Crop Pests

CULTURAL CONTROL OF WHITE-FRINGED WEEVIL

R. EAST and J. PARR

*Soil and Field Research Organisation, Ruakura Agricultural
Research Centre, MAF, Hamilton*

Summary

Intensive cultivation (three rotary hoeings at 7-day intervals) in both October to early November and mid to late December reduced white-fringed weevil (*Graphognathus leucoloma*) populations by 83%. A summer sudax crop (*Sorghum bicolor* $\times$ *S. sudanense*) reduced a white-fringed weevil population by 94%, compared to a 98% reduction by a January to April fallow. Thorough cultivation prior to establishing a weed- and legume-free summer cereal crop appears to be an effective technique for controlling white-fringed weevil.

INTRODUCTION

White-fringed weevil adults have much greater longevity and fecundity when fed on legumes than when fed on grasses and cereals, which suggests that one method of suppressing white-fringed weevil infestations may be to sow a summer cereal crop (East 1977). Another cultural practice which may be useful for controlling white-fringed weevil is cultivation. Young *et al* (1950) reported that thorough discing of the soil at 10-day intervals for 2 months in mid-summer killed a large proportion of white-fringed weevil pupae, and Todd (1964) observed that while white-fringed weevil populations were apparently unaffected by normal routine cultivation they may have been reduced markedly by intensive cultivation.

This paper describes the effects on white-fringed weevil populations of a summer sudax crop (cultivar 'ST6') and the effects of various cultivation regimes in the spring, prior to the appearance in large numbers of the delicate pupal stage, and in early summer (mid to late December), when peak numbers of pupae occur.

METHODS

Both trials were carried out in a clover-dominant ryegrass (*Lolium perenne*), paspalum (*Paspalum dilatatum*) and white clover (*Trifolium repens*) pasture at the Otakanini research area near Helensville. Pre-treatment sampling of the trial site in early October 1976 revealed a heavy infestation of 350-500 white-fringed weevil larvae per m².

Trial 1 contained four cultivation treatments and a control:

Treatment 1 — spring cultivation, low intensity (one cultivation on 20 October 1976).

Treatment 2 — spring cultivation, high intensity (six cultivations at 7-day intervals between 20 October and 24 November).

Treatment 3 — summer cultivation, low intensity (one cultivation on 16 December 1976).

Proc. 30th N.Z. Weed and Pest Control Conf.

Crop Pests

Treatment 4 — summer cultivation, high intensity (three cultivations at 7-day intervals between 16 and 30 December).

Treatment 5 — uncultivated pasture.

All cultivations were carried out with a garden rotary hoe to a depth of 12-15 cm. Plot size was 5 x 3 m and there were four replicates of each treatment in a randomized complete block design. Prior to the first cultivation in each treatment the plots were mown to 1 cm and sprayed with paraquat (0.6 kg/ha). Post-treatment white-fringed weevil populations were assessed by taking 20, 5.0 cm diameter, soil cores per plot and extracting the weevils by a flotation and wet sieving process. The effects of spring cultivations were assessed on 10 November (after three cultivations in treatment 2) and 8 December 1976, and the effects of summer cultivations on 6 January 1977.

In mid-January 1977 the cultivated plots in trial 1 were randomly divided into two groups, one of which was maintained in a summer fallow by occasional surface hand-hoeing while the other was allowed to become weed-infested. White-fringed weevil numbers on all plots were assessed on 26 May 1977.

Trial 2 contained two treatments, sudax and uncultivated pasture, each replicated four times in 5 x 4.5 m plots in a randomized complete block design. The sudax plots were worked lightly with a rotary hoe to a depth of about 5 cm on 20 and 28 October 1976. Sudax seed was hand-sown in drill rows at 20 kg/ha on 30 November 1976. The sudax plots received a broadcast application of 150 kg/ha of reverted superphosphate immediately after sowing, and were sprayed with dicamba (200 g/ha) in early January 1977 to suppress clover regrowth. Herbage production was measured between 20 October 1976 and 13 April 1977 with a Swift Current forage plot harvester. Post-treatment white-fringed weevil populations were assessed on 26 May 1977 in the same manner as in trial 1.

RESULTS AND DISCUSSION

Trial 1 revealed that intensive cultivation reduced white-fringed weevil numbers by 83-86% in both spring (treatment 2) and summer (treatment 4) (Table 1). The reduction achieved by treatment 2 was similar after three cultivations (83%) to that after six cultivations (86%). Treatment 4 was therefore not extended beyond three cultivations. A single rotary hoeing reduced weevil populations by approximately 50% (treatment 1) and 70% (treatment 3). No differences were apparent in the susceptibility of different sized white-fringed weevil larvae to cultivation, but pupae and teneral adults comprised 16% of the post-treatment population in treatment 5 (control), 12% in treatment 3 and nil in treatment 4.

In late autumn white-fringed weevil larvae can be divided into two size classes, large (weighing more than 45 mg), which are larvae entering their second winter, and small (less than 20 mg), representing larvae arising from eggs laid during the previous summer. Maintaining a fallow during the main period of white-fringed weevil adult activity (January to April) caused a reduction of 98% below the control population (Table 2), with little oviposition in the fallow plots and large

Crop Pests

TABLE 1: White-fringed weevil populations under different cultivation regimes

Treatment (see text)	Number of weevils /m ²		
	10 Nov. 1976	8 Dec. 1976	6 Jan. 1977
1	274 B	217 B	ns
2	81 C	74 C	ns
3	ns	ns	178 bB
4	ns	ns	94 cB
5	481 A	533 A	572 aA

ns = not sampled

larvae eliminated, presumably due to starvation. The major volunteer species in the plots allowed to become weed-infested were nightshade (*Solanum nigrum* complex), *Portulaca oleracea*, *Amaranthus* spp., broad-leaved fleabane (*Erigeron floribundus*), *Lotus* spp. and white clover. All of these species apart from *E. floribundus* are favourable food plants for adult white-fringed weevil survival and oviposition (D. Steven, pers comm; East 1977 and unpublished). Hence it is not surprising that these plots supported similar numbers of small larvae to the uncultivated pasture (Table 2). The reduction in the population of large larvae of the weed-infested plots below that of the controls reflects the effects of earlier cultivations (Table 1).

TABLE 2: White-fringed weevil numbers/m² after different summer treatments

Treatment	Small larvae	Large larvae	Total population
fallow	6.2 bB	0.0 cB	6.2 bB
weed-infested	339.2 aA	18.5 bB	357.7 aA
uncultivated pasture	271.4 aA	197.3 aA	468.7 aA

The sudax, which was almost completely free of weeds and legumes following spraying with dicamba, reduced the white-fringed weevil population by 94% (Table 3), similar to the reduction achieved by a summer fallow. Sudax is apparently an unfavourable food for white-fringed weevil larvae as well as adults, since it eliminated the large larvae as well as greatly reducing the number of small larvae. The pre-sowing cultivations of the sudax treatment may have reduced the population of large larvae but would not have eliminated it (Table 1). White-fringed weevil larvae have been reported to cause severe damage to cereals such as maize (Young *et al* 1950; Given 1973) but the sudax appeared to be completely unaffected, as shown by a complete lack of visible damage and the herbage yield (Table 3). In contrast the pasture was severely damaged by white-fringed weevil.

Crop Pests

TABLE 3: Post-treatment white-fringed weevil populations under sudax and pasture, and herbage production

Treatment	No. larvae /m ²			kg DM/ha
	small	large	total	
sudax	29.6 B	0.0 B	29.6 B	7163 A
pasture	386.0 A	98.7 A	484.7 A	1363 B

CONCLUSIONS

Intensive spring cultivation reduced white-fringed weevil populations as effectively as similar cultivation in December, when peak numbers of pupae occurred and were eliminated by intensive cultivation. A weed- and legume-free sudax crop was as effective as a summer fallow in controlling white-fringed weevil. Thorough cultivation of infested land prior to establishing a weed- and legume-free crop of sudax, or another summer cereal (East 1977), should effectively suppress a white-fringed weevil infestation.

REFERENCES

- East, R., 1977. Effects of pasture and forage crop species on longevity, fecundity, and oviposition rate of adult white-fringed weevils *Graphognathus leucoloma* (Boheman). *N.Z. J. Exp. Agric.* 5 (in press).
- Given, B.B. 1973. Insect pests of maize. *Proc. 26th N.Z. Weed and Pest Control Conf.*: 166-72.
- Todd, D.H., 1964. Biology and control of white-fringed weevil. *Proc. 17th N.Z. Weed and Pest Control Conf.*: 125-9.
- Young, H.C., App, B.A., Gill, J.B., and Hollingsworth, H.S., 1950. White-fringed beetles and how to combat them. *U.S. Department of Agriculture Circular No. 850*, 15.