

BUREAU OF SUGAR EXPERIMENT STATIONS
QUEENSLAND, AUSTRALIA

**ENHANCEMENT POTENTIAL OF 'ETHOKEM'
IN CONTROL OF THE COMMON REED
(*PHRAGMITES AUSTRALIS*) USING GLYPHOSATE**

by

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FINAL REPORT

A trial investigating the enhancement of treatment of the common reed with Roundup herbicide by the addition of 'Ethokem'.

EXECUTIVE SUMMARY

A significant, positive response trend to the addition of the adjuvant Ethokem to Roundup has demonstrated the potential for this additive to enhance herbicidal activity when applied to control the common reed, *Phragmites australis*.

Efficacy was not elevated to acceptable levels in any of the Roundup:Ethokem combinations tested. The trial results have indicated however, that further investigation of the enhancement potential of Ethokem at concentrations in excess of 0.37% v/v at the 6 L rate of Roundup, is warranted.

PREFACE

This report concerns the second of two trials conducted by BSES on behalf of Vetsearch Rural. The initial trial, established in January, 1989 was subjected to repeated floodings which rendered assessment of treatments inconclusive.

AIMS AND OBJECTIVE

To conduct on a contract basis for Vetsearch Rural, a replicated trial of a randomised complete block design with an objective of testing the control-enhancement potential of the proprietary cationic additive 'Ethokem' when added to the herbicide glyphosate (as Roundup) applied to control the common reed, *Phragmites australis*.

INDUSTRY SIGNIFICANCE

An ability has been claimed for the cationic additive Ethokem to enhance herbicidal efficacy by improved adherence, penetration and rain-fastness of the spray mix. Improvements to herbicidal efficacy of up to 30% are claimed by the manufacturers, and results of trials conducted by Vetsearch Rural indicate similar levels of enhancement are possible under Australian conditions.

Ethokem is registered overseas for addition to a number of herbicides used, or under trial, in the Australian sugar industry including glyphosate, paraquat, diquat, fluazifop and asulam. Significant enhancement of these herbicides would lead to their more efficient and less costly use overall. This applies especially to glyphosate where savings approximating \$40/ha are possible if the highest application rate (9 L/ha) could be reduced to the median level (6 L/ha).

Additional potential benefits include improved reliability of control of resilient weed species, and a reduction in costly re-treatments. This latter situation applies especially to *Phragmites* sp. and gives incentive to the testing of Ethokem against this weed pest.

EXPERIMENTAL DETAILS

The trial protocol was supplied by Vetsearch Rural.

Date of application 28/11/90

Trial design Randomised complete block design of three replicates set out as a 12 x 4 layout

Plot size 10 m x 3 m = 0.003 ha; as sward

Treatments

Glyphosate as Roundup at 3, 6 and 9 L/product ha in a partial factorial arrangement with 'Ethokem' at 0, 1.0, 0.5 and 0.25 L/ha. A treatment combining Roundup at 6 L/ha and Ethokem at 0.6 L/ha was included to reflect rates applied in current investigations with other weed species. Two control treatments were included : a nil treatment (x2), and a treatment of the heaviest rate of Ethokem (1 L) without Roundup.

Site

The trial block had a history of heavy reed infestation and had not been cropped for several years. Cultivation during the previous harvest season had resulted in a dense and generally even stand of *Phragmites* sp.

Conditions at spraying

Clear, sunny and still, moderate humidity, no dew present. Soil moist but less than field capacity despite recent showery conditions. Rainfall data is recorded on attachment 4.

Reed lush, averaging 0.86 to 1.34 m with 8 to 9 unfurled leaves.

Application specifications

Application	Mesto pressurised knapsack
Nozzle	Flat fan, Hardie 4110-14
Pressure	2.5 bar
Water use	270 L/ha

Time of application 0700-1100 hours

Time to next rainfall event 5 days - 20.3 mm

Assessment

Five visual assessments of control were made at 7, 14, 27, 43 and 67 days post-application. Efficacy was rated on a 0-10 scale (EWRC) where 0 = nil effect, 10 = complete death. Scores of 7 and above signify effective control.

An assessment of control of the lower weed storey was carried out also at 27 days post-treatment.

Analyses of variance was applied to the final rating (67 days post-application) when treatment effect was judged to be stable. Additional analyses were conducted to investigate linear and polynomial trends within each of the three herbicide bands.

RESULTS AND DISCUSSION

Treatment ratings for the five assessments are given in Attachment I.

Response to treatment proved relatively fast with significant leaf chlorosis and death of growing points evident at seven days post-application. Initial assessment indicated slight enhancement of herbicidal effect at 6 L Roundup plus 0.5 L Ethokem. However, a negative effect was indicated initially to Ethokem at the 9 L rate of Roundup, while at the 3 L herbicide rate response was indicated at the 0.25 L and 1 L rates of Ethokem only.

Little significance can be placed on these early results because of the difficulty of visually assessing initial reaction to treatment in the common reed.

Differentiation of treatment effect between standard rates of Roundup was established by 14 days post-application when the effect upon the lower storey of mixed broadleaf and narrowleaf species was rated normal. While enhancement was evident at the 6 L rate of Roundup at this assessment, the enhancement trend at the 3 L and 9 L rates of herbicide appeared cyclic. This trend persisted to the trial's conclusion suggesting antagonism may have occurred at the median rate of Ethokem but was overcome at the higher concentration of the additive.

Changes to efficacy caused by the addition of Ethokem at three rates of Roundup are illustrated in Attachment 2. Variability between replicates and the effect that regrowth has upon a efficacy rating system where levels are set in 10% bands have contributed to the non-linear trends depicted.

Differences between increasing rates of Ethokem within each herbicide level are significant for only a few rate comparisons. However, linear and polynomial trends were highly significant; a summary of linear responses is presented in Attachment 3. The positive trends indicated warrant further investigation of Ethokem as an enhancer for Roundup applied for the control of common reed.

It was noted that a majority of treatments demonstrating moderate control or better, contained Ethokem concentrations of 0.19%-0.37% V/V which compares with mixing rates advised in Ethokem promotional material of 0.2%-0.5% V/V.

Despite the linear response achieved to Roundup alone, the failure of the 9 L treatments to reach efficacy is of concern. Trial variability is considered partly responsible for this but consistent low scoring of some treatments e.g. 9 L Roundup + 0.5 L Ethokem, is inexplicable.

CONCLUSIONS

- * The addition of Ethokem to Roundup applied to control the common reed failed to elevate the efficacy of control to acceptable levels (rating $\neq 7$) in any of the combinations tested.
- * A positive and highly significant ($P=0.01$) response trend to the addition of Ethokem was demonstrated and establishes a potential for Ethokem to enhance Roundup when applied to control the common reed.
- * Significance ($P=0.05$) between increasing rates of Ethokem was achieved only at the 1 L and 0.25 L rate with 3 L Roundup. Further investigation of enhancement potential at the 6 L rate of Roundup and at concentrations of Ethokem in excess of 0.37% V/V is warranted with a view of reducing the effective application rate of Roundup for common reed from 9 L to 6 L/ha.
- * Ethokem applied alone had no significant effect upon the common reed.

ATTACHMENT I

**EFFICACY RATINGS OF ROUNDUP X ETHOKEM TREATMENTS AT
7, 14, 27, 43 AND 67 DAYS POST-TREATMENT**

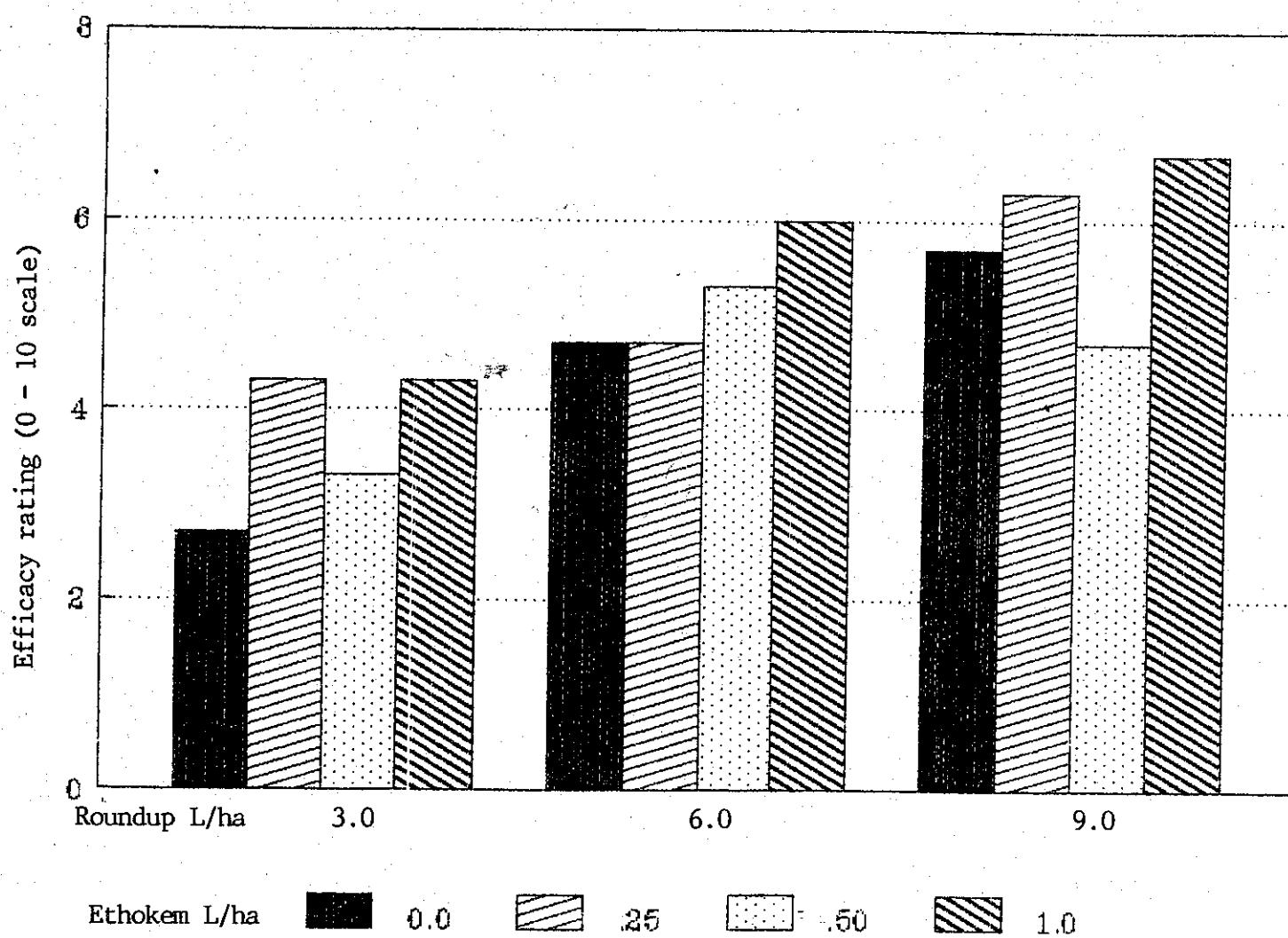
Treatment Roundup/Ethokem L/ha	Efficacy ratings (average 3 reps)					$\sqrt{\text{Rating}}^*$ 67	
	Days post-application						
	7	14	27	43	67		
9	0.0	5.0	5.0	5.7 (7.0)	5.3	5.7	2.481
	1.0	3.7	4.7	4.7 (5.7)	6.0	6.7	2.676
	0.5	4.3	4.3	4.0 (6.3)	4.3	4.7	2.271
	0.25	4.7	5.3	5.0 (5.0)	6.3	6.3	2.612
6	0.0	3.7	4.3	4.0 (4.3)	4.3	4.7	2.256
	1.0	4.0	5.0	5.3 (6.3)	6.0	6.0	2.544
	0.5	4.7	4.7	5.0 (6.3)	4.7	5.3	2.407
	0.25	3.7	4.3	4.3 (4.7)	4.3	4.7	2.264
3	0.0	3.0	3.3	3.0 (2.3)	2.7	2.7	1.774
	1.0	3.7	4.0	3.7 (3.7)	4.3	4.3	2.187
	0.5	3.0	3.7	3.0 (2.3)	3.0	3.3	1.954
	0.25	3.7	3.7	3.3 (4.0)	4.0	4.3	2.196
6	0.6	4.0	5.3	5.0 (6.0)	6.0	6.0	2.544
0	1.0	0.7**	1.0	0.7 (0.0)	0.7	0.7	1.052

* LSD treatments 5% = 0.328 : 1% = 0.442

() Ratings of lower storey at 27 days shown in brackets

** Denotes minor spindle death only

ATTACHMENT 2



Illustrating efficacy changes due to addition of Ethokem at 3.0, 6.0 and 9.0 L rates of Roundup

ATTACHMENT 3**EFFICACY TREND ANALYSES OF ETHOKEM ADDED TO ROUNDUP**

Roundup rate L/ha	Source	Degrees of freedom	Mean squares	F value	Probability
3	linear	1	2.417	61.97	<0.01
	error	6	0.039		
6	linear	1	4.255	59.93	<0.01
	error	8	0.071		
9	linear	1	0.777	45.60	<0.01
	error	6	0.017		

ATTACHMENT 4**RAINFALL DATA**

(Recorded at Bli Bli)

Month	Day	Rainfall (mm)
November '90	2	12.7
	3	5.1
	4	110.2
	5	59.6
	6	2.5
	7	25.4
	8	10.2
December '90	9	19.0
	3	20.3
	4	14.0
	5	3.8
	10	5.1
	22	5.8
	23	7.1
January '91	24	2.5
	30	3.8
	1	2.5
	2	8.9
	4	2.5
	5	2.5
	21	14.0
	25	3.8
	27	13.7