ISAZOPHOS: EVALUATION FOR GRASS GRUB CONTROL

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Summary

Four trials in the North Island and three in the South Island showed isazophos at 2 kg/ha to have equivalent activity to fensulfothion at 2 kg/ha on grass grub (*Costelytra zealandica*) larvae and both to have caused similar pasture responses, together with a slight depressant effect on earthworm populations. Treatment with isazophos in February demonstrated superior grass grub control to April applications. Grass grub population reductions continued through to the second year on some trials. In one trial where isazophos was drilled into the soil with seed, a significant grub mortality and superior new grass establishment resulted from rates of isazophos down to 0.5 kg/ha.

INTRODUCTION

During recent years many organophosphorus insecticides have been tested for effectiveness on grass grub (*Costelytra zealandica*) with varying degrees of success. Following extensive testing (Kelsey and Read 1966; Rough and Haeshe 1966; Kain and Christie 1966) diazinon and fensulfothion have been widely used in practice. Kain and Atkinson (1968) found fensulfothion to be more reliable than diazinon.

Ethoprophos has also shown activity against grass grub, but Fenemore (1970) found a double application of 2.2 kg/ha was required to achieve results comparable to fensulfothion. Under farm practice the broadcast application of fensulfothion is considered to be more reliable than diazinon or ethoprophos.

The properties of isazophos (CGA 12223) were described by McPhail (1974). This paper reports results from a series of trials laid down to investigate the activity of isazophos under a range of conditions in the North and South Islands.

METHOD

Trial sites were selected on the basis of uniformity of grass grub larvae distribution and population levels, these being determined by random digs and the visual appraisal of the degree and extent of pasture damage. All trials were of a randomised block design with broadcast trials replicated 8 times and drilled trials 4 times. Plot sizes were 5 × 5 m for broadcast trials and 20 × 2.5 m for drilled trials.

Prior to treatment, grub counts were made from one or two spade digs per plot, and plots containing too few grubs were omitted from the random layout. In general, the grass grub larvae were in the second or third instar at the time of treatment. To ensure accurate post-treatment pasture production records, sites with an uneven pasture height were trimmed prior to treatment.

Insecticide granules were broadcast either by hand shaker, or by hand, employing an inert filler to facilitate even distribution. In drilling trials, insecticide and superphosphate were mixed in a proportion related to the on-site calibration of a Duncan 730 Multiseeder drill. In addition to the insecticide mixture, 'Grasslands Tama' ryegrass (*Lolium multiflorum*) was also drilled into the plots, via a triple disc coulter system to a depth of 2 - 3 cm.

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Post treatment grub counts were made within a period of 7-18 weeks following treatment, and again approximately 1 year following treatment. Four or five 14 cm² digs per plot were made on the broadcast trials and 6 on the drilled trials, and live grubs counted. In the 'time of application' trials, all treatments were counted at the same time. In the North Island trials, worm counts were also made in both the year of and year after treatment.

Pasture responses were measured by mowing each plot and in the drilling trial new ryegrass tiller counts were made.

In all trials isazophos and fensulfothion were formulated as 5% granules and diazinon as a 10% granule.

RESULTS

Detailed results calculated as percentages relative to untreated control are shown in Tables 1 - 3.

The influence of rate and locality

There was a significant improvement in grass grub control with an increase in rate of isazophos from 1 to 2 kg/ha in two out of four trials, and from 1 to 3 kg/ha in three out of four trials (Table 1). There was no significant difference, however, from an increase in rate from 2 to 3 kg/ha or 2 to 4 kg/ha. Isazophos 2 kg/ha provided a similar level of grass grub control to fensulfothion 2 kg/ha in all trials. Where compared with diazinon 2 kg/ha, the isazophos 2 kg/ha treatment was similar on trials B and C, but significantly superior on trial D where only 8 mm of rain fell within 10 days following treatment.

TABLE 2: THE EFFECT OF TIME OF APPLICATION ON THE EFFECTIVENESS OF ISAZOPHOS 2 kg/ha — NUMBER OF GRUBS AS A PERCENTAGE OF UNTREATED

<i>Time of application</i>	<i>Trial C</i>	<i>Trial D</i>
late February	33 b	25 b
late March	66 ab	43 ab
late April	100 a	52 a
CV %	56	41
Assessment date	29.7.75	21.8.74

The absolute effectiveness of isazophos and fensulfothion varied markedly between trial locations; the degree of variation being similar for both insecticides.

Counts made 1 year following treatment with isazophos and fensulfothion showed there to have been an extension of grass grub control into the second season on three trials, whilst the treated plots on the other four trials recorded similar populations to untreated.

Time of application

The results in Table 2 show February treatment with isazophos 2 kg/ha to have been significantly superior to April treatment; there was a general reduction in effectiveness of control with isazophos from February to March and from March to April.

Pasture responses

Pasture responses following treatment were generally upwardly aligned to an increase in rate of isazophos, with the 2 kg/ha rate recording similar dry matter production responses to that achieved by fensulfothion. Responses on the isazophos 2 kg/ha treatment ranged from nil on trial C, to a 96% increase over untreated on trial F; with an average increase of 42% over untreated for a period of from 3-6 months following treatment, on all trials except trial B which was not harvested.

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TABLE 3: SOUTHLAND DRILLING TRIAL

Location : Wendon, Southland				
Soil type : Matuara recent alluvial				
Treatment date : 18 March 1975				
Pre-treatment grub population/m ² : 2850				
Treatment	kg/ha	Tillers/m*	Yield†	No. grubs†
		28.4.75	29.4.75	3.6.75
untreated control		4 a	100 c	100 a
isazophos	0.5	18 a	148 bc	72 b
isazophos	1.0	48 b	264 a	34 c
isazophos	1.5	54 b	203 ab	21 c
untreated — grubs/m ²				889
untreated — kg DM/ha			181	
CV %		33	21	28

* Sown 'Tama' ryegrass

† as % of untreated

Worms

Earthworm counts were made on trials A - D, 3 - 4 months following insecticide application, and showed isazophos to have significantly reduced worm populations on trial A, and fensulfothion to have significantly reduced populations on trials A and D. In general all treatments, except diazinon, caused a reduction in worm populations in the year of treatment. Counts made 1 year following treatment showed treated and untreated plots to have similar worm populations.

Drilling trial

Drilling isazophos into soil resulted in a significant increase in the number of new ryegrass tillers and pasture yield, and a significant reduction in grass grub populations relative to untreated (Table 3). There was a significant improvement in effectiveness from an increase in rate of isazophos from 0.5 to 1.0 kg/ha but little worthwhile advantage above 1.0 kg/ha.

DISCUSSION

Throughout the trials, isazophos consistently performed as well as fensulfothion both in grass grub kill and pasture response. There was an indication from early counts following treatment that isazophos was slower acting than fensulfothion, but ultimately both were equivalent. There was some evidence in grub counts and in one yield response, that isazophos 3 and 4 kg/ha were superior to 2 kg/ha, however this was not generally the case, and in practice the use of higher rates would appear unjustified.

Grass grub mortality ranged from 30 - 90% following the application of either isazophos or fensulfothion at 2 kg/ha; whilst the reasons for this variability are not obvious, it would appear that time of application, soil type, and rainfall following treatment, could all be important factors influencing absolute levels of control.

Low rainfall following treatment on trial D seems a likely factor for the poorer performance of diazinon on this trial, as a superior result was achieved by this chemical at a similar location in the subsequent season following more favourable rainfall. Both on this, and other trials where a low rainfall was recorded following treatment, the effectiveness of isazophos appeared unaffected relative to fensulfothion.

TABLE 1: THE INFLUENCE OF RATE AND LOCALITY ON THE EFFECTIVENESS OF ISAZOPHOS –
NUMBER OF GRUBS AS % OF UNTREATED

Trial	A	B	C	D	E	F	G
Location	Takapau Hawkes Bay	Dannevirke Hawkes Bay	Normanby Taranaki	Kimbolton Manawatu	Winchmore Canterbury	Wendon Southland	Waimumu Southland
Soil Type	Matamau-Kopua Silt Loam	Takapau-Gwavas Stoney Silt Loam	Egmont-Warea Yellow Brown Loam	Kiwhitea Silt Loam	Lismore Yellow Grey Earth	Mataura Recent Alluvial	Waimumu Yellow Grey Earth
Treatment Date	5.4.74	17.4.75	2.4.75	30.4.74	6.5.74	10.3.75	26.3.75
Grub Population at treatment / m ²	431	476	436	735	685	2359	1472
Assessment date	27.8.74	28.7.75	29.7.75	21.8.74	1.8.74	24.4.75	5.6.75
Treatment kg/ha							
untreated	100a	100a	100a	100a	100a	100a	100a
isazophos 1.0	42b	68b	100a	60b	—	—	—
isazophos 2.0	9b	40c	66ab	39c	25b	17b	9b
isazophos 3.0	15b	26c	39b	38c	—	—	4b
isazophos 4.0	—	—	—	—	9b	9b	3b
fensulfothion	12b	34c	72ab	38c	19b	16b	3b
Diazinon 2.0	—	40c	100a	72ab	—	—	—
Untreated – Grubs / m ²	108	229	123	518	586	1298	1114
CV %	18	40	59	11	39	27	62

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Second year effects were not necessarily linked with first year effects; however, small plot trials are not generally considered a valid means of accurately predicting likely second year control from paddock scale usage.

Pasture responses following treatment generally related to the levels of grass grub control achieved, but were also related to the extent and degrees of damage at treatment as these influenced the rate and extent of pasture recovery. This, coupled with the demonstrated marked superiority of early treatment for grass grub control with isazophos in the trials, further confirms the cost efficiency benefits from early treatment. The stage of larvae development is considered to be the major factor influencing the greater susceptibility of larvae to early treatment with isazophos.

The drilling trial was conducted in order to ascertain the feasibility of lower insecticide rates, coupled with the introduction of new grasses. In the reported trial, satisfactory 'new grass' establishment yields and grass grub control were achieved, although new plants were somewhat retarded by competition. On another site, existing ryegrass recovered and only a 50% grub mortality was achieved. The poorer control may have been a reflection of the greater ryegrass recovery between drill rows allowing insecticide free feeding zones.

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