Vole trapping fences - a new approach to migration barriers

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Abstract

To control problematic vole species in organic orchards farmers can choose between different measures. Some methods like gassing, trapping and even the support of natural vole antagonists target to reduce vole population by killing individuals. Other methods like protective guards or migration barriers exclude voles from single trees or whole orchards. Recent combinations of the two approaches worked well but had some drawbacks in practice. Nevertheless, efficiency of migration barriers can be improved by attracted natural predators. Here we present first practical experiences and field observations of a vole-trapping-fence prototype. The new construction consists of prefabricated recyclable polypropylene pieces which are mounted to modules and assembled to fences of any length. It has a H-shaped profile with the horizontal line at ground level. The two „legs" are pushed into the ground and the two „arms" building a double wall fence above ground. Through one-way doors voles can enter the space between the walls they are trapped in. In contrast to wire mesh fences it allows the seasonal use in annual cultures due to its fast mounting and dismantling features. For the long term protection of orchards, however, an additional wire mesh to prevent deep tunnelling is still recommended. The above ground construction has shown some additional advantages as maintenance is easier with a decreased risk of penetration by mowing devices. Most important the new construction improved the accessibility by predators as not only terrestrial but also avian predators were attracted and were able to take the captured voles.

Keywords: plant protection, pest control, vole management, vole predation

Introduction

The most frequently applied techniques to control problematic vole species in organic orchards are gassing and trapping (Walther & Pelz, 2003). Both methods can be very successful, but invaders will return soon from surrounding habitats (Lapasha & Powell, 1994). Migration barriers to enclose whole orchards can reduce the risk of vole invasion over a long time (Walther & Pelz, 2006) but during vole peaks the migration pressure and the risk of a vole infestation increases. The infestation of orchards is caused by above ground dispersal of young voles (Saucy & Schneiter, 1997), whereas resident adults play a minor role. These dispersers are highly exposed to predation while they move above ground (Norrdahl & Korpimäki, 1998). Consequently, tests were made to concentrate vole predators along fences. In a Swiss field study Fuelling (2009) combined migration barriers with self-service vole traps which successfully attracted vole antagonists. This fence-trap-combination, however, allowed only terrestrial predators to take the captured voles. Furthermore, the maintenance was time-consuming making the used trap model less optimal for agricultural practice. To employ terrestrial as well as avian predators and to reduce maintenance effort we developed a new type of vole-trapping-fence.

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Development and construction of vole-trapping-fences

In July 2008 a first test was realised in an agronomic habitat near Muenster in Westphalia. On a field margin we set up two parallel fences made of polyethylene (HDPE) panels. The 400 mm distance between the two fences was covered with panels of the same material. The whole construction was 20 meters long, reached 100 mm into and 300 mm above ground. To push the fence panels into the ground two parallel trenches were cut with a spade. By one-way swing doors every two meters voles were enabled to enter but not to leave the double fence. At both ends the construction was closed with wire mesh (Fig. 1).

Based on the experiences with the first construction a new modular vole trapping fence made of recyclable polypropylene material (PP) has been developed in 2008 and 2009. One floor panel and two side walls are assembled with a snap-in connection to form a single H-shaped module of 1,15 m length. In the centre of each side wall a perforation allows an optional one-way-door. Single H-shaped modules can be connected to any length. The resulting double fence stands 270 mm above ground and roots 90 mm into the soil. The space between the walls is 300 mm wide. At both ends the trapping channel can be closed with fitting panels. The first practical test with the new vole fence started in June 2009 when a 10 meter fence was erected on a meadow (Fig. 1).

Installation and maintenance of the two trap fences have been documented to improve construction, function and practicability. Along the fences movements and behaviour of species of concern were monitored by automatic infrared cameras, tracking and direct observations.

<u>Field experiences and observations</u>

Cutting the trenches for the side walls was the most time-consuming work during the construction process. The installation of the prefabricated modules was much easier and faster than assembling the single panels. Furthermore, the industrial fabricated fence modules turned out to be more solid under different weather conditions. The handmade panel construction expanded and contracted much more with changing temperature leading to gaps penetrated by vegetation.

Vegetation at the fences had to be cleared two or three times each year. Even in high and dense vegetation mowing with line trimmer or power mower was fast, easy and did not cause any damage to the walls or doors. The space between the walls was cleaned two times a year with a broom.

So far we observed common voles (*Microtus arvalis*), bank voles (*Myodes glareolus*), wood mice (*Apodemus sylvaticus*), brown rats (*Rattus norwegicus*), red squirrels (*Sciurus vulgaris*), hedgehogs (*Erinaceus europaeus*), hares (*Lepus europaeus*) and rabbits (*Oryctolagus cuniculus*) at the trapping fences. While the voles were captured and not able to escape from the system, the other species crossed the fences by jumping over the walls. A european mole (*Talpa europaea*) started to dig along the first trapping-fence in June 2009 and finished undermining in October 2009. On the second trial site no mole tunnelled the fence so far.

The trapping-fences were controlled by domestic cats (*Felis catus*), dogs (*Canis lupus familiaris*), foxes (*Vulpes vulpes*), buzzards (*Buteo buteo*) and tawny owls (*Strix aluco*). Stoats (*Mustela erminea*) and hen harriers (*Circus cyaneus*) have been observed nearby. In high and dense vegetation terrestrial predators used the trap channels not just for hunting but also as passages.

Figure 1: Experimental vole-trapping-fence consisting of HDPE panels (A) and prototype of a commercial modular trapping-fence (B) in practical field tests. The fences were frequently visited by buzzards (A) and domestic cats (B).

Discussion

Practical experiences (Husistein, 1986; Malevez & Schwitzer, 2005) and recent field studies have shown the efficiency of barriers (Walter & Pelz, 2003; 2006) and natural predators (Fuelling et al., 2010) to protect orchards and other high valued crops from damages by voles. The used barrier material and construction, however, had some disadvantages preventing a wide distribution and acceptance. Here we will discuss possible improvements of the new designed vole-trapping-fence.

For the protection of permanent cultures like orchards, all kinds of barriers should extend deep, around half a meter, into the ground as water voles (*Arvicola spp.)* and moles (*Talpa europaea*) rarely dig deeper than 400 mm (Witte, 1997). Walther & Pelz (2003, 2006) as well as Fuelling (2009) used custom made devices to install their fences into the ground. For protection against water voles and moles in permanent cultures the new trapping fence needs as well additional wire mesh protection below ground. The same machinery as used by Walther & Pelz (2006) can do the job. At this point the new system does not give any additional benefit. In annual cultures or heaps, however, there is a huge benefit as the new system can easily be mounted and dismantled even for short time use. In our tests its two 90 mm below ground legs gave sufficient protection for weeks and months. To save construction time, a simple tool pulled by a tractor should cut the parallel trenches for the legs. Our experience while building the trial fences showed that doing this by hand is less precise and too much time consuming.

Once erected vole fences have to be maintained regularly as they lose their efficiency if overgrown by the surrounding vegetation (Witmer et al., 2007). Barriers made from plastic sheets or wire mesh have to be treated very carefully to avoid penetration by line trimmers, power mowers or similar devices (Walther & Nachtwey, pers. obs.). In contrast the material of the new vole-trapping-fences has proven to be resistant against such damages. Nevertheless, damages may occur if for example vehicles run into the fence. In such cases the modular construction allows easy exchange of damaged parts. Furthermore, the double wall construction makes it impossible for voles to cross the barrier by climbing even if the vegetation reaches slightly higher than the walls. Under such conditions we observed terrestrial predators using the plain space between the walls as an easy pathway through the dense vegetation. Traps as an addition to wire mesh fences as tested by Fuelling (2009) needed an additional maintenance effort. To be accessible for terrestrial predators, the vegetation around self-service traps had to be clear cut. To achieve this half a meter on both sides of the fence was treated with a herbicide. Such practice is of course not applicable in organic farming. Due to its H-shaped profile predators access to prey is provided between the two walls without any need for herbicides.

As an additional but very important benefit the double fence can be exploited not only by terrestrial but also by avian predators. During the field experiment we observed buzzards and tawny owls searching for prey at our fences. Attracting avian predators increases the efficiency of barriers as some birds are very important vole predators (Halle, 1988). Attracting as much different predator species as possible may have an additional negative effect on vole populations (Erlinge, 1987; Norrdahl & Korpimäki, 1998). Voles on the other hand are able to perceive at least some predation risk (Jedrzejewski et al., 1993) and answer it by flexible behavioural responses (Fuelling & Halle, 2004). This behavioural predator-prey interaction will give an additional benefit of vole-trapping-fences compared to simple migration barriers. This surplus can be especially important if trapping-fences are used as distinct lines. In agricultural practice it is not always possible to build total enclosures whereas the construction of a distinct barrier line between an adjacent vole refugium and the orchard is suitable. Whether to build a full enclosure or a barrier line against known vole refugia has to be decided individually.

Finally each enclosure or barrier built as a vole-trapping-fence has to be cost efficient. We are convinced that fences are cost efficent if fruitgrowers take all components like working time, baits, traps or other tools, replacement of trees and the lost yield into account. Walther et al. (2008) gave a suitable tool to calculate these losses. Nevertheless, voles underground work is quite often underestimated.

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