REORGANISING THE RABBIT CONTROL TOOLBOX: DO WE NEED TO REACH FOR VIRUS FIRST?

P.G. Elsworth[1]
[1]Biosecurity Queensland, Department of Agriculture and Fisheries, 203 Tor St, Toowoomba, Qld, 4350.

ABSTRACT

Biological control viruses have been at the forefront of rabbit management for nearly 60 years. The successful reduction in numbers of and damage from rabbits has allowed environmental systems to regenerate and agricultural systems to be more profitable. It has also allowed rabbit control to be effective at the property/local landscape level. This level of control, however, has often been neglected as the success of the biocontrol is seen as enough. This is not the case and rabbit numbers continue to recover from biocontrol outbreak and increase in number and damage caused. Current control programs still begin with an application of virus and then follow-up with mechanical or chemical control. Often the follow-up does not happen, yet this is the key requirement for long-term reduction in rabbit numbers. Two recent case studies at Wallangarra and Highfields in Queensland have shown that deliberate releases of virus into rabbit populations has minimal effect in the short-term and no effect if follow-up control does not occur. The mechanical control of removing breeding harbour is the key component of rabbit management and needs to the main and first control tool used where possible. Biocontrol viruses are in the environment and spread naturally, we don’t currently need to add more, we need to push the message of harbour removal as the first control tool.

Keywords: Rabbit, biocontrol, management, ripping, RHDV.

INTRODUCTION

The European rabbit (*Oryctolagus cuniculus*) is the greatest threat to endangered species in Australia (Kearney *et al.* 2018) and causes over $200 million in damage to the agriculture sector (Gong *et al.* 2009). As a result governments and landholders have been trying to control rabbits since they first established in the 1850’s.

The introduction of myxoma virus (MV) in 1960 changed the landscape with rabbit numbers devastated across Australia. The rabbits quickly (within three years) developed resistance to MV (Marshall and Fenner 1958) and the virus itself became less lethal (Best and Kerr 2000; Marshall and Fenner 1960). Fewer rabbits died, rabbit populations increased and so too did resulting damage. The same decline in rabbit populations was seen with the introduction of RHDV1 Classic 1995. Again, though, rabbit resistance to the virus developed (within 10 years) and rabbit numbers began to increase (Elsworth *et al.* 2012).

In the last five years Australia has had three new strains of RHDV enter the landscape; one deliberately released (RHDV1 K5) and two (RHDVa and RHDV2) that arrived by accident (Cox *et al.* 2017; Hall *et al.* 2015; Mahar *et al.* 2018). With all the virus releases the message has been to “take advantage of the virus release” and undertake follow-up control. But often it doesn’t occur. The common perception is that the “silver bullet” has worked and the drive to keep going with control subsequently disappears. But viruses will never kill all the rabbits and remaining rabbits, now immune or resistant, breed and the cycle re-starts.

Follow-up control can take the form of shooting, poisoning, fumigating and removing harbour. All of these can reduce or remove rabbits from an area, but the key method is the removal of breeding harbour. By removing breeding harbour, you remove the ability for rabbits to establish and increase their population. Where warren ripping programs have been undertaken, rabbit numbers have remained very low for up to, or over 20 years, and the warrens have not been re-opened (Berman *et al.* 2011; McPhee and Butler 2010).

If warren ripping and breeding harbour removal is the key to maintaining low rabbit numbers over the long-term (where biocontrol cannot) are these sufficient to reduce the numbers in the first place? There are four lethal biocontrol viruses circulating in the Australian environment that help control rabbits, so do we need to keep putting more out? Can we get a better outcome by doing the "follow-up" control first? We examine five sites where rabbit control has been done with a virus release and different levels of follow-up (Table 1).

Table 1. Site information showing the virus released as part of the control program, other viruses found to be present from virology testing of shot rabbits or carcasses found, and the follow-up control undertaken.

Site	Monitoring	Virus released	Other viruses present	Follow-up control
Wallangarra	Spotlight (2km) seasonally, Shot samples	RHDV1 K5	RHDV2	Ripped warrens, fumigating, shooting
Toowoomba	Spotlight (1.3km) once pre, 12 post virus release	RHDV1 K5	RHDV2	Burning, cleaned rubbish, shooting
Mt Kynoch	Spotlight (1.3km) once pre, 4 post virus release	RHDV1 K5	RHDV2, RHDV1a-China	Fumigating
Woolmer	Spotlight (1.3km) once pre, 4 post virus release	RHDV1 K5	None	None
Highfields	Spotlight (1.5km) once pre, 3 post virus release	RHDV1 Classic	RHDV2	Cleared lantana, ripped warrens

As part of the national RHDV1 K5 release program in March 2017, an intensive monitoring site was established on the outskirts of the township of Wallangarra in southern Queensland.

Rabbit numbers at the Wallangarra site fluctuated greatly over the survey period. Following the virus release rabbit numbers dropped by 10 percent, but following the ripping dropped by 86 percent (Figure 1). Rabbit numbers have remained low ever since.

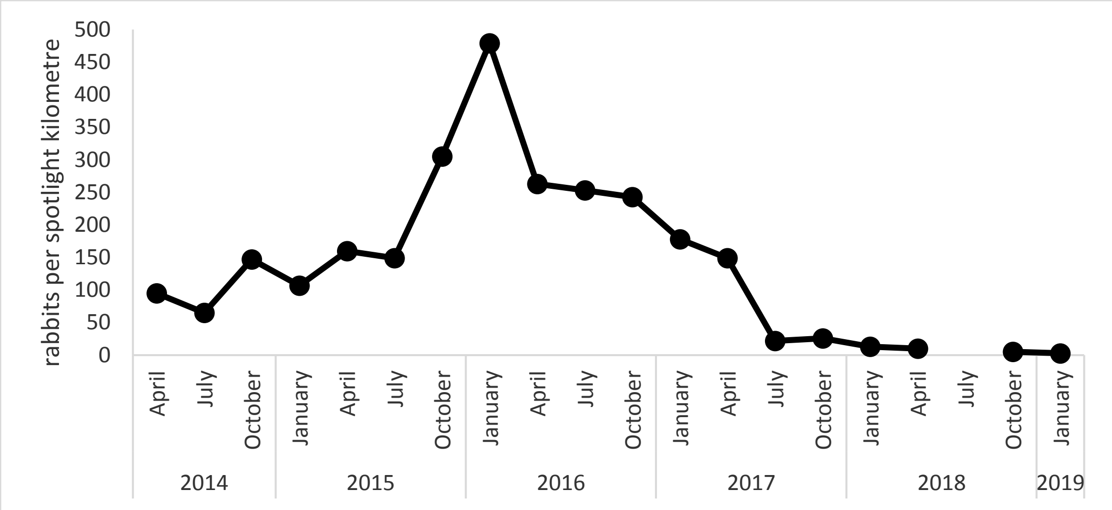

Figure 1. Rabbits seen per spotlight kilometre for each monitoring survey at Wallangarra. RHDV1 K5 was released in March 2017 and warren ripping, followed by shooting for surface rabbits and fumigating and closing re-openings was done in May 2017.

Virology testing of shot rabbits showed that RHDV2 was present at the site in April 2016 and February 2017 (just prior to the RHDV1 K5 release) and that myxomatosis was present from July 2016 to January 2017. Three carcasses were recovered in the week following the RHDV1 K5 release and confirmed for death by RHDV1 K5. In November 2017 two carcasses were positive for RHDV2.

Three sites around Highfields were chosen to be a part of the national RHDV1 K5 release. Additionally, a fourth site at Highfields undertook a virus release of RHDV1 Classic in February 2018.

There was a 48 percent reduction in rabbits at Site 1 following the release of RHDV1 K5. Sites 2 and 3 had reductions of 15 and 12 percent respectively. Following the release of RHDV1 Classic at Site 4 there was a 7 percent reduction (Figure 2). At the time of release at Sites 1 and 4, RHDV2 was known to be present.

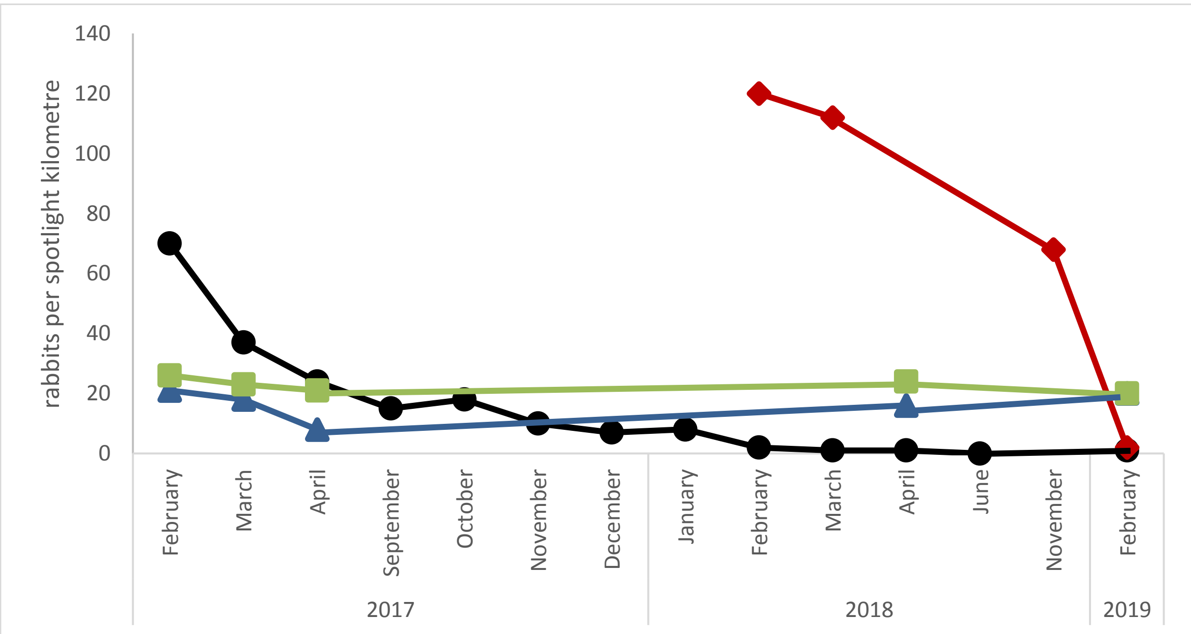

Figure 2. Rabbits seen at Highfields Site 1 (black line and circles), Site 2 (blue line and triangles), Site 3 (grey line and squares), and Site 4 (red line and diamonds). RHDV1 K5

was released at Sites 1, 2 and 3 in March 2017. RHDV1 Classic was released at Site 4 in February 2018.

Site 1 has had a continual decline in rabbit numbers following shooting and harbour removal. Site 2 had an initial decrease (56 percent) following fumigation and warren covering, but numbers have returned to levels seen prior to any control activity. Site 3 remained fairly constant in numbers across the survey period. Site 4 saw a 40 percent decrease through 2018, probably due to RHDV2 which was active at other sites nearby. The clearing of lantana and ripping of rabbit warrens in December 2018 resulted in a 97 percent reduction in remaining rabbits.

DISCUSSION

The use of biocontrol viruses in the management of rabbits in Australia has reduced their numbers and damage significantly (Cooke *et al.* 2013). However, biocontrol can never remove all rabbits, and those remaining become immune or are resistant (Cooke 2002; Elsworth *et al.* 2012). The success of the biocontrol viruses means that populations are no longer widespread in large numbers. As such, control using mechanical and chemical methods can achieve long-lasting reductions in rabbit numbers and damage at local landscape/property levels.

Current practice still begins with the request or suggestion of a virus release followed by mechanical and chemical control. With four lethal RHDVs circulating naturally in the Australian environment, there are few rabbit populations that have not had any exposure to at least one of them (Cooke 2002; Elsworth *et al.* 2012). This makes rabbit populations less susceptible to a virus release as the majority of individuals will have antibodies that protect them. Subsequently, the level of control gained with virus release alone is likely to be limited.

At our five trial sites, the reduction in rabbits from a deliberate RHDV release ranged from 7 to 48 percent, with most (four out of the five) below 15 percent. At two sites, natural occurrence of virus activity appeared to reduce numbers by 40 percent (Highfields Site 4) and 50 percent (Wallangarra). In all these instances, rabbit numbers were still locally high and would have allowed the populations to recover very quickly. This was seen at Highfields Sites 2 and 3 where there was no removal of breeding harbour.

At Wallangarra and Highfields Site 1 where warren ripping, harbour removal and additional shooting to clean up surface rabbits was completed, rabbit numbers have decreased dramatically and remained low through two breeding seasons. At Highfields Site 4 ripping and harbour removal have reduced the rabbit numbers to almost zero. With the lack of breeding harbour reducing the ability of the population to recover there should be long-term relief from rabbit impacts.

The success of warren ripping and harbour removal on keeping rabbit populations at low levels is well documented (Berman *et al.* 2011; Edwards *et al.* 2002; McPhee and Butler 2010). The removal of key breeding harbour is the most important part of an integrated rabbit control program, yet it is often neglected after a virus release. This provides opportunity for rabbits to recover and breed back up to high levels again. The message for rabbit control needs to change to bring the focus onto breeding harbour removal. Biocontrol viruses are already impacting on rabbit populations without the need for re-introduction except in isolated naïve areas. Removal of breeding areas by ripping warrens and clearing harbour needs to come to the front of the rabbit control toolbox. RHDV can go to the back of the toolbox as a follow-up biocide to help clean-up remaining rabbits, along with shooting and poisoning.

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