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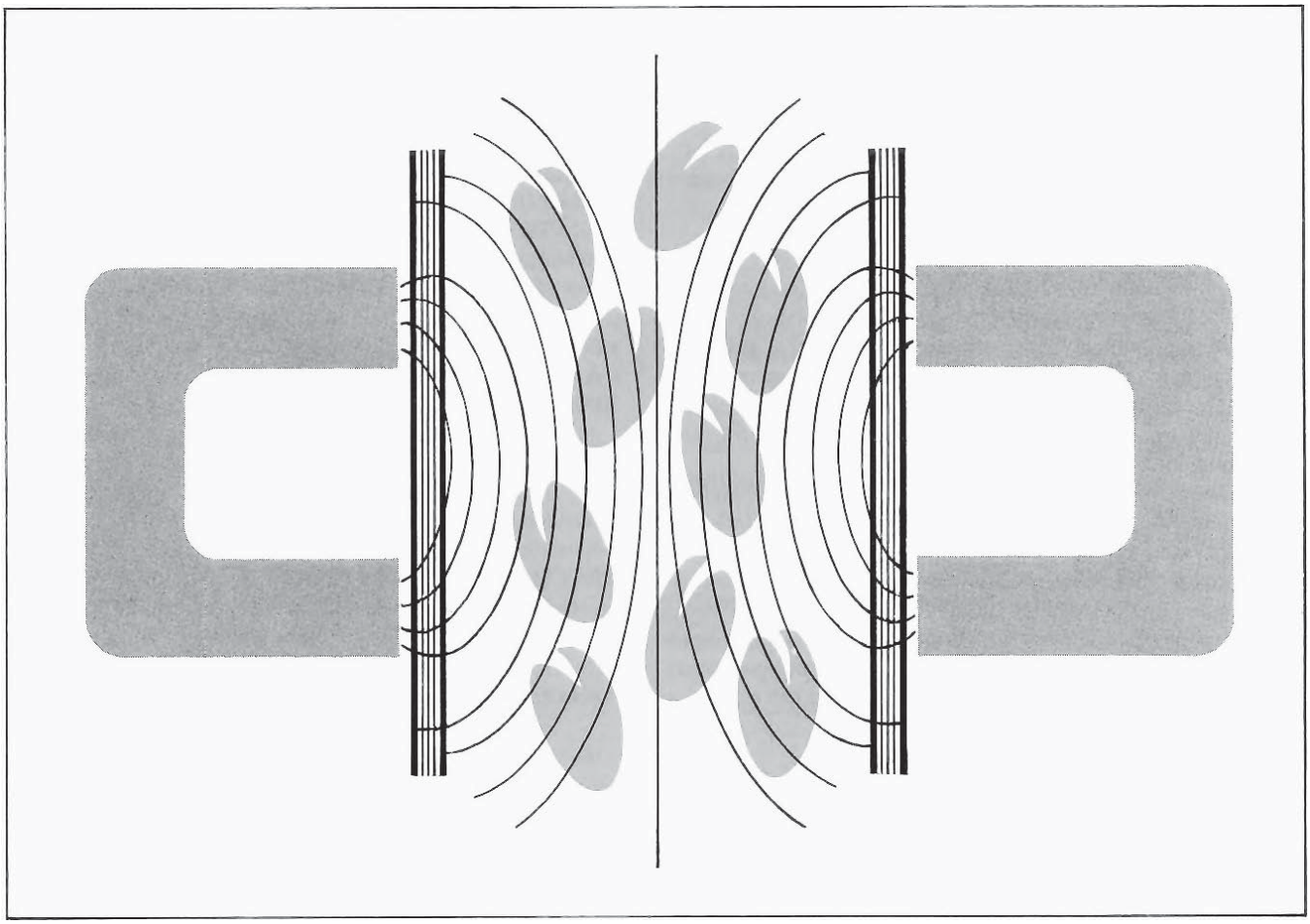


Pre-Germination Magnetic Seed Treaters

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

Acknowledgement

The Prairie Agricultural Machinery Institute wishes to thank the following for supplying the field yield data used in preparation of Figures 1 to 5: Prof. H.M. Austenson, University of Saskatchewan; Mr. D.W.L. Read and Dr. J. McElgunn, Agriculture Canada, Swift Current; Dr. U.J. Pittman, Agriculture Canada, Lethbridge; Mr. D.J. Warnock and Mr. K.E. Bowren, Agriculture Canada, Melfort and Mr. R.N. McIver, Agriculture Canada, Indian Head.

We also wish to thank the various manufacturers and distributors who supplied the magnetic seed treaters used for preparation of Figures 6 to 17.

Summary

Results of field growth trials conducted in various prairie locations have shown no benefit from magnetic seed treatment. Growth trials in environmentally controlled growth chambers have, however, indicated that magnetic seed treating enhances plant growth. It appears that all of the benefits of magnetic seed treating, as shown by growth chamber trials, are completely masked by environmental factors such as moisture and temperature in actual field crops.

Results also indicate that much of the seed being sown may have inadvertently been magnetically treated in regular handling of grain. All results indicate that no one should be recommending magnetic seed treating for prairie grain crops. If a producer still wishes to magnetically treat seed, it is recommended that choice of seed treater should be on the basis of price and convenience of use. Certainly, anyone using magnetically treated seed should not expect yield increases due to the treatment.

Chief Engineer
E.O. Nyborg

Extension Engineer
G.R. Hjertaas

In keeping with the intent of the Canadian Metric Commission, this report has been prepared in S.I. units. For comparative purposes, the following conversions may be used:

1 acre	=	0.4047 hectare (ha)
1 pound (lb.)	=	0.4536 kilogram (kg)
1 lb/acre	=	1.121 kg/ha
1 Gauss (G)	=	0.1 milli Tesla (mT)

Introduction

Many conflicting statements about the effectiveness of magnetic seed treaters have recently appeared. Proponents of magnetic seed treating claim startling yield increases, earlier emergence, earlier maturity and better tillering. Conversely, the majority of field tests conducted in the prairies have shown no benefit from magnetic seed treating.

To help prairie farmers assess the value of magnetic seed treating, the Prairie Agricultural Machinery Institute decided to gather all available information into one report. This report.contains results of field tests conducted by the Crop Science Department, University of Saskatchewan (Figure 3) and by Agriculture Canada at Melfort (Figure 1), Swift Current (Figures 4 and 5), Indian Head (Figure 2) and Lethbridge. In addition, the report lists specifications of most of the magnetic seed treaters presently being sold in the prairie provinces. Much of the initial work on magnetic seed treating must be credited to Dr. U.J. Pittman of the Agriculture Canada Research ,Station at Lethbridge, Alberta. The field data presented by Dr. Pittman however, outlined only spot observations of selected treatments within a series of plots but did not include overall results or their statistical significance. It was therefore, not possible to prepare a figure representing results of field trials at Lethbridge.

From work conducted by Dr. Pittman and by other researchers, it is apparent, in many cases, when plants are grown in ideal environmental conditions (in growth chambers with controlled temperature,

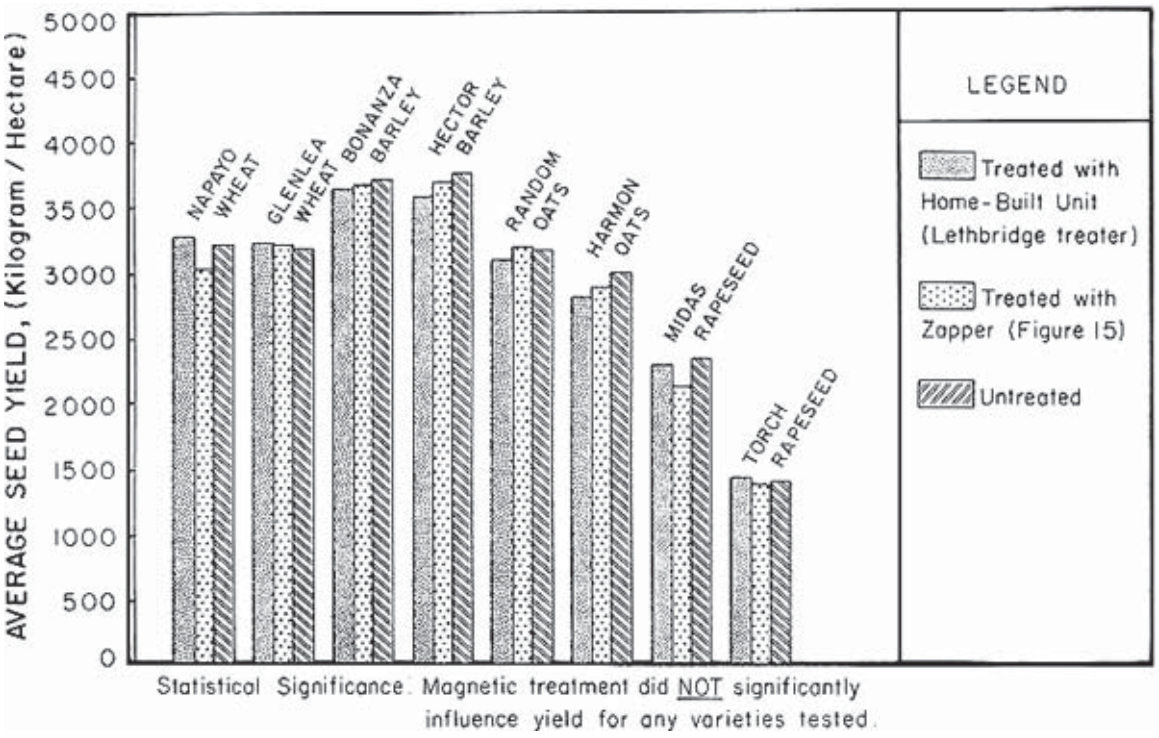


Figure 1. Yield results from field tests on magnetically treated seed conducted in 1975 by the Agriculture Canada Research Station, Melfort, Saskatchewan.

lighting, humidity and nutrient feeding) the rate of emergence, overall plant vigour, the amount of tillering and subsequent plant yield are all improved by magnetic seed treating. However, from analysis of field data (in plots grown in actual field conditions) no conclusive benefits of magnetic seed treating can be shown. It appears that the effect of environmental factors such as soil moisture content and temperature completely mask any of the possible benefits of magnetic treating which may be shown in growth chamber trials.

The farm press often contains articles by knowledgeable people and advertisements with testimonials outlining the benefits of magnetic seed treating. As mentioned previously, many of these are based on misinterpretation of data or presentation of spot data which do not include an analysis of overall results or their statistical significance. As an example of how this is easily done, refer to Figure 4. It is correct to say that magnetic treatment significantly increased yields in field trials on Wascana durum at Eastend and on Sioux oats at Swift Current in 1974. However, this only describes a small part of the experiment. To be correct, we have to conclude from Figure 4 that in 28 field trials conducted by the Swift Current Research Station in 1974, two fields showed a significant yield increase due to magnetic seed treating, two fields showed a significant yield decrease due to magnetic seed treating and in 24 fields there was no significant difference in yields among magnetically treated seed or untreated seed.

Field Trials

Figures 1 to 5 show the results of field trials on magnetically treated seed conducted in the past two years by the University of Saskatchewan and by Agriculture Canada at various locations in Saskatchewan.

Melfort Research Station, Agriculture Canada

Figure 1 shows yield results from field trials conducted by Agriculture Canada at Melfort in 1975. The tests included two varieties of wheat, barley, oats and rapeseed. In each case, the yield from untreated seed was compared to the yield from seed treated with the Zapper (Figure 15) and treated with a "homebuilt" treater from the Lethbridge Research Station.

As can be seen from Figure 1, magnetic treatment did not significantly affect crop yield in all eight crops used in the comparison. In addition, plant counts, plant heights, dates of emergence, dates of heading and maturity were also compared. No significant differences were observed among the treatments.

Indian Head Experimental Farm, Agriculture Canada

Figure 2 presents yield results from field trials conducted by the Indian Head Experimental Farm at various locations in southeastern Saskatchewan in 1975. Trials were conducted on Neepawa wheat, Kelsey oats, Bonanza barley and Noralta flax. Comparisons were made between untreated seed and seed treated with a "homebuilt" treater from the Lethbridge Research Station.

From Figure 2 it is seen that magnetic treatment significantly reduced the yield in one test plot of Kelsey oats at Indian Head. In all other crops and locations (26 comparisons) there was no significant difference in yield from treated or untreated seed. As well, no differences were observed in date of maturity, straw length or plant counts.

Crop Science Department,
University of Saskatchewan, Saskatoon

Yield results from field trials conducted by the Crop Science Department, University of Saskatchewan in 1975 are shown in Figure 3. Trials were conducted on several different varieties of wheat, barley, oats, rapeseed, flax, field peas and faba beans. Untreated seed was compared to seed treated with

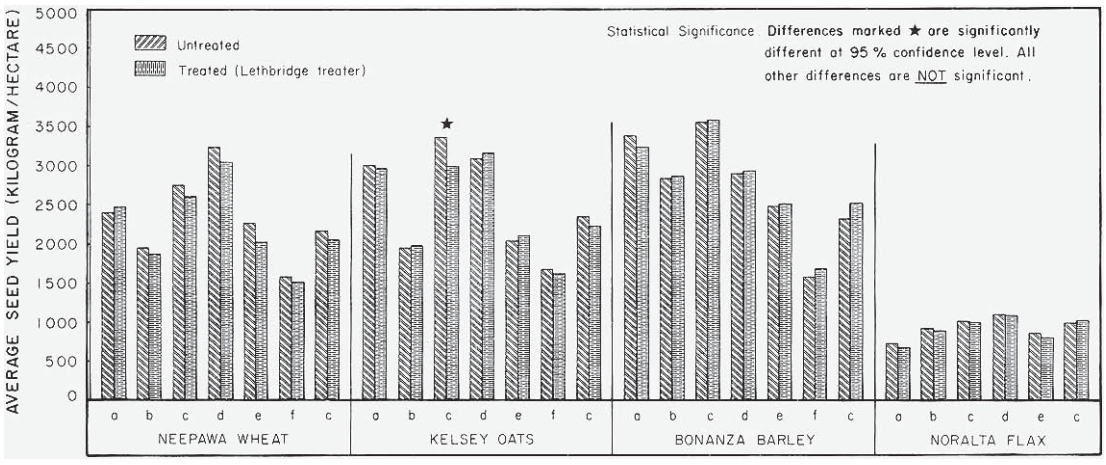


Figure 2. Yield results from field tests on magnetically treated seed conducted in 1975 by the Agriculture Canada Experimental Farm, Indian Head, Saskatchewan. Location of test plots: (a) Arcola, (b) Fleming, (c) Indian Head, (d) Kelliher, (e) Langenburg, (f) Yorkton.

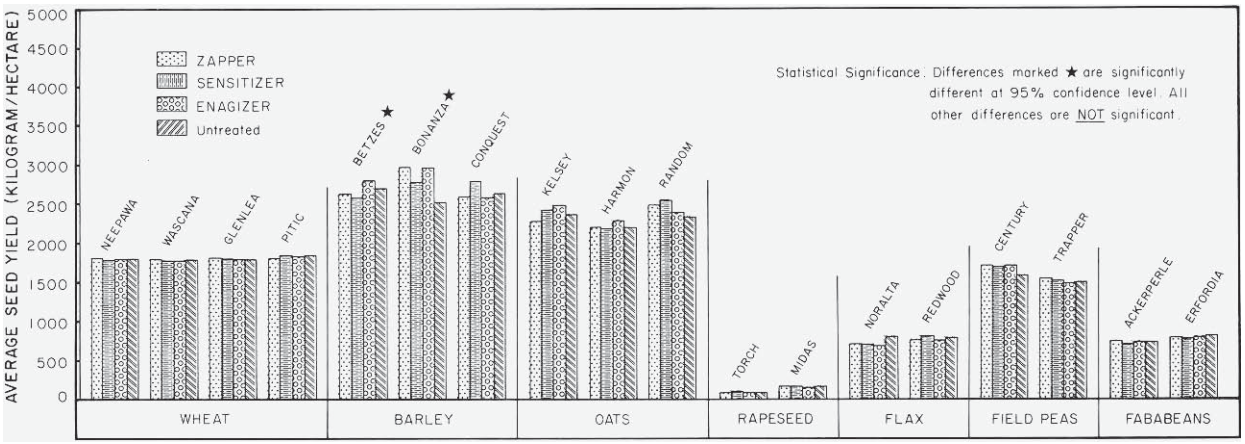


Figure 3. Yield results from field tests on magnetically treated seed conducted in 1975 by the Crop Science Department, University of Saskatchewan, Saskatoon.

the Zapper (Figure 15), Sensitizer (Figure 10) and the Enagizer (Figure 8).

Significant yield differences were shown among the treatments of Bonanza and Betzes barley. In one case the treated seed produced a yield increase and in the other, a yield decrease. In 16 other crops, no significant yield differences occurred among untreated and treated seed. No differences could be observed among the three types of seed treaters (The Enagizer retails for $1,795.00, while the Zapper retails for $179.00 and the Sensitizer retails for $99.00). Earlier emergence of magnetically treated barley was observed but no differences were apparent three days after emergence.

Swift Current Research Station, Agriculture Canada

Figures 4 and 5 present yield results from field trials conducted by the Swift Current Research Station at various locations in southwestern Saskatchewan in 1974 and 1975. Tests included Neepawa wheat, Wascana durum, Conquest barley and Sioux oats. Comparisons were made between untreated seed and seed treated with a “home-built” treater from the Lethbridge Research Station.

Of a total of 62 tests, six resulted in significant yield increases due to magnetic treatment, three resulted in significant

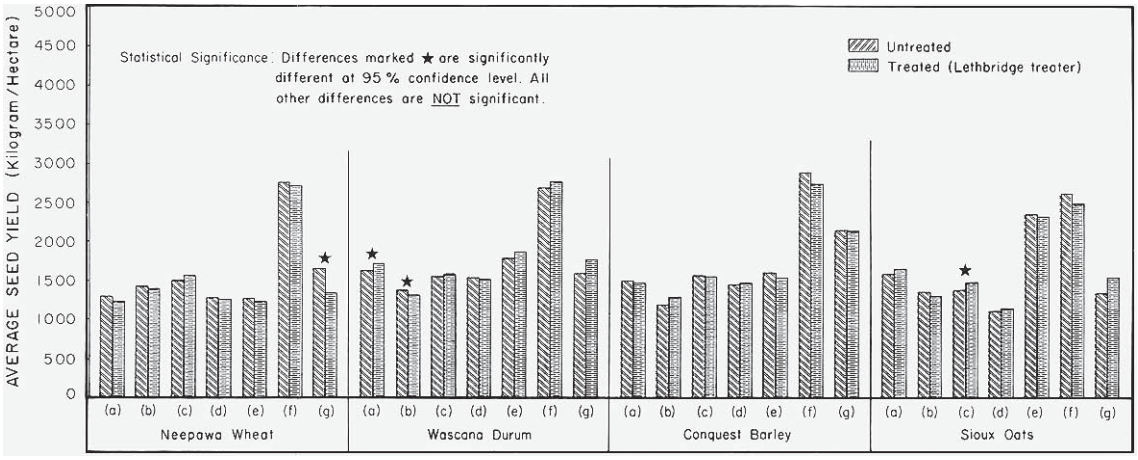


Figure 4. Yield results from field tests on magnetically treated seed conducted in 1974 by the Agriculture Canada Research Station, Swift Current, Saskatchewan. Location of test plots: (a) Eastend, (b) Golden Prairie, (c) Swift Current, (d) Gravelbourg, (e) Hazlet, (f) Stewart Valley, (g) Beverly.

yield decreases due to magnetic treatment; and in the remaining 53, crop yields were not significantly different. At some locations, slight differences were observed in the growing crop but none of these were reflected in crop yield. Comparisons were also made among kernel weight, bushel weight and sheaf weight but no differences were apparent.

Lethbridge Research Station, Agriculture Canada

Field tests on magnetically treated seed have been conducted at Lethbridge from 1972 to 1975. Varieties tested include winter wheat, spring wheat, durum, barley and oats. Available summaries of field reports indicate instances of yield increases due to magnetic seed treatment. Unfortunately, insufficient field data were made available to the Prairie Agricultural Machinery Institute to enable preparation of a figure or to permit statistical analysis of yield results. In some instances differences in germination rate, plant stand or time to maturity were observed. These observations did not necessarily correspond with yield increases or decreases.

Examination of Commercial Magnetic Seed Treaters

Twelve commercial magnetic seed treaters were obtained from manufacturers. Measurements were conducted to determine the approximate shape and intensity of magnetic field produced by the treaters. In addition, the maximum seed fiow capacity (treating rate) was determined for each treater and, in the case of battery operated models, the power consumption was measured.

Specifications for these treaters, including magnetic field characteristics and flow rates, are listed on Figures 6 to 17. In addition, the suggested retail price, as supplied by each manufacturer, is included. As can be seen, maximum treating rates for the 12 treaters ranged from 2590 kg/hr (95 bu/hr) to 56930 kg/hr (2090 bu/hr) for dry wheat. Suggested retail price varied from $56.00 to $1,795.00.

Wide variations were found in magnetic field strengths of the various treaters. This should not be interpreted as having any relationship to their effectiveness in pre-germination magnetic treatment. Growth chamber trials by some plant scientists have indicated that intensities as low as 0.05 mT (0.5 Gauss) may provide adequate treatment. It should be noted, that such low intensity treatments undoubtedly often occur from normal movement of grain through most processing equipment (combine harvesters, seed drills, grain augers, etc.) due to residual magnetism in many of the components. It should also be noted that strength of the magnetic field of the earth in the prairie region is approximately 0.05 mT. There is no information presently available to indicate the maximum field intensity which may successfully be used in magnetic seed treatment.

Available research data indicate no difference in effectiveness due to time of treating before seeding. Growth chamber results indicate no significant difference in the properties of fields created by electro-magnets or by permanent magnets. Gradual loss of field strength of a permanent magnet over time can be considered as insignificant for purposes of magnetic seed treatment.

The only general conclusions which may be drawn from reference to Figures 6 to 17, is that a prospective purchaser is advised to select a magnetic seed treater on the basis of cost, treating capacity and ease of operation. Field test results (Figures 1 to 5) certainly do not indicate that magnetic seed treating offers any yield benefits. Furthermore, most of the seed being used has probably already been subjected to various forms of magnetic treatment due to processing machinery and the earth's magnetic field.

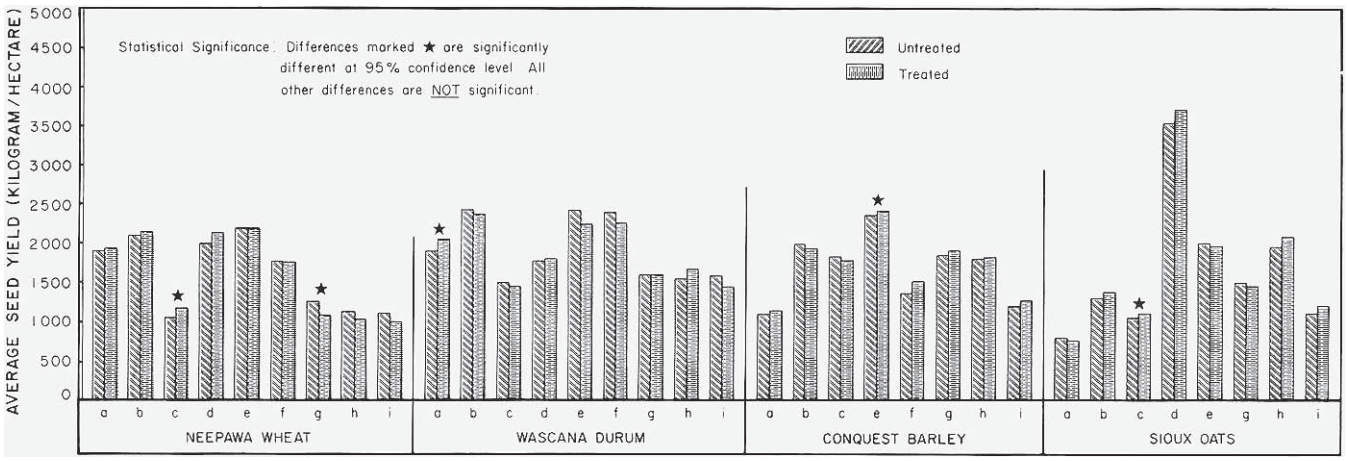
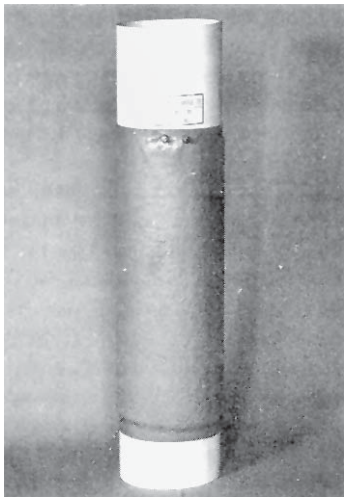


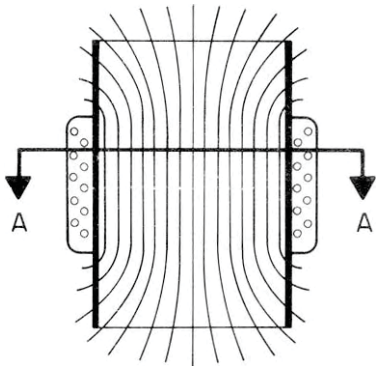
Figure 5. Yield results from field tests on magnetically treated seed conducted in 1975 by the Agriculture Canada Research Station, Swift Current, Saskatchewan. Location of test plots: (a) Eastend, (b) Golden Prairie, (c) Swift Current, (d) Gravelbourg, (e) Hazlet, 09 Stewart Valley, (g) Beverley, (h) Ponteix, (i) Morse.



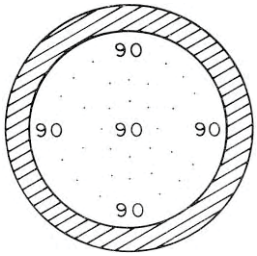
Specifications:

Manufacturer:	-- Hagen Electric Lethbridgc Limited Lethbridge, Alberta
Type:	-- Electro-magnetic
Magnetic Flux Density	-- 9 mT (90G)
Current Draw:	-- 9.8 amperes at 12 volts
Construction:	-- PVC pipe 156 mm in diameter x 750 mm long
	-- 460 mm long axially wound coil section
Weight:	-- 10.5 kilograms
Maximum Treating Rate: (dry wheat)	-- 56930 kg/hr (2090 bu/hr)
Suggested Retail Price:	--$275.00

Figure 6. MAGNA 90



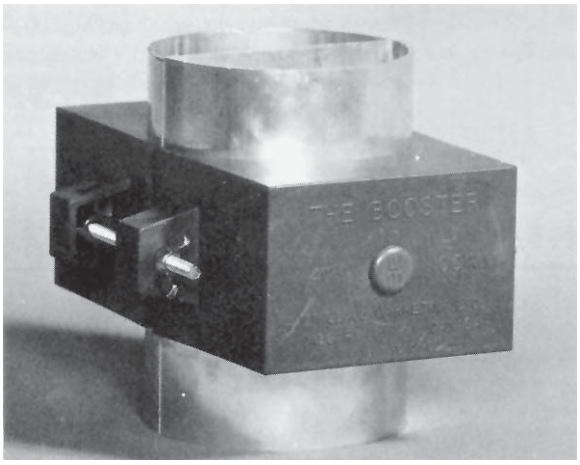
(a)



(b)

(a) approximate shape of magnetic field

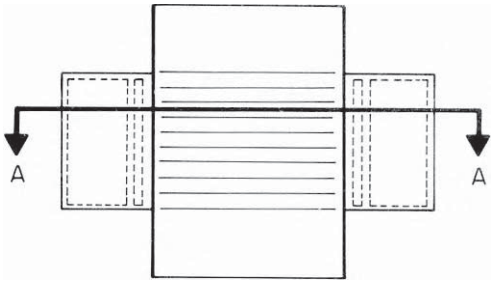
(b) approximate magnetic field intensity (G) at Section A-A



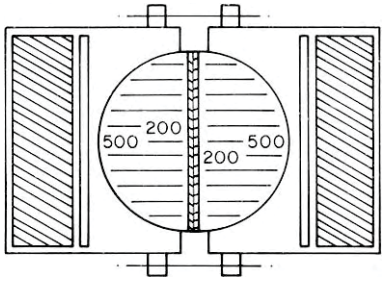
Specifications:

Manufacturer:	-- Willaul Marketing Ltd. Calgary, Alberta
Type:	-- Permanent ceramic magnets
Magnetic Flux Density	-- 20 to 50 mT (200 to 500G)
Construction:	-- Extruded aluminum tube 98 mm in diameter x 150 mm long
	-- Ceramic magnets mounted in luran plastic caps
Weight:	-- 2.1 kilograms
Maximum Treating Rate: (dry wheat)	-- 10210 kg/hr (375 bu/hr)
Suggested Retail Price:	-- $70.00 (larger models available)

Figure 7. THE BOOSTER



(a)



(b)

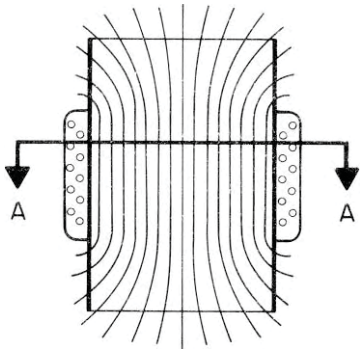
(a) approximate shape of magnetic field

(b) approximate magnetic field intensity (G) at Section A-A

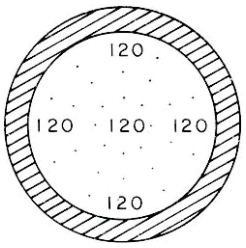
Specifications:

Manufacturer:	-- Agra-Tronix Inc., Des Moines, Iowa
Type:	-- Electro-Magnetic
Magnetic Flux Density	-- Adjustable 0 to 12 mT (0 to 120G)
Current Draw:	-- 110 volts A.C.; 8.8 amperes to motor
Construction:	-- Molded plastic body integral with 100mm diameter x 1220 mm long conveyance tube -- 83 mm diameter inlet - -80 mm diameter discharge
Weight:	-- 30.24 kilograms
Maximum Treating Rate: (dry wheat)	-- 2590 kg/hr (95 bu/hr)
Suggested Retail Price:	-- $1795.00

Figure 8. ENAGIZER



(a)



(b)

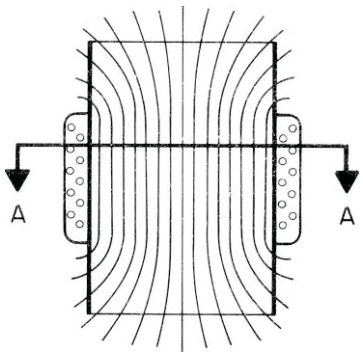
(a) approximate shape of magnetic field

(b) approximate magnetic field intensity (G) at Section A-A

Specifications:

Manufacturer:	-- Davie's Electric Co. Ltd., Saskatoon, Saskatchewan
Type:	-- Electro-magnetic
Magnetic Flux Density	-- 17.5 mT (175G)
Current Draw:	-- 4.25 amperes at 12 volts
Construction:	-- ABS pipe 100 mm in diameter x 290 mm long -- 115 mm long axially wound core
Weight:	-- 3.41 kilograms
Maximum Treating Rate: (dry wheat)	-- 15120 kg/hr (555 bu/hr)
Suggested Retail Price:	-- $109.50

Figure 9. DAVIE'S ELECTRIC MODEL SD3



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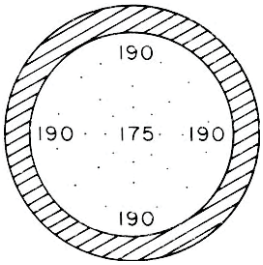
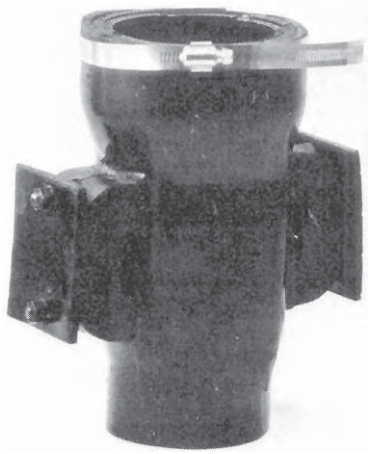


(b)

(a) approximate shape of magnetic field

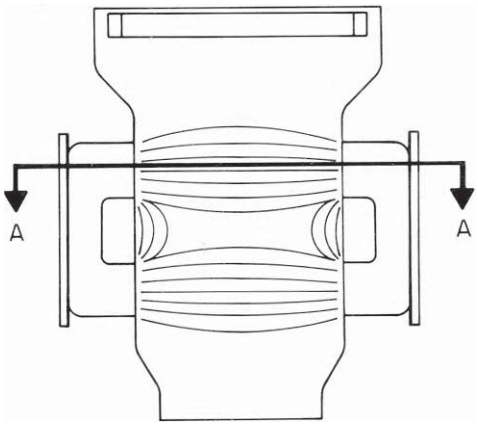
(b) approximate magnetic field intensity (G) at Section A-A



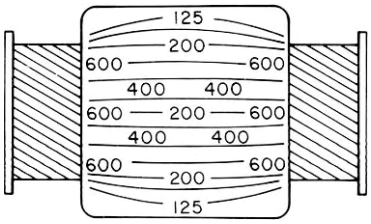
Specifications:

Manufacturer: -- Senstek Ltd., Saskatoon, Saskatchewan
Type: -- Permanent ALNICO horseshoe magnets
Magnetic Flux Density -- 20 to 60 mT (200 to 600G)
Construction: -- ABS pipe molded to shape 255 mm long
-- 95-120 mm diameter inlet (removable rings)
-- 89 mm diameter discharge
Weight: -- 3.90 kilograms
Maximum Treating Rate: -- 14850 kg/hr (545 bu/hr) **(dry wheat)**
Suggested Retail Price: -- $99.00

Figure 10. SENSITIZER



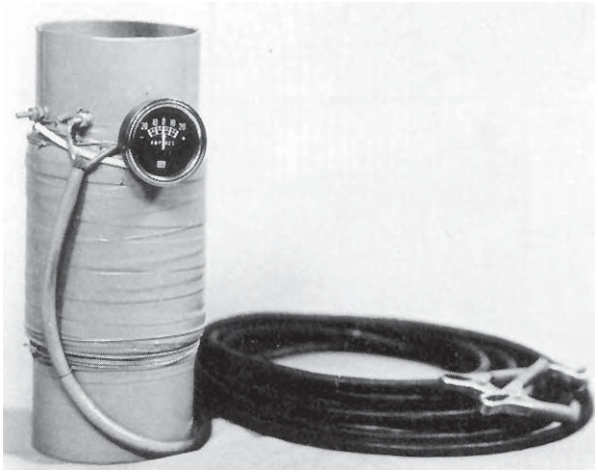
(a)



(b)

(a) approximate shape of magnetic field

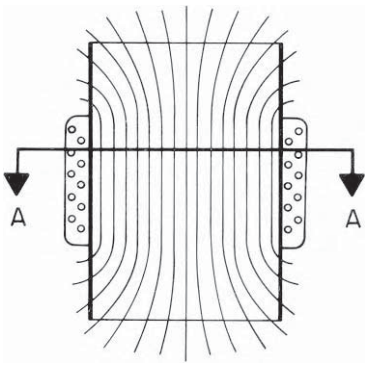
(b) approximate magnetic field intensity (G) at Section A-A



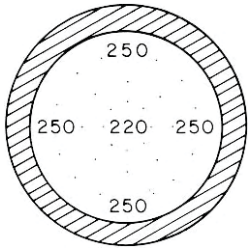
Specifications:

Manufacturer--Strueby Electric, Muenster, Saskatchewan
Type: -- Electro-magnetic
Magnetic Flux Density -- 22 mT (220(3)
Current Draw: -- 8.4 amperes at 12 volts
Construction: -- ABS pipe 100mm in diameter x 280 mm long -- 152 mm long axially wound core
Weight: -- 2.59 kilograms
Maximum Treating Rate: -- 16890 kg/hr (620 bu/hr) (dry wheat)
Suggested Retail Price: --$85.00

Figure 11. STRUEBY ELECTRIC



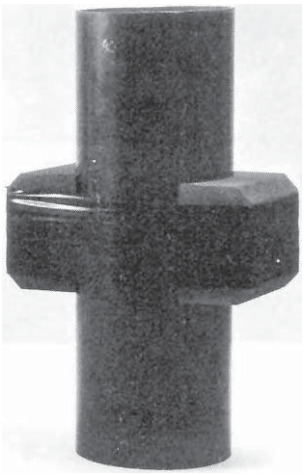
(a)

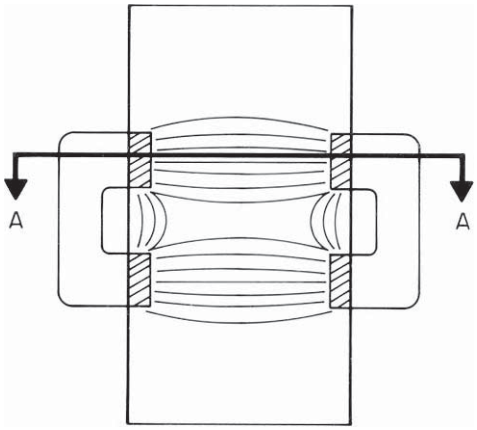


(b)

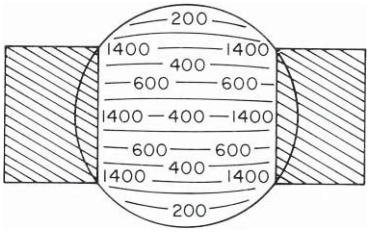
(a) approximate shape of magnetic field

(b) approximate magnetic field intensity (O) at Section A-A





(a)



(b)

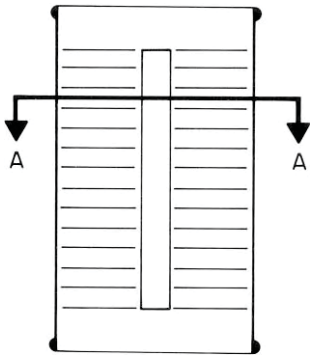
(a) approximate shape of magnetic field

(b) approximate magnetic field intensity (G) at Section A-A

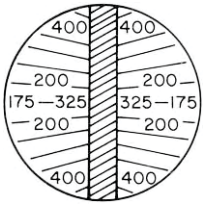
Specifications:

Manufacturer:	-- Shuh's Farm Supply, Eatonia, Saskatchewan
Type:	-- Permanent ALNICO horseshoe magnets
Magnetic Flux Density:	-- 40 to 140 mT (400 to 1400 G)
Construction:	-- ABS pipe 100 mm diameter x 300 mm long -- Horseshoe magnets cut and taped into place
Weight:	-- 3.95 kilograms
Maximum Treating Rate: (dry wheat)	-- 15800 kg/hr (580 bu/hr)
Suggested Retail Price:	-- $65.00 (sold as a kit)

Figure 12. SHUH'S FARM SUPPLY



(a)



(b)

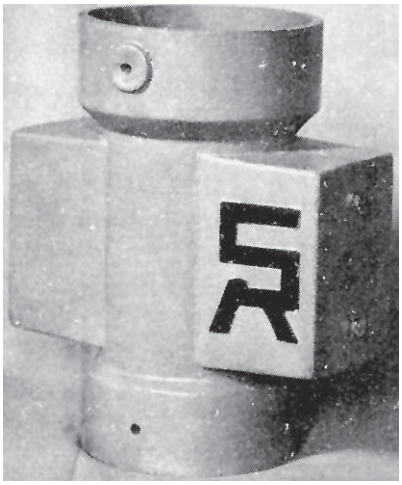
(a) approximate shape of magnetic field

(b) approximate magnetic field intensity (G) at Section A-A

Specifications:

Manufacturer:	-- Western Instruments Ltd., Edmonton, Alberta
Type:	-- Permanent ceramic magnet
Magnetic Flux Density:	-- 17.5 to 40 mT (175 to 400G)
Construction:	-- Zinc plated steel tube 95 mm diameter x 200 mm long -- Flat polyurethane coated ceramic magnet 20 mm thick x 95mm wide x 140mm long
Weight:	-- 2.41 kilograms (b)
Maximum Treating Rate: (dry wheat)	-- 10760 kg/hr (395 bu/hr)
Suggested Retail Price:	-- $75.00

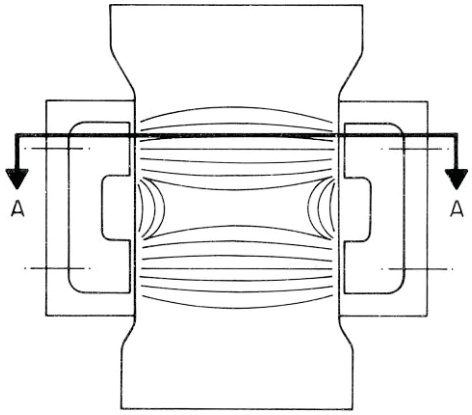
Figure 13. MAG-A-SEED.



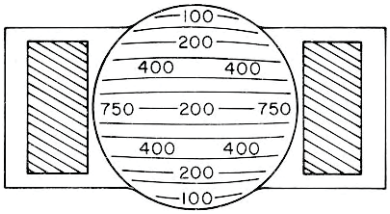
Specifications:

Manufacturer:	--Smith-Roles Ltd., Saskatoon, Saskatchewan
Type:	-- Permanent ALNICO horseshoe magnets
Magnetic Flux Density:	-- 20 to 75 mT (200 to 750G)
Construction:	-- Die-cast aluminum body 254mm long 127 mm diameter inlet 111 mm diameter discharge
Weight:	-- 5.58 kilograms
Maximum Treating Rate: (dry wheat)	--12260 kg/hr (450 bu/hr)
Suggested Retail Price:	--$195.00

Figure 14. THE STINGER



(a)



(b)

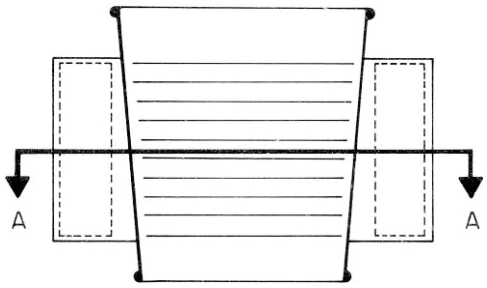
(a) approximate shape of magnetic field

(b) approximate magnetic field intensity (G) at Section A-A

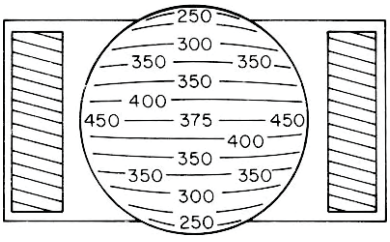
Specifications:

Manufacturer:	-- Agronetics Ltd., Champion, Alberta
Type:	-- Permanent ceramic magnets
Magnetic Flux Density:	-- 37.5 to 45 mT (375 to 450G)
Construction:	-- Molded Lexan Polycarbonate plastic 305 mm long -- 117 mm diameter inlet -- 83 mm diameter discharge
Weight:	-- 4.77 kilograms (b)
Maximum Treating Rate: (dry wheat)	-- 23780 kg/hr (875 bu/hr)
Price:	-- $179.00

Figure 15. ZAPPER



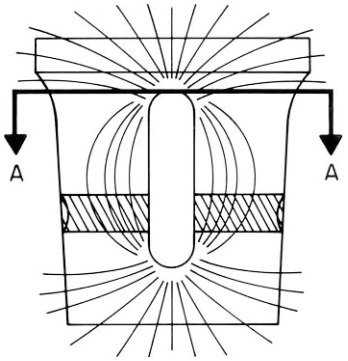
(a)



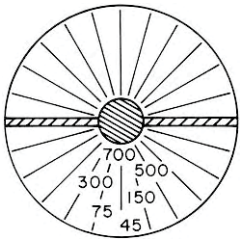
(b)

(a) approximate shape of magnetic field

(b) approximate magnetic field intensity (G) at Section A-A



(a)



(b)

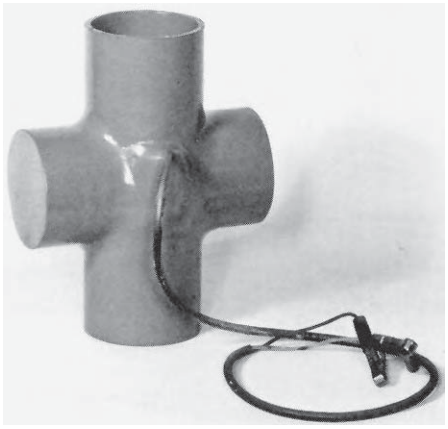
(a) approximate shape of magnetic field

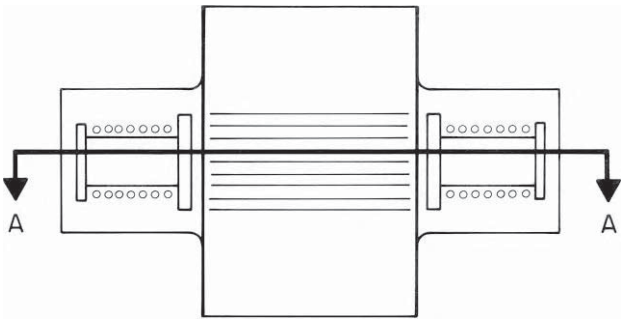
(b) approximate magnetic field intensity (G) at Section A-A

Specifications:

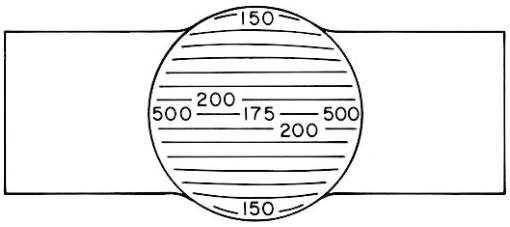
Manufacturer:	-- Qsine Corporation Ltd., Calgary, Alberta
Type:	-- Permanent ceramic magnet
Magnetic Flux Density:	-- 4 to 70 mT (40 to 700G)
Construction:	-- Molded urethane plastic body 160mm long -- 92 mm diameter inlet -- 80 mm diameter discharge -- Centrally located 20mm diameter x 80mm long ceramic magnet
Weight:	-- 0.27 kilograms
Maximum Treating Rate: (dry wheat)	-- 4900 kg/hr (180 bu/hr)
Suggested Retail Price:	-- $56.00

Figure 16. BIO-MAG





(a)



(b)

(a) approximate shape of magnetic field

(b) approximate magnetic field intensity (G) at Section A-A

Specifications:

Manufacturer:	-- H. Roenspiess, Moose Jaw, Saskatchewan
Type:	-- Electro-magnetic
Magnetic Flux Density:	-- 17.5 mT (175G)
Current Draw:	-- 5.2 amperes at 12 volts
Construction:	-- PVC pipe 100 mm in diameter x 300 mm long -- 25 mm diameter x 45 mm long wound iron cores
Weight:	-- 4.77 kilograms
Maximum Treating Rate: (dry wheat)	--15120 kg/hr (555 bu/hr)
Suggested Retail Price:	-- $150.00

Figure 17. ROENSPIESS

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