

RODENT DAMAGE CONTROL IN NO-TILL CORN AND SOYBEAN PRODUCTION

RON HINES, University of Illinois, Department of Crop Sciences, Dixon Springs Agricultural Center, RR #1, Box 256, Simpson, IL 62985

ABSTRACT: In recent years the primary cause of reduced plant stands in no-till crops planted into heavy residue has been small eared rodents called voles (*Microtus spp.*). Past research has indicated that severe stand reductions (80 to 100 percent) can occur if vole populations in the field exceed 75 per hectare (30 per acre) at planting time. This vole population should be considered intense. If field scouting about 30 days prior to planting reveals at least 12 active vole colonies per hectare (five per acre) an intense population can develop, and damage control measures should be planned. Of all the legal techniques currently available for vole damage control in no-till, utilizing a combination of "habitat modification" techniques may be the most effective, lowest cost, easiest to complete, and safest on the environment. Second in all of these categories would be use of preemergence herbicides and broadcast alternative food such as corn or soybean.

Proc. East. Wildl. Damage Mgmt. Conf. 7:195-201. 1997.

Weed control, sod allelopathy, insects, diseases, seed inoculation, and hybrid or variety selection are all necessary considerations before planting CRP to row crops. However, if this land is to be successfully planted to no-till crops one primary pest cannot be overlooked. That pest is a small-eared rodent known as a vole. The primary species of vole in the Midwest is the prairie vole (*Microtus ochragaster*).

The mature prairie vole is reddish brown to gray in color, larger than a house or field mouse but smaller than a rat. The ears of a vole are very small. Its torpedo shaped body is about four to five inches long when mature. The tail of a prairie vole is short--only one and one-half times as long as its hind foot.

Voies require a full canopy cover for protection from predators. Established grass or legume sod fields and field borders (including wheat or rye stubble, set-aside and cover crop seedings) provide an ideal habitat for the development of a high population of this rodent. In fields that have vegetative cover maintained for more than one year prior to planting no-till corn or soybeans, plant stand reductions can reach 80 to 100 percent in intense (more than 30 per acre) vole populated areas.

High field populations can develop very rapidly. Litters of three to eight voles can be produced about every 21 days. Female voles normally mature in 35 to 40 days and start raising litters of their own. Population change from late winter to planting time can be dramatic.

Prairie voles are active feeders day and night, the year around. They do not hibernate. Their favorite habitat is the dry ridge area of a rolling hill field that has a closed canopy of lush vegetation. The active feeding range of a vole colony can be as small as 10 to 15 feet from the burrow if the food supply is abundant. However, the average range is usually about one-fourth acre.

The favorite food of a prairie vole is high protein, succulent legumes or grasses. Voies appear to reproduce actively on a food protein diet of at least 8 percent. Established stands of alfalfa, clovers and other legumes usually develop the highest vole populations. Undisturbed, established grass sod in the spring and fall also provides ideal food and habitat. Grains such as corn, soybeans, wheat, etc., will be eaten if present--particularly if competition for other existing food is high. Weed or crop seeds, underground tubers, insects and some animal remains are also used for food if needed.

Scouting fields and field borders to identify the vole population at least 30 days prior to planting no-till is the first step to prevent losses by the rodent. Look for active vole colonies and runways while scouting. Start in field areas with good drainage and soil aeration. The dark green, high spots in a grass area usually signifies a colony. Urine and feces deposited close to the burrow opening gives the vegetation a dark green color. If a colony is found, inspect the opening to determine if it is actively in use. The presence of fresh clippings and/or fresh feces next to a slick, open hole is a sure sign of activity.

If at least five active vole colonies per acre are identified, damage prevention control measures should be planned. This guide is based on the reproductive potential of the prairie vole and the population per acre required at planting to signal the presence of an intense population.

DAMAGE CONTROL OPTIONS

Predators

Natural predators of voles include: snakes, hawks, owls, coyotes, foxes, etc. Relying on natural predators for control of high populations of voles has not been successful. The continuous fluctuation of the vole population and decline of necessary predator habitat at a given site causes fluctuation in the predator population. Although natural predators help reduce the vole population, other control measures have been required if intense vole populations develop just prior to planting.

Toxicants

In the fall of 1989 the federal label clearance for use of 2 percent zinc phosphide treated bait on field corn for rodent control was discontinued due to relabeling requirements of FIFRA. Since this was the only labeled toxicant for that use, there are currently no federally labeled products available for use on field crops. Indiana still maintains a state label subject to annual renewal.

Recent research has shown that in-the-furrow applications at planting of five pounds of treated bait or pellets per acre can provide more effective vole control during wet weather than ten pounds broadcast on top of the ground in no-till. It is also much safer for other non-target wildlife. However, label clearance for this use on field corn is not anticipated before at least 1997. The lack of availability of acceptable application equipment to place the bait in-the-furrow utilizing current manufactured planting equipment appears to be the main problem. Research on the use of zinc phosphide treated bait or pellets in-the-furrow in soybean production is incomplete at this time. Other uses of zinc phosphide treated baits in orchards and non-cropland areas are still labeled.

Repellents

In December 1989, the label for use of methiocarb (Mesurol) seed treatment on field corn as a bird repellent was discontinued. It probably could have been relabeled, but the manufacturer determined that the cost of reregistration and labeling through FIFRA would be more than the potential return from the sale of the product. Although effective in repelling voles, methiocarb was never labeled for that use.

Research completed in the 1970's found that seed treatments containing methiocarb were as effective at preventing vole damage as an in-the-furrow application of zinc phosphide treated bait. Unfortunately for no-till crop producers, there are still no current plans by the product manufacturer to develop a new label.

Products that contain the active ingredient, "capsaicin" (the *hot* in hot peppers), are the only taste repellents labeled for voles in field crops. They are labeled for use in a spray that can be applied between crop emergence and when edible portions of the plant begin to form. Current research indicates that treatment effectiveness can be reduced during periods of wet weather. However, current data is not available for use in no-till crops.

Seed treatments containing "thiram" are labeled for use on corn and soybeans. Although past research has indicated some repellency of voles, none of these products are labeled for that use in no-till. Past research also indicates that treatment effectiveness can be reduced in wet soil conditions.

Injecting 10 cc's of turpentine into the seed corn bag about 24 hours before planting has been suggested as an effective vole damage control treatment. Recent research indicates this may have some beneficial effect in dry years, but has little effect during wet springs. This product has no label as a rodent repellent, or for legal application directly to seed.

Using seed treatments containing lindane, or an in-the-furrow soil insecticide such as chlorpyrifos on no-till corn is not labeled, and has not worked as a vole repellent. Research has shown that vole damage can still reach 80 to 100 percent with these treatments.

No other known repellents are currently labeled to control vole damage in no-till field crops.

Alternative Feeding

If pre-emergence herbicides are used in no-till, the first 21 to 28 days after planting is the most critical time to prevent vole damage. Under most conditions broadcasting an alternative food can be successful. If alternative feeding is to be effective, the food must be:

- as attractive to the vole as the seed being planted;
- applied prior to planting in order to let voles become attracted to it, before they find the seed in the furrow;
- applied in a sufficient amount to feed the voles until planted corn is at least eight inches tall and soybeans are in the trifoliolate leaf stage;
- applied evenly across the vole populated areas of the field;
- weed seed free !

Recent research has concentrated on the use of coarse cracked corn, whole kernel corn, and

whole soybeans. Grain is broadcast over the field using a fertilizer buggy about one to two days prior to planting. The existing vegetation should be dry when this is done. Set the applicator according to test weight of the grain (pounds/cu. ft. = grain test weight in lbs./bu. X 0.8) to apply the desired pounds per acre.

These alternative foods have all been successful in reducing vole damage to no-till corn. However, the coarse cracked corn and whole soybeans have provided the control without concern for the development of volunteer plants. Whole kernel corn can cause volunteer plants to develop if significant rainfall occurs shortly after application. It has taken four bushels of coarse cracked corn to provide similar vole damage prevention vs. two bushels per acre of whole kernel corn. Two bushels per acre of whole soybeans appears to be adequate, but there is little research on this amount. More research is needed before broadcast whole soybeans can be recommended for no-till corn.

Research results indicate that alternative feeding may not be as successful in no-till soybeans. The emerging cotyledons appear to be too attractive to the vole. The only alternative grain that appears to offer help in no-till soybeans is two bushels per acre of broadcast whole soybeans. However, more research is needed to justify its recommendation.

The introduction of herbicide resistant and tolerant crops makes the alternative feeding option possibilities look very bright. One example is the use of Roundup Ready soybeans. If standard soybeans were broadcast into a field that was later planted to Roundup Ready soybeans, the volunteer standard soybeans could be controlled with the normal Roundup herbicide application.

Cultural Control

Destroying the vole's colony, cover and food supply by clean tilling or plowing before planting is a very effective way to control damage. Voles will not stay where they do not have food or cover. This practice, however, has several

disadvantages on highly erodible land and drouthy soils. The erosion prevention requirements for the land should be the farmer's main concern when considering this damage control option. It should not be used on HEL land.

Habitat Modification Without Tillage

Voles live where they have adequate overhead cover from predators and a sufficient supply of food. Changing the amount of cover or food that is available can be a very effective way to control the vole population at a particular location. Some habitat modification techniques include:

- removing hay or pasturing before planting;
- applying herbicides early preplant (EPP) in the fall or about 30 days before planting instead of pre-emerge (PRE) over the top after planting;
- low mowing field borders and fields that you plan to plant the next spring; and
- controlled burning of existing field cover in late winter before spring planting.

If a producer does not have livestock, the haying or pasturing techniques may not be options-- but they can be very effective. Low mowing should not be used by itself, but as a part of a total management program to improve predator control of voles. Controlled burning can be successful if regrowth does not resupply voles with food and cover prior to planting. The use of EPP herbicide sprays has consistently been successful, and is available to all no-till farmers as an option.

CONCLUSIONS

Utilizing an effective damage control technique when voles are present before planting has consistently provided additional net returns at harvest of at least \$100 per acre. Of all techniques currently available and legal for vole damage control in no-till corn or soybeans, utilizing a combination of "habitat modification" techniques including EPP herbicides may be the most effective, lowest cost, easiest to complete, and safest on the environment. Second in all of these categories for no-till corn

would be use of PRE herbicides and broadcast alternative food such as corn or soybeans.

The best control prescription may be:

- Mow fields low in the fall before they are to be planted next spring.
- If planting soybeans, control the cool season perennial grasses and perennial broadleaf weeds with a spray application in the fall about six weeks after low mowing and at least two weeks before a killing frost.
- Check fields in late winter for active vole colonies in order to determine the population potential.
- If more than five active colonies per acre are found in late winter, plan a control prevention program.
- If no-till early preplant (EPP) herbicides are to be used, apply them about 30 days before planting.
- Scout again for active vole colonies one week before planting. If few are found, plant when you are ready. If colonies are still active apply an alternative food.
- In no-till corn apply "weed seed free" food mixed with dry fertilizer (this can save a trip across the field) within two days prior to planting. Make sure the vegetation is dry when spreading, so it can fall to the ground. In soybeans, only broadcast soybeans appear to reduce vole damage.
- Plant the field "no-till."

No-till corn or soybeans can be successful when following CRP if good management practices are followed. The ability to control rodent damage potential in no-till corn may give it the edge over soybeans during the first conversion year of CRP-- particularly if the perennial sod was not controlled the previous fall.

LITERATURE CITED

- Anon. Controlling field voles (field mice). U. S. Dept. of Interior, Animal Control Leaflet 303.
- Baker, R. H. 1983. Michigan Mammals. Wayne State University Press, Detroit, Michigan. pp. 298-304.

- Beasley, L. E., and G. E. McKibben. 1975. Controls for mouse damage to no-till corn. Ill. Agr. Exp. Sta. DSAC 3:96.
- Cole, R., and G. O. Batzli. 1979. Nutrition and population dynamics of the prairie vole *Microtus ochrogaster* in central Illinois. Appl. Ecol. 48:455-470.
- Corrigan, R., and R. Hines. 1995. Controlling rodent damage in conservation tillage systems. Illinois Agricultural Pest Management Handbook. 1995:127-130.
- Desy, E. A. 1987. Effect of food availability and predation on the population dynamics and spacing behavior of prairie voles. PhD. Thesis, Department of Biology, University of Illinois, 1987.
- Hines, R. A. 1993. Prairie vole damage control in no-till corn and soybeans. Proc. Eleventh Great Plains Wildlife Damage Control Workshop. R. A. Pierce and F. R. Henderson, Editors. Kansas State University, Manhattan, KS 66506.
- _____, W. R. Bonwell, S. A. Ebelhar, K. L. Steffey. 1993. Rodent damage control in no-till corn. Proceedings National No-Tillage Conference, Indianapolis, IN, January 12-14. No-Till Farmer, Brookfield, WI. pp. 283-298.
- _____. 1994. Converting CRP acres back to crop production. Proceedings of University of Missouri-Columbia, Agricultural Chemicals Short Course, Columbia, MO, November 21-22.
- _____. 1995. Rodent (prairie vole) damage control in no-till corn and soybean production. Tour Reports - 15th Annual Milan No-Till Crop Production Field Day, University of Tennessee Agricultural Experiment Station, Milan, Tennessee. pp. 29.
- O'Brien, J. M. 1994. Voles. Prevention and Control of Wildlife Damage. University of Nebraska. B-177-182.

University of Illinois

THREE YEAR SUMMARY - CONTROL OF PRAIRIE VOLE DAMAGE IN NO-TILL CORN
 PLANTED INTO ESTABLISHED GRASS OR LEGUME SOD - 1992 THRU 1994.

Project Code: HINES 1 - PULASKI Location: TF - PULASKI COUNTY

Cooperator: HINES, STEFFEY By: D.S.A.C.

Treatment/Acre Name	AV. ACTIVE COLONIES PER ACRE	AV. CORN PLANTS PER ACRE	AV. DAMAGE PERCENT PER ACRE	AV. TOTAL PLANTS PER ACRE	AV. CORN YIELD BU./ACRE
NO-TILL EARLY PREPLANT HERBICIDES + NO BAIT	47 a	23093 a	6 c	23093 b	168 a
NO-TILL PREEMERGE HERBS + 2 BU. OF WHOLE CORN	46 a	22571 a	8 c	26424 a	159 a
NO-TILL PREEMERGE HERBS + 5 LBS. ZINC PHOSPHIDE PELLETS IN THE FURROW	56 a	21441 ab	13 bc	21441 b	158 a
NO-TILL PREEMERGE HERBS + 4 BU. CRACKED CORN	45 a	20147 b	18 b	21720 b	156 a
NO-TILL PREEMERGE HERBS + NO BAIT (CHECK)	42 a	13483 c	45 a	13540 c	105 b
LSD (.05) =	NS	1940	8	1946	20
Standard Dev.=	5.19801	971.089	3.94999	973.911	9.79681
CV =	11.01	4.82	22.28	4.58	6.58

Means followed by same letter do not significantly differ (P=.05, Duncan's MRT)

NOTE: The 1992 trials were in unmowed and fall mowed KY 31 tall fescue. The 1993 trial was in hairy vetch seeded after wheat in 1992. The 1994 trial was in hairy vetch seeded after wheat in 1993. "TOTAL PLANTS PER ACRE" also include volunteer plants resulting from the treatment.

University of Illinois

TWO YEAR SUMMARY - CONTROLLING PRAIRIE VOLE DAMAGE IN NO-TILL DRILLED SOYBEANS PLANTED ONE YEAR AFTER NO-TILL CORN WAS DAMAGED WHEN PLANTED INTO GRASS OR LEGUME SOD IN 1993 AND 1994.

Project Code: HINES 2 - PULASKI Location: TF - PULASKI COUNTY

Cooperator: HINES, STEFFEY By: D.S.A.C.

Treatment/Acre Name	2 YR AV. PLANTS PER ACRE	2 YR AV. DAMAGE PERCENT	2 YR AV. YIELD BU./ACRE
NO-TILL EARLY PREPLANT HERBICIDES + NO BAIT	220412 a	21 a	39 a
NO-TILL PREEMERGE HERBS + 2 BU. WHOLE KERNEL CORN	218751 a	21 a	40 a
NO-TILL PREEMERGE HERBS + 5 LBS. ZINC PHOSPHIDE PELLETS IN THE FURROW	211686 a	23 a	41 a
NO-TILL PREEMERGE HERBS + 4 BU. CRACKED CORN	209199 a	24 a	44 a
NO-TILL PREEMERGE HERBS + NO BAIT (CHECK)	187197 a	32 a	42 a
LSD (.05) =	NS	NS	NS
Standard Dev.=	15116.8	5.57875	2.40901
CV =	7.22	23.10	5.83

Means followed by the same letter do not significantly differ (P=.05, Duncan's MRT). NS means there was no significant difference between treatments.

NOTE: Only the EPP or PRE herbicides were applied on the soybeans. The remainder of the treatment had only been applied to the corn produced on the same treatment area the previous year. The 1993 trial followed 1992 corn planted into tall fescue. The 1994 trial followed 1993 corn planted into hairy vetch.