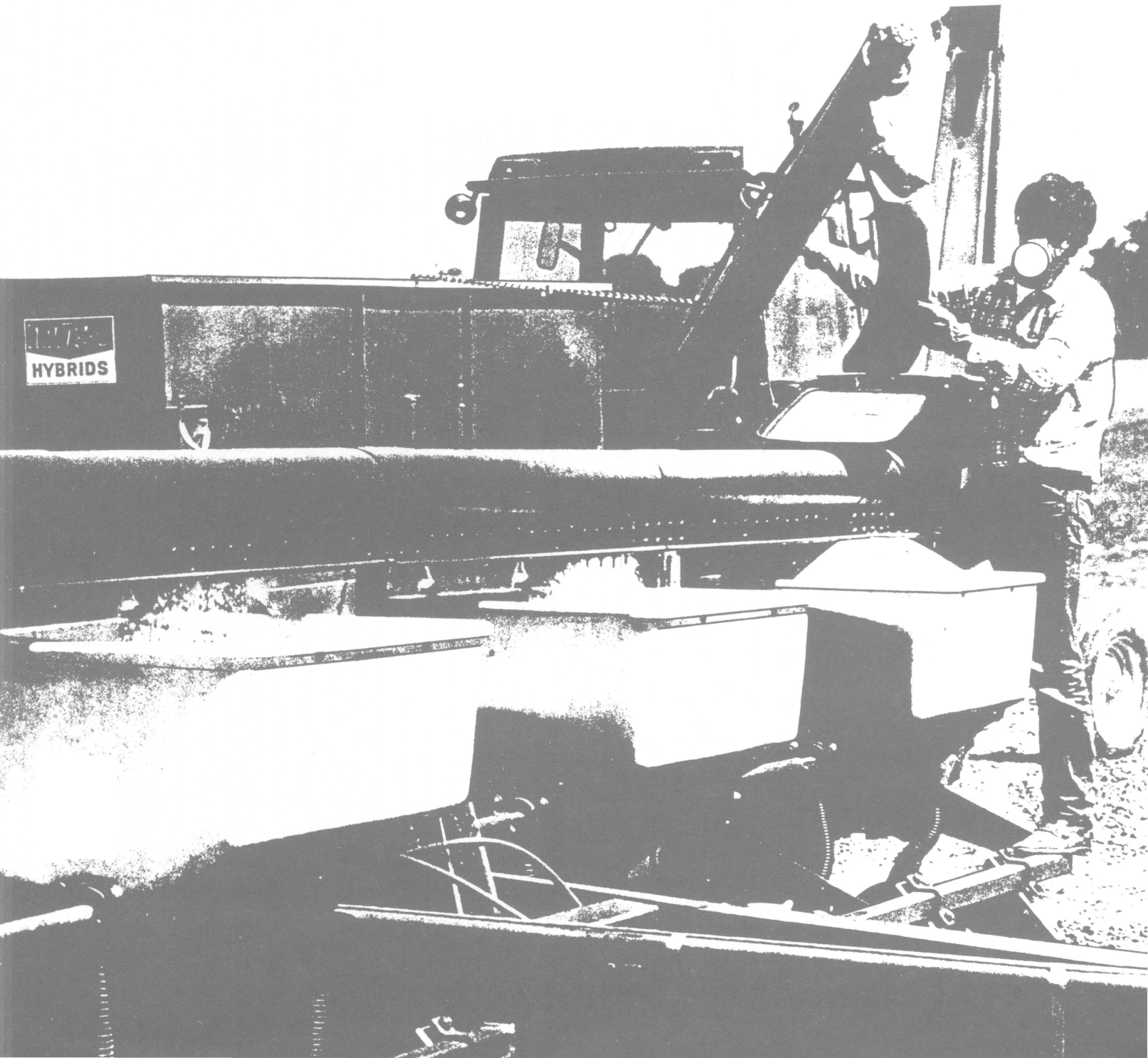
BULLETIN 704
AGDEX 100/600/744

EQUIPMENT FOR APPLICATION OF GRANULAR PESTICIDES



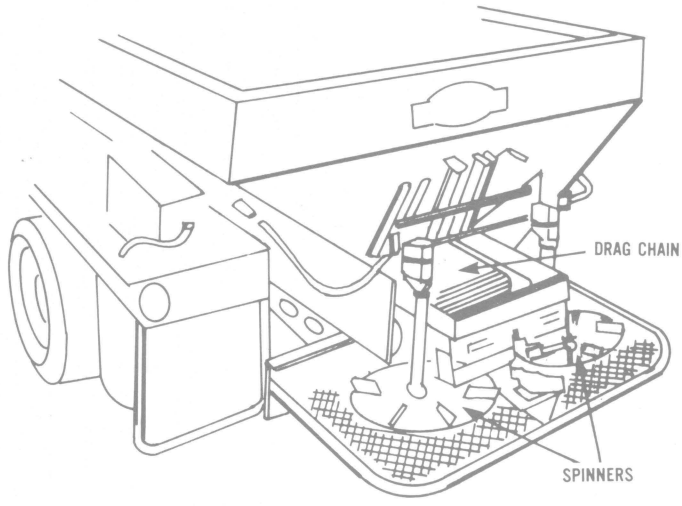


Fig. 1: Spinner spreader

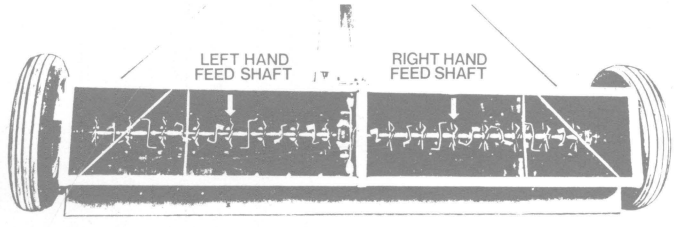


Fig. 2: Drop type spreader

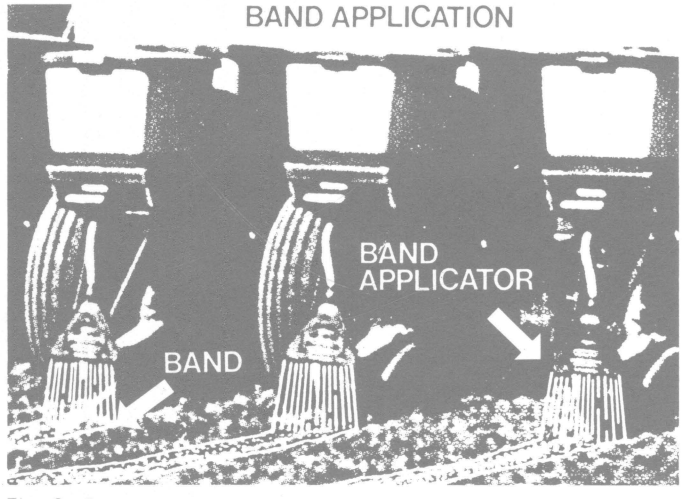


Fig. 3: Band application

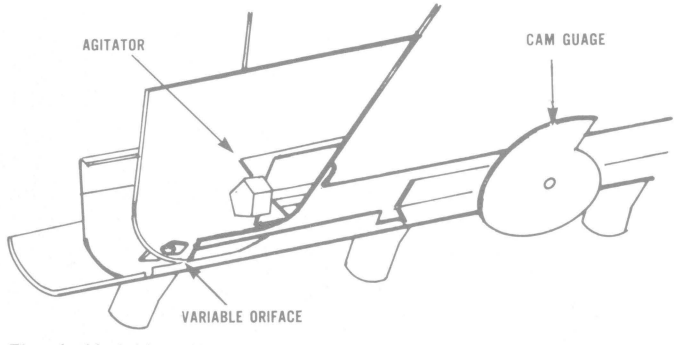


Fig. 4: Variable orifice metering

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Granular pesticides are made by applying a liquid formulation of active ingredient to granules of a porous material. The resulting material requires no further mixing. It may be broadcast over an entire area (Figs. 1 & 2), applied in a band 7 to 14 inches wide over the row (Fig. 3) or applied as a concentrated band in the row.

The recommended amount of pesticide must be applied to achieve pest control. Application of too much pesticide may cause damage to present or subsequent crops. An inadequate amount may not control the pest. In either case, the result can be costly. Even though the proper amount of material is applied per acre, over and under application may occur because the pesticide is not uniformly distributed.

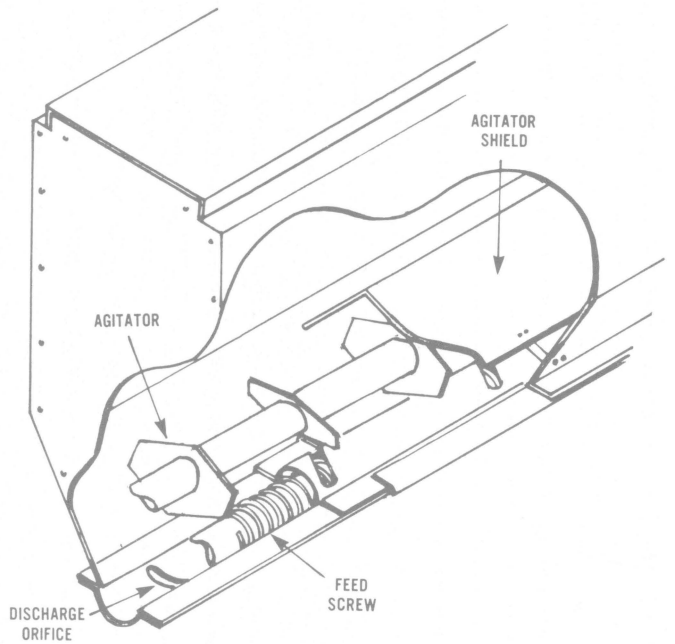

Fig. 5: Positive feed meterinig

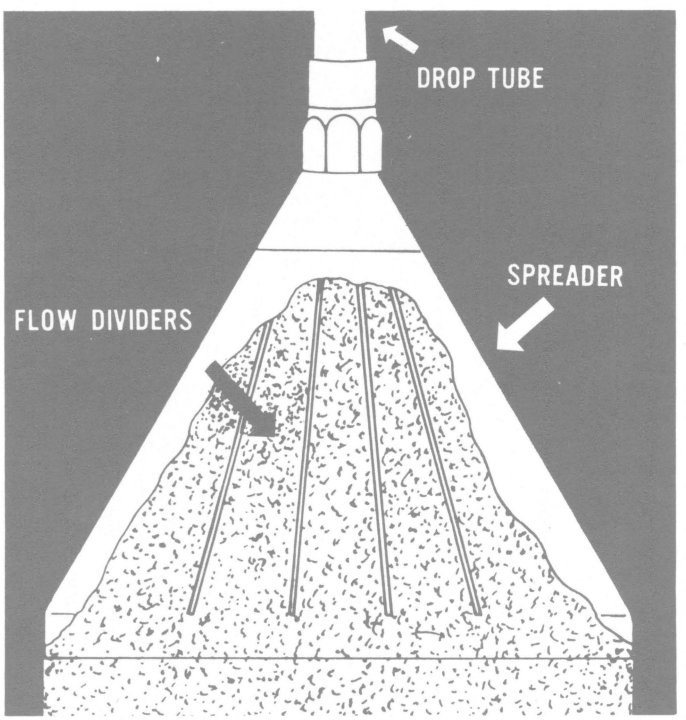

Fig. 6: Flow divider for band application

Granular Application Equipment

Granular applicators consist of a hopper, a metering device and a means of distributing the material. The metering device is usually some combination of a fixed or variable orifice, an agitator and a metering wheel. Generally speaking, the devices meter either by gravity (continuous) flow through an adjustable orifice (Fig. 4) or by a positive (volumetric) metering device (Fig. 5). Positive metering devices usually have some type of fluted wheel or auger. The metering rate may be changed either by changing the speed of rotation or by changing the exposed width of the fluted wheel.

On most machines, agitators and metering wheels are ground driven. However, on some machines the metering device is driven from the power take-off or by an electric or hydraulic motor. The machine may have only one metering device, one for each row or many closely spaced over the full width covered. Distribution may be accomplished by permitting the material to fall freely from the metering device, impacting the material against a flat surface, using a flow divider (band spreading-Fig. 6) and by the use of single or multiple spinners (Fig. 1).

Application equipment may be pulled or transported by hand, tractor, truck or aircraft.

Application Rate

The application rate (pounds per acre, pounds per 1000 square feet, ounces per 1000 feet of row, etc.) primarily depends on one or more of the following:

- Size of the fixed or adjustable orifice
- Speed of rotation of the fluted metering wheel
- Speed of travel
- Ground slope
- Properties of the material

Size of orifice, speed of rotation and travel: The effect of the first three of these upon the application rate depends on the type of metering device. If the device meters by gravity flow with a variable orifice, increasing orifice size increases the application rate. Application rate will decrease with increased speed of travel and with some machines change with roughness of the ground and rate of agitation.

If a positive metering device is driven by a ground wheel, speed of travel may have little effect upon application rate. However, if the metering device is driven by the PTO or a similar source of power, application rate will increase with an increase in speed of rotation of the fluted metering wheel. Thus, the application rate changes if the ratio of ground speed to fluted wheel RPM changes.

Ground slope: The rate of application may be changed if the equipment is operated either across or up and down a slope. If the equipment is to be operated on slopes, check the rate of application to find how your equipment performs under these conditions.

Properties of the material: Flow rate is affected by particle density (weight per unit of volume), particle size, particle shape and the moisture content of the material. Thus, the machine must be calibrated and adjusted to give the desired application rate for every material used. A change in atmospheric conditions can change the characteristics of the material with a re-

sulting change in application rate. A machine adjusted to apply the proper amount in the morning may apply too much or too little material by afternoon.

Uniformity of Distribution

Uniformity of distribution is affected by the characteristics of the equipment and the manner in which it is operated, size and weight of the granules and wind velocity. Equipment that uses multiple, closely spaced, metering devices may tend to band the material immediately below the openings. The flow rate from some positive metering devices (fluted wheels and augers) is not constant. This can result in periodic variations in application rate in the direction of travel.

Spinner type applicators have widely varying distribution patterns. Most users will have no idea of the distribution pattern for the machine being used. If the manufacturer does not specify a swath width, it is suggested that the path of the machine travel (swath width) be one-third of the pattern width. (Fig. 7). This gives a triple overlap and should provide a fairly uniform distribution for any spreader. For example, if the pattern width is 24 feet, the swaths should be 8 feet apart. When practical, travel around the perimeter of an area rather than using a back and forth pattern. This compensates for spreaders which apply more of the material to either the right or the left of the centerline of travel.

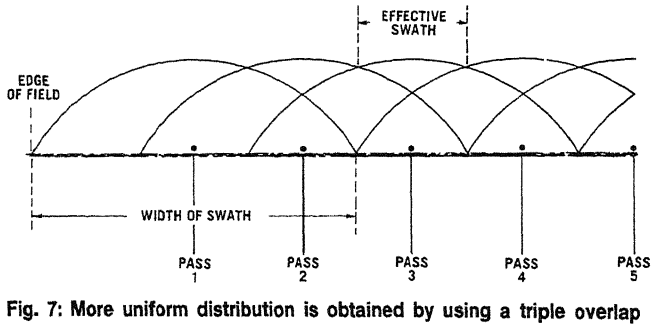

Fig. 7: More uniform distribution is obtained by using a triple overlap

Calibration

Granular applicators are calibrated by collecting and weighing the material metered while covering a known area. The following steps are recommended:

1. Determine the desired application rate. Recommendations for broadcast applications will be given either as weight of material per unit of area planted (lbs/ac, lbs/1000 ft², etc.) or as weight of active ingredient per unit of area planted. Application rates for bands are the same as for broadcast. However, because only a portion (the band) of the total area is treated, the amount of material required per acre is less than when broadcast. If you have only the broadcast rate recommendation, the amount required per acre planted for band treatment can be calculated as follows:

$$\text{lbs/ac. planted} = \text{broadcast rate lbs/ac} \times \frac{\text{band width, inches}}{\text{row width, inches}}$$

Band application rates may be specified in terms of pounds per acre for 40-inch row widths. The same amount of material is applied per unit of row length regardless of row spacing. Thus, equipment calibrated for 40-inch rows would also be calibrated for any other row width. For this reason, band and row application rates may be given in ounces or pounds of material per 1000 feet of row. The ounces per 1000 feet of row can be calculated as follows:

$$\frac{\text{ozs}}{\text{1000 ft row}} = \frac{\text{lbs/ac planted x row width in inches}}{32.67}$$

Example 1:

Apply 10 lbs/ac in 14 inch bands, 28-inch row spacing.

$$\frac{\text{ozs.}}{\text{1000 ft row}} = \frac{10 \times 28}{32.67} = \text{8.6 ozs/1000 ft row}$$

2. Use the calibration information provided by the equipment manufacturer or the recommendations on the pesticide label to obtain an initial setting of the metering device.

3. Fill the hopper half-full and collect the material in plastic bags while travelling at normal speed for a measured distance. The distance must be far enough that sufficient material is collected to be weighed accurately on scales (such as postal, food or baby scales) suitable for small quantities. Calculate the application rate and compare to the recommended rate. You should be within plus or minus 5 percent of the recommended rate.

4. Adjust metering rate as required and recheck.

Example 2:

Material is to be broadcast at the rate of 20 lbs/ac. Twenty ounces are collected while travelling 250 feet. The effective width is 10 feet.

$$\text{application rate} = \frac{\text{weight of material collected}}{\text{area covered}}$$

$$= \frac{\text{wt. collected (20 ozs)}}{\text{width (10 ft) x dist. (250 ft)}} \times \frac{43560 \text{ ft}^2}{1 \text{ ac}} \times \frac{1 \text{ lb.}}{16 \text{ ozs}}$$

$$= 21.78 \text{ lbs/ac}$$

Reduce application rate and retest.

Example 3:

Material to be applied in 12-inch bands over 30-inch rows at the rate of 8 lbs/acre covered. A 4-row unit is being used. The material is caught, weighed and recorded separately for each row while travelling 2000 ft.

a.	Row	1	2	3	4
b.	Ounces/2000 ft.	13.6	14.0	15.0	14.8
c.	Divide b by 2 ounces.	6.8	7.0	7.5	7.4
d.	Find recommended ounces per 1000 ft. $= \frac{8 \times 30}{32.67} =$	7.35	7.35	7.35	7.35
e.	Subtract d from c.	−0.55	−0.35	0.15	0.05
f.	Take 5% of d.	±0.37	±0.37	±0.37	±0.37

Compare the actual variation from the recommended (e) with the permissible variation (f). Row 1 is not within the permissible variation and must be adjusted and rechecked.

After calibrating, constantly check quantity applied and area covered to be certain the application rate does not change.