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Evaluation of the Øyjord Bulk Feeder for Fertilizer Experiments

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1.0 Introduction

The Øyjord bulk feeder is a fluted feed wheel seed dispensing attachment for an experimental plot seeding system developed by Egil Øyjord of Norway (3, 4). The bulk feeder offers definite advantages in a experimental plot seeding system in that the feeder can be quickly installed to existing or new applications, and the hopper can be easily removed at any time for dumping excess seed or fertilizer. Feed rates are easy to change, and the unit is compact. The feeder also has merit in that only one hopper is required for a given number of rows.

2.0 Description

The bulk feeder (Fig. 1) consists of a 11 cm diameter fluted wheel, 8 cm high and having 17 flutes 1 cm deep and 1.9 cm wide. The fluted wheel is encased for 230 degrees and has an opening of 60 degrees or 5 cm for the hopper opening and an equal opening for the discharge. A gate is fitted over the hopper attachment opening and moves up and down to meter the amount of feed. This gate is controlled by a lever, and a graduated scale is provided to repeat settings. A second gate fits over the discharge opening and is adjustable to suit the size of seed. This gate setting will affect accuracy, so must always be set at the smallest possible value on the scale.

The hopper is made of sheet metal and is pyramidical in shape holding 9 litres.

The fluted wheel is hollow and has a drive pin fitted to an interior bore which fits over the post of an Øyjord Cone. Installation of the feeder to other applications is possible, and is explained elsewhere (2).

3.0 Calibration

Calibration graphs are given by the manufacturer for several crops, but these should be considered as guidelines only. Also, these graphs are calculated on the presumption that the fluted wheel will make a complete turn in 8.8 meters (29 ft). On some specific applications, this ratio between the drive wheel and the drive post will not be available and individual graphs will have to be produced. A calibration stand was made for this purpose (Fig. 1). To produce a calibration graph, the fluted wheel can be turned exactly one or two turns, the sample weighed and calculated against area covered when the seeder used would advance the distance required to turn the fluted wheel the number of turns used for calibration.

4.0 Use of Fertilizer

Øyjord equipment is not claimed by the manufacturer to be suitable for fertilizer. Short term experimentation has shown that this equipment is suitable for fertilizer, but wear of components will be accelerated. It is, therefore, imperative that fertilizer is cleaned from the apparatus with a vacuum cleaner after each use, and the feeder disassembled and wiped with oil after each season before storage. Bearings cannot be expected to last as long around fertilizer and should be replaced periodically.

5.0 Testing

A number of bench tests were made to evaluate the feeder for fertilizer. Results are shown in Tables 1 to 4. All tests were made at an ambient temperature of 70°F and relative humidity 20%.

A series of repeated tests were made at each setting, at different speeds and with the feeder tilted at different angles. Standard Deviation and Coefficient of Variation was calculated for each series, and is tabulated in the following tables.

Table 1. Output of bulk feeder at different settings showing mean, range, standard deviation and coefficient of variation. 9

Product - 10-10-10 Fertilizer

Gate position - 1

Setting	Mean Output	Range		S.D.	C.V. %
		High	Low		
1	18.29	18.68	17.48	0.40	2.19 %
1.5	32.06	32.50	31.59	0.39	1.22 %
2	49.98	49.74	48.08	0.60	1.20 %
3	77.00	78.19	76.12	0.98	1.27 %
4	104.11	106.97	101.66	1.60	1.54 %
5	134.44	139.97	130.45	2.89	2.15 %
6	162.10	165.46	159.22	2.10	1.30 %
7	185.54	190.24	181.07	2.99	1.61 %

Means for 10 runs

Table 2. Effect of speed on output. Setting #3

Product - 10-10-10 granular fertilizer

Gate position - 1

No. of seconds to turn fluted wheel 1 complete turn	Equivalent M.P.H. @ 18 ft/turn	Mean Output	C.V. %
1.6 seconds	7.67 m.p.h.	67.41	4.17 %
3.25 seconds	3.77 m.p.h.	75.16	2.57 %
4.6 seconds	2.66 m.p.h.	76.98	1.70 %

Means for 10 runs

Table 3. Effect of tilt on accuracy. Setting #3

Product - 10-10-10 granular fertilizer

Gate position - 1

Tilt & position	Output	C.V. %
Front up - 4%	74.76	2.54 %
Right side up - 4%	76.30	2.21 %
Back up - 4%	77.81	2.42 %
Left side up - 4%	76.06	1.09 %
Level	75.16	2.57 %

Means for 10 runs

Table 4. Effect of rubber gate setting on output and accuracy.

Setting #2

Product - 10-10-10 granular fertilizer

Gate setting	Output	C.V. %
0	47.01	1.43 %
1	48.58	.47 %
2	51.68	1.39 %
3	54.34	2.28 %
4	108.20	3.04 %

Means for 10 runs

6.0 Discussion

Accuracy or repeatability of the feeder in each range as shown in Table 1 is good. The coefficient of variation is lower than normally expected for a volumetric feeder. The effect of speed on the feeder, as shown in Table 2, should be noted, indicating that all applications should be made at a constant repeatable speed. The speed test also indicated that accuracy decreased as the speed was increased. The effect of tilt on the dispenser shows less affect than the range of outputs from Table 1 for setting #3. The differences do indicate, however, the need for well prepared land where plot seeders operate, and where it is necessary to operate on a slope, travel should be constantly in one direction to reduce the variation between plots.

Table 4 shows an error that could easily be introduced by failure to properly adjust the sliding rubber gate at the ejection point of the fluted wheel.

Accuracy, as shown in Table 1, was for repeated runs at each setting. No attempt was made to test the repeatability capabilities of the feeder when the feed gate was returned to a given setting. This is strictly an operation dependent on the operator, as a pointer is matched to a corresponding value on a scale. A better method to insure repeatability of settings would be a vernier screw to control the gate.

This feeder can be recommended for fertilizer application where rates are variable, but the same mixture is used over a given treatment. It is important that: 1. care be taken in setting the pointer on the scale to ensure repeatability; 2. the rubber gate be set properly; 3. the seeder or applicator be operated at a constant speed; 4. the feeder be

calibrated for each varied form or manufacturer of fertilizer, and

5. the feeder be properly cleaned after each use, and great care be taken not to allow fertilizer to become wet in the feeder or associated dividing equipment.

7.0 References

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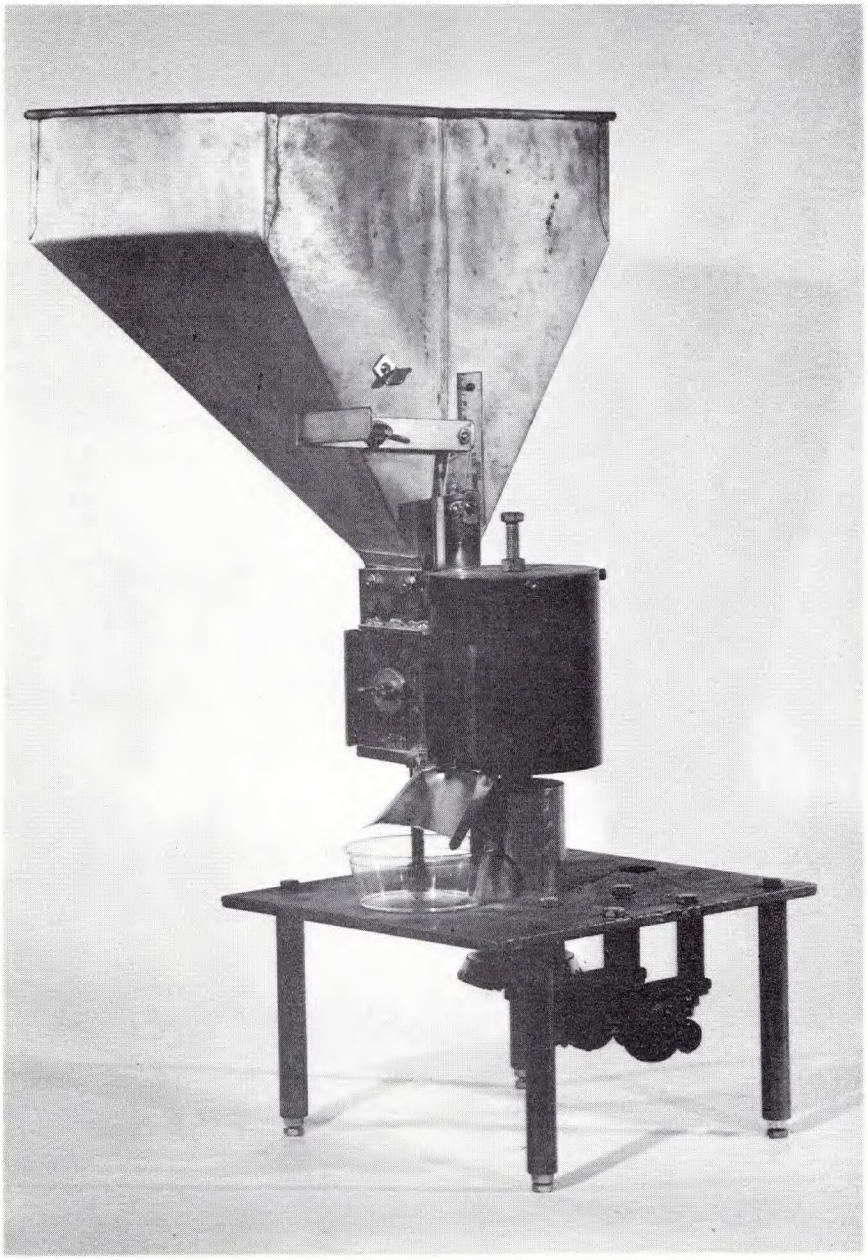

Fig. 1. Øyjord bulk feeder mounted on a calibration stand.