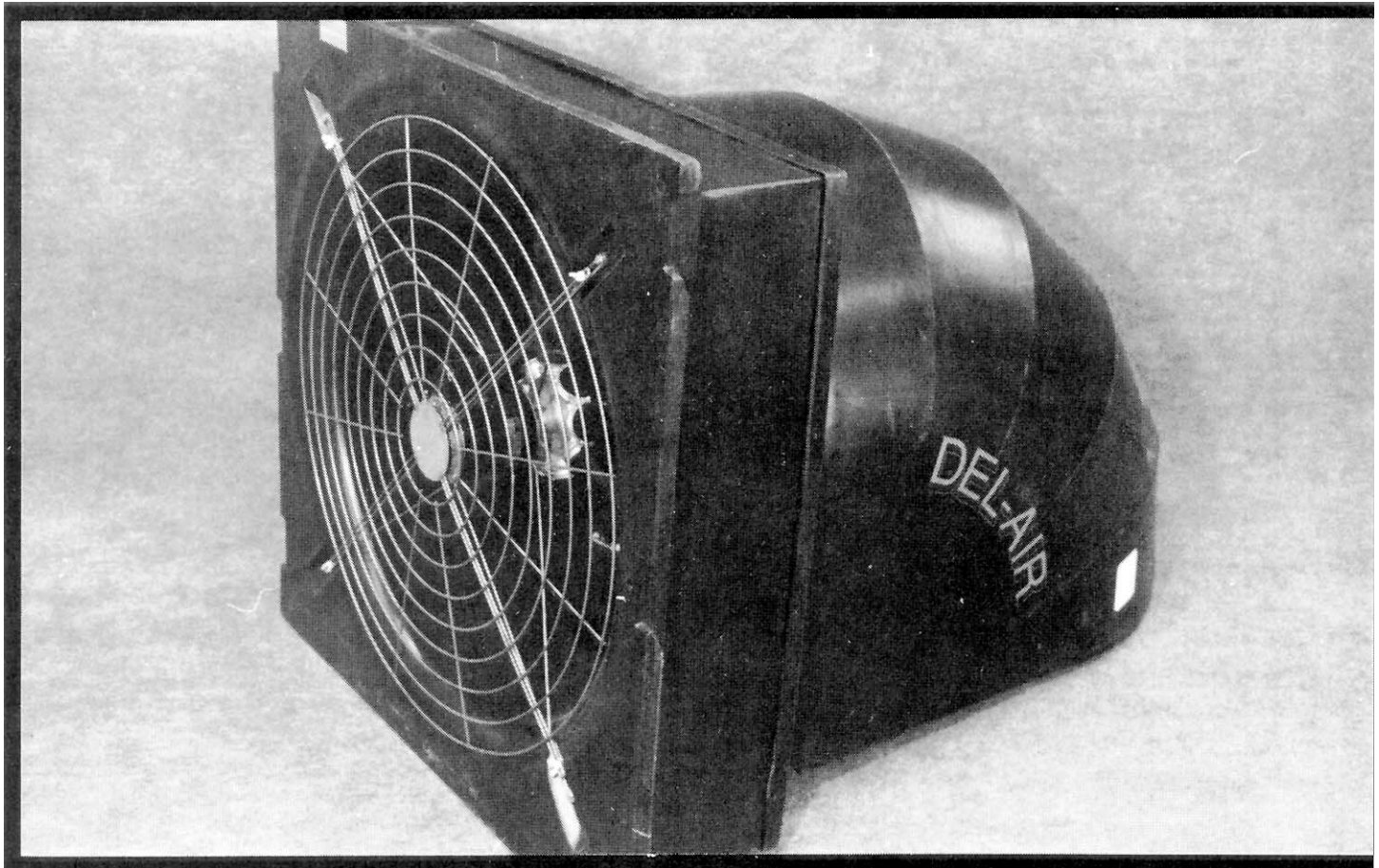


Evaluation Report

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Del-Air Northwinds Model 10K Ventilation Fan

A Co-operative Program Between



DEL-AIR NORTHWINDS MODEL 10K VENTILATION FAN

MANUFACTURER:

Del-Air Systems Ltd.
P.O. Box 2500
1704 Fourth Avenue
Humboldt, Saskatchewan
S0K 2A0 Phone: (306) 682-5011

RETAIL PRICE: \$995 (Complete fan with windhood, butterfly damper and winter door)
\$706 (Panel fan only)
(December 1991, f.o.b., Lethbridge, Alberta)

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Performance data resulting from these tests will be distributed to customers. Customers making comparisons will be encouraged to contact AFMRC/PAMt for data on competitors fans as well.

GENERAL DESCRIPTION

The Del-Air Northwinds Model 10K ventilation fan is a 36.5 in (930 mm) diameter, variable speed, direct drive, propeller type axial flow fan. The 10K is primarily used in livestock and poultry barns as an exhaust fan located in the wall.

The Del-Air Northwinds 10K ventilation fan is a flush-mount unit equipped with an inlet guard grill, a mounting face plate, optional wind hood and outlet damper. The 3 blade polypropylene propeller and aluminum hub are mounted directly on a 0.33 hp (0.246 kW), single phase, 230 volt electric motor. The motor mount is integral with the wire inlet guard grill and is bolted to the fan housing.

FIGURE 1 shows the location of major components, while detailed specifications are given in APPENDIX 1.

SUMMARY OF RESULTS

TABLE 1: Del-Air Northwinds Model 10K Fan Performance At Typical Levels of Operation.

SETTING	STATIC PRESSURE		AIR FLOW RATE		INPUT POWER kW	TOTAL EFF. %	FAN SPEED rpm
	in wg	(Pa)	cfm	(L/s)			
Single Speed Direct	0.000	(0.0)	10440	(4930)	0.459	33	780
	0.050	(12.5)	9520	(4490)	0.468	35	770
	0.100	(24.9)	8480	(4000)	0.472	36	770
	0.125	(31.1)	7830	(3700)	0.473	37	770
Variable Speed Maximum (204 V)	0.000	(0.0)	9820	(4630)	0.497	25	750
	0.050	(12.5)	8630	(4070)	0.506	27	740
	0.100	(24.9)	7270	(3430)	0.509	27	740
	0.125	(31.1)	6540	(3090)	0.510	26	730
Variable Speed Range (189 V)	0.000	(0.0)	8860	(4180)	0.476	19	690
	0.050	(12.5)	7420	(3500)	0.486	20	670
	0.100	(24.9)	5870	(2770)	0.485	20	660
	0.125	(31.1)	4850	(2290)	0.481	18	670
Variable Speed Minimum (175 V)	0.000	(0.0)	6400	(3020)	0.441	8	530
	0.050	(12.5)	4650	(2200)	0.435	9	530
	0.100	(24.9)	1970	(930)	0.429	5	540
	0.125	(31.1)	1140	(540)	0.435	4	520
Direct with Damper	0.000	(0.0)	10250	(4840)	0.470	30	790
	0.050	(12.5)	9300	(4400)	0.483	32	780
	0.100	(24.9)	7940	(3750)	0.484	33	770
	0.125	(31.1)	7130	(3370)	0.483	32	770
Direct with Wind Hood	0.000	(0.0)	2780	(1310)	0.484	17	760
	0.000	(0.0)	9780	(4620)	0.475	26	780
	0.050	(12.5)	8980	(4240)	0.479	30	780
	0.100	(24.9)	8070	(3810)	0.482	33	770
Direct with Damper and Wind Hood	0.125	(31.1)	7510	(3540)	0.480	34	770
	0.250	(62.3)	3560	(1680)	0.482	24	760
	0.000	(0.0)	9580	(4520)	0.476	24	780
	0.050	(12.5)	8620	(4070)	0.479	28	770
Direct with Damper and Wind Hood	0.100	(24.9)	7800	(3680)	0.483	32	770
	0.125	(31.1)	7280	(3440)	0.481	33	770
Direct with Damper and Wind Hood	0.250	(62.3)	780	(1310)	0.481	17	760

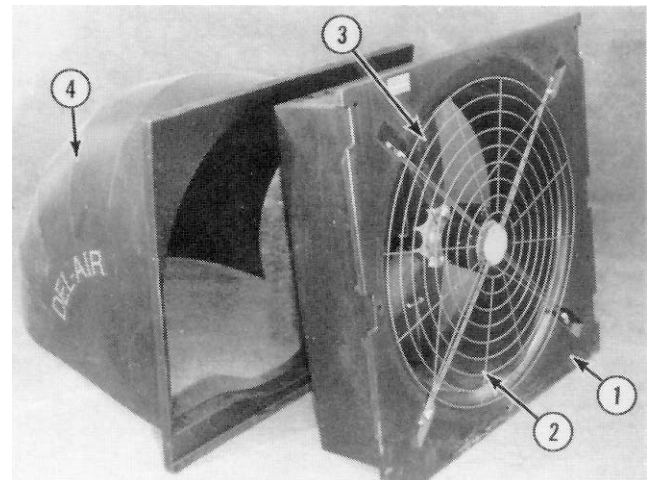


FIGURE 1. Del-Air Northwinds Model 10K Ventilation Fan: (1) Mounting Face Plate, (2) Inlet Guard Grill, (3) Outlet Dampers and (4) Wind Hood.

SCOPE OF TEST

The fan evaluated by Alberta Farm Machinery Research Centre (AFMRC) was configured as described in the General Description, FIGURE 1, and the Specifications section of this report. The manufacturer may have built different configurations of this fan before or after the AFMRC test. Therefore, when using this report check that the fan under consideration is the same as the one reported here. If differences exist, assistance can be obtained from AFMRC or the manufacturer to determine changes in performance.

The Del-Air Northwinds Model 10K was tested in the inlet chamber set-up (FIGURE 2) in accordance with Canadian Standards Association Ventilation Fan Test Standard No. CAN/CSA C320-M86. The intent was to determine the performance of the fan in terms of air flow rate, static pressure, input power and total efficiency. The Del-Air control unit was not evaluated and was used only to set fan speed.

The fan was tested at 230 V in the single speed and variable speed modes. Using the Del-Air Model 5000 Automatic Zone Control, fan performance was determined at the maximum setting, the mid-range setting and the minimum setting. The minimum setting was established by selecting a fan speed at a setting where a static pressure of 0.125 in wg (31.1 Pa) could still be obtained. Voltages supplied to the fan at maximum, mid-range and minimum settings in the variable speed mode are recorded in Table 1. The effect of the wind hood and damper on fan performance was determined in the single speed

RECOMMENDATIONS

The Alberta Farm Machinery Research Centre recommends the manufacturer:

1. Supply fan performance data over a complete range of static pressures.

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Project Engineer: R. C. Maze
Test Engineer: R. J. Proctor

setting. The fan was also evaluated for ease of operation, maintenance, operator safety and suitability of the operator's manual.

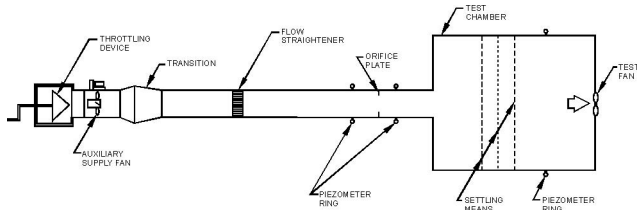


FIGURE 2. Schematic of Fan Test Apparatus—inlet Chamber Set-Up.

RESULTS AND DISCUSSION

FAN PERFORMANCE

Fan performance results in this report are given at standard air¹ so direct comparisons can be made with other fan test reports. Fan performance under actual operating conditions could differ from these results by up to 10%, depending on such things as temperature, barometric pressure, humidity and elevation above sea level.

Air Flow Rate: Fan output in both the single speed mode and at the maximum setting on the controller were similar (FIGURE 3). Reducing the fan speed greatly reduced the air flow rate for a given static pressure². For example, at a static pressure of 0.125 in wg (31.1 Pa), reducing the speed from maximum to mid-range to minimum setting reduced the air flow rate from 6540 cfm to 4850 cfm to 1140 cfm (3090 to 2290 L/s to 540 L/s), respectively. At higher static pressures the reductions were even larger. Air flow rates at typical levels of operation (i.e., static pressure) are given in Table 1. Ventilation fans are often rated on their output at a static pressure of 0.125 in wg (31.1 Pa). The AFMRC's measured flow rate in a single speed direct mode at 0.125 in wg (31.1 Pa) was 7830 cfm (3700 L/s). There was no manufacturer's airflow information provided. Building ventilation design is possible over a range of static pressures. For fan selection purposes, the manufacturer should include a table or curve of air flow rates over a complete range of static pressures.

Power Consumption: The power consumption numbers given in TABLE 1 can be used to calculate the cost of operating the fan. To calculate the cost of fan operation, multiply the power consumption (kW) by the number of hours of fan operation times the cost per kilowatt hour.

The power consumed by the fan depends on fan speed. For typical levels of static pressure (Table 1), the input power varied from 0.459 to 0.488 kW in the single speed mode, from 0.497 to 0.524 kW at maximum speed, from 0.476 to 0.519 kW at mid-range speed and from 0.429 to 0.441 kW at minimum speed. Attaching the damper and wind hood had little effect on the range of power consumption. The maximum amperage drawn by the motor was 2.6 amps, which was greater than the rated motor amperage of 1.8 amps plus the \pm 10% allowable limit established by CSA Standards. Prolonged operation in excess of rated amperage could reduce motor life.

Total Efficiency: Total efficiency is the ratio of air horsepower over the input power. Air horsepower is dependent upon the air flow rate and corresponding total pressure. For typical levels of operation, the total efficiency (TABLE 1), using the variable speed control ranged from 10 to 27% at maximum speed, 2 to 20% at mid-range speed and 4 to 9% at minimum speed. The total efficiency with no damper or wind hood at a static pressure of 0.125 in wg (31.1 Pa) was 37%.

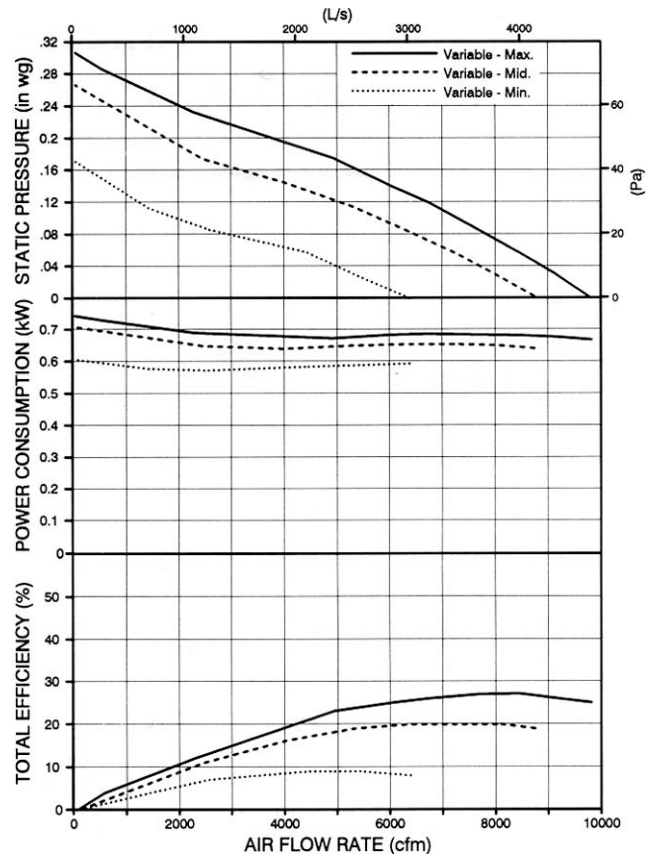


FIGURE 3. Del-Air Northwinds Model 10K Fan Performance Curves.

Effect of Wind Hood: An optional wind hood was installed on the outlet side of the fan to determine the effect on fan output. The fan was tested with the wind hood in the single speed mode only. Using the wind hood reduced the air flow rate by a maximum of 6% (FIGURE 4) over a typical range of operation. For example, at a static pressure of 0.125 in wg (31.1 Pa), the wind hood reduced the air flow by 4%, from 7830 cfm (3700 L/s) to 7510 cfm (3540 L/s) (Table 1). The efficiency was, in turn, reduced from 37 to 34%.

Effect of Damper: The optional damper was installed on the outlet side of the fan (FIGURE 3) to determine the effect on fan output. The fan was tested under these conditions in the single speed mode only. Using the damper reduced the air flow rate by 2 to 19% (FIGURE 4) over the typical range of operation. For example, at a static pressure of 0.125 in wg (31.1 Pa), the damper reduced the air flow rate by 9%, from 7830 cfm (3700 L/s) to 7130 cfm (3370 L/s) (TABLE 1). The efficiency was, in turn, reduced from 37 to 32%.

Effect of Wind Hood and Damper: A test with the wind hood and damper was completed. Using both the wind hood and damper reduced the air flow by 7 to 19% (FIGURE 4) over the typical range of operation. For example, at a static pressure of 0.125 in wg (31.1 Pa), the damper and wind hood reduced the air flow by 7%, from 7830 cfm (3700 L/s) to 7280 (3440 L/s) (Table 1). The efficiency was, in turn, reduced from 37 to 33%. The use of other control devices such as shutters, screens and louvres will also reduce air flow rates by varying amounts. The use of control devices must be considered when designing a ventilation system.

¹Standard air is air with a density of 0.075 lbm/ft³ (1.2 kg/m³) which occurs at 68°F (20°C), 50% relative humidity and a barometric pressure of 29.92 in Hg (101.325 kPa).

²Static pressure is a measure of the pressure difference between the pressure inside the building and the pressure on the outside of the building. Static pressure is usually expressed in inches of water gauge (in wg) or Pascals (Pa).

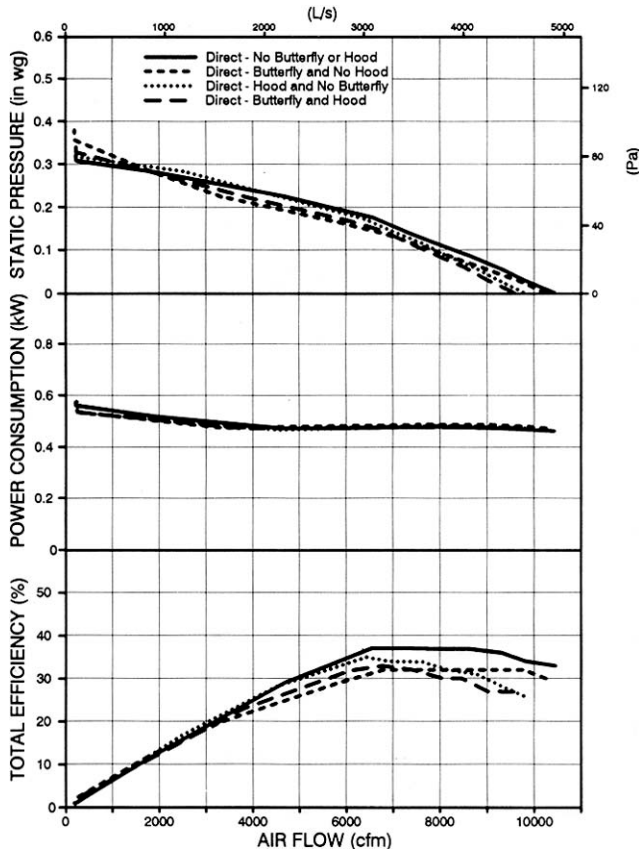


FIGURE 4. Effect of Damper and Windhood on Fan Performance.

EASE OF OPERATION

Maintenance: The operator's manual advised a routine cleaning program to remove dust, dirt and ice build-up. A check of the free movement of the fan was also recommended. The fan wind hood and damper were easily removed, making for easy access to clean the fan blades and housing.

OPERATOR SAFETY

The inlet guard grill provided adequate protection from the fan blades. The motor was a totally enclosed unit and presented no safety hazards. The Del-Air Northwinds Model 10K ventilation fan was CSA approved.

The noise level of the Del-Air Northwinds Model 10K without the wind hood at a distance of 4.9 ft (1.5 m) from the centre of the fan inlet, while operating at a 0.125 in wg (31.1 Pa) static pressure, was 81 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Del-Air Northwinds Model 10K ventilation fan falls within Range 3 of the AFMRC noise level range classification (APPENDIX II). The noise level produced by this fan can be considered annoying and be detrimental to hearing and operator performance under continuous exposure. Ear protection should be considered if working near the fan for prolonged periods.

OPERATOR'S MANUAL

The operator's manual was very informative and contained information on operation, specifications, installation, wiring, maintenance, safety, service and troubleshooting. The operator's manual provided detailed information on installation, maintenance and troubleshooting.

APPENDIX I SPECIFICATIONS

MAKE:	Del-Air Northwinds
MODEL:	10K
SERIAL NUMBER:	KT36-121
MANUFACTURER:	Del-Air Systems Ltd. P.O. Box 2500 1704 Fourth Avenue Humboldt, Saskatchewan S0K 2A0
OVERALL DIMENSIONS:	
- housing width	48.0 in (1220 mm)
- housing depth (wind hood included)	60.0 in (1520 mm)
- housing height	48.0 (1220 mm)
- discharge opening	36.9 in (940 mm)
- guard grill diameter	40.2 in (1020 mm)
- grill opening	0.19 in (5 mm) dia. wire spaced at 2.0 in (51 mm)
IMPELLER:	
diameter	36.5 in (927 mm)
hub diameter	8.0 in (200 mm)
number of blades	3
blade angle	Hub 34°, Tip 9°
blade width maximum	5.3 in (140 mm)
blade width minimum	3.9 in (100 mm)
tip clearance (minimum and maximum)	0.4 in (10 mm)
WEIGHT (wind hood included):	108 lb (49 kg)
MOTOR NAMEPLATE DATA:	
make	FASCO
model	7124-0101
type	U28B1
rpm	850
ambient temperature rise	40° C
volts	230
amps	1.8
phase	1
cycles	60
horsepower	0.33 hp (248 W)
rev	E

APPENDIX II NOISE LEVEL RANGES

RANGE	SOUND LEVEL	COMMENTS
1	up to 45	Tolerable, low level background noise.
2	45 to 60	Dominating background noise that would interfere with normal conversation,
3	60 to 85	Could be annoying and detrimental to hearing and operator performance under long-term, continuous exposure. Ear protection should be considered.
4	over 85	Could damage hearing, depending on level and exposure time. Ear protection is definitely recommended.

SUMMARY CHART

DEL-AIR NORTHWINDS MODEL 10K VENTILATION FAN

RETAIL PRICE:	\$995 (Completed fan with windhood, butterfly damper and winter door) \$706 (Panel fan only) (December 1991, f.o.b. Lethbridge)
FAN DESCRIPTION:	36.5 in (930 mm) propeller fan, variable speed, direct drive, 0.33 hp (246 W), 230 V electric motor.
FAN PERFORMANCE:	
Air Flow Rate:	1140 to 10440 cfm (540 to 4930 L/s)
range	7830 cfm (3700 L/s) without wind (31.1 Pa) hood or damper
at 0.125 in wg	7130 cfm (3370 L/s) with damper 7510 cfm (3540 L/s) with wind hood 7280 cfm (3440 L/s) with damper and wind hood
Power Consumption:	0.459 to 0.488 kW
Efficiency Range:	
- without wind hood or damper	22 to 37%
- with wind hood	24 to 34%
- with damper	17 to 33%
- with wind hood and damper	17 to 33%
Efficiency at 0.125 in wg (31.1 Pa):	
- without wind hood or damper	37%
- with wind hood	34%
- with damper	32%
- with wind hood and damper	33%
OPERATOR SAFETY:	Inlet guard provided CSA approved noise level = 81 dB(A) at 4.9 ft (1.5 m) from fan inlet
OPERATOR'S MANUAL:	Very good

 <p>ALBERTA FARM MACHINERY RESEARCH CENTRE</p>	<p>Prairie Agricultural Machinery Institute Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0 Telephone: (306) 682-2555</p>		
<p>3000 College Drive South Lethbridge, Alberta, Canada T1K 1L6 Telephone: (403) 329-1212 FAX: (403) 329-5562 http://www.agric.gov.ab.ca/navigation/engineering/afmrc/index.html</p>	<p>Test Stations:</p> <table> <tr> <td>P.O. Box 1060 Portage la Prairie, Manitoba, Canada R1N 3C5 Telephone: (204) 239-5445 Fax: (204) 239-7124</td> <td>P.O. Box 1150 Humboldt, Saskatchewan, Canada S0K 2A0 Telephone: (306) 682-5033 Fax: (306) 682-5080</td> </tr> </table>	P.O. Box 1060 Portage la Prairie, Manitoba, Canada R1N 3C5 Telephone: (204) 239-5445 Fax: (204) 239-7124	P.O. Box 1150 Humboldt, Saskatchewan, Canada S0K 2A0 Telephone: (306) 682-5033 Fax: (306) 682-5080
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