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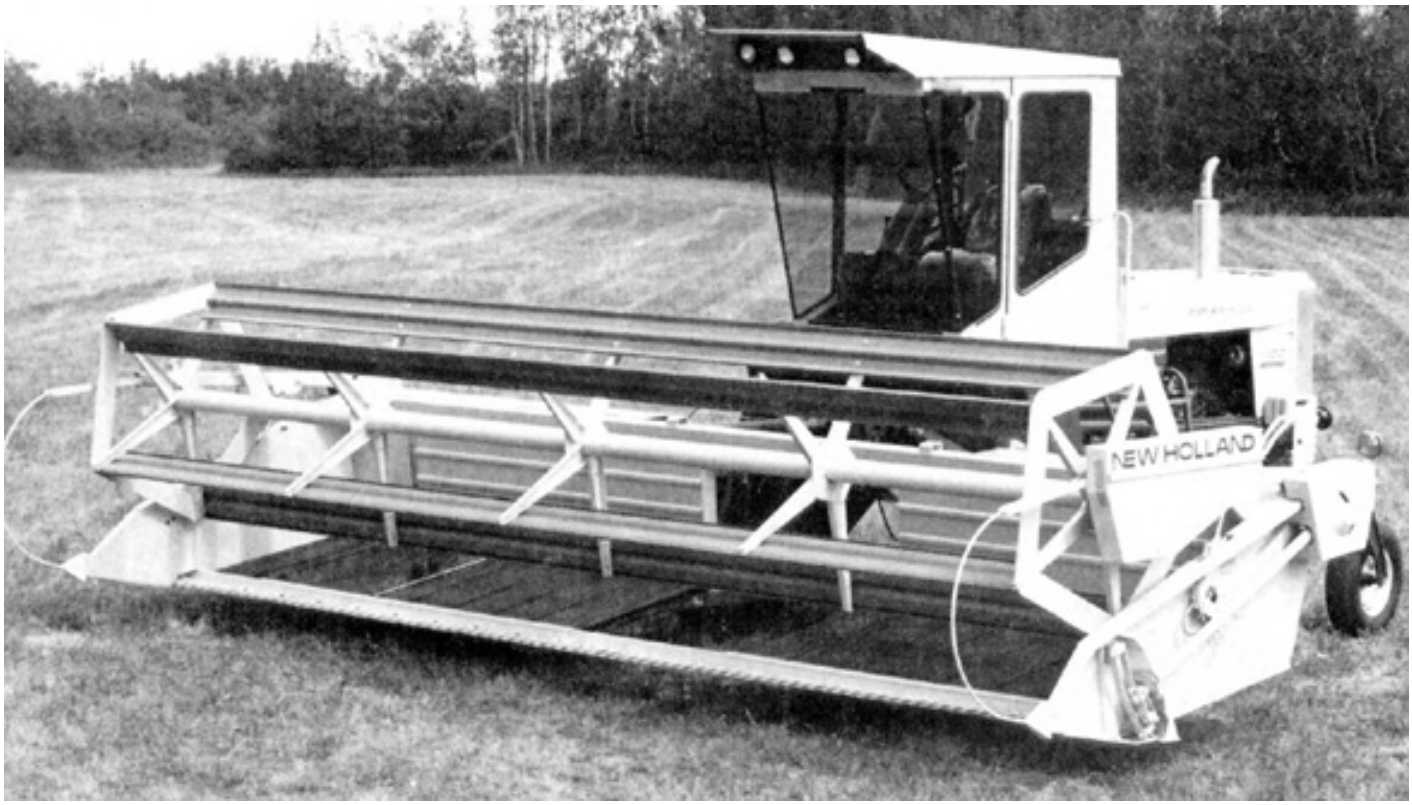
Evaluation Report 402



Sperry New Holland 1100 Self-Propelled Windrower

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

SPERRY NEW HOLLAND 1100 SELF-PROPELLED WINDROWER

MANUFACTURER:

Sperry New Holland
Division of Sperry Corporation
New Holland, Pennsylvania 17557

RETAIL PRICE:

$54,752.00 (February, 1985, f.o.b. Humboldt with 21 ft. (6.4 m) model 1116D draper header).

DISTRIBUTORS:

Sperry New Holland
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Winnipeg, Manitoba
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1055 Mackay Street
Regina, Saskatchewan
S4N 4X9

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Calgary, Alberta
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SUMMARY AND CONCLUSIONS

Rate of Work: Average speeds for the New Holland 1100 windrower were 5 to 6 mph (8 to 10 km/h). Maximum working speed was about 10 mph (16 km/h). Average work rates varied from 8 to 10 ac/h (3.3 to 4.0 ha/h).

Quality of Work: Performance of the dividers was fair. The dividers flattened a strip of crop, Reel performance was very good. Cutting ability was very good in ali crops if sickles and guards were in good condition. The knife had adequate power, but the knife drive vibrated at full speed, Header flotation was very good. The cutterbar rode safely over stones and obstructions. Draper performance was fair. The drapers frequently plugged in tall crops and were slightly underpowered in heavy rapeseed crops.

Windrow formation was very good. Parallel and fantail windrows were formed in centre delivery. Parallel and angled parallel windrows were formed in end delivery. Single windrows were typically 3 to 4 ft. (0.9 to 2.4 m) wide. Double windrows were 7.5 to 10 ft. (2.3 to 3.1 m) wide. Windrow uniformity was good. Bunching occurred in tall, straight crops when the drapers frequently plugged.

Ease of Operation and Adjustment: Header visibility was very good but shadows caused the cab windows to act like mirrors. Operator comfort was good. The cab was clean, but the knife drive caused annoying vibrations. Cab noise level was about 89 dBA. The controls were good. They were well placed, but the header lift pedals were awkward to operate, The instruments were easy to view.

Handling was very good. The windrower maneuvered easily and was very stable on slopes. Ease of transporting was very good. High range provided adequate speeds for short moves.

Ease of adjustment was very good. Ease of lubrication and maintenance was very good, Daily lubrication took about 10 minutes. Routine maintenance was easily performed. The draper pump drive belts could not be tightened properly.

Engine and Fuel Consumption: The diesel engine had ample power and consumed about 2.4 gal/h (11.0 L/ha) while operating.

Operator Safety: No safety hazards were apparent on the NH 1100. Adjustments and controls were safe. A seat belt was not provided.

Operator's Manual: The operator's manuals were very good. Separate manuals were supplied for the traction unit, the diesel engine and the header. They included concise and welt illustrated information on operation, servicing and assembly.

Mechanical History: Several mechanical problems occurred during the test. Most problems were related to the hydraulic systems on the traction unit and header.

RECOMMENDATIONS

tt is recommended that the manufacturer consider:

1. Modifications to the dividers to reduce crop loss.
2. Modifications to reduce knife drive vibrations.
3. Modifications to reduce draper plugging.
4. Increasing the power of the hydraulically driven drapers.
5. Modifications to reduce internal reflection of the cab windows when working around shadows from buildings or trees.
6. Modifications to the header lift system to make it more convenient to operate.
7. Improving the ease of tightening the hydraulic pump drive belts.
8. Providing a seat belt with the machine.
9. Modifications to improve hydraulic system reliability.

Senior Engineer: G.E. Frehlich

Project Engineer: M.E. Jorgenson

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Divider losses are related to stubble length and crop density, which make it difficult to make one design to suit all conditions, Modifications to the divider shoe and rod wilt be considered.
2. Header vibration is greatly reduced when the sickle operating speed is reduced from 875 cycles per minute to 675 - 740 cycles per minute. Sickle speed will be reduced on all future productions and changeovers will be made on all past production machines in the field and at the dealers.
3. Modifications have been made to the header structural members to eliminate draper plugging. These changes will also be implemented on past production machines.
4. Insufficient hydraulic pump drive belt tension, draper plugging and draper roller movement and drag combined to overtax the draper drive system. Elimination of these problems should permit proper draper operation. Changeovers will be made on all past production machines.
5. Modifications will be considered for future models.
6. A single header lift pedal, plus a "trim" pedal to allow header ti ting from side to side will be retrofitted on past machines and included on future machines. The trim feature can be easily overriden or ignored if desired.
7. A positive drawbolt belt tensioner will be retrofitted on past production machines and included on future modets.
8. This may be considered.
9. On all past and future machines, the hydraulic system return lines will be enlarged or relocated to reduce back pressure. The positive pump belt tensioner will ensure proper oil flow. Component suppliers have been advised and design changes are being considered. Quality control is being reviewed.

GENERAL DESCRIPTION

The New Holland 1100 is a self-propelled windrower with a draper header capable of centre, left or right end delivery for laying single or double windrows. It runs on two traction drive wheels and two rear castor wheels. It is powered by a Perkins 236 cu in (3.9 L) four cylinder diesel engine. The traction drive wheels

are powered by dual range hydrostatic transmissions on each wheel. The two sections of cutterbar are mechanically driven from the traction unit through a series of drive shafts and wobble drives. The two sliding drapers and the reel are driven by hydraulic motors, while the right divider draper is belt driven.

Draper speed, reel speed, and draper delivery position are hand controlled from the operator station. The reel and header lifts are foot controlled.

The test machine was equipped with a 21 ft (6.4 m) double windrow draper header and five bat reel. Detailed specifications are given in APPENDIX 1.

SCOPE OF TEST

The NH 1100 was operated in the conditions shown in TABLE 1 for 107 hours while cutting about 964 ac (390 ha). It was evaluated in hay[1], cereal grain, and oilseed crops for cutting ability, windrow formation, ease of operation and adjustment, sound level, fuel consumption, operator safety, and suitability of the operator's manual.

TABLE 1. Operating Conditions

CROP	VARIETY	OPERATION	YIELD		HOURS	AREA	
			bu/ac	(t/ha)		ac	(ha)
Hay	Native				4	16	(7)
	Brome		0.9*	(2.0)	4	14	(16)
		Single					
Flax	Dufferin	Windrows	10 to 20	(0.6 to 1.3)	7	75	(30)
Rapeseed	Westar		24	(1.3)	11	110	(44)
Fall Rye	Puma, Musketeer		25	(1.6)	22	144	(58)
		Single and					
Barley	Bonanza	Double Windrows	25 to 70	(1.3 to 3.8)	34	370	(150)
Wheat	Neepawa		30 to 38	(2.0 to 2.6)	25	235	(95)
* ton/ac				TOTAL	107	964	(390)

RESULTS AND DISCUSSION

RATE OF WORK

Uniform windrows were formed in most crops at average speeds of 5 to 6 mph (8 to 10 km/h). Slower speeds were required in tangled or tall leaning crops and in rough fields. Speeds up to 10 mph (16 km/h) were achieved in level fields with straight even stands.

Average work rates for the 21 ft (6.4 m) windrower varied from 8 to 10 ac/h (3.3 to 4.0 ha/h) in most crops. In straight even stands on level fields, work rates of 15 ac/h (6 ha/h) could be achieved.

QUALITY OF WORK

Dividers: Divider performance was fair. The wide divider flattened a strip of crop causing a slight crop loss (FIGURE 1). Cutting in the opposite direction on the next pass usually recovered most of the flattened crop. When double windrowing, this flattened crop could not be recovered because the windrower travelled in the direction of crop lean. The divider also flattened crop when making steering corrections or turning gradual corners. It is recommended that the manufacturer consider modifications to the dividers to reduce crop loss.

When double windrowing, the left divider did not snag the windrow or crop because the right divider draper laid the first windrow away from the standing crop.

Reel: Reel performance was very good. Reel speed was variable from 0 to 60 rpm. Reel tip speed ranged from 0to 10 mph (0to 16 km/h). The reel was usually adjusted for a reel speed index[2] of 1.1 to 1.2 to minimize shatter losses. Material did not wrap on the reel ends except in tangled flax when operating the reel too low.

The range of vertical and fore-and-aft reel adjustments was suitable for all crops.

Cutterbar: Cutting ability was very good in all crops provided the knife was maintained in good condition. Stubble was usually ideal (FIGURE 2). In rough fields undulating stubble resulted from excessive header bouncing. In tough green flax, material collected on dull sections and guards, plugging the knife.

All field work was conducted with overserrated knife sections. The knife had adequate power in all crops including hay. With the engine operating at full throttle, the knife was not properly counterbalanced and vibrated the entire header. Although no serious damage occurred, it is recommended that the manufacturer consider modifications to reduce knife drive vibrations.

Independently controlled header lift pedals permitted the cutting height to be varied across the width of the header. This procedure was useful for catching all heads in varying crops, reducing the quantity of straw in the windrow, and providing a snow trap.

Header Flotation: Header flotation was very good. Flotation was provided by four tension springs on the traction unit linkage (FIGURE 3). Good header flotation minimized cutterbar damage in stony fields and enabled the header to follow most ground contours. Undulating stubble occurred in rough fields.

FIGURE 1. Crop Flattened by the Divider.

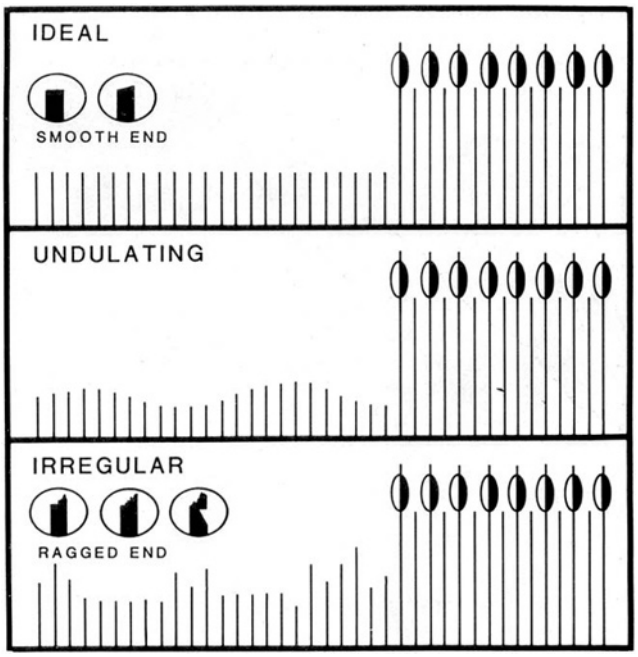

FIGURE 2. Types of Stubble.

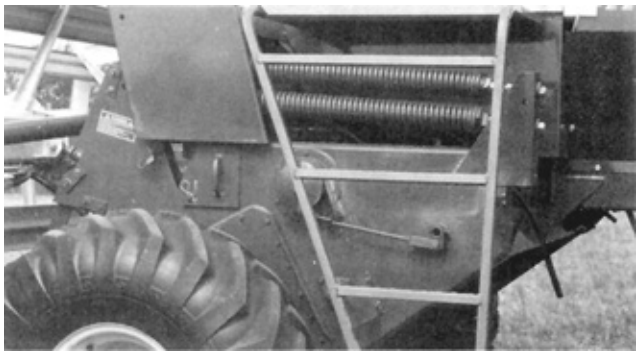

FIGURE 3. Header Flotation System.

[1] *The manufacturer recommends that this header not be used in hay crops,*
[2] *Reel Speed Index is the ratio of reel tip speed to travel speed.*

Drapers: Draper performance was. fair. Draper speed could be varied from 0 to 500 fpm (0 to 2.5 m/s). In most crops, the drapers were run at full speed. Uniform windrows could usually be formed at this draper speed. However, in tall crops, such as fall rye and wheat and in heavy stands of bromegrass and barley, the drapers frequently plugged when material caught on the rear shields at the windrow opening. It was then pulled under the drapers where it caught on the cross braces, stopping the draper (FIGURE 4). Plugging occurred when centre and end delivering, but was most severe when end delivering because of the greater quantity of material on one side of the opening.

Factory representatives modified the draper cross braces and shields to reduce plugging. In the centre delivery opening, the draper motor shields and the rear draper guide were trimmed down. In the end delivery openings, the rear roller mounts were enclosed in shielding and the draper support straps were rounded and shortened. These modifications were not adequate as plugging still occurred in wheat and barley crops. It is recommended that the manufacturer consider further modifications to reduce draper plugging.

Some material wrapped on the rollers on the right divider draper. A cover plate was available to prevent this, but had not been installed on the test machine. Also, in short crops such as barley, some crop fell through the wide gap between the right sliding draper and the right divider draper.

The hydraulically driven drapers had adequate power to convey most crop materials. However, in one field of heavy green rapeseed, the drapers stopped due to lack of power. Since this crop condition is typical for the prairies, it is recommended that the manufacturer consider increasing the power of the hydraulically driven drapers.

When double windrowing, the right divider draper kept the first windrow about 12 to 18 in (305 to 457 mm) from the standing crop edge (FIGURE 5). This kept the divider from snagging the windrow on the second pass.

FIGURE 4. Plugged Draper in Fall Rye.

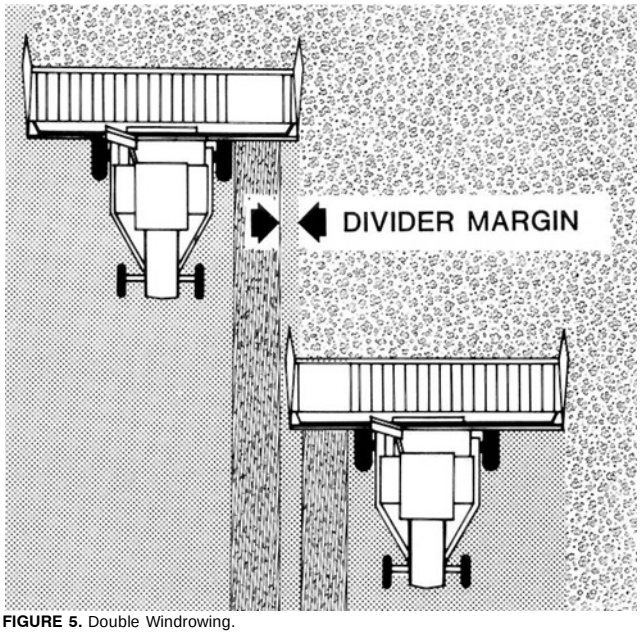

FIGURE 5. Double Windrowing.

Platform angles of less than 20 degrees are suitable for grain windrowing while steeper angles are used when windrowing hay. The platform angle of the NH 1100 was adjustable from 8 to 15 degrees which was suitable for all grain and oilseed crops. The 21 ft (6.4 m) double windrow header was not recommended for cutting hay.

Windrow Formation: Windrows may be classified into four general patterns (FIGURE 6), although many combinations and variations exist. Windrow formation was very good. FIGURES 7 to 11 show typical windrows formed by the NH 1100. Centre delivery windrows were usually formed parallel or fantailed. Alternating end delivery resulted in parallel or angled parallel windrows depending on direction of crop lean. Herringbone windrows occurred in light crops, while fantailed windrows occurred in heavy tall stands or ripe crops. Hay windrows were wide and parallel which could make them difficult to pick up. The 1116-D draper header was not recommended for use in hay.

The slight adjustment in platform angle had no effect on windrow formation. Reduced travel, draper, and reel speeds resulted in a more parallel windrow.

Single, centre-delivery windrows were normally 3 to 4 ft (0.9 to 2.4 m) wide. Single rapeseed windrows were about 6 ft (1.8 m) wide. Side-by-side double windrows formed with alternating end delivery varied from 7.5 to 10 ft (2.3 to 3.1 m) wide. The gap between the windrows could be reduced from 20 in (508 mm) to about 6in (152 mm) by driving closer to the first windrow on the second pass, but this reduced the width of cut by about 14 in (356 mm).

Windrow Uniformity: Windrow uniformity was good. Windrows were uniform in average and short crops at speeds up to 6 mph (10 km/h). In tall and heavy crops such as fall rye and wheat, bunchy windrows resulted when the drapers plugged, or when material caught on the rear draper shielding at the windrow openlng. Modifications to reduce draper plugging have been recommended.

EASE OF OPERATION AND ADJUSTMENT

Operator Comfort: The NH 1100 was equipped with an operator's cab positioned behind the windrow opening and above the traction drive wheels. Visibility of the header was very good, except when windrowing around shadows. If high objects such as trees or buildings cast a shadow upon part of the windows, the windows acted like a mirror, making it extremely difficult to see the divider. It is recommended that the manufacturer consider modifications to improve visibility in these conditions.

Operator comfort was good. The seat and steering column were adjustable to suit most operators. Incoming air was effec-

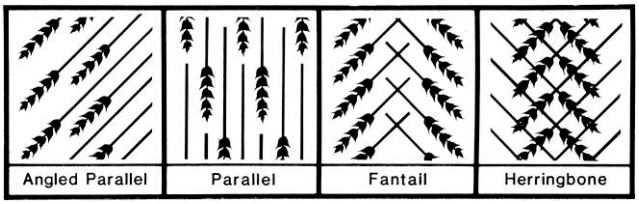

FIGURE 6. Windrow Types.

FIGURE 7. Wheat, Double Windrow: 38 bu/ac (2.6 t/ha).

tively filtered and the air conditioner provided comfortable cab temperatures. A heater was not included on the test machine.

Operator station sound level at full speed under load was about 89 dBA. For sound levels exceeding 85 dBA, ear protection should be worn. At full engine speed, knife drive vibrations were annoying to the operator.

Controls: Ease of operating the controls was good. Most of the controls for the NH 1100 (FIGURE 12) were conveniently located and properly identified. The travel speed control lever and the range shifter were conveniently located and easy to engage.

Header height was controlled by two foot pedals on the left side of the steering column. Separate header lift pedals for each side permitted the cutting height to be varied across the width of the header. However, the two controls made it difficult to raise or lower the entire header uniformly. A pin supplied by the manufacturer to lock the pedals together was not useful because one end of the header dropped faster than the other. Also, the header dropped too fast. A restrictor was fabricated and installed by PAMI in the hydrau!ic line to slow down the lowering rate. It is recommended that the manufacturer consider modifications to the header lift system to make it more convenient to operate. The reel lift system was conveniently operated by one foot pedal on the right side of the steering column.

FIGURE 8. Brome Hay, Single Windrow: 0.9 ton/ac (2.0 t/ha).

FIGURE 9. Rapeseed, Single Windrow: 24 bu/ac (13 t/ha).

FIGURE 10. Barley, Double Windrow: 30 bu/ac (1.6 t/ha).

FIGURE 11. Fall Rye, Double Windrow 25 bu/ac (1 6 t/ha).

Reel and draper speeds were hand-controlled with knobs in the cab. The draper speed control knob was inconveniently located, but since adjustments were rarely required, this was not a serious problem. The reel speed was very easy to adjust on-the-go.

For double windrowing, draper positions and directions were easily controlled with an electric switch from the operator station. The cable control knob which operated the sliding draper connecting latch was difficult to pull, but was only used when switchIng between double and single windrowing.

Instruments: The instruments were very good as the console was conveniently located and easy to observe (FIGURE 13). It included gauges for fuel level, engine oil pressure, engine coolant temperature, and engine hours. Warning lights indicated alternator charge and hydrostatic oil pressure. An audible alarm signailed an unsafe operating condition. The instrument panel light shone in the operator's eyes which was annoying at night.

Lights: The NH 1100 was equipped with four forward lights and two rear lights. This provided ample lighting for operation at night, but the reel bats flashed through the lights causing eye strain and making operation tiring. Warning lights and turn signals were adequate for safe road travel.

Handling: Handling of the NH 1100 was very good in all field conditions. Steering was quick and responsive and the crop edge was visible and easy to follow. Double windrowing was convenient, since the right divider draper laid the first windrow away from the standing crop. This allowed for some error in steering on the following round without missing crop or snagging the windrow.

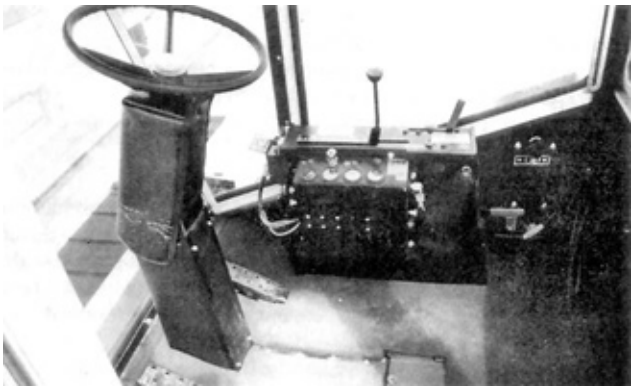

FIGURE 12. Operator Station Controls.

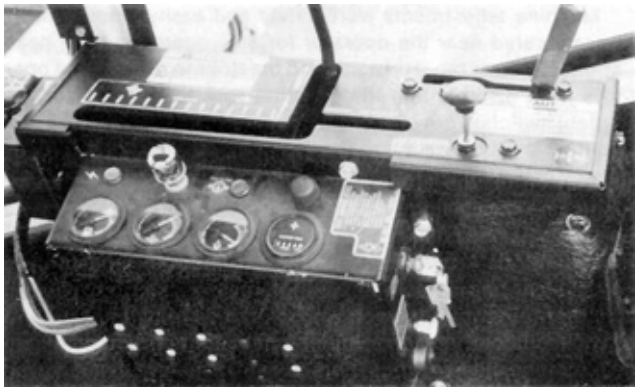

FIGURE 13. Instrument Panel.

Cornering was difficult if the header height had to be reset. Modifications to the header height controls have been recommended.

The hydrostatic drive made reversing direction quick and easy. The header lifted high enough to maneuver over tall windrows and similar obstacles The windrower was very stable. It did not tip forward when operating down steep slopes or during sudden stops.

Transporting: Ease of transporting was very good. The NH 1100 travelled very well on open roads. High range provided speeds up to 14.5 mph (23 km/h). The 21 ft (6.4 m) header was too wide for meeting traffic on most roads. The windrower had to be backed into the ditch to allow vehicles to pass. For tong distance moves, a windrower transporter is recommended.

Adjustments: Ease of adjustment was very good. The header platform angle was easily adjusted by turning the threaded upper header link. Reel fore-and-aft position was easily adjusted by hand and with wrenches. The sliding drapers were easily tightened wi.th a wrench while the right divider draper was tightened by hand. The polyester drapers did not stretch and shrink due to moisture. Header flotation was easily adjusted by tightening the springs with a wrench.

Lubrication and Maintenance: Ease of lubrication and maintenance was very good. Daily lubrication took about 10 minutes. The NH 1100 had 22 pressure grease fittings on the traction unit, and 14 fittings on the header. Six of these required greasing every 10 hours, while the remainder required greasing every 50 hours. In addition, the engine and hydraulic oil levels had to be checked daily. The knife was to be oiled every 5 hours, except in sandy soils where oiling was not recommended.

Lubrication points were easily accessible, except the universal joints on the power take-off shafts.

Most routine maintenance and service, such as tensioning belts and chains, and changing guards and knife sections, were easily performed. The drive belts for the hydraulic pump were difficult to properly tighten and would not stay tight. The washers on the bolts deformed and did not hold the pump in place. It is recommended that the manufacturer consider modifications to improve the ease of tightening the hydraulic pump drive belts.

In moist, cool weather, the fuel tank water trap had to be drained frequently to keep the engine from stalling.

ENGINE AND FUEL CONSUMPTION

The engine had ample power for all conditions encountered. Average fuel consumption was 2.4 gal./h (11.0 L/h). The 21 gal (95 L) fuel tank permitted about 8.5 hours of operation between fillings.

OPERATOR SAFETY

The NH 1100 was safe to operate if normal safety precautions were followed. The operator's manual emphasized safety. Several decals on the machine warned the operator of safety hazards. Moving parts were well shielded. The skid proof steps and platform made access to the cab safe and convenient. A stow moving vehicle sign was provided.

A rearview mirror provided good visibility when transporting. A seat belt was not available. It is recommended that the manufacturer consider providing a seat belt.

Machine adjustments were safely and easily made. Controls were located near the operator for safe operation. The header engaging lever blocked access to the door to discourage operators from dismounting the machine with the header engaged. Safety switches prevented the engine from starting if the speed control lever or steering wheel were not in neutral. The emergency brake safely locked the traction wheels for parking with the engine running.

OPERATOR'S MANUAL

The operator's manuals were very good. They contained much useful information on operation and adjustment of the windrower. Separate operator manuals were supplied for the Perkins diesel engine and for the 1116-D draper header. All information was accurate, easy to follow, and well illustrated.

MECHANICAL HISTORY

TABLE 2 outlines the mechanical history of the NH 1100during 107 hours of field operation while windrowing about 964 ac (390 ha). The intent of the test was functional performance evaluation. Extended durability testing was not conducted.

TABLE 2. Mechanical History

ITEM	HOURS	EQUIVALENT AREA ac	(ha)
Traction Unit:			
A metal diesel fuel line broke off due to engine vibrations and was replaced at	2	8	(3)
The electric starter was damaged by moisture and was replaced on warranty at	37	251	(102)
The bolts on the left adjustable rear axle were lost and replaced at	40, 94	287, 874	(116, 354)
Shaft seals on the left hydrostatic transmission blew out allowing oil to leak out	Nine times during the test		
Three metal clamps holding a steel hydraulic line under the traction unit frame broke and were replaced at	The end of the test		
Header:			
The header lift system did not function properly and the hydraulically driven reel stopped frequently at They began to work properly after a brief run-in period. No cause was determined.	The beginning of the test		
The right draper tightener interfered with the draper connector stopping the draper. The draper had to be shortened and the tightener readjusted at	The beginning of the test		
The left draper drive roller slipped forward on its bearings and rubbed on the mounting bracket. It was repositioned and the motor shaft sleeve retightened at	27	154	(62)
It came loose again and was replaced at	37	251	(102)
The left draper tore when the draper connector caught and jammed under the rear guide. The draper was shortened and reinstalled at	30	174	(70)
The draper drive hydraulic pump belts were glazed from slipping and were replaced at	37	251	(102)
Bolts and nuts vibrated loose or were lost on the knife drive shields, draper position cylinder, and draper position solenoid valve	Throughout the test		
Factory representatives made minor modifications to the draper shields and support straps in the windrow openings at	37	251	(102)
The left draper drive motor was damaged. It was replaced at	37	251	(102)
A smaller hydraulic restrictor was fabricated and installed by PAMI to reduce header drop rate at		506	(205)
The left reel height adjusting bolt broke and was replaced at		560	(227)
Eleven dulled or broken knife sections were replaced	During the test		
All five reel bats were dented from clearing material off the drapers and cutterbar They were replaced at	Throughout the test The end of the test		

Transmission Shaft Seals: Each time the seal blew out, almost all the oil was lost from the system before the leak could be detected. From a total of nine failures, 43 gal (195 L) of hydraulic oil was lost. The o-ring seal and keeper plate at the base of the shafts were replaced or straightened with each failure, but failures continued to occur. At the end of the season, the manufacturer examined the left hydrostatic transmission and found that the failures resulted from a factory defect.

Hydraulic System: Upon first operation, the header would not lift its full height and the reel and drapers operated jerkily, sometimes stopping altogether. A cause was not determined. The system began to work properly after running stationary for over an hour. The reel and drapers began stopping again after 37 hours of trouble free operation. It was discovered that the left draper motor internal parts had been scored, making the motor difficult to turn and increasing hydraulic pressure.

Since the hydraulic pump belts could not be properly tightened, the pump slowed down or stopped at high operating pressures. The pump belts were replaced and properly tightened, and a new draper motor was installed. No further problems occurred. It is recommended that the manufacturer consider modifications to improve hydraulic system reliability.

Vibration: Knife vibrations caused bolts and nuts on the header to loosen or fall off, and caused an annoying rumble in'the operator cab. No serious damage occurred during the 107 hours of field work.

APPENDIX I

SPECIFICATIONS

MAKE:	Sperry New Holland Self-Propelled Windrower
MODEL:	-- traction unit 1100 -- header 1116-D
SERIAL NUMBERS:	-- traction unit 471258 -- header 491424
MANUFACTURER:	Sperry New Holland New Holland, Pennsylvania

CUTTERBAR:

-- width of cut (divider points)	21.8 ft (6.6 m)
-- effective cut (inside dividers)	21.1 ft (6.4 m)
-- range of cutting height	1.5 to 27 in (38 to 686 mm)
-- guard spacing	3.0 in (77 mm)
-- length of knife section (over-serrated)	
-- full depth	3.2 in (81 mm)
-- cutting length	1.8 in (46 mm)
-- knife stroke	2.4 in (61 mm)
-- knife speed	875 cycles/min

HEADER:

-- platform angle		
-- fully raised	3.5° below horizontal	
-- fully lowered	14.5° below horizontal	
-- number of drapers	3	
-- draper width	42 in (1067 mm)	
-- draper lengths		
-- sliding drapers	7.6 ft (2,3 m)	
-- right extension draper	1.5 ft (0.46 m)	
-- draper material	polyester with plastic slats	
-- draper speed range	0 to 500 fpm (0 to 2.5 m/s)	
-- draper roller diameter	2.3 in (58 mm)	
-- height of windrow opening	3.4 ft (1.04 m)	
-- width of windrow opening	End Delivery	Centre Delivery
-- between windboards	3.6 ft (1.09 m}	4.6 ft (1.32 m}
-- between rollers	3.5 ft (107 m)	3.5 ft (1.07 m)
-- raising time	3.0 s	
-- lowering time		
-- as supplied	0.5 s	
-- with restrictor	8.0 s	

REEL:

-- number of bats	5
-- number of arms per bat	5
-- diameter	4.6 ft (1.4 m)
-- speed range	0 to 60 rpm
-- range of adjustment	
-- fore-and-aft	17 in (432 mm}
-- height above cutterbar	25 in (635 mm)
-- raising time	0.5s
-- lowering time	1.0s

TRACTION DRIVE:

-- type	Cessna hydrostatic transmission with chain drive to wheels
-- speed control	hand lever
maximum forward speed	
-- high range	14.5 mph (23 km/h)
-- low range	70 mph (11 km/h)

STEERING:	steering wheel mechanically linked to hydrostatic pumps
BRAKES:	foot pedal operating mechanical drum brakes

HYDRAULIC SYSTEM:

-- hydrostatic traction drive	(see Traction Drive)
-- reel and draper drives	belt driven pump, flow control valves, and motors on reel and drapers
-- reel lift	master and slave cyhnder, one pedal control
-- header lift	two cyhnders with separate pedal controls

NO. OF CHAIN DRIVES:

-- traction unit	4
-- header	1

No. OF V-BELTS:

-- traction unit	10
-- header	1

LUBRICATION POINTS:

-- pressure grease fittings	40
-- gearboxes	1

NO OF PRELUBRICATED BEARINGS:	26

ENGINE:

-- make	Perkins Diesel
-- model	4236
-- displacement	236 cu in (3.9 L)
-- no load speed	2500 rpm
-- power (nominal)	6O hp (45 kW)
-- fuel tank capacity	21.0 gal (95 L)

TIRES:

-- drive wheels	13.50 - 161, 6 ply traction tread
-- castor wheels	7.50 - 14, 4 ply ribbed implement

OVERALL DIMENSIONS:

-- width	22.9 ft (70 m)
-- length	20.7 ft (6.3 m)
-- height	108 ft (3.3 m)
-- wheel tread	7.8 ft (2.4 m)
-- wheel base	9.3 ft (2.8 m)

WEIGHT: (fuel tanks empty)

-- left drive wheel	3400 lb (1545 kg)
-- right drive wheel	4090 lb (1859 kg)
-- castor wheels	1500 lb (682 kg)
Total	8990 lb (4086 kg)

OPTIONS AND ATTACHMENTS:

-- Ford 200 gasoline engine
-- 15 or 18 ft (4.6 or 5.5 m) draper headers
-- numerous haying headers and conditioners

APPENDIX II

Machine Ratings

The following rating scale is used in Machinery Institute Evaluation reports:

excellent	fair
very good	poor
good	unsahsfactory

SUMMARY CHART

SPERRY NEW HOLLAND 1100 SELF-PROPELLED WINDROWER

RETAIL PRICE	$54,752.00 (February, 1985, f.o.b. Humboldt, Sask.)
RATE OF WORK	
Average Speed	5 to 6 mph (8 to 10 km/h)
Average Workrate	8 to 10 ac/h (3.3 to 4.0 ac/h)
QUALITY OF WORK	
Dividers	**Fair;** flattened a strip of crop
Reel	**Very good**
Cutterbar	**Very good;** adequate power
Header Flotation	**Very good;** rode safely over stones
Drapers	**Fair;** frequently plugged in taller crops, lacked power in heavy crops
Windrow Formation	**Very good;** parallel and fantail with centre delivery, parallel and angled parallel with end delivery
Windrow Uniformity	**Good;** uniform in most short crops, bunchy due to plugging in tall crops
EASE OF OPERATION AND ADJUSTMENT	
Visibility	**Very good;** entire header easily viewed
Operator Comfort	**Good;** cab was clean but noisy, vibrations from knife were annoying
Controls	**Good;** controls and instruments were easy to operate, header lifts were awkward
Handling	**Very good;** very stable on slopes
Transporting	**Very good;** transporter required for long moves
Adjustments	**Very good;** all adjustments were easy
Lubrication and Maintenance	**Very good;** daily lubrication took 10 minutes
ENGINE AND FUEL CONSUMPTION	2.4 gal/h (11.0 L/h); ample engine power
OPERATOR SAFETY	No safety hazards apparent
OPERATOR'S MANUAL	**Very good;** separate manuals for Perkins engine and 1116-D header
MECHANICAL HISTORY	Many problems with the hydraulic systems

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