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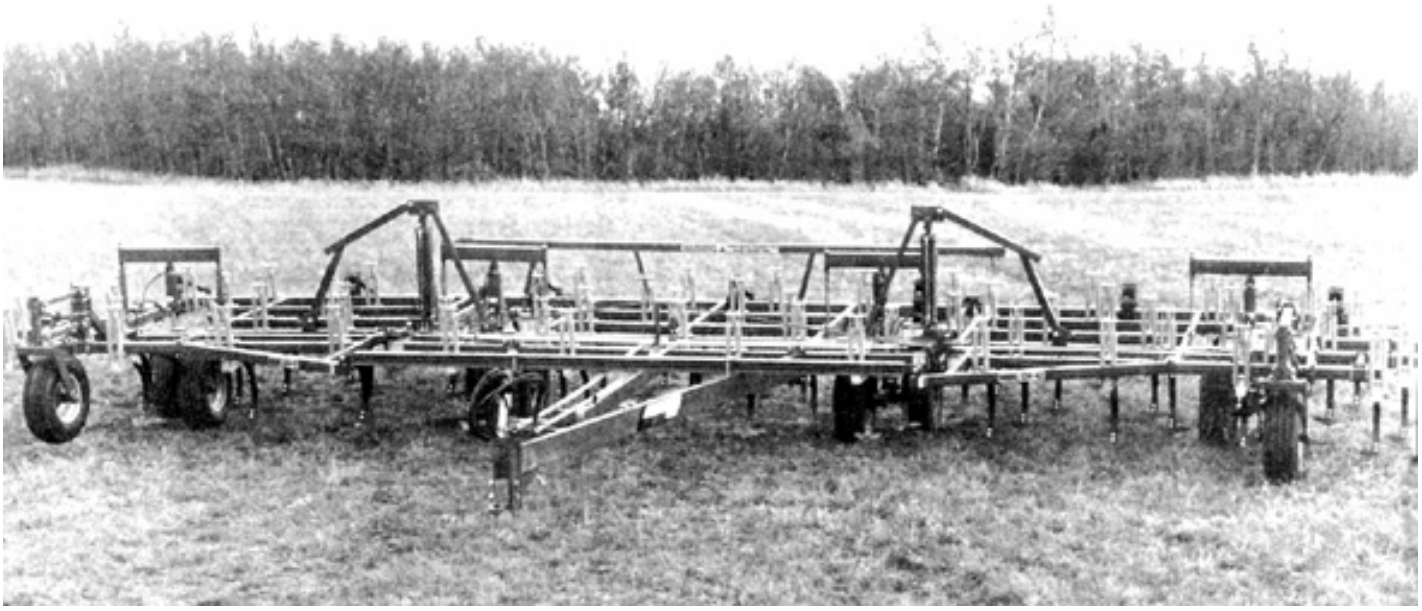
Evaluation Report 412



Bourgault 534-42 (41.3 ft) Cultivator

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

BOURGAULT 534-42 CULTIVATOR

MANUFACTURER AND DISTRIBUTOR:

F.P. Bourgault Industries Ltd.
P.O. Box 130
St. Brieux, Saskatchewan
S0K 3V0

RETAIL PRICE:

$24,600.00 [February, 1985, f.o.b. Humboldt, 41.3 ft (12.6 m) width, with optional harrows].

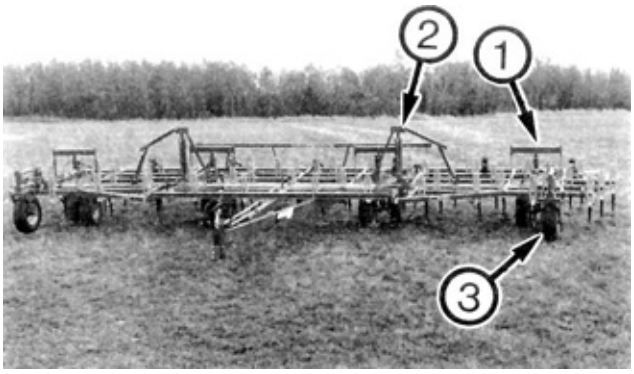


FIGURE 1. Bourgault 534: (1) Depth Control Cylinder, (2) Wing Lift Cylinder, (3) Stabilizer Wheel.

SUMMARY AND CONCLUSIONS

Quality of Work: The Bourgault 534 was suitable for secondary tillage and light primary tillage,but not for heavy primary tillage with 11 in (280 mm) sweeps. The spring-cushioned shanks of the Bourgault 534 cultivator could lift 11.5 in (292 mm) to clear stones. When equipped with 47 degree sweeps, sweep pitch ranged from 5 to 7 degrees over the normal range of secondary tillage draft Shank cushion spring preload was exceeded at drafts greater than 322 lb/ft (4.8 kN/m), well below the limit of the primary tillage draft range.

Penetration was good in most conditions. Excessive furrow bottom ridging occurred in heavy primary tillage with 11 in (280 mm) sweeps. Uniformity of the tillage depth was good.

Trash clearance was excellent and the field surface left by the Bourgault 534 was very good, providing the three row tine harrows were used. However, the harrows left bunches typical of all mounted harrows, on the field surface in heavy trash. Weed kill was good except in heavy trash conditions where the harrows were less effective.

Ease of Operation and Adjustment: Ease of hitching to the Bourgault 534 was very good. The rigid hitch link and hitch jack made one-man hitching easy. Ease of transporting the Bourgault 534 was fair. It could be placed into transport in less than five minutes. Because of its very high transport height, transporting on public roads required extreme caution. Maneuverability was good. However, the front stabilizer wheels left furrows when making tight turns with the cultivator in the soil.

Ease of levelling the Bourgault 534 was very good. Adequate adjustment was provided for fore-and-aft frame levelling and lateral levelling of the wings. Ease of setting the tillage depth was very good. A depth stop was provided. It was positioned on the left hydraulic cylinder on the centre frame. Ease of installing sweeps and shanks was very good. About 5 minutes was required to install a new shank.

Power Requirements: In light secondary tillage, at 3 in (75 mm) depth and 6 mph (9.7 km/h), a tractor with 138 hp (103 kW) maximum power take-off rating wilt have sufficient power reserve to operate the 41.3 ft (12.6 m) wide Bourgault 534. In heavy secondary and light primary tillage at the same depth and speed, a 194 hp (145 kW) tractor is required.

Safety: The Bourgault 534 was equipped with centre frame and wing transport locks. In transport, the tires of the centre section were adequate. Transport height was high enough that overhead power lines could be contacted while moving. A slow moving vehicle sign was not provided.

Operator's Manual: Detailed procedures for frame levelling and depth adjustment were not included.

Mechanical History: Fourteen shanks bent severely when they hit the cultivator frame while tripping over rocks. The centre frame truss rod loosened up several times during testing. Several other minor mechanical problems occurred during the tests.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to prevent the depth stop on the left hydraulic cylinder and cylinder leak-down from interfering with positioning of the transport locks.
2. Modifications to the front stabilizer wheets to prevent skidding during sharp turns.
3. Modifications to prevent rotation of the shank retaining bolt when replacing shanks.
4. Providing a slow moving vehicle sign.
5. Adding detailed frame levelling and depth adjustment procedures to the operator's manual.
6. Modifications to prevent shank damage when tripping over large rocks.
7. Increasing the length of the hydraulic lines to the tractor to prevent accidental uncoupling during operation.
8. Modifications to the centre frame truss rod to prevent it from loosening during field operations.
9. Modifications to the wing transport pin to prevent bending during transport.
10. Modifications to increase the stability of the hitch jack when unhooking the cultivator.

Senior Engineer: G.E. Frehlich

Project Engineer: H.D. Kydd

Project Technologist: M.J. Bennett

THE MANUFACTURER STATES THAT:

With regard to recommendation number:

1. A new transport lock is being designed and will be included on some of the 1985 fall models.
2. Turns shorter than allowed by the caster wheel stops may damage the outside shanks.
3. Modifications will be considered.
4. A bracket is provided and slow moving vehicle signs are available from our dealers.
5. This information will be included in the future.
6. This problem was corrected in the fall of 1982. Since that time optional shanks (7/8 x 2") were made available and recommended to farmers with very rocky field conditions.
7. Your authorized Bourgault dealers will size the length of hose required during the pre-delivery check.
8. In the operator's manual, it is recommended that all bolts and nuts be retightened after the first 20-30 acres use and rechecked after 300-500 acres. If this is done, the truss rod will seat itself and stay tight. However, modifications wilt be considered to prevent the truss rod from coming off the truss rod tower.
9. This pin has been sized and graded to fail if a farmer accidentally forgets to remove the wing pins when unfolding his cultivator. This prevents more serious damage to the wing frame. We also recommended that the wing lift cylinder be pressurized for transporting rather than allowing the wing pins to carry the load.

10. This has-not been reported by dealers or customers. We suggest, however, that care be taken to park on level ground when unhitching.

MANUFACTURER'S ADDITIONAL COMMENTS

1. Regarding heavy primary tillage conditions. For heavy primary tillage conditions which occur in the normally dryer months of September and October, we recommend the use of 4 in (100 mm) sweeps or 2 in (50 mm) spikes. Using these chisels, the Bourgault spring cushion trip assembly generates the penetration forces required to work heavy primary tillage and reduces unnecessary draft
2. Regarding the standardization of sweep and stem angles. The design of the sweep can adversely effect the cultivator's ability to penetrate and the resulting field finish. Therefore, we recommend using only those sweeps which have been thoroughly tested by us.

GENERAL DESCRIPTION

The Bourgault 534-42 is a trailing, flexible, three section intermediate cultivator suitable for light primary tillage such as first operation summerfallow, or secondary tillage such as seedbed preparation, herbicide incorporation, and heavy secondary sumrnerfallow. It is not intended for heavy primary tillage with 11 in (280 mm) sweeps.

It is available in widths from 34.8 ft (10.6 m) to 41.3 ft (12.6 m), with a shank spacing of 8 in (203 ram). The test machine is 41.3 ft (12.6 m) wide with a 16.3 ft (5.0 m) wide centre frame and two 12.6 ft (3.9 m) wide wings. It has 62 spring-cushioned shanks, laterally spaced on each row at 32 in (813 ram), and arranged in five rows.

The centre frame is carried by four wheels, while each wing is supported by two wheels. Four hydraulic cylinders, connected in series, control tillage depth. The wings fold into transport position with two hydraulic cyl.inders connected in parallel. A tractor with dual remote hydraulic controls is needed to operate the Bourgault 534. The test machine is equipped with optional three row tine harrows.

Detailed specifications are given in APPENDIX I, and FIGURE 1 shows the location of major components.

SCOPE OF TEST

The Bourgault 534 was operated in the field conditions shown in TABLE 1 for 108 hours while cultivating approximately 1791 ac (725 ha). It was evaluated for quality of work, ease of operation and adjustment, power requirements, safety, and suitability of the operator's manual.

TABLE 1. Operating Conditions

FIELD CONDITION	HOURS	FIELD AREA	
		ac	(ha)
Soil Type			
— sand	14	270	(109)
— light loam	12	180	(73)
— loam	70	1171	(474)
— clay	12	170	(69)
TOTAL	108	1791	(725)
Stony Phase			
— stone free	36	620	(251)
— occasional stones	44	674	(273)
— moderately stony	22	369	(149)
— very stony	6	128	(52)
TOTAL	108	1791	(725)

RESULTS AND DISCUSSION

QUALITY OF WORK

Shank Characteristics: Many manufacturers use different shank and sweep stem angles (FIGURE 2) when designing their cultivators. Sweeps and shanks'must be matched to obtain sufficient sweep pitch to achieve and maintain penetration. Usually manufacturers recommend sweeps with a stem angle from 0 to 5 degrees less than the shank stem angle to result in a slightly positive no-load sweep pitch.

Sweep pitch increases in proportion to draft due to shank flexing. Depending on shank stiffness and cushion-spring preload, sweep pitch may become excessive on some cultivators in normal tillage. A slightly positive sweep pitch results in uniform tillage depth and a smooth furrow bottom while excessive sweep pitch causes furrow bottom ridging, rapid sweep tip wear, and increased draft Shanks which maintain a low, relatively constant sweep pitch over the normal range of tillage forces, are desirable.

The Bourgault 534 was equipped with spring-cushioned shank holders, spaced at 8 in (203 mm) intervals. Spring tension was adjustable. The Bourgault 534 was used with 11 in (280 mm) sweeps with a 47 degree stem angle. This gave a no-load sweep pitch of 5 degrees.

FIGURE 3 shows the sweep pitch characteristics of the shank assemblies on the Bourgault 534. The lower sloped line results from shank flexing, while the steep upper line occurs when draft is large enough to overcome cushion-spring preload. Over the normal secondary tillage draft range, sweep pitch varied 2 degrees at the manufacturer's recommended setting. With the 47 degree sweeps this represents a working sweep pitch range from 5 to 7 degrees in secondary tillage. Shank cushion-spring preload was exceeded at a draft of 322 lb/ft (4.8 kN/m), well below the upper limit of the primary tillage draft range. This shows that the Bourgault 534 was suitable for both secondary and light primary tillage, but not for heavy primary tillage due to excessive sweep pitch when equipped with 11 in (280 mm) sweeps.

FIGURE 4 shows the lifting pattern when shanks encountered stones or field obstructions. Maximum lift height was 11.5 in (292 mm).

Penetration: Penetration was good in most field conditions. In secondary and light primary tillage, the spring cushioned shanks held the sweeps level, resulting in an even furrow bottom. In heavy primary tillage, excessive furrow bottom ridging occurred as the draft exceeded the shank cushion spring preload.

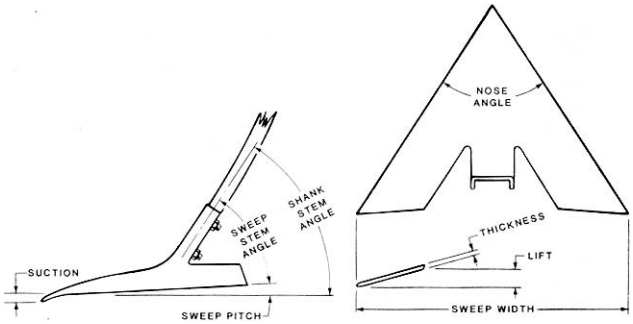


FIGURE 2. Shank and Sweep Terminology.

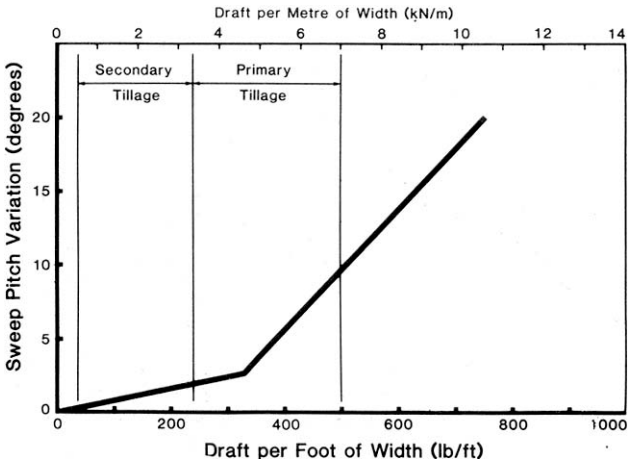


FIGURE 3. Sweep Pitch Variation over a Normal Range of Draft [8 in (203 mm) Shank Spacing].

Uniformity of the tillage depth across the cultivator width was good provided the frame was properly levelled. The frame remained level in secondary and light primary tillage. The front stabilizer wheels minimized twisting of the wing frames. As with most rigid hitch cultivators, large variations in tillage depth occurred in fields with abrupt contour changes.

Trash Clearance: The Bourgault 534 was excellent at clearing large amounts of trash. Even shanks close to the wheels did not plug in trash that would plug many other cultivators. The 8 in (203 mm) shank spacing allowed 32 in (813 mm) between any two shanks on the same row. A sweep-to-frame clearance of 27 in (686 mm) allowed large amounts of trash to pass through the cultivator.

Trash Burial and Field Surface: In moderate trash conditions, the harrows were effective in distributing the trash evenly. In heavy trash the harrows left bunches on the field surface (FIGURE 5), typical of all mounted harrows. In light trash the harrows were effective in levelling the ridges left by the cultivator to produce a uniform seedbed (FIGURE 6).

Skewing and Stability: The Bourgault 534 was stable and did not skew sideways in normal field conditions. The sweep pattern (FIGURE 7) was symmetrical and did not impose any side forces on the cultivator during normal tillage. As with most cultivators, skewing occurred only on hillsides or when soil hardness varied across the machine width. With the 11 in (280 mm) sweeps, the cultivator had to skew more than 2.4 degrees for weed misses to occur

Weed Kill: Weed kill was good with the 11 in (280 mm) sweeps and 8 in (203 mm) shank spacing. The finishing harrows were effective in exposing weeds in light trash conditions. The harrows were less effective in exposing weeds in heavy trash conditions.

EASE OF OPERATION AND ADJUSTMENT

Hitching: Ease of hitching to the Bourgault 534 was very good. The rigid hitch link and hitch jack made one-man hitching easy (FIGURE 8). Hitch weight was positive in transport and field position with mounted harrows. The hitch jack was unstable and care was needed to position it properly when unhooking the cultivator,

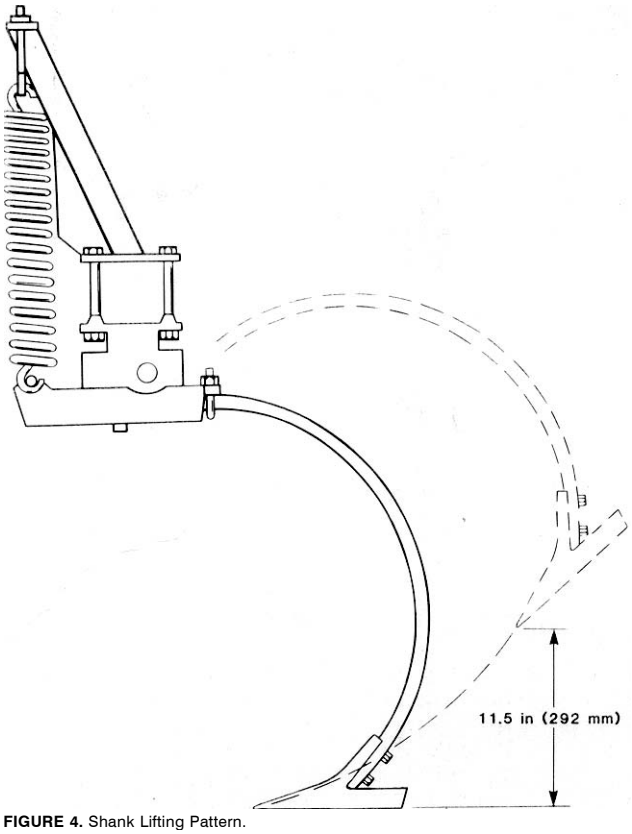


FIGURE 4. Shank Lifting Pattern.

Transporting: Ease of transporting the Bourgault 534 was fair. It was easily placed in transport position (FIGURE 9) by one person in less than five minutes. Locks were provided for the wings and the centre frame wheels.

The wing transport locks were easily positioned without climbing onto the cultivator frame. However, it was necessary to climb onto the cultivator frame to position the centre frame transport locks. If the wings had already been raised, the weight on the centre frame caused the hydraulic cylinders to leak down. This prevented installation of the transport locks. Also, the depth stop on the left hydraulic cylinder occasionally interfered with the positioning of the transport lock (FIGURE 10). It is recommended that the manufacturer consider modifications to prevent these problems.

Transport width of the test machine was 22.6 ft (6.9 m) while transport height was 17.4 ft (5.3 m). This was high enough to contact many of the rural electrical supply lines. Extreme care was needed when transporting on public roads, through gates, over bridges, and beneath power lines.

The Bourgault 534 towed well without sway at normal transport speeds. At speeds over 16 mph (26 km/h) bouncing of the hitch occurred. If towed by a truck or light tractor, the bouncing could cause an unstable condition. A sweep-to-ground clearance of 6.5 in (165 mm) provided sufficient ground clearance, and a wheel tread of 14.0 ft (4.3 m) allowed adequate stability in the field or on the road while transporting.

Maneuverability: Maneuverability of the Bourgault 534 was good. The hitch frame was narrow, permitting normal turns without tractor wheel interference. There were a sufficient number of sweeps beyond the wing wheels to allow moderate overlap without running a wheel on the cultivated ground. Running all wheels on similar untilled soil maintains proper flotation and a uniform tillage depth.

FIGURE 5. Typical Field Surface in Heavy Trash Conditions.

FIGURE 6. Typical Seedbed Preparation.

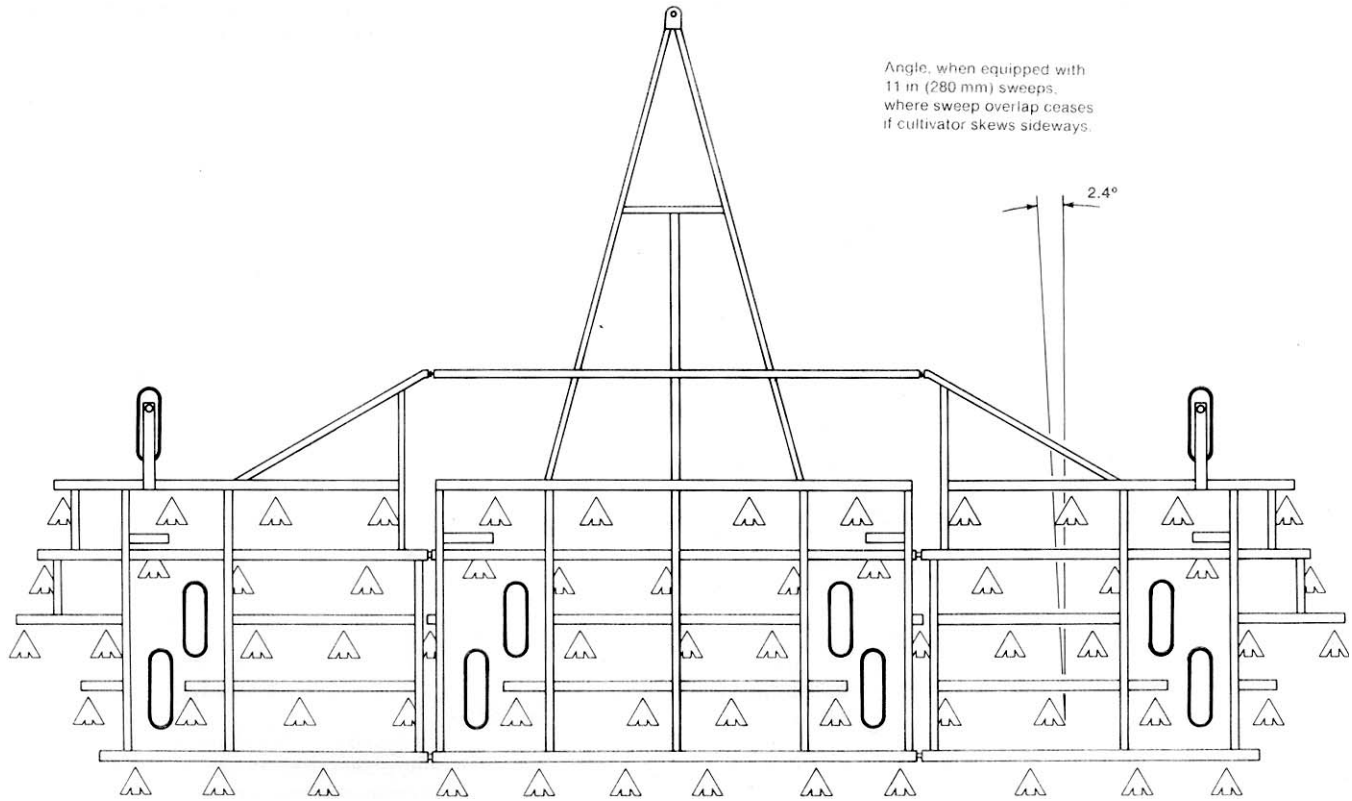


FIGURE 7. Sweep Pattern [8 in (203 mm) Shank Spacing].

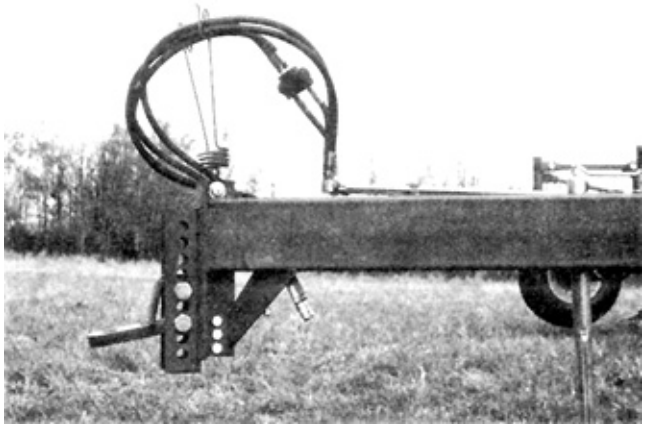


FIGURE 8. Hitch Height Adjustment.

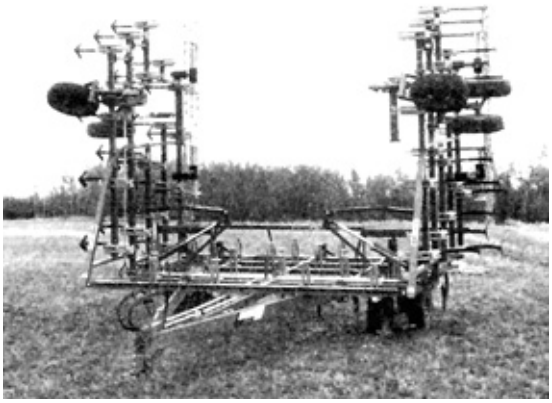


FIGURE 9. Transport Position.

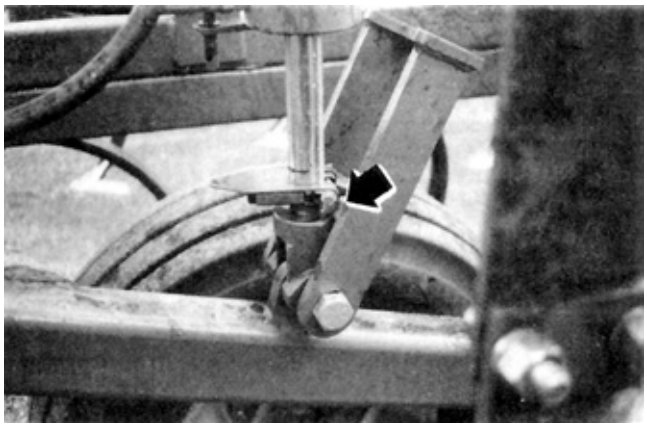


FIGURE 10. Interference Between Depth Stop and Transport Locks.

During tight turns, with the cultivator in the ground, the inside front stabilizer wheel did not pivot far enough and skidded, making furrows in the soil. It is recommended that the manufacturer consider modifications to prevent this.

Frame Levelling: Ease of frame levelling was very good. Adequate lateral levelling adjustments were provided for both the centre and wing sections. The frame was levelled by adjusting the parallel bars at the top of the hydraulic cylinder mounts.

Fore-and-aft levelling was accomplished by adjusting the hitch height. Hitch height could be adjusted 14 in (356 mm) in seven increments by removing two bolts. This range was adequate to allow fore-and-aft frame levelling with all tractors used during testing.

Depth Adjustment: Ease of setting the tillage depth was very good. Tillage depth was controlled with four hydraulic cylinders connected in series; two on the centre section and one on each wing section. An adjustable stop on the left centre frame cylinder could be adjusted to set tillage depth. To ensure uniform tillage depth, the hydraulic cylinders had to be synchronized periodically by completely extending them to a fully raised position.

Sweep and Shank Installation: It took one person about 3-1/2 hours to replace the 62 sweeps on the Bourgault 534. Thread damage to the sweep bolts from soil abrasion was only slight and did not hamper the removal of the bolts.

It took about 5 minutes to install a new shank. Shank replacement required removing one bolt and loosening one u-bolt. If the shank retaining bolt turned during removal, the spring tension had to be released to allow access to the head of the bolt. It is recommended that the manufacturer consider modifications to the shank holder to prevent this inconvenience.

POWER REQUIREMENTS

Draft Characteristics: FIGURE 11 shows draft requirements for cultivators in typical primary and secondary tillage at a speed of 5 mph (8 km/h). This figure gives average requirements based on tests of 27 cultivators and 53 different field conditions. Attempting to compare draft requirements of different makes of cultivators usually is unrealistic. Draft requirements for the same cultivator, in the same field, may vary by as much as 30% in two different years, due to changes in soil conditions. Variations in soil conditions affect draft much more than variations in machine make, usually making it impossible to measure any significant draft differences between makes of cultivators.

In light secondary tillage, such as seedbed preparation and herbicide incorporation, average draft at 5 mph (8 km/h) varied from 55 lb/ft (0.8 kN/m) at 1.6 in (40 mm) depth to 150 lb/ft (2.2 kN/m) at 4 in (100 mm) depth. For the 41.3 ft (12.6 m) wide test machine, this corresponds to a total draft ranging from 2271 to 6195 lb (10.1 to 27.6 kN).

In heavy secondary and light primary tillage, average draft varied from 90 lb/ft (1.3 kN/m) at 1.6 in (40 mm) depth to 250 lb/ft (3.7 kN/m) at 5 in (125 mm), corresponding to a total draft ranging from 3717 to 10325 lb (16.5 to 45.9 kN) for the 41.3 ft (12.6 m) wide test machine.

Increasing speed by 1.0 mph increased draft by 10 lb/ft (90 N/m draft increase for each 1.0 km/h speed increase). This represents a total draft increase of 413 lbs. for a 1.0 mph speed increase (1.1 kN for a 1.0 km/h speed increase) for the test machine.

Tractor Size: TABLES 2 and 3 show tractor size needed to operate the 41.3 ft (12.6 m) wide Bourgault 534 in light secondary tillage as well as in heavy secondary or light primary tillage. The Bourgault 534 was notsuited for heavy primary tillage operations with 11 in (280 mm) sweeps.

Tractor sizes have been adjusted to include tractive efficiency and represent a tractor operating at 80% of maximum power on a level field. The sizes presented in the tables are the maximum power take-off rating, as determined by Nebraska tests or as presented by the tractor manufacturer. Selected tractor sizes will have ample power reserve to operate the Bourgault 534 in the stated conditions.

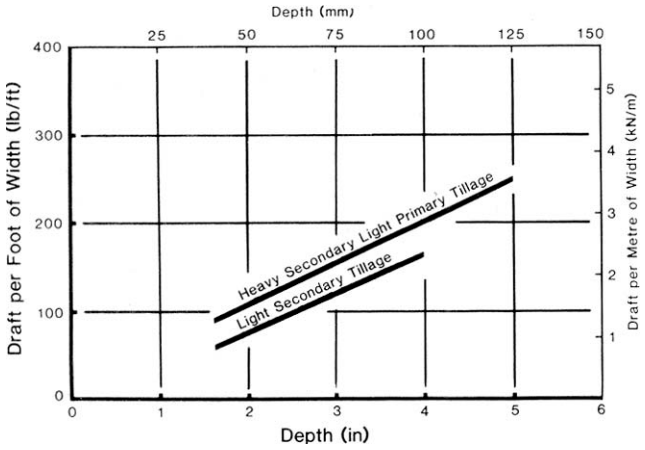


FIGURE 11. Average Draft Requirements for Intermediate Cultivators at 5 mph (8 km/h).

Tractor size may be determined by selecting the desired tillage depth and speed from the appropriate table. For example, in light secondary tillage at 3 in (75 mm) depth and 6 mph (9.7 km/h) a 138 hp (103 kW) tractor is needed to operate the Bourgault 534. In heavy secondary or light primary tillage at the same depth and speed, a 194 hp (145 kW) tractor is required.

TABLE 2. Tractor Size: Maximum Power Take-Off Rating hp (kW) Required to Pull the 41.3 ft (12.6 m) Bourgault 534 in Light Secondary Tillage.

DEPTH	SPEED mph (km/h)		
in (mm)	5 (8)	6 (9.7)	7 (11.3)
2 (50)	64 (48)	90 (67)	103 (77)
3 (75)	102 (76)	138 (103)	157 (117)
4 (100)	141 (105)	185 (138)	208 (155)

TABLE 3. Tractor Size: Maximum Power Take-Off Rating hp (kW) Required to Pull the 41.3 ft (12.6 m) Bourgault 534 in Heavy Secondary or Light Primary Tillage.

DEPTH	SPEED mph (km/h)		
in (mm)	5 (8)	6 (9.7)	7 (11.3)
2 (50)	106 (79)	145 (108)	171 (128)
3 (75)	150 (112)	194 (145)	232 (173)
4 (100)	193 (144)	246 (184)	295 (220)
5 (125)	237 (177)	300 (224)	351 (262)

OPERATOR SAFETY

Extreme caution is needed in transporting most folding cultivators to avoid contacting power lines. Minimum power line heights over farmland or secondary roads vary in the three prairie provinces. In Alberta and Manitoba, lines over roads may be as low as 16 ft (4.8 m). In Saskatchewan, they may be as low as 17 ft (5.2 m). In all three provinces, lines in farm yards may be as low as 15 ft (4.6 m).

Transport height of the 41.3 ft (12.6 m) wide three section machine was 17.4 ft (5.3 m). This did not permit safe transport under prairie power lines. The legal responsibility for safe passage under utility lines rests with the machine operator and not with the power utility or machinery manufacturer. All provinces have regulations governing maximum permissible equipment heights on various types of public roads. If height limits are exceeded, the operator must contact power and telephone utilities before moving.

The test machine was 22.6 ft (6.9 m) wide in transport position and required caution when transporting. A slow moving vehicle sign was not supplied. It is recommended that a slow moving vehicle sign be supplied as standard equipment.

Locks for the centre frame and the wings were provided. The rigid hitch link and hitch jack allowed safe hitching by one person.

The tires of the cultivator without mounted harrows were adequate for transport speeds of 20 mph (32 km/h). The load on the centre section tires did not exceed the Tire and Rim Association maximum load ratings when the cultivator was fitted with mounted harrows.

STANDARDIZATION

Sweep Bolt Holes: The bolt hole size and spacing on cultivator sweeps and shanks, as well as stem angles, should be standardized to provide some degree of interchangeability of sweeps.

OPERATOR'S MANUAL

The operator's manual supplied instructions on initial assembly, lubrication, maintenance, and safety. It also provided a complete parts listing. Detailed procedures for frame levelling and depth adjustment were not included. It is recommended that the manufacturer include these procedures in the operator's manual.

MECHANICAL HISTORY

TABLE 4 outlines the mechanical history of the Bourgault 534 during 108 hours of field operation while tilling 1791 ac (725 ha).

The intent of the test was evaluation of functional performance. The following mechanical problems occurred during functional testing. An extended durability test was not conducted.

TABLE 4. Mechanical History.

ITEM	OPERATING HOURS	EQUIVALENT FIELD AREA ac (ha)
-- fourteen shanks were severely, bent when tripping over rocks and were replaced	During the test	
-- the hydraulic hoses pulled out of the tractor remote hydraulic coupler	Several times during the test	
-- the centre frame truss rod came loose and had to be tightened	Several times during the test	
transpor', lock pins were bent while transporting	During the test	
-- the hitch jack was slightly bent at	55	926 (375)

Shank and Holder: During testing, fourteen shanks bent severely (FIGURE 12) when they hit the cultivator frame while tripping over large rocks. Seven of these were bent in extremely rocky conditions. It is recommended that the manufacturer consider modifications to prevent this.

Hydraulic System: During testing, the hydraulic hoses occasionally pulled out of the tractor's remote hydraulic couplers. It is recommended that the manufacturer install longer hydraulic hoses to prevent this.

Frame: The centre frame truss rod loosened several times and came off the truss rod tower once. This truss rod distributes the weight of the wings over the centre frame section when the cultivator is in the transport position. It is recommended that the manufacturer consider modifications to prevent this.

Transport Locks: The transport lock pins were bent during transport when hydraulic leak-down caused the full weight of the wings to rest on them. It is recommended that the manufacturer consider modifications to prevent transport lock pin damage.

Hitch Jack: The hitch jack was bent slightly when unhooking the tractor from the Bourgault 534. If the cultivator rolled ahead, it put a large enough side load on the hitch jack to cause binding. It is recommended that the manufacturer consider modifications to prevent this.

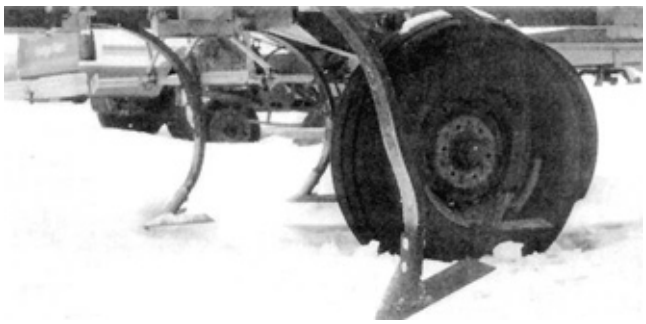


FIGURE 12. Bent Shank.

APPENDIX I

SPECIFICATIONS

MAKE:	Bourgault
MODEL:	534-42
SERIAL NO:	3230
MANUFACTURER:	F.P. Bourgault Industries Ltd, P.O. Box 130 St. Brieux, Saskatchewan S0K 3V0

OVERALL DIMENSIONS:	FIELD POSITION	TRANSPORT POSITION
-- width	41.3ft (12.6m)	22.6 ft (6.9 m)
-- length		
--with mounted harrows	26.9 ft (8.2 m)	26.9 ft (8.2 m)
-- height	6.6 ft (20 m)	17.4 ft (5.3 m)
-- maximum ground clearance	6.5 in (165 mm)	6.5 in (165 mm)
-- wheel tread	34.0 ft (10.4 m)	14.0 ft (4.3 m)

SHANKS:	
-- number	62
-- lateral spacing	32 in (813 mm)
-- trash clearance (frame to sweep tip)	27 in (686 mm)
-- number of shank rows	
-- centre section	5
-- wings	5
-- distance between rows	21 in (533 mm)
-- shank cross section	0.75 x 2 in (19 x 51 mm)
-- shank stem angle	52 degrees
-- sweep hole spacing	1.75 in (44 mm)
-- sweep bolt size	7/16 x 1.5 in
HITCH:	
-- vertical adjustment range	sufficient
DEPTH CONTROL:	series hydraulic system
FRAME:	
-- cross section	3.5 in (89 mm) square tubing
TIRES:	
-- centre section	4, 11LT x 15, 8 ply
-- wing sections	4, 11L x 15, 8 ply
-- stabilizer wheels	2, 11L x 15, 8 ply
NUMBER OF LUBRICATION POINTS:	
-- grease fittings	
-- wheel bearings	

HYDRAULIC CYLINDERS:	
-- depth control	1, 4.25 x 8 in (108 x 203 mm) 1, 4 x 8 in (102 x 203 mm) 1, 3.75 x 8 in (95 x 203 mm) 1, 3.5 x 8 in (89 x 203 mm)
-- wing lift	2, 4 x 24 in (102 x 610 mm)

WEIGHTS (WITHOUT HARROWS):	FIELD POSITION		TRANSPORT POSITION	
-- right wheels	1958 lb	(890 kg)		
-- right centre wheels	2288 lb	(1040 kg)	4488 lb	(2040 kg)
-- left centre wheels	2310 lb	(1050 kg)	4444 lb	(2020 kg)
-- left wheels	2178 lb	(990 kg)		
hitch	1771 lb	(805 kg)	1573 lb	(715 kg)
TOTAL	10505 lb	(4775 kg)	10505 lb	(4775 kg)

WEIGHTS (WITH MOUNTED HARROWS):	FIELD POSITION		TRANSPORT POSITION	
-- right wheels	2530 lb	(1150 kg)		
-- right centre wheels	2794 lb	(1270 kg)	5324 lb	(2420 kg)
-- left centre wheels	2662 lb	(1210 kg)	5324 lb	(2420 kg)
-- left wheels	2618 lb	(1190 kg)		
hitch	1100 lb	(500 kg)	1056 lb	(480 kg)
TOTAL	11704 lb	(5320 kg)	11704 lb	(5320 kg)

OPTIONAL EQUIPMENT INCLUDED:

-- mounted finishing harrows (three row)

OPTIONAL EQUIPMENT AVAILABLE:

-- 6 width options from 34.6 to 41.3 ft (10.5 to 12.6 m)
-- 7/8 x 2 in (22 x 51 mm) shanks for extreme rock conditions mounted packer with single bar harrow
-- front hitch levelling mechanism
-- mud scrapers for main frame and wing tires
-- heavy duty trailing hitch

APPENDIX II

MACHINE RATINGS

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

excellent	fair
very good	poor
good	unsatisfactory

SUMMARY CHART

BOURGAULT 534-42 CULTIVATOR

RETAIL PRICE	$24,600.00 [February, 1985, f.o.b. Humboldt, 41.3 ft (12.6 m) width, with optional harrows]
QUALITY OF WORK	
Shank Characteristics	
-- trip clearance	11.5 in (292 mm)
-- spring preload	Exceeded at draft of 322 lb/ft (4.8 kN/m), not suitable for heavy primary tillage with 11 in (280 mm) sweeps
-- working sweep pitch	5 to 7 degrees over normal range of secondary tillage
Penetration	
-- ability	**Good;** excessive furrow bottom ridging in heavy primary tillage
-- uniformity	**Good**
Trash Clearance	**Excellent**
Trash Burial & Field Clearance	**Good;** harrows left bunches of straw in heavy trash
Weed Kill	**Good;** harrows were less effective in heavy trash
EASE OF OPERATION AND ADJUSTMENT	
Hitching	**Very Good;** hitch weight was always positive
Transporting	**Fair;** depth stop occasionally interfered with transport locks, very high transport height
Maneuverability	**Good;** front stabilizer wheel made furrows during tight turns
Frame Levelling	**Very Good**
Depth Adjustment	**Very Good;** a depth stop was provided
Sweep & Shank Installation	**Very Good;** about 5 minutes to install a shank
POWER REQUIREMENTS	
Light Secondary Tillage	138 hp (103 kW) at 3 in (75 mm) depth and 6 mph (9.7 km/h)
Heavy Secondary or Light Primary Tillage	194 hp (145 kW) at 3 in (75 mrn) depth and 6 mph (9.7 km/h)
OPERATOR SAFETY	Operator had to climb on frame to position transport locks, very high transport height
OPERATOR'S MANUAL	Complete frame levelling and depth adjustment procedures were not included
MECHANICAL HISTORY	Fourteen shanks were severely bent when tripping over rocks Centre frame truss rod loosened several times

ALBERTA FARM MACHINERY RESEARCH CENTRE

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

Prairie Agricultural Machinery Institute
Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-2555

Test Stations:

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