# TOTAL VEGETATION CONTROL WITH ETHIDIMURON ( R USTILAN)

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Summary. Total vegetation control prior to the registration of ethidimuron is discussed. Problems which arose from use of the then existing "total" herbicides are described including replacement of dominant easy-to-kill weeds by resistant (previously sub dominant) weeds. Properties of ethidimuron are summarised and the development of weed control strategies to overcome shortcomings of older herbicides described.

## INTRODUCTION

Total vegetation control with herbicides is a well established practice in Australia, but relatively little is written about problems associated with it.

Problems are identified and information is presented about the way ethidimuron can be used to overcome them.

## PROPERTIES OF ETHIDIMURON

. Chemical and toxicological.

Ethidimuron is a substituted urea herbicide developed by Bayer AG. The chemical name of the compound is 3-(5-ethylsulphonyl-1, 3,-4-thiadiazol-2-yl)-1, 3-dimethyl urea.

Ethidimuron is soluble to the extent of 3000 ppm in water. It is not hydrolysed in buffer solutions - pH4.7 and pH9 at 30$^{o}$C and 50$^{o}$C after 30 days.

Ethidimuron has a favourable toxicological profile. The acute oral LD50 for male and female rats is >5000 mg kg$^{-1}$, the acute dermal LD50 for male rats is >5000 mg kg $^{-1}$, and it is not a skin irritant, and not mutagenic in the Ames test. It is exempt from the poisons schedule and, therefore, may be classified as safe.

. Biological.

The active ingredient is absorbed mainly through plant roots and is transported in the transpiration stream to aerial parts.

Ethidimuron is a photosynthetic inhibitor. Its speed of action depends on its movement to the root zone, which in turn depends largely on rainfall.

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## WEED PROBLEMS

In simplest terms weed problems are approached two ways: -

- control of existing growth with or without concern for the composition of replacement vegetation which establishes after existing growth dies.

Weed growth occurs in many and varied situations. It is characterised by a flush of growth in spring, beginning with germination in autumn in winter rainfall zones or in summer in the tropics and sub-tropics.

Whilst a multitude of species occur as weeds in various locations, it is common in particular situations to find relatively few species with one or several dominating.

Thus in summer in east coastal areas and some other higher rainfall areas paspalum (*Paspalum dilatatum*) is one species dominant in the many places weed control is required. In drier inland winter rainfall areas annuals such as wild oats (*Avena fatua*) annual ryegrass (*Lolium rigidum*) brome grasses (*Bromus* sp) thistles - saffron (*Carthamus lanatus*) variegated (*Silybum marianum*) and others, Paterson's curse (*Echium plantagineum*) or cruciferous weeds predominate.

The choice of herbicide is based on the susceptibility of the dominant weed species and safety to nearby desirable vegetation.

There is sometimes little regard for its effect on sub-dominant or dormant species. Long term intentions for the site become subordinated.

None of the available herbicides with post-emergence activity can be applied only once a year to kill whatever species create the weed problem throughout the different seasons of the year.

Some are highly effective at specific times of the year for specific weed species. For example, a single application of glyphosate is capable of killing Johnson grass (*Sorghum halepense*) in summer, but not the weeds which replace it later in the year.

Herbicides are capable of selecting weed species. For example, bromacil selects paspalum; diuron selects common plantain (*Plantago lanceolata*).

Recognition of this problem has led to the development of mixture products which have a broader spectrum but are still selective to some extent.

The result is that tolerant species or those not completely killed regenerate to become dominant, e.g. couch grass dominates after a mixture of atrazine and amitrole.

Ground bared when weeds die may be colonised from seed or invaded by species otherwise unable to compete and which are likewise tolerant or less susceptible to the chosen herbicide.

Thus a vegetation change is induced. Usually easy-to-kill annual weed species are replaced by harder-to-kill perennials. Unless another herbicide is available to control the new problem species which ultimately develop, it is

questionable whether the first chosen herbicide should be used.

Thus there existed a gap or inadequacy in the armoury of products for total vegetation control.

## EFFICACY OF ETHIDIMURON

Development of weed control strategies to overcome these problems is possible when ethidimuron is used.

Australia wide tests with ethidimuron began in 1972 with the knowledge that European tests had shown it to be a broad spectrum herbicide which controls both broad leafed and grass weeds. The initial objective was to determine the post-emergence susceptibility of commonly occurring weeds and the subsequent objective was to determine the longevity of pre-emergence effect.

In 1976, by the time Australian results were consolidated, world wide trials listed 133 species susceptible to 3.5-7.0 kg ethidimuron $ha^{-1}$. Australian tests continued to determine the susceptibility of as many weed species as possible.

Differences in susceptibility between species treated post-emergence were observed - shallow rooted plants being easier to kill than deep rooted or mat forming or dense clump forming perennials.

During the period of development, sites were chosen from the Pilbara through the winter rainfall zones to the wet tropics to determine the influence of environment on ethidimuron's performance. The over-riding factor was rainfall. Provided there was sufficient rain for plant growth ethidimuron worked without any obvious effect from temperature, hours of sunshine, etc. In the presence of ash, carbon or oil, ethidimuron's availability for root uptake and efficacy was reduced.

Determination of the longevity of pre-emergence effect has taken a long time because a single application of ethidimuron has provided complete pre-emergence weed control for periods from approximately six months on tram tracks in North Queensland treated at the beginning of the wet season to more than six and a half years on a roadside near Wagga Wagga in Southern N.S.W.

The longevity of its pre-emergence capability is remarkable compared with older herbicides. In time, when the residue dissipates, weeds colonise treated areas. Where rhizomatous or stoloniferous species such as couch (*Cynodon dactylon*) or Johnson grass grow alongside, they encroach. Otherwise weeds colonise from seed. Where this occurs the species are the same as those growing in adjacent, untreated areas so that both areas have the same appearance and population.

In other words, ethidimuron does not induce a vegetation change with the development of harder-to-kill species.

Consequently the accent on weed control strategies can be changed.

Total vegetation control implies control of all existing weed growth. The availability of ethidimuron enables definition of the term to be broadened and encompass total vegetation prevention. Accepting this broader definition highlights ethidimuron's ability to solve past problems - re-invasion and development of species tolerant of older, more selective herbicides.

Ethidimuron kills young seedlings of all species, enabling strategies to be based on non-selective pre-emergence capability.

## STRATEGIES WITH ETHIDIMURON

Strategies for using ethidimuron are: -

1. Where only annuals constitute the weed problem control of existing growth can be achieved with an application of 3.5-7.0 kg ethidimuron $ha^{-1}$ without perennial weeds colonising and taking over.

2. Where mostly annuals create the weed problem, control of the annuals can be achieved, using the same rate without the perennials increasing. Perennials can be spot treated at the appropriate time with glyphosate.

3. Where perennials are the problem, control can be achieved with glyphosate applied at the appropriate time. Afterwards ethidimuron can be applied at the rates already given before weeds re-establish from seed.

Having achieved bare ground it can be maintained bare by retreatment with ethidimuron at the rate of 3.5-7.0 kg ethidimuron $ha^{-1}$ when seedling weeds appear to be re-establishing. This will vary from site to site, depending on rainfall and soil type. Application rate of ethidimuron can be developed from local experience.

## CONCLUSION

Investigation at widely varying industrial sites around Australia, followed by commercial use by transport and service authorities, has demonstrated the significant contribution that ethidimuron has made to total vegetation control. It has solved the problem created by season flushes of weed growth and the old problem of re-invasion of ground by tolerant difficult-to-kill species.