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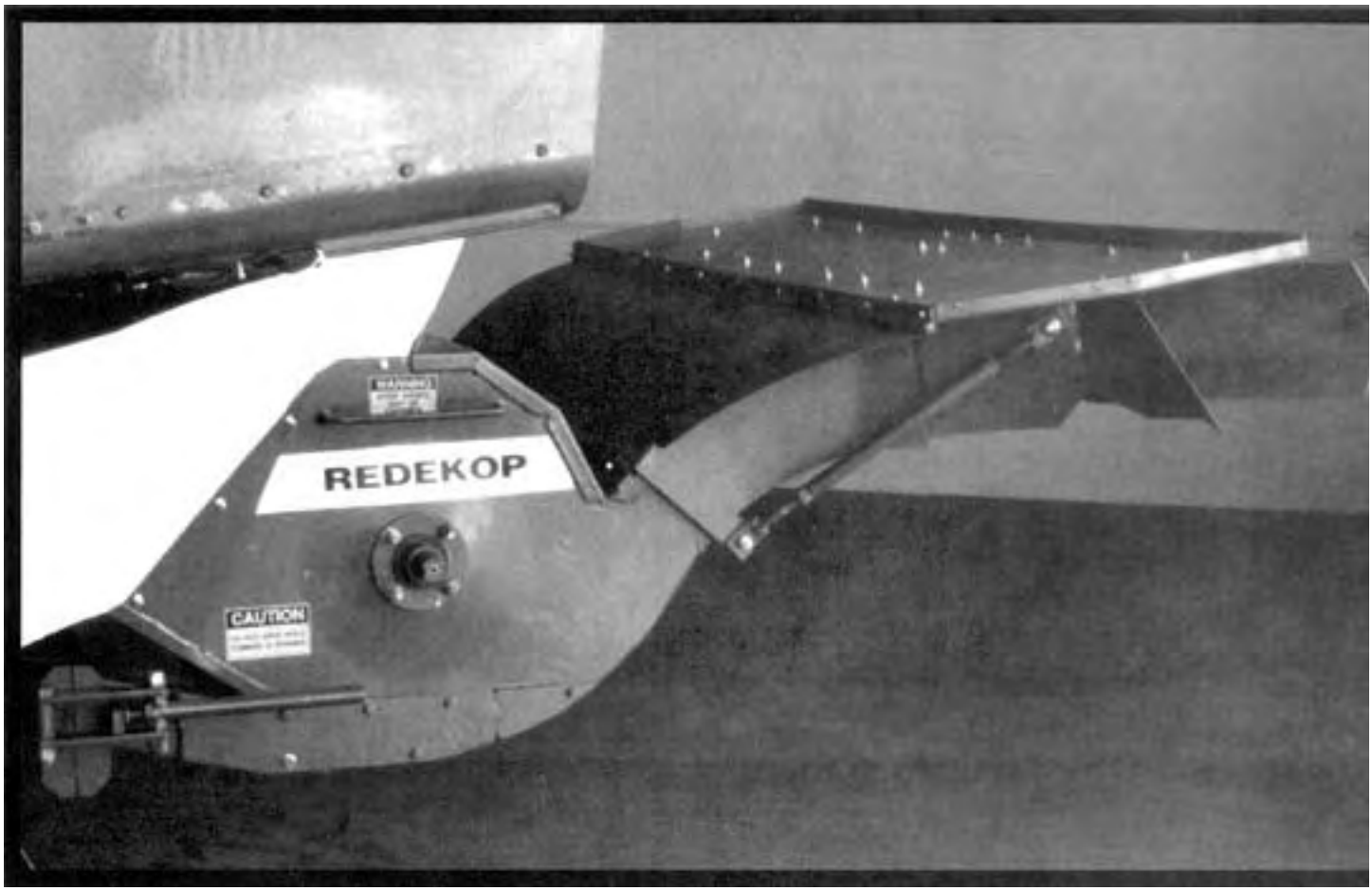
Evaluation Report 697



Redekop Chopper

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

REDEKOP CHOPPER

MANUFACTURER & DISTRIBUTOR:

Redekop Chaff Systems
Box 178A, R.R. 4
Saskatoon, SK
S7K 3J7
Phone: (306)931-6664

RETAIL PRICE:

$4995.00 (May, 1993, f.o.b. Humboldt, Saskatchewan), Model 50, suitable for mounting on a John Deere 7720 Titan II combine.

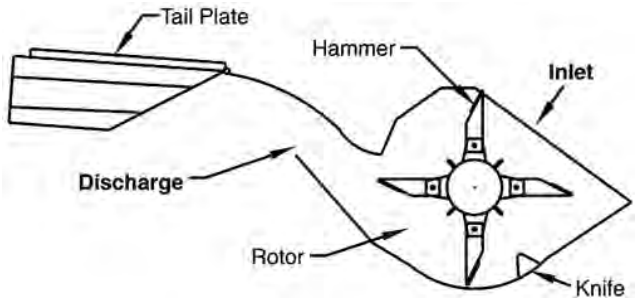


FIGURE 1. Redekop Chopper.

SUMMARY AND CONCLUSIONS

Quality of Work: Material flow through the chopper was very good. No plugging or bridging occurred. Some tough straw wedged between vanes which only affected spread.

Straw and chaff spreading was excellent. Spread width was typically 35 to 40 ft (10.7 to 12.2 m). Straw and chaff were spread with desirable uniformity.

Quality of cut was excellent. Dry straw was cut into 3 to 6 in (76 to 152 mm) lengths. Tough straw was also effectively cut.

Rate of Work: The Redekop chopper easily handled all of the straw and chaff from the John Deere 7720 combine in all crops.

Ease of Operation and Adjustment: Ease of installation was good. Mounting took two people about 3 hours. A lifting device was required. Ease of spreader adjustment was good. The vanes were positioned to set spread uniformity while tail plate angle was adjusted to set the spread width.

Ease of adjusting the combine was good. The chopper was hinged and could be swung away to access to the shoe. Checking grain loss was difficult as samples from the shoe or walkers could not be easily collected.

Ease of servicing was excellent. Only checking belt tension was required.

Power Requirements: The power to drive the Redekop chopper in tough wheat was 35 hp (26 kW).

Safety: All combine choppers and spreaders are potentially dangerous. Three decals were provided. No guard for the driven pulley was available.

Operator's Manual: No operator's manual was available.

Mechanical History: Hammers contacted the inlet sheet metal. The sheet metal was reformed and welded.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to permit easier removal to allow dropping straw for baling.
2. Modifications to permit easier and more convenient knife adjustment.
3. Modifications that would allow checking combine losses.
4. Supplying guards for the driven pulley.
5. Supplying an operator's manual.

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THE MANUFACTURER STATES THAT:

It should be noted that the chopper tested was a prototype. The production units have their own chaff delivery systems suited to the individual combine models. Also, key areas have been strengthened by using heavier and superior materials.

With regard to the recommendations:

1. Production models for conventional combines can now be converted to dropping straw in minutes without removing the chopper. For rotary combines, it must be swung to the side and lifted off.
2. An easily adjustable knife bar, which swivels to any desired position is now standard equipment.
3. Possiblities for checking loss are being investigated.
4. Pulley guards are standard equipment on all production choppers.
5. A complete operator's manual will be supplied with all choppers.

GENERAL DESCRIPTION

The Redekop Chopper (FIGURE 1) mounts at the rear of a combine and chops and spreads both straw and chaff (see APPENDIX I for applicable combines). The chopper may also be used to chop and blow straw and chaff into a collection wagon.

The chopper evaluated was a prototype. The design was the same as production units but was built with lighter material. A chaff conveying pan was not available at the time of testing. The one used was built by PAMI. Also, at the time of the evaluation, an operator's manual was not available.

The rotor is transversely mounted. Hammer supports are welded to the rotor tube. The hammers are attached to the supports by a single bolt, which allows the hammers to pivot. The hammers consist of an arm with the pivot at one end and a paddle fixed to the outer end (FIGURE 2). The knife consists of a row of sickle sections along the bottom of the housing.

FIGURE 2. Hammers.

The straw falls directly into the chopper. Chaff is fed into the chopper by either a conveyor or a reciprocating chaff conveying pan. The unique design of the hammers enable the chopper to also act as a fan. Air and light chaff are drawn into the front of the chopper. The hammers pull in the straw and heavy chaff. The mechanical force of the hammers combine with the air to discharge the material. As material exits the chopper, the tail plate and the cupped vanes control the spread width and uniformity.

The chopper is belt driven. The spreader body is hinged on the right side and swings away from the combine for access to the shoe adjustments. No shaft speed sensor was supplied.

Detailed specifications for the Redekop are given in APPENDIX I.

SCOPE OF TEST

The prototype chopper evaluated by PAMI was configured as described in this General Description, FIGURE 1, and Specifications section of this report. The manufacturer may have built different configurations of this machine before or after PAMI tests. Therefore,

when using this report, check that the machine under consideration is the same as the one reported here. If differences exist, assistance can be obtained from PAMI or the manufacturer to determine changes in performance.

The Redekop Chopper was mounted on a John Deere 7720 Titan II combine. It was operated in conditions shown in TABLE 1 for about 41 hours. During this time, measurements and observations were made to evaluate the spreader for rate of work, quality of work, ease of operation and adjustment, power requirements and operator safety.

TABLE 1. Operating Conditions

Crop	Yield Range		Width of cut		Hours	Field Area	
	bu/ac	t/ha	ft	m		ac	ha
Canola	12 to 22	0.7 to 1.2	22	6.7	15.7	103	43
Fall Rye	26 to 66	1.6 to 4.1	20, 21, 25	6.1, 6.4, 7.6	13.3	76	31
Wheat	24 to 30	1.6 to 2.0	21, 22	6.4, 6.7	11.7	46	19
Total					40.7	227	92

Spread width and distribution patterns were developed in lab conditions. The combine was positioned on a gridded concrete floor. The combine remained stationary while the chopper discharged material onto the floor. Distribution patterns were developed by gathering and weighing the material from each grid area. Developing distribution patterns on a concrete floor resulted in some skidding when heavy material hit the floor with considerable sideways velocities. Thus, slightly narrower patterns will result in the field.

RESULTS AND DISCUSSION

QUALITY OF WORK

Straw and Chaff Handling: Material flow through the chopper was very good.

Straw and chaff did not bridge or plug at the inlet. The chaff conveying pan did not restrict the transfer of chaff from the shoe to the chopper. The inlet suction pulled in light airborne material keeping the shoe discharge relatively clean of chaff. The hammers aggressively grabbed straw and chaff. Centrifugal action along with air velocities of about 49 ft/s (15 m/s) resulted in high material exit velocities. The material discharged in a thin, compact stream, which flowed smoothly under the tail plate and across the distribution vanes.

With the fourth vane set to the most outward position, tough straw wedged between the fourth and fifth vanes (FIGURE 3). Although this did not plug the chopper, the spread pattern was affected.

FIGURE 3. Tough Wheat Straw Wedged Between Fourth and Fifth Distribution Vanes.

Spreading: Straw and chaff spreading was excellent.

Chaff and straw spreading is a key part of good soil management. Heavy concentration or rows of chaff and/or straw can cause difficulty is subsequent tillage and seeding operations. Heavy concentrations may also cause slow soil warming, nitrogen depletion or toxic buildup.

Ideally, all crop residue should be redistributed evenly over the field. This seldom happens. To get the most effective spread, it is necessary to match cutting and spreading widths closely. It is important that the spreader provide suitable spread uniformity over the spread width.

FIGURE 4 shows the combined straw and chaff spread pattern. It also shows the material concentrations across the spread that would be typical for a 50 bu/ac (3.4 t/ha) wheat crop (MOG/G = 1)*, when the spread and cut widths are closely matched. APPENDIX II provides a guideline for crop residue ratings.

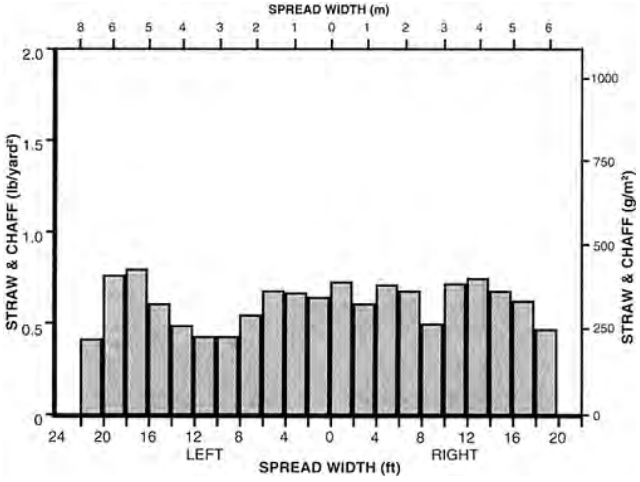

FIGURE 4. Typical Spread Pattern Uniformity for Straw and Chaff Combined.

The distribution pattern of the Redekop Chopper in FIGURE 4 shows that straw and chaff could be spread up to 42 ft (12.8 m). Total concentrations were in the desirable range when the width of cut was similar to the spread width. Higher yields, wider widths of cuts and over-lapping spreads would increase the concentrations while lower yields would reduce the concentrations.

In the field, typical spread widths were between 36 to 40 ft (11.0 to 12.2 m) when using a 7 in (178 mm) diameter pulley on the chopper (FIGURE 5). The material was spread to desirable uniformity. Finely chopped straw slightly reduced the spread width, but resulted in very uniform distribution. With the chopper set to spread greater than 25 ft (7.6 m) the spread pattern was noticeably affected by wind. To reduce rowing at outer edges for spread widths greater than 25 ft (7.6 m), the third and fourth (from centre) distribution vanes were adjusted. The fourth vane was adjusted outward and the third was adjusted inward. This prevented the two streams from merging. Adjusting the chopper spread to 25 ft (7.6 m) or less greatly reduced the effect of wind. Spread uniformity was also greatly affected when operating on side slope of 3° or more. This resulted from the straw concentrating on the low side as the straw fell from the straw walkers to the chopper. The result was a spread pattern with a dense row of straw on the low side.

FIGURE 5. Typical Field Spread Pattern.

The maximum spread could be increased to 47 ft (14.3 m) under ideal conditions by using a 6 in (152 mm) diameter pulley on the chopper. The smaller pulley increased chopper speed from 2350 to 2650 rpm and increased spread width slightly. The smaller pulley resulted in significant belt slip at feedrates of 700 lb/min (19.0 t/h). This was above the maximum operating range of this combine, but may occur on larger combines.

Quality of Cut: Quality of cut was excellent.

Straw at about 10% moisture was cut in lengths of about 3 to 6 in (76 to 152 mm). The cut length increased with straw moisture.

**MOG/G refers to the weight of Material-Other-than-Grain divided by the weight of grain. A value of 1 means that for every unit weight of MOG there is an equivalent weight of grain.*

FIGURES 6 and 7 shows the cut length for the Redekop and a typical chopper, in green, tough wheat straw, which had been severely frozen. In this crop, considerably more straw from the Redekop chopper fell through the stubble right away than did the straw from the typical chopper.

FIGURE 6. Straw on Stubble From a Typical Chopper.

FIGURE 7. Straw on Stubble From Redekop Chopper.

RATE OF WORK

The Redekop chopper easily handled all the material from the John Deere 7720 Titan II combine in all crops. MOG feedrates at times were in excess of 700 lb/min (19.0 t/h). With the chopper installed, combine loss performance was unchanged. The chopper power required reduced maximum feedrate attainable. However, but not below the normal operating feedrates where grain loss was acceptable was not affected.

EASE OF OPERATION AND ADJUSTMENT

Installation: Ease of installation was good.

Specific instructions were not available for mounting the chopper. However, mounting was straightforward. It took 2 people about 3 hours to install the chopper. The mounting bracket was easily attached, although, two holes did not line up and had to be elongated. A lifting device was necessary to aid attaching the chopper to the mounting frame as the chopper with the tail plate weighed 558 lb (253 kg). The existing combine chopper drive was used, although a slightly longer belt was required.

Chopper Adjustment: Ease of adjustment was good.

Eight vanes on the tail plate were adjusted using small hand tools. Two were not adjustable. Once the vanes were set to achieve a desired straw and chaff distribution behind the combine, they were seldom moved. The tail plate angle was adjusted by turn buckles on either side. These adjustments also required hand tools. Raising and lowering the tail plate effectively controlled spread widths. Raising the tail plate increased spread width while lowering reduced the width. However, raising the tail plate directed more fine material into the air (FIGURES 8 and 9). With a tail wind this material was blown over the combine.

The chopper was heavy and difficult to remove for windrowing straw. It is recommended that the manufacturer consider modifications to permit easier removal to allow dropping straw for baling.

Removal of the knife was quick and easy with the aid of hand tools. However, once removed, it was no longer attached to the chopper for storage. Reinstalling the knife was difficult since some of the knives did not line up and had to be pried into place. It is recommended that the manufacturer consider modifications to permit easier, more convenient knife adjustment.

Combine Adjustments: Ease of combine adjustment was good.

FIGURE 8. Fine Material Blown Into Air With Tail Plate Raised for Maximum Spread.

FIGURE 9. Fine Material Blown Downward with the Tail Plate Lowered.

The chopper body was hinged and swung away from the rear of the combine to provide access to the shoe.

Checking grain loss was not possible. Individual samples from the shoe or walkers of the John Deere 7720 combine could not be collected. It is recommended that the manufacturer consider modifications that would allow checking combine losses.

Servicing: Ease of servicing was excellent.

No greasing was required. The drive belt tightener was spring loaded and required only occasional inspection.

Cleaning: Ease of cleaning was excellent.

With the aid of a blower or broom the top of the chopper and tail plate was easily cleaned. The high air volumes through the chopper kept the inside clean.

POWER REQUIREMENTS

At a rotor speed of 2350 rpm with no material passing through the chopper, power consumption was 12 hp (9.0 kW). This power was primarily used to move air.

The average power required to drive the Redekop Chopper in tough wheat straw, at about 25% moisture, was about 35 hp (26.1 kW) at typical feedrates for the John Deere 7720 Titan II. The power requirements varied with load. Lighter loads and drier straw will reduce power requirements. Removing the knife reduced power requirements by 5 to 10 hp (3.7 to 7.5 kW). Increasing chopper speed from 2350 to 2650 rpm increased power requirements by 5 to 10 hp (3.7 to 7.5 kW).

SAFETY

All combine choppers and spreaders are potentially dangerous. Material discharged can reach velocities that can cause serious injury or death. Extreme caution is required at all times when working near operating choppers or spreaders. It is especially important when working near choppers that discharge closer to head height.

The Redekop chopper did have three caution decals warning of rotating blades. They were too small to be effective if the chopper was operating.

At the time of the evaluation, no guard was provided for the driven pulley. It is recommended that the manufacturer consider supplying guards for the driven pulley.

OPERATOR'S MANUAL

No operator's manual was available. It is recommended that the manufacturer supply an operator's manual.

MECHANICAL HISTORY

The intent of the test was to evaluate functional performance. Extended durability testing was not conducted. The mechanical problems that occurred during functional testing were noted.

The chopper evaluated was a prototype and was made of lighter sheet metal than production models.

At 38 hours, the hammers contacted the inlet sheet metal causing some of the welds to fracture. The sheet metal was bent away from the rotor and rewelded.

On final inspection, 0.025 in (0.64 mm) wear was found on both the hammer pivot hole and bolt.

APPENDIX I
SPECIFICATIONS

MAKE:	Redekop Chopper
MODEL:	50
MANUFACTURER:	REDEKOP Chaff Systems Box 178A, R.R. 4 Saskatoon, SK S7K 3J7 Phone: (306) 931-6664
DIMENSIONS: (Chopper Body Only)	
-- width	84.2 in (2138 mm)
-- length	80 in (2032 mm)
-- depth	26.5 in (673 mm)
WEIGHT: (without mounting frame)	558 lb (253 kg)
SPREADING SYSTEM:	
-- type	stationary knife with rotating hammers
-- inlet area	1086 in²(0.70 m²)
-- outlet area	322 in² (0.21 m²)
-- rotor	
-type	closed and reinforced tube with pivoting hammers
-diameter	23.1 in (588 mm)
-- hammer	
-type	straight with paddle
-number	50
-thickness	0.2 in (5 mm)
-paddle forward angle	27°
-paddle width	1.1 in (29 mm)
-- distribution vanes	
-type	2 bent, 6 cupped, 2 straight
-number	10
-adjustment	slotted hole
-- knife	
-type	removable sickle
-number	24
-- drive	single “C” belt
SERVICING:	inspection of spring loaded belt tightener
COMBINES AVAILABLE FOR:	Case IH 1400 and 1600 series Ford New Holland TR John Deere

APPENDIX II
CROP RESIDUE CONCENTRATION RATINGS

Conclusive scientific research could not be located to rate the impact of different concentrations of crop residue. However, field experience has provided basic information in this area. The following explains the development of ratings used by PAMI in this report.

In Western Canada, a typically high wheat yield is about 50 bu/ac (3.4 t/ha). These crops usually have at least an equal amount of Material-Other-than-Grain(MOG). In such crops, when very dry, some combines can put up to 35% of the MOG over the cleaning shoe (i.e. chaff). Conversely, if conditions are tougher, the amount of chaff goes down, and up to 85% of the MOG from the combine is straw.

When chaff is dropped directly behind the combine, the accumulation is very noticeable. However, chaff spread over 40% of the width of cut appears acceptable, while spreading over 50% of the width of cut is desirable. Straw typically appears acceptable when spread over 70% of the width of cut, while spreading over 80% of the width of cut is desirable. The following table shows approximate concentrations of chaff, straw or a combination, which could occur at various levels in the 50 bu/ac (3.4 t/ha) crop described.

These concentrations can be used as a guide for maximum concentrations in other yields also.

CONCENTRATION lb/yd² (gm/m²)			
Rating	**Chaff**	**Straw**	**Total MOG**
Desirable	below 0.44 (238)	below 0.66 (358)	below 1.10 (596)
Acceptable	below 0.55 (298)	below 0.76 (412)	below 1.31 (710)
Unacceptable	over 0.55 (298)	over 0.76 (412)	below 1.31 (710)
Theoretical	*0.22 (119)*	*0.53 (297)*	*0.62 (336)*

APPENDIX III
MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

Excellent	Fair
Very Good	Poor
Good	Unsatisfactory

SUMMARY CHART
REDEKOP STRAW/CHAFF CHOPPER

RETAIL PRICE	$4995.00 (May 1993, f.o.b. Humboldt, Saskatchewan), Model 50, suitable for mounting on John Deere 7720 Titan II combine
QUALITY OF WORK	
Straw and Chaff Handling	**Very Good;** no plugging or bridging at inlet or discharge
Spreading	**Excellent;** 35 to 40 ft (10.7 to 12.2 m) all crops with desirable uniformity
Quality of Cut	**Excellent;** normally 3 to 6 in (75 to 152 mm) straw fell through stubble in all crops
RATE OF WORK	Handled all straw and chaff from combine at MOG feedrates up to 700 lb/min (19.0 t/h)
EASE OF OPERATION AND ADJUSTMENTS	
Installation	**Good;** straightforward, although no instructions provided, required lifting device
Chopper Adjustment	**Good;** tail plate adjusted width, vanes adjusted uniformity, quick removal difficult for windrowing
Combine Adjustment	**Good;** chopper body swung away for access to combine; impossible to collect separate loss samples from combine's shoe or walkers
Servicing **Excellent;**	one spring loaded belt tightener required inspection
POWER REQUIREMENTS	35 hp (26.1 kW) in tough wheat
SAFETY	Decals provided were small
OPERATOR'S MANUAL	Not available at time of test
MECHANICAL HISTORY	Prototype inlet metal bent by hammers

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