

NOTES ON THE DESIGN OF A HERBICIDE BOOM SPRAYER

By E. C. GILFILLAN

Agronomist for The Tongaat Sugar Co. Ltd.

Introduction

Perhaps the single most important factor in achieving success with pre-emergent herbicides is to ensure that the herbicide is applied under optimum surface soil moisture conditions. Pre-emergent herbicides must be applied within a very short time of burning and harvesting a field of sugarcane. Operations such as re-burning, cultivating and sub-soiling and raking must be done within a week at the height of the growing season, so that the herbicide can be applied as a proper pre-emergent treatment.

In order to ensure that pre-emergent herbicides are applied under the correct conditions, particularly regarding soil moisture, it is essential that large acreages be done in as short a time as possible. In many respects, aerial application of herbicides has provided the ideal solution to spraying large acreages in a very short time. More particularly, aerial application is well suited to the treatment of steep or broken terrain, which is unsuited for tractor applicators.

With low liquid volumes to be applied and reasonably large acreages to be sprayed, the cost per acre of aerial applications can be brought down to approximately 57 cents per acre, which is considerably cheaper than the cost of knapsack applications at approximately 65 cents per acre. There are, however, a number of disadvantages to aerial spraying. A considerable amount of organisation is required in order to arrange all the personnel and equipment necessary for the operation. This is not always possible at short notice, and, in some instances, the aeroplanes are not always immediately available. It was felt, therefore, that on a large estate, such as Tongaat, use could be made of a high-capacity tractor-mounted boom sprayer, as well as aerial application of herbicides.

A boom sprayer has been designed, which it is hoped will be able to fit into the general programme at Tongaat. It is planned to use it in conjunction with aerial and knapsack applications of herbicides.

Elements of the Design

Versatility has been a main objective in the design of this boom sprayer, and the following points have been incorporated:

1. Two 100-gallon glass fibre tanks are mounted longitudinally in place of the mudguards on the tractor (see Plates 1 and 2). The tanks are mounted low down and are long, and with the tractor wheels set as wide apart as possible the machine is sufficiently stable to permit working on steep slopes.

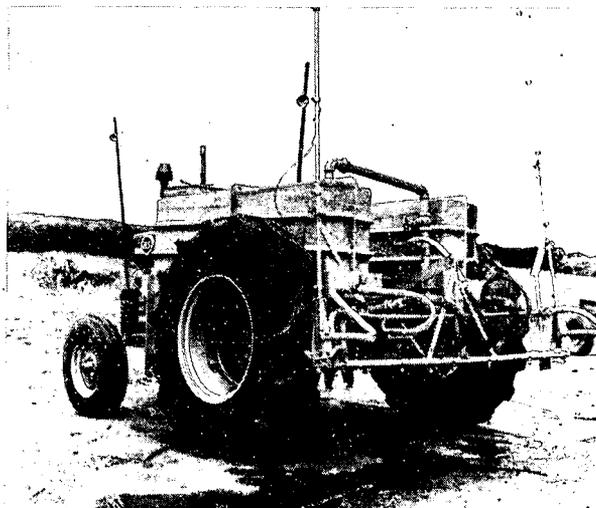


PLATE 1: General view of equipment showing tanks and boom in raised position.

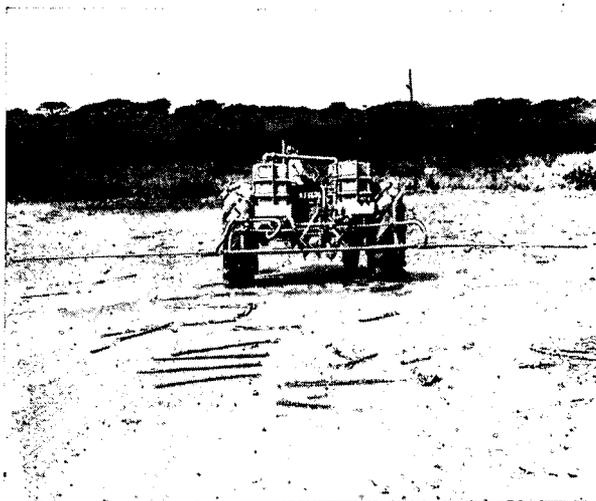


PLATE 2: Rear view of equipment showing boom in fully extended position.

2. By mounting only the boom on the three-point linkage of the tractor, it is possible to use the tractor for other purposes as the boom can be removed in a very short time.
3. A high-capacity (60 gallons per minute) rotary pump driven from the power take-off shaft of the tractor has been fitted. This is used in conjunction with 2-inch flexible hoses fitted with quick couplings to ensure that the time taken for the self-filling operation from a separate 400-gallon tanker is kept to a minimum. If this pump does not prove suitable for handling wettable powders it will be necessary to fit a

diaphragm pump instead. Used without the boom, the tractor pump and tanks have proved ideal for supplying aircraft with herbicide mixtures for aerial spraying.

4. A three-section boom, 26 ft. wide, has been fitted. The centre section is 8 ft. wide and rigidly mounted on the boom frame, while the two 9 ft. outer sections are spring-hinged to swing forwards or backwards and are suspended from the frame by light cables. Any of the three sections of the boom can be isolated by means of valves. The two outer sections are placed in a vertical position when the boom is attached to the back of a toolbar so that pre-emergent herbicides can be applied directly after cultivation (see Plate 3).

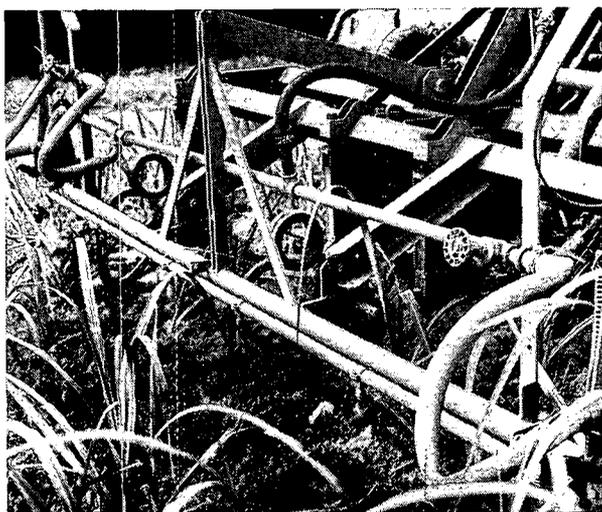


PLATE 3: Boom attached to the rear of a cultivator toolbar.

Performance

Very little work has been done with this machine at the time of writing. It appears, however, from initial assessments, that it should be possible, under good conditions, to spray 80 acres per eight-hour working day, including stops for filling the tanks. It is anticipated that the cost will be in the region of 30-40 cents per acre, which is appreciably lower than either knapsack or aerial applications.

Discussion

Dr. Cleasby (in the chair): During discussion on this paper I would welcome comments on chemical weed control generally.

Mr. Richardson: Mr. Gilfillan has moved away from three-point linkage and in placing the tanks forward he has achieved a high payload without losing manoeuvrability.

With such a big tank what by-pass agitation is there for correct mixing of the chemicals? Would not the long boom span of 26 feet cause difficulties on rough terrain?

Dr. Thompson (who read the paper on behalf of Mr. Gilfillan who was unable to be present): The

pump can handle 60 gallons a minute and the boom only supplies 5 gallons a minute so the by-pass is 55 gallons per minute which should be ample.

The boom has not given trouble, probably because the wheels are so wide apart.

Dr. Cleasby: Mr. Gilfillan has plenty of experience of North Coast conditions and designed the machine with them in mind.

Mr. Wise: Does 57c per acre aircraft cost include labour, etc., for filling the aircraft?

Dr. Cleasby: It is purely the cost of the aircraft. There are additional costs for filling, marker buoys, etc. The knapsack cost of 65c per acre includes all costs.

Mr. Moberley: What control has Tongaat had with aerial spraying, either pre-emergent or post-emergent?

Dr. Cleasby: Last year about 1,500 acres at Tongaat were given pre-emergent treatment from the air using the aerial form of the amine of 2,4-D. Most of it was on burnt ratoon fields and the results were far better than hand application of 2,4-D or tractor application. It is possible to spray up to 150 acres in the early morning under ideal conditions, particularly if there is some moisture present, and coverage is very uniform.

The treatment lasts up to six weeks.

Mr. Bartlett: How do you handle your grasses?

Dr. Cleasby: Last year about 1,500 acres at 2,4-D in all fields with bare land. In fields where we expect watergrass to be a problem we will use a Gramoxone post-emergent treatment.

For other weeds Karmex and Afalon have been used on a limited scale as a post-emergent treatment.

Mr. Souchon: Does an aircraft in spraying use the same amount of liquid as required for knapsack or tractor?

Dr. Cleasby: The aircraft uses less — only two gallons of liquid per acre.

Mr. Glisson: Why was the costly aerial method adopted — was it because of timing or terrain perhaps?

Dr. Cleasby: It is extremely convenient. It is possible to treat large areas as soon as they are ready and when conditions are right. In countries with more rainfall than us it is easier to use chemicals. We should apply weedicide after rain or when a heavy dew is present.

Mr. Wise: Are there any figures for yield when hand weeding is employed as opposed to weedicides?

Dr. Cleasby: Both are equally effective. There should be no damage to cane with herbicides as long as the correct amounts are used.

Dr. Thompson: The susceptibility of sugar cane to 2,4-D as a post-emergent treatment varies according to variety. Unfortunately N Co. 376 appears to be particularly susceptible.

Knowing that 2,4-D can have an effect on the crop, we are now trying to measure this quantitatively.

Meanwhile, we suggest that if 2,4-D is used post-emergent the spray should be directed to avoid cane foliage if possible.

Mr. Wise: At what rate is Karmex applied to ratoons?

Dr. Cleasby: Four pounds per acre, full cover. A line only application, as we would use, would be effectively half of that.

Mr. Richardson: What you say brings us back to tractor application. Low volume applications have been mentioned, and I wonder if Mr. Wardle could tell us something about this in connection with his tractor-mounted venturi mist blower which delivers at a rate of 13 gallons per acre.

Mr. Pearson: If 2,4-D is applied under proper moisture conditions, such as in the mist belt, results are quite remarkable as compared to when it is applied under less favourable dry conditions.

Mr. Wardle: I think tractor application of herbicides will always have a place in the sugar industry.

The machine used by Illovo, as described last year, has been further developed and now has three-point linkage. We are making tanks as mudguards which will reduce the height below the axle level. A lighter boom is being tried, a plastic one, which can be easily moulded. The linkage can be moved so that the tractor may be used for other operations.

Mr. Stewart: In a tractor-mounted sprayer we believe the water should be brought forward from the three-point linkage. We mounted 45-gallon drums which have the disadvantage of bringing the weight right forward and the stability is affected. Instead of a long boom we had skids with independently mounted nozzles but they were too cumbersome. They have been discarded for a narrower boom which gives better control of application. If a wide boom is used, possibly skids could be attached so as to modify height variations to suit the terrain.

Mr. Gosnell: In Mauritius it has been found that cane in the 5 to 7 leaf stage is very sensitive to even low doses of 2,4-D but before and after this stage it is much less susceptible.

Dr. Cleasby: When we had damage from a second post-emergent application of 2,4-D the cane was at about the 5 to 7 leaf stage.