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EVALUATION REPORT 409

Farm King 10 x 50 Grain Auger

A Co-operative Program Between
ALBERTA FARM MACHINERY RESEARCH CENTRE
PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

FARM KING 10 x 50 GRAIN AUGER

MANUFACTURER:
Farm King Ltd.
Box 1450
Morden, Manitoba
R0G 1J0

DISTRIBUTORS:
Alberta: Renn Sales
Saskatchewan & Manitoba: Farm King Dealers

RETAIL PRICE:
$4,550.00 (February, 1985, f.o.b. Portage la Prairie, Manitoba) 10 in x 50 ft (250 mm x 15.2 m) grain auger.

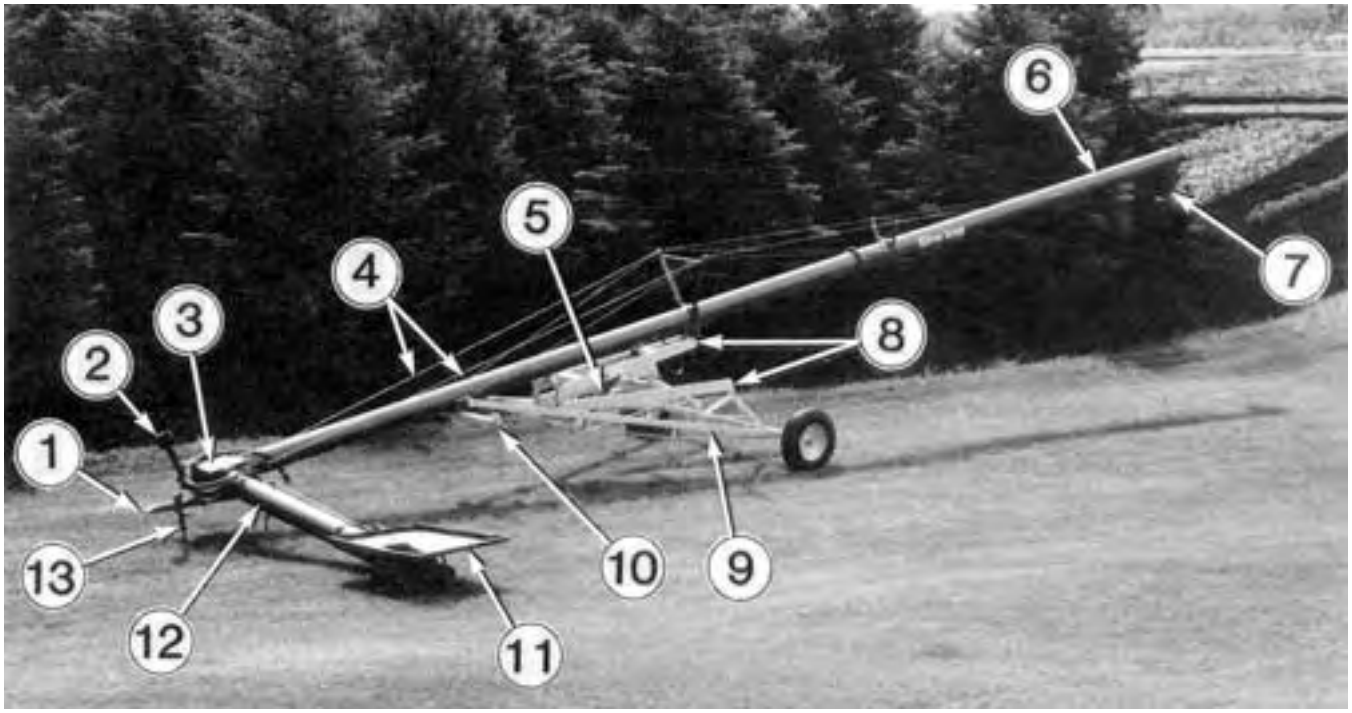

FIGURE 1. Farm King 10 x 50 Grain Auger: (1) Tow H itch, (2) Power Take-off Driveline, (3) Auger Boot, (4) Truss Cables, (5) Hydraulic Cylinder, (6) Main Auger Tube, (7) Discharge Spout, (8) Lift Arms, (9) Undercarriage, (10) Intake Auger Lift Boom, (11)intake Hopper, (12) Intake Auger Tube, (13) Jack.

SUMMARY

Ease of Operation: The Farm King 10 x 50 was very easy to position and operate since raising the main tube and engaging the flighting were performed from the tractor seat. Maneuverability and transportability were very good.

Rate of Work: At the 30° elevation angle, corresponding to a discharge height of 26 ft (7.9 m), maximum capacities were 4700, 4400, 4500 and 4600 bu/h (128, 68, 114 and 104 t/h) in wheat, oats, corn and rapeseed respectively. Maximum capacities were usually obtained at flighting speeds between 470 and 570 rpm.

Power Requirements: Combined power requirements for the main auger and the swing auger ranged from 8 to 53 hp (6 to 40 kW) in dry grain. In damp grain, combined power requirements ranged from 13 to 59 hp (10 to 44 kW).

Quality of Work: In dry wheat, damage was less than 0.2% for each pass through the auger.

Safety: All nip points, rotating drive shafts, and inlet flighting were guarded in accordance with safety standards.[1]

Operator's Manual: The manual was generally well written but lacked illustrations throughout the text.

Mechanical History: No mechanical problems occurred during the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider modifications to the hopper to facilitate cleaning.

Station Manager -- G.M. Omichinski

Project Engineer -- D.J. May

THE MANUFACTURER STATES THAT

With regard to the recommendation: The hopper was designed with the 'ball and socket' style of force feed hook-up. This enabled it to be easily tipped onto its side to dump out all remaining grain. In fact, it can be turned completely upside down if so desired, to keep rain out of the hopper.

MANUFACTURER'S ADDITIONAL COMMENTS

A new style intake hopper with a larger grill was produced in 1984 and is supplied with all current augers. Higher capacities are possible with this intake auger than with the model that was tested.[2]

One other improvement that was made in 1984 was that the flighting thickness on the intake auger and the bottom three feet of the main auger was increased by approximately 1/16".

[1]American Society of Agricultural Engineering Tentative Standard ASAE S361.2 T, "Safety for Agricultural Auger Conveying Equipment," December 1983.

[2]Capacity and power requirement tests were performed in wheat and corn with the new style intake hopper. PAMI results are given in APPENDIX IV.

GENERAL DESCRIPTION

The Farm King 10 x 50 Grain Auger (FIGURE 1) is a 10 in (250 mm) diameter, 50 ft (15.2 m) long portable screw conveyor with a hopper section at the bottom which can be hinged from either side of the main auger.

The main auger tube is mounted on a tubular steel under carriage and supporting truss cables, and is raised or lowered hydraulically. The swing auger is raised or lowered with a hand-operated cable winch. The test machine utilized a direct drive 540 rpm, PTO drive shaft to the main auger and a hydraulic motor drive on the swing auger.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Farm King 10 x 50 was operated for about 20 hours while conveying a total of 400 ton (360 t) of dry and damp wheat, oats, corn and rapeseed. A standard test material (APPENDIX II) was also used. The machine was transported over gravel and paved highways for a distance of 500 miles (800 km). It was evaluated for ease of operation and adjustment, rate of work, power requirements, quality of work, operator safety and suitability of the operator's manual.

RESULTS AND DISCUSSION

EASE OF OPERATION AND ADJUSTMENT

Discharge Height: The discharge height (FIGURE 2) could be varied from 8.5 to 35.4 ft (2.6 to 10.8 m) with the hydraulic lift mechanism. Corresponding elevation angles varied from 10° to 43°. See TABLE 1. The auger discharge height could be easily adjusted from the tractor seat. The hydraulic lift required a pressure of 1500 psi (10.3 MPa) to raise the auger. Auger Reach: The bin eave clearance and horizontal reach (FIGURE 2) of the Farm King 10 x 50 are shown in TABLE 1. Bin eave clearance, measured from the ground to the auger tube at the foremost part of the undercarriage, varied from 5.5 ft (1.7 m) at 10° to 19.7 ft (6.0 m) at 43° elevation. The reach, measured from the foremost part of the undercarriage to the centre of the discharge, varied from 24.5 ft (7.5 m) at 10° to 19.7 ft (6.0 m) at 43°.

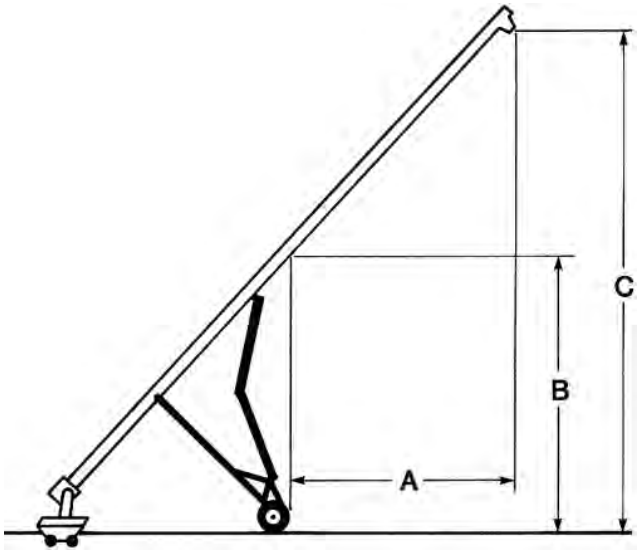

FIGURE 2. Dimensions: (A) Horizontal Reach, (B) Bin Eave Clearance, (C) Discharge Height.

TABLE 1. Reach Clearance and Discharge Height at Various Elevations

Angle	A Horizontal Reach		B Bin Eave Clearance		C Discharge Height	
Degrees	ft	m	ft	m	ft	m
10 (min)	24.6	7.5	5.6	1.7	8.5	2.6
20	23.0	7.0	10.2	3.1	17.4	5.3
30	21.7	6.6	14.4	4.4	25.9	7.9
40	19.7	6.0	18.4	5.8	33.1	10.1
43 (max)	19.4	5.9	19.7	6.0	35.4	10.8

Maneuverability: The Farm King 10 x 50 was designed as a tractor implement. It could be transported, raised, positioned, and operated from the tractor seat. The large hitch weight of 510 lb (230 kg) made moving the auger by hand impractical. The auger was very stable and raised and lowered smoothly making it very maneuverable. However, it was difficult to judge the distance between the auger outlet and obstructions due to its length.

The auger transported very well and was stable at speeds up to 50 mph (80 km/h) on paved highways and up to 30 mph (50 km/h) on gravel roads, although the manufacturer cautions against towing faster than 20 mph (32 km/h). The auger was supplied with a rigid reliable hitch. The operator should use a suitable hitch pin and safety chain to prevent accidental unhitching when transporting on public roads. Clearance under power lines was ample when fully lowered. The transport height was 10.3 ft (3.2 m). See cover photo.

Intake Auger: The intake auger was easily moved to and from the transport position. It was easily positioned under most grain trucks and operated very well. When changing from one side of the main auger to the other some adjustment of the hinge swivel was needed to centre the pivot ring to eliminate binding of the intake auger swivel. This operation plus modifications to the intake auger lift boom and cable required approximately 30 minutes. The flighting speed of the intake auger varied with engine and hydraulic pump speed of the tractor. It had a flow control valve to vary the flighting speed in relation to the flighting of the main auger for damp or hard to move grain. There was no cleanout hole at the bottom of the hopper making removal of grain difficult. It is recommended that the manufacturer consider modifications to the bottom of the hopper to facilitate cleaning.

Capacity: FIGURE 3 shows the capacities of the Farm King 10 x 50 in various dry grains at 30° elevation angle. Maximum capacities at this angle were 4700, 4400, 4500, and 4600 bu/h (128, 68, 114 and 104 t/h) in dry wheat, oats, corn and rapeseed respectively. As flighting speeds are increased, the capacity of screw conveyors increases to a peak, then levels off or decreases. Maximum or peak capacities for the Farm King 10 x 50 occurred at flighting speeds (PTO speeds) ranging from 470 to 570 rpm.

The effect of elevation angle is illustrated in TABLE 2. Peak capacities in wheat dropped 6% from 4700 bu/h (128 t/h) at 20° elevation to 4400 bu/h (120 t/h) at 40° elevation.

TABLE 2. Peak Capacity, Specific Capacity and Power Requirements Vs Elevation Angle (Dry Wheat).

Elev. Angle Deg.	Discharge Height		Peak Capacity		Specific Capacity		Power Input	
	ft	m	bu/h	t/h	ton/hp•h	t/kW•h	hp	kW
20	17	5.3	4700	128	4.9	5.8	28	22
30	26	7.9	4550	124	3.9	4.8	35	26
40	33	10.1	4400	120	2.5	3.0	53	40

Specific Capacity: Specific capacity is the amount of grain moved per unit of power in a specific time. A high specific capacity indicates efficient use of energy. In general, specific capacity decreases (less grain is moved per horsepower-hour) with increasing flighting speed and elevation angle. Specific capacity at 30° ranged from 5.3 to 3.5 ton/hp-h (6.4 to 4.3 t/kW-h) in wheat, oats, corn and rapeseed. TABLE 2 indicates the effect of elevation angle on peak and specific capacities for the Farm King 10 x 50.

Critical Speeds: At certain critical flighting speeds auger vibration may become excessive. This phenomenon, known as resonance, is common to all augers (although the critical speed may be outside of the operating range of any particular auger) and varies with grain type and operating conditions. Care should be taken not to operate at these critical speeds. On the Farm King 10 x 50 a drop in capacity due to resonance was occasionally noted at a PTO speed of about 520 rpm.

Power Requirements: FIGURE 3 gives power requirements for the Farm King 10 x 50 in dry wheat, oats, corn and rapeseed at a 30° elevation angle. Power requirements ranged from 8 to 53 hp (6 to 40 kW). It should be noted that the swing auger uses 25 to 40% of the total power input in TABLE 2 and 3 and FIGURE 3.

Damp Grain: TABLE 3 shows the effect of damp grain on peak capacity, specific capacity and power requirements for the Farm King 10 x 50.

Generally, as grain moisture contents rise, power requirements increase while capacities decrease. If augers are used to move damp grain the power source should be sized accordingly.

The power requirement for augers without side delivery will increase by approximately 5%, 33%, and 50% when moving damp rapeseed, corn and wheat respectively.

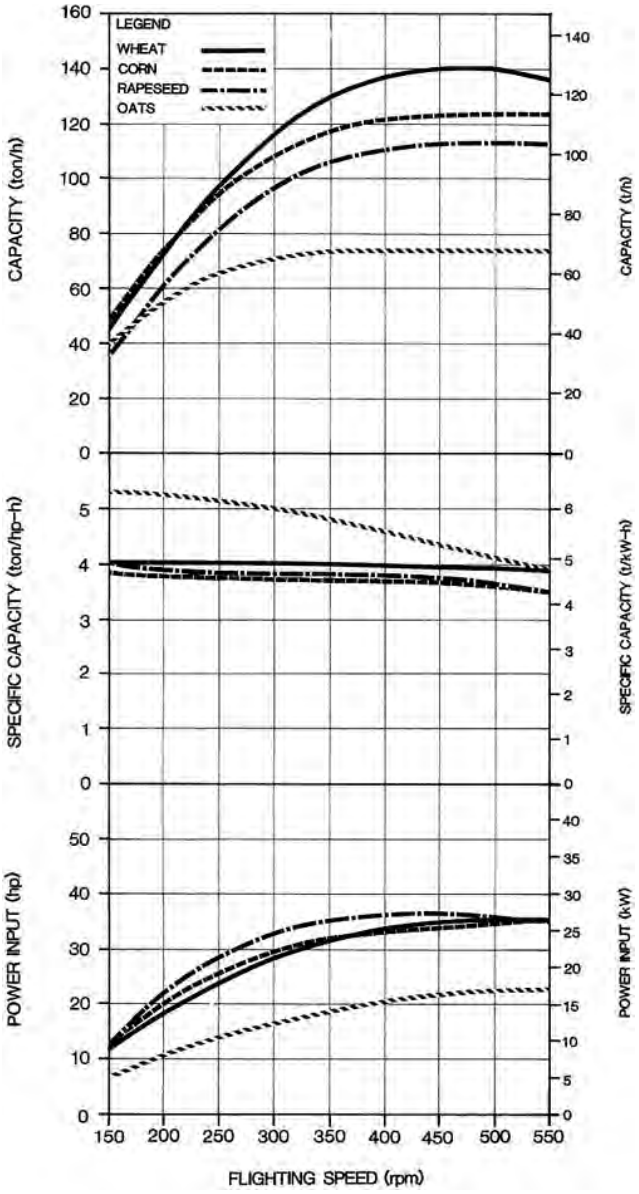

FIGURE 3. Capacity, specific capacity and power requirement for various speeds at 30° elevation angle (Dry Grain).

TABLE 3. Peak Capacity, Specific Capacity and Power Requirements in Damp Grain at 30° Elevation

Grain (moisture content)	Peak Capicity		Specific Capacity		Power Input		Power Input (dry grain)	
	bu/h	t/h	ton/hp-h	t\kW-h	hp	kW	hp	kW
Wheat (20% MC)	3000	82	1.6	2.0	55	41	35	26
Corn (30% MC)	300	76	1.7	2.1	48	36	35	26
Rapeseed (15% MC)	4300	98	3.0	3.6	36	27	37	28

QUALITY OF WORK

Grain Damage: Damage in dry wheat was less than 0.2% for each pass through the auger. This was insignificant as long as the same grain was not augered many times. Crackage would be lower at higher moisture contents.

OPERATOR SAFETY

The Farm King 10 x 50 met current safety standards for grain augers. It was safe to operate if normal precautions were observed. Safety signs were appropriately displayed alerting the operator of potentially hazardous areas.

Shielding was provided for all rotating shafts and pinch points. An adequate inlet safety guard (FIGURE 4) was provided. All capacities were determined with this inlet safety guard in place. The Institute strongly recommends that grain augers be operated with all safety equipment in place.

FIGURE 4. Inlet hopper and safety guard.

OPERATOR'S MANUAL

The operator's manual included instruction on set-up, operation, adjustment, maintenance, storage, warranty and safety. It was generally well written but lacked illustrations throughout the text.

MECHANICAL HISTORY

The Farm King 10 x 50 was operated for about 20 hours. No mechanical problems arose during the test.

APPENDIX I
SPECIFICATIONS:

MAKE:	Farm King
MODEL:	10 x 50
SERIAL NUMBER:	8172343
OVERALL DIMENSIONS:	
-- transport length along ground	52.0 ft (15.9 m)
-- field width	18.0 ft (5.5 m)
-- transport width	10.0 ft (3.1 m)
-- transport height	10.2 ft (3.2 m)
DRIVE:	
Main Auger	
-- 540 rpm tractor power take-off	
-- direct drive	
-- power take-off to flighting speed ratio 1:1	
Intake Feed Auger	
-- hydraulic motor	
-- displacement	4.2 in³ (69 cm³)
-- motor to flighting speed ratio	1:1
LUBRICATION:	
-- pressure grease fittings	2
-- sealed bearings	2
-- packed wheel bearings	2
AUGER TUBE:	
-- inside diameter	9.9 in (250 mm)
-- material thickness	0.1 in (3.0 mm)
-- discharge spout	10.0 x 11.0 in (255 x 280 mm)
FLIGHTING:	
-- diameter	8.9 in (225 mm)
-- pitch	9.1 in (230 mm)
-- exposed length	17.9 in (455 mm)
-- thickness	
-inner	0.16 in (5 mm)
-outer	0.13 in (3 mm)
INLET SAFETY GUARD:	
-- material dimensions	0.20 in dia. (5 mm)
-- overall size	21.3 x 13.4 in (540 x 340 mm)
-- grill openings	
-maximum open area	8.7 in² (56 cm²)
-maximum open dimensions	4.2 in (105 mm)
LIFT MECHANISM:	
-- type	hydraulic cylinder & cable
-- cylinder size	3.5 x 30 in (89 x 760 mm)
-- minimum pressure	1500 psi (10.3 MPa)

WEIGHT:	**Maximum Elevation**	**Minimum Elevation**
-- right wheel	899 lb (408 kg)	842 lb (382 kg)
-- left wheel	908 lb (412 kg)	866 lb (402 kg)
-- hitch	428 lb (194 kg)	507 lb (230 kg)
TOTAL	2235 lb (1014 kg)	2235 lb (1014 kg)

APPENDIX II
Performance with Standard Test Material

The standard test material is a high density granular polyethylene. The material is consistent and not subject to damage or changes in physical properties as are grains.

FIGURE 5 gives the capacity, specific capacity and power requirements for the Farm King 10 x 50 in a standard test material. These data may be used for comparison of different grain augers.

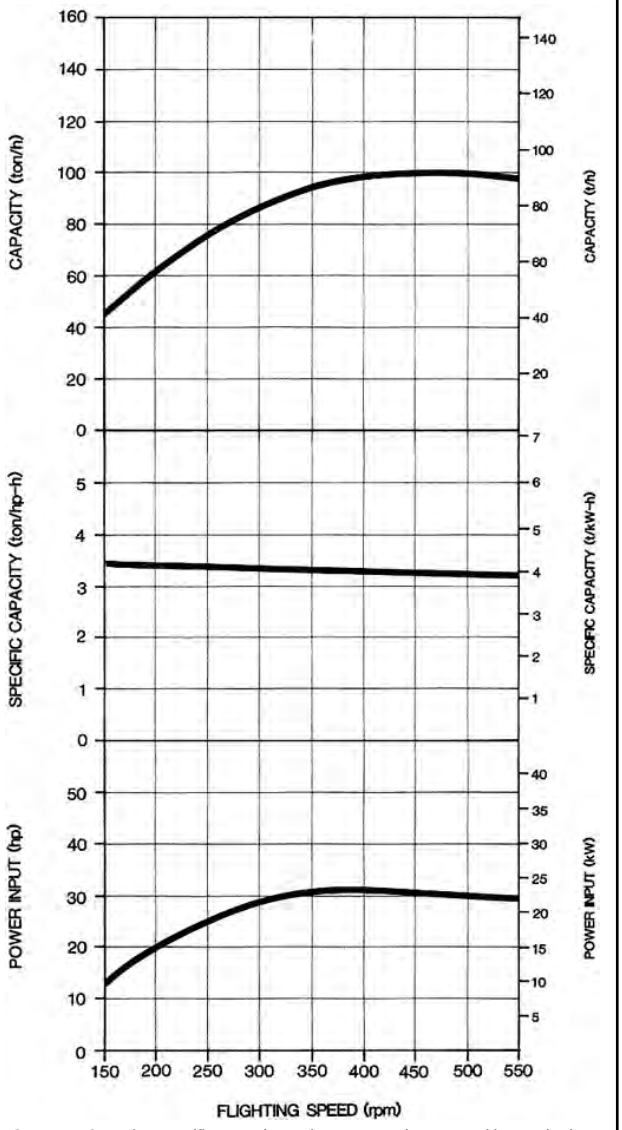

FIGURE 5. Capacity, specific capacity and power requirements with standard test material at 30° elevation angle.

APPENDIX III
MACHINE RATINGS

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

Excellent	Fair
Very Good	Poor
Good	Unsatisfactory

APPENDIX IV

FIGURE 6 shows the capacity of the Farm King 10 x 50 in wheat and corn with the new style intake hopper. Peak capacities increased by 19% in corn and 6% in wheat when using the new intake hopper in place of the old one.

Total power requirements also increased when using the new intake hopper. A power requirement increase of 17% in corn and 26% in wheat was noted at the peak capacities.

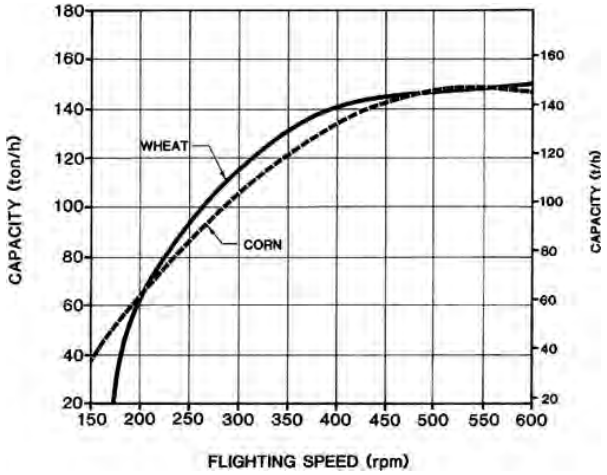

FIGURE 6. Capacities in wheat and corn at 30°, using the new style intake hopper.

SUMMARY CHART

FARM KING 10 x 50 GRAIN AUGER

RETAIL PRICE:	$4,550.00 (February, 1985, f.o.b. Portage la Prairie, Manitoba)
EASE OF OPERATION:	
Maneuverability	**Very good**
Transportability	**Very good**
RATE OF WORK:	
Capacity at 30°:	
Wheat (dry)	4700 bu/h (128 t/h)
Standard material	100 ton/h (91 t/h)
POWER REQUIREMENTS:	
Dry grain	8.0 to 53 hp (6.0 to 40 kW)
QUALITY OF WORK:	
Dry wheat	less than 0.2% damage per pass.
OPERATOR SAFETY	guarded in accordance with safety standards.
OPERATOR MANUAL	very well written but lacked illustrations throughout the text.
MECHANICAL HISTORY	no mechanical problems.

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