	1
Curves of engine speed, specific fuel consumption and equivalent crankshaft torque/power take-off horsepower	2
DRAWBAR TEST WITH BALLAST	
Curves of drawbar horsepower and wheelslip/drawbar pull	3
Curves of fuel consumption and specific fuel consumption/drawbar pull	4
DRAWBAR TEST WITHOUT BALLAST	
Curves of drawbar horsepower and wheelslip/drawbar pull	5
Curves of fuel consumption and specific fuel consumption/drawbar pull	6

This report has been approved by the O.E.C.D. Coordinating Centre (C.N.E.E.M.A., Antony, France) as being in accordance with the O.E.C.D. Tractor Test Code.

Date of Approval: 19th January 1966 Serial No.: 105

This bulletin is based on engineering tests in accordance with the O.E.C.D. Tractor Test Code. It does not contain an evaluation of the performance of the tractor on practical farm work.

PART I

SPECIFICATION OF TRACTOR

Tractor:

Make:	IMR — Rakovica Engine Factory, Belgrade
Model:	ZADRUGAR 50-Special
Type:	Diesel wheel type tractor, unit construction
No.:	5015061

Engine

Make:	IMR — Rakovica Engine Factory, Belgrade
Model:	IM — 034/TA
Type:	4-stroke — diesel with swirl chamber
No.:	39981/A
Cylinders:	4 cylinders, vertical, in-line 91.4 mm (3.6 in) bore × 127.0 mm (5 in) stroke, compression ratio 17.4:1, replaceable dry cromium plated liners, overhead valves
Rated speeds:	2000 rev/min, governor setting — no load engine speed 2160 rev/min
Fuel system:	Fuel — Diesel oil "Industrija precizne mehanike" type YPE 4 A 60 U 310/106 injection pump, Serial No. 05-473/1964 "Industrija precizne mehanike" type YDL 11OS/916 injector nozzles, sediment bowl and water trap on suction side of feed pump, "Ikarus" paper elements double filter on delivery side. Injection pressure 160 kp/cm² (155 atm). Injection timing: 29° before TDC. Capacity of fuel tank 39 l (8.6 UK gal)
Governor:	"Industrija precizne mehanike" type YEPA MZ 80 A/04 pneumatic governor incorporated in injection pump. Governed range of engine speed up to 2000 rev/min
Air cleaner:	"Ikarus" oil bath cleaner with cyclonic pre-cleaner outside hood. Oil capacity 0.8 l (1.4 pt).
Lubricating system:	Forced feed from gear-type pump. "Industrija precizne mehanike" oil filter. Recommended oil: additive oils Extra HD, viscosities SAE 10 Z for — 30° - 0° (— 22 - 32°F), SAE 20 for 0° C - 27°C (32 - 80°F), SAE 30 for over 27° C (80° F). Recommended oil change period 250 h. Oil capacity 8.0 l (14.0 pt)
Cooling system:	Water cooled, pressuried, impeller assisted with 400 mm (15.8 in) dia, belt driven 6-blade fan, thermostat and radiator shutters for temperature control. Cooling water capacity 13 l (2.9 UK gal)

Transmission:

Clutch: "Ikarus" dual, dry, clutch, two plates for p.t.o. shaft and gearbox drive respectively, foot-pedal operated

Gearbox: Own make, gearbox with reduction gear, 6 forward speeds and 2 reverse

Differential: Crown wheel and pinion differential with spur gear final drives. Foot-pedal operated differential lock automatically disengaging. Total transmission oil capacity 20 l (35 pt)

Gear		Number of engine revolutions for one revolution of driving wheel	Theoretical travelling speed for 2000 rev/min rated speed of engine km/h	(mile h)
Forward	1	205.96	2.49	(1.55)
	2	109.84	4.67	(2.90)
	3	70.26	7.30	(4.55)
	4	55.08	9.29	(5.77)
	5	29.37	17.50	(10.86)
	6	18.79	27.30	(19.95)
Reverse	1	132.73	3.87	(2.41)
	2	35.49	14.45	(8.97)

Steering device: Worm type and linkage

Brakes: Mechanical band brakes, foot and hand controls; dual main foot pedal combined by a latch for normal use, independant for steering brake use

Wheels:

Steering wheels: Two at front. Tyres 6.50 - 20, 4 - ply pneumatic. Track 1370 mm (53.9 in) by 100 mm (3.9 in) steps to 1870 mm (73.6 in) changed by extending front axle. Maximum permissible weight on each tyre 600 kg (1323 lb) at 2.0 kp/cm^2 (28.4 lb/in^2)

Driving wheels: Two at rear. Tyres 14 - 30, 6 - ply pneumatic. Track 1250, 1450, 1490, 1510, 1690, 1710, 1750, 1960 mm (49.2; 57.1; 58.7; 59.4; 66.5; 67.3; 68.9; 77.1 in) changed by reversing wheels and offset lugs on rims. Maximum permissible weight on each tyre 1450 kg (3197 lb) at 1.2 kp/cm^2 (17.1 lb/in^2)

Wheelbase: 1890 mm (6.21 ft)

Belt pulley:

Location: Attachable to rear of tractor in two alternative horizontal positions, fast p.t.o. driven

Diameter-width: 240 mm (9.45 in) × 170 mm (6.69 in)

Speeds: 1244 rev/min giving 15.65 m/s (3078 ft/min) linear speed at 2000 rev/min rated engine speed

Direction of rotation: Optional, related to position of unit

Power take-off:

Main	Independent p.t.o. foot-pedal and dual clutch operated
Location:	At rear of tractor 695 mm (27.4 in) above ground in centre line of tractor
Dimensions:	6 - spline shaft 29 × 34.9 × 8.7 mm (1 3/8 in) (acc. to JUS M.L1.601 form A, and B.S. 1495)
Proportional engine speed:	622 rev/min at 2000 rev/min rated engine speed; standard p.t.o. speed 540 rev/min at 1736 rev/min engine speed, may be set by aid of the tractormeter
Direction of rotation:	Clockwise viewed from tractor rear
Proportional ground speed:	1 revolution of p.t.o. for approximately 310 mm (12.2 in) of travel
Direction of rotation:	Clockwise viewed from tractor rear in forward gear
Shaft for belt pulley drive:	At rear of tractor 825 mm (32.5 in) above ground in centre line of tractor
Dimension:	6 - spline shaft 29 × 34.9 × 8.7 mm (1 3/8 in)
Speed:	2000 rev/min at 2000 rev/min rated engine speed
Direction of rotation:	Anti-clockwise viewed from tractor rear

Power lift: Hydraulic with gear type oil pump, draft and position controll system. Oil is supplied at maximum pressure of 150 kp/cm² (2140 lb/in²) to a ram cylinder and one external tapping. Maximum load liftable trough the complete range of movement at hitch points of the lower links 760 kg (1675 lb) (test figures), the hitch points are set for deepest position 290 mm (11.4 in) above ground for the beginning of movement

Drawbar:

Linkage drawbar:	Fixed drawbar on hydraulically controlled three point linkage; height above ground from 290 mm (11.4 in) to 1120 mm (44.1 in) adjustable by power lift; distance from rear axle in horizontal position of lower links 845 mm (33.3 in)
Swinging drawbar:	Lateral adjustment 42, 84, 126 mm (1.65, 3.3, 4.95 in); vertical height to centre of clevis 415, 520, 475, 610 mm (16.3, 20.5, 18.7, 24.0 in). Drawbar hole to take 23 mm (0.91 in) dia pin. Distance behind rear axle 670 mm (26.4 in)

Trailer hitch: Not fitted

Towing hitch: At front of tractor; height above ground 655 mm (25.8 in)

Electrical equipment:

Voltage:	12 Volts
Generator:	"Iskra" type DEA 12/200/1600
Bateries:	Two batteries lead acid "Vesna", type N 7, 12 V, capacity 56 Ah
Starting device:	"Iskra" type SN 1/N — 12/2,5/11 solenoid engaged starter motor. "Industrija precizne mehanike" inlet manifolt cold starting aid

Overall dimensions:

Overall length:	3135 mm (10.26 ft) with three point hitch
Overall width:	1915 mm (6.29 ft) at 1490 mm (58.7 in) track
Overall height:	1710 mm (5.61 ft) to top of pre-cleaner, 1680 mm (5.51 ft) to top of steering wheel
Maximum ground clearance:	510 mm (20.1 in)

Weights: With full fuel tank, oil, cooling water, with operator

	Without ballast, kg (lb)	With ballast, kg (lb)
On front wheels	789 (1740)	906 (1997)
On rear wheels	1465 (3230)	2223 (4901)
Total	2254 (4970)	3129 (6898)

Special remarks: None

PART II

LABORATORY TESTS

Compulsory tests: Power take-off test

Date and location of tests: 3rd December 1965, Zagreb

Type of dynamometer: Electrical swinging frame, Siemens-Schuckert

Fuel: Diesel oil, density 0.834 kg/dm³ at 15° C (59° F), Cetane No. 58

Engine oil: EXTRA HD 30, SAE No. 30

Transmission oil: Hypoid oil SAE No. 140

Horse power,	Speeds,		Equivalent crankshaft torque,	Fuel consumption			Temperature			Atmospher. conditions	
	Engine	P. t. o.		Per hour,	Specific,	HP hours/unit of vol.,	Coolant,	Oil,	Fuel,	Air temp.,	Atmos. pressure,
Metric hp (U. S. hp)	rev/min	rev/min	kpm (lb ft)	kg/h (UK gal/h)	g/metric hp h (lb/hp h)	metric hp h/l (hp h/gal)	°C (°F)	°C (°F)	°C (°F)	°C (°F)	mm Hg (in Hg)
A. Maximum power — sustained											
46.2 (45.5)	1993	620	16.6 (120.1)	9.88 (2.62)	214 (0.477)	3.90 (17.4)	95 (203)	96 (205)	20 (68)	14 (57)	743 (29.25)
B. Power at standard p. t. o. speed (540 rev/min)											
42.0 (41.4)	1736	540	17.35 (125.5)	8.40 (2.22)	203 (0.453)	4.20 (18.6)	92 (198)	94 (202)	19 (66)	14 (57)	743 (29.25)
C. Power at maximum torque											
29.7 (29.3)	1157	360	18.33 (132.5)	5.11 (1.35)	173 (0.386)	4.81 (21.7)	96 (205)	92 (198)	20 (68)	14 (57)	743 (29.25)
D. Power at rated speed											
46.0 (45.3)	2000	622	16.5 (119.3)	9.88 (2.62)	215 (0.479)	3.88 (17.3)	95 (203)	96 (205)	20 (68)	14 (57)	743 (29.25)
No load, maximum engine speed: 2090 rev/min											

PART III

DRAWBAR TESTS ON ARTIFICIAL TRACK

Date of tests:	30th October-9th November 1965
Type of track:	Concrete
Position of governor control lever	Fully open, giving no-load engine speed of 2090 rev/min
Type of tyre:	Rear—B.F. Goodrich Silvertown, open centre, 16.9/14-30, 6-ply, pneumatic Front — Alliance, 6.50 - 20, 6 - ply
Fuel:	Diesel oil, density 0.840 kg/dm³ at 15° C (59° F), Cetane No. 58
Engine oil:	EXTRA HD 30, SAE No. 30
Transmission oil:	Hypoid oil, SAE No. 140

A. Tests with ballast

Weight of tractor with driver

Weight without ballast:	Front — 789 kg (1740 lb) Rear — 1465 kg (3230 lb) Total — 2254 kg (4970 lb)
Weight with ballast:	Front 906 kg (1997 lb) Rear 2223 kg (4901 lb)
Total with ballast:	3129 kg (6898 lb)

Weight of ballast:

Front:	Wheel — weights: 116 kg (255 lb) water — nil
Rear:	Wheel — weights (2 per wheel): 246 kg (542 lb) water: 513 kg (1131 lb)

Tyre inflation pressure:

Front:	2.0 kp/cm² (28.4 lb/in²)
Rear:	1.2 kp/cm² (17.1 lb/in²)

Height of drawbar above ground: 415 mm (16.3 in)

(1) MAXIMUM POWERS AND PULLS

Gear	Maximum powers						Air temp., °C (°F)	Atmos. pressure, mm Hg (in Hg)	Maximum pulls	
	Horse-power, Metric hp (U. S. hp)	Corres-ponding pull, kp (lb)	Wheel-slip, %	Engine speed, rev/min	Forward speed, km/h (mile/h)	Engine coolant temp., °C (°F)			Pull, kp (lb)	Reason for stall
1 st	17.9 (17.7)	2200 (4850)	12.6	2020	2.19 (1.36)	92 (198)	7 (45)	760 (29.92)	2390 (5268)	Wheelspin
2 nd	35.4 (35.0)	2425 (5346)	15.9	1980	3.94 (2.45)	85 (185)	6 (43)	757 (29.80)	2536 (5590)	Wheelspin
3 rd	37.9 (37.4)	1588 (3502)	7.5	1950	6.45 (4.01)	90 (194)	7 (45)	757 (29.80)	1780 (3924)	Engine stall
4 th	39.3 (38.8)	1248 (2752)	4.9	1940	8.46 (5.26)	90 (194)	6 (43)	758 (79.83)	1472 (3246)	Engine stall
5 th	35.7 (35.3)	586 (1292)	2.3	1930	16.4 (10.2)	90 (194)	6 (43)	757 (29.80)	723 (1594)	Engine stall

(2) FUEL CONSUMPTION

Gear	Optimum fuel consumption			Range of pull over which specific fuel consumption does not exceed optimum consumption by more than 10% kp (lb)
	Specific fuel consumption, g/metric drawbar hp h (lb/drawbar hp h)	Metric drawbar hp h/l (drawbar hp h/UK gal	Corresponding pull, kp (lb)	
1 st	323 (0.721)	2.60 (11.7)	2200 (4850)	1420 — 2380 (3131 — 5246)
2 nd	256 (0.573)	3.28 (14.7)	2183 (4812)	1400 — 2410 (3087 — 5313)
3 rd	238* (0.532)	3.53 (15.8)	1640 (3616)	1365 — 1780 (3008 — 3924)
4 th	253* (0.565)	3.32 (14.9)	1452 (3202)	600 — 1472 (1323 — 3246)
5 th	279* (0.624)	3.01 (13.5)	586 (1292)	370 — 723 (815 — 1594)

* The drawbar specific fuel consumption in gears 3, 4 and 5 had no clearly marked minima and the values shown for optimum fuel consumption in these gears are corresponding to maximum drawbar horsepower.

B. Tests without ballast

Weight of tractor with driver:

Front:	789 kg (1740 lb)
Rear:	1465 kg (3230 lb)
Total:	2254 kg (5970 lb)

Tyre inflation pressure:

Front:	2.0 kp/cm² (28.4 lb/in²)
Rear:	1.2 kp/cm² (17.1 lb/in²)

Height of drawbar above ground: 415 mm (16.3 in)

(1) MAXIMUM POWERS AND PULLS

Gear	Maximum powers						Air temp., °C (°F)	Atmos. pressure, mm Hg (in Hg)	Maximum pulls	
	Horse-power, Metric hp (U. S. hp)	Corres-ponding pull, kp (lb)	Wheel-slip, %	Engine speed, rev/min	Forward speed, km/h (mile/h)	Engine coolant temp., °C (°F)			Pull, kp (lb)	Reason for stall
1 st	12.45 (12.27)	1843 (4064)	29.2	2050	1.82 (1.13)	90 (194)	23 (73)	750 (29.52)	1843 (4064)	Wheelspin
2 nd	24.4 (24.0)	1690 (3726)	18.2	2030	3.90 (2.42)	90 (194)	24 (75)	750 (29.52)	1893 (4174)	Wheelspin
3 rd	33.6 (33.2)	1485 (3274)	13.6	1880	6.07 (3.77)	85 (185)	21 (70)	749 (29.49)	1698 (3744)	Engine stall
4 th	37.9 (37.4)	1197 (2639)	7.4	1900	8.02 (4.98)	85 (185)	21 (70)	748 (29.45)	1400 (3087)	Engine stall
5 th	35.6 (35.2)	625 (1378)	3.5	1885	15.3 (9.51)	85 (185)	17 (63)	748 (29.45)	738 (1627)	Engine stall
6 th	31.8 (31.4)	380 (837)	2.1	1880	22.6 (14.04)	80 (176)	16 (61)	747 (29.42)	500 (1102)	Engine stall

(2) FUEL CONSUMPTION

Gear	Optimum fuel consumption			Range of pull over which specific fuel consumption does not exceed optimum consuption by more than 10%
	Specific fuel consumption, g/metric drawbar hp h (lb/drawbar hp h)	Metric drawbar hp h/l (drawbar hp h/UK gal)	Corresponding pull, kp (lb)	kp (lb)
1 st	420 (0.940)	2.00 (8.98)	1360 (2998)	1030 — 1843 (2271 — 4064)
2 nd	296 (0.662)	2.84 (12.7)	1503 (3314)	970 — 1725 (2138 — 3803)
3 rd	273 (0.610)	3.08 (13.8)	1692 (3731)	960 — 1585 (2116 — 3494)
4 th	195 (0.436)	4.31 (19.3)	1380 (3042)	1345 — 1400 (2965 — 3087)
5 th	277* (0.619)	3.03 (13.6)	625 (1378)	380 — 738 (837 — 1627)
6 th	311* (0.695)	2.70 (12.1)	380 (837)	330 — 500 (727 — 1102)

* The drawbar specific fuel consumption in gears 5 and 6 had no clearly marked minima and the values shown for optimum fuel consumption in these gears are corresponding to maximum drawbar horsepower.

PART IV

1. Location of centre of gravity

Tractor equipped as in	test III A. — ballasted	test III B. — unballasted
Height above ground	780 mm (30.71 in)	835 mm (32.88 in)
Distance forward from the vertical plane containing the axis of the rear wheels	541 mm (17.35 in)	660 mm (25.95 in)
Distance from the median plane parallel to the longitudinal axis of the tractor bisecting the track	— — —	3 mm (0,1 in)

2. Turning space and turning radius

Tractor weight and wheel equipment as for drawbar test without ballast

Wheel track: Front — 1370 mm (53.9 in)
Rear — 1490 mm (58.7 in)

	With brakes		Without brakes	
	Right-hand	Left-hand	Right-hand	Left-hand
Radius of turning space	3.40 m (11.16 ft)	3.25 m (10.66 ft)	3.54 m (11.61 ft)	3.42 m (11.22 ft)
Turning radius	3.30 m (10.83 ft)	3.15 m (10.33 ft)	3.44 m (11.28 ft)	3.32 m (10.89 ft)

PART V

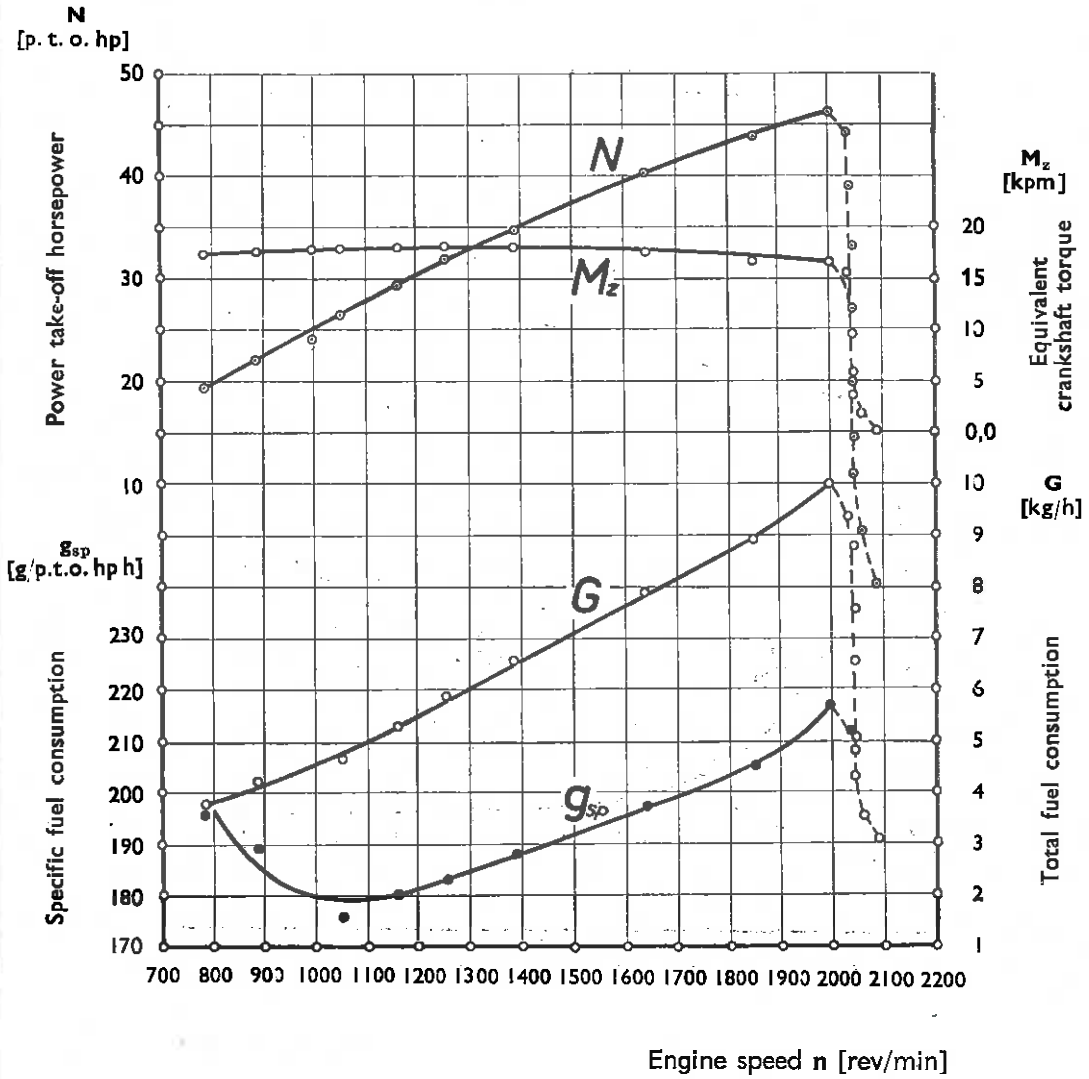
1. **Repairs and adjustments during tests:** None
2. **Remarks:** None

Test Engineer: D. KRPAN
Officer in charge: V. OBELIĆ
Director: I. TODORIĆ
Date: 14th December 1965.

APPENDIX

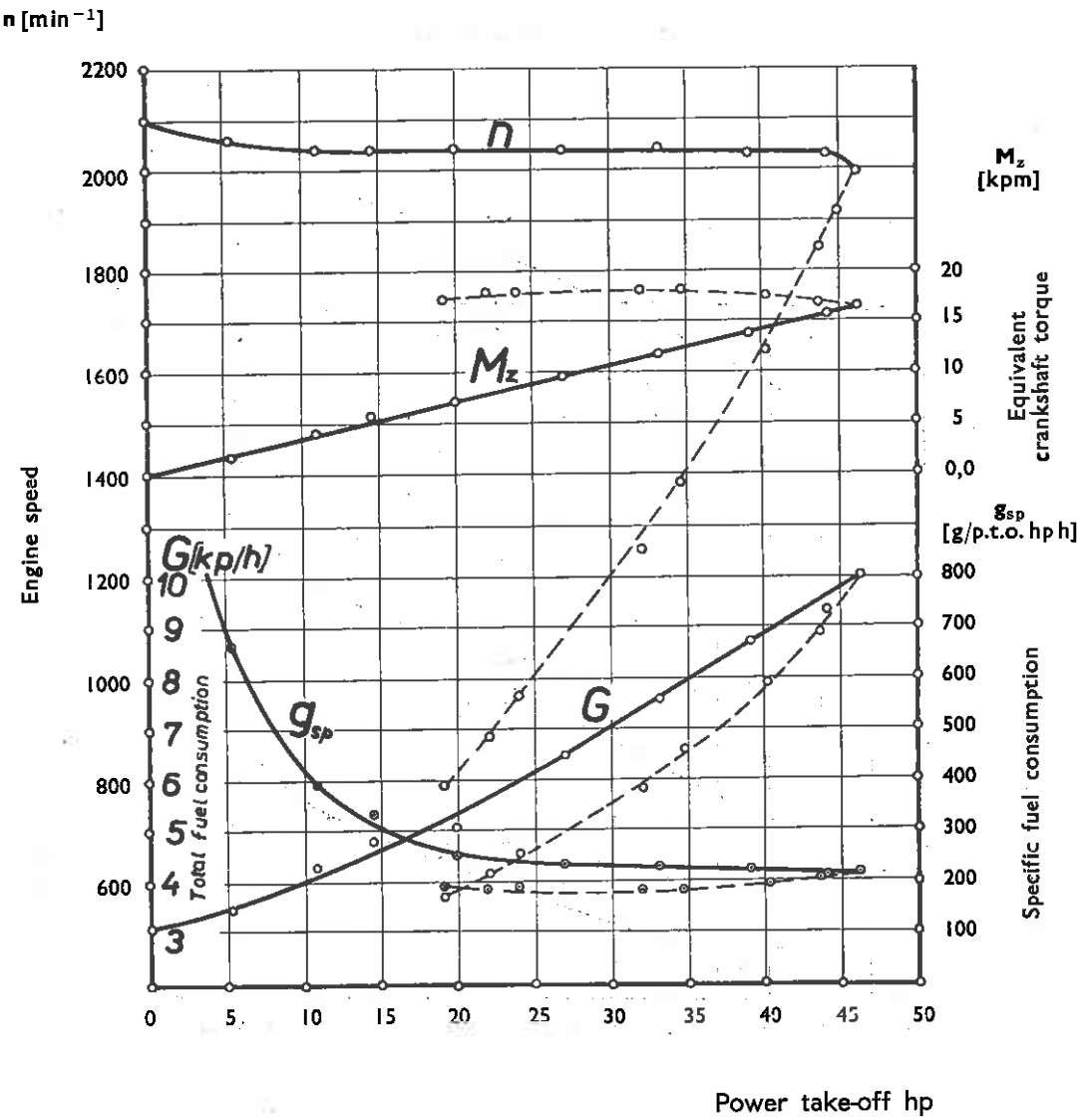
Institut za mehanizaciju poljoprivrede ZAGREB	**Tractor ZADRUGAR 50-Special**	Figure 1
		A—204 e

Power take-off test



Institut za mehanizaciju poljoprivrede ZAGREB	**Tractor ZADRUGAR 50-Special**	Figure 2
		A—205 e

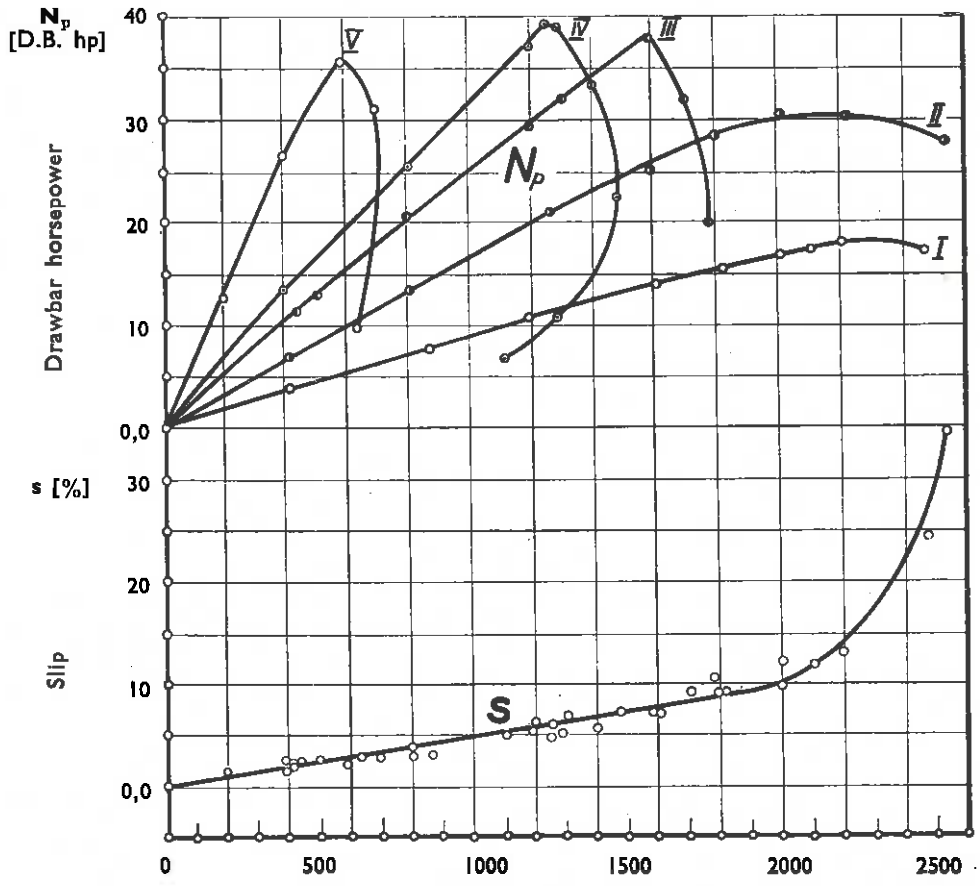
Power take-off test



Institut za mehanizaciju poljoprivrede ZAGREB	**Tractor ZADRUGAR 50-Special**	Figure 3
		A—208 e

Drawbar test on concrete, with ballast

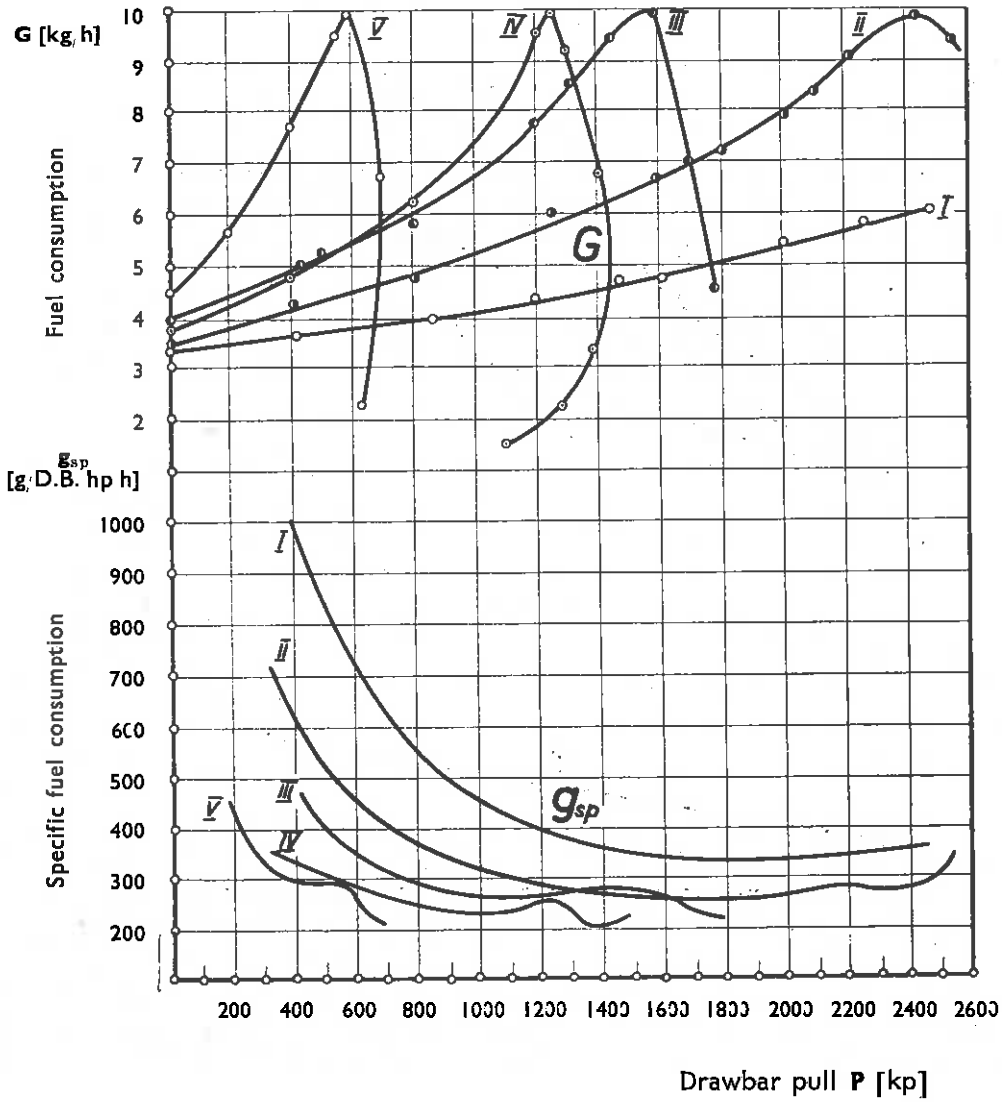
Drawbar horsepower and slip



Institut za mehanizaciju poljoprivrede ZAGREB	**Tractor ZADRUGAR 50-Special**	Figure 4
		A—209 e

Drawbar test on concrete, with ballast

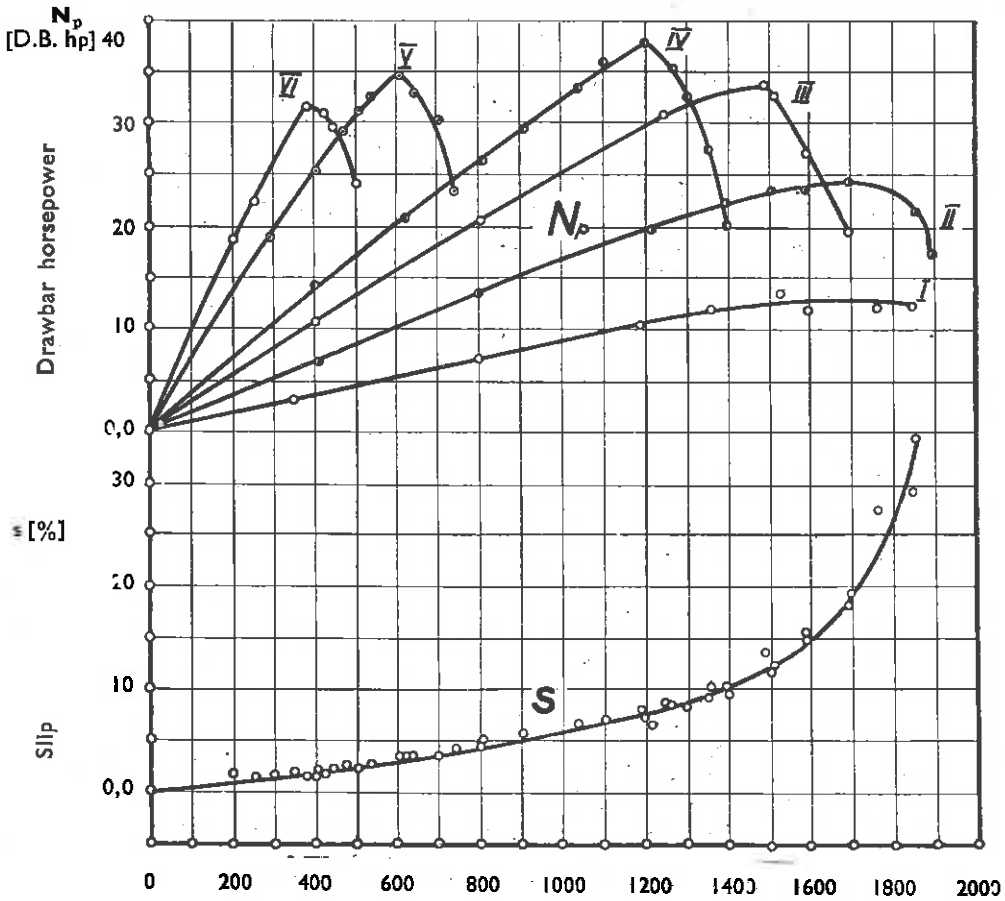
Fuel consumption



Institut za mehanizaciju poljoprivrede ZAGREB	Tractor ZADRUGAR 50-Special	Figure 5
		A—206 e

Drawbar test on concrete, without ballast

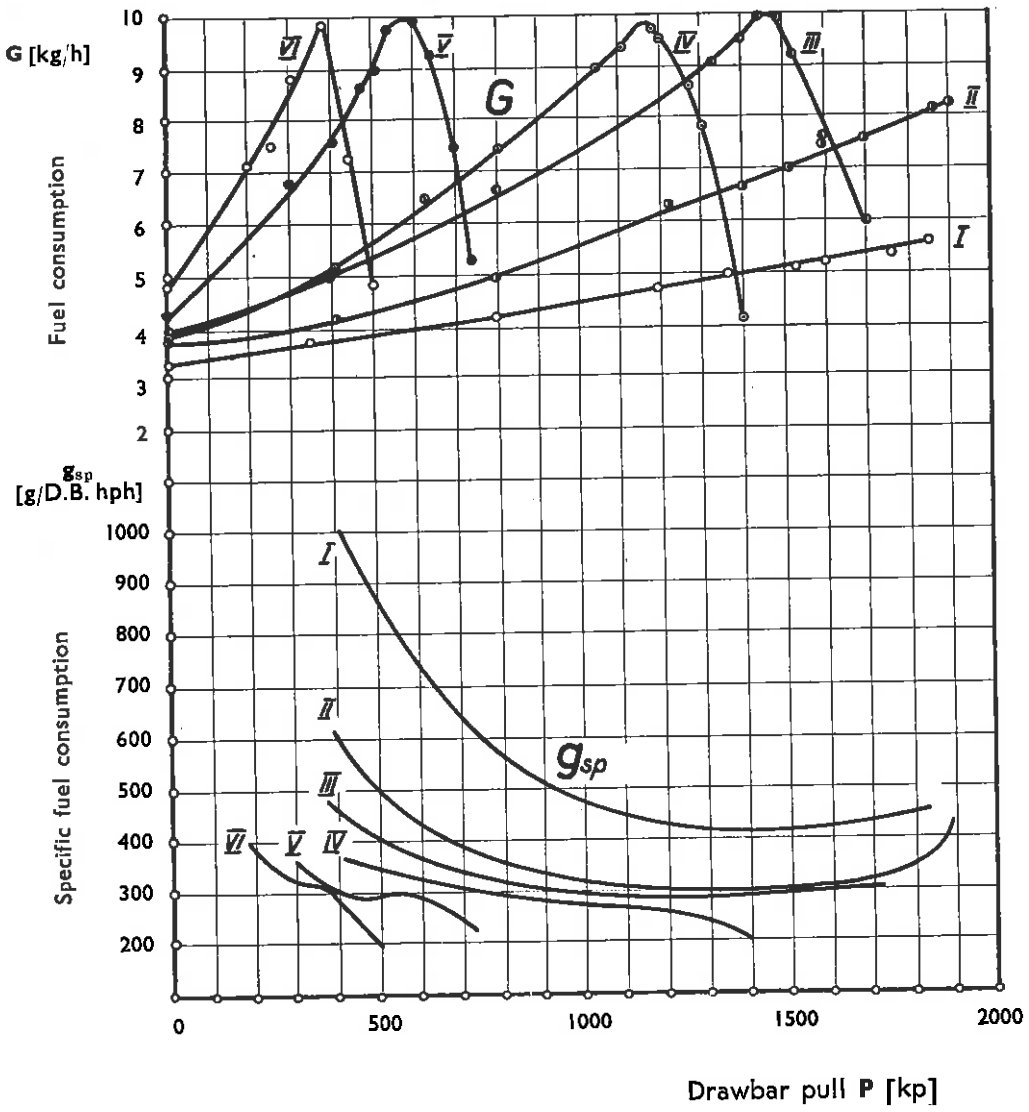
Drawbar horsepower and slip



Institut za mehanizaciju poljoprivrede ZAGREB	**Tractor ZADRUGAR 50-Special**	Figure 6
		A—207 e

Drawbar test on concrete, without ballast

Fuel consumption



Tisak Grafičkog zavoda Hrvatske, Zagreb