FINNISH RESEARCH INSTITUTE OF ENGINEERING IN AGRICULTURE AND FORESTRY
(VAKOLA)

Testing, research and development of the machines used in agriculture, gardening, forestry, dairy, household work and home industries

Address: Rukkila, Helsinki 100, Finland

TEST BULLETIN: O.E.C.D. No. 333

Report on test in accordance with O.E.C.D.
Test Code for Agricultural Tractors



VALMET 700 Mk II DIESEL TRACTOR

Manufactured by: Valmet Oy, Tourulan Tehdas,
Jyväskylä, Finland

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

Date of approval: 7th August 1970

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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.

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Tractor manufacturer:	Valmet Oy, Tourulan Tehdas, Jyväskylä, Finland
Submitted for the test by:	The manufacturer
Selected by:	The manufacturer with the agreement of the institute
Place of running-in:	Jyväskylä and district
Duration of running-in:	120 hours

SPECIFICATION OF TRACTOR

Tractor

Make:	Valmet Oy, Tourulan Tehdas
Model:	700 Mk II
Type:	Four wheel, rear wheel driven
Serial No.:	5321

Engine

Make:	Valmet Oy, Linnavuoren Tehdas
Model:	411 A 7
Type:	4- stroke, direct injection diesel, water cooled
Serial No.:	5851
Cylinders:	4 cylinders, vertical, in line, 108 mm bore, 114 mm stroke, capacity 4180 cm^3, compression ratio 17:1, overhead valves, dry replaceable cylinder liners
Fuel system:	A.C. diaphragm type fuel feed pump, C.A.V. type FAS 5836180 paperfilter with watertrap, capacity of fuel tank 70 l, Simms type P 4658/2 injection pump, serial No. 42 G, manufacturer's production setting: 14,00 kg/h at 2100 rev/min rated engine speed, Simms type NL 141 injector nozzles, injector setting 200 kp/cm^2, injection timing 18° before T.D.C.
Governor:	Simms type 1000 S 740, mechanical governed range of engine speed 600...2300 rev/min, rated engine speed 2100 rev/min
Air cleaner:	Main filter Mann, dry paperfilter 45 165 65 104
Lubrication system:	Forced feed from gear type pump, full flow replaceable paper filter type Fram CH-801 PL, total oil capacity 10 l, recommended oil change period 150 h
Cooling system:	Water cooled, pressurized at 0,4 kp/cm^2, impeller assisted with 410 mm dia, belt driven 4 blade fan, thermostat and radiator curtain for temperature control, cooling water capacity 15 l
Starting system:	Electrical, Lucas type M 50 12 V 4 HP solenoid engaged starter motor, operable only when main gear selector is in neutral position, thermostart system C.A.V. 1854050 12 V for cold starting
Electrical system:	Voltage: 12, negative earth Generator: Bosch type 0101 206 138 Battery: Salama type 12 EF 140 lead acid, capacity 140 Ah

Transmission

Clutch: Borg & Beck, dry double plate, 280 mm dia, operated with two separate pedals, when needed the two pedals can be locked together so that they work as one

Gearbox: Own make, four synchromesh, reverse and dual range synchromesh reduction gears, 8 forward speeds and 2 reverse

Rear axle and final drive: Own make, crown wheel and pinion with bevel gear type differential and spur gear final drives, pedal operated differential lock

Oil capacities: Transmission 20 l, final drives 5,5 l each, recommended oil change period 750 h

Gear	Number of engine revolutions for 1 revolution of driving wheel	Nominal travelling speed at 2100 rev/min rated speed of engine km/h
forward		
1 (L1)	151,43	3,45
2 (H1)	91,47	5,71
3 (L2)	69,48	7,52
4 (H2)	41,97	12,45
5 (L3)	33,24	15,72
6 (L4)	26,05	20,06
7 (H3)	20,08	26,02
8 (H4)	15,74	33,20
reverse		
1 (LR)	80,07	6,53
2 (HR)	48,36	10,80

Power take-off: At rear of the tractor in vertical centre plane, 6 splines, 1 3/8 in (34,85 mm)dia, height above ground 695 mm, proportional engine speed giving 729 or 1050 rev/min at 2100 rev/min rated engine speed, standard p.t.o. speed 540 rev/min at 1556 rev/min engine speed and standard p.t.o. speed 1000 rev/min at 2000 rev/min engine speed, ground speed p.t.o., direction of rotation clockwise viewed from tractor rear, p.t.o. in front of engine

Belt pulley: Attacheable to rear of tractor in two alternative horizontal positions, p.t.o. driven, manually engaged, 270 mm dia x 165 mm face width 1080 or 1575 rev/min giving 917 or 1335 m/min linear speed at 2100 rated engine speed, direction of rotation: optional

Power lift: Own make, live hydraulic with gear type pump directly driven from engine supplying oil to ram cylinder and external tapping, category 2 three point linkage with lower link sensing, draught, position and pressure controls, adjustable draught response and speed to drop implement, vertical lift movement above ground: 0...685 mm or 275...960 mm depending on lift rod position

Drawbar	Fixed on hydraulic hitch-hook, height above ground 445 mm, distance from rear axle 730 mm, 245 mm under p.t.o. and 390 mm behind it, lateral adjustment 500 mm
Trailer hitch	At rear of the tractor, hydraulic hitch-hook, height above ground 495 mm, distance from rear axle 289 mm to rear, 200 mm under p.t.o. and 46 mm in front of it
Towing hitch	At front of tractor, height above ground 640 mm
Steering	Own make, hydrostatic steeringsystem gets pressure oil from the same pump as power lift. Oilflow is 15 l/min and max. pressure 70 kp/cm^2, steering valve is Orbitrol type OSP 160
Brakes	Own make, hydraulically operated double disc dry type on differential half shafts, hydraulic brake force egualizer, indepenedet or combined pedal operated, hand lever ratched operating both brakes for parking
Wheels	
Steering wheels:	Two at front, Nokia 7.50-16 tyres, 8 ply ratings, maximum permissible weight on each tyre 860 kp at 3,5 kp/cm^2 pressure, track 1370 - 1470 - 1520 - 1570 - 1620 - 1670 - 1720 - 1820 mm by extending front axle and reversing wheels
Driving wheels:	Two at rear, Pirelli 16.9-30 tyres, 8 ply ratings, mounted on DW 14 - 30 rims, maximum permissible weight on each tyre 2110 kp at 1,5 kp/cm^2 pressure, track 1500 - 1620 - 1780 - 1880 mm changed by reversing wheel centres and offset lugs on rims
Wheelbase:	2212 mm

Tractor and ballast weights

(without driver but tanks full)

Weight without ballast:	Front:	1072 kg
	Rear:	2006 "
	Total:	3078 "
Ballast:	Front:	10 frame weights and frame, total 459 kg, 1 weight per wheel, total 53 kg
	Rear:	4 weights per wheel, total 533 kg, liquid 582 kg
Weight with full ballast:	Front:	1722 kg
	Rear:	2983 "
	Total:	4705 "

Seat	Bostrom Argus XL upholstered cushion and backrest, torsiospring with hydraulic damper, adjustable for driver's weight from 50 to 110 kp, range of adjustment 75 mm fore and aft

Number of grease points

Whole tractor:	19

Overall dimensions

Overall length:	3,64 m without ballast weights 4,15 m with front weights fitted
Overall width:	Without ballast weights 1,94 m at 1500 mm rear wheel track With ballast weights 2,25 m at 1500 mm rear wheel track
Overall height:	2,31 m to roof of safety cab
Minimum ground clearance:	423 mm to underside of trailer hitch

Lighting

	Height above ground of centre cm	Diameter cm	Distance from outside edge of tractor at 1500 mm wheel track to centre cm
Head lights	87,5	12	78
Side lights	167	5	9,5
Rear lights	167	5	9,5
Reflectors	139	7,5	11

Unrestricted beam angle of headlight in plan view 108°

FUELS AND LUBRICANTS USED IN TESTS

Fuel:	Shell diesel oil, specific gravity 0,830 at 15°C, cetane number 55
Engine oil:	Shell Rotella T, SAE 30
Transmission oil:	Esso Gear Oil, SAE 80

COMPULSORY TESTS

1. MAIN POWER TAKE-OFF PERFORMANCE

Date and location of tests: 1st April 1970
Helsinki, Finland

Type of dynamometer: Water brake, Schenck U1-30

Horsepower	Speeds rev/min		Fuel consumption		
metric hp	Engine	P.t.o.	l/h	g/metric hph	metric hph/l
Maximum power - 2 hour test					
73,1	2100	729	16,90	192	4,32
Standard p.t.o. speed (540 rev/min)					
59,5	1556	540	12,91	180	4,61
Speed recommended by the manufacturer for drawbar work					
73,1	2100	729	16,90	192	4,32
Part loads					
62,8	2125	738	13,85	183	4,53
0	2280	792	4,00	-	-
32,7	2215	768	8,26	209	3,96
73,1	2100	729	16,90	192	4,32
16,7	2265	787	6,17	307	2,71
48,4	2190	760	10,70	184	4,52

No load maximum engine speed:		2280	rev/min
Equivalent crankshaft torque at maximum power:		24,9	kpm
Maximum equivalent crankshaft torque: at 1310 rev/min engine speed		27,4	kpm
Mean atmospheric conditions:	temperature	17	°C
	pressure	751	mm Hg
	relative humidity	24	%
Maximum temperatures:	coolant	86	°C
	engine oil	102	°C
	fuel	29	°C

2. DRAWBAR PERFORMANCE

Date of tests: 29th May - 5th June 1970
Type of track: tarmacadam
Height of drawbar above ground: 495 mm

Gear	Horse-power metric hp	Drawbar pull kp	Speed km/h	Engine speed rev/min	Wheel slip %	Spec. fuel consumption g/metric drawbar hph	Spec. fuel consumption metric drawbar hph/l	Temperature °C Coolant	Temperature °C Fuel	Temperature °C Engine oil	Atmospheric conditions Tempera-ture °C	Atmospheric conditions Relative humidity %	Atmospheric conditions Pressure mm Hg
(i) Maximum power (ballasted)													
1 (L1)	39,2	3110	3,4	2230	11,9	236	3,52	75	28	70	22	32	774
2 (H1)	59,0	2830	5,6	2135	9,0	231	3,60	80	30	85	22	32	774
3 (L2)	60,5	2120	7,7	2150	5,4	232	3,58	80	31	84	24	43	775
4 (H2)	60,5	1280	12,7	2100	2,8	221	3,76	80	28	75	24	43	774
5 (L3)	58,7	960	16,5	2140	1,4	224	3,70	80	28	75	24	43	774
6 (L4)	55,5	765	19,6	1995	1,7	211	3,94	80	36	82	23	48	773
(ii) Five hour test at 75 % of pull at maximum power in 3rd gear													
3 (L2)	47,0	1590	18,0	2190	3,6	221	3,75	86	35	102	27	26	752
(iii) Five hour test at pull corresponding to 12,0 % wheelslip in test (i)													
1 (L1)	-	3120	3,3	-	-	-	-	88	35	100	27	26	752
(iv) Maximum power (unballasted)													
1 (L1)	29,0	2180	3,6	2280	9,5	275	3,02	80	18	70	14	70	764
2 (H1)	45,2	2200	5,5	2240	12,7	252	3,29	80	20	70	14	70	764
3 (L2)	60,7	2200	7,4	2130	7,7	230	3,61	80	20	75	15	66	766
4 (H2)	59,9	1320	12,3	2045	4,5	224	3,71	80	22	74	14	54	766
5 (L3)	58,6	985	16,1	2110	2,8	232	3,57	80	22	74	14	54	768
6 (L4)	58,5	790	20,0	2020	1,2	227	3,65	80	22	74	14	54	768

Total oil consumption during ten hours duration of tests (ii) and (iii): 29 g/h

3. TURNING SPACE AND TURNING CIRCLE

Details of wheel equipment: As in specification without ballast

Track of wheels: Front: 1370 mm
Rear: 1500 mm

	With brakes		Without brakes	
	right-hand m	left-hand m	right-hand m	left-hand m
Radius of turning space	3,50	3,49	4,02	4,10
Radius of turning circle	3,35	3,34	3,87	3,95

4. LOCATION OF CENTRE OF GRAVITY

	mm
Height above ground	860
Distance forward from the vertical plane containing the axis of the rear wheels	770
Distance from the median plane of the tractor	0

5. BRAKE TESTS

Date of tests: 14th April and 4th June 1970

Type of track: tarmacadam

Type of decelerometer: Moto Meter

Weight of ballasted tractor with driver: 4780 kg

Cold brakes

	Ballasted	Without ballast
Travelling speed of tractor km/h	25,0	25,0
Maximum deceleration m/s^2	4,4	4,1
Stopping distance m	7,4	8,0
Force exerted on the brake pedal kp	60	48

Brake fade characteristics (hot tests)

Maximum deceleration hot/cold	100 %
Stopping distance cold/hot	100 %
Force on pedal cold/hot	100 %

Parking brake

Efficiency of handbrake:	
facing up slope	good
facing down slope	good
Pull on handbrake:	30 kp

6. MEASUREMENT OF AMBIENT NOISE EMITTED BY THE TRACTOR

Date of tests:	26th May 1970	
Type of sound level meter:	Brüel & Kjaer, 2203	
Type of track:	tarmacadam	
Results of tests:	gear:	8th
	travelling speed before acceleration	24,9 km/h
	sound level:	86 dB A

7. NOISE MEASUREMENT AT THE DRIVER'S EAR LEVEL IN THE SAFETY CAB

Date of tests:	25th April 1970
Type of sound level meter:	Brüel & Kjaer, 2203
Type of octave filter:	Brüel & Kjaer, 2112 + 2305
Type of track:	tarmacadam
Results of tests:	

Gear	Travelling speed[1] km/h	Sones
1 (L1)	3,5	118
3 (L2)	7,5	130
4 (H2)	12,5	125
6 (L4)	20,1	122
8 (H4)	33,2	128

1) The first gear tested corresponding to the travelling speed nearest to 7,25 km/h

8. POWER LIFT AND HYDRAULIC PUMP PERFORMANCE

Date and location of tests: 10th April and 24th June 1970, Helsinki, Finland

Hydraulic fluid: Shell, Tellus 29

Type of linkage lock for transport: hydraulic

Opening pressure of the cylinder over pressure relief valve: 180 kp/cm^2

	Height above ground in down positon mm		Vertical movement mm	Maximum force exerted through full range kp	Pressure kp/cm^2	Lifting force when front of tractor lifts kp
	hitch point	frame				
Linkage giving maximum mechanical advantage						
At hitch points	250	-	600	1900	175	-
On the frame	-	310	450	1500	175	1440
Linkage giving minimum mechanical advantage						
At hitch points	50	-	660	1780	175	-
On the frame	-	115	470	1410	170	1440

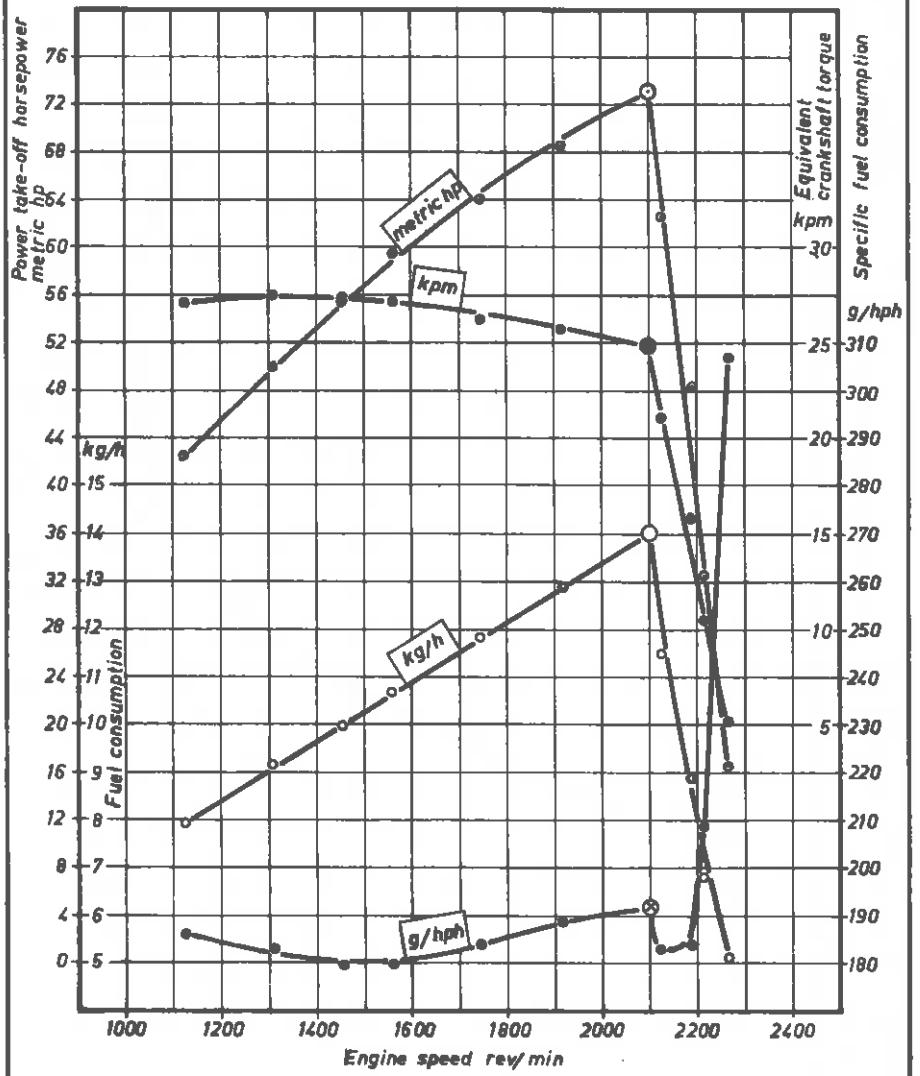
Pump characteristics:

Opening pressure of the relief valve:	170	kp/cm^2
Sustained pressure by the open relief valve:	180	"
Pump delivery rate at external tapping at minimum pressure and rated engine speed:	38,1	l/min
at maximum hydraulic power:	34,5	"
delivery pressure:	175	kp/cm^2
power:	13,6	metric hp

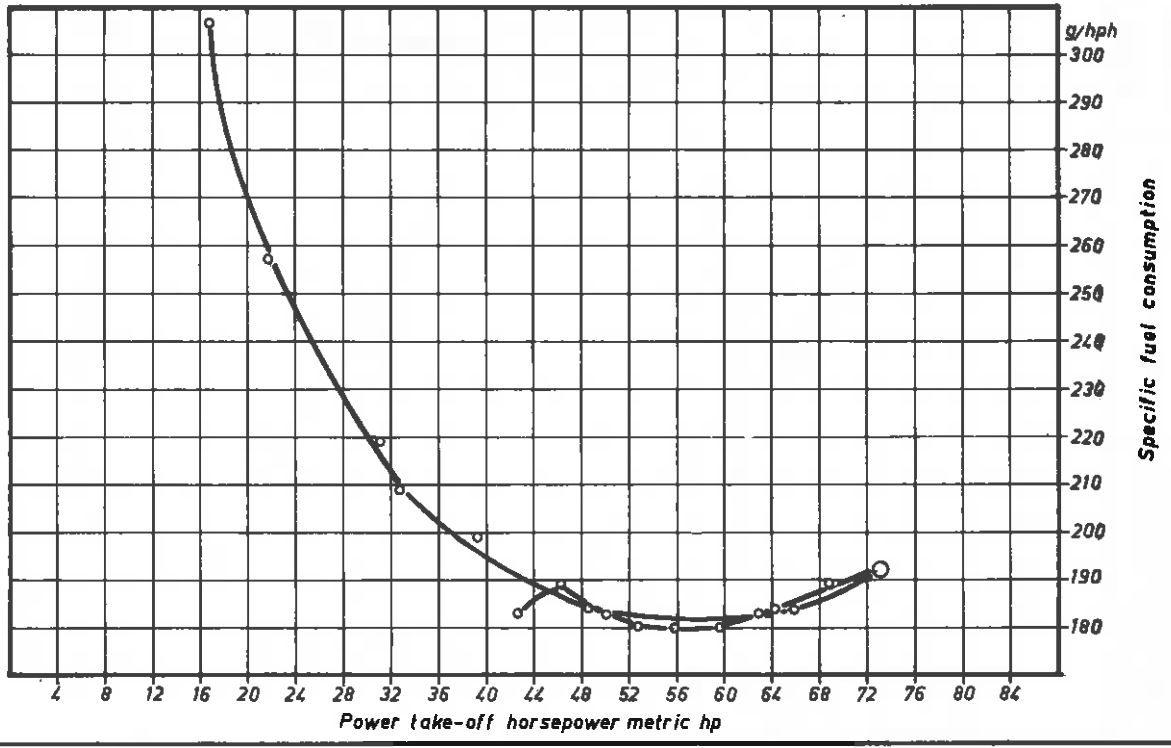
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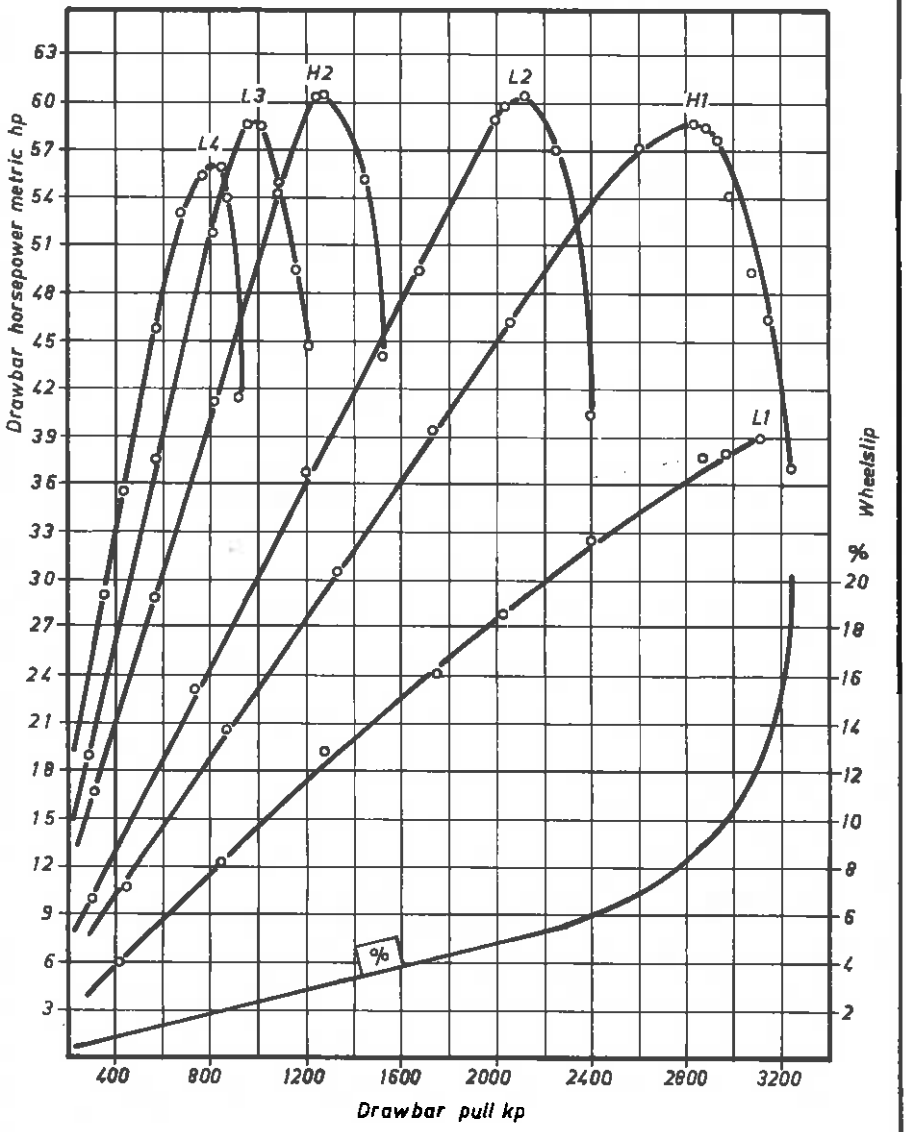
Finnish Research Institute of Engineering in Agriculture and Forestry	Power take-off test	Valmet 700 MkII diesel tractor



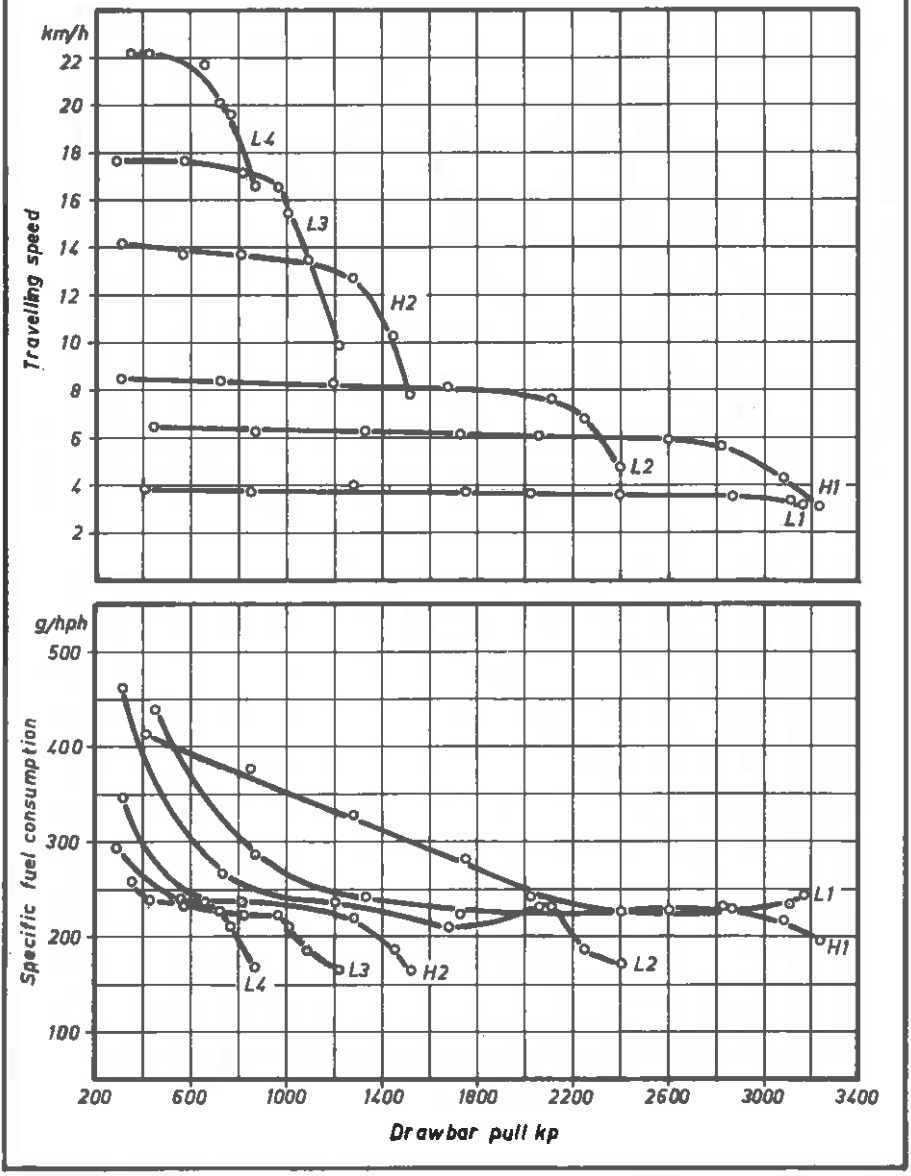
Finnish Research Institute of Engineering in Agriculture and Forestry	Power take-off test	Valmet 700 Mk II diesel tractor



Finnish Research Institute of Engineering in Agriculture and Forestry	Drawbar test with ballast	Valmet 700 MkII diesel tractor



Finnish Research Institute of Engineering in Agriculture and Forestry	Drawbar test with ballast	Valmet 700 MkII diesel tractor



Finnish Research Institute of Engineering in Agriculture and Forestry	Drawbar test without ballast	Valmet 700 Mk II diesel tractor

