Mirid management- effect of salt rate when mixed with reduced rates of chemical

Moazzem Khan[1], Adam Quade[1] and David Murray[2]
[1]DPI&F, Plant Science and Cotton Catchment Communities CRC, PO Box 23, Kingaroy Q 4610
[2]DPI&F, Plant Science and Cotton Catchment Communities CRC, PO Box 102, Toowoomba Q 4350

In Australia, problems with mirids, *Creontiades spp.* have increased substantially following the adoption of Bollgard II. According to Cotton Consultants Association (CCA) 2005-06 season survey, over this past cotton season two to four insecticide sprays were required to manage mirids. Unlike conventional cotton, in Bollgard II mirids are causing damage from seedling through to late boll formation stage (Khan and Bauer 2001; Lei *et al*. 2002) and require management intervention throughout the season. Integrated pest management (IPM) is becoming a popular management approach for mirids in the Australian Cotton Industry. With the IPM approach, insecticides are not excluded as a management option; instead judicious application of insecticides is encouraged to maximise use of beneficial arthropods in cotton fields. In Australian cotton, IPM options for sucking pests include the use of reduced rates of insecticides and use of adjuvants/additives with insecticides to obtain greater benefit. The adjuvants/additives used in Australian cotton include table salt (NaCl) and petroleum spray oil (PSO). Several studies have investigated salt mixture with insecticide against green vegetable bug, *Nezara viridula* (GVB) and mirids in cotton in Australia (Khan *et al.* 2002; Khan 2003; Khan and Murray 2004). When salt is mixed with reduced rates of insecticides, efficacy is enhanced and is equivalent to the full rate of the chemical alone. However, information on the rate of salt mixed with chemical was not clear cut. Some confusion has arisen since salt is used in pulse crops at 5 g/L of water while the cotton use rate is 10 g/L of water. It was therefore necessary to clarify this issue. The objective of this study was to determine the optimum rate of salt mixed with reduced rates of chemical to obtain maximum mortality of target pests with minimum disruption to the beneficial arthropods in cotton.

Methods

Two trials were conducted in irrigated Bollgard II at Byee (S 26°11.525; E 151°49.865) and Kingaroy Research Station (KRS) (S 26°34.759; E 151° 50.036).

Trial 1 (Byee) was conducted in a Sicala 60BR cotton field at early boll setting stage and Trial 2 (KRS) was conducted in a Sicot 289BR cotton field at late boll stage. In both trials five rates of salt - 0, 2, 5, 7 and 10 g/L of water were mixed with reduced rates of chemicals. The chemicals used in the trials were dimethoate (Rogor®) at 200 mL/ha in Trial 1 and fipronil (Regent®) at 40 mL/ha in Trial 2 as these are the common chemicals and rates being used against mirids in the area. In both trials treatments were replicated 3 times in a randomised complete block (RCB) design. Each replication measured 25 m X 24 rows for Trial 1 and 15 m X 12 rows for Trial 2. The chemicals were applied with a ground rig (100 L/ha) using a 24 m Hardi boom spray, fitted with Turbo Tjet

(110 X 02'S) nozzles (one from the top and two from the sides) at 13 km/h with 5 bar pressure in Trial 1 and with air assisted sprayer (120 L/ha), flat band (110 X 02) nozzle at 6 km/h with 3 bar pressure in Trial 2.

For both trials pre-treatment counts were made the day before treatments were applied. Post treatment counts were made at 3 and 7 days after treatment (DAT). Mirids and beneficial insects and spiders were sampled using the beat sheet method on three 1 m sections of row/ replication. Data were analysed by ANOVA in MINITAB and means were compared using LSD at 5%.

Results

Trial 1

Pre-treatment mirid numbers were moderate, with 2 to 5/m, with 4 to 10 beneficial arthropods/m. The proportions of mirid adults and nymphs and different beneficial arthropods are presented in Figure 1. More than 80% of the mirid population were nymphs. Among the beneficial arthropods, spiders were the dominant group (47%) followed by damsel bug (DB – 26%), lady beetles (14%) and brown smudge bug (BSB) (9%). The least dominant beneficial was lacewings, less than 1/m and these were excluded from further analysis.

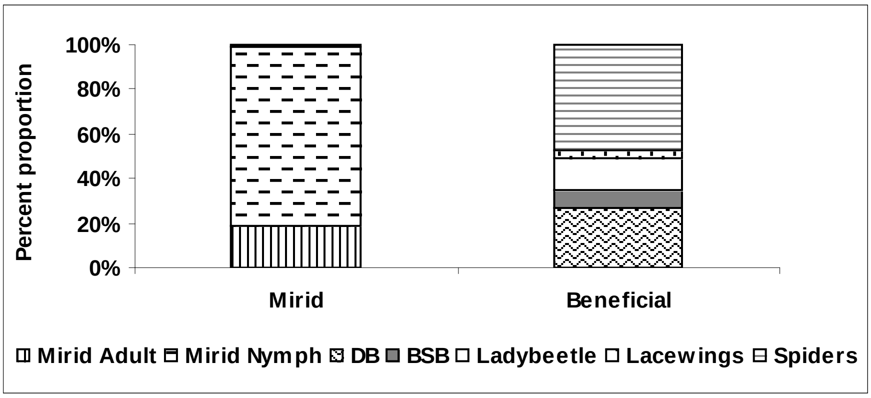

Figure 1. Population structure of mirids and beneficial arthropods before treatment

The effect of dimethoate at 200 mL/ha plus different rates of salt on mirid adults and nymphs and beneficial arthropods are summarised in Figures 2 and 3 respectively.

Figure 2 shows that both mirid adult and nymph numbers decreased for different rates of salt when mixed with dimethoate at both 3 and 7 DAT. Population reduction was greater with salt rates of 7 and 10 g and the difference was significant ($P<0.05$) for nymphs at 3 and 7 DAT compared to other salt rates and dimethoate alone. There was no significant difference ($P>0.05$) between 7 g and 10 g of salt.

While dimethoate alone reduced mirid adult numbers by 59%, salt rates of 2, 5, 7 and 10 g reduced numbers by 70 to 100%. For nymphs 2, 5, 7 and 10 g salt mixture reduced mirid numbers by 48 – 66, 71 – 72, 80 – 93 and 91 – 92% respectively.

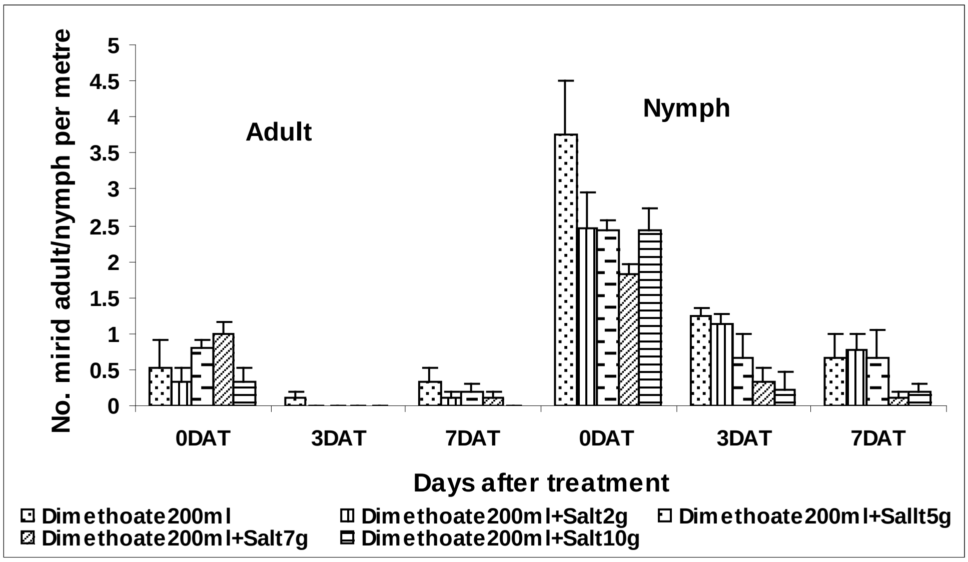

Figure 2. Effect of different rates of salt mixture with dimethoate against mirids in Bollgard II in Trial 1. Error bars indicate standard error of means.

Figure 3 shows that for different rates of salt, the impact on beneficial arthropods was low to moderate except on lady beetles and brown smudge bug for 10 g salt mixture where impact was high. However, differences between treatments were not significant (*P*>0.05).

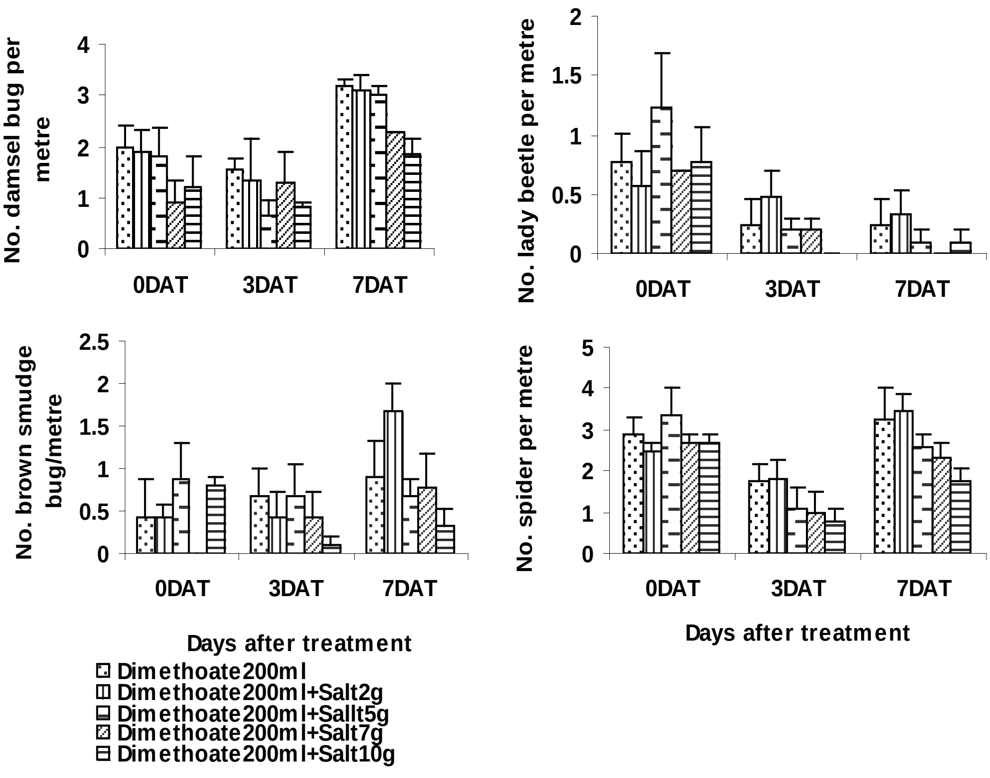

Figure 3. Effect of different rates of salt mixture with dimethoate against beneficial arthropods in Bollgard II in Trial 1. Error bars indicate standard error of means.

Trial 2

In this trial pre-treatment mirid numbers were low, 0.3 to 2/m, as were beneficial arthropods except spiders with 7/m. The proportions of mirid adult and nymphs and different beneficial arthropods are presented in Figure 4. Mirid adults represented 79% of the population. Among the beneficial arthropods spiders were the dominant group (69%) followed by red and blue beetle (RBB – 23%). Other predators were negligible and therefore not included for further analysis.

Figure 5 summarises the effect of fipronil (at 40 mL/ha) plus different rates of salt against mirid adults and nymphs and beneficial arthropods. Figure 5 shows that higher salt rates substantially reduced the mirid population, both adults and nymphs. However, differences between treatments were not significant (*P*>0.05).

Figure 5 also shows that while fipronil alone reduced RBB population by 45 – 58%, the effect of different rates of salt mixture was negligible. Spider populations were unaffected either by fipronil alone or salt mixtures.

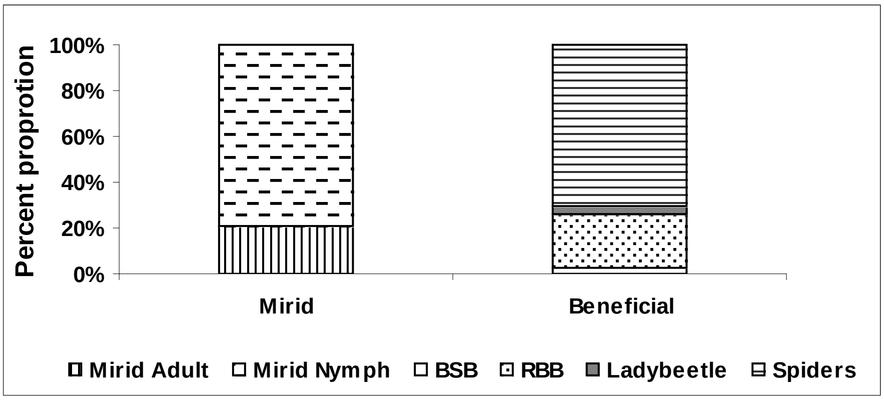

Figure 4. Population structure of mirids and beneficial arthropods before treatment in Trial 2.

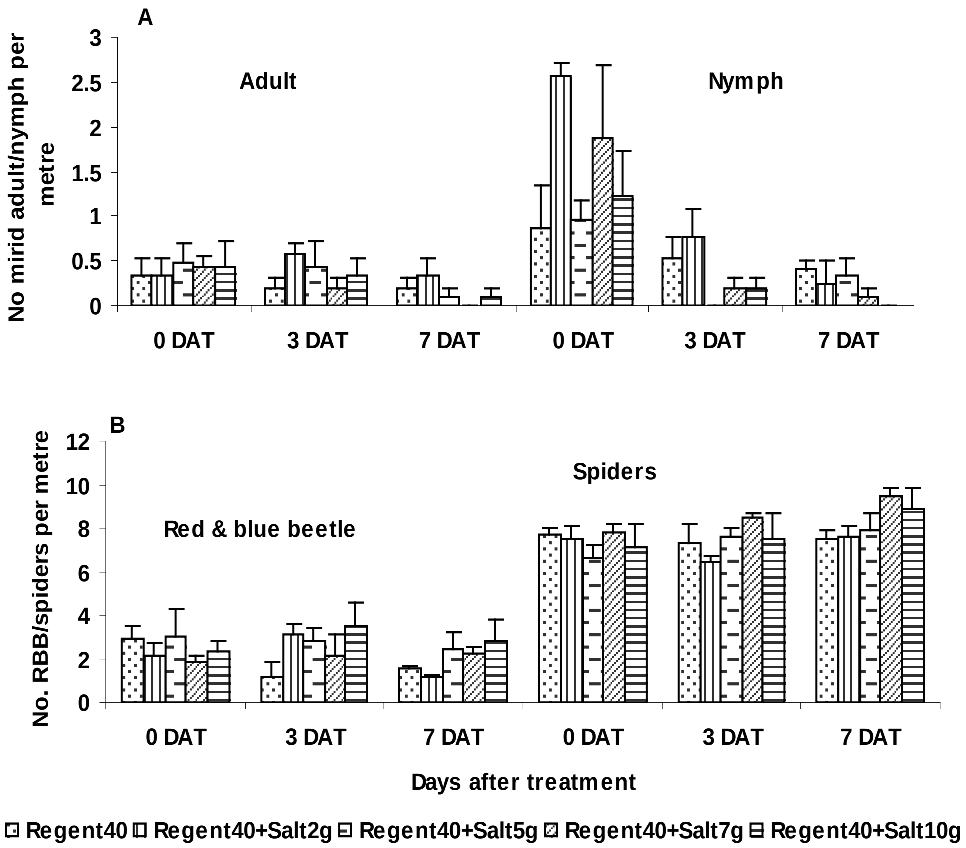

Figure 5. Effect of different rates of salt mixture with fipronil against mirid (A) and beneficial arthropods (B) in Bollgard II in Trial 2. Error bars indicate standard error of means.

Discussions and Conclusions

The study showed that irrespective of chemical types, 7 and 10 g of salt mixture were most effective against mirids (see Figures 2 and 5A). The results were more consistent for nymphs than for adults. One of the reasons for this was perhaps the behaviour of the adults in the field. Unlike other sucking pests, such as GVB, adults of mirids are usually unsettled, and move in and out of fields. This is particularly true if there are alternative hosts available and surrounding fields are sprayed. In our case, for Trial 1 there was a pigeon pea field within 200 m and adjacent cotton fields were sprayed 2 days after the treatments were applied and Trial 2 field was surrounded by mungbeans and soybeans. Pigeon pea, mungbeans and soybeans are marginally better hosts for mirids than cotton but not as good as lucerne (Mensah and Khan 1997) and failed to trap all adult population in.

This study also showed that overall impact of salt mixtures on the natural enemies was low (see Figures 3 and 5B) except for the mixture with dimethoate against lady beetles (see Figure 5B). Dimethoate alone at 200 mL/ha reduced 70% of the lady beetle population. The disruption level of dimethoate specifically is not recorded in the Cotton Pest Management Guide (Farrell and Johnson 2005). However, organophosphates generally have a high overall disruption ranking. If lady beetles are the major component of beneficial arthropods in a field, dimethoate should not be the preferred management option for mirids. Though 7 g and 10 g salt mixtures were equally effective against mirids, in some instances 10 g mixtures were more disruptive to beneficial arthropods. Salt at 7 g/L of water is the preferred rate to add to reduced rates of chemicals against mirids.

Previous studies showed that salt alone does not kill insects (Khan 2003). Salt enhances efficacy of the chemicals by encouraging probing (Khan and Murray 2004). In general, salt mixture against mirids will only be effective if it is mixed with the correct chemical i.e. the chemical that is effective by itself at full rate against mirids. Salt mixture will allow users to reduce the rate of chemical but maintain the same level of efficacy as the full rate. Salt mixture sprays should be timed to avoid any dilution effect from dew.

In conclusion, this study clearly showed that the mixture of table salt at 7 g/L of water with reduced rates of either dimethoate or fipronil is quite effective against mirids. The main advantage of salt mixture is that it allows reduced chemical rates. This improves the cost effectiveness of the treatment and reduces disruption of beneficial arthropods in the field.

Acknowledgements

We would like to thank Michael and Andrea Stuart of Byee for allowing us to conduct the trial and for helping with the spray. The Cotton Research and Development Corporation funded this project (DAQ 131).

References

Farrell, T. and Johnson, A. 2005. Cotton Pest management Guide 2005/06. NSW DPI, 96 pp.

Khan, M. and Bauer, R. 2001. Comparing damage to cotton bolls caused by green mirid and green vegetable bug. *The Australian Cottongrower* 22(4): 16-18.

Khan, M., Bauer, R. and Murray, D. 2002. Enhancing the efficacy of insecticides by mixing with table salt – a soft approach to manage stinkbugs in cotton. *Proceedings of the 11th Australian Cotton Conference*, Brisbane, 401 – 406.

Khan, M. 2003. Salt mixtures– an IPM option to manage mirids in cotton. *The Australian Cottongrower* 24(3): 10 – 13.

Khan, M. and Murray, D. 2004. Salt mixture- an IPM option for managing sucking pest in cotton. *Twenty Second International Congress in Entomology*, Brisbane.

Lei, T., Khan, M. and Wilson, L. 2002. Boll damage by sucking pests: An emerging threat but what do we know about it? *Proceedings of the 11th Australian Cotton Conference*, Brisbane, 385 – 393.

Mensah, R. K. and Khan, M. (1997). Use of *Medicago sativa* (L.) interplanting/trap crops in the management of the green mirid, *Creontiades dilutus* (Stål) in commercial cotton in Australia. *International Journal of Pest Management* 43(3): 197-202.