FIELD EVALUATION OF ISOURON FOR THE CONTROL OF WEEDS IN SUGARCANE IN AUSTRALIA

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Summary. Isouron is a new urea herbicide discovered by Shionogi & Co. Ltd., in Japan in 1975. World wide field trials have demonstrated its potential use for pre- and post-emergence weed control in sugarcane.

Preliminary results from field trials conducted by Agrisearch Services Pty. Ltd. in sugarcane in Queensland are described. Isouron was applied post-planting pre-emergence and as a lay-by treatment after the final cultivation before the out of hand stage. The results show that when surface applied at 1.0 kg ha^{-1} isouron gave good crop safety and very effective control of grasses and broadleaved weeds including crowsfoot grass (*Eleusine indica*), bellvine (*Ipomoea plebeia*), cupid's flower (*I. quomoclit*) and billygoat weeds (*Ageratum* spp.). The main benefits in using isouron in plant cane will be to reduce the number of cultivations specifically for weed control in the young crop and to control weeds later in the season.

Trials are in progress in young ratoon cane for weed control particularly within the row where weeds are difficult to remove by cultivation. Early results show good selective activity when isouron is applied at 1.0 kg ha^{-1} post-emergence to both the young crop and a range of small weeds.

INTRODUCTION

Isouron (code number SSH43) is an experimental pre- and post-emergence herbicide developed by Shionogi & Co. Ltd. in Japan. Herbicidal properties of the compound were first reported by the company in 1975. Isouron belongs to the substituted urea group of herbicides. It has a low toxicity to mammals and wild life, its acute oral LD 50 for rats being 2950 mg kg^{-1} of body weight. Isouron is taken up through leaves and roots and is active against both grasses and broad-leaved weeds. Translocation occurs readily upwards from the roots but movement from the leaves is very slow. Isouron is readily leached downwards particularly in sandy soils. Adsorption onto soil particles also occurs and this is greatest in montmorillonite clay soils.

In overseas field trials isouron has shown promise for pre- and post-emergence use in sugarcane. The compound has given effective weed control in sugarcane for 3 to 4 months after a single dose of 0.5 to 1.0 kg ha^{-1}.

In Queensland the usage of herbicides for weed control has been

relatively low; farmers rely mainly on cultivation with rakes and cultivators. While some soil disturbance is necessary early in the crop's life for reasons other than weed control the introduction of residual pre-emergence herbicides has enabled the number of cultivations specifically for weed control to be reduced.

Agrisearch Services Pty. Ltd. began field trials in sugarcane in 1979 to evaluate isouron under Queensland conditions to find the most effective and appropriate application in sugarcane. A number of trials are still in progress. This paper describes the results of completed field work.

MATERIALS AND METHODS

Six 1979-80 trials were conducted in plant cane cvs Q86, Q87, Q108 and NC0310 in the Nambour, Bundaberg and Mackay areas. Isouron formulated as 50% w/w wettable powder was surface applied (without soil incorporation) post-planting pre-emergence in October (two trials) and as lay-by treatments after the final cultivation before the out of hand stage in January (four trials) at five rates. Tank mixtures of isouron and diuron at 0.75+ 1.6 kg ha^{-1} and isouron and atrazine at 0.75+ 1.5 kg ha^{-1} were also tested. Diuron at 3.2 kg ha^{-1} was used as a standard treatment. Plot size was 6 m (4 rows) wide by 7.5 to 10 m long replicated four times in all trials. Treatments were applied with a gas operated spray boom to weed free soil in a 1 metre band along the crop row in the post-planting pre-emergence trials and in the interrow space beneath the crop canopy in the lay-by trials. Soil types included a sandy scrub soil, a clay loam and a medium textured clay soil.

In the trials where isouron was applied post-planting pre-emergence the soil was not disturbed by cultivation for 6 to 8 weeks after spraying in order to evaluate the direct affect of the herbicide treatments on the crop and weeds. During this time one to two cultivations were avoided. Thereafter normal cultural practises were carried out by the co-operators. In the lay-by trials there was no soil disturbance after application of the herbicide treatments.

Weed control was assessed by weed counts taken one month after spraying and visual weed control ratings two and three months after spraying and at harvest. Weeds encountered in these trials included barnyard grass (*Echinochloa crus-galli*), crowsfoot grass, billygoat weeds (or blue top), spurges (*Euphorbia* spp.), redshank (*Amaranthus cruentus*), bellvine, cupid's flower, pigweed (*Portulaca oleracea*) and nutgrass (*Cyperus rotundus*).

The grasses were the main weed problem in the trials in southern Queensland while the broadleaved weeds were more important in the northern trials.

Crop safety and yields were recorded in the trials.

RESULTS

Weed control. In the Nambour trials where isouron was applied post-planting pre-emergent crowsfoot grass and barnyard grass were the most important weeds present. Isouron applied alone gave very effective control of all weeds at rates of 1.0 kg ha^{-1} and above. The 1.5 and 2.0 kg ha^{-1} rates did not give significantly ($P<0.05$) better control than 1.0 kg ha^{-1} so this latter rate was considered optimal in these trials. The results of the weed cover rating (mean of four replicates) made at harvest in one of the trials are given in Table 1. Up to the time of the first cultivation after spraying (approximately two months) isouron at rates of 1.0 kg ha^{-1} and above kept crowsfoot grass down to 10 to 20% cover

Table 1. Weed cover score at harvest (Nambour 1980 pre-emergence trial).

Treatment	Rate (kg ha^{-1})	Weed cover score[1,2]
Isouron	0.50	4.2 bc[3]
Isouron	0.75	4.2 bc
Isouron	1.00	2.0 a
Isouron	1.50	1.5 a
Isouron	2.00	1.5 a
Isouron + Diuron	0.75 + 1.60	1.3 a
Isouron + Atrazine	0.75 + 1.50	1.7 a
Diuron	3.2	3.0 ab
Untreated control		6.0 c

[1] Mainly crowsfoot grass.
[2] Arithmetic scale 0-10 where 0 = no weeds
10 = 100% plot covered by weed.
[3] Means with a common letter are not significantly different at P = 0.05. (Duncan's multiple range test).

compared with 90 to 100% cover in the untreated plots. At the equivalent rates of isouron (0.75 kg ha^{-1}) the mixtures were more effective than isouron alone.

In trials at Bundaberg and Mackay where isouron was applied as a lay-by treatment broadleaved weeds were generally more important although crowsfoot grass persisted through to harvest at Bundaberg. Isouron at all rates was more effective against broadleaved weeds (spurges and billygoat weeds) than grasses (Table 2).

Isouron at 0.5 kg ha^{-1} was very effective against the broadleaved weeds present in trials. At harvest crowsfoot grass was the only weed of importance in the trials at Bundaberg. Isouron at rates of 1.0 kg ha^{-1} and above was significantly ($P < 0.05$) more effective than the lower rates against this weed. Also isouron + diuron was more effective than isouron alone at the same rate (0.75 kg ha^{-1}) and isouron + atrazine.

In the Mackay trials broadleaved weeds were present in abundance although their growth was slightly retarded by the crop canopy. Against the vines, bellvine and cupid's flower, all rates of isouron gave close to 100% control, while rates less than 1.0 kg ha^{-1} were significantly ($P < 0.05$) less effective against billygoat weeds than 1.0 kg ha^{-1} and above. Even so the lowest rates gave 90% control of billygoat weeds and this result was significantly ($P < 0.05$) better than diuron (50% control) at harvest. The isouron mixtures performed better than isouron alone at 0.75 kg ha^{-1} only against billygoat weeds.

Crop safety and yield. Isouron at 2.0 kg ha^{-1} was the only treatment to cause any

Table 2. Weed control rating three months post spraying (Bundaberg, 1980 lay-by trial).

Treatment	Rate (kg ha^{-1})	Weed control rating[1]	
		Crowsfoot grass	Broadleaved weeds
Isouron	0.50	7.2 b[2]	8.2 bc
Isouron	0.75	7.5 b	8.0 bc
Isouron	1.00	8.7 ab	9.2 ab
Isouron	1.50	8.7 ab	9.2 ab
Isouron	2.00	9.7 a	10.0 a
Isouron + Diuron	0.75 + 1.60	9.5 a	9.7 a
Isouron + Atrazine	0.75 + 1.50	7.5 b	8.0 bc
Diuron	3.2	7.2 b	7.0 c
Untreated control		0 c	0 d

[1] Scale 0-10 where 0 = no weed control
10 = 100% weed control.

[2] Means with a common letter are not significantly different at P = 0.05. (Duncan's multiple range test).

significant ($P < 0.05$) crop phytotoxicity in both the pre-emergence and lay-by trials on the lighter soils. This treatment reduced crop height compared with the untreated sugarcane. In the pre-emergence trials at Nambour none of the isouron treatments affected crop establishment. Four of the six trials were harvested. None of the isouron treatments significantly ($P < 0.05$) reduced or increased yield.

DISCUSSION

The results of the first series of trials in plant cane showed that isouron surface applied either post-planting pre-emergence or as a lay-by treatment at 1.0 kg ha^{-1} gave effective weed control with crop safety. Weeds controlled included a range of species commonly occurring in sugarcane in Queensland.

The use of isouron soon after planting would allow growers to leave the soil undisturbed until a cultivation is necessary for the benefit of the crop. Two cultivations for weed control could be saved. This would be particularly advantageous in wet weather when the soil is too wet to work. When cool weather in winter-planted crops slows growth, isouron would prevent weeds competing with the young crop. Grass weeds in particular can be a problem at this time.

As a lay-by treatment applied after the final cultivation isouron will control broadleaved weeds particularly vines growing in and entangling the crop.

Isouron does not require mechanical incorporation although shallow raking does not reduce its effectiveness and would be of benefit when rainfall is limited after application.

Current trials. Trials currently in progress include research with split applications of isouron in plant cane in areas with particular weed problems e.g. Guinea grass (*Panicum maximum*).

Weeds can present a major problem in young ratoon cane and trials were commenced late in 1980 to evaluate isouron applied in the row of young ratoon cane where weeds are difficult to remove by cultivation. Isouron has been applied post-emergence to the crop and very young weeds to study crop safety and pre- and post-emergence weed control.

By removing weed competition in ratoon cane isouron is likely to give a yield advantage. In plant cane where cultivation within the young crop is necessary for purposes other than just weed control the application of isouron may not directly increase cane yields. However, the benefit of its use lies in the savings in cultivation. Isouron is currently under investigation in large block harvestable trials in which grower applications are being compared with normal cultivation practice.

Trials to date indicate that isouron will be a most effective herbicide for weed control in plant and ratoon cane.