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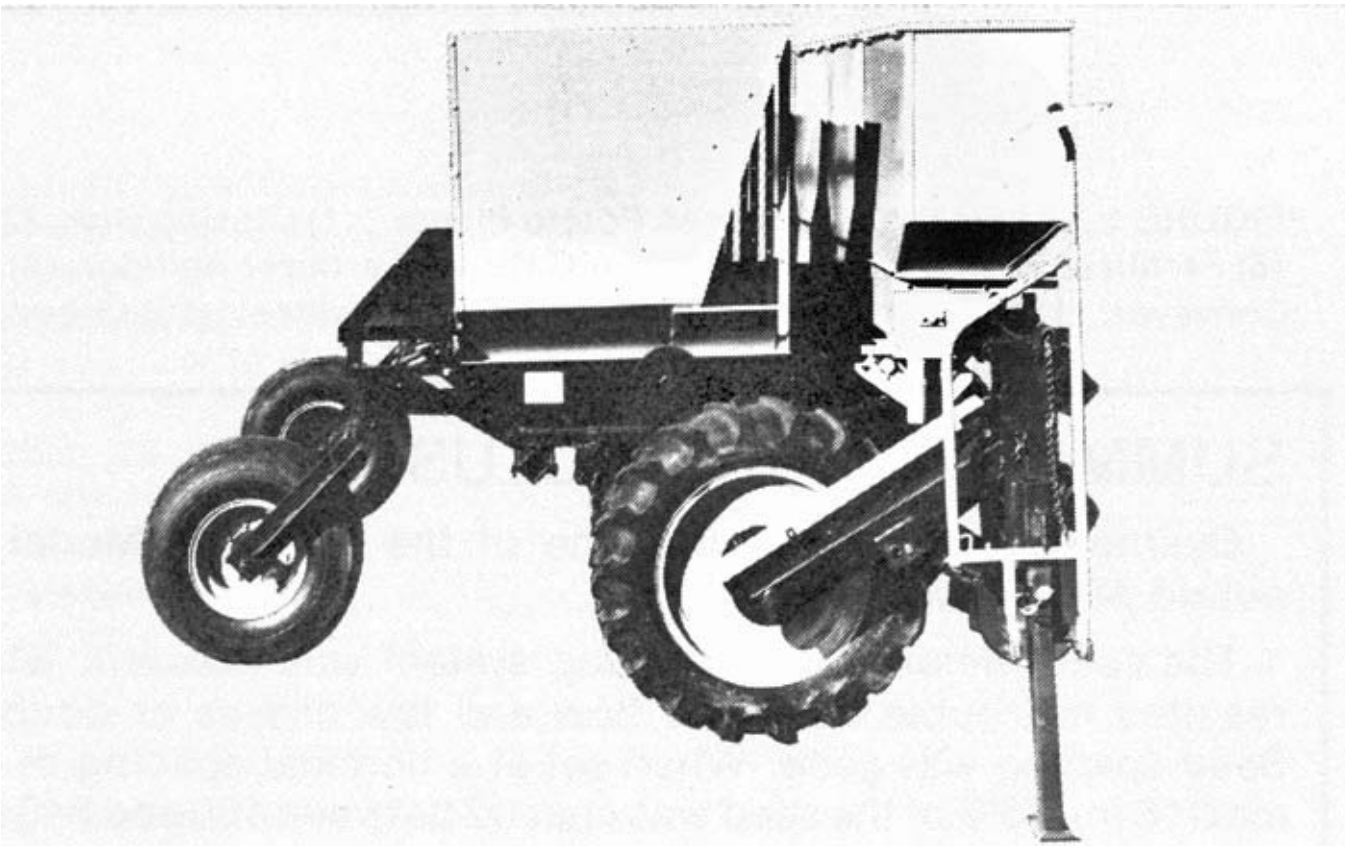

Dahlman Model PT Potato Planter

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

DAHLMAN MODEL PT POTATO PLANTER

MANUFACTURER AND DISTRIBUTOR:

Dahlman Inc.
P.O. Box 504
Braham, Minnesota 55006 U.S.A.

RETAIL PRICE:

$11,250.00 (April, 1978, f.o.b. Portage la Prairie, Manitoba with rear tires 12.6 x 15 and dry fertilizer attachment.)

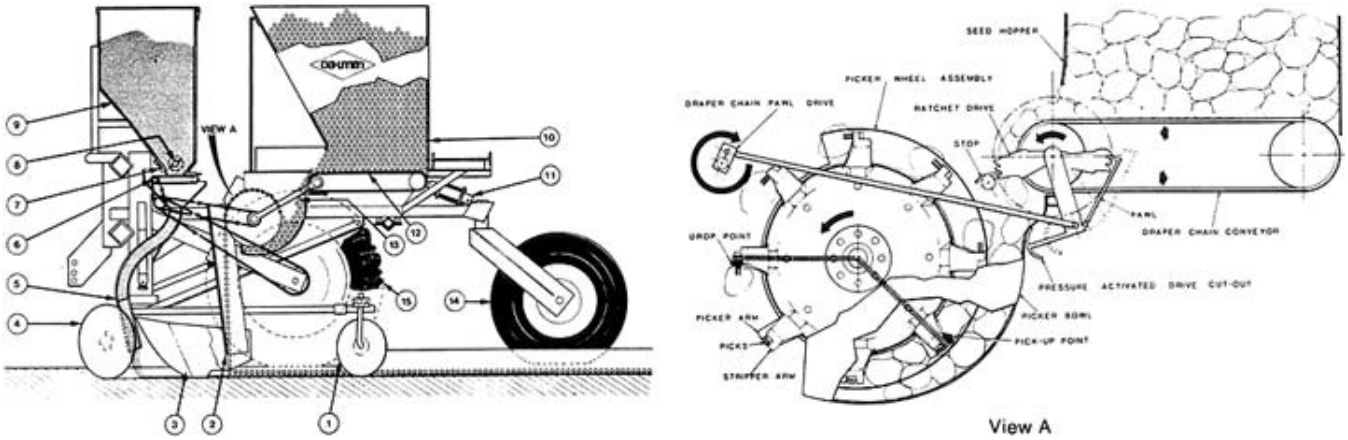

FIGURE 1. Schematic of Dahlman Potato Planter: (1) Closing Disk, (2) Seed Chute, (3) Planting Shoe, (4) Opening Disk, (5) Fertilizer Feed Hose, (6) Fertilizer Feed Chain, (7) Fertilizer Gate, (8) Fertilizer Agitator, (9) Fertilizer Hopper, (10) Seed Hopper, (11) Hydraulic Cylinder, (12) Draper Chain Conveyor, (13) Picker Chamber, (14) Rear Castor wheel, (15) Ground Drive Wheel.

SUMMARY AND CONCLUSIONS

Overall functional performance of the Dahlman Model PT potato planter was very good.

The seed metering and feeding system was excellent which resulted in trouble free seed flow and few misses or doubles. Seed spacing was good. When set at a nominal spacing of 460 mm (18 in), 76% of the seed was spaced between 160 and 840 mm (6 and 33 in) with an average spacing of 440 mm (17 in). The coefficient of variation of single seed spacing was 38%. This coefficient was constant for all planting speeds. Control of seeding depth was very good with seed pieces placed within 12 mm (0.5 in) of the desired depth. The closing disks could be adjusted to produce very good hills with uniform cover in all soil conditions.

Performance of the fertilizer metering system was good. Performance was reduced by occasional feeding problems and exposure of the feed chains to rain. The application rate was not affected by field roughness, field slope, ground speed or fertilizer level in the hoppers. Fertilizer placement was good, with bands placed 130 mm (5 in) to each side of the seed. Opener adjustment was adequate to permit the fertilizer to be placed below seed level in all soil conditions. The manufacturer's fertilizer calibration chart was inaccurate which made it necessary to recalibrate the applicator.

Both the fertilizer and seed systems were convenient to adjust and service and easy to operate. An adequate walkway was supplied for filling the seed hoppers but the fertilizer hopper had no walkway.

A 60 kW (80 hp) tractor had adequate power to operate the Dahlman in most soils, at speeds up to 10 km/h (6 mph).

The operator's manual was fair, containing instructions on operation, adjustment, maintenance and safety. The Dahlman was safe to operate if normal safety procedures were followed.

Several minor durability problems occurred with the picker arms and one castor wheel spindle had to be replaced during the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifying the picker arms so they close consistently and modifying the cam rollers on the picker arms to reduce wear.
2. Modifying the castor wheels to eliminate bending of the spindles.
3. Supplying an operator walkway to provide access to the fertilizer hoppers and providing access to the rear walkway.
4. Modifying the fertilizer applicator to prevent fertilizer entering the picker bowls and to prevent moisture entering the fertilizer tubes during rain, and improving the hopper lid hinges to prevent failure.
5. Modifying the row marker retaining pins to eliminate bending.
6. Improving the operator's manual to improve clarity and ease of use, and supplying fertilizer calibration charts for fertilizer commonly used in the prairie provinces.
7. Recommending the use of a suitable planter monitor when the planter is equipped with the fertilizer attachment.
8. Supplying a slow moving vehicle sign as standard equipment.

Chief Engineer -- E. 0. Nyborg
Senior Engineer -- J.C. Thauberger
Project Engineer -- R.J. Van Kleeck

THE MANUFACTURER STATES THAT:

With regard to recommendation number:

1. The picker arms have been changed to a higher strength material with a redesigned assembly and mounting stand to assure functional accuracy. The sliding cam followers have been changed to rolling followers for improved efficiency and extended life.
2. The pivot material on the dolly wheels has been changed from cold rolled carbon steel bar to alloy steel shafting, strengthening the spindle, to prevent bending during use.
3. Walkway platforms for the front of the planter are available as optional equipment. Mounting ladders and full width railings are included with this option.
4. The fertilizer attachment is in the process of being redesigned to prevent leaking into the picker bowl. Methods of shielding out precipitation are included in this design change.
5. The row markers are being totally redesigned using individual cylinders, for each side, actuated alternately by tractor mounted control system. The arm assemblies have been widened and strengthened by a heavier grade material.
6. The operator's manual is being reprinted and is being edited for reader clarity and accuracy with updated graphic illustrations.
7. Seed placement monitors are available from several manufacturers and include custom adaptors for Dahlman planters. Factory installation of these monitors is available upon special request.
8. Slow moving vehicle decals are now standard on all planters.

GENERAL DESCRIPTION

The Dahlman Model PT (FIGURE 1) is a four row, semi-mounted, pick type potato planter. The main frame is fabricated

in one piece and is supported by the two lifting links of a tractor (Category II) three point hitch and two rear castor tires. It is designed for use without a riding operator.

The Dahlman is equipped with a 2680 L (95 ft³) seed hopper placed above four draper chain conveyors, which feed seed to the picker bowls. A shut-off controls the level of seed in the picker bowl by disengaging a pawl from the ratchet drive on the draper chain. A picker wheel assembly, containing 16 cam-activated picker arms, is located in each picker bowl. Steel picks on each picker arm pierce the seed, carry it out of the picker bowls, and drop it through seed chutes into furrows formed by the planting shoes. Seed spacing can be varied by changing drive sprockets while seed depth is controlled by the three point hitch and hydraulic cylinders on the rear castor wheels. Two covering disks cover each seed row with soil hills.

Fertilizer hoppers are provided for each row. Fertilizer is metered from the hoppers with feed chains. The application rate can be varied by adjustable gates or by changing feed chain drive sprockets. Flexible hoses deliver the fertilizer to opening disks on each side of each seed row. Fertilizer placement depth is adjusted by means of a set of holes on the opening disk support bracket.

The test machine was equipped with hydraulically controlled row markers.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Dahlman was operated in the conditions shown in TABLE 1 for 40 hours while seeding about 65 ha (160 ac). It was evaluated for rate of work, quality of work, ease of operation, ease of adjustment, power requirements, operator safety and suitability of the operator's manual. In addition, the fertilizer system was calibrated in the laboratory.

All seed placement trials[1] were performed with cut Netted Gem seed with average seed size of about 40 g (0.1 lb) with the machine set at a nominal 460 mm (18 in) spacing.

TABLE 1. Operating Conditions

Soil Texture	Field Area		Hours
	ha	ac	
Sandy clay loam	3	7	2
Loamy sand	62	153	38
Total	65	160	40

RESULTS AND DISCUSSION

RATE OF WORK

Average planting rates obtained with the Dahlman in loamy sand were about 1.6 ha/h (4 ac/h). Maximum planting rates of about 3.5 ha/h (9 ac/h) were obtained. Maximum planting rates do not include the time required to fill the fertilizer and seed hoppers.

QUALITY OF WORK

Seed Placement: Seeding depth uniformity was very good. Deviations of less than 12 mm (0.5 in) from the desired depth were maintained for planting speeds from 3 to 11 km/h (2 to 7 mph).

Seed spacing in the rows was good. TABLE 2 shows seed placement uniformity. When planting at 8.6 km/h (5.4 mph) in level loamy sand, with the planter at a nominal 460 mm (18 in) setting, 76 percent of the seed was spaced between 160 and 840 mm (6 and 33 in). Average spacing of single seed was 440 mm (17 in) with a coefficient of variation[2] (CV) of 38%. This CV was not affected by changes in planting speed from 3 to 11 km/h (2 to 7 mph). It is commonly accepted that for acceptable seed placement, the CV should be less than 40%.

Seed spacing increased slightly with an increase in speed. Average spacing increased from 435 to 460 mm (17 to 18 in) when the planting speed was increased from 3 to 11 km/h (2 to 6 mph).

Fertilizer Placement: Fertilizer placement was good for planting speeds from 3 to 11 km/h (2 to 7 mph). The fertilizer was placed in bands on either side and slightly below the seed. At slow speeds the bands were compact and well defined. As speed was increased the fertilizer bands became less clearly defined.

Fertilizer Metering System: FIGURE 2 shows PAMI calibration results for 16-20-0 fertilizer with a density of 1010 kg/m³ (63 lb/ft³). Comparisons to the manufacturer's calibration on the same figure show large differences between the two calibration curves even though the manufacturer's curve was adjusted to account for differences in sprockets. It is recommended that the manufacturer supply fertilizer application rate tables suitable for fertilizers commonly used in the prairie provinces.

TABLE 2. Seed Placement

Uniformity of Placement	Percent of Total Seed
Single seed	76
Double seed	14
Missed seed	9
Double missed seed	1
Total	100%

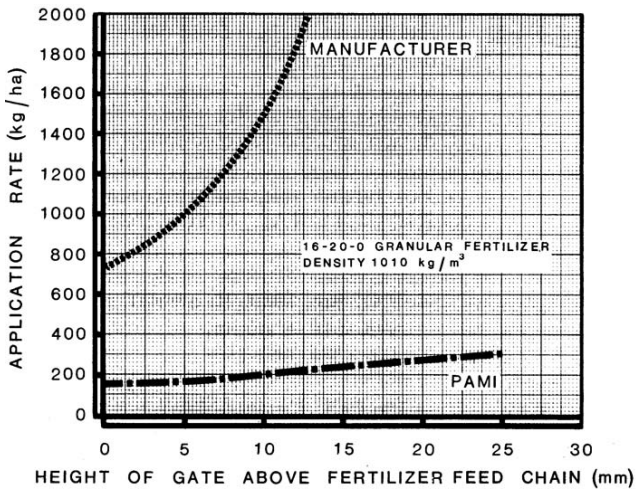

FIGURE 2. Calibration of Fertilizer Metering System.

The fertilizer application rate was not significantly affected by the fertilizer level in the hopper, ground speed, sloping terrain or field roughness.

Hill Formation: Very good hills were produced over the seed. Hills were uniform in size for planting speeds from 3 to 11 km/h (2 to 7 mph).

Flotation: The Dahlman was equipped with two support wheels and two rear castor wheels, which provided good flotation in soft soil. The wheels operated between the rows and did not cause any soil compaction of the hills.

EASE OF OPERATION

Row Markers: The hydraulically controlled row marker attachment was effective and easy to use. The disk markers could be adjusted to create a clear mark, while marker length was adjustable to suit the row spacing. However, the markers would occasionally stay in the raised position due to bent retaining pins.

It is recommended that modifications be provided to eliminate bending of the marker stops.

Hopper Filling: Filling of the seed hopper was safe and convenient. A suitable metal walkway was supplied at the rear of the planter to aid in filling although it was difficult to use since no mounting step was provided. The planter did not have proper footing at the front. Filling the fertilizer hoppers was therefore unsafe and inconvenient. It is recommended that the manufacturer consider providing a suitable walkway on the front of the planter to allow safe and convenient filling of the fertilizer hopper. Separate lids were supplied for each of the fertilizer hoppers.

Moisture: The fertilizer hoppers were adequately sealed to prevent leakage into the hoppers during rain. However, rainwater entered the fertilizer feed chain, which was exposed, and penetrated the feed hoses. If the planter was left to stand in the rain with loaded fertilizer hoppers, the fertilizer chains and feed hoses had to be checked for fertilizer caking before operation.

Cleaning: As with most potato planters, a pressure washer was most suitable for a thorough machine cleaning. The seed hopper

[1] *PAMI T7714-R78, Detailed Test Procedure for Potato Planters.*

[2] *The coefficient of variation is the standard deviation of seed spacing, expressed as a percent of the mean seed spacing. It is a measure of seed spacing uniformity.*

could be tilted backwards for seed removal and cleaning of the seed hopper and picker bowls. Removal of the drive chain allowed the fertilizer hopper to be tilted forward to allow fertilizer removal and cleaning of the hoppers and feed belts.

Hitching: The Dahlman was relatively easy to hitch to the tractor.

Planting: It was difficult for the tractor operator to monitor the flow of fertilizer and impossible to monitor two of the four seed wheels. Since the machine is intended for use without a machine operator, it is recommended that the manufacturer recommend the use of a suitable planting monitor, when the planter is equipped with the fertilizer attachment. The draper chain conveyor delivered seed to the picker bowl and bridging of seed did not occur. The picker arms frequently failed to close against the stripper arms, due to dirt and fertilizer jamming the mechanisms. It is recommended that the manufacturer modify the fertilizer applicators to ensure that fertilizer does not enter the picker bowls. It is also recommended that the manufacturer modify the picker arm assemblies to eliminate this Problem.

Transportation: The Dahlman transported well at speeds up to 25 km/h (15 mph) on smooth roads. On rough roads, speed had to be reduced to 17 km/h (10 mph) due to the castor wheels catching in ruts or potholes and pushing the planter over to one side.

EASE OF ADJUSTMENT

Seed Spacing: Seed spacing was adjusted by varying the picker wheel and axle drive sprockets. Sprockets were accessible and easy to change. Nominal seed spacings of 150 mm to 405 mm (6 to 16 in) were possible with the standard sprockets supplied by the manufacturer. Special sprockets are available for other spacings.

Seed Depth: Adjustment of the planting depth was easy. Field operating control was through the tractor hydraulics to a cylinder on the castor wheels and through the two lifting links on the three point hitch which enabled the operator to keep the machine level.

Fertilizer Placement: The level of the fertilizer in relation to the seed depth was easily adjusted with individual control for each row. Two bands of fertilizer were applied slightly below the seed level and about 130 mm (5 in) to each side of the seed.

Hill Formation: A wide range of adjustments was provided for the closing disks. Uniform hills could be produced, over the seed, without disturbing the fertilizer, at normal operating speeds.

Fertilizer Application Rate: The fertilizer feed chain drive sprocket had to be changed to adjust the fertilizer application rate. Changing sprockets was easy. Additional adjustment was provided with an adjustable gate above each feed belt.

Lubrication: The Dahlman was equipped with 48 pressure grease fittings. All grease fittings, drive chains, idlers and other components were accessible for greasing or oiling. Daily servicing took about twenty minutes.

POWER REQUIREMENTS

Average draft in average soil conditions with full hopper, on level fields, was about 15,300 N (3360 lb). A 60 kW (80 hp) tractor had adequate power to operate the Dahlman in most soils at speeds up to 10 km/h (6 mph). Power was not the criterion for determining a suitable tractor, but tractor size and the ability of the three point hitch to lift the planter, with full hoppers, were of greatest importance. Front ballast may be required for some tractors to properly handle the Dahlman.

OPERATOR SAFETY

The Dahlman pick type potato planter was safe to operate, and service if the manufacturer's safety recommendations were followed. Three safety problems were evident:

a) The planter did not have a platform at the front, which made filling of the fertilizer hopper unsafe and inconvenient.
b) The planter did not have a step for easy mounting of the rear platform.
c) The planter was not equipped with a slow moving vehicle sign, or mounting bracket.

All moving parts were adequately shielded.

OPERATOR'S MANUAL

The operator's manual contained some useful information on adjustments, maintenance and safety but was sometimes unclear and difficult to read. As indicated previously, the fertilizer application chart was in error. A comprehensive parts list was provided in the operator's manual. A separate manual dealing with safety was included.

DURABILITY RESULTS

TABLE 3 outlines the mechanical history of the Dahlman during 40 hours of field operation while seeding about 65 ha (160 ac). The intent of the test was evaluation of functional performance and failures represent those, which occurred during this functional testing. An extended durability evaluation was not conducted.

TABLE 3. Mechanical History

Item	Operating Hours	Field Area ha	(ac)
-chain tightener arm welds failed at	4	6	(15)
-right castor wheel spindle bent and was straightened at	16.5	27	(66)
-bolt missing from drive was replaced at	16.5	27	(66)
-two collars missing from the closing disk rods were replaced at	16.5	27	(66)
-one opening disk broke and was replaced at	20	32	(80)
-right castor wheel spindle bent and was replaced at	23.5	38	(94)
-picker arms remained open due to dirt and fertilizer, and bent picks were cleaned and picks straightened	many times		
-three of eight hinges on fertilizer lids were broken at	end of test		
-cam followers had worn requiring replacement at	end of test		

DISCUSSION OF MECHANICAL PROBLEMS

Opening Disk

The conditions resulting in failure were not unusual. It was determined that failure of the disk was a result of improper heat treatment during manufacture. Failure was due to brittle fracture.

Castor Wheel Spindle

The failure was initiated by backing the machine and turning with fully loaded hoppers. This caused the castor wheels to turn under the machine and carry a proportionately greater part of the total load. Failure was determined to be due to improper heat treatment or material, which was of inadequate strength. No further problems were experienced after a replacement was installed.

APPENDIX I
SPECIFICATIONS

Make:	Dahlman
Model:	PT
Serial No.:	P09378
Weight: (with hopper empty)	
-- right wheel	538 kg (1185 lb)
-- left wheel	524kg (1155 lb)
-- hitch point	1790 kg (3945 lb)
-- total weight	2852 kg (6285 lb)
Overall Dimensions:	
-- tire size, drive	9.00 x 24
-- tire size, rear caster	12.5 x 15
-- length	3400 mm (134 in)
-- width	5060 mm (199 in)
-- height	2245 mm (88 in)
-- transport ground clearance	100 mm (4 in)
Seeding System:	
-- type	pick
-- number of rows	4
-- pickers per row	16
-- picks per picker	2
-- type of drive	chain and gear from ground wheel
-- type of adjustment	interchangeable drive and driven sprockets
-- range of normal seed spacing	150 mm to 405 mm (6 in to 16 in)
-- range of row spacing	860 mm to 1010 mm in 50 mm increments (34 in to 40 in in 2 in increments)
-- seed hopper capacity	2680 L (95 ft³)
-- closing disk diameter	355 mm (14 in)
-- number of closing disks	2 per row
-- space between closing disk	adjustable
-- angle of closing disk	adjustable
Fertilizer System:	
-- type of drive	chain and gear from ground wheel
-- type of adjustment	interchangeable drive and driven sprockets and slide gate
-- application rate	150 kg/ha to 320 kg/ha (135 lb/ac to 288 lb/ac)
-- type of feed	chain
-- number of hoppers	4
-- fertilizer hopper size (approx.)	328 kg per row (720 lb per row)
-- opening disk diameter	400 mm (16 in)
-- space between opening disks	105 mm at front
-- angle of opening disks	16° toe-in
-- fertilizer agitator type	finger
Number of Chain Drives:	18
Number of Lubrication points:	48
Other Optional Equipment:	dry fertilizer attachment, 9.5 x 15 or 7.5 x 16 rear caster tires.

APPENDIX II
MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports.

(a) excellent	(d) fair
(b) very good	(d) poor
(c) good	(f) unsatisfactory

APPENDIX III
METRIC UNITS

In keeping with the Canadian metric conversion program, this report has been prepared in SI units. For comparative purposes, the following conversions may be used.

1 hectare (ha)	= 2.47 acres (ac)
1 kilometre/hour (km/h)	= 0.62 miles/hour (mph)
1 kilogram (kg) = 1000g	= 2.2 pounds (lb)
1 newton (N)	= 0.22 pounds force (lb)
1 litre (L)	= 0.035 cubic feet (ft³)
1 kilogram/hectare (kg/ha)	= 0.9 pounds/acre (lb/ac)

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