A MARKER SYSTEM USING TITANIUM OXIDE

By G. H. BLAIR, Christchurch

IN introducing the subject of a marking device to assist accurate spraying of weeds in crops and pastures I do not think it necessary to go over all the reasons why it should be used; suffice to say a conscientious workman will welcome it provided it is of practical and economic value.

I do not claim that this device is a complete answer but rather that it is a practical partial answer consistent with economic soundness in so far as it not only minimises the risk of misses due to wide driving even while using booms of 24ft. width, but also relieves the operator from the strain of concentration, particularly the contractor.

Other methods we tried prior to adopting this titanium oxide system were careful judgment in driving, an extension to the boom with a chain attached to drag over the wheel mark of the previous round, and a system of sighter poles. The first two methods gave mediocre results while using narrow booms, but were impractical with wide booms. The third method, besides being uneconomic, caused an undue strain on the operator.

The efficiency of the device in pasture is high. In cereals it is also high with the exception that due to refraction the line is not quite so easily picked up when driving into the sun. In pea paddocks where there is a heavy infestation of weeds no trouble is experienced, but on the other hand if the weeds are very small and far apart, some trouble is experienced in picking up the line. This is due to the fact that the marker spray droplets run together on the smooth glassy pea leaf to form a globule, which on the one hand reduces the area covered and on the other does not dry fast enough to emphasise the vivid whiteness of titanium oxide. In these cases we generally double the quantity of titanium oxide per gallon of water and at this concentration it is possible to leave a practicable line on bare earth. The use of polaroid glasses assists in observing the line in difficult sun conditions.

The design of the device is on the basis of a $\frac{3}{4}$ in. centrifugal pump driven at 3000 r.p.m., giving an output of approximately 750 gallons per hour against an approximate head of 42ft. or 18lb. per sq. in. pressure. The pressure may be maintained by either a stop cock or relief valve on the delivery relief line. In either case the pressure must be set by using a test gauge, after which the stop cock or relief valve, as the case may be, must be locked in adjustment and the gauge removed in order to prevent damage to the mechanism due to sedimentation of the titanium. If a relief valve is used, it must be set in an upright position to prevent sedimentation jamming the spring.

The tip used in the single marker nozzle is a Tee-jet 6503 with an output capacity of approximately 16 gallons per hour at 18lb. per sq. in. Therefore the return which is used for agitation is at the rate of approximately 734 gallons per hour. To get greater efficiency from

this return it is advisable to use as small a tank as possible and to this end we use a 4-gallon tank, which will at $4\frac{1}{2}$ miles per hour using a 23ft. 4in. boom do approximately 3 acres per fill. To minimise the chance of the hose between the pump and the nozzle acting as a settling out chamber for the suspended titanium it is desirable to have as small a diameter hose as possible. To this end we use $\frac{3}{16}$ in. internal diameter pressure hose, which is run out along and attached to the boom. The marker nozzle itself is used about 6in. above the crop or about 12in. above the ground and is pointed forwards. Further, it is pointed about 30 degrees below the horizontal and about 20 degrees inwards to the tractor with the fan of the nozzle more vertical than horizontal. The nozzle is screwed into a $\frac{1}{4}$ in. gas socket, which is welded on to one end of a 12in. length of $\frac{1}{4}$ in. gas pipe at an angle 120 degrees below the vertical. To the other end the hose is attached through a $\frac{1}{4}$ in. thread and $\frac{3}{16}$ in. tail, which is screwed into another $\frac{1}{4}$ in. socket, which is welded to the other end of the 12in. length of $\frac{1}{4}$ in. gas pipe at 120 degrees below the vertical. The 12in. length of pipe is held in a clip, which is tightened by a wing nut. To adjust the height of the nozzle in relation to the boom it is a matter of loosening the wing nut and sliding the pipe up or down as the case may be. The clip is welded to a piece of steel $\frac{1}{4}$ in. thick and 1in. square which has a $\frac{3}{8}$ in. hole in the centre. On the end cap of the boom is welded a $\frac{3}{8}$ in. bolt $1\frac{1}{2}$ in. long and if the following parts are placed on this bolt in the following sequence— $\frac{3}{8}$ in. steel washer, piece of $\frac{1}{4}$ in. hard rubber of same diameter as washer, piece of steel with clip and pipe attached, piece of $\frac{1}{4}$ in. hard rubber, $\frac{3}{8}$ in. steel washer—and the nut tightened to moderation, the bolt will act as the spindle of a slip clutch, which will give protection to the device in the event of it striking the ground. To the other end of the boom another $\frac{3}{8}$ in. bolt is welded to the end cap and on this is suspended a length of light chain sufficient to drag on the ground when the boom is in its highest working position.

The amount of titanium oxide used with a Tee-jet 6503 is 11b. per 4 gallons of water for normal work. In operation the spraying outfit is driven round and round the paddock with the chain end of the boom to the fence for the first round. In the second and subsequent rounds the outfit is driven with the chain dragging over the white line left by the marker nozzle on the preceding round. Titanium oxide suspension should not be left in the tank for long without agitation, as it settles and packs to the point that water agitation will not re-suspend it. Settling is hastened by hard water. Thorough flushing of the system each night or on cessation of work is necessary. Under some conditions, for example short thick turf, it has been found advantageous to direct the marker nozzle almost vertically downwards. As the device is adjustable, this is possible. The system has been devised to operate on booms that are rigid as far as vertical movement is concerned and it is not envisaged that full efficiency could be achieved from a fluctuating suspended type of boom.

In conclusion I would like to mention some modifications recently made to the set-up, which though they have given very satisfactory results under trials, have not yet been used on commercial work. The tank has been modified to the extent that it has been set on end and a conical bottom added with the outlet to the pump from the bottom of this inverted cone. This ensures that any portion of the mix which tends to settle is immediately re-agitated through the pump and back to the top of the mix in the tank. The manner of return is such that a swirling motion is set up in the tank by introducing the return stream at only a small offset angle from the side of the tank. If the return is

overdone under this system, a vortex forms as the tank becomes empty, with the result that the pump intermittently sucks air. Further, an inch centrifugal pump has been substituted for the $\frac{1}{2}$ in. pump. This gives a delivery of approximately 1800 gallons per hour at 3000 r.p.m. with a 42ft. head. The use of a Tee-jet 6503 with an output of 16 gallons per hour therefore gives a return of approximately 1780 gallons per hour.

DISCUSSION

Q.—Could the speaker indicate the position regarding present availability of titanium oxide?

A.—It is in very short supply.

Q.—What is the cost of the necessary equipment?

A.—A lin. pump costs about £11. The whole outfit would cost £15, or possibly less.

Q.—What does it cost per acre sprayed to use the marker?

A.—Cost of using it is less than 6d. per acre.

Q.—Has the speaker used wetting agents to get titanium oxide to stick better and show up better?

A.—I have not got much satisfaction from wetting agents.

Comment: Tests with titanium oxide as a marker in gorse spraying did not indicate any serious incompatibility between the oxide and the wetting and emulsifying agents in the weedicides used for this purpose.

Q.—Has the speaker considered intermittent spraying of titanium oxide as distinct from the continuous line effect in order to reduce the amount of material required and consequently reduce cost?

A.—Yes, but it would require pneumatic or electrical equipment, which would be delicate and costly.

Q.—Has the speaker used titanium oxide as a marker for gorse?

A.—No, I can foresee no difficulty in using this marker on short gorse, but on tall gorse the results would probably be unsatisfactory.

Q.—Has the speaker tried water-soluble dyes?

A.—I have used potassium permanganate, but found it not vivid enough.