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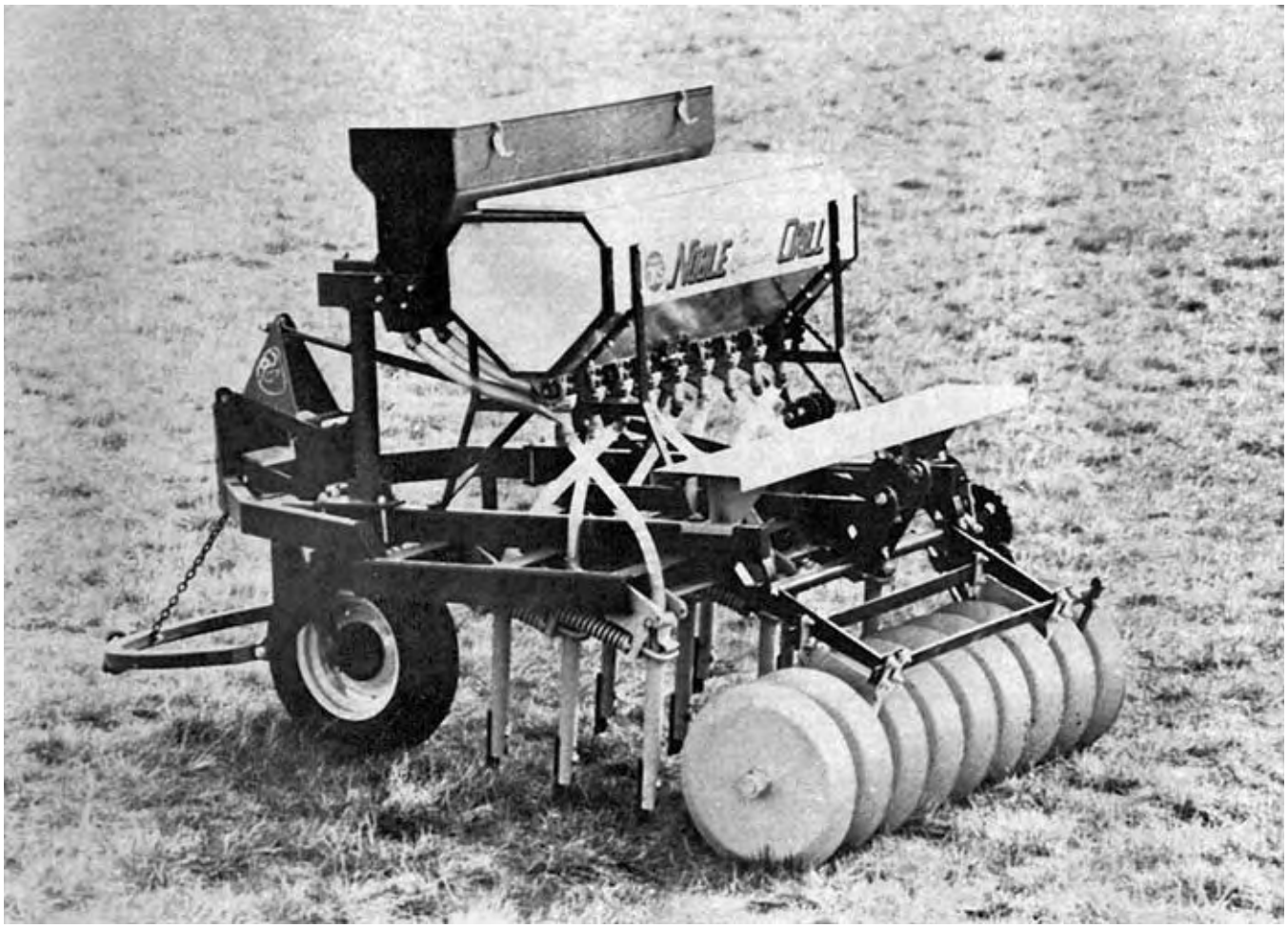
Evaluation Report 175



Noble DK5 Grain Drill

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

NOBLE DK5 GRAIN DRILL

MANUFACTURER AND DISTRIBUTOR:

Noble Cultivators Ltd.
P.O. Box 60
Nobleford, Alberta
T0L 1S0

RETAIL PRICE:

$4,208.55 (May, 1979, f.o.b. Lethbridge, complete with Gandy Model 44-NDK 59 fertilizer attachment, acre tally, seed shaft speed reducer package, rear walk, hydraulic cylinder, and transport attachment.

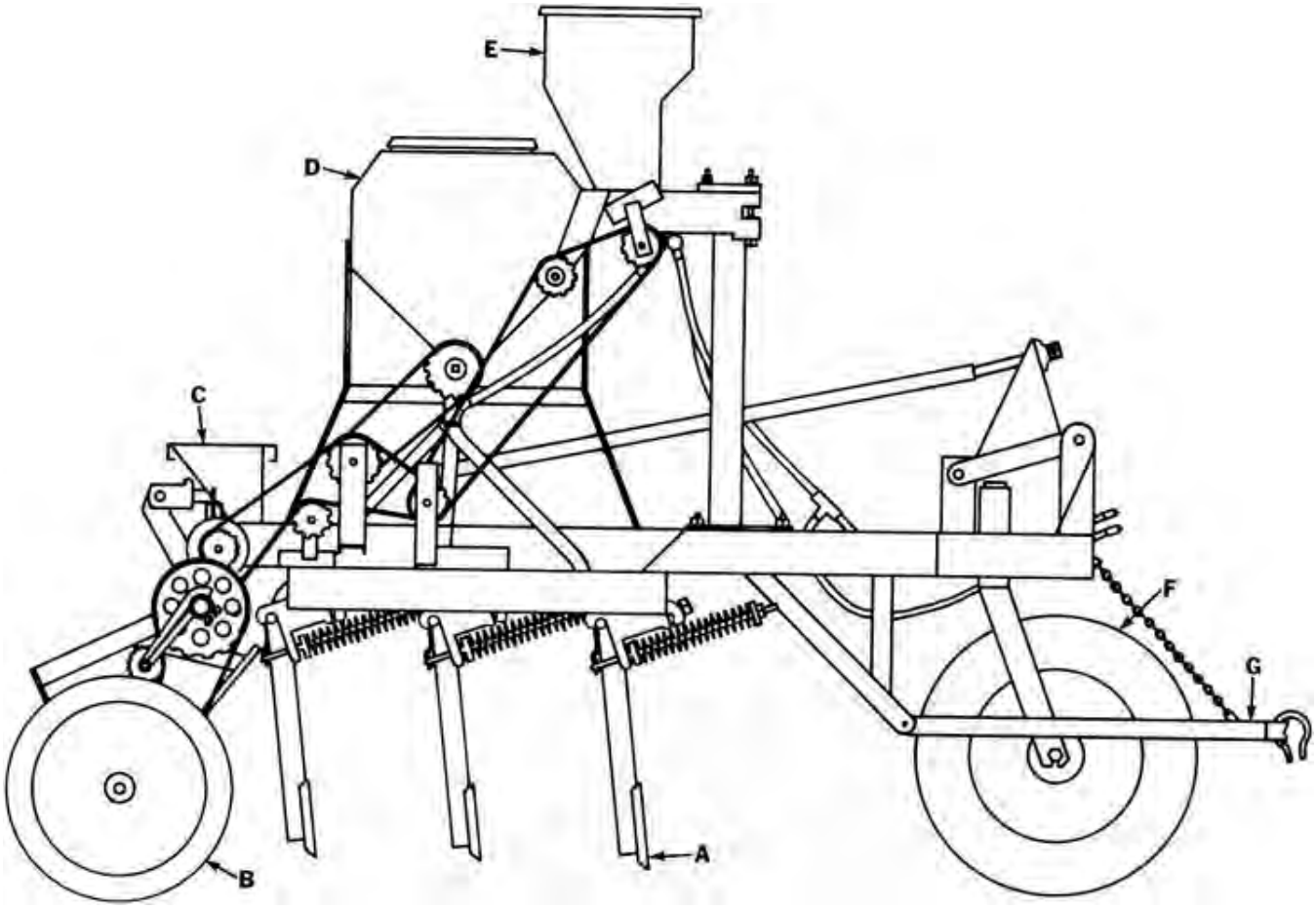


FIGURE 1. Noble DK5: (A) Hoe Opener, (B) Packer Wheel, (C) Rear Walk, (D) Grain Box, (E) Optional Gandy Model 44-NDK 59 Fertilizer Attachment, (F) Castor Wheel, (G) Hitch.

SUMMARY AND CONCLUSIONS

Overall functional performance of the Noble DK5 was very good. Penetration and seed placement were good in a Wide range of soil and trash conditions providing the seedbed had been properly prepared. Press wheel performance, trash clearance, and performance in stony fields were good.

The seed metering system was fairly accurate in barley, wheat and oats, but the manufacturer's calibration for rapeseed was 40% high at low application rates and 20% low at higher rates. The variation in the seeding rates among seed runs was insignificant when seeding large seeds such as wheat, oats and barley, or when seeding small seeds such as rapeseed at rates above 5 kg/ha (4.5 lb/ac). Lower rapeseed rates resulted in non-uniform seeding rates across the machine width. The minimum seeding rate in rapeseed was 3.6 kg/ha (3.2 lb/ac). Seeding rate was not affected by level of grain in the grain box, ground speed, field bounce or side slope. Fore-and-aft slope caused slight changes in seeding rate.

A grass seeding attachment was available for the Noble DK5 but was not evaluated. Grass seed such as alfalfa or ryegrass could be seeded through the grain box by using the optional slow speed drive. Large light seed such as bromegrass bridged over the seed cups.

Seeding rate was easily changed using wrenches. Changing to the optional slow speed drive for small seeds such as rapeseed was tedious. Filling the grain box was convenient and an adequate walkway was provided. Transporting using the optional transport package was convenient. Cleaning was easy and only nine lubrication fittings required greasing.

Tractor size needed depended on field preparation and soil. Tractor size needed to pull one 2.1 m (6.8 ft) section of Noble DK5 at 8 km/h (5 mph) ranged from 28 kW (38 hp) in fine sandy loam to 32 kW (43 hp) in clay loam.

The operator's manual contained much useful information on adjustments, maintenance and operation. A detailed parts list was also included.

Mechanical problems occurring during the test were seizing of the grain shaft bearing and shifting of the grain box calibration.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifying the calibration chart so it is more accurate when seeding rapeseed.
2. Providing a slow moving vehicle emblem.
3. Converting the kg/ac calibration charts to kg/ha to coincide with proper metric (SI) nomenclature.
4. Modifications to prevent grain box calibration changes.

Chief Engineer: E. O. Nyborg
Senior Engineer: E. H. Wiens
Project Engineer: K. W. Drever

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Although the DK 5 model drill is no longer in production, the new 2000 series drill employs the same seed metering system. The calibration for small seeds such as rape will be checked and the charts corrected if necessary.
2. A slow moving vehicle emblem is standard equipment on the 2000 series drill.
3. At present we feel the kg/ac calibration charts are easier for the North American customer to relate to than kg/ha. The customer may be buying his grain and fertilizer in kilograms, but he is still measuring his land in acres.
4. The seed setting indicator bracket shifting was not a common problem on the DK5 drills. The indicator mounting bracket on the 2000 series however, is held more rigidly so the calibration setting should not change while seeding.

NOTE: This is report has been prepared using SI units of measurement. A conversion table is given in APPENDIX III.

GENERAL DESCRIPTION

The Noble DK5 is a 2.1 m (6.8 ft) hoe drill with 230 mm (9 in) spacing. It is equipped with 9 openers in three rows. Seeding depth is controlled with a hydraulic cylinder.

Grain is metered from the 338 L (9.5 bu) grain box by externally fluted feed rolls through nylon discharge tubes to the openers. One gang of 560 mm (22 in) diameter V-shaped press wheels packs the soil directly behind the openers.

The test machine was equipped with an optional Gandy 44-NDK 59 fertilizer attachment[1], acre tally, seed shaft speed reducer package, rear walk, hydraulic cylinder and transport attachment.

FIGURE 1 shows the location of major components while detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Noble DK5 was operated in the conditions shown in TABLE 1 for 62 hours while seeding about 88 ha (220 ac). It was evaluated for quality of work, ease of operation, ease of adjustment, power requirements, operator safety and suitability of the operator's manual.

TABLE 1. Operating Conditions

Crop	Soil	Stone Conditions	Field Area ha	Hours
Durum wheat on summerfallow	Silty loam	occasional stones	9	7
	Sandy loam	occasional stones	8	5
Durum wheat on tilled wheat stubble	Silty loam	occasional stones	6	6
	Sandy loam	occasional stones	8	5
Spring wheat on summerfallow	Sandy clay loam	occasional stones	6	4
Spring wheat on tilled rapeseed stubble	Sandy clay loam	occasional stones	15	11
Rapeseed on summerfallow	Clay loam	occasional stones to very stony	10	7
Fall rye on summerfallow	Fine sandy loam	moderately stony	11	10
Winter wheat on summerfallow	Clay loam	occasional stones to very stony	14	11
Winter wheat directly on wheat stubble	Heavy loam	occasional stones	1	1
Total			88	62

RESULTS & DISCUSSION

QUALITY OF WORK

Penetration: Penetration was good in a wide variety of field conditions provided adequate preseeding tillage had been performed. Opener position was controlled by the position of the hydraulic lift cylinder. The hoe assemblies (FIGURE 2) were equipped with a spring cushioned trip and 57 mm (2.25 in) wide, vertical opener. The spring cushioned trips were effective in providing opener protection in stony fields.

Seed Placement: Ideally, grain is seeded into moist soil on a firm seedbed. A firm seedbed aids in the packing of moist soil around the seed and provides a barrier to the seepage of rainfall below the seed zones.

Seeds were normally placed 15 to 20 mm (0.6 to 0.8 in) shallower than the working depth of the hoe opener in a 50 mm (2 in) wide band. Measurements of seed depth when seeding wheat indicated that most of the seeds were within 15 mm (0.6 in) of the average seed depth in uniform soil conditions.

Uniform field preparation was required for uniform seed depth due to the hoe assembly trip design (FIGURE 2). Typical soil drafts caused the shank to rotate back to a vertical position. Large draft increases on hard spots caused the shank to rotate back further than vertical, resulting in shallow seeding. Wheel sinking in soft spots caused seed depth increase. A typical increase in one clay loam field was 28 mm (1.1 in).

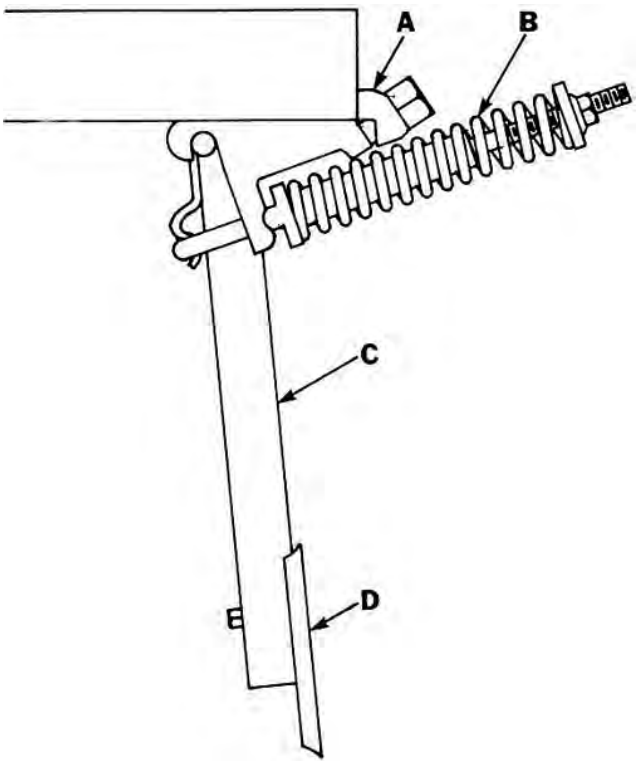


FIGURE 2. Hoe Assembly: (A) Frame Clamp, (B) Cushion Spring, (C) Opener Tube, (D) Hoe Opener.

Soil Compaction: The V-shaped press wheels followed directly behind the openers, effectively pressing soil around the seeds. Press wheel furrow depth ranged from 40 to 65 mm (1.6 to 2.6 in), depending on soil conditions. FIGURES 3 and 4 show the soil surface after seeding in summerfallow and stubble fields. In dry, loose soils, excessive field speeds caused soil pulverization.

FIGURE 3. Soil Surface after Seeding Summerfallow.

Trash Clearance: The 230 mm (9 in) hoe spacing and 410 mm (16 in) frame clearance resulted in good trash clearance.

Operation in Stony Fields: The spring cushioned hoe opener assembly performed well during the test and no problems occurred in stony fields. The maximum lift height when openers encountered

[1] *See PAMI Evaluation Report E2079B.*

stones or field obstructions was 152 mm (6 in).

FIGURE 4. Soil Surface after Seeding Stubble.

Plant Emergence: As with most drills, plant emergence depended primarily upon seed bed preparation and soil moisture. FIGURE 5 illustrates good emergence in a summerfallow field seeded to wheat.

FIGURE 5. Wheat Emergence on Summerfallow.

Metering Accuracy: The grain metering system was calibrated in the laboratory[2] and compared with the manufacturer's calibration. Since actual seeding rates for certain settings depend on things such as seed size, density and moisture content, it is not possible for a manufacturer to present charts to include all the varieties of seed. Field calibration checks may be necessary for seed with properties differing from those indicated in the manufacturer's table. Research has, however, shown that small variations in seeding rates will not significantly affect grain crop yields.

A seed setting indicator (FIGURE 6) on the back of the seed box controlled the seed rate by positioning flute projection into the seed cup. Calibration charts showed seed indicator settings for various grains. An optional seed shaft speed reducer package was available for rapeseed.

Seeding rates when compared to the manufacturer's calibration charts were 15% low when seeding 770 kg/m³ (60 lb/bu) Neepawa wheat, 7% high when seeding 590 kg/m³ (46 lb/bu) Sioux oats, and 15% high when seeding 690 kg/m³ (54 lb/bu) Betzes barley.

The calibration for 680 kg/m³ (53 lb/bu) Tower rapeseed when using the optional speed shaft reducer package was 40% high at low rates and 20% low at higher rates. It is recommended that the manufacturer consider modifying the calibration chart so it is more accurate when seeding rapeseed.

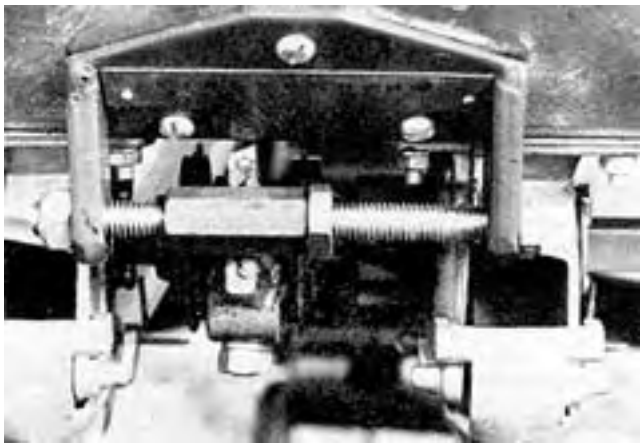


FIGURE 6. Seed Setting Indicator.

Level of grain in the grain box, variation in ground speed, field bounce, and side slope did not seriously affect seeding rates. Travelling at a 15° slope caused a 10% increase in seeding rate, and travelling down a 15° slope caused a 5% decrease in seeding rate.

The coefficient of variation (CV)[3] can be used to describe the variation of seeding rates among individual seed cups. An accepted variation for seeding grain is a CV value not greater than 15%. If the CV is less than 15%, seeding is uniform, whereas if the CV is greater than 15%, the variation among individual seed cups is excessive.

The Noble DK5 was capable of very uniform seeding, with CV's of 1 to 4% when seeding wheat, oats and barley at normal seeding rates. Seeding of rapeseed at rates greater than 5 kg/ha (4.5 lb/ac) was also uniform. For example, the CV was about 5% when seeding rapeseed at 11 kg/ha (10 lb/ac). Attempting to seed at 3.6 kg/ha (3.2 lb/ac) resulted in non-uniform seeding with a CV over 20%.

Grass Seeding: A grass seeding attachment was available as optional equipment for the Noble DK5 but was not evaluated. Grass seeds such as alfalfa and ryegrass could be seeded through the grain box using the optional seed shaft speed reducer package, even though calibration charts were not provided. PAMI calibrations are shown in TABLE 2. Uniformity was similar to that when seeding cereal grains. Large light seeds such as bromegrass bridged over the seed cups, so they had to be seeded through the grain box by mixing the seed with heavier material such as grain.

TABLE 2. PAMI Calibrations for Ryegrass and Alfalfa using Seed Shaft Reducer Package

Seed Indicator Setting	Ryegrass (kg/ha)	Alfalfa (kg/ha)
0.0	1.8	5.0
2.5	2.6	7.4
5.0	3.5	9.8
7.5	4.4	12.2
10	5.2	14.7
15	7.0	19.5
20	8.7	
25	10.4	
30	12.2	
35	13.9	
40	15.6	
Seed Densities:	Russian Wild Ryegrass 270 kg/m³	
	Rambler Alfalfa 770 kg/m³	

Acre Counter: The acre counter read about 6% low on most fields. The counter recorded the nearest tenth acre up to 1000 acres. A metric counter was not available.

EASE OF OPERATION

Hitching: The Noble DK5 was easy to hitch to a tractor. A hydraulic cylinder was supplied as standard equipment.

[2] *PAMI T773, "Detailed Test Procedures for Grain Drills."*

[3] *The coefficient of variation (CV) is the standard deviation of seeding rates from individual seed cups expressed as a per cent of the mean seeding rate.*

Filling: Filling the grain box from the 290 mm (11.5 in) wide optional rear walk was convenient. The grain box opened to 300 mm (12 in).

Cleaning: As with most drills, a vacuum cleaner or compressed air was needed for thorough cleaning of the grain box. All parts were readily accessible for cleaning.

Transporting: The optional drill transport package (FIGURE 7) was convenient for transporting each section of drill. For wide multiple hook-ups over long transport distances the operator should consider using an end drill transporter.

FIGURE 7. Optional Transport Package.

EASE OF ADJUSTMENT

Lubrication: Lubrication was convenient with fair access to the pressure grease fittings. A grease gun with a flexible hose was needed. Nine fittings required greasing twice daily.

Seeding Rate: Seeding rate was changed with the seed setting indicator (FIGURE 6). Wrenches were required. Changing to the optional slow speed drive for small seed such as rapeseed was tedious since the drive sprockets had to be moved and roller chain links added or deleted.

Depth Adjustment: Seeding depth was conveniently adjusted by positioning the hydraulic cylinder. The frame was easily levelled for uniform depth by adjusting the castor wheel linkage.

POWER REQUIREMENTS

Draft: Draft requirements depended on field preparation, soil and moisture. Average draft at 8 km/h (5 mph), with fully loaded seed and fertilizer boxes, ranged from 7000 N (1570 lb) in fine sandy loam to 8000 N (1800 lb) in clay loam.

Tractor Size: Tractor size[4] needed to pull the 2.1 m (6.8 ft) section of Noble DK5 varied from a 28 kW (38 hp) power takeoff rating in fine sandy loam to 32 kW (43 hp) in clay loam.

OPERATOR SAFETY

The Noble DK5 was safe to operate if normal safety precautions were observed. The platform at the rear of the drill was large enough for safe filling of the grain and fertilizer boxes. A bolt was provided to lock the hydraulic cylinder for transporting. No slow moving vehicle emblem was provided. It is recommended that the manufacturer consider providing a slow moving, vehicle emblem.

OPERATOR'S MANUAL

The operator's manual contained useful information on adjustments, maintenance and operation. Calibration charts were provided in the operator's manual and on the drill box. Seeding rates were expressed in imperial units (lb/ac) and in mixed units (kg/ac). It is recommended that the units kg/ac charts be converted to kg/ha charts to coincide with proper metric (SI) nomenclature.

DURABILITY RESULTS

The Noble DK5 grain drill was operated for 62 hours while seeding about 88 ha (220 ac). The intent of the test was evaluation of functional performance and an extended durability evaluation was not conducted. TABLE 2 outlines the mechanical problems that occurred during functional testing.

TABLE 2. Mechanical History

Item	Operating Hours	Field Area ha
Grain Box		
-The bearing on the right side of the grain shaft seized, causing drive chain failure at	50	
-Calibration of the grain box changed	throughout the test	
Seed Shaft Speed Reducer Package		
-A portion of the secondary chain idler bracket had to be cut with a torch to facilitate installation of the jack shaft bracket at	beginning of test	

DISCUSSION OF MECHANICAL PROBLEMS

GRAIN BOX

Bearing Failure: The feed cup shaft bearing seized after 50 hours due to dust entering the bearing. This caused the secondary drive chain to break, the slow speed drive jackshaft to twist and bend, and the idler bracket to bend (FIGURE 8). The bearing and jackshaft assembly were replaced and the bracket straightened.

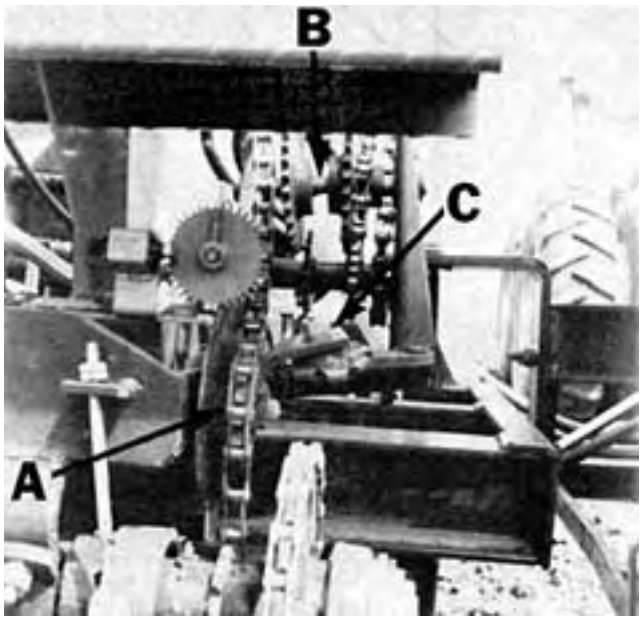


FIGURE 8. Drive Failure Caused by Feed Cup Shaft Bearing Seizure: (A) Broken Secondary Drive Chain, (B) Bent and Twisted Jackshaft, (C) Bent Idler Bracket.

Calibration: Calibration of the grain box changed due to shifting of the seed setting indicator assembly (FIGURE 6). The mounting bolts were not sufficient to hold the assembly in place. The bracket shifted, resulting in excessive flute exposure for a given setting. It is recommended that the manufacturer consider modifications to prevent grain box calibration changes.

[4] *PAMI Detailed Test Procedure for Cultivators*

APPENDIX I
SPECIFICATIONS

MAKE:	Noble Grain Drill
MODEL:	DK5-9
OVERALL DIMENSIONS:	
-- height	1870 mm
-- length	3250 mm
-- width	2000 mm
-- effective seeding width	2057 mm
-- transport ground clearance	85 mm
SEED METERING SYSTEM:	
-- type	externally fluted feed rolls
-- drive	chain from press wheels
-- adjustment	fork assembly controlling feed roll protrusion
-- transfer to openers	plastic discharge tube
OPENERS:	
-- type	hoe
-- point	straight type
-- number	9
-- spacing	229 mm
-- number of rows	3
--- distance between rows	407 mm
-- options	straight or spear type point, hard faced point, 229, 254, 294 or 343 mm opener spacing
-- protection	spring cushion
PRESS WHEELS:	
-- type	V-shaped formed steel
-- diameter	559 mm
-- width	100 mm
-- number	9
-- spacing	229 mm
-- number of gangs	1
CASTOR WHEEL:	1, 6.70 x 15, 4-ply rib implement
GRAIN BOX CAPACITY:	338 L

WEIGHT: (with Gandy Model 44-NDK 59 fertilizer attachment):

	Boxes Empty	Boxes Full
-- press wheels	640 kg	859 kg
-- castor wheels	535 kg	762 kg
Total	1175 kg	1621 kg

NUMBER OF CHAIN DRIVES: 4 (including fertilizer attachment drive)

HYDRAULIC CYLINDER: 1, 65 x 203 mm

NUMBER OF LUBRICATION POINTS: 9

OPTIONAL ATTACHMENTS INCLUDED ON TEST MACHINE:

-- Gandy Model 44-NDK 59 fertilizer attachment, acre tally, seed shaft speed reducer package, rear walk, hydraulic cylinder, transport attachment.

OTHER OPTIONAL EQUIPMENT:

-- multiple hitches and hydraulic kits for two, three, four, five, six or seven drills, markers, Gandy 39-57710 grass seed attachment.

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
CONVERSION TABLE

1 hectare (ha)	= 2.5 acres (ac)
1 kilometre/hour (km/h)	= 0.6 miles/hour (mph)
1 metre (m)	= 3.3 feet (ft)
1 kilowatt (kW)	= 1.3 horsepower (hp)
1 millimetre (mm)	= 0.04 inches (in)
1 kilogram (kg)	= 2.2 pounds mass (lb)
1 newton (N)	= 0.2 pounds force (lb)
1 litre (L)	= 0.03 bushels (bu)
1 kilogram/hectare (kg/ha)	= 0.9 pounds/acre (lb/ac)
1 kilogram/cubic metre (kg/m^3)	= 0.08 pounds/bushel (lb/bu)

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