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MIRIDS IN 'GRASSLANDS MAKU' LOTUS SEED CROPS: FRIENDS OR FOES?

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Abstract

The need for mirid (Calocoris *norvegicus* Gmel.) control to improve seed yields of 'Grasslands Maku' lotus seed crops was studied over two seasons on a crop near Lincoln, Canterbury. In 1980 seed yields were increased by 40% to 850 kg/ha by the application of bromophos (500 g a.i./ha) in mid-December to remove a population of 30 mirids/20 net sweeps. In 1981, demeton-S-methyl (200 g a.i./ha) was applied along with a water only control in mid-November, followed by a blanket spray of bromophos in mid-December. There were two separate effects resulting from the use of metasystox. Although demeton-S-methyl protection gave a higher seed yield/stem for early-formed flowerheads the pattern was reversed for the later-formed flowerheads because early mirid attack increased flowerhead numbers/stem. Later-formed umbels gave a more concentrated span of flowering, which enhanced better timing of harvest of this crop which is prone to pod shattering. The recommendation is to control mirids only in mid-December using bromophos. an insecticide that is relatively bee safe.

Key Words: Seed production, *Lotus pedunculatus,* mirids, *Calocoris norvegicus,* insecticide control

INTRODUCTION

Because 'Grasslands Maku' *(Lotus pedunculatus* Cav.) lotus tends to have a non-determinate flowering pattern, decision on optimum harvest date to get highest seed yields can be difficult, particularly as an unwarranted delay can cause high seed losses in this crop which is prone to pod shattering. Thus any pest which destroys flowers and flowerheads will not only reduce seed yield, but should the attack occur at main flowering, it will further impair the growers' ability to determine the best time for harvest.

The potato mirid *(Calocoris norvegicus* Gmel.) a sap sucking insect, which is found widely on stands through Blenheim and Canterbury from mid-October through to the end of January, is such a pest (Macfarlane *et al.*, 1981; Wightman & Whitford, 1982).

This paper presents the preliminary findings of a continuing programme to assess the extent to which the potato mirid impairs the components of potential seed yield and subsequently the choice of optimum harvest date, and the current state of knowledge on control measures needed.

EXPERIMENTAL

Trials were carried out in the 1980-81 and 1981-82 seasons on the same Lotus crop, growing near Lincoln, Canterbury. Insect collection techniques used were as described by Wightman & Whitford (1982).

Trial 1.

In 1980, the lotus crop was sprayed with bromophos (Nexion), an insecticide approved for use on flowering legume crops, in mid-December except for two control strips 10m wide. Rate of application was 500 g a.i./ha in 200 L of water. At harvest, on 15 February, 1981, four 2 m^2 samples of crop were taken from each of the unsprayed strips and their adjacent sprayed area. These were hand-threshed to determine seed yield, after counting the number of flowerheads and pods on 20 stems/sample. Insect numbers (nymphs + adults) were determined from 20 sweeps/plot with a 400 mm sweep net before and after application of bromophos.

Trial 2.

In 1981, the effect of controlling mirids a month earlier (mid-November) was examined. As flowering was just about to commence this allowed the assessment of the use of demeton-S-methyl (Metasystox) (hereafter referred to as D-S-M) which is more persistent than bromophos but is more toxic to bees. The rate of application was 200 g a.i./ha in 200 L water. Five plots (0.09 ha) were sprayed with insecticide and five with water alone. The subsequent bromophos application on 18 December (rate as in Trial 1) was applied to all plots.

Flowering measurements: On 18 December (main flowering on D-S-M plots) total flowered and flowering heads/m^2 were counted on all plots. For 20 stems/plot, flowering was characterised into numbers initiating, developing, flowering, green pod and mature heads. Flowers/flowerhead were counted for the latter three categories. Flowerheads with green pods starting to develop (IO/plot) were tagged and collected on 25-l -82 for measurement of early treatment effects (pre-bromophos) on potential seed yield/flowerhead and its components. At that tagging, 25 initiating flower-heads were also marked in one plot of each treatment to trace the subsequent floral development of the bromophos alone treatment (10-I-82). This allowed determination of the ability of any later initiating flowerheads to contribute to the potential seed yield as at 16-2-82. As flowerheads initiated after the December marking made no significant contribution to flowering, the data was sufficient to describe arbitrary flowering patterns caused by the spray treatments (Fig.1). A further 10 open flowerheads/plot were tagged on IO-I-82 and collected 16-2-82 as a measure of post-bromophos effects on potential yield and its components. As inflorescences initiating after 18-12-81 did not contribute to potential yield and its components these were calculated from the measurements mentioned.

RESULTS AND DISCUSSION

Trial I (1980)

Application of bromophos in mid-December completely controlled an infestation of 30 potato mirids/20 sweeps. As a consequence the hand-harvested seed yield rose significantly from 610 to 850 kg/ha. In the sprayed plots, flowerheads/stem were 13% higher and pods/flowerhead 25% higher than unsprayed plots. Seeds/pod and seed weights were similar in both treatments.

Trial 2 (1981)

Mirid Control: D-S-M reduced mirid numbers from mid-November through to early December (Fig. 1). By contrast, mirid numbers on the unsprayed plots peaked in early December then fell to a level similar to that caused by reinfestation of sprayed plots in mid-December. As mirid numbers were similar to those found at about the same time in Trial 1 (30/20 net sweeps) a similar seed

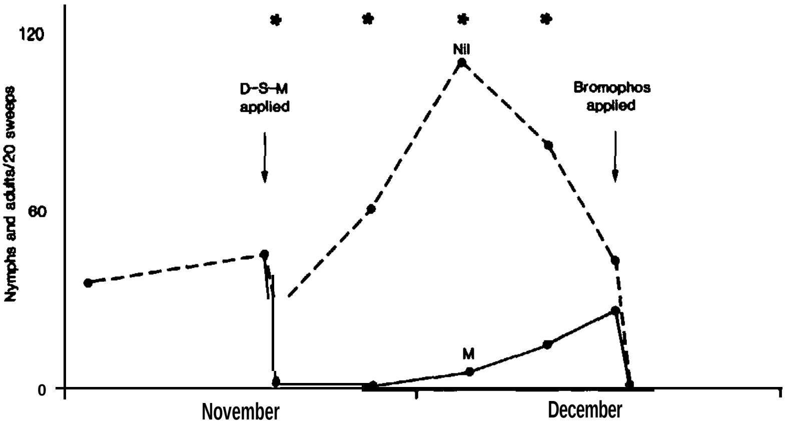

FIG. *1: Effect of insecticides on mirids infesting Maku Lotus in the 1981-82 season.*
Nil -no D-S-M; M = with *D-S-M*
. ($P > 0.05$)

yield increase would be expected if they were controlled by bromophos. As for Trial 1, use of bromophos in mid-December gave total control for the remainder of flowering.

Flowering: The control of mirids with D-S-M increased the total number of flowerheads present significantly from 220 to 510/m^2 just before the bromophos application in mid-December. By contrast, the later flowerings in bromophos-only plots were far more concentrated and contained more flowerheads (Fig.2) It was the concentration of that flowering which would allow harvest to be timed so that seed losses are minimised.

Seed Yields: Because of differences in flowering patterns caused by the use or non-use of D-S-M a common harvest date would not reflect the actual harvestable seed yields. Therefore, the potential harvestable seed yields and their compo-

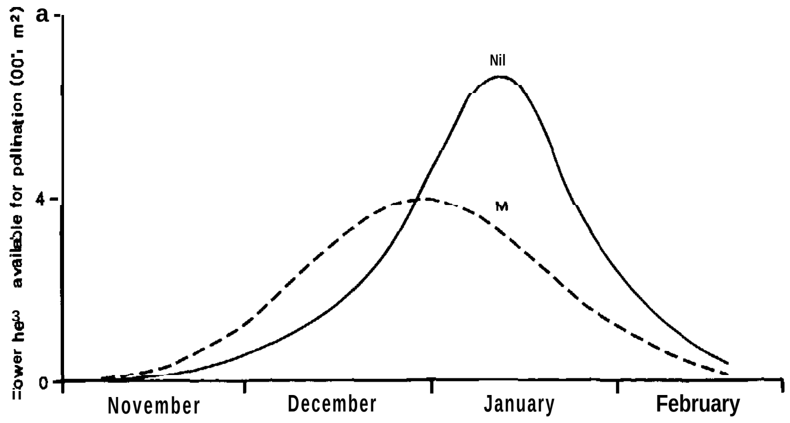

FIG. *2: Effect of pest control measures on the arbitrary flowering patterns of a Maku Lotus seed crop.*
Nil = *no D-S-M;* M = *with D-S-M*

nents were assessed on a basis of flowerheads occurring pre- and post-bromophos application, to give an accurate measure of the protection effects of the spray treatments used (Fig.3). This was possible because all plots contained a similar stem density (300 ± 20/m^2) at harvest.

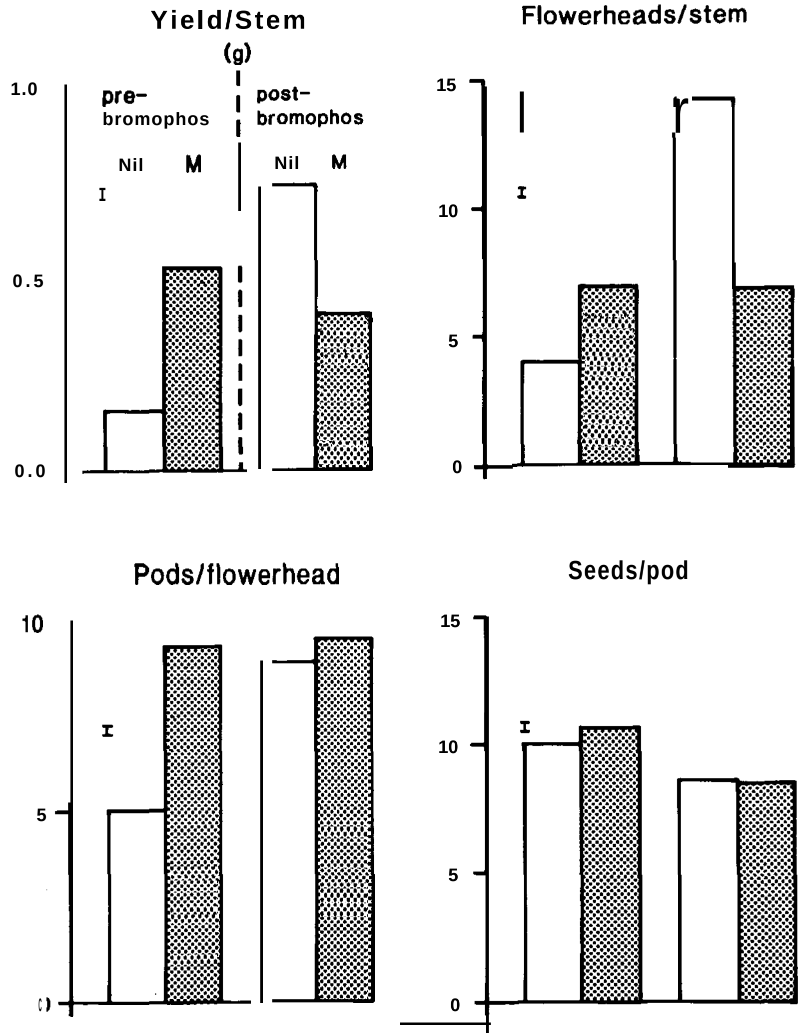

FIG. 3: *Potential seed yield/stem and its components as affected by use of DS-M to protect early flowerheads (pre-bromophos) and bromophos to protect later flowerheads (post-bromophos)*
Nil -no D-S-M; M = with D-S-M. Bars = S.E.S.

For flowerheads pollinated prior to the application of bromophos (pre-bromophos), potential yield/stem was three times greater for D-S-M sprayed than unspraved plots. The former had higher numbers of flowerheads/stem and pods/flowerhead (Fig.3). However, whereas potential yield/stem for later flowerings (post-bromophos) on these plots declined, those for the bromophos-alone treatment increased dramatically. This enhanced yield for the bromophos-alone treatment was only a consequence of higher numbers of flowerheads/stem. As there were fewer pods/flowerhead on that treatment compared to plots earlier sprayed with D-S-M, the protection afforded by bromophos was considered similar for both treatments (Fig.3). Such a result implied that the advantage in numbers of flowerheads/stem on bromophos alone treatments was caused by mirid damage prior to spraying. Further, had the bromophos application been omitted this advantage would have been diminished, either in total or in part, This surmise was evidenced in the obvious flower loss due to mirid attack on contributing heads forming prior to bromophos application on these previously unsprayed plots (Fig.3).Because the higher numbers of flowerheads/stem were associated with a greater level of branching it was considered that early apical dominance of these primary stems had been impaired, either by way of physical mirid damage or some hormonal effect induced by the injection of mirid 'saliva'. As there was a lack of difference in stem density between spray treatments at harvest, only increased stem branching was the primary effect of early mirid attack.

The overall result suggested that the highest harvestable seed yields would be obtained where a severe attack of mirids early in the season initiated a high level of primary stem branching which supported the development of high numbers of later-formed flowerheads. These flowerheads when protected with a bromophos spray in mid-December gave the most concentrated flowering (Fig.2) thereby ensuring minimum seed losses at harvest. This finding raises the question that, in the absence of a mirid attack, would some form of high topping management with a mower to remove only primary apical meristems, promote a similar level of stem branching in the crop. Further research is being done on this aspect,

As both seeds/pod (Fig.3) and 1000-seed weight were similar for all treatments, thereby duplicating the result of the previous season, it was considered that mirid attack had no further deleterious effect on lotus flowers once pod formation had commenced.

In the light of these preliminary results it would appear that properly timed mirid control could considerably enhance growers' seed yields. In that case it is recommended that bromophos (Nexion) should be applied at a rate of 500 g a.i./ha in 200 L water only if mirid populations exceed 10-15/20 net sweeps in mid-December, with due regard to MAF regulations on spraying of legumes during the flowering period.

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REFERENCES

Macfarlane, R.P.; Wightman, J.A.; Griffin, R.P.; Whitford, D.N.J., 1981. *Proc. 34th* N.Z. *Weed & Pest Control Conf.: 39-42*

Wightman, J.A.; Whitford, D.N.J. 1982. N.Z. *J. exp. Agric. 10: 209-215*