

# THE CONTROL OF WEEDS IN PLANT CANE BY CHEMICAL SPRAY

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## Introduction

In presenting these observations on the application of chemical sprays for the control of weeds in plant cane and of the results obtained, it is not intended to express dogmatic ideas or to cross swords with the experts. This paper is merely a record of what has been done at Kearsney recently with chemicals to eradicate weeds, with different methods of application and with various mixtures and concentrates. The facts are given in the hope that they may assist planters in selecting some method of chemical weed control which might be sufficiently economical for use on their own farms. As will be shown, the cost of the various methods varies considerably. Generally speaking, the more expensive the mixture and the greater the number of applications the better are the results which are obtained, and the main consideration is to find that point where the expense involved justifies the control obtained.

## Methods of Application and Cost

There are at present two methods used for applying the spray. Firstly by means of a knapsack pump fitted with a boom with four or six nozzles. Using this method with a six-nozzle boom, one boy is able to spray two-and-a-half acres per day putting on emulsion at the rate of forty gallons per acre. For every two pumps, an additional boy is required to prepare the mixture, supply the pumps and generally assist the spray boys. Thus it takes three boys to cover five acres per day. Putting the cost of one boy at 5s., to cover wages, rations, etc., the total cost by this method is 3s. per acre for application. It is essential that a good type of knapsack sprayer be used—a suitable one costs about £12. Du Toit<sup>1</sup> states that at the Kekaha Sugar Co., in Hawaii, one boy with a hand-spray, applying solution at the rate of twenty-five gallons per acre, will do three to four acres per day.

The second method is application by means of a wheel tractor fitted with a fifty-gallon drum, a pump to maintain a pressure of 70 lb. and a hinged boom on which there are twenty-four nozzles or spraying jets. The cost of the drum, pump and boom is approximately £100; £25 for the pump and £75 for the rest of the equipment. This outfit can spray twenty acres per day comfortably, provided water for the solution is available alongside the field. If the tractor has to travel to the source of the water supply each time the drum is empty, the acreage done per day will naturally be reduced

according to the distance travelled to fetch water. Assuming that the area covered is twenty acres per day, then the cost of application is calculated thus:

	s.	d.
1 tractor driver (including rations, etc.) ...	10	0
1 assistant ... ..	5	0
10 gals., Power Paraffin @ 1s. 4d. per gallon	13	4
Oil and grease ... ..	1	0
Depreciation on tractor @ £100 per 300 days ... ..	6	8
	£1 16 0	

That is £1 16s. 0d. for twenty acres or, say, 1s. 10d. per acre, as against 3s. per acre by the knapsack method as shown above. It will be noticed that no allowance has been made in the above figures for depreciation of the spraying equipment. The tractor boom sprays four lines 4 ft. 6 in. apart, or 18 ft. at a time, and one filling of the fifty-gallon drum completes one-and-a-half acres, thus giving a cover of thirty-three gallons per acre.

The area covered daily by a tractor can be increased greatly by using a larger tractor and more elaborate equipment. Du Toit<sup>1</sup> shows that in Hawaii, by use of a D4 tractor with two tanks each containing two hundred gallons of solution, and with twenty-nine nozzles doing nine lines at a time, sixty-five acres per day are accomplished. With the success that is being achieved in Natal by chemical spray the day cannot be too far distant when these larger spraying units must come into operation.

## Chemicals Used, Cost and Effect

Let us now consider the chemicals at present being used and their cost. Firstly there is weed-killer D-Concentrate, a description of which by the manufacturers<sup>2</sup> is as follows:

"Weedkiller D-Concentrate is a selective hormone-type herbicide containing 4 lb. of 2, 4D acid equivalent per gallon. It is toxic to broad-leaved weeds and sedges, but generally not to grasses once they have emerged. Its mode of action is to induce a systematic physiological disorder. When it is applied to moist soil before weeds have appeared it will prevent the germination not only of broad-leaved weeds and sedges, but many annual grasses." (The *Oxford Dictionary* describes sedges as "Water-side plants resembling coarse grass growing together in a mass.") The price of D-Concentrate is 26s. 6d. per gallon or 3s. 3½d. per pint.

The second type of chemical is designated as "Q" and is described as "A non-selective herbicide containing 4.5 per cent. pentachlorophenol in phytotoxic oils. It is primarily used to control seedling weeds which are resistant to D-Concentrate and its mode of action is one of burning aerial growth on contact." The price of "Q" is 4s. 5d. per gallon.

All spraying done so far has been with D-Concentrate alone or with a mixture of "D" and "Q." Satisfactory results have been obtained in areas that have little or no water grass, by applying five pints of D-Concentrate two or three days after planting. This keeps the broad-leaved weeds under control for approximately two months. That is to say it is about two months before the field begins to look "dirty." A second application of five pints of D-Concentrate is then applied which keeps the weeds in check, so that the first-hand weeding will not be necessary until the cane is four or five months old. The cost of five pints of D-Concentrate at 3s. 3 $\frac{3}{4}$ d. per pint is, say, 16s. 7d., plus cost of application by knapsack pump gives a total cost of 19s. 7d. per acre. If the spraying is done by tractor the cost is reduced to 18s. 5d. per acre per application. It must be emphasised that treatment with D-Concentrate alone will not be satisfactory in water grass areas. Where there is both water grass, other grasses and weeds, as is usually the case, it has been found that a mixture of four pints of D-Concentrate and six gallons of "Q" in the fifty-gallon drum mounted on the tractor gives good results. As has been mentioned above the fifty gallons of mixture when sprayed by tractor covers one-and-a-half acres, giving an application of two and two-thirds pints of D-Concentrate and four gallons of "Q" per acre in thirty-three gallons of emulsion. The cost of this is 8s. 10d. for the D-Concentrate, plus 17s. 8d. for the "Q," plus 1s. 10d. for application—a total of 28s. 4d. per acre.

When using a knapsack sprayer a convenient mixture is three pints of D-Concentrate plus four gallons of "Q" in a forty-gallon drum which must be all sprayed on to one acre. The greater the dilution of the emulsion the better, provided the correct amount of chemical is applied per acre, because the weeds and the soil get a better soaking and a more uniform distribution is assured.

The mixture of D-Concentrate and "Q" as described above may be used as a pre-emergence spray or the application may be delayed until there is a fair growth of weeds and water grass. The second procedure has the advantage of carrying the crop longer before the second application is required, and thus longer before the first hand weeding is necessary. Water grass up to four inches in height will be killed if the first application is delayed until then. One disadvantage, however, of allowing weed growth to develop before treatment, is that any

weeds must take up a certain amount of plant food. Owing to the presence of the contact herbicide "Q" in the mixture the leaves of the young cane, with a late first application and with a second application, will all turn brown. Although this presents rather an alarming picture we have found that the heart of the cane plant is not effected and continues to grow, so that in ten days or a fortnight the field is green again and does not appear to have been set back to any noticeable extent. As it is easier to keep the spray off the cane with knapsack sprayers, this method should be used if a second application is done.

### A Practical Example

The photograph shows a field of young plant N:Co.310 where an area was sprayed with two and two-thirds pints of D-Concentrate plus four gallons of "Q" at the rate of thirty-three gallons of solution



per acre. This cane was planted on 10th October, 1955, and sprayed for the first time exactly four weeks later, on 7th November, by which time the majority of the cane had germinated and was showing above ground in spikes and flags. The weed population consisted of well-established water grass between four and six inches in height, and other small miscellaneous weeds. All this growth was totally destroyed within six days of spraying as can be clearly seen in the photograph, in contrast to the untreated section. These pictures were taken twelve days after spraying and forty days after planting. Some water grass grew again after two weeks, but there was no appearance of other weeds for a month. The field was then scarified, which kept the water grass and weeds under control. The first hand-weeding was not done until 5th March, seventeen weeks after spraying; this was a very light weeding, taking only four Togat women per acre at a cost of

10s. This field will now require only one more weeding in approximately three months' time. Before the cane gets too big it will have been cultivated, by means of a scarifier drawn by a mule, six times. Scarifying costs 2s. per acre at three acres per day per unit. The total cultivation cost per acre of bringing this field to maturity is therefore:

	s.	d.
1 spraying by tractor with two and two-thirds pints "D" and 4 gallons "Q" ...	18	5
2 light weedings, 4 Togt units per acre @ 2s. 6d. ...	1	0
6 scarifyings @ 2s. per acre ...	12	0
	£2	10 5

If no spraying is done an average field of plant cane needs three hand-weeding which, if only the most expensive type of labour is available, contracted men at an overall rate of 5s. per day, would cost at five units per acre, 25s. per weeding, or 75s. for the three weedings. Add to this scarifying six times, 12 s. per acre, gives a total cost of £4 7s. 0d. per acre. If the cheaper Togt labour is obtainable this cost is reduced to £2 9s. 6d. per acre, which is practically the same as shown above when combining spraying and hand-weeding. Thus the whole question of whether to spray or not, rests on the supply and type of labour available. The reason for Natal not being advanced as are other sugar-producing countries in the use of chemicals is that, until fairly recently, an abundant supply of cheap labour has been obtainable. The fact that this is no longer the case makes it essential that chemical weed control methods will have to be adopted to a greater extent.

So far we have used only the two: 4-D and "Q" as described. The use of other chemical sprays is, however, under consideration and the details of an experiment recently laid down are shown below. All information is as given by the manufacturers.

#### Weedkiller Experiment

<i>Object:</i>	Chemical control of all weeds (especially water grass) using pre-emergence technique.
<i>Location:</i>	Alluvial flats of Tugela River. Soil—alluvial clay.
<i>Equipment Used:</i>	Knapsack sprayer with full cover boom delivering 25 gallons per acre.
<i>Date of Application:</i>	16th February, 1956.
<i>Conditions at Time of Application:</i>	Weather extremely hot and overcast. Soil very dry. Seeded in parts very rough (cloddy). Negligible wind.

*Replications:* All treatments replicated four times.

#### COST OF TREATMENTS

<i>Treat- ment</i>	<i>Application per Acre</i>	<i>Cost per Acre</i>
		s. d.
T.1	Fernimine 4—8 pints ...	33 6
T.2	Fernimine 4—16 pints ...	67 0
T.3	Fernesta 8 pints ...	30 0
T.4	Fernesta 16 pints ...	60 0
T.5	Fernimine 4—8 pints+20 lb. T.C.A.	86 10
T.6	Fernimine 4—16 pints+20 lb. T.C.A.	120 4
T.7	Fernesta 8 pints+20 lb. T.C.A.	83 4
T.8	Fernesta 16 pints+20 lb. T.C.A.	113 4

It will be noticed that the cost per acre is considerably higher than for the procedures employed by us. This may, or may not, be justified by the results obtained, but as yet the experiment is in too early a stage for any opinion to be expressed.

#### General

There are several important things to remember when using herbicides. Firstly, no cultivation of any description must be done for several weeks after spraying, as this disturbs the layer of herbicide which has been spread over the soil, with a consequent loss of effect. If desired, cultivators may be used just before spraying, but not just after. Secondly, the chemicals must be thoroughly mixed with the water—it is advisable to put the chemicals in the container first and then add the water while constantly stirring the mixture. It is important to keep the solution free from foreign matter by means of sieves, as otherwise the spraying jets become clogged and much time can be wasted freeing them. After each day's work all jets and pumps should be dismantled and cleaned, so as to ensure efficient operation the following day. To obtain the best results, spraying should be carried out under suitable weather conditions. The soil should be damp, and the less wind there is the more even the application. For contact weedkiller best results are obtained on a hot sunny day, after rain.

#### Further Information

Anybody requiring more detailed information, particularly regarding the chemicals available for weed control, is advised to study the very informative papers presented at last year's Congress. One of these papers is by M. J. Stewart and the other by N. C. King and F. L. Almond. They are published in the Proceedings of the Twenty-Ninth

Annual Congress of the South African Sugar Technologists' Association on pages 126 and 122 respectively.

### Conclusions

The chemical control of weeds has now been established as a practical and economical factor in sugar agricultural practice in Natal and will be used to a greater extent by the average farmer in the future. As Altona and Mentz<sup>3</sup> say: "The use of weedkillers is worldwide and each year a new crop of weedkillers emerges from the chemist's laboratory. In the United States the total consumption of weedkillers in 1951 was estimated to be 122,000,000 lb. There was little doubt that weedkillers had established themselves in agriculture. As an aid to good farming practices they could play a big part in crop production, but their limitations must be realised. They are not a panacea to all farming operations."

### Acknowledgements

The writer would like to thank those members of the field staff of Messrs. Sir J. L. Hulett & Sons Ltd., who have carried out the work outlined in this paper and supplied much of the data.

### REFERENCES

<sup>1</sup> du Toit, J. L. (1953), Report on Visit to Hawaii, Louisiana, Florida, Puerto Rica, and the Eighth I.S.S.C.T. Congress in B.W.I. S.A. Sugar Association, p. 37.

<sup>2</sup> Shell Bulletin No. 513 (1954), "Chemical Weed Control in Sugar Cane with Shell Weedkillers," p. 1.

<sup>3</sup> Altona, Dr. R. E., and Mentz, N. J., "Wide Range of Chemical Weedkillers," *S.A. Farmers' Weekly*, 8th September, 1955.

**Mr. Twinch** regretted that there were not more planters present because the subject was so practical and valuable information was given which might never get to their ears.

He said that seed-bed preparation was extremely important. The seed-bed should not be prepared and treated too long before the cane was planted.

The tith was also important as it was difficult to spray cloddy ground.

He asked Mr. Steward about the quantities of spray employed. These high rates, he thought, might be cut down with advantage.

He wanted to know from Mr. Steward if he always applied weed-killer at the rate of 40 gallons per acre as he had found 25 gallons quite sufficient.

**Mr. Steward** said that he had tried using only 25 gallons per acre but found that water grass, the weed it was especially necessary to destroy, was not killed satisfactorily unless it received a thorough soaking which could be done only by applying a minimum of 40 gallons per acre. He had found that, provided the correct amount of chemical was applied per

acre, the more water used in doing so the better the results obtained.

He considered that the reason for their originally not getting good control of water grass was due to putting on too little water with the chemical. The reason that 33½ gallons per acre, instead of 40, was applied when using the tractor was simply because that was the maximum amount that could be sprayed with the particular type of boom fitted at present. When using hand pumps, however, it was a simple matter to apply the required 40 gallons per acre.

**Mr. Pearson** said that this paper should be brought to the attention of the farmers.

He asked Mr. Steward if he did not find that by using small quantities of solution the jet blocked up more readily. With heavy applications of liquid, the jets could be bigger and less blocking would occur.

**Mr. Steward** replied that obviously a larger jet would give less trouble than a smaller one, but, in any case, he had stressed that all jets should be kept scrupulously clean.

**Mr. King** was grateful that Mr. Steward had given costs of weeding, etc.

As far as application by tractor was concerned, he thought this would be better for post-emergent spray rather than pre-emergent spray, as even big estates only planted a small acreage per day, which could easily be covered by knapsack spray.

He felt that not sufficient stress had been placed upon the possible spread to gardens of these commercial weed-killers. He felt that a warning should be given about the possible effects on other crops, and that the dangers inherent in the use of weed-killers had not been stressed enough.

**Mr. Rault** also remarked upon his experience with garden plants and fruit trees being affected by weed-killers, probably wind-borne, as such plants were at some distance from the cane fields.

**Mr. Twinch**, commenting upon a statement in the paper that water grass up to 4 inches in height had been killed, wished to have further clarification. He wondered if it was not merely a case of it being controlled but not being killed.

**Mr. Steward** said that what he had meant was that full grown water grass starting to seed, was, after spraying, completely burned down. He did not mean that the plant was completely killed as some of the roots would grow again. However, the water grass was set back in its harmful effects for a couple of months or longer, and by the time it re-grew, the cane was very much higher and the water grass could be easily controlled by scarifiers.

**Dr. Dodds** stated that this paper was very valuable at this stage. It had been proved conclusively by scientists that chemicals could control weeds, but the next question was—did it pay?

This paper by Mr. Steward, giving costs, was, therefore, especially welcome. He considered it only a matter of time before the application of chemicals for controlling weeds would become economical everywhere. As the materials for the manufacture of these chemicals were plentiful, he considered that before long the cost of their manufacture would be considerably reduced.

**Mr. Stewart** remarked upon the number of nozzles and considered this fixed the amount of liquid which was applied.

**Mr. Steward** replied that six nozzles were used because they wanted 40 gallons to be applied per acre. If it was required to reduce quantity some nozzles could be removed.

**Mr. Stewart** said that there was more than one type of water grass, one being more easily controlled than the other.

**Mr. King** said that from the paper, they were using 5 pints of 'D' Concentrate, which was equal to 2½ lbs. of 2, 4D per acre. Some years ago at Illovo, they claimed to control weeds by using only 1 lb. of 2, 4D per acre, but this had not been the experience at the Experiment Station. It would appear that we are now increasing the quantity of 2, 4D used. He wondered if the more resistant type of plants were now left, or whether there was an increase in the number of organisms which broke down the 2, 4D. There was also the possibility that we were now expecting better control than previously.

**Mr. Stewart** said that he had tried using smaller quantities, but he found the amounts now given were the minimum that were required to control the weeds. He said it was their practice only to spray plant cane so a period of up to 9 years would pass before more spraying would be done on the same land, when it had been replanted.

**Mr. Twinch** did not agree that it was now necessary to use heavier applications than before, because application of these weed-killers in the cane belt was quite recent. He related that even 1 lb. per acre would assure some control. In his own experiments he has applied up to 8 lbs. per acre, which gave complete control from planting to complete canopy.

He asked for some information about very heavy applications, up to 150 lbs. of 2, 4d per acre.

**Mr. King** replied that cane was still growing on that land.

**Dr. Dick** here asked if the use of more chemical was due to the fact that to begin with the more easily killed weeds were destroyed and now the tougher varieties were in evidence.

**Mr. Stewart** replied that, as far as he could see, there was no change in the weed population. Except for water grass, of which some areas were free, the weed varieties appeared to be similar in any location.

**Dr. Dick** reminded the Meeting that when synthetic organic insecticides were first used, they were more effective than they are now. He wondered if the same might not apply to weed-killers.

**Mr. Twinch** pointed out that the number of types of weed-killers was increasing far quicker than the types of weed, and that if one chemical proved to be no longer effective, another could be used to take its place.

**Mr. Stewart** said that the heavy applications of weed-killers were directed against the nut grasses. Ordinary weeds could be controlled at the rate of 2 lbs. of 2, 4D per acre, whereas nut grass required at least 8 lbs. per acre to control it. Such heavier applications, however, also affected the cane.

**The Chairman**, Mr. du Toit, said that the Association was grateful for such a very practical paper, and the Meeting could be assured that it would receive adequate publicity amongst the cane growing section of the industry.