Cooperative Extension Service
Colorado State University
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AGRON-O-GRAM

April, 1986

There are three different subjects covered in this newsletter. Mark Brick and Bill Brown wrote an article on the "Occurrence of and Damage by the Alfalfa Stem Nematode in Colorado." Bob Croissant has been getting some calls on the use of "crib corn" seed, thus, he has summarized some information from the DeKalb Crop Management Manual on using second generation corn seed. We have been getting several calls regarding freeze damage to winter wheat. Jim Echols has written an article on "Spring Freeze Injury to Winter Wheat" which may help answer some of the questions that you may be getting on possible freeze damage to wheat.

This is the second issue of the Agron-O-Gram that we have sent to the Extension Agents. After the first issue, we received some good ideas for possible subjects for future issues. We would like to encourage your suggestions for subjects that need to be covered in the future.

Sincerely,

Bob Croissant	James W. Echols	R. Hunter Follett
Extension Specialist	Extension Specialist	Extension Specialist
Crops	Crops	Soils

File: Alfalfa
April, 1986

OCCURRENCE OF AND DAMAGE BY THE ALFALFA STEM NEMATODE IN COLORADO

BY

MARK A. BRICK AND WILLIAM M. BROWN[1]

The alfalfa stem nematode [Ditylenchus dipsaci (Kuhn) Filipjev] is a microscopic round worm which attacks buds and young shoots of alfalfa. This nematode occurs most frequently where alfalfa is irrigated with surface water; however, it can occur in fields which are irrigated with ground water if the nematode has been introduced and soil moisture conditions are high. It is usually not a problem on dryland alfalfa.

The stem nematode is a plant parasite which has a feeding structure (stylet) resembling a small hypodermic needle. The nematode uses the stylet to puncture plant cells to withdraw and feed on plant cell contents. The nematodes also enter the plant and feed on internal bud tissue. The feeding wounds provide entry for other microorganisms such as bacteria and fungi, thus predisposing the plant to further injury by these organisms. When this occurs, the bacterial or fungal pathogens may kill the plant before the nematode. Infection by the stem nematode also predisposes the plant to winter injury, thereby thinning healthy stands.

Nematodes usually occur in large numbers. Consequently, they can cause severe direct injury to the plant. The stem nematode can harbor the causal organism for bacterial wilt in alfalfa. Research conducted in Canada has shown that the stem nematode may render genetic resistance to bacterial wilt ineffective. Consequently, bacterial-wilt resistant varieties may become damaged by this pathogen when attacked by the stem nematode.

Stem Nematode Identification

Identification of the stem nematode is important as there are many nematodes that are naturally occurring in soil. Identification is dependent upon a laboratory analysis by a trained nematologist; however, several plant symptoms are good indicators that the nematode is present.

Plant Symptoms

Stem nematode infestations are usually first observed in low-lying areas or where water collects. These areas are often dominated by weeds after the alfalfa has been killed by the stem nematode or secondary pathogens. The weedy areas gradually increase in size and extend downfield in streaks following the direction of water flow. This type of stand loss is similar to phytophthora root rot, so it is not symptomatic of the stem nematode in itself.

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Infected plants sometimes produce white shoots and stems. This symptom is referred to as "white flagging." White flagging is most pronounced in the regrowth following the first hay cutting. Although white flagging is very diagnostic, it is not always observed in alfalfa fields with severe infestations.

The crown buds of the infected plants are swollen and pale, and can be easily broken away from the crown tissue. Often shoots arising from infected buds are severely dwarfed, with short internodes. Later in the season, growth may be fairly normal in infested plants.

Optimum temperatures for invasion and reproduction by the stem nematode are 60-70°F. The stem nematode requires about 19-23 days to complete its life cycle on susceptible varieties at the optimum temperature. It is for these reasons that most of the visual symptoms occur on the regrowth following the first cutting.

Stem Nematode Spread

The stem nematode is most commonly spread by irrigation water. However, it may also be spread by contaminated hay or seed or by soil attached to machinery or livestock. Once the the nematode is introduced, it is difficult to eradicate. Movement of infected plant material (hay or seed), soil (on implements or livestock), or water movement (as runoff) from one field to another can spread the nematodes. The preadult (larval) stages of stem nematodes can survive on the surface of seeds and crop debris for many years. Upon rehydration, they can continue their life cycle to form adult nematodes which will subsequently reproduce. They can also survive in irrigation water as it flows along the irrigation canal or spread as eggs or larvae on soil attached to livestock and implements. Thus a field with a severe nematode infestation should be tilled and harvested last, and the machinery used in that field cleaned thoroughly before use in other fields. Irrigation runoff from an infested field should not be reused on other fields. Furthermore, livestock should not be moved from an infested field to clean fields.

Control

Because there are no suitable labelled chemical control methods for the stem nematode, the best control methods are: 1) crop rotation, 2) use of resistant varieties, 3) use of clean seed free from crop debris, and 4) field management.

Crop rotation with a two- to three-year period between alfalfa and nonhost crops will decrease the nematode population below damaging levels. It is important to control weeds that may serve as host plants during this period. The nematode eggs can survive longer than this time period; however, it takes three to four years for the population to increase to damaging levels. Hence, it will usually be necessary to again rotate out of alfalfa after three to four years of production.

Varieties resistant to the stem nematode are available (Table 1). Consult your local seed dealer or Extension specialist for more information regarding resistant varieties adapted to your area. Because phytophthora root rot is often prevalent under the same field conditions as the stem nematode, resistance to both diseases should be considered when choosing an alfalfa variety. Clean seed is important because the nematode can be present in the trash that accompanies poorly cleaned seed. Field management such as sanitary practices (as discussed earlier) and harvesting when the top 2-3 inches of soil is dry will reduce the spread within and between fields.

TABLE 1. Alfalfa varieties with genetic resistance to phytophthora root rot and the alfalfa stem nematode winter hardiness level.

Variety	Marketer	Winter Hardiness Level	Phytophthora Root Rot Resistance	Stem Nematode Resistance
888cor	Northrup King	VH*	MR**	R
120	DeKalb-Pfizer	H	R	R
629	Garst	H	MR	R
Blazer	Land O Lakes	H	MR	HR
Elevation	Jacques	H	MR	HR
Shield	Great Lakes	H	R	R
Sparta	Land O Lakes	H	MR	HR
Valor	Land O Lakes	H	Unknown	MR
Apollo	Agri Pro	MH	R	MR
Apollo II	Agri Pro	MH	HR	MR
Commandor	Northrup King	MH	R	MR
DK-135	DeKalb-Pfizer	MH	MR	R
Decathlon	Cargill	MH	MR	R
Drummor	Northrup King	MH	R	MR
Eagle	Asgrow/O's Gold	MH	MR	R
Epic	L. Peterson, Ltd.	MH	R	HR
Excalibur	Agway/Allied	MH	LR	R
Magnum	Dairyland	MH	LR	LR
Maxim	Cenex	MH	MR	R
Pacer	Land O Lakes	MH	LR	LR
Peak	Research Seeds	MH	MR	HR
Spectrum	Cenex	MH	MR	R
Thor	Northrup King	MH	Unknown	MR
Trumpetor	Northrup King	MH	LR	R
Vernema	Public Variety	MH	LR	HR
WL-315	WL Research	MH	MR	MR
WL-316	WL Research	MH	MR	MR

*VH = very winter hardy; H = hardy; MH = moderately winter hardy.
**LR = low level of resistance; MR = moderate level of resistance; R = resistant; HR = high level of resistance.

FILE: CORN-SEED
APRIL, 1986
SOURCE: DEKALB CROP
MANAGEMENT MANUAL

STEER CLEAR OF SECOND GENERATION CORN "SEED"

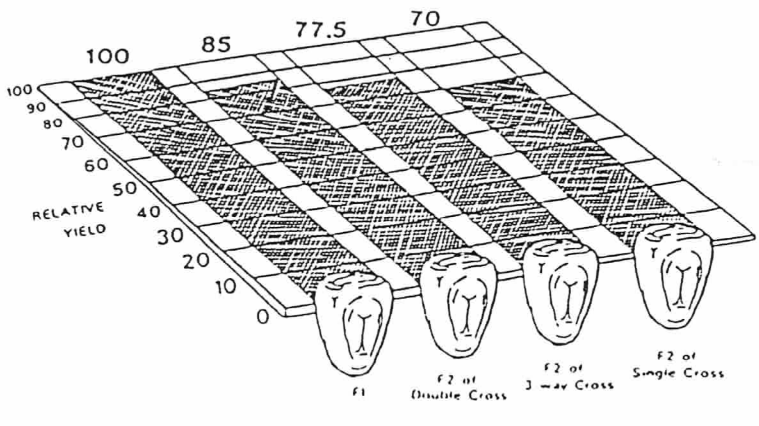
Selecting the best hybrids to grow is a tough assignment. The choice can mean the difference between a profit and a loss. Most farmers undoubtedly rely a good deal on past performance of hybrids they have grown plus their observations of neighbors' fields, demonstration plots, and research plantings. Established dealers of reputable seed firms are also important sources of information, especially concerning new hybrids. The important point: plant research-proven hybrids from dependable sources.

The hybrid corn seed offered to U.S. farmers is F1 (first generation) seed, the result of controlled pollination between two unlike parents. From time to time, F2 (second generation) seed is offered and sold to farmers who ignore the basic rules of hybrid selection. The results are always disappointing and sometimes disastrous to the farmer, particularly when he finds that such seed is not offered by reputable producers and there is no one to turn to with his complaint.

F2 "crib corn" seed is open pollinated seed harvested from a farmer's field. It is not hybrid seed and cannot match the performance of hybrid seed. In addition to poor yield performance, plants grown from F2 seed are likely to be more susceptible to disease, insects and population stresses. This is written to point out the lack of merit of F2 corn seed: facts that should be considered by any farmer to whom such seed is offered for sale.

Genetic theory indicates that the difference in yield between F1 (first) and F2 (second) generations of the same hybrid depends upon the type of hybrid. The F2 of a single cross hybrid can be expected to yield 30% less than the F1 of the same hybrid. Three-way crosses can be expected to suffer a 22.5% yield reduction and four-way or double crosses will yield about 15% less when F2 is compared with F1. This graph shows the theoretical yield of F2 corn from various hybrid types compared to yield of the F1 hybrid taken as 100:

CORN YIELD DEPRESSIONS FROM F2 SEED



Tests conducted in Nebraska, Iowa, Wisconsin, and Ohio in the 1920's, 1930's, and 1940's proved that the above theoretical yield reductions were actually true and essentially correct. Naturally, different tests will give somewhat different results and the range will vary somewhat.

In tests conducted at DeKalb, Illinois, and Dayton, Iowa, from 1965 through 1968, Dr. C. W. Crum, DeKalb Research Agronomist, found yield reductions of 41 to 28% when F2 generation was compared to F1 generation on several single crosses.

More recent tests (conducted because F2 seed was suggested by some as an alternative to T cytoplasm seed in 1971) confirmed the early evaluations and showed that F2 seed should not be accepted and planted by serious corn growers. Yield reduction in bushels per acre becomes greater as yield level increases, so the use of F2 seed becomes more and more costly as production potential goes up.

In a 1971 Auburn University comparison of F1 and F2 corn performance, there was an average yield reduction of 25% from using F2 seed. In addition, F2 plants lodged slightly more. Average F2 yield at 11 Alabama locations was 80 bushels per acre; the F1 counterpart yield was 107.

The F2 of one hybrid yielded 44% below its F2 counterpart in 1971 Georgia tests (nine trials, 36 replications). Another F2 yielded 27% less than the hybrid. F2's had poorer grain quality and exhibited more stalk lodging.

Silage yield in the Georgia comparisons showed F2's producing 62 to 80% the green weight of F1 hybrids. Moisture content and ear:stover ratio was essentially equal; there was just less dry matter produced by F2 plants.

At DeKalb's Dayton, Iowa, Experiment Farm, 24 F2 entries were grown in comparison with their F1's in 1971. This was a year of drought at that location and all yields were depressed as a consequence. A summary of the results showing yields in bushels of #2 corn per acre follows:

	15 Single Crosses	6 3-Ways	3 Double Crosses	Overall
F1	97.1	88.0	95.0	94.5
F2	58.2	61.8	79.5	61.7
Bu. Loss	38.9	26.2	15.5	32.8
% Loss	40	30	16	35

In light of the yield performance results quoted here, there appears to be no situation where F2 corn seed should be recommended to a farmer for grain or silage production when F1 seed is available.

References: Auburn University Leaflet 83, Jan., 1972
Georgia Agricultural Research, Fall, 1972
DeKalb AgResearch, Inc., Sources

File: Wheat, Freeze Damage
April, 1986

SPRING FREEZE INJURY TO WINTER WHEAT

BY

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The cold temperature on the nights of April 13 and 14 has caused considerable concern to wheat growers throughout eastern Colorado. The big question is "Has our wheat been damaged?" Low temperatures ranging from 16 to 20°F have been reported over most of the wheat growing area. This temperature was low enough to cause considerable damage to the crop. The extent of damage depends on (1) stage of maturity, (2) temperature at the particular location, (3) length of exposure to low temperature, and (4) condition of the plant at the time of the freeze. In most years, a mid-April freeze in eastern Colorado does not produce serious damage, however, conditions are much different in 1986 because of unusually warm temperatures from late January through March. This caused the wheat to break dormancy and start growing.

Development of the wheat plant from the vegetative to the reproductive stage begins when the days get longer and temperatures consistently reach 40°F. The wheat plants begin to lose resistance to cold as soon as they break dormancy in the spring. When the wheat plant starts jointing, the head is also beginning to form. After wheat begins to joint and the head is above ground level, some damage can occur when temperatures are below 24°F. The youngest plants are damaged least and the amount of damage will increase progressively with the size of the plant. The most severe damage will be apparent as scorched leaves and stems of the plant. Damage to the growing point of the plant can occur and could prevent heading and grain formation.

To determine damage, locate the "bulge" of the head by feeling the stem with your thumb and fingers. Split the stem lengthwise with a sharp blade and observe the appearance of the growing point of the head. If it has been damaged, it will first appear as white instead of green and gradually deteriorate by turning yellow and finally brown to black. Damage will be visual in four to ten days. If damage has occurred, the head will not develop, but this does not mean a total crop loss. Wheat plants usually produce more tillers than are needed and if the older ones are damaged, the later tillers can still develop and produce a good crop.

When the wheat is in the boot to late bloom stage, freezing temperatures of 28° to 30°F may cause head sterility or "wavy awns." Head sterility may affect the entire head or only a portion of the head. Severe damage will usually show up in three to six days after the freeze occurs. Head damage only may not be apparent, but can be determined by skillfully removing the outer glume from the small kernel and carefully observing the male anthers. There are three anthers for each kernel and if they are healthy, they will have a bright green healthy color. If they are damaged, they will begin to shrivel and turn white.

On April 16, 17 and 18, I examined many fields in northeastern Colorado. The wheat heads were two to six inches above ground level and I did not see visible damage anywhere north of Interstate 70. Some slight damage was observed south of Burlington. Since it was only three to five days after the freeze, it is possible that some damage was not visible.

Ed Langin, CSU Extension Agronomist from Lamar, has made detailed surveys in Baca and Prowers Counties. Damage in that area ranges from slight to severe. Ten days after the freeze, farmers can easily assess damage by cutting into the plant and observing the head.

Wheat farmers should not make hasty decisions about destroying the crop. If it is severely damaged, they have the option of salvaging the crop as pasture or hay and plowing it up and planting a warm season crop such as grain sorghum in southeastern Colorado and millet in the northeast. The success of either of these crops is dependent upon the amount of moisture left by the growing wheat.