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EFFECT OF AMETRYNE AND 2,4-D ON NUT-GRASS (CYPERUS ROTUNDUS)

By W. H. L. HAZARD, B.Agr.Sc., Q.D.A.

SUMMARY

In a trial at the Gatton Research Station in south-eastern Queensland, reductions in nut-grass (*Cyperus rotundus*) plant numbers were obtained with post-emergence applications of 2,4-D. Significant reductions were obtained only at the highest rate tested (4 lb a.e./ac). There were no significant reductions in nut-grass plant numbers with ametryne at rates of 0·5 and 1·0 lb a.i./ac.

There were no significant reductions in the oven-dry weight of nut-grass when ametryne and 2,4-D were applied separately. However, significant reductions were obtained when ametryne at 0·5 and 1 lb a.i./ac were combined with 2,4-D at 4 lb a.e./ac. The results indicate that these two herbicides may be operating synergistically in reducing the vigour of surviving plants.

The addition of a non-ionic surfactant had no effect on any treatment.

I. INTRODUCTION

Nut-grass (*Cyperus rotundus* L.) is a problem in many of the areas used for cropping in coastal and sub-coastal Queensland. Of the herbicides available, 2,4-D is the most widely used. It is preferred because of its short residual life in the soil and low cost.

Many papers have been published on the post-emergence control of nut-grass with 2,4-D (Harrison 1946; Burgis 1951; Loustalot, Muzik and Cruzado 1954; Verhoeven and Cowdry 1961; Hocombe and Ivens 1962; Hauser 1963; Chapman 1964). There is no general agreement amongst these workers on the rate of application necessary for the control of nut-grass. Effective rates reported have varied between 1·5 and 7·5 lb. a.e./ac. Surfactants are frequently added to commercial formulations of 2,4-D for the control of nut-grass, despite the fact that Ennis, Williamson and Dorschner (1952) and Chapman (1964) indicate that they are not necessary.

The post-emergence herbicidal activity of ametryne has been shown by Weiss and Hall (1963). The chemical has also been reported to be active against nut-grass when applied as a post-emergence application at the rate of 4 lb a.i./ac (Parker, Holly and Hocombe 1969). W. J. Burke (personal communication, 1964) on the other hand claimed the chemical to be ineffective against nut-grass at rates up to 1 lb. a.i./ac, but suggested that in the control of nut-grass a synergistic effect was apparent when ametryne was combined with 2,4-D.

This study was designed to clarify the issues of optimum rate of 2,4-D, effect of ametryne on nut-grass, the alleged synergism of 2,4-D and ametryne and the effect of adding a non-ionic surfactant to 2,4-D and/or ametryne for the control of nut-grass.

II. MATERIALS AND METHODS

The experimental site at the Gatton Research Station was a dark brown alluvial clay soil that had been subjected over a period of 2 years to frequent cultivations and irrigations during the summer months to obtain a uniform and high nut-grass population free from other weeds.

Pretreatment sampling on January 28, 1965, gave a mean count of 35·4 nut-grass plants per sq ft with a range of 49–102 and a coefficient of variation of 12·44.

The experiment was established on a 3^2 x 2 factorial design with three replications of plots, each 6 ft by 6 ft.

Ametryne, containing 50% w/w 6-ethylamino-4-isopropylamino-2-methylthio-1, 3, 5-triazine, was applied at 0, 0·5 and 1·0 a.i./ac. 2,4-D containing 50% w/v 2,4-dichlorophenoxyacetic acid present as the dimethylamine salt was applied at 0, 2 and 4 lb. a.e./ac. The 2,4-D formulation used contained 1·5% w/v of the non-ionic surfactant sodium akyl sulphate. Each treatment was applied both with (0·2%) and without the non-ionic surfactant "Plus 50" which is manufactured by Ciba-Geigy Australia Limited.

The treatments were applied on February 3, 1965, four weeks after the area was rotary cultivated and irrigated and the majority of nut-grass plants were in the 4–6 leaf stage.

Spray application was by means of an. "Oxford Precision Sprayer" at 20 gal/ac and 30 lb/sq in using flat fan nozzle tips.

Wet and dry bulb readings in a Stevenson screen at the time of commencement of spraying (9.00 a.m.) were wet bulb 66°F and dry bulb 76°F. Relative humidity was calculated as 59%. Forty-four points of rain fell in the three days prior to spraying, 112 points between spraying and the first sampling and a further 14 points between the first and second sampling. For the month of February 1965, the mean maximum temperature was 88·2°F and the mean minimum temperature was 62·8°F.

Assessments of the treatment effects were made on February 17, 1965 (2 weeks after spraying) and on March 3, 1965 (4 weeks after spraying). In the first sampling, green emerged nut-grass plants in two randomly placed 1 sq ft quadrats per plot were counted; in the second, they were counted, then cut and the green material oven-dried at 180°F and weighed.

III. RESULTS

Inconsistent results were obtained from the first sampling. It was considered that the sampling was too early, in that treatments had not had time to exert their full effect. At the second sampling, treatments had exerted their full effect and conclusions were drawn only from these data.

Effects on nut-grass stand.—A highly significant difference in percentage reduction in nut-grass stand (Table 1) was obtained only with 2,4-D at 4 lb a.e./ac. No significant reduction occurred with 2,4-D at 2 lb a.e./ac. Neither ametryne nor the surfactant applied separately produced significant reductions in numbers and there were no significant interactions.

TABLE 1

MAIN EFFECT OF 2,4–D ON PERCENTAGE REDUCTION IN STAND OF NUT-GRASS

Treatment	Percentage Reduction in Nut-grass Stand 4 Weeks after Treatment Application
2,4-D at 0 lb a.e./ac	−7·2
2,4-D at 2 lb a.e./ac	8·3
2,4-D at 4 lb a.e./ac	50·8
S.E.	5·9
Necessary differences for significance 5%	16·9
Necessary differences for significance 1%	22·6

Effects on oven-dry weight of nut-grass.—A signficant interaction occurred between 2,4-D and ametryne (Table 2). Significant reductions occurred when 2,4-D was added to 0·5 and 1·0 lb a.i./ac ametryne but not when 2,4-D was applied alone. The relative size of these reductions was greater with higher amounts of ametryne. At the same time, the addition of ametryne to 2,4-D produced significant reductions only when it was applied with 2,4-D at 4 lb a.e./ac. These reductions are apparently linear.

TABLE 2

INTERACTION OF 2,4-D AND AMETRYNE ON PERCENTAGE REDUCTION IN STAND AND OVEN-DRY WEIGHT OF NUT-GRASS

Treatment		Percentage Reduction in Nut-grass Stand 4 Weeks after Treatment Application	Oven-dry Weight of Nut-grass Plants 4 Weeks after Treatment Application (g/2 sq ft)
2,4-D (lb a.e./ac)	Ametryne (lb a.i./ac)		
0	0	−4·0	8·23
0	0·5	19·0	11·27
0	1·0	1·4	9·99
2	0	8·2	6·90
2	0·5	−0·0	7·23
2	1·0	16·5	7·07
4	0	48·0	6·34
4	0·5	46·1	5·01
4	1·0	58·3	3·86
S.E.		10·2	0·75
Necessary differences for significance 5%		N.S.	2·15
Necessary differences for significance 1%		..	N.S.

The addition of non-ionic surfactant had no effect on the oven-dry weight of nut-grass when it was made either separately or in combination with ametryne or 2,4-D.

IV. DISCUSSION

In this trial the greatest reduction in nut-grass plant numbers was obtained with 2,4-D at 4 lb a.e./ac. At this rate, 2,4-D significantly reduced nut-grass stand and its effect on oven-dry weight of nut-grass, although not significant, was nearly as great as the reduction in stand would suggest. The difference could well have been due to a compensatory effect, with a lower nut-grass population producing slightly larger plants (Table 2).

The finding that the addition of added surfactant to 2,4-D did not improve its ability to reduce either stand or oven-dry weight of nut-grass is in agreement with that of Chapman (1964), who showed that the addition of a non-ionic surfactant at 0·5% concentration was of no value in improving the control of nut-grass by 2,4-D. The lack of a surfactant response with the other treatments is also consistent with the findings of Ennis, Williamson and Dorschner (1952), who showed that contrary to popular belief the wax-like surfaces of nut-grass leaves are readily wetted and therefore the use of a surfactant to improve wetting would not appear justified.

Ametryne applied separately did not produce a significant reduction in either stand or oven-dry weight. The figures in fact indicated that an increase in oven-dry weight occurred. This increase, which is associated with a low (although non-significant) nut-grass stand, is consistent with the compensatory effect which has been exhibited by 2,4-D.

The combination of ametryne and 2,4-D resulted in a greater reduction in the oven-dry weight of nut-grass than the additive effect of each herbicide applied separately. This finding does add some support to the observations of W. J. Burke (personal communication, 1964) that ametryne and 2,4-D may be operating synergistically; however, further research would be necessary to elucidate the exact mechanism of this synergism.

V. ACKNOWLEDGEMENTS

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The author is an officer of Agriculture Branch, Queensland Department of Primary Industries, stationed at Research Station, Gatton.