Pasture pests - are they the real problem?

Colin M Ferguson and Sue Peoples

AgResearch Ltd, Invermay Agricultural Centre, PB50034, Mosgiel, New Zealand
Contact email: colin.ferguson@agresearch.co.nz

Keywords: Pasture pests, mitigation, technology adoption.

Introduction

The New Zealand grass grub, *Costelytra zealandica* (White)(Coleoptera: Scarabaeidae) and species of the porina complex, *Wiseana* spp. (Lepidoptera: Hepialidae), (hereafter referred to as 'porina') are endemic New Zealand insects whose larvae have a long history as significant, intransigent, agricultural pests. Both affect pasture production and plant composition in most regions of the country. Grass grubs are root feeders while porina caterpillars, although dwelling in permanent subterranean burrows, emerge at night to feed on above ground plant foliage. Both find ryegrass and white clover, the basis of most New Zealand pastures, very favourable food plants. The life histories and larval development of both are well understood and the onset of damage caused by both insects is related to development. Pasture damage as a result of their feeding is generally first noticed by farmers in late autumn and becomes more severe through winter as their body sizes increase and plant growth slows.

Damage mitigation has historically centred on chemical insecticides, particularly organochlorine insecticides in the 1950s and later of organophosphate insecticides, and resulted in the entrenchment of palliative applications of insecticide when damage by either of these pests was observed as a consequence of apparent effectiveness, ease of application and, initially at least, low cost. This entrenchment is still present in contemporary farming.

While reliance on insecticides has been implicated in a lack of fundamental ecological research being undertaken (*e.g.* Pottinger 1968), research into naturally occurring diseases of these pests (*e.g.* Jackson 1984; Crawford and Karmakoff 1977; Fleming *et al.* 1986) has lead to an understanding of natural population regulation of both insects which allows predictions of damage to be made. Simply put, when associations between pathogens of these insects, which are generally obligate on their hosts, and the insects are disrupted the insect populations are subsequently able to increase to levels they would not otherwise attain and as a result cause damage to pasture. The most common causes of disruption of these associations are abnormally dry weather, especially in late spring and early summer, and cultivation as part of pasture renewal. For both insects high densities will result 2-4 years after the disruption.

Measurements of pest densities before damage starts to occur can be used to predict the severity and potential cost of the pests (Garnham and Barlow 1993). In the case of cultivation, damage is likely to occur only to paddocks that have recently been renovated, but in the case of dry summers, damage can occur at farm and district scales with pastures of all ages affected.

It is possible therefore to predict damage outbreaks based on climate and pasture history two to four years before it occurs (although the precision of this can be +/- 1 year). Hence, farmers can be alerted to the possibility of future damage to enable them to monitor pastures at risk for high numbers of early non-damaging stages of either pest before damage begins. Sampling to measure pest numbers is straightforward. By digging and searching the soil for young larvae in late summer/early autumn estimates of pest density can be obtained which can be used to indicate the severity of the pending pest impact and enable cost benefit analyses to be performed. Should mitigation be shown to be beneficial, not only can it be implemented early to minimise damage but, in the case of porina, the cost of intervention can be substantially less than if used later.

However, despite the apparent benefits of prediction and early measuring of pest levels, few farmers adopt the practice and most of those who do, only do so for a few years following suffering significant pest damage. Treatment of "damage" by insecticides after significant production, or plant, loss continues to be the most common practice adopted.

Methods

A review of farmer adoption of new technologies was used to examine farmer uptake of new practices and innovations on New Zealand farms to provide some insights to why farmers, generally, have not adopted pre-emptive pest mitigation strategies (Peoples 2012, 2011, 2009; Burton *et al.* 2007).

Discussion

Low farmer uptake of pest management practices reinforces general observations regarding farmer adoption of new technologies/practices, particularly the non-adoption of practices unless the time taken to apply is outweighed by the benefits of the solution. That farmers are not adopting pest mitigation strategies suggests that the perceived benefits do not warrant the effort. Furthermore, the decision to adopt is not made in isolation but in response to a network of socio-economic and environmental factors/influences (Burton *et al.* 2007; Peoples 2012), hence pest management may not even be deemed important.

These observations highlight the need for scientists to understand farmer attitudes and behaviours towards grass grub/porina. By knowing how farmers perceive these pests, what they are prepared to do to manage them, and what they expect from the mitigation solution, scientists will gain a greater appreciation of farmer behaviour and their potential for change. In particular, what farmers are prepared to do to and why, what trade-offs they are prepared to make and why, and whether farmers actually understand pest damage, mitigation solutions and the overall benefits of early intervention.

Scientists also need to acknowledge that there will be no single 'best strategy' for increasing pest mitigation strategy adoption but rather a collection of options, such as a range of options for gathering pest prevalence data. 'Fear' is one area of leverage that scientists can use to produce farmer behavioural change, particularly the prospect of negative economic consequences resulting from non-adoption.

Solutions must motivate farmers to change and this requires convincing them of four key points. First, underline the seriousness of the pest problem using specific examples of economic/environmental impacts. Second, highlight how susceptible a farmer is to the problem in the short and long term. Third, specify the efficacy of the solution and lastly, convince farmers that they are able to take effective action. Together, whilst trying to shock behavioural change, farmers must also know they can solve the problem themselves.

Conclusion

Farmers and scientists represent distinctive knowledge cultures whereby each group has diverse understandings and skills. Consequently, pest mitigation strategies designed for farmers need to accommodate and understand not only their attitudes and behaviour to pest management but also the context in which they are making decisions, their leverage to change points, and their capacity to understand and implement scientific information.

References

Burton RJF, Dwyer J, Blackstock K, Ingram J, Brown K, Mills J, Schwarz G, Mathews K, Slee B (2007) Influencing positive environmental behaviour among farmers and landowners - a literature review. Report to DEFRA. Socio-Economic Research Group, The Macaulay Land Use Research Institute

Crawford AM, Kalmakoff J (1977) A host-virus interaction in a pasture habitat: Wiseana spp. (Lepidoptera: Hepialidae) and its baculoviruses. *Journal of Invertebrate Pathology* **29**, 81-87.

Fleming SB, Kalmakoff J, Archibald RD, Stewart KM (1986) Density dependent virus mortality in populations of *Wiseana* (Lepidoptera: Hepialidae). *Journal of Invertebrate Pathology* **48**, 193-198.

Garnham ML, Barlow ND (1993) Defining the cost of grass grub. Proceedings of the 6th Australasian Grasslands Invertebrate Ecology Conference. RA Prestidge (Ed.) pp. 32-38

Jackson TA (1984) Honey disease, an indicator of population decline in grass grub. Proceedings of the 37th New Zealand Weed and Pest Control Conference, pp 113-116.

Peoples S (2012) Increasing on-farm adoption of technology: Grasping for the non-existant silver bullet., In:, P Wilson (Ed.) Cervetec Conference 2012 Proceedings Queenstown, Massey University, pp 33-36.

Peoples S (2011) Pasture Renewal Technology Adoption and the Role of Networks in Dairy Farming, Final Report, SFFF/MAF, AgResearch Ltd, Invermay.

Peoples S (2009) Technology Adoption: Less about the technology, or, more about managing the adoption experience? DairyNZ Final Report, AgResearch Ltd. Invermay.

Pottinger RP (1968) Comments on the ecology of grass grub and porina caterpillar. Miscellaneous reprint (Lincoln College (University of Canterbury) No 30.