THE CONTAINERISATION OF HERBICIDE MIXTURES AS DEVELOPED AT ILLOVO

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Abstract

A system is described which has reduced errors in the application of herbicides. The chemicals are mixed into a concentrated slurry which is then packed into plastic bags, one or more bags being required for each spraying unit. A pacemaker is also described which can be used to correct the walking speed of labourers when spraying with knapsacks.

Introduction

One of the main factors contributing to the failure of herbicides is poor application, which results in either too little or too much chemical being applied to a given area. Weed control is either very poor or crop damage severe.

Herbicide use at Illovo has increased from 100 hectares sprayed ten years ago to some 1 600 hectares per annum at present. In financial terms the herbicide budget has increased ten-fold. The chemicals currently used are expensive and are far more sophisticated than those originally used. Failures must now be avoided as they are expensive in terms of chemical wasted and in terms of subsequent weed control measures required. The main cause of failure could be that the incorrect quantity of chemical is added to the spraying device. The system presented in this paper has reduced this source of error at Illovo. Poor application can now only result from poor spraying, i.e. incorrect speed, pressure or nozzle size.

The containerisation system has evolved over a number of years. In the early days of herbicide use on the estate, most of the chemicals used were liquids (e.g. 2,4-D) and could easily be measured out in the field. With the introduction of wettable powders, measurement by mass in the field was more difficult and a volume measure was often used. This led to large errors, as the measure was easily damaged and the volume weight of the powders could vary greatly with compaction. The mixture was then made up in a 200 litre drum, whereupon settling out of the powder was difficult to eliminate, especially once a layer of wet powder had formed at the bottom of the drum. Weed control was often erratic and cane damage was frequent.

The bottle system

To overcome the problem a centralised mixing shed was established, in which the various herbicide mixtures were made up into a concentrated slurry. This concentrate was then decanted into a returnable plastic bottle. Each marked bottle contained enough chemical for one knapsack. At this stage all the spraying on the Estate was done with knapsacks.

Although the bottles contained the correct quantity of chemical, settling in the bottle resulted in a layer of chemical which was extremely difficult to remove. With some chemicals this layer became very hard and again the quantity of chemical reaching the knapsack was subject to large variations with the obvious results. The transport of these bottles was also difficult and many were lost and damaged and leakage was also a problem.

The bag system

It was then decided to test plastic bags, such as those used for milk in some areas. The bag chosen was made of 300 gauge plastic film, 225 × 345 mm and cost 1,5 cents. The removal of the herbicide from a bag this size is simple as the bag can be manipulated to bring the sediment back into suspension.

The central mixing shed has been modified to streamline the operation and improve ventilation two mixing tanks being used. These were supplied originally with hand operated paddles but electric motors through gear boxes have now been fitted to activate the paddles, which now rotate at 50 rpm, this motion ensuring proper mixing and preventing settling.

FIGURE 1 A marked bottle and plastic bags filled with herbicide.

FIGURE 2 The paddles in the mixing tank.

When making up a mixture, the weighing of powders is avoided as far as possible by using complete containers of chemical. Liquids are easily measured and present little problem.

A mixture of diuron and MCPA would be prepared as follows (the rates required are 2 kg diuron, 5 ℓ of MCPA and 1,5 ℓ of surfactant per hectare):

The diuron is received in a 25 kg drum, enough for 12,5 ha. Thus 62,5 ℓ of MCPA and 18,75 ℓ of surfactant should be added to the 25 kg of diuron. The quantity of water required then depends on the amount of liquid to be sprayed per hectare. If a knapsack of 18 ℓ capacity is used and the liquid rate is 180 ℓ per ha, then each knapsackful covers 1/10 of a hectare. The slurry must then be made up into 125 parts. At Illovo it has been found that these parts can be as little as one litre. Thus the slurry in this instance is made up to 125 ℓ with water.

Once the liquid rate per hectare has been established at 180 ℓ, then all the herbicide mixtures can be made up into 1/10 ha lots. At present the slurry is measured out in a one litre jug but it is hoped in due course to have a machine which will deliver a litre at a time. This will speed up the operation and reduce the current labour requirement from two men to one man. It will also be possible for one man to fill and seal 200 bags per hour.

Once filled the bags are heat-sealed in a sealing machine and then packed into a plastic crate. These crates can be stacked for storage and any leakage can be collected and used. Each crate holds 35 bags.

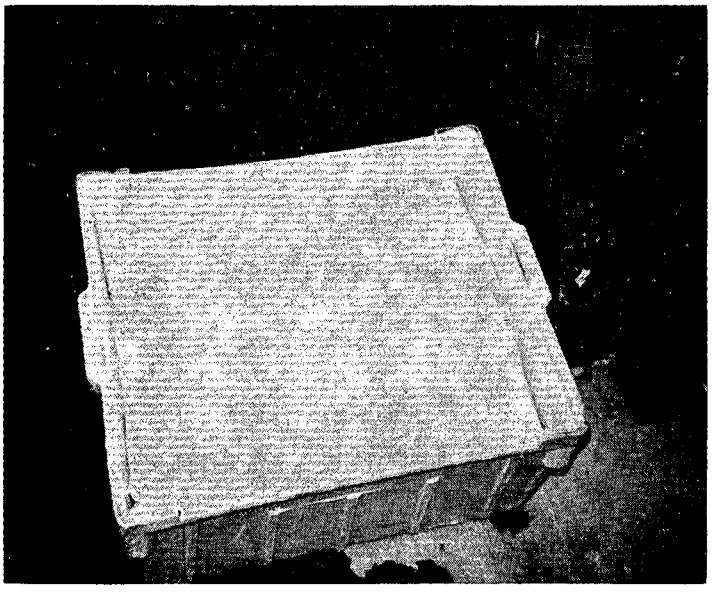

FIGURE 3 Crate filled with bags of herbicide.

The crate is marked with the mixture number and the number of bags in the crate. A numbering system is used for all herbicide mixtures. This has proved to be very useful as the labourers seem to find it is easier to use numbers rather than names. The crates are then transported to the field for use.

The contents of one bag is added to each knapsack. In tractor-mounted spray rigs more bags are required. The tanks of the rigs are marked off in 1/10 ha units and the herbicide from the required number of bags is added to the tank. The rig can be re-filled at any convenient point in the field even before it is empty. As a result, the output from the machine can be increased because the re-filling time is reduced.

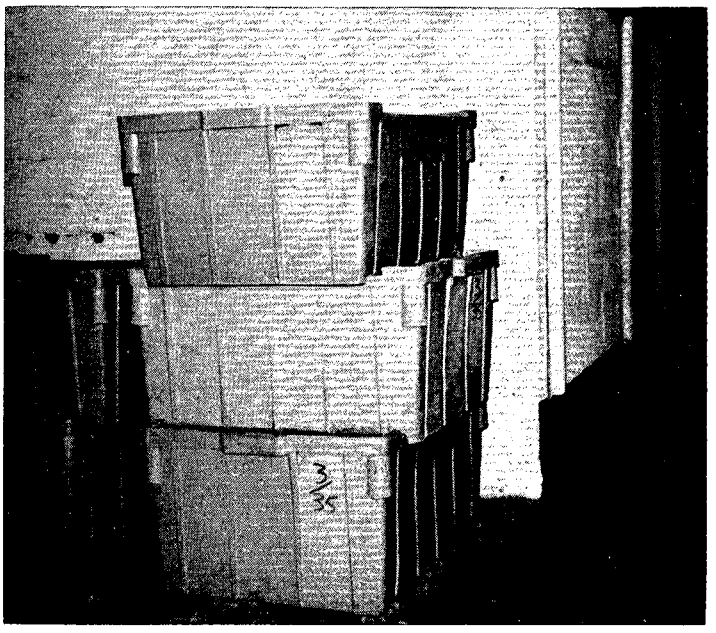

FIGURE 4 Filled crates stacked in store room.

The empty crates are returned to the mixing shed for re-filling. The bags are not re-used, as at a cost of 15 cents per hectare re-use is not warranted. The overall cost of the system is very low. This includes the cost for the two labourers, and the depreciation on the equipment, i.e., 2 mixing tanks and the heat sealing machine.

The pacemaker

The three basic sources of error in spraying are variations in speed, pressure and nozzle height. When spraying with knapsacks the variations of all three can be high. Pressure regulators can eliminate much of the variation in pressure but nozzle height variations are extremely difficult to eliminate. Speed can be broken down into pace length and the number of paces per unit time. If length of the walking pace can be maintained fairly constant then only the number of paces per minute need be controlled and with this in mind a pacemaker is being developed. This is an electronic device that emits a sound at a set time interval, the time interval being determined by the length of the walking pace and the required speed of travel.

One member of the spraying gang is chosen and his pace length is accurately determined. The pacemaker is set for him. He then sets the walking speed for the other members of the gang, their pace length and number per minute are immaterial, so long as they keep up with the leader.

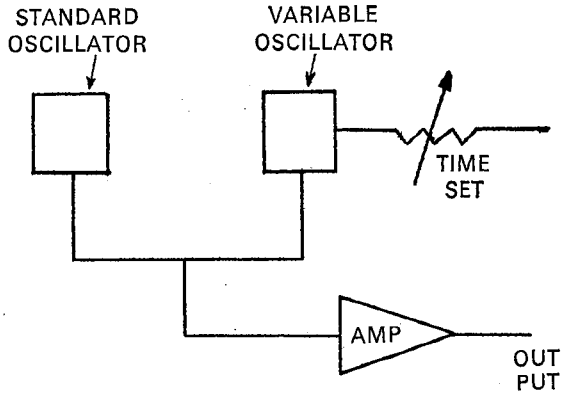

FIGURE 5 Block diagram of the pacemaker.

The circuit for this instrument is relatively simple. Two oscillators are compared and the resultant is fed into a driver amplifier. One oscillator can be varied to set the time interval, and this is compared with the standard. The accuracy is 0,01 % per one volt drop.

Conclusions

The plastic bag system has been used at Illovo for two seasons and has been very successful. There have been very few herbicide failures during this period and they have been the result of incorrect walking speeds. Problems have been encountered with mixtures containing alachlor and paraquat as these chemicals attack the plastic and leaks occur.

It has been found, however, that if the mixtures are used within ten days, no leakage will occur. Mixed chemicals are not normally stored for an extended period because spraying and mixing programmes are planned weekly.

The pacemaker has improved the consistency of the walking speed of the labourers and hence the accuracy of application. With this device the operator can concentrate on maintaining the correct nozzle height. It has also been very useful in training labourers to apply herbicide by means of knapsacks.

Acknowledgements

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