RAILWAY TRACK TRIALS

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THE problem faced by the Railways Department in track weeding is that of maintaining in a weed-free condition a narrow ribbon 15ft. wide by 3500 miles long. You will agree that this is a formidable task when you calculate that this corresponds to 6000 acres of land, 50 per cent. of which is threatened continuously by weed seed contamination, both from tall-growing marginal grasses and from stock-wagon spillage.

In the North Island for the last 11 years the Department has attained relief from hand weeding, as a result of spraying about 120lb. per acre of Atlacide twice annually over the track. This fails to kill adult grasses and many seedling grasses, although it kills most broad-leaved weeds. But, should heavy rains occur at or soon after spraying, the result may be total failure. The Department seeks, therefore, some chemical treatment which may be relied upon to give improved grass kills under a wide range of climatic conditions.

In trials carried out between 1946 and 1952 studies were made of such factors as time and frequency of hand weeding and Atlacide applications, volume rates of Atlacide, comparison of Atlacide with arsenicals, DNOC, TCA, PCP, 2,4-D, 2,4,5-T, oil, and various combinations. In this work the rates of application and therefore the results also were governed in high degree by the current cost of the standard Atlacide application in use; that is, 100 to 130lb. in 100 to 130 gallons of water per acre.

The more intensive trials now in progress are planned to continue over a period of years, whereas previous work suffered from the disadvantage that it was of short-term duration. Again, in planning, we encountered the problem of a cost limit to put on the various materials. Lovatt (1) 1950, in reference to the standard Atlacide treatment, states that the material cost varied up to £8 10s. per acre per annum and that the cost of the applications (train) was £1 10s. He gives no definite figures for the cost of hand weeding accessory to Atlacide treatment or for the alternative of total hand weeding. Even if they had been given they would not bear close comparison with present-day costs.

It has therefore been found necessary in the planning of trial work and for its rational evaluation to look carefully at more recent cost figures and to check up on the actual speeds and costs of hand weeding on the track.

The following are some considerations which have guided the decisions as to what quantities of materials to put on trial.

(a) Atlacide spraying as at present carried out requires the expenditure on hand weeding of £22 per acre annually, at the most conservative estimation, and may rise to more than twice as much.

(b) Costs of trial applications should be related to Atlacide treatment plus the labour factor involved.

(c) It could be economical to use either Atlacide or other materials at increased cost provided this resulted in equivalent labour savings.

(d) It is desirable in order to assess accurately the potentialities of test materials to study each at low, at intermediate, and at what may appear to be extravagant rates of application.

TREATMENTS

The following is a list of chemicals and their rates of application which are at present on test or have been tested in lb. per acre:—

- (1) Atlacide 120, 180, 240, 360, 480, and 600.
- (2) Ammate 60 and 120.
- (3) Polyborchlorate 250, 500, 1000, and 1244.
- (4) Borascu 1000 and 2240.
- (5) "Monoborchlorate" liquid mixture equal to 140lb. Atlacide.
- (6) CMU 5, 10, 20, 40, and 80.
- (7) DCMU 5 and 10.
- (8) Dalapon 5, 7½, 10, 15, 20, 40, and 80.
- (9) TCA 80.
- (10) Atlacide/Dalapon 30/8, 60/10, 60/15, 60/20, 60/40, 120/10, 120/15, 120/20, and 180/10, 15, 20.
- (11) Atlacide/TCA 60/40, 120/40, 180/32, and 180/40.
- (12) TCA/Dalapon/2,4-D 20/10/1.4.
- (13) TCA/2,4-D 40/3.6.
- (14) Polyborchlorate/Dalapon 250/10.
- (15) CMU/DCMU 10/10, 20/20, and 40/40.
- (16) Small-scale trials in control of verge grasses.

RESULTS

Most of the tests are still in progress and the following notes are of an interim nature.

Atlacide: Two sprayings annually of 240lb. per acre are the minimum required to kill all grass seedlings as well as broad-leaved weeds on a track already free of mature weeds. This treatment is insufficient to reclaim a grass-infested track and its efficiency is reduced considerably by rainfall. Higher rates have not been evaluated yet.

Polyborchlorate: Two sprayings annually of 500lb. under good weather conditions prevent the establishment of practically all weeds and are more effective than one application annually of 1000lb. Spring applications give better and more lasting effects than do autumn ones. There is no indication yet of an effective build-up of soil toxicity after four applications at 1000lb. over a 2-year period. Residual effects on seedling establishment disappear after 4 to 6 months.

CMU: Single applications of 20lb. to 80lb. have kept plots weed free for up to 16 months except for *Paspalum* seedlings and two or three CMU-tolerant broad-leaved weeds susceptible to hormone sprays (*Plantago*, *Veronica*, *Polygonum*, *Galium* spp.) Eighty pound is little better than 20lb.

DCMU: This may prove more effective than CMU.

Atlacide/Dalapon: A wide range of application rates has been applied this autumn in consequence of some favourable results secured from earlier trials at the 30/8 and 30/10lb. rates. There are indications that these mixtures may be susceptible to wet weather and low temperature conditions. It appears possible that a mixture of these materials may be the answer in track weeding to the problem of grass resistance to Atlacide.

None of the other materials or mixtures shows much promise as alternatives to Atlacide and no materials at any of the rates used appear likely to be economically useful for reclaiming a railway track already infested with mature grassy weeds.

Observations have been made on the occurrence of species of *Paspalum*, *Festuca*, and *Bromus* alongside the track, the effect of this upon the track weed population, and the resistance of seedlings of these species to most weed spray chemicals. It is concluded that their occurrence is a determining factor in the performance of weed sprays, for, in their absence

from the track verge, they are rarely to be seen as a track weed. In small-scale tests mature paspalum has been removed from the track verge by means of February spray applications of Dalapon amounting to 6lb. per mile. This method of control would be more economical than repeated and imperfect scything.

The following table, based on present indications from the trials, gives the estimated costs of controlling both grasses and broad-leaved weeds by various spray chemicals, probably without hand weeding:—

Material and rate of application lb. per acre	No. of applications per annum	Cost per mile per annum		
		Material £	Application £	Total £
Atlacide/Dalapon 120/20	Spring and autumn	36	3	39
180/15	Spring and autumn	36	3	39
Atlacide				
240	Spring and autumn	27	3	30
480	Spring and autumn	54	3	57
CMU 20 }	Spring }	59	1.5 {	68
Hormone 3.6 }	Autumn }		1.5 {	
Polyborchlorate 500	Spring and autumn	74	3	77

For comparison, the following figures show the average cost per mile over the last two seasons for the Auckland district lines, approximately 800 miles of track:—

	£
Hand weeding ..	46
Spray train, operation ..	2
Atlacide ..	14
Total	<u>62</u>

To this figure must be added the cost of scything, estimated to be from £6 upwards.

CONCLUSIONS

No finite conclusions can be drawn at this stage, but there are grounds for suggesting:—

(a) That some chemical treatments show promise of better economic performance than the standard rate of Atlacide, taking the labour factor into consideration.

(b) That some materials will give improved performance when more effective control is imposed on the seeding of verge grasses, and

(c) That some degree of residual soil toxicity must be imparted by the chemical in order to control short-lived annuals capable of developing to the seed stage between sprayings.

Impressions gleaned from 10 years' experience, on and off, of working on track weed control problems have distilled down to the following ideas:—

(1) Efficient track weed control work extends far beyond deciding what is the most suitable chemical, purchasing requirements, and then applying it to the track.

(2) So wide is the range of factors which determine track contamination, and the establishment and killing of the many species of weed found

infesting the track, that it appears improbable that any simple solution will be found to deal effectively with them all.

(3) Weed control work should be extended to include the regular spraying of all sidings and loading yards and the efficient and regular cleaning of stock wagons.

REFERENCE

1. Lovatt, E. H. 1950. "New Zealand Engineering", 5(4). 335-336.

DISCUSSION

Since the introduction of large scale spraying operations in 1945 at least £100,000 has been saved each year by chemical weeding of railway tracks. Soon after these operations commenced it became apparent that these savings, although substantial, could be increased on sections where the minimum dosage (120lb. Atlacide per acre spring and autumn) did not give entirely satisfactory results. This problem was then referred to the Department of Agriculture and has been competently investigated as described in the paper. However, it should be recorded that the Chief Civil Engineer, New Zealand Railways, had 2 years ago directed the use of increased dosages (up to double and even treble strength) where the minimum dosage was not fully effective. Arrangements have also been made recently for the Extension Division of the Department of Agriculture to assist in field inspections and to give expert advice to railway engineers where existing weed control methods are either very costly or only partly successful. Further benefits can be expected from the application of this research to track weeding problems.

Q.—With the use of boron compounds is there no residual build-up of material which will give control of weeds?

A.—Boron is fairly soluble and under heavy rainfall in Waikato leaching accounts for a great loss. Best effects should be in a lower rainfall area, say, 20in. and under.

Q.—How did you determine the cost factors?

A.—All costs were based on bulk purchase of materials.

Q.—Were experiments done in one area or throughout New Zealand?

A.—Confined to the Hamilton area only.

Q.—Does Mr. Ward think that results from trial work done at Hamilton would be applicable in Canterbury in view of the difference in rainfall figures?

A.—Because of lower rainfall figures less leaching will take place. TCA did not give good results at Hamilton, but should be quite suitable in other places.

Q.—What is your experience with Dalapon? Does addition of 2,4-D to Dalapon reduce the efficiency of Dalapon?

A. Dalapon on its own gave poor results even on broad leaf plants and so did Dalapon and 2,4-D, so that I am no longer interested in further use of Dalapon.

Q.—What effect has 2,4-D as a soil sterilant in conjunction with boron compounds?

A.—Probably poor, as boron is not much used in the Waikato on account of the high rainfall.

Q.—What is the cost of hand-weeding as against chemicals?

A.—Hand-weeding of neglected track could cost £200 per mile.

Q.—Do various sprays affect electrical signals, etc.?

A.—Atlacide and other salts will give trouble if not used carefully.