A BRAN BAIT SPREADER

R. J. Ford

Research Station, Research Branch, Agriculture Canada
107 Science Crescent, Saskatoon, Saskatchewan S7N 0X2

Contribution no. 880, received 3 December 1984, accepted 26 September 1985

Ford R. J. 1986. A bran bait spreader. Can. Agri. Eng. **28**: 19–21.

The development of a truck-mounted spreader to apply dry bran bait for the control of grasshoppers is described. The spreader is air assisted and uses a ground-driven feeder to provide constant application rates regardless of ground speed.

INTRODUCTION

Grasshoppers have been a recurring problem on the Canadian prairies for as long as cereal crops have been grown in the area. Current practice often is to treat infested areas with aqueous sprays of insecticides when the grasshopper infestations have reached levels where they can cause economic damage. With the toxicity of modern insecticides has come pressure to reduce the amount of chemical applied and to improve the selectivity of application, so that the chemical is delivered to the target insects without contaminating the crop or killing nontarget species.

In the 1920s, grasshoppers were controlled by a poison bait consisting of sawdust, molasses, water and arsenic. The bait was broadcast from a truck or wagon with a scoop shovel or by a ground-driven spinning disk similar to those now used for spreading sand on the road in winter (Riegert 1980). This type of application was abandoned after the advent of 2,4-D for weed control, which made sprayers commonly available, and the introduction of newer insecticides. It was much easier to pour the insecticide into a tank, add water and spray the solution on the field than it was to mix and shovel out the wet, heavy bait.

Recent studies have shown the efficacy of insecticide baits using wheat bran as the carrier (Mukerji et al. 1981). There is, however, no equipment available with which to spread the baits in the field.

MATERIALS AND METHODS

A spreader was built following the pattern of the old style spinning disk spreaders (Fig. 1). Bran was delivered by a small auger to a horizontal spinning disk. Both auger and disk were electrically operated. The spreader was mounted in the rear of a four-wheel-drive truck.

Following initial field tests a second spreader was built (Fig. 2). This spreader used the same hopper and auger as in the original spreader but the disk was replaced with a squirrel cage fan. The bran was

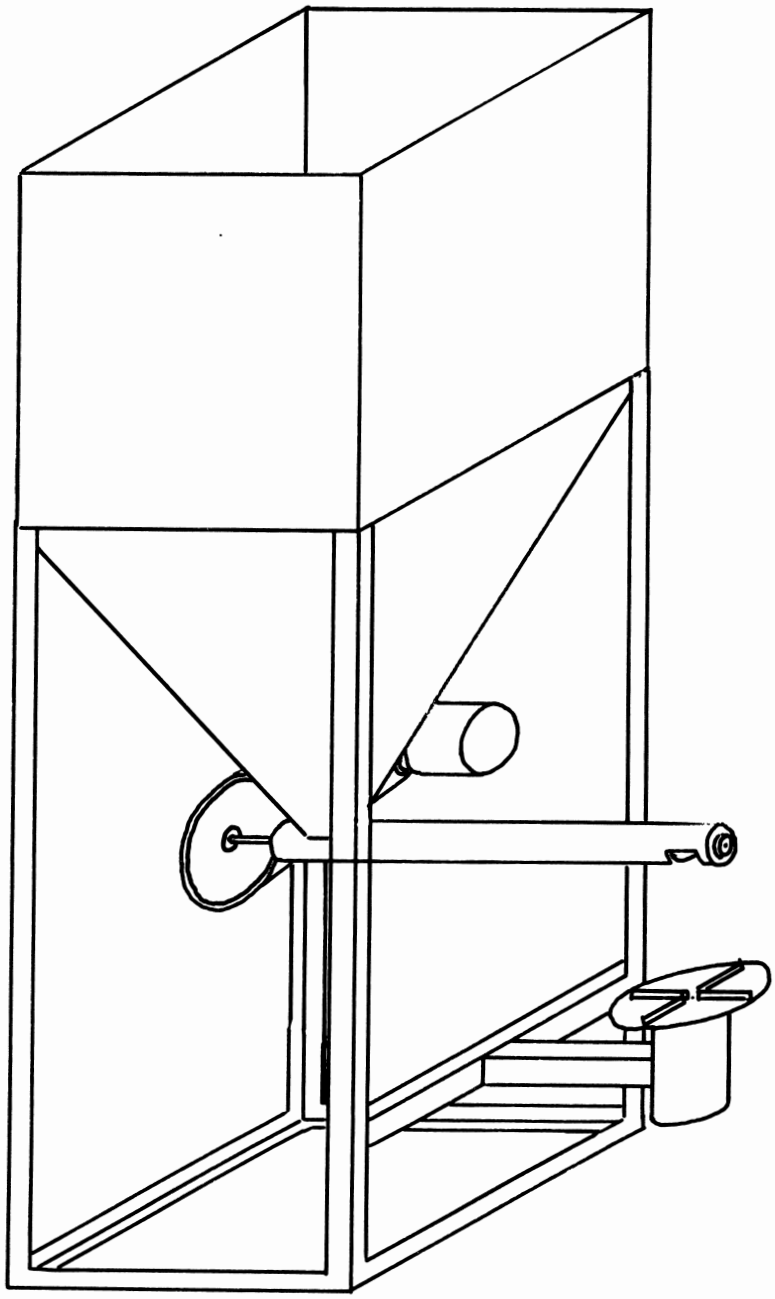

Figure 1. Spinning disk spreader as originally constructed.

delivered by the auger into the inlet of the fan, which was located with its outlet normal to the direction of travel of the truck on which the spreader was mounted.

Some trials were carried out in which the air stream was protected by a shroud, consisting of a frame extending 10 m out from the fan discharge and over which was hung a canvas shield (Fig. 3).

The configuration finally adopted, which has been in use three seasons now, is shown in Fig. 4.

The hopper and auger assembly remained almost unchanged. The auger discharged bran into the outlet of a 60-cm squirrel cage fan which was directed towards the rear of the vehicle. The air stream containing the bran was split and directed to both sides of the vehicle. A baffle was installed in the air duct to prevent the bran's settling to the bottom of the air stream before leaving the outlets.

A second change from the original design of the spreader was the addition of a ground drive for the auger. A power-take-off from the truck's transfer case was connected to the auger through a variable ratio belt drive consisting of a pair of step pulleys and a pair of continuously variable pulleys. This drive could be set to deliver bait at rates 2–15 kg · ha $^{-1}$. Applications were made only over the range of 3–5 kg · ha $^{-1}$.

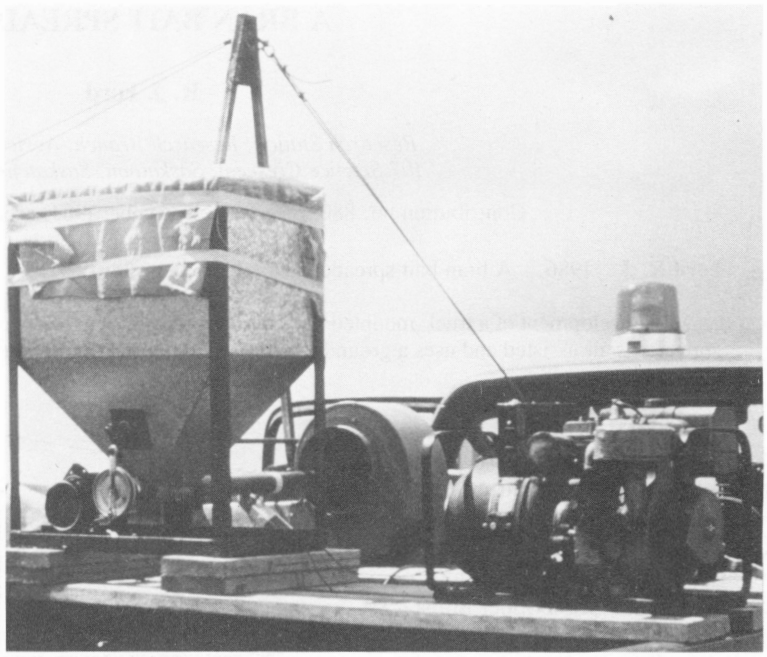

Figure 2. Truck-mounted bran blower with side-mounted blower and auger feeding directly into the fan outlet.

Figure 3. Truck-mounted bran spreader with shroud added. Note the effect of wind on the sides of the shroud, which are beginning to form an airfoil shape.

RESULTS AND DISCUSSION

The first attempt to use the spinning disk spreader revealed that dry bran does not behave the same as wet sawdust.

Wet sawdust tends to form relatively large clumps which, with their roughly spherical shape and high mass, will travel a considerable distance through still air. Bran bait does not clump into large aggregates, but remains as small, separate, planiform particles. These particles tend to orient themselves at right angles to their trajectory, developing high drag forces and losing horizontal velocity very quickly. As a result, the spinning disk, which could throw pelletted material 5 m or more, could not broadcast over a swath greater than 1 m.

The spinning disk spreader was tried under field conditions, but in order to achieve suitable application rates with the narrow swath width, it was necessary to resort to ground speeds approaching 40 km · h $^{-1}$. This proved unworkable.

Since the primary factor limiting the swath width was the air resistance experienced by the bran particles, it was decided to add an air assist by replacing the spinning disk with a squirrel cage fan (Fig. 2). This system functioned adequately under calm conditions. If there was any breeze, however, the stream of air from the fan broke up within a couple of metres, thus again limiting the swath width.

The addition of a shroud to the spreader gave a swath width approaching 10 m under most conditions, but the shroud was awkward to handle and tended to shape itself into an airfoil that caused the entire shroud assembly to lift. Also, the rough ground conditions that are often found on range land usually caused the shroud to hit the ground and also caused the feed auger to contact the blades of the fan, ultimately causing the fan to fail.

The redesign of the spreader with the bait being introduced into the outlet of a larger fan solved many of the problems experienced with the earlier designs. The increased air output of this fan, combined with the bilateral discharge, gave a swath width of about 10 m at vehicle speeds from 5 to 40 km · h $^{-1}$ without the use of any protective shroud. With the provision of the variable drive the delivery rate of bran to the fan outlet could be adjusted over a wide range yet remain constant with respect to distance travelled regardless of

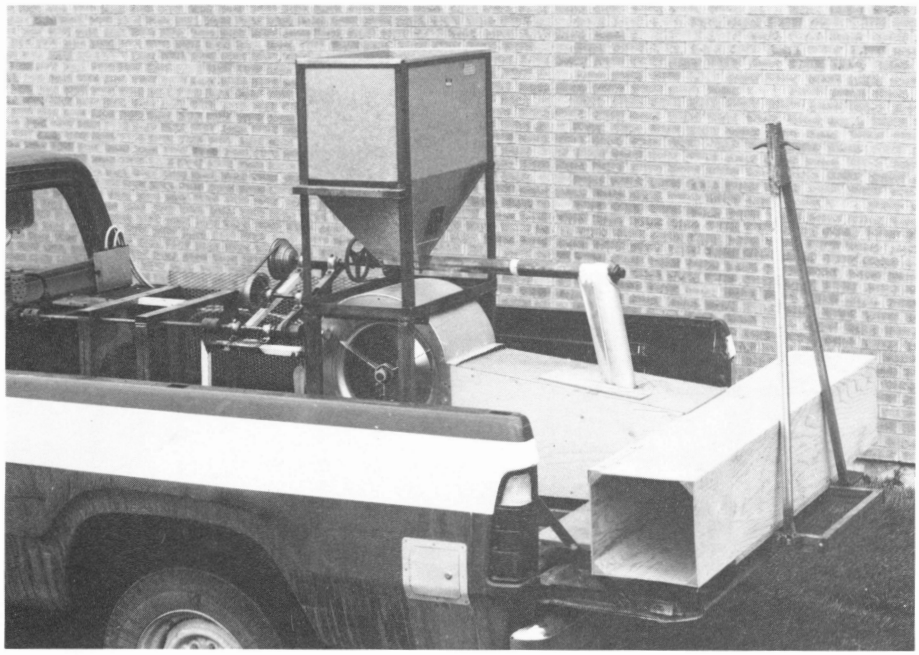

Figure 4. Truck-mounted bran bait spreader with two-sided rear discharge and PTO operated feeder mechanism discharging into the fan outlet.

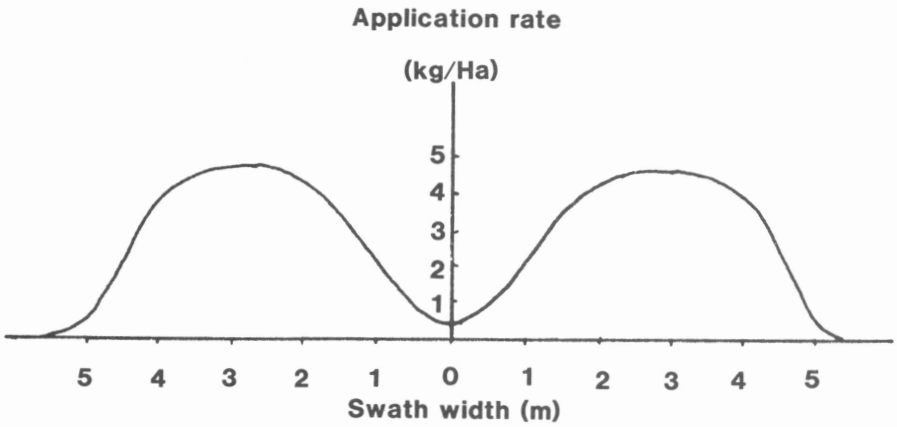

Figure 5. Typical swath pattern from the bran bait spreader with two-sided rear discharge operating in calm air conditions.

vehicle speed. Stopping the vehicle also stopped the auger, preventing localized overdosing.

Experience over three seasons has indicated that this applicator is capable of applying bran bait at rates within 5% of the desired rate. The swath pattern of the spreader is strongly dependent on vehicle speed as well as wind velocity with respect to the vehicle. Under calm air conditions, with the vehicle kept stationary by shifting the transfer case selector to neutral, the swath pattern is of the form shown in Fig. 5. The spreader was used in a series of comparative tests with four insecticides which were formulated as baits (Mukerji et al. 1981). During the course of these trials baits were applied at rates of 2.25, 4, 7, 9, 11 and 13 kg · ha^{-1}. Application speeds ranged from 5 to 40 km · h^{-1} depending on ground conditions. Spreader passes were made at 10-m intervals to the extent that the terrain permitted. Some of these trials were carried out on rough terrain which required the use of the truck's four wheel drive in order to climb steep slopes. There was no indication of a reduction in efficacy of the applications carried out under these conditions.

Treatments were completed in about one-half the time required by the conventional ground spray equipment used as a control in biological tests of efficacy which were being carried out, because of the higher speeds possible, particularly over rough terrain.

CONCLUSION

The air-assisted spreader described was capable of distributing wheat bran baits at rates of 2.25–13 kg · ha^{-1} in a 10-m swath at variable speeds over both smooth and rough terrain for the control of grasshoppers, an operation for which there is no equipment available commercially.

REFERENCES

RIEGERT, P. W. 1980 From arsenic to DDT. University of Toronto Press, Toronto, Ont.

MUKERJI, M. K., EWEN, A. B., CRAIG, C. H. and FORD, R. J. 1981. Evaluation of insecticide-treated bran baits for grasshopper control in Saskatchewan (Orthoptera: Acrididae). Can. Entomol. **113**: 705–710.