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Soil-Building Practices in the 1940 AAA Program as They Apply To Iowa

The AAA program for 1940 places increased emphasis upon the conservation and improvement of the soil resources of the nation. The docket for the North Central Region, including Iowa, lists a large number of practices which can be followed by farmers in earning their AAA soil-building payments.



Fig. 1. Heavy erosion losses on this sloping field have been largely controlled by planting strips of small grain on the contour. The picture was taken in Monona County.

This manual has been prepared to assist the township AAA committeemen of Iowa in explaining to cooperators under the program which of the practices listed are most valuable under Iowa conditions and how to use them to best advantage. The manual follows the 1940 docket and administrative rulings listed in the docket insofar as possible. **Information herein contained represents the college's recommendations from the standpoint of good farming practice and should not be construed as administrative rulings.**

The recommendations listed in this schedule of practices should enable farm operators to map out their farm plans for

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1940 to achieve maximum soil conservation.

Additional information, including bulletins and circulars, may be obtained upon request to the County Extension Office or to the Extension Service, Iowa State College, Ames, Iowa.

APPLICATION OF MATERIALS

(1) **Fertilizers.**—It must be recognized at the outset that limestone is the basis of any good soil management program. For most efficient results, commercial fertilizer, such as superphosphate, should be applied only to land that has been well limed or for which tests show no need for lime.

The most satisfactory method of applying fertilizer to seedings is with a grain drill and fertilizer attachment which applies both the fertilizer and the seed at the proper place in the soil.

Fertilizer can also be broadcast with an endgate-type or trailer-type lime spreader. When granular fertilizer (which has granules about the size of wheat grains) is used, the fertilizer can be spread with an endgate seeder. All fertilizer - spreading machinery should be thoroughly cleaned after using to prevent corrosion.

When fertilizer is broadcast, it should be **thoroughly** disked into the soil.

(a) **Superphosphate.** — Better stands and yields of legumes and grasses have been



Fig. 2. The effect of fertilizing and reseeding depleted pastures is strikingly demonstrated in the above pictures taken in Winneshiek County. Top picture shows the old, untreated pasture. The area below was limed, phosphated and reseeded. Notice the luxuriant growth.

obtained on many Iowa soils by the application of 200 to 300 pounds of 0-20-0 superphosphate (containing 20 percent of phosphoric acid) or its equivalent per acre at the time of seeding.

The phosphate fertilizer most commonly used is the 20 percent, or 0-20-0. However, many farmers use higher analysis phosphates such as 0-32-0 and 0-45-0.

For legume seedings on sandy or peaty soils or on poor soils that have received little manure an 0-20-10 fertilizer (20 percent phosphoric acid, 10 percent potash) can be used.

Recommended rates of application for specific crops are as follows, when 0-20-0 or 0-20-10 are used:

Alfalfa.—200 to 300 pounds per acre applied at the time of seeding.

Red, sweet and alsike clover.—150 to 200 pounds at the time of seeding.

Permanent pasture.—200 to 300 pounds disked in the spring previous to reseeding.

To earn one unit under the 1940 AAA docket, the following amounts must be applied on land classified as non-depleting:

0-16-0	300 pounds
0-20-0	240 pounds
0-32-0	150 pounds
0-45-0	107 pounds
0-20-10	183 pounds

(b) **Potash.**—Used mainly in north-central Iowa on alkali (or high-lime) soils. Muriate of potash containing 50 percent by weight of water-soluble potash or its equivalent is applied at the rate of 100 pounds per acre previous to seeding legumes.

1. If the alkali or lime content is lower or on mixed alkali and peat soils, a fertilizer combining phosphorus and potash may be used—such as 0-20-20 (20 percent phosphoric acid and 20 percent potash) at the rate of 200 to 250 pounds per acre. (To determine the alkali content, take samples to your county agent, who will obtain a test for you.)

To earn one unit under the 1940 AAA docket, the following amounts must be applied on land classified as non-depleting:

150 pounds of 0-0-50 muriate of potash (containing 50 percent potash).

147 pounds of 0-20-20 (20 percent phosphoric acid, 20 percent potash).

When phosphate-potash combinations are used, like the 0-20-20, credit is also given for the phosphorus in the fertilizer.

(c) **Basic Slag or Rock Phosphate.**—Superphosphate furnishes available phosphoric acid more cheaply and is usually preferable. The recommended rate of application for rock phosphate is 500 to 1,000 pounds per acre. Basic slag is not used in Iowa because of freight rates.

(2) **Gypsum.**—Gypsum is not recommended as a fertilizer for use in Iowa.

(3) **Mulching Orchards and Commercial Vegetable Land.**—Two hundred pounds of mulch per tree per year is recommended; this would be 3 tons per acre in the average orchard with 30 trees to the acre. In addition to straw, some orchardists use sweet clover after it is threshed for seed, soybean straw or shredded cornstalks. The mulch should be kept 1½ feet away from the trunks of the trees because of danger of damage to the bark from field mice. Mulching is rarely used on commercial vegetable land in Iowa.

(4) **Limestone.**—Any system of farming that does not maintain an adequate supply of lime in the soil leads to a rapid decrease in fertility, because of the difficulty in obtaining good stands of legumes. Liming is beneficial in many ways. Tests show that it:

Corrects acidity.

Furnishes available calcium to crops.

Makes manures and fertilizers more effective.

Favors soil organisms that make more plant food available.

Helps control certain plant diseases and insects.

Improves heavy soils.

Fully 75 percent of Iowa's soils are acid and in need of lime for the best growth of alfalfa, clover and other legumes. In the eastern half and south-central parts of the state, 90 percent of the soils need from 2 to 4 tons of ground limestone per acre. The soils of the rest of the state are as a rule better supplied with lime. Here, however, at least half the land shows acidity to a greater or lesser degree.

If the lime requirements of a soil are not known, take samples to your county agent who is equipped to test them free of charge. If there is a vocational agriculture teacher in the high school, he may be able to run the test.

USE CARE IN TAKING THE SOIL SAMPLES

The soil sample can be obtained with a spade. After scraping away all trash, a small hole should be dug to plow depth. After cleaning out the loose soil, a narrow slice should be removed from the side of the hole and placed in a clean sack or other container. This procedure should be repeated in at least eight different places in the field and the samples thoroughly mixed

together. From this mixture or composite sample a small sample of about one pint should be saved for testing. In case different parts of the field have received different treatments in the past or have different kinds of soil, one composite sample should be taken from each part. A record should be kept of where the sample is taken. The sample should be air-dried (not by artificial heat such as in an oven) before being submitted for testing.

(a) Apply quantity of limestone indicated by soil test as being necessary.

(b) Whenever possible, put on ground 6 months to a year ahead of legume seedings to allow time for the lime to neutralize the soil.

(c) The lime should be worked into the soil by disking or cultivating but **should not be plowed under**, since this will put the lime too deep for good early legume growth.

(d) If the limestone is not 90 percent or above in purity and crushed fine enough so that 90 percent or more passes a 10-mesh screen, use proportionately larger amounts.

(e) In counties where the Iowa Limestone Act is in operation, farmers can get better prices and quality by availing themselves of the provisions of the Act. (See your county agent for information.)

SEEDINGS

(5) **Seeding Alfalfa.**—Alfalfa is grown with success in every county in Iowa.

(a) Alfalfa should be seeded on well-drained fields.

(b) It requires a soil that is well supplied with lime. Tests for acidity should be made, and on acid soil limestone should be applied at least 6 months prior to seeding the alfalfa.

(c) Variegated strains such as Grimm and Cossack are more winter hardy than common alfalfa. These and northern grown common from the Dakotas and Montana are recommended in Iowa except where soils have become infested with bacterial wilt.

For seeding where it is known that bacterial wilt is present, Ladak, a hardy, variegated, wilt-resistant strain, is recommended. Nebraska Hardistan, a common alfalfa, is also recommended for wilt-infested soils.

(d) Alfalfa should be seeded at the rate of 12 to 15 pounds of clean high-germinating seed per acre. Ten to twelve pounds of alfalfa and four pounds of timothy may be seeded for any purpose for which straight alfalfa is used. The alfalfa-timothy mixture may outyield alfalfa alone, and stands last longer on wilt-infested soils than straight seedings of alfalfa. The timothy helps to hold the soil in place on rolling ground.

(e) On most normal Iowa soils an application of 200 to 300 pounds of superphosphate per acre will result in increased yields and will aid in establishing successful new stands. (See 1-a above.)

(f) Seed alfalfa in early spring with one-half the normal rate of early oats, flax or barley. (See "Nurse Crop Management" on P. 7.) It also may be seeded in August without a nurse crop.

(6) **Permanent Grasses or Pasture Mixtures**

(a) For permanent pasture on average soils, 8 to 10 pounds of alfalfa and the same amount of smooth brome grass make a good mixture. (See 7 and 11 for other seedings to be used as pastures.)

(b) Crested wheat grass, slender wheat grass, western wheat grass, grama grass, buffalo grass and bluestem are not recommended for any part of Iowa.

(7) **Biennial Legumes, Perennial Legumes and Perennial Grasses**

1. **Sweet Clover.**—This crop will thrive on almost any Iowa soil that is well supplied with lime. Sweet clover is recommended as the most valuable soil-building crop adapted to Iowa if left over the second year. If seeded alone, use 10 to 12 pounds per acre.

If primarily intended for pasture it is usually preferable to mix 3 pounds of medium red clover and 4 pounds of timothy with 7 pounds of biennial sweet clover per acre. On low or heavy, poorly drained soils, $1\frac{1}{2}$ to 2 pounds of alsike should be substituted for the red clover in the above mixture.

2. **Red Clover.**—Red clover is more tolerant of soil acidity than sweet clover or alfalfa, but good stands are not usually obtained on poor acid soils without the addition of lime and phosphate. Red clover usually responds to applications of lime on any soils that are acid.

For straight seedings of red clover use 8 to 10 pounds of seed per acre.

On soils not well adapted to red clover, mixtures with timothy, or alsike and timothy, are recommended at the following rates:

5 pounds red clover, 2 pounds alsike and 5 pounds timothy or

8 pounds red clover and 5 pounds timothy.

3. **Alsike Clover.**—Alsike tolerates more acidity and poorer drainage than red clover, but does not yield as well on well-drained soils well supplied with lime. Alsike contains

twice as many seeds per pound as red clover; therefore, use half as much.

4. **Mammoth Red Clover.**—Not ordinarily as valuable as red clover. On soils inclined to be a little sandy and therefore subject to drying, it is a little more likely to make a successful stand. Matures 2 weeks later than red clover and makes only one crop per season, while the red clover will make two.

5. **Reed Canary Grass.**—This is valuable as pasture in boggy, wet places where water is likely to stand for considerable time.

6. **Smooth Bromegrass.**—Smooth brome is recommended for permanent pasture or for hay on fertile to average soils. It is especially recommended for seeding on the porous soils of western Iowa. It should be seeded with sweet clover, red clover or alfalfa.

(8) **Korean Lespedeza, Annual Rye Grass and Annual Sweet Clover**

(a) **Korean Lespedeza.**—Recommended only in extreme southern Iowa on very poor, acid soils in permanent pastures where better legumes will not thrive.

(b) **Annual Rye Grass.**—Can be used for quick pasture, but small grains, particularly oats, are more plentiful, usually cheaper to seed and as good or better for pasture.

(c) **Annual Sweet Clover.**—Annual sweet clover or Hubam is not recommended in place of biennial sweet clover unless for an annual cash clover seed crop or for plowing under at the end of the first year to escape trouble caused by biennial sweet clover volunteering the following spring.

(9) **Winter Legumes.**—Not recommended for field conditions in Iowa.

(10) **Timothy and Red Top.**—Timothy is recommended in mixtures with alfalfa, red clover, sweet clover and alsike. Timothy can well be added to all legume seeding on rolling ground where erosion is a problem. Red top is not recommended in Iowa except in pasture mixtures and then only on the poorest soils or for waterways and terrace outlets.

NURSE CROP MANAGEMENT

For all seedings of alfalfa, and for clovers and grasses with a nurse crop in the spring, the following methods of handling the nurse crop are suggested:

1. Use half normal rate of grain seeding.
2. Pasture off the nurse crop, preferably with cattle or sheep, avoiding overgrazing.
3. Cut for hay or clip the nurse crop if there is evidence of



Fig. 3. Broad-based terraces are primarily useful on sloping lands that must be used for crops and on which less expensive conservation measures will not provide adequate erosion control.

it competing too strongly with the clover or other new seeding.

4. In case of drouth, cut or pasture off the nurse crop before it robs the new seeding of needed moisture, regardless of whether the nurse crop has reached the best stage for hay.

5. If left for grain, use an early stiff-strawed variety of grain or use flax.

PASTURE IMPROVEMENT

(11) **Reseeding Depleted Pastures.**—The following procedure is recommended to improve permanent pastures.

(a) Lime the soil, if acid.

(b) Apply 200 to 300 pounds of 0-20-0 (20 percent) superphosphate per acre.

(c) Disk thoroughly on the contour very early in the spring, until the ground is black and the sod or weeds are thoroughly cut up. Harrow once with the teeth sloping if the ground is rough.

(d) Broadcast or drill the seed and roll. If a roller is not available, harrow.

(e) Control the grazing to permit the new seeding to become thoroughly established.

Reseeding Mixtures.—For average conditions, use a mixture of 5 pounds of sweet clover, 3 pounds of red clover and 2 pounds of alsike per acre, if there is a fair stand of bluegrass.

If there is a very poor stand of bluegrass, add 4 or 5 pounds

of timothy and 3 pounds of Kentucky bluegrass seed per acre to the above mixture and use about a bushel of oats per acre as a nurse crop.

If there is some acidity and lime is not applied, increase the red and alsike clovers and cut down on the sweet clover.

Reseeding **without** thorough seedbed preparation, proper soil treatments and controlled grazing is usually of little value. Very early spring seedings are most successful.

(12) **Natural Reseeding.**—Probably natural reseeding has very little if any value in thickening the stand of grass, but the deferred grazing will permit the development of stronger roots and greater vigor of growth the following year.

GREEN MANURE CROPS AND GO-DOWN CROPS

(18, 19 and 21) **Green Manure Crops and Go-Down Crops.**—Soybeans and Hubam clover are recommended as annual legume green manure crops. They are to be preferred to the non-leguminous green manure crops because they increase the nitrogen content of the soil, whereas non-legumes do not.

Any of the small grains, sudan grass, millet, annual rye grass, buckwheat and sweet sorghums may be used as green manure crops and are about equal in value but definitely inferior to legumes.

Crops grown for green manure are seeded in the usual manner.

Crotalaria and sesbania are not recommended in Iowa.

(20) **Green Manure Crops for Commercial Orchards.**—Crops most commonly used for this purpose in Iowa are sweet clover, red clover, oats and rye. **Do not use soybeans or alfalfa in orchards**, because they harbor the buffalo tree hopper which ruins young orchards and causes serious damage to mature fruit trees. Soybeans also loosen the soil and pave the way for soil washing on sloping land. Alfalfa competes with the tree roots for moisture.

EROSION CONTROL

(25) **Construction of Terraces.**—Terracing supported by necessary cropping practices is primarily applicable on sloping lands that must be used for crops and on which less expensive conservation measures will not provide adequate erosion control. Terracing should not be considered for land that can be kept under permanent vegetative cover, except possibly where terraces may be required for moisture conservation or diversion of water for gully control, or as aid in establishing permanent vegetation. Where erosion can be controlled through contour tillage, crop rotations and strip cropping, terracing is not necessary.

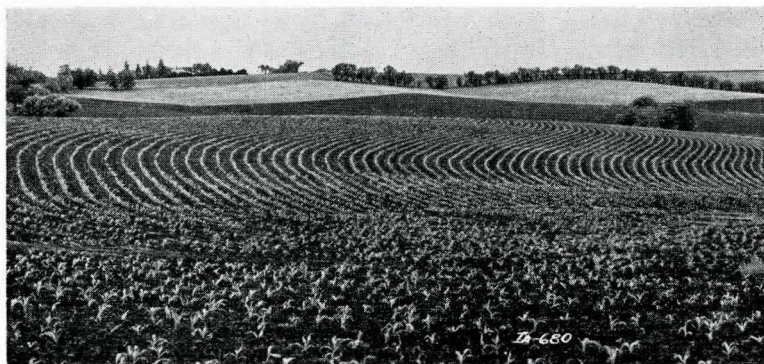


Fig. 4. Not all farms are well suited to a full and complete use of the contour method because of very irregular slopes necessitating sharp curves in the rows. However, it is possible to lay out many difficult areas with surprising success. All of the cornfields of this farm of E. H. Stevens of Farragut, in Fremont County, are planted on the contour.

(a) When planning a terrace system, consider the whole farm instead of fields or parts of fields.

(b) Provide for practical and effective outlets for the drainage water. Natural outlets are preferable to road ditches or artificial outlets.

(c) Be sure no water drains from fields above onto fields to be terraced, unless some means is provided to intercept the head water.

(d) Terracing should begin at the top of the hill. The location and construction of the top or "key" terrace is very important as the success of the whole system depends on it.

(e) Farmers should not attempt to construct terraces until they are thoroughly familiar with necessary requirements for spacing, slope, size, etc. Your county agent can assist you in obtaining technical advice.

(f) Terraced fields must be farmed on the contour if the terraces are to be effective.

(28) **Shrub Windbreaks on Muck Land.**—Cottonwoods and various species of willows are recommended for this purpose.

(29) **Contour Furrows on Pasture Land.**—Contour furrows are made with a plow, a small grader or a special contour-furrowing plow, the furrow slice being turned downhill. They should be constructed on as nearly the exact contour as possible and should be dammed at intervals of 100 feet or less in order to prevent flow of water along the furrow.

Where moisture conservation is an important item in maintaining pasture land, contour furrows provide a means of intercepting and holding runoff water.

Contour furrows are a hindrance to the mowing of pasture, and are of doubtful value on pastures having a good sod.

(32) **Strip Cropping.**—Strips of sod or closely growing crops planted across the slope approximately on the contour between intertilled crops divide up long, seriously erosive slopes, reduce the velocity of runoff water, filter from it a large part of its load of silt and allow more time for absorption of the water into the soil.

The width of each strip depends upon the slope, rotation of crops, type of soil and intensity of rainfall.

In chinch bug areas there is an objection to having adjacent strips of small grain and corn because of the difficulty of controlling the chinch bugs. It is recommended that grass strips, called "buffer strips," be used in such areas.

Rotation strip cropping is easily started on meadow or hayland by leaving strips in the existing vegetation.

Existing grassed waterways should be carefully preserved. Natural drainageways not already grassed should be prepared and seeded to grasses or close-growing crops.

(35) **Contour Farming of Intertilled Crops.**—Contour farming consists essentially of laying out contour lines around the slopes and planting the intertilled crops parallel to these guide lines.

(a) Contour farming increases crop yields by conserving moisture. It also decreases soil losses and lessens power requirements because the machinery is operated on the level.

(b) The rows on a hillside should not be perfectly level, but should drain slightly toward grassed waterways. The drop from the contour should not be more than $1\frac{1}{2}$ to 2 feet per 100 feet and less is preferable.

(37) **Contour Seeding of Small Grain Crops.**—Contour drilling of small grain on land where erosion is a problem is a very practical and effective practice for reducing both soil and water losses.

Although accurately surveyed base lines as planting guides are desirable, approximate contouring is satisfactory but less effective. A satisfactory method of approximate contouring, especially on uniform slopes, is to survey one base line midway on the slope and seed both ways from it.

FORESTRY

Farm woodlots, properly managed and protected from livestock, can be made to yield fence posts, poles and fuel for the farm, and in many cases will bring in an additional cash income from the sale of wood products. Most farmers prefer to locate their woodlots on land unsuited to the growing of other farm crops—irregular or remote pieces of good land or land that is eroded, poor or stony.

A good windbreak of evergreen trees around a farmstead will materially decrease the cost of heating the home and will prevent the snow from banking around the building and blocking the farm lot. Livestock can be kept in condition on less feed when protected by an efficient windbreak.

(39) **Planting Trees.**

(a) **For woodlots, erosion control or protective plantings.**—Although the docket specifies 650 trees per acre, a more thrifty plantation can be obtained by planting trees according to the spacings recommended below. A 6' x 6' spacing figures out 1,000 trees per acre.

Following are the varieties of trees recommended for these purposes in Iowa:

FOR FARM WOODLOTS

Broadleaf species (1 or 2-year seedlings or transplant)
Evergreen (3 years or older)

Species	Spacing	Use of wood	Site requirements
White and Green Ash	6' x 6'	Fuel, poles, handles	Moist or dry slopes
Hardy Catalpa	6' x 6'	Posts, fuel	Moist or dry slopes
Red Cedar	6' x 6'	Posts	Moist or dry slopes
Wild Black Cherry	6' x 6'	Furniture	Moist or dry slopes
American (White) Elm	6' x 6'	Fuel, poles, logs	Moist, dry slopes, stream borders
Red (Slippery) Elm	6' x 6'	Fuel, poles, logs	Moist, dry slopes
Hickories	6' x 6'	Fuel, handles	Dry or moist slopes
Black Locust	4' x 4' to 6' x 6'	Posts	Dry slopes, steep gully sides
Soft (Silver) Maple	6' x 6'	Fuel, logs	Dry or moist slopes, stream borders
Hard (Sugar) Maple	6' x 6'	Logs	Moist clay slopes, dry rich slopes
Mulberry	6' x 6'	Posts	Dry and moist slopes
White Oak	6' x 6'	Logs, posts, fuel	Dry slopes
Red Oak	6' x 6'	Logs, posts, fuel	Dry or moist slopes
Bur Oak	6' x 6'	Logs, posts, fuel	Dry or moist slopes
Osage Orange (Hedge)	4' x 6'	Posts	Dry or moist slopes
Southern half of state only			
Pines (White, Red, Jack, Austrian, Western Yellow)	6' x 6'	Logs	Dry slopes
Cottonwood (Cuttings)	10' x 10'	Fuel, logs, boxes	Moist sites or dry sites
Willows (Cuttings)	4' x 4' to 6' x 6'	Fuel	Moist sites
Black Walnut	30' x 30' or 40' x 40'	Logs	Moist bottomland, rich soil
		and interplant with other species	

TREES AND SHRUBS FOR GAME COVER OR FOOD

Amelanchier (Juneberry or
Service berry)
Mountain Ash
Prickley Ash
Wafer Ash
Bladdernut
Choke Cherry
Dogwoods
Hawthornes
Wild Cherries
Sumacs

Mulberries
Junipers
Dwarf Maples
Pawpaw (South Iowa)
Persimmon (South Iowa)
Wild Grape
Bittersweet
Wild Plum
Red Bud
Prairie Crabapple
Viburnums

Preparation of Soil.—On areas with a heavy sod or other heavy vegetation this cover should be removed to allow each tree to have a spot 18 inches in diameter relatively free of competing vegetation. Furrows may be plowed at the proper intervals in place of clearing heavy vegetation by hand. On slopes, furrows should be plowed with caution and always on the contour. On areas where there is little or no vegetation present, no preliminary preparation of the soil is required.

Sources of Trees and Shrubs.—Many of the trees listed may be obtained from commercial nurseries. A few species of forest trees for woodlots, reforestation and erosion control are supplied in quantities of not less than 1,000 trees per order by the State Forest Nursery, Ames, Iowa, at reasonable prices. For

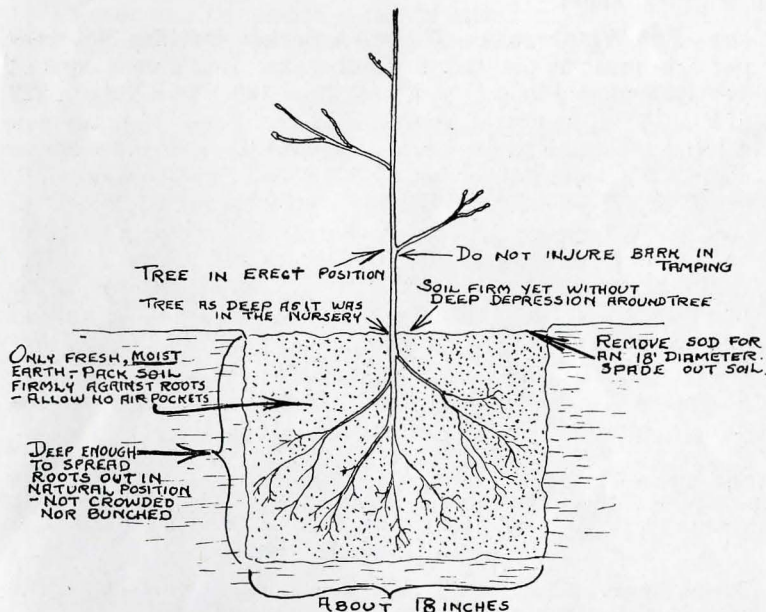


Fig. 5. In planting trees be sure to keep the tree erect, spread roots out in natural position, and pack soil firmly so that no air pockets remain. The trees should be planted as deep as they were in the nursery.



Fig. 6. The gully shown in the picture was threatening the farm of M. P. Christensen of Coin, Iowa, when it was treated by placing wire check dams and willows in the bottom and planting the banks and shoulders to black locusts.

further information about state nursery trees see your county agricultural agent.

(b) **For Windbreaks.**—The AAA docket specifies 300 trees per acre must be planted in windbreaks. Evergreens, spaced as recommended below, will total from 189 (20' x 20') to 222 (14' x 14') per acre. Three rows of evergreen trees are considered adequate for a permanent windbreak. In order to fill out the required number of 300 trees, a temporary windbreak of mulberry, osage orange (Southern Iowa), black locust, hardy catalpa, willows or cottonwoods can be planted in one or more rows outside the evergreens and spaced 6' by 6'.

Following are the recommended species of evergreens for windbreak planting (all evergreen trees should be 3 years of age or older):

Species	Spacing	Species	Spacing
Norway Spruce	16' x 18'	White Pine (Northeast Ia.)	20' x 20'
White Spruce	16' x 18'	Austrian Pine	20' x 20'
Black Hills Spruce	16' x 18'	Red Cedar	14' x 14'
Douglas Fir	16' x 16'	Western Yellow Pine	20' x 20'
		White Cedar	14' x 14'

Preparation of Soil.—Soil should be thoroughly prepared by deep plowing and disking before the windbreak is set out.

Protection.—The windbreak should be fenced against the in-

trusion of livestock and poultry and protected against surface fires. Clean cultivation should be given one or more seasons.

(40) **Maintaining an Existing Stand of Trees.**—See above for recommended varieties of forest trees and shrubs.

(41) Removal of poorly formed, undesirable species, dead, diseased and insect-infested trees, thinning a thick stand and subsequent protection from grazing is considered as improving a forest stand.

(42) If livestock is permanently excluded from an existing woodland, young trees will be able to establish themselves and not be damaged by browsing animals. Compliance under this practice requires no labor or cash outlay.

OTHER PRACTICES

(43) **Control of Perennial Noxious Weeds in Organized Weed Control Districts.**—For information as to whether your county is classified as an organized weed control district, consult your county AAA committee. Farmers not in organized weed control districts cannot earn AAA payments for weed control.

(a) **By Chemicals.**—Two chemicals are recommended for the control of noxious perennial weeds in Iowa, namely, "Atla-cide" and sodium chlorate. Either compound may be used in liquid or dry form.

1. Liquid applications are recommended for small areas on farms and for either small or large areas along roadsides and railroad right-of-ways where mowing or cultivation in



Fig. 7. The same as fig. 6, photographed 1 year and 8 months later, showing how the black locusts have begun to heal up the gully.

the summer is difficult. Either material is dissolved in water at the rate of 1 pound to 1 gallon. The solution should be sprayed on the tops of the weeds when they are in bud, when the soil moisture is high, the temperature is moderate and the air moist. Two or more applications are necessary for most weeds. One to two gallons per square rod are required for each treatment.

2. Dry treatments are recommended for the early fall months after heavy rains. Plenty of soil moisture increases the effectiveness of the material. From $2\frac{1}{2}$ to 5 pounds per square rod are required, depending on the kind of weed to be treated. Applications may be made by hand or with a fertilizer spreader.

(b) **By Tillage.**—It is possible in Iowa to destroy weeds and produce a crop each season. The recommended methods are as follows:

1. **Use smother crops:**

a. Alfalfa for Canada thistle, horse nettle and perennial sow thistle. Fallow until August the first year, seed alfalfa and cut for hay the following several years. It may be feasible also to sow oats in the spring, cut for hay, plow, cultivate and seed the area to alfalfa in late August.

b. Sorghum and sudan grass. These two annual smother crops may be sown in June for 2 or 3 successive seasons on areas infested with any of the primary noxious weeds.

2. **Fallowing:**

A spring-tooth harrow used one season (July to September) on an area infested with quack grass will usually kill all the roots. A surface cultivator is recommended for other perennial weeds, but 2 or 3 seasons of such treatment are required for bindweed and horse nettle.

3. **Fallowing and Fall Seeded Crops:**

Summer fallowing with a surface cultivator in combination with fall seeding of rye and wheat may be used effectively against bindweed in particular and also other perennial noxious weeds, provided the same procedure is continued for about 3 years. Each summer cultivation should follow immediately after the removal of the crop.

4. **Surface Cultivation in a Growing Crop:**

Areas of certain perennial weeds may be planted to sorghum or soybeans drilled in rows or to corn that is checked. Frequent tillage with a surface cultivator is necessary to prevent top growth of the weeds. (See Iowa Extension Circular No. 201.)

(42) **Deep Sub-soiling Crop Land or Orchards.**—The purpose of this practice is to trap water and permit it to soak into the ground. It should be done on the contour. This practice is not very applicable to Iowa.