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White Grub Management

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Several species of white grubs (*Phyllophaga* spp.) attack crops and pastures in North Dakota, primarily in the southeastern part of the state. Mature larvae (Fig. 1) are white, C-shaped, and about one inch long when full grown with a brown head and a black anal spot. Larval feeding begins in early spring on the roots of grasses and row crops such as corn, sugarbeets, and potatoes. Feeding causes young plants to wilt and die, resulting in stand reduction. In field crop areas with heavy grub infestation, replanting may be necessary if significant stand reduction occurs.

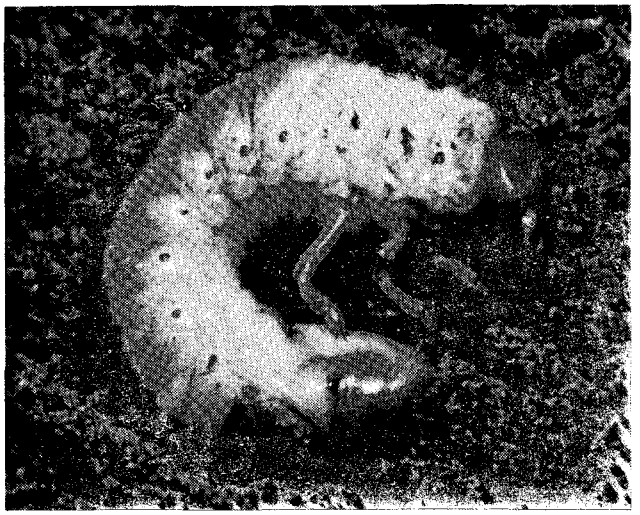


Figure 1. Third-instar larva of *Phyllophaga implicita*.

44.3 Adults, known as May or June beetles, feed on the leaves of trees. In North Dakota, larval infestations are most often in close proximity to shelterbelts. Since adults are relatively weak fliers, females do not fly far from their food source before landing and depositing eggs.

Of the species of *Phyllophaga* which occur in southeastern North Dakota, *Phyllophaga implicita* (Horn) has been encountered most frequently. This species frequently causes damage to corn in the sandhills area of southeastern North Dakota. Willow and poplar, tree species commonly found in shelterbelts, are preferred hosts of adult *P. implicita*. Pasture and rangeland can have high populations of white grubs and notable damage can occur when grassland is converted to cropland. Soil sampling should be done prior to cropping such areas to determine if economic levels of white grubs are present.

Life Cycle

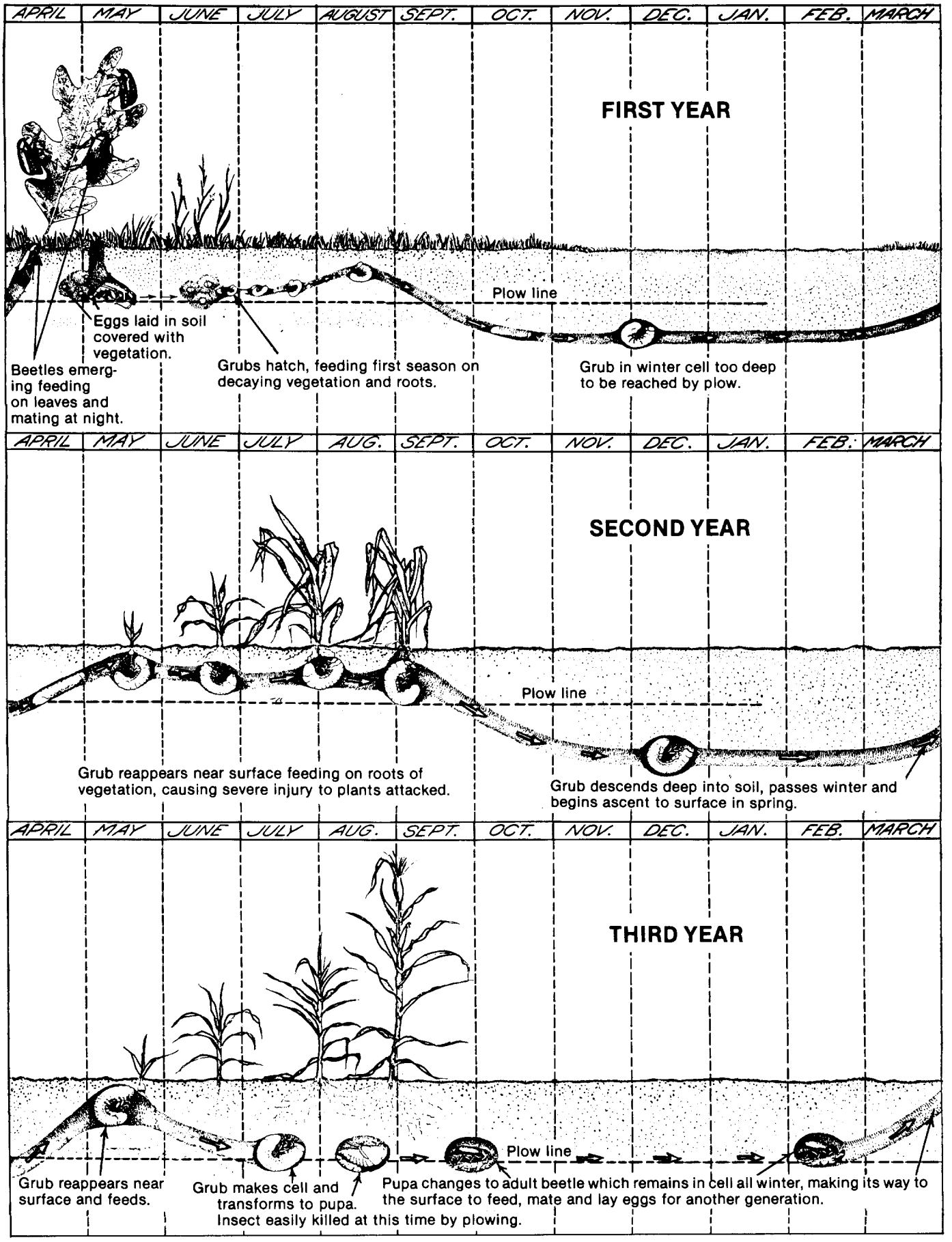
A single generation takes three years to complete in North Dakota (Fig. 2). As the soils warm in the spring, adults emerge from the soil at dusk and migrate to trees to feed and mate. The adult (Fig. 3) is about 0.75 inch long, brown colored, and is frequently found swarming around lights during late May and early June. Adults actively feed throughout the night, but they fly from trees to nearby fields about dawn. During the day the beetles burrow into the soil or leaf litter where females deposit their eggs. Each female will deposit 35-60 white eggs (Fig. 4) in individual cells of soil at a depth of 1 to 8 inches. In North Dakota, adults are present for two to four weeks in late May to early June.

Small, C-shaped, first instar larvae emerge two to three weeks following egg deposition and feed on the smaller roots of grasses or crops. Usually crops have a well developed root system, and significant damage does not occur the first year. Larvae molt once during their first summer. As cooler temperatures occur in the fall, the grubs migrate to a depth of one to several feet below the soil surface and form an earthen cell in which they overwinter.

The second instar grubs migrate upward into the root zone and begin feeding in the spring of the second year. Larvae feed heavily on roots the entire second summer. Consequently, damage is usually greatest in the second year. By the second fall, grubs have molted to the third instar and again descend in the soil to form overwintering cells.

Larvae will ascend to the root zone in the spring of the third year and feed until mid to late summer. Crop stand reduction can also occur early in the third summer although usually damage is not as extensive as the previous year. Grubs begin to migrate downward by late July and form earthen cells in which they pupate. During late August and early September the pupae (Fig. 5) transform to the adult stage. Adults remain dormant in the soil until the following spring at which time they will emerge to begin the cycle again.

Figure 2. Diagram illustrating the life cycle of *Phyllophaga implicita*. (Modified from an illustration from the Wisconsin Agricultural Experiment Station.)



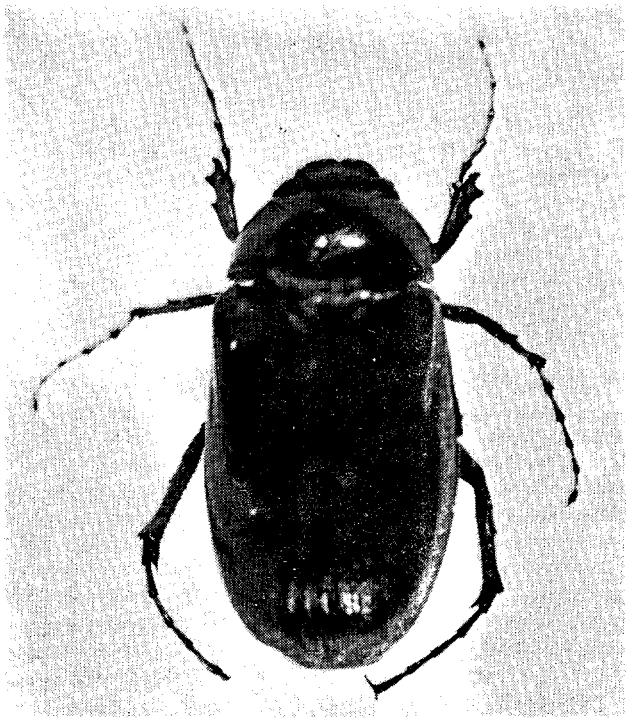


Figure 3. Adult of *Phyllophaga implicita*.

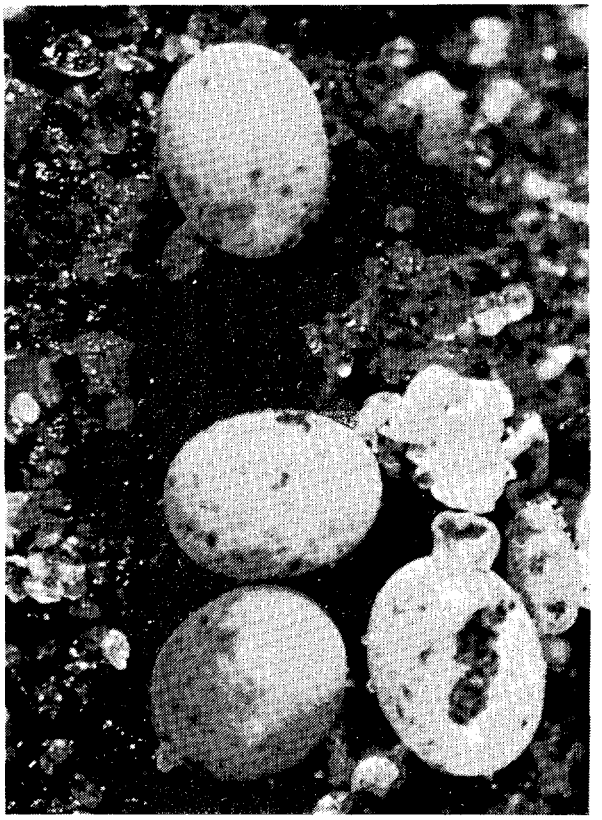


Figure 4. Eggs of *Phyllophaga implicita* (Courtesy of A.W. Anderson, NDSU).

Surveying for White Grubs

White grubs are sometimes detected when they are turned up on the soil surface by spring tillage practices. However, detection and determination of the level of an infestation must be accomplished by taking soil samples before planting in the spring. Samples should be one square foot of soil 8 to 12 inches deep. Samples should be spread out and the number of grubs determined. Infestations as low as one grub per square foot can result in significant stand reductions in a seedling crop. Samples should be taken randomly throughout the field at a rate of 20 well spaced samples per 40 acres of land. Special attention in sampling should be given to areas of fields that had thin stands the previous seasons and along field margins adjacent to shelterbelts.

Because white grub infestations often occur along field margins near shelterbelts, chemical treatment of these areas can give adequate white grub control without treating an entire field, thus minimizing treatment cost and unnecessary pesticide use. If spot treatments are to be used, thorough sampling is essential in order to determine the extent and location of the infestation.

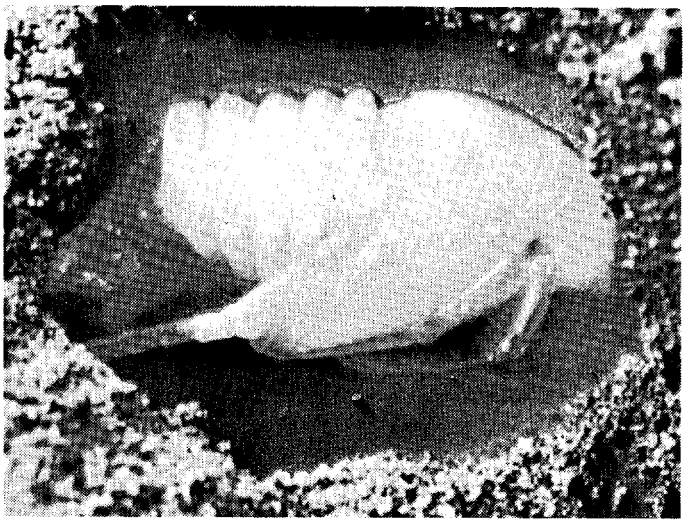


Figure 5. Pupa of *Phyllophaga implicita*.

Crops Attacked

Corn

Corn growing areas in southeastern North Dakota frequently experience white grub infestations that result in economic yield losses. Research at North Dakota State University has indicated that *P. implicita* is the most frequently encountered species. High populations of adults emerged in the spring of 1985. This would indicate that potential for larval damage will be high in 1986 and 1987, with adult emergence occurring in 1988 and every three years thereafter.

Corn plants usually emerge and reach a height of 2 to 6 inches before white grub damage becomes apparent. Affected plants turn light tan or yellow, wilt, and die. Insecticidal control for white grubs must be applied at planting time since no rescue treatments are registered

or effective. Granular insecticides recommended for white grub control in corn are listed in Table 1.

Sugarbeets

White grubs occasionally can be a problem in sugarbeets. Symptoms of grub damage in beets include patchy areas of dead or dying plants with pruned roots. No insecticide is currently registered for white grub control in sugarbeets. However, chemicals registered for control of the sugarbeet root maggot such as Terbufos (Counter 15G) at 1.0 lb. active ingredient per acre (4.5 ozs./1000 ft. row) will often suppress white grub problems.

Soybeans and Dry Beans

White grubs can damage soybeans and dry beans by reducing stands. Various granular insecticides have been experimentally tested for white grub control in beans with varied results. Currently no insecticides are registered for white grub control in soybeans or dry beans.

Potatoes

White grubs can be quite destructive to potato tubers causing damage which reduces both grade and quality. For white grub control in potatoes, see North Dakota State University Extension circular #E-881, Potato Insect Control.

Pasture

White grub damage to forage grasses in rangeland is quite common. In grasslands, the occurrence of white grub infestation is indicated by large circular areas of dead or dying grass. Larval feeding on the grass roots can be so severe that the top layer of sod can be rolled up like a carpet. The grubs will then be seen lying underneath on the soil in a curled or C-shaped position. Skunks often detect a grub infestation and root up pasture sod to feed on the grubs below.

No insecticide is registered for white grub control in pasture or rangeland due to the potential hazard to cattle and poor economic return for such a treatment. Due to the three-year cyclic nature of damage caused by grubs, good pasture management is the best procedure to reduce damage. Regrowth from adjacent grasses will help replace damaged patches, but sometimes pasture renovation practices can speed recovery. If damaged areas are to be renovated, a good seedbed can be prepared by breaking up the sod in the fall and again in the spring. Spring seeding of a mixture of grasses and legumes followed by regulated grazing the first season will allow the new stand to establish.

Table 1. Corn Insecticides Registered for White Grub Control 1986.

Insecticide	Amt. Formulation per 1,000 ft. of Row[1]	Remarks
terbufos (Counter 15G)*	8-16 ounces[2]	Apply in a 7 inch band (16 oz. rate) or in-furrow (8 oz. rate).
carbofuran (Furadan 15G)*	8 ounces	Apply in a 7 inch band or in-furrow at planting time.
chloropyrifos (Lorsban 15G)	8-16 ounces	Apply in-furrow at planting time. (NDSU research indicates that Lorsban aids in white grub suppression, with heavy white grub infestation, some stand reduction may still occur.)

[1]8 ounces of formulated material is equal to 1.3 lbs. AI/acre based on 30 inch rows.

[2]In most instances the 8 oz. rate will be sufficient. Under severe infestation levels the 16 oz. rate may be needed.

*EPA has classified this insecticide as a restricted use pesticide. Restricted use pesticides are to be applied by or under direct supervision of certified pesticide applicators only.

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