Update on gerbil management in maize

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A project called "Ecologically-based rodent pest management in maize crop fields in the summer rainfall regions of South Africa", funded by the Maize Trust and the Agricultural Research Council, started at the end of 2013.

Field surveys and research trials were conducted in the Hoopstad and Wesselsbron areas of the Sandveld where severe rodent damage to maize crops on sandy soils in the North West Free State had been reported. Damage is usually restricted to the crop planting stage when gerbils forage on germinating maize seeds and newly emergent seedlings.

The project actions consist of ecological surveys; rodent species identification, habitat utilisation, rodent breeding ecology, and food utilisation, with a short term objective of determining effective chemical control methods.

Background

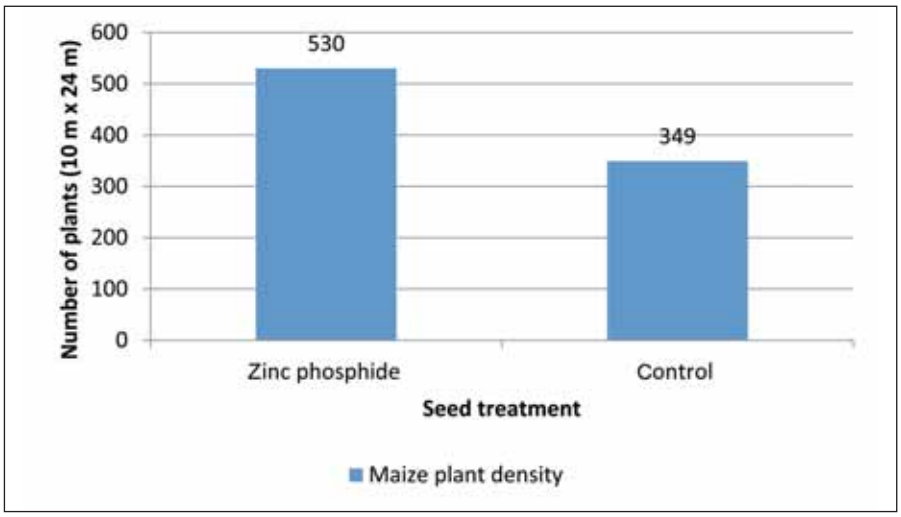
Two *Gerbilliscus* species (formerly *Tatera*) are indigenous and common to central South Africa. They have a wide geographical distribution, from grassland to savannah woodland, but prefer sandy soils irrespective of vegetation. The Bushveld gerbil (*Bosveldse nagmuis, Gerbilliscus leucogaster*) occurs from northern KwaZulu-Natal in the east, to the Northern Cape in the west and further north into southern Africa.

The Highveld gerbil (*Hoëveldse nagmuis, G. brantsii*) occurs from the Eastern Cape, the highveld of the Free State, Mpumalanga, Gauteng and the North West Province, to Limpopo, Botswana and Namibia.

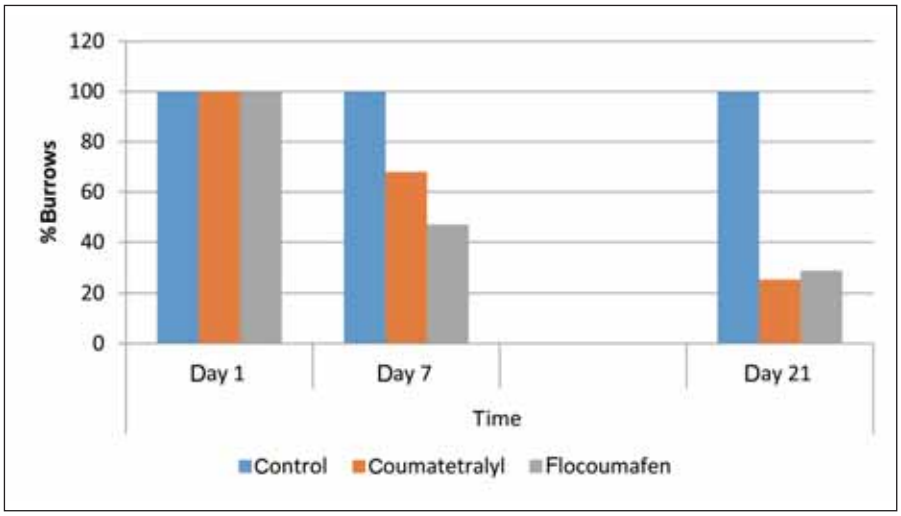
Both these species were found in the study area, but the Highveld gerbil (**Photo 1**) was the species identified in the maize fields. The two species are similar in diet and habitat, but the Highveld gerbil tolerates drier conditions than the Bushveld gerbil.

They are nocturnal, eat seeds, herbage and insects and do not hoard food. They dig burrows, live in a loose social association in colonies and males have a home range area of up to 0,5 ha. They do not climb and do not enter buildings.

A third species, the Cape gerbil (*Kaapse nagmuis*, *G. afra*) is endemic to the Western Cape.



Graph 1: Maize plant density of zinc phosphide treated seed compared to untreated seed (10 m x 24 m).



Graph 2: Burrow baiting with two rodenticides in a maize field.

Chemical control trials

The effect of two types of chemical control was tested as potential gerbil management tools on commercial maize producing farms in the Hoopstad and Wesselsbron areas. They were a seed treatment with a metal phosphide at planting, and burrow baiting with ready-bait rodenticides. Gerbil colony size and activity were monitored before and after applications of the chemicals in both treated and untreated sites.

Seed treatment

The effect of zinc phosphide treatment on the germination of maize seed was tested in the laboratory, with no significant difference in the germination and seedling development between treated and untreated seed.

In the field, maize seed treated with zinc phosphide was compared to untreated maize seed. Plots of 10 m x 24 m were marked out around gerbil colonies. In the untreated maize, gerbils dug up the germinating maize seed around the colonies, resulting in bare patches, but in plots where maize seed had been treated with zinc phosphide, the incidence of gerbil damage

▲ 1: The Highveld gerbil.
◥ 2: Maize seedlings of zinc phosphide treated seed compared to untreated seed. (a) Gerbil digging marks are visible near treated seedlings; (b) untreated seed was removed by gerbils.
▲ 3: Burrow baiting in maize.

to seedlings was reduced. Gerbil digging marks in the soil near treated seedlings (**Photo 2**) were noted, and the conclusion was made that a sub-lethal dose caused aversion towards zinc phosphide treated seed by surviving gerbils.

Two months after planting, maize plants in the marked plots (10 m x 24 m) were counted to determine the impact of gerbil colonies on maize plant density. Zinc phosphide treated maize had an average 530 plants per plot, compared to the average of 349 plants in the untreated plots – a decrease of 34% in plant density (**Graph 1**).

Although seed treatment with zinc phosphide was effective at reducing the impact of gerbil damage on maize at planting where it was tested at sites in the Free State Sandveld, it may not be as effective in areas with acidic (low pH) water or soil moisture.

Zinc phosphide (Zn_3P_2) is used as a rodenticide because it is claimed that its pungent, garlic-like odour attracts rodents, but repulses other animals. Birds are not sensitive to the smell. The acid in the digestive system of rodents reacts with phosphide to generate the toxic phosphine gas (PH_3). Zinc phosphide breaks down when exposed to water or moist soil in the environment, thus zinc phosphide treated seed must be planted within 24 hours of treatment. The use of correct protective clothing when mixing is important.

Information gathered from producers that terbufos and ammoniac gas may have a repulsive effect on gerbils, was tested in trials where these chemicals were used as part of normal farming practices. In a trial with zinc phosphide treated seed, planted together with terbufos (as a soil applied insecticide/nematicide) and compared to zinc phosphide treated seed only, the combination did not add to the effect of the zinc phosphide treated seed on gerbils.

Where ammoniac gas was used as fertiliser, the number of burrows in the colonies of both treated and untreated sites was reduced, but differences between the sites were not significant. The reduction in colony size can be attributed to the soil disturbance during the tillage (rip) process and not to the "smell" of the chemical.

Burrow baiting

Burrow baiting trials were conducted in a maize field during February to March when maize was in the vegetative growth stage and it was presumed that gerbils would be susceptible to the bait, as there was little food available on the soil surface (**Photo 3**). Two different ready-bait (wax block) rodenticides, namely coumatetralyl and flocoumafen, and an untreated control, were applied in 20 m x 20 m plots with known gerbil colonies.

Burrows in the plots were closed, the active burrows were baited on day 1, the process repeated a week later (day 7) and the active burrows counted again after 14 days (day 21). Both rodenticides reduced the number of active burrows by more than 70% compared to the untreated control within the three week period (**Graph 2**).

The trials were repeated in the same plots with the same gerbil colonies during May when maize was at the pre-harvest stage, with similar results in the reduction of gerbil burrows. It must be noted that the gerbil colonies had recovered to more or less the same numbers during March to May so that the trial could be repeated.

Project trials are ongoing. We thank our funders; the Maize Trust and the ARC for their support, and Grain SA and the producers in the Sandveld for their co-operation. ■