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Evaluation Report 315

Alloway 836 Row Crop Cultivator

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

ALLOWAY 836 ROW CROP CULTIVATOR

MANUFACTURER:

Alloway (Subsidiary of Rau)
610 N University Dr,
Fargo, North Dakota
58102

DISTRIBUTORS:

Loeppky & Sons Ltd.
Altona, Manitoba
R0G 0B0

RETAIL PRICE: $12,110.00 (April 1983, f.o.b Portage la Prairie, Manitoba)

8-row, 38 in (900 mm) spacing with tunnel shields, guide wheels, support wheels, helper springs, 4 in (100 mm) sweeps, and potato hillers

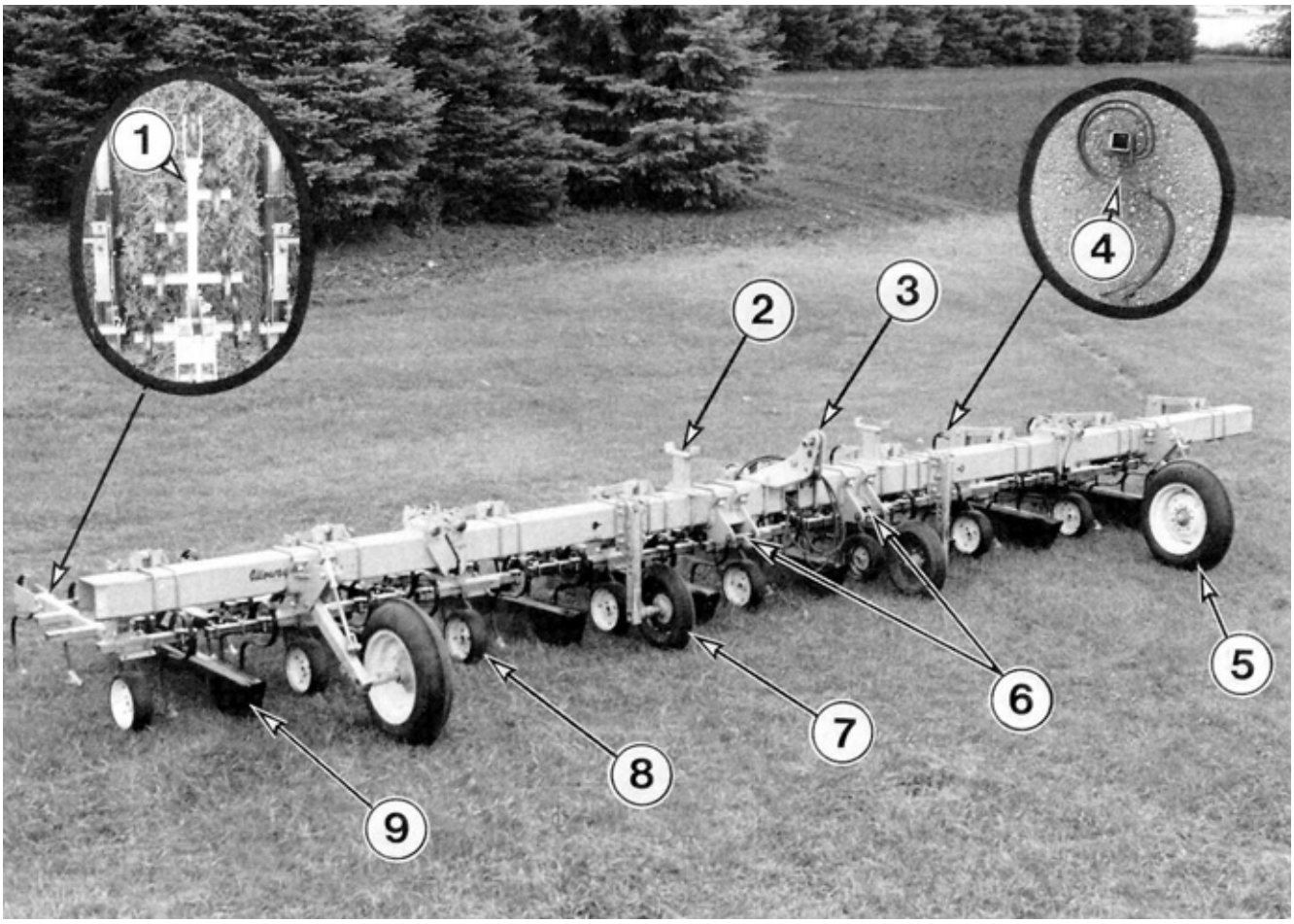

FIGURE 1. Alloway 836: (1) Gangs, (2) WingTransport Braces, (3) Upper Hitch Mast, (4) Tines with Helper Springs, (5) Support Wheels, (6) Lower Hitch Points, (7) Guide Wheels, (8) Gauge Wheels, (9) Shields.

SUMMARY AND CONCLUSIONS

The overall performance of the Alloway 836 row crop cultivator was very good. Weed kill was good with the 4 in (100 mm) sweeps. Penetration was very good in average field conditions.

The flexibility of the tines provided a high speed vibrating action, and allowed clearance of large stones. Tine helper springs provided additional tine force to break up hard ground. Trash burial in light and moderate trash was good. In areas of heavy trash, the gangs on the Alloway 836 tended to collect the trash, and eventually plug. This caused the gang to push the soil instead of tilling it. Only moderate skewing occurred where soil hardness varied across the machine width.

The Alloway 838 could be conveniently placed into transport or field position from the tractor seat. The wings folded 180 degrees and did not require locks. The 14 in (350 mm) sweep-to-ground clearance was ample for normal transport. Transporting on public roads required caution because of the machine's large transport width. The Alloway 836 was stable during field work and in transport,

Tillage depth was usually level across the cultivator width. Fore-and-aft and lateral levelling was accomplished on the three-point hitch of the tractor. One man could hitch or unhitch the Alloway 836 in about 5 minutes.

Total draft (pull force) under average row crop conditions at 5 mph (8 km/h) varied from 1900 to 3800 lb (9 to 17 kN) for depths of 2 to 4 in (50 to 100 mm) respectively. Under average soil conditions, at 6.2 mph (10 km/h) and 4 in (100 mm) depth, the draft power requirement was 103 hp (77 kW). A tractor of about 130 hp (98 kW) was req uired for safe ove rail operation of the Alloway 836.

Only minor mechanical problems developed during the 193 hours of field operation. The leading tip broke off of six sweeps after 130 hours. The U-Bolts that clamp the hitch-mast to the tool-bar broke after 400 mi (650 km) in transport.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Working with the agricultural industry to make the cultivator more compatible with tractors having high profile tires.
2 Supply more detailed instructions on set-up, operation, adjustment, maintenance, safety and installation of optional equipment.

Senior Engineer -- G. M. Omichinski
Project Coordinator -- R. R. Hochstein
Protect Engineer -- D. J. May

THE MANUFACTURER STATES THAT

1. An extended three-point hitch for the Alloway Row Crop Cultivator is available from Alloway Manufacturing upon request. This optional hitch creates an additional 5 inches of clearance between tractor tires and Alloway's 4.5 in x 20 in guide tires. The use of a quick-hitch on the tractor's three-point hitch also creates 5 inches of additional clearance.
2. The 1983 Operator's Manual provides more detailed instructions on set-up, operation and safety than the 1982 manual you received. Attention was given to operation and set-up of optional equipment available for row-crop cultivators.

MANUFACTURER'S ADDITIONAL COMMENTS

In reference to plugging problems:

Alloway manufactures an adjustable tine tree which allows vertical adjustment and fore-and-aft adjustment of the individual "S" tines. We recommend the optional adjustable tree in heavy trash conditions.

In reference to broken U-bolts:

Alloway has discontinued the use of U-bolts on the upper three-point mast on Row Crop Cultivators, which use the heavy potato hillers on the rear of gang linkages. We now use grade 8 bolts and back strap plates in place of U-bolts.

GENERAL DESCRIPTION

The Alloway 836 is a mounted, folding, eight-row, row crop cultivator suitable for light tillage, and chemical incorporation in row crops of 36 in (900 mm) row spacing (adaptable to a 40 in (1000 mm) maximum row spacing). There are five gangs on the centre section, and two gangs on each of the wings. Each of the inner gangs has seven tines, while the two outer gangs have four tines each. The test machine was equipped with 4 in (100 mm) sweeps and deep tunnel row shields.

FIGURE 1 shows the location of the major components on the Alloway 836. Support and guidance is controlled by the two support wheels on the wings and the guide wheels on the centre section. Tillage depth is controlled by the gauge wheels on each gang. The wings fold into transport position by means of a hydraulic cylinder located within each end of the centre section of the tool bar. A tractor with dual remote hydraulic controls, and a Category II or III three-point hitch is required to operate the Alloway 836.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST[1]

The Alloway row crop cultivator was operated under field conditions as shown in TABLE 1 for 193 hours, while cultivating 2010 ac (804 ha). It was evaluated for quality of work, ease of operation and adjustment, power requirements, operator safety, and suitability of the operator manual.

TABLE 1. Operating Conditions

FIELD CONDITION	OPERATING HOURS	EQUIVALENT FIELD AREA ac (ha)
Soil type:		
— sand	34	350 (140)
— sandy loam	50	520 (208)
— loam	54	560 (224)
— clay loam	55	580 (232)
TOTAL	193	2010 (804)
Crop:		
— corn	167	1745 (698)
— sunflowers	16	165 (66)
— potatoes	10	100 (40)
TOTAL	193	2010 (804)

EQUIVALENT FIELD AREA includes two to three successive cultivations on the same field. Duration between cultivations was about two weeks.

[1] *Prairie Agricultural Machinery Institute Detailed Test Procedure for Row Crop Cultivators*

During the test only a few small stones were encountered. They did not have a significant effect on the test. The cultivator was transported over 200 mi (325 km) on paved roads and over 200 mi (325 km) on gravelled roads.

RESULTS AND DISCUSSION

QUALITY OF WORK

Tine/Sweep Characteristics: There is a large variation in tine and sweep stem angles (FIGURE 2) on cultivators from different manufacturers. Sweeps and tines must be matched to obtain sufficient sweep pitch to achieve and maintain penetration. To achieve this, manufacturers usually recommend the use of sweeps with a stem angle from 0 to 5 degrees less than the tine stern angle.

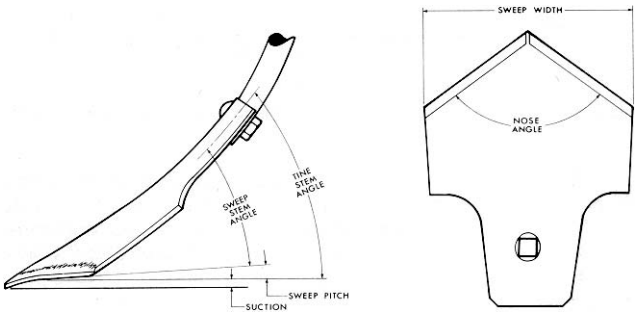

FIGURE 2. Tine and sweep terminology.

Sweep pitch increases in proportion to draft, due to the deflection of the tine (FIGURE 3). A small positive sweep pitch provides uniform tillage depth and a smooth furrow bottom, while excessive sweep pitch causes furrow ridging and rapid sweep wear. Tines outfitted with the helper springs maintained a small sweep pitch in hard soils, by minimizing tine deflection.

The force/deflection characteristics of the S-tine on the Alloway 836 (with and without helper springs) are presented in FIGURE 4. The use of helper springs yielded adequate performance, except in very hard packed soil conditions. In general, the high speed vibrating action of the S-tines on the Alloway 836 provided effective weed kill, crust shattering, and soil levelling.

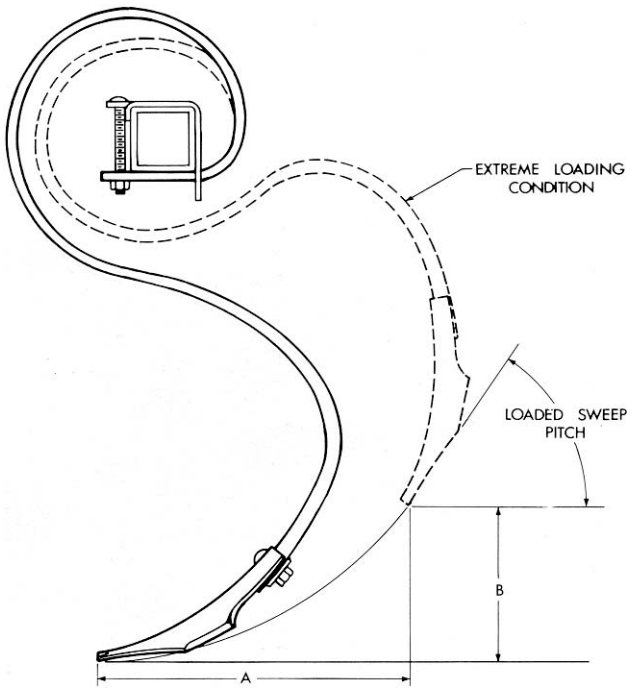

FIGURE 3. Schematic showing the increases in sweep pitch with increase in draft. This also illustrates the relative movement of a tine as it passes over an obstruction. (A) 10 in (250mm) (B) 6 in (150 mm).

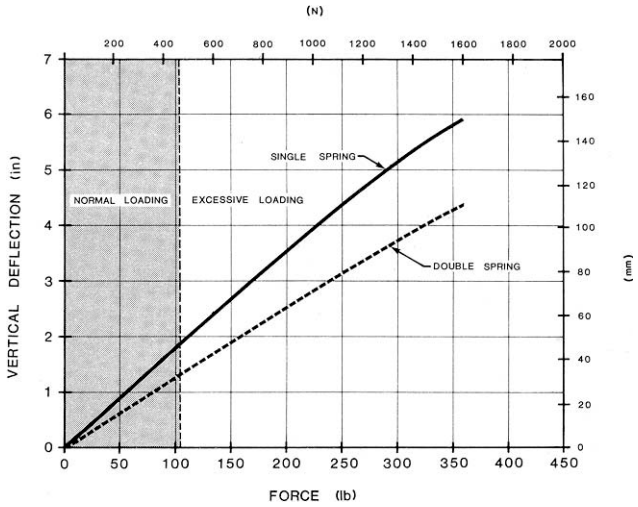

FIGURE 4. Tine deflection characteristics (Excessive loading due to very hard soil or shock loading such as rocks).

Penetration: Overall penetration was very good under average field conditions, but was not always uniform across the cultivator width. The cultivator tines behind the tractor and implement wheels tended to ride on top of hard soil, packed by these wheels. Helper springs on the tines behind the wheels did improve penetration to some degree.

Uniform penetration also depended on the levelness of the cultivator. There was no upward creep of the wings throughout the field test despite the absence of locks to hold the wings rigid with the centre section.

Trash Effects: In row crop conditions of moderate or light trash (residue corn stalks and weeds), there *were* generally no problems with plugging. In areas of heavy trash, the tine "V" configuration at each gang formed a natural funnel which held the trash, causing the gangs to plug and ride on top of the soil. This problem was partially alleviated by reducing the number of tines, and spreading out the remaining tines on each gang. This lessened the *weed* kill effectiveness when using 4 in (100 mm) sweeps.

Also, in heavy trash conditions, trash would sometimes accumulate between the front tines and tunnel shields. This was not a serious problem however, and to alleviate it, either the tines were moved away from the shields or the shields removed completely.

Trash and weed burial wasgood with the Alloway 836. In heavy trash conditions, the dry lighter stalks were left on top of the soil while the moist heavy ones were tilled under.

Field Surface: In normal row crop, the field surface was left quite smooth with a small furrow between the rows and the soil slightly hilled towards the row (FIGURE 5A). Tunnel shields were used during the first cultivation where crop height was about 2 to 12 in (50 to 300 mm). These provided young plants with very good protection.

In row crop cultivation of potatoes, the cultivator was used with potato hillers (FIGURE 6) supplied by the manufacturer. These provided very good hilling action (FIGURE 5B).

FIGURE 5A. Normal surface left by cultivator.

FIGURE 5B. Surface left by potato hillers.

FIGURE 6. Potato hiller attachment.

Furrow Bottom Ridging: Furrow bottom ridging[2] was apparent wherever the ground was hard packed such as behind the tractor tire or in soils with a hard subsurface layer. The added stiffness of the helper spring on some of the tines reduced this problem, but in extremely hard soil, ridging still occurred.

Skewing and Stability: The Alloway 836 was stable and did not skew sideways under average field conditions. The symmetrical sweep pattern on each gang (FIGURE 7) did not impose any side forces on the cultivator during normal tillage. Some skewing did occur where soil hardness varied across the machine width, despite the three-point hitch rigid mounting. No crop loss occurred due to skewing of the cultivator. The Alloway used a parallel linkage with a wide stance lower link.

Weed Kill: Weed kill was good with the 4 in (100 mm) sweeps. The vibrating tine action increased weed kill by breaking lumps and exposing small weeds. Larger deep rooted weeds sometimes slipped past the sweeps without being cut off. In areas of heavily infested weeds the manufacturer recommends larger sweeps to permit greater overlap.

[2] *Ridges left by ground tool in hard surface or subsurface soil*

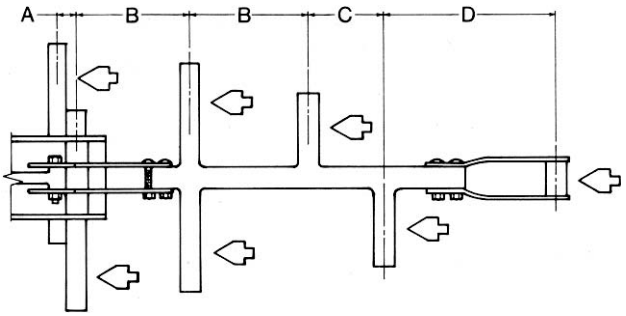

FIGURE 7. Sweep pattern (A) 2 in (50mm), (B) 12 in (305mm), (C) 7 in (175mm), (D) 16 in (400mm).

EASE OF OPERATION AND ADJUSTMENT

Hitching: One person could hitch or unhitch the cultivator in about 5 minutes. Bushings were provided to permit hitching the cultivator to tractors with Category II or III three-point hitch. As with all rear-mounted implements, careful backing of the tractor was required to hitch the cultivator quickly.

Frame Levelling: Levelling of the cultivator was achieved by shortening or lengthening the linkage on the three-point hitch. The two bottom links controlled the lateral levelling while the top link controlled the fore-and-aft levelling. The links were adjusted until all of the sweeps touched the ground at the same time. Some adjustments on the levelness could also be made at the support wheels.

Tillage Depth: Tillage depth was controlled by a gauge wheel at the front of each gang. The gauge wheel arms were marked for accurate depth control. Raising the gauge wheel lowered the gang, thus increasing the tillage depth. The lower links on the three-point hitch had to be adjusted low enough to allow the cultivator to float at the required tool bar working height.

Maneuverability: Maneuvering the Alloway 836 was convenient due to the three-point hitch rigid mount. Cultivating with the outer tines of each gang set close to the rows, demanded extra operator alertness, to keep skewing loss to a minimum. The heavy cultivator weight required ballasting of the tractor front end, in order to retain tractor stability.

Transporting: The Alloway 836 row crop cultivator was easily placed into transport position (FIGURE 8) by one person from the tractor in less than one minute. Transport locks were not necessary since the wings folded 180 degrees to rest on top of the centre section. Caution should be observed when folding or unfolding the wings even though they move at a moderate speed.

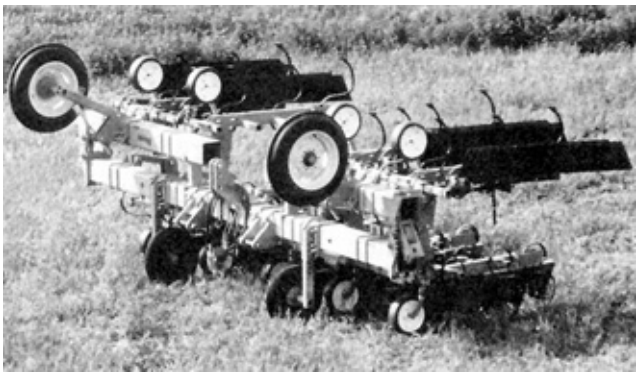

FIGURE 8. Transport position.

Transport width of the test machine was 16.4 ft (5.0 m) while transport height was only 5.0 ft (1.5 m). Care was required when transporting on public roads, through gates and over bridges.

The Alloway transported well without sway at normal transport speeds. The transport sweep-to-ground clearance of 14 in (350 mm) was adequate on slopes and rough terrain. Care should be taken not to engage the clutch too quickly as the front tractor tires may tend to lift off of the ground, even when front end ballast is used.

Sweep Installation: The 57 sweeps could be changed by one person in about one hour. The sweep bolts were short enough to have their threaded ends completely covered by the retaining nuts, preventing thread damage during tillage. Sweep-to-ground clearance of 14 in (350 mm) was ample for easy sweep removal.

Tine Installation: The tines were easily removed or adjusted by loosening one bolt and sliding them along the cross members.

POWER REQUIREMENTS

Draft Characteristics: FIGURE 9 shows draft requirements per row for the Alloway 836 under average field conditions at a speed of 5 mph (8 km/h) in moist clay loam. It should be noted that variation in soil conditions affect draft much more than variation in machine make, usually making it difficult to measure significant draft differences between different makes of row crop cultivators.

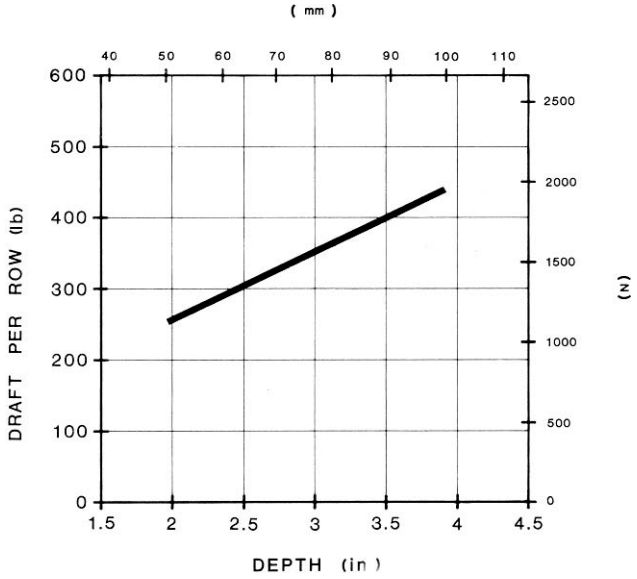

FIGURE 9. Typical draft requirements for Alloway 836 at 5 mph (8 km/h), under average conditions.

Increasing speed by 0.6 mph (1 km/h) increased draft by about 22 lb/row (100 N/row). This represents a draft increase of about 180 lb (800 N) for the eight-row test machine.

Actual draft power requirements for the Alloway 836 at the 4 in (100 mm) depth varied from 84 to 117 hp (63 to 87 kW) for speeds of 4.3 to 7.5 mph (7 to 12 km/h) respectively.

Tractor Size: Tractor size was dictated by the stability requirements for this eight-row test machine. A tractor (with front ballasting) of about 130 hp (98 kW) was suitable.

OPERATOR SAFETY

The low transport height of 5.0 ft (1.5 m), of the test machine, presented no problem with regard to power and telephone lines.

The test machine was 16.4 ft (5.0 m) wide in transport position. This necessitated caution when transporting on public roads, over bridges and through gates. A slow moving vehicle sign was not provided by the manufacturer.

The test machine could be safely hitched to a tractor by one person. If additional personnel are involved with hitching the cultivator, they should stand behind the cultivator away from the tractor, for maximum safety.

STANDARDIZATION

Hitching: During the test some difficulty was encountered hitching the cultivator to some tractors. The hitch pins were so close to the cultivator frame that high profile tractor tires would sometimes rub on the cultivator guide wheels (FIGURE 10). More standardization is needed in this area. It is recommended that the manufacturer work with the agricultural equipment industry to make the cultivator more adaptable to tractors with high profile tires.

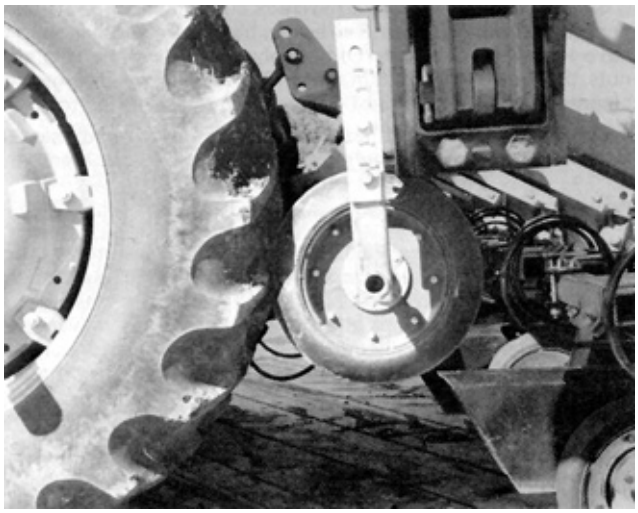

FIGURE 10. Interference between tractor tire and cultivator.

OPERATOR MANUAL

The set-up, operation and adjustment instructions supplied in the operator manual were sketchy. There were no instructions on maintenance or safety. It is recommended that the manufacturer provide more details on these aspects as well as on set-up, operation, adjustment, and installation of optional equipment.

DURABILITY

The intent of this evaluation was a measure of general performance. An extended durability evaluation was not conducted. The following is a discussion of the mechanical history of the Alloway 836 during 193 hours of field operation while tilling about 2010 ac (804 ha).

Sweeps: Of the 57 sweeps, the seven located behind each tractor tire and the rearmost sweep on each gang wore the quickest and had to be replaced regularly [about 70 hours or 700 ac (280 ha)]. The remaining sweeps were replaced as they were worn [about 150 hours or 1500 ac (600 ha)]. Six sweeps broke across the leading tip at 130 hours or 1300 ac (520 ha). This did not represent a serious problem since the sweeps were appreciably worn and required replacement.

Hitch: The U-Bolts that clamp the hitch-mast to the tool-bar broke during transport on a gravel road at 193 hours/2010 ac (804 ha). Since the test machine was transported over 400 mi (650 km) on gravelled and paved roads, this failure does not represent a serious problem.

APPENDIX I

SPECIFICATIONS

MAKE:	Alloway
MODEL:	387836. eight-row, 36 in spaclng
SERIAL NUMBER:	071955

DIMENSIONS:	**Field Position** ft	(m)	**Transport Position** ft	(m)
width	27.7	(8.4)	16.4	(5.0)
length (from lower hitch point to rear of cultivator)	6.3	(1.9)	6.0	(1.8)
height	3.8	(1.2)	5.0	(1.5)
ground clearance			1.2	(0.4)

TINES:

number	57
trash clearance (frame to sweep tip)	16 in (410 mm)
number of tine rows	6
longitudinal distance between tine rows	
first-second	2 in (50 mm)
second-third	12 in (305 mm)
third-fourth	12 in (305 mm)
fourth-fifth	7 in (175 mm)
fifth-sixth	16 in (400 mm)
tine cross section	1.3 x 0.4 in (33 x 10 mm)
sweep bolt size	3/8 x 1-1/8 in UNC

TINE TREES:

number of tines per gang	7
weight with shields (seven tines)	304 lb (138 kg)
weight without shields	207 lb (94 kg)
gauge wheel adjustment	5 in (120 mm)
gauge wheel angle	20°
maximum width of cut per tree	36 in (900 mm)

HITCH AND DEPTH CONTROL:

three-point hitch
Category II and III

FRAME:

type	180° folding wings
tool bar	7 in (178 mm) square tubing, 0.2 in (6 mm) wall
tine tree	2 in (51 mm) square tubing, 0.2 in (5 mm) wall

SUPPORT WHEELS:

adjustment	8 in (200 mm)
tire	two. 5.50 x 16 4 ply

GUIDE WHEELS:

adjustment	8 in (190 mm)
tire	two, 4.50 x 20 High Peak Point

NUMBER OF LUBRICATION POINTS: four grease fittings

HYDRAULIC CYLINDERS:

wing lift	two, 5 in x 10 in (127 mm x 254 mm)

WEIGHTS:

overall, with shields	3830 lb (1740 kg)
overall, without shields	3060 lb (1390 kg)

OPTIONAL EQUIPMENT:

tunnel, rolling or open shields
dual disc/dual knife combinations
guide coulters
gauge and guide wheels

APPENDIX II

MACHINE RATINGS

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

Excellent	Fair
Very Good	Poor
Good	Unsatisfactory

APPENDIX III

CONVERSION TABLE

IMPERIAL UNITS	**MULTIPLY BY:**	**S.I. UNITS**
Acre (ac)	0.405	Hectare (ha)
Foot (ft)	0.305	Metre (m)
Inches (in)	25.4	Millimetres (mm)
Horsepower (hp)	0.746	Kilowatt (kW)
Miles/Hour (mph)	1.61	Kilometre/Hour (km/h)
Pounds Force (lb)	4.45	Newton (N)
Pounds Force/Foot (lb/ft)	14.6	Newton/Metre (N/m)
Pounds Force-Feet (lb-ft)	1 36	Newton-Metre (N-m)
Pounds Force/Square Inch (psi)	6.89	Kilopascal (kPa)
Pounds Mass (lb)	0.454	Kilogram (kg)

SUMMARY CHART

ALLOWAY 836 ROW CROP CULTIVATOR	EVALUATION	COMMENTS
QUALITY OF WORK		
Penetration	Very Good	reduced slightly in hard packed soil
Trash Clearance	Good	some plugging in trashy conditions
Trash Burial	Good	moist, heavy stalks well buried
Field Surface	Very Good	generally left smooth and flat hilling capabilities
Weed Kill	Good	with 4 inch sweeps
EASE OF OPERATION AND ADJUSTMENT		
Hitching	Very Good	about 5 minutes for Category III
Frame Levelling	Good	additional adjustment at support & guide wheels
Tillage Depth	Good	markings on gauge wheel arms
Maneuverability	Very Good	three point hitch rigid mount
Transporting	Very Good	large transport width no need for transport locks
Sweep Installation	Very Good	ample sweep-to-ground clearance
Tine Installation	Very Good	adjusted by sliding along cross members
OPERATOR SAFETY	Fair	no caution decals provided large transport width
OPERATOR MANUAL	Poor	set-up, operation and adjustment instructions were sketchy

POWER REQUIREMENTS	Per Row	Total	
Draft at 5 mph (8km/h)	350 lb (1.6 kN)	2850 lb (12.9 kN)	in clay loam
Draft Increase per mph (1.6 km/h)	36 lb (0.2 kN)	280 lb (1.3 kN)	
Minimum Overall Tractor Size		130 hp (98 kW)	for cultivator stability

CAUTION: This summary chart is not intended to represent the final conclusions of the evaluation report. The relevance of the ratings is secondary to the information provided in thefull text of the report. It is not recommended that a purchase decision be based only on the summary chart.

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