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Evaluation Report 33

SED Model 912 Grain Loss Monitor

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

SED MODEL 912 GRAIN LOSS MONITOR

MANUFACTURED AND DISTRIBUTED BY:

Sed Systems Ltd.
Box 1464
Saskatoon, Saskatchewan
S7K 3P7

RETAIL PRICE:

$370.00 (July, 1978, f.o.b. Humboldt, Saskatchewan

FIGURE 1. SED Model 912 Grain Loss Monitor: (A) Control Box (B) Sensors (C) Mounting Hardware (D) Wiring Harness.

SUMMARY AND CONCLUSIONS

The SED Model 912 grain loss monitor, when properly installed to suit combine characteristics and when calibrated to suit crop conditions, was a very good indicator of changes in combine lossrate. It could effectively be used to aid the combine operator in maintaining the feedrate at an efficient level.

Although the SED 912 was effective in indicating changes in lossrate, its accuracy in indicating the actual grain lossrate was only fair. Monitor sensitivity was excellent in wheat, barley and rapeseed.

Meter visibility was good for both day and night operation. However, the meter was undamped which allowed it to fluctuate occasionally, making it difficult to read.

The manufacturer's calibration procedure was simple and functional. Proper calibration to suit crop conditions was very important.

It took about four man hours to install the SED 912 on a combine. As with most monitors proper sensor positioning was critical to the performance of the system.

The operator's manual was clearly written and well illustrated and contained detailed information on the installation and operation of the loss monitor.

One circuit failure occurred during the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider: Since test results did not indicate the need for any modification, no recommendations are made.

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GENERAL DESCRIPTION

The SED Model 912 grain loss monitor senses grain losses over the shoe and straw walkers of a combine and indicates changes in the rate of grain loss to the operator. It is designed to mount on most self-propelled or pull-type conventional combines.

Small pad-type sensors, which detect impacts from grain kernels, are attached beneath the rear of the straw walkers and shoe to intercept grain losses. Sensor signals are fed by cables to a control box mounted at the operator's station, where the rate of kernel impacts is measured and displayed.

The SED 912 may be powered by any 12V, positive or negative ground electrical system.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The SED 912 was used on a combine for 50 hours while harvesting wheat, barley, and rapeseed. In addition to lossrate measurements in the field, various laboratory tests were conducted to aid evaluation.

It was evaluated for ease of installation, ease of operation and adjustment, quality of work, and suitability of the operator's manual.

RESULTS AND DISCUSSION

EASE OF INSTALLATION

Installation Time: It took about four man hours to install the SED 912 on a combine using standard tools found in most farm shops. Installation instructions were clear, well illustrated, and easy to follow.

Sensor Installation: The SED 912 is supplied with two 125 x 65 mm (5 x 2.5 in) pad-type sensors (FIGURE 2) for mounting beneath the rear of the straw walkers and shoe.

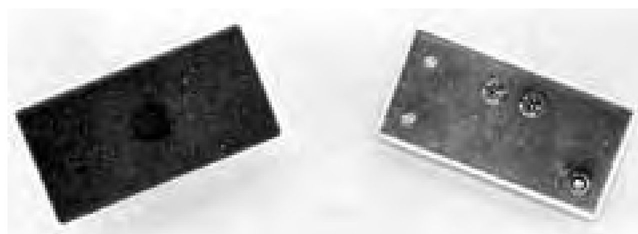

FIGURE 2. Sensors.

The shoe sensor may be mounted behind the shoe or beneath the shoe behind the tailings auger. It was found that a sensor, mounted behind the shoe, gave more positive sampling of losses than did the one beneath the shoe.

The straw walker sensor may be mounted behind or beneath the straw walkers. The sensor may be mounted in the bottom of the walker pan on a closed walker or on the grain pan under an open walker.

The manufacturer recommends the installation of a second sensor on both the shoe and walker when combining in rolling land.

Although the instructions clearly outline various mounting locations and sufficient brackets and hardware are supplied for different mounting configurations, it is important to check the flow of losses over the shoe and straw walkers during operation to determine the optimum sensor location which permits the sensors to intercept the flow of losses.

Control Box and Wiring Harness: The control box (FIGURE 3) is supplied with a pivoting mounting bracket to permit easy installation at a suitable location in a tractor or combine cab. Sufficient cable ties and clamps are supplied to route the wiring harness from the sensors to the control box. An optional quick coupler is available for use on pull-type combines.

EASE OF OPERATION AND ADJUSTMENT

Sensitivity Adjustment: Before combining, the sensitivity of the monitor must be set. This is easily done by selecting either the "heavy kernel" or "light kernel" position of a switch to correspond to the type of grain being harvested. Proper sensitivity adjustment is important since it sets the monitor to distinguish impacts of grain from impacts of straw for the specific crop being harvested.

Calibration: Once the sensitivity has been adjusted the monitor has to be calibrated to suit the loss characteristics of the combine in the specific crop being harvested. The following calibration, which is similar to that given in the operator's manual, was functional and was easy to perform.

FIGURE 3. Control Box: (A) Loss Meter, (B) Calibration Control, (C) Sensor Selector, (D) Sensitivity Control and Power Switch.

First, set the combine for best performance in the crop being harvested. Then, determine the maximum forward speed at which the combine can operate at an acceptable loss level. This is easiest if a second person checks for losses behind the combine. Since highest losses usually occur over the straw walkers and since losses are hard to detect after passing through the straw chopper or spreader, it is best to use a suitable container to catch a sample of the losses. Once the maximum acceptable forward speed has been determined, the calibration control on the control box is set to give a meter reading of one-half scale while combining at this speed.

Once the monitor has been calibrated, the meter reading is used to set the forward speed. If the meter rises above mid-point, losses are higher than desired and forward speed should be reduced. Conversely, if the meter reading drops below mid-point, the combine operation is inefficient and forward speed should be increased.

As with most loss monitors, recalibration is necessary whenever crop conditions change significantly. The operator should make occasional loss checks to determine if recalibration is required. Once an operator becomes familiar with the loss characteristics of his combine, monitor adjustment is easily made.

Meter Readability: The meter, although small, was readily visible during the day and was illuminated well for night use.

Moderate fluctuations in combine lossrate occur, which are beyond operator control because he cannot vary the feedrate quickly enough to counteract them. The loss monitor must be damped just enough so that these fluctuations do not appear and make the meter difficult to read. Too much damping will cause the monitor to lag behind loss changes.

The SED 912 meter was undamped and fluctuated during rapidly changing loss conditions, making it difficult to read.

QUALITY OF WORK ACCURACY

FIGURE 4 is a comparison of actual losses from a conventional combine to the losses as indicated by the SED 912 in a field of Bonanza barley. In addition to the simple calibration procedure the manufacturer also provides a procedure whereby the monitor can be calibrated to indicate the rate of grain loss in bushels per hour. This graph was prepared to illustrate the accuracy of the monitor in performing this. The position of the monitor curve in relation to the actual lossrate curve is determined by the calibration control. FIGURE 4 represents monitor settings for which the monitor curve most closely approximates the actual loss curve, and further adjustment cannot improve the overall accuracy.

From FIGURE 4 it can be seen, as is common with most loss monitors, that the monitor curve does not directly follow the actual loss curve and does not increase as rapidly as the actual loss curve at high feedrates. Therefore, if the monitor is used to measure combine loss in bushels per hour, significant error should be expected. However, when properly calibrated, the SED 912 can be effective in indicating changes in combine performance. The monitor effectively senses changes in the combine lossrate and a higher meter reading corresponds to higher losses. For example, in the crop shown in FIGURE 4, if the monitor is calibrated so that the meter midpoint reading corresponds to a feedrate of about 6 t/h, combine loss can be maintained at an acceptable level while operating the combine near peak efficiency if combine speed is adjusted to hold the meter at midpoint.

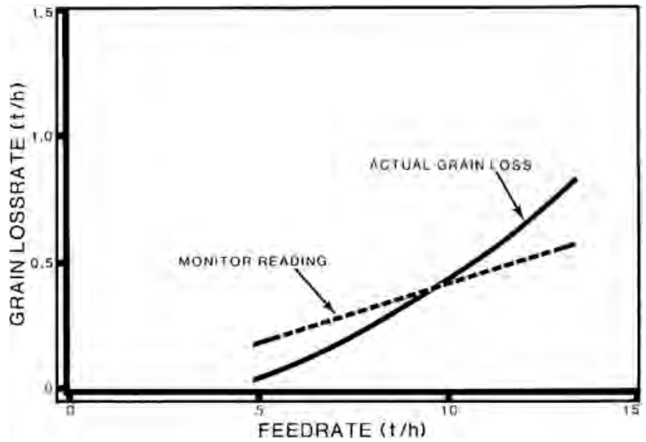

FIGURE 4. Comparison of Monitor Reading to Actual Combine Lossrate in a Field of Bonanza Barley.

SOURCES OF ERROR

There are several sources of error, which affect the accuracy of a loss monitor. Because of these errors, most combine loss monitors cannot be accurate instruments and are not valid indicators of the actual amount of combine loss. However, with proper calibration, they can be effective in indicating changes in the lossrate thereby permitting the operator to continuously combine at a more efficient level.

Sensitivity: Sensors intercept the flow of material coming off the shoe and the straw walkers and are impacted by straw, chaff and grain. Sensitivity describes the ability of the monitor to distinguish between impacts of grain kernels and impacts of straw or chaff. Inaccuracy arises if the monitor fails to distinguish grain from straw and chaff in this way.

The SED 912 had a sensitivity control for setting to the particular grain type being harvested. When properly adjusted, sensitivity was excellent in wheat, barley and rapeseed.

Sensor Positioning: For high accuracy, sensors must be positioned in the straw and chaff flows so that the meter readings obtained from the shoe and straw walker sensors are in the same proportion as the actual losses from the shoe and straw walkers. Since the loss from the shoe is discharged in a thinner blanket layer than from the straw walkers, more kernels per bushel of loss may strike the shoe sensor than the straw walker sensor. Since different combines have different straw and chaff flow patterns and since the sensor sample ratios change with crop type and condition, and combine feedrate, it is difficult for the manufacturer to predict, and compensate for these differences.

Sidehill combining may result in significant losses especially over the lower side of the shoe. Full width sensors, or two appropriately placed smaller sensors are necessary to sample losses of this nature. The SED 912 has only one small sensor for shoe sampling but provision is made for the installation of more sensors, which can be obtained from the manufacturer as options.

Crop and Combine Characteristics: Changes in crop conditions such as straw length and straw moisture content, and changes in the combine feedrate, cause changes in the separating characteristics of the straw walkers. These changes affect the accuracy of the loss monitor.

OPERATOR'S MANUAL

The operator's manual was clearly written and well illustrated. Detailed installation instructions were provided which contained various sensor mounting suggestions. Instructions for the operation and use of the loss monitor were detailed, simple and functional.

POWER REQUIREMENTS

The SEE) 912 drew a maximum current of 0.26 A and could be attached to any 12 volt electrical system with positive or negative ground.

The monitor occasionally gave erratic readings caused by electrical noise from the combine electrical system. The installations of a noise suppressor ended the problem.

DURABILITY RESULTS

The SED Model 912 grain loss monitor was operated in the field for 50 hours. The intent of the test was functional evaluation and an extended durability evaluation was not conducted. One circuit failure occurred during the test due to a poor solder connection.

APPENDIX I
SPECIFICATIONS

MAKE:	SED Grain Loss Monitor
MODEL:	912
SERIAL NUMBER:	370101
ELECTRICAL POWER REQUIREMENTS:	12V DC positive or negative ground
CONTROL BOX:	
-- size	160 x 63 x 127 mm (6.3 x 2.5 x 5.0 in)
-- weight	0.65 kg (1.4 lb)
-- display	45 mm (1.8 in) diameter meter with needle indicator
-- controls	Sensor selector, sensitivity adjustment and calibration adjustment
SENSORS:	
-- number	2
-- type	plastic pad-type sounding board
-- size	125 x 65 x 12 mm (5.0 x 2.5 x 0.5 in)
-- weight	0.1 kg (0.2 lb)
WIRING HARNESS:	
-- power supply cable	2.4 m (8.0 ft)
-- sensor cables	1, 11 m (36.0 ft), 4-conductor plastic clad 2, 2 m (6.5 ft), 2-conductor metal shielded and rubber clad
OPTIONS:	Pull-type cable extension and connector Extra sensors

APPENDIX II
MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

(a) excellent	(d) fair
(b) very good	(e) 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 metre (m) = 1000 millimetres (mm)	= 39.37 inches (in)
1 kilogram (kg)	= 2.2 pounds (lb)

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