Changes in diazinon concentrations in shower and plunge dip dip-wash using traditional and constant replenishment methods of dip-wash management

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Summary

During a research project to improve the performance and operation of shower dips, a series of measurements of the diazinon based dip-wash concentrations were taken. These measurements, although not replicated, indicated that the concentrations were falling to levels which were considered to be too low. As a result a replicated trial was conducted on the same shower dip, modified as per the findings of the previous research. The trial investigated operating the dip using (a) the conventional reinforce/replenish method and (b) using constant replenishment. This work reinforced our concerns with respect to the stripping of diazinon based dip-wash, particularly with respect to constant replenishment. A second trial was then conducted in conjunction with a dipping contractor using a diazinon based dip-wash in a mobile plunge dip using constant replenishment. Even though the contactor charged the dip and the replenishment tanks at twice the recommended lice rate (the blowfly rate), the results are concerning, not only with respect to residues in the wool and the disposal of the used dip-wash, but also with respect to lice eradication, induced chemical resistance and OH&S.

Further work is urgently required to review the field performance of not only diazinon based dip-wash but all current wet dip formulations using the two re-charging methods.

Keywords

Lice, dip-wash, shower dip, plunge dip, diazinon.

Introduction

In a report to the International Wool Secretariat (IWS) on work to improve the design and use of shower and plunge dips for the eradication of sheep lice, Lund *et al.* (1997) identified concerns with respect to dip-wash concentrations when using a shower dip. Despite the dip sump being charged and managed according to label directions, one dip wash sample collected immediately before reinforcement and topping up, contained diazinon at a concentration of 7 mg/L, which was only marginally above the minimum level of 5 mg/L required to kill susceptible lice. The concentration of diazinon in sludge taken from the bottom of the sump was 360 mg/L, more than three times the initial charging concentration of the dip, indicating that some diazinon was being lost through binding to the organic material and settling to the bottom of the sump.

A literature search was then conducted to determine whether or not similar effects were being reported elsewhere. Two records are cited. Robinson *et al.* (1998), in work concerning the disposal of dip wash, reported final dip wash concentrations of diazinon significantly lower than calculated concentrations and, in three cases, the levels present, in their opinion, were below the minimum effective concentration; one as low as 3.1 mg/L. Sherwood *et al.* (1999) also found concerningly low levels of diazinon whilst undertaking a series of commercial field trials using both constant replenishment (CR) and traditional methods of replenishment.

As a result of this mounting evidence, two experiments, one using a shower dip and the other using a mobile plunge dip, were conducted to investigate the relationship between dip wash concentration and time during dipping.

Methods

The first experiment used the modified Buzacott 60R® at Trangie Agricultural Research Centre, showering the sheep for 12 min top sprays only. Samples of the dip wash were taken to determine the concentration profile during dipping, using both the conventional reinforce/replenish system and the constant replenishment (CR) system. Again, the dip wash used was the commercially available diazinon-based formulation, Topclip Blue®. The dip sump and the CR tanks were initially charge at 500 mL per 1000 L (100 mg/L).

A second experiment was conducted using plunge dipping in conjunction with a commercial contractor. 3013 sheep were dipped over two days using a diazinon based dip-wash, Di-Jet®, in a modified ‘U’ shaped RippaDippa® mobile dip (5000 L capacity) using CR only. A series of dip wash concentration measurements were taken. This time the dip and the CR tanks were charge at 1000 mL per 1000 L (200 mg/L - the registered rate for blowfly treatment, agreed between the contractor and the grazier).

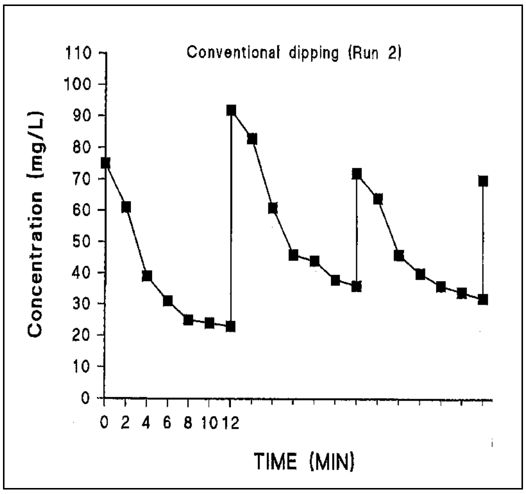

Figure 1. Diazinon concentrations during conventional dipping using a modified shower dip charged at 100 mg/L.

Results

Shower dipping: The results of the conventional reinforce/replenish technique (Figure 1), indicate that the recommendations are appropriate, with minimum concentrations ranging from 18 – 36 mg/L. Of note are the top-up concentration results. Although we followed label instructions only once did the top-up concentration reach ≥ 100 mg/L; the others ranged between 92 – 70 mg/L.

Of concern were the results from the CR treatments. The first 12 min treatment immediately following the initial charging of the dip (Figure 2), resulted in a curve taking the sump concentration down to a mean 26.6 mg/L (n=3). However on one run (Figure 3), we dipped a second mob as if to carry on with a day's dipping, as per defined practice. The concentration began at 22 mg/L and settled at 14 mg/L (n=1).

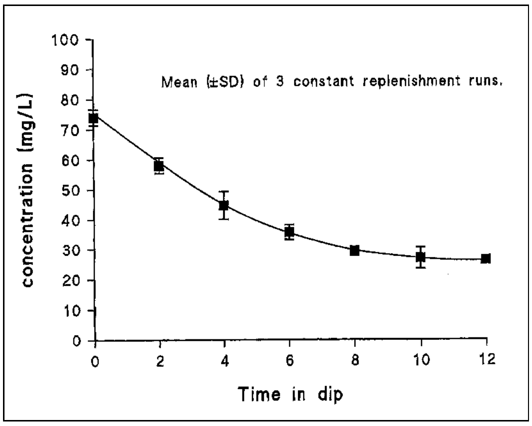

Figure 2. Diazinon concentrations during the first dip of sheep using a modified shower dip and constant replenishment.

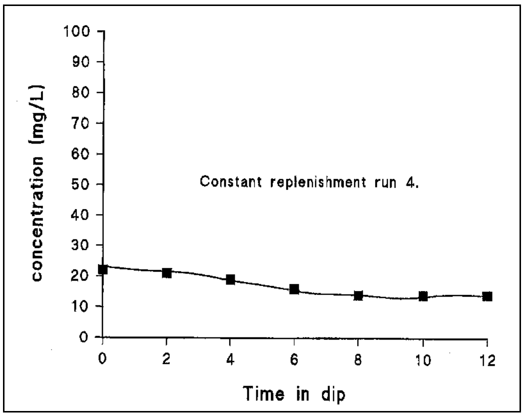

Figure 3. Diazinon concentrations during on-going constant replenishment using a modified shower dip.

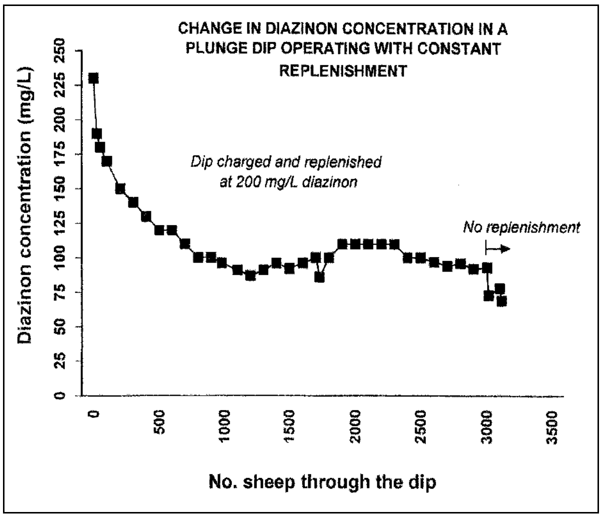

Figure 4. Diazinon concentrations during constant replenishment in a plunge dip.

***Plunge dipping*:** The initial charge resulted in a concentration of >200 mg/L. The concentration then declined steadily to ≅ 100 mg/L after 800 sheep were dipped. From there-on the concentration remained at ≅ 100 mg/L until 'dipping out': Figure. 4.

Discussion

From our limited results it would appear that the labelled use of diazinon for shower dipping may need to be modified. If, as indicated above, constant replenishment of (small) shower dip sumps leads to low concentration levels then this practice should be discouraged, even if it is more convenient for the grazier to do otherwise: Sherwood *et al.* (1999) also found that sump volume impacted on concentrations. One answer might be to charge the CR tank at a higher concentration than the initial charge rate. Our results also indicate that the 'reinforce/replenish' advice may need to be modified to suggest that this practice be undertaken for each dip full of sheep.

With respect to plunge dipping, it is general practice to use constant replenishment and therefore constant replenishment should be labelled and encouraged. Our concerns are (a) the use of the fly rate of diazinon for the treatment of lice, particularly with respect to OH&S and residues (Robinson *et al.*, 1998), and (b) that if the correct charge concentration of 100 mg/L of diazinon is used, the average concentration after the first few sheep may approach a less than therapeutic level. One answer may be to charge the CR tanks at a rate higher than the current recommendations.

All our work to date has focused on the use of diazinon based formulations. We are now concerned as to what is happening with the other wet-dipping formulations.

Conclusion

Further work is urgently required to review the field performance of all dip-wash formulations, not only diazinon based dip-wash, using the two re-charging methods, the conventional reinforce/replenish and constant replenishment, in both shower and plunge dips.

References

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