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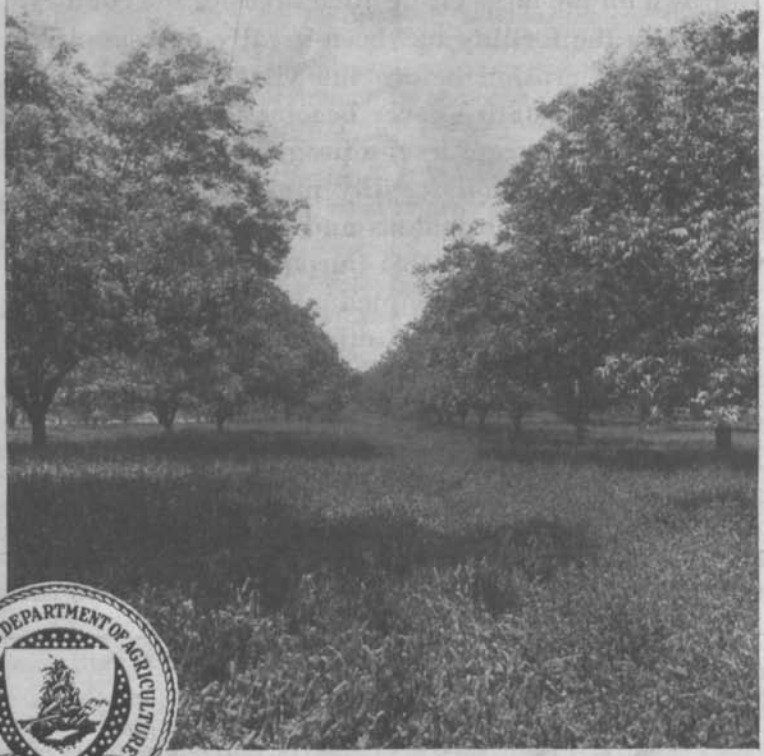
COVER CROPS FOR SOIL CONSERVATION



COVER CROPS FOR SOIL CONSERVATION

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INTRODUCTION

COVER CROPS are crops sown or planted in thick stands for the purpose of protecting and enriching the soil. In some cases such crops may be maintained semipermanently or for an indefinite period, but more generally they occupy the land during the period between two main crops or are grown with wide-spaced crops seasonally or semipermanently as is the practice in orchards.

When the cover crop is perennial and allowed to stand for a term of years it is called a permanent cover crop. Annual crops sown in the fall and occupying the land during the winter are known as winter cover crops; those that are grown during the summer are called summer cover crops.

That the use of cover crops is a most efficient means for preventing soil erosion and increasing soil fertility is well known; yet this practice is not nearly so widely and extensively followed as it should be.

The kinds of cover crops that should be used and the method of utilizing them to the best advantage varies in different regions, according to climatic conditions but almost everywhere cover cropping in some form can be profitably followed.

In the Cotton Belt on practically every farm producing clean-cultivated crops, as corn, cotton, and tobacco, and in clean-cultivated orchards, there is an opportunity to use a winter cover crop. A loss of both soil and fertility will result if the ground is left uncovered during the winter (fig. 1). Many years of experience have demonstrated that prevention of this loss justifies a much greater expense than is required for labor and seed in growing the winter cover crop.

On erosible sloping land it has also been demonstrated that much more plant food is lost by erosion than is used by ordinary crop production for clean-tilled crops.

Aside from protection given the soil by the growing plant, cover crops add organic matter to the soil, which during the periods when fields are given clean cultivation greatly reduces soil-erosion loss.

General observations throughout the United States, confirmed by both detailed and reconnaissance erosion surveys, clearly indicate the havoc wrought by erosion where the humus supply has been depleted and the vegetative cover sacrificed by bad tillage practices. Soil loss due to erosion is almost entirely responsible for the nearly complete destruction of about 50 million acres of once-fertile land, and another area of nearly equal extent is in almost as bad condition. Erosion has removed the greater part of the topsoil from approximately 100 million acres more, and unless checked promptly the process will to a large extent destroy the productivity of this area. Furthermore, erosion is getting actively under way on approximately an additional 100 million acres.

Experimental evidence supports the conclusion that the soil is most susceptible to erosion when fields are bare of vegetation. It also

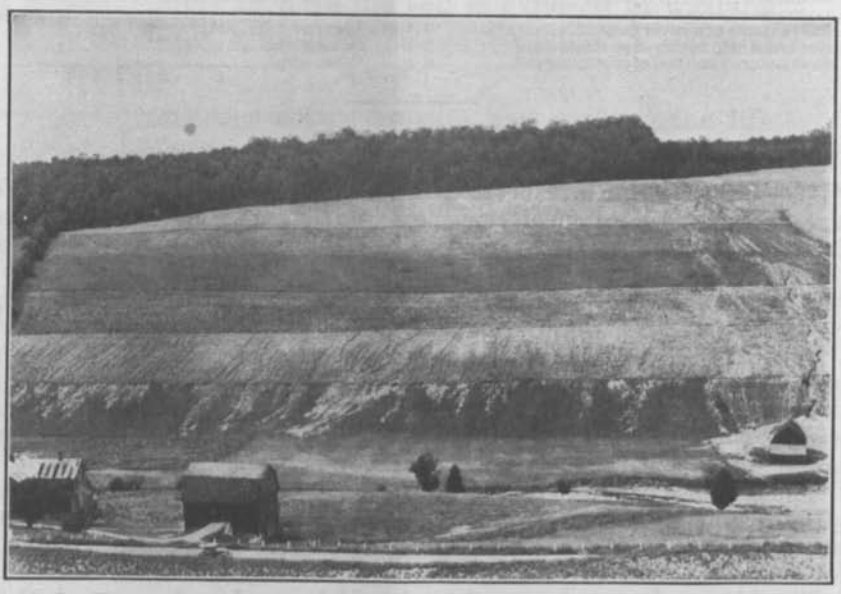

FIGURE 1.—The result of one heavy downpour—a "gully washer." A glance at the unprotected soil reveals what would have happened had the entire field been bare of vegetation. Every rain of sufficient volume to cause run-off will also cause the erosion of unprotected soil, although the action is frequently unnoticed until the surface soil is all gone.

indicates that soils low in organic matter or of low fertility are more easily eroded than those high in organic matter and humus. Further, the evidence shows that except on very gentle slopes soil losses occasioned by water erosion are certain to occur if the soil is not held by a ground cover. This situation is especially serious as about three-fourths of all farm crops are produced on land with sufficient slope to induce erosion if not protected with adequate vegetative cover or other control measures.

The continuous loss of soil from the cultivated lands of the United States means reduced fertility and increased expense if crop production is to be maintained. As the fertile topsoil is washed away or becomes depleted, the plow turns up the less productive subsoil, crop yields diminish unless maintained by the use of organic matter and

commercial fertilizers, tillage operations become more difficult, and farm profits dwindle.

The stupendous task of reclaiming and rebuilding these wasted acres emphasizes the importance of conserving the remaining productive areas of the United States.

ADVANTAGES OF A COVER CROP

The principal advantages of a cover crop may be summarized, briefly, as follows:

1. Reduces run-off of rain and thus conserves moisture (a rug for rain-worn soils).
2. Prevents excessive erosion of soil.
3. Adds organic matter to the soil.
4. Prevents the leaching of available plant food, especially nitrate nitrogen.
5. When turned under, forms organic acids or other compounds which aid in the liberation of mineral plant food.
6. May provide late fall, winter, and early spring pasture.
7. Protects newly constructed terraces and other mechanical soil-erosion devices (fig. 2).
8. Increases yield of corn, cotton, and other regular farm crops.
9. When plowed under, improves the structure of both heavy and light soils and increases the water-absorbing capacity and the infiltration of water into the soil.

DISADVANTAGES OF A COVER CROP

The advantages of cover crops ordinarily outweigh any reasonable objections which can be made to them; nevertheless, for the practical information of farmers the principal features which might become possible disadvantages in the use of a cover crop are listed as follows:

1. The cost of seed.
2. Cost of labor in the preparation of the seedbed and seeding.
3. Uncertainty of getting a stand.
4. Possible adverse effect on the moisture condition of the soil.
5. A possible refuge for insect pests, such as cutworms, that later attack corn or other crops.

COVER CROPS HELP MONEY-CROP ROTATIONS

Cover cropping is not a cure-all. It represents only one of the recommended practices of a well-rounded soil-conservation program. When seed is available on the farm, cover crops can be established by the individual farmer with little extra labor and no cash outlay, and when they occupy the land during the periods between the main crops they make an efficient ground cover until plowed under.

Crops grown in wide rows with cultivation, like cotton, corn, potatoes, and tobacco, are highly conducive to soil loss. All of these crops should be grown in approved rotations and the rotations supplemented with cover crops if soil loss is to be reduced to a minimum and crop yields maintained. Wheat and other small-grain crops, when grown on steep slopes, especially under a summer-fallow system, also need to be given special consideration if extreme soil loss and reduced yields are to be avoided.

Both experimental and practical results show that the use of winter cover crops in the Cotton Belt has given greatly increased yields, averaging for cotton about 35 percent and for corn about 75 percent,

and at the same time has greatly reduced soil erosion. In many sections of the United States the use of winter crops in orchards accomplishes similar results.

The annual lespedezas following winter-grain cash crops make an efficient and economical ground cover and soil-improving crop. Legume cash crops that are grown in thick stands reduce erosion to a minimum during the period they occupy the land and increase the yield of any crop with which they may be grown in rotation. Any close-drilled or broadcast summer crop used in rotations is a means of erosion control and increases soil fertility.

Since the growing of cover crops in conjunction with rotated cash crops is recommended for the purpose of preventing winter leaching and erosion, and not primarily for harvest, they should not under any good system of crop production ordinarily require fertilization or special soil treatment. Their plant food requirements will have been

FIGURE 2.—Hairy vetch used as a cover on a newly constructed terrace ridge in South Carolina. Oats and rye are also commonly used to reinforce new structures.

taken care of in the fertilizer application made to the cash crops in the rotation.

Many permanent cover crops, such as kudzu, perennial lespedezas, grass, various shrubs, vines, and other plants which are not commonly grown with cultivated crops and which occupy the land for a long time can be grown on poor, eroded soil that is not under cultivation. This is well illustrated in figure 3. The area was fenced to keep livestock out and seeded with a bushel of barley and 20 pounds per acre of the following mixture: Kentucky bluegrass, redtop, alsike clover, red clover, Korean lespedeza, and sweetclover. About 300 pounds per acre of superphosphate was applied. There was no bank sloping or other soil or seedbed preparation; the land was seeded in its natural condition. The dominant vegetation became Korean lespedeza; there was a little sweetclover, redtop, and some

barley in the gully bottoms. Erosion was effectively checked, and soil rebuilding was started.

The use of these more or less permanent forms of vegetative cover in this manner affects only indirectly the regular or money crops of the farm.

FIGURE 3.—*A*, An eroded field in West Virginia before protective crops were used; *B*, the same field after it had been seeded to protective crops.

In 1929 (according to the Census of Agriculture) about 95 to 100 million acres of corn, 40 to 45 million acres of cotton, 3 to 3½ million acres of potatoes and sweetpotatoes, and a little less than 2 million acres of tobacco were being grown in the United States. These figures approximate the normal acreage over a period of 15 years. Each of these crops is clean-cultivated and leaves the soil exposed

to the elements and consequently subject to erosion a great part of the year.

In the cotton and tobacco region of the South a very small percentage of this acreage is seeded to winter cover crops of field peas, vetch, crimson clover, and rye. In the North, where corn, soybeans, and potatoes are largely grown, winter cover crops and close-drilled crops such as wheat, clover, etc., used in rotations must be depended on for soil improvement and erosion control, although in some cases rye, as a winter cover, may be used. Much of this crop acreage is left bare during the fall and winter months, and it is on these areas that cover crops such as close-drilled crops of clover, and grains should be grown if erosion is to be retarded and economical production improved or maintained.

FIGURE 4.—Red clover seeded in wheat. Red clover, other legumes, and grass seeded in small grain prevent erosion after the grain is harvested.

FOLLOW NATURE'S METHOD OF PROTECTING SOIL

The seeding and growing of cover crops is an imitation of Nature's method of holding the soil. As the natural soil-forming agencies progressed throughout the ages, Nature always protected her handiwork with a varied vegetative blanket. Man cannot disregard this plan and ignore the fundamental principles of soil building and soil holding without paying the price of accelerated soil erosion and finally land abandonment.

Under natural conditions some type of vegetation occupies the soil throughout the growing season and leaves an organic residue to cover the ground during the winter. If agriculture is to be permanent, the soil must be managed so as to maintain productivity not by temporarily supplying plant food but by conserving the soil itself by using cover crops of legumes and broadcast crops in rotation or association with row crops (fig. 4), orchard fruits (fig. 5),

and other crops that occupy the land for only a part of the growing season or form a partial soil cover.

COVER CROPS FOR GREEN MANURE

The practice of using cover crops for green manure, or, turning them into the soil while yet green, is a more or less common practice in certain parts of the United States. When used in this way, they improve the soil by adding organic matter and supply plant food for succeeding crops. A green-manure crop thus provides a ground cover and prevents erosion during its growing period and subsequently adds fertility to the soil. In order to utilize such crops most efficiently, special consideration must be given to many factors; but in any case erosion or loss of soil will have been prevented during a part of the year, and if the green manure is properly utilized increased crop production will result.

KINDS OF COVER CROPS

The kind of cover crops to use must be determined by local conditions and needs, and the special purpose for which they are de-

FIGURE 5.—Red clover cover in a young New Jersey orchard.

sired. In the agricultural areas west of the one-hundredth meridian the disadvantages of cover crops may offset the advantages. In parts of this region, however, where the land when left bare is subject to severe wind erosion a cover crop of wheat or other small grain or a more permanent cover of grass is essential to soil conservation. East of the one-hundredth meridian and south of about latitude 40°, where the annual rainfall is from 20 to over 50 inches, winter cover crops of hairy vetch, smooth vetch, Austrian Winter field peas, clovers, and Abruzzi rye, and summer crops of lespedeza, crotalaria, and cowpeas are recommended and are the crops most commonly used.

The use of cover crops will undoubtedly result in soil conservation and improvement, but sufficient information is not at hand to determine whether such practice will be profitable in northern latitudes when used exclusively for this purpose. As a matter of fact in the northern Corn Belt and in other northern areas of the United States, cover crops may be used in part as cash crops in rotations.

With orchard crops throughout the United States permanent cover crops and sometimes annual crops can be used to advantage, but with most other cash crops effective rotations supplemented with winter cover crops must be depended on for fertility maintenance and erosion control.

On lands not producing cash crops and where erosion is severe it is often advisable to use a mixture of locally adapted herbaceous perennial cover crops with a view to allowing the best suited and most aggressive ultimately to form a permanent cover, which in time may naturally or artificially be displaced by a forest cover. On cultivated lands, however, ordinary field crops such as sweetclover, alfalfa, red clover, crimson clover, vetch, field peas, rye, lespedeza, etc., that are known to be locally adapted can be depended on to furnish the most economical and effective cover. When used for soil-erosion control and soil improvement these crops should be seeded and cultivated in the manner recommended locally when they are grown as forage. The time of seeding of any crop should be determined according to its most effective use as a cover crop (table 1).

TABLE 1.—*Information on dates and rates of seeding of those crops commonly used as winter or general cover crops*

Crop	Date of seeding	Rate of seeding [1]	
		Pounds	*Bushels*
Sweetclover	February to April or August to Sept. 15	12–18	
Crimson clover	August to October	[2] 20–25	
Bur-clover	August to November	[2] 12–15	[3] 3–5
Vetch	Aug. 20 to Oct. 15	30–35	
Austrian winter peas	August to Oct. 15	35–40	
Lespedeza	Feb. 1 to Apr. 15	15–25	
Rye	August to November		1–1½
Winter oats	September to November		1½–2½
Wheat	do		1½
Oats and barley	February to June		2–2½

[1] The rate of seeding should be increased when the crops are seeded late in the fall. Heavy seed applications will frequently give a better stand and partially make up for lost time.
[2] Hulled seed.
[3] Burs.

LEGUMES

SWEETCLOVER

Sweetclover in broadcast stands is a good erosion-control crop and by reason of its large top and root growth adds much organic matter to the soil. Neutral or alkaline soil is necessary for its successful growth, consequently the northern Corn Belt and the western part of the United States are best suited for its use. Its most advantageous use is in rotations with wheat and corn, the sweetclover being seeded with the wheat. Less soil erosion results in such a rotation than would be the case in a wheat-corn rotation, and at the same time it greatly increases soil fertility.

CRIMSON CLOVER

Crimson clover is one of the standard cover crops along the Atlantic seaboard from New Jersey in region 1 south to northern Georgia in region 2 (fig. 6). It can also be grown farther west in regions 2, 3, and 4, where similar conditions prevail. When good stands can be obtained it makes an efficient erosion-control crop for the fall, winter,

and spring seasons (fig. 7). The principal objection to crimson clover as a cover crop, as for any other use, is the difficulty of obtaining a stand. For best results, seed should be sown in the hull on a well-prepared seedbed at the rate of 50 pounds an acre and the seed pressed into the soil with a corrugated or similar roller.

BUR-CLOVER

Bur-clover can be used as a winter cover crop in the northern part of region 2 on soil having more than average fertility. The feature of bur-clover that especially recommends it is the possibility of its perpetuating itself from year to year without reseeding. If encouraged by late spring plowing or by leaving unplowed strips it will sometimes reseed and maintain itself naturally, germinating in the

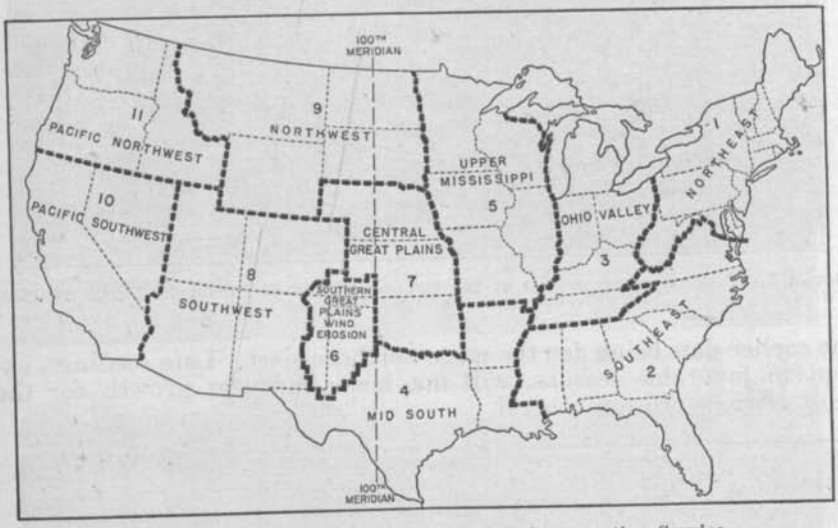

FIGURE 6.—Regional divisions of the Soil Conservation Service.

fall and growing throughout the winter. For the Cotton Belt, spotted bur-clover is the best-suited variety. In parts of California, in region 10 where bur-clovers are common, California bur-clover is best adapted. All kinds of bur-clover make a matted growth that prevents erosion, and they can be recommended for erosion control wherever they succeed.

VETCHES

Vetches are excellent winter cover crops for the Cotton Belt, region 2, and the eastern half of region 4, and can be used in other parts of the United States where winter temperatures are not severe (fig. 8) or where temperatures during the growing season are moderately cool. In the South they are seeded in the fall, generally following a cash crop of cotton or corn, and occupy the land during the winter months, thus preventing erosion and conserving soil fertility. Both smooth vetch and hairy vetch are recommended for this region, in which they should be seeded from September 15 to October 15,

FIGURE 7.—Crimson clover seeded at the last cultivation of cotton, in North Carolina, prevents erosion and fertilizes the soil.

the earlier date being for the more northern part. Late seedings, except in favorable seasons, will not make sufficient growth for the most efficient erosion control.

FIGURE 8.—Hairy vetch seeded at last cultivation of corn, in New Jersey.

AUSTRIAN WINTER FIELD PEAS

Austrian winter field peas are used as a cover crop in the same general region and in the same way as hairy vetch and smooth vetch. Field peas do not make as dense growth as the vetches but still make an efficient cover for erosion prevention. With the exception of the Austrian winter variety, the field peas commonly available commercially are not sufficiently winter-hardy for planting even in the Southern States, and even the Austrian winter variety should not be fall-seeded north of Tennessee and Maryland.

FIGURE 9.—*A*, Kudzu in Alabama. *B*, Winter cover of kudzu, in Tennessee. One kudzu vine, planted 7 years ago on the right bank near the large tree, has formed a perfect covering and is controlling a gully 18 feet deep and 25 feet wide. The one vine has spread 300 yards up and down the gully and 100 yards across. Soil type, Memphis silt loam, 14 miles southwest of Jackson, Tenn.

KUDZU

Kudzu, one of the best perennial cover crops not only to check but to cure erosion, is a vigorous-growing vining plant, well adapted for use in controlling gullies and eroding banks (fig. 9). It not only prevents washing but rebuilds the soil, is a valuable hay and pasture

crop wherever it can be successfully established. Kudzu is recommended where the soil is too poor or too badly gullied to be used for cultivated crops.

LESPEDEZA

Lespedeza sericea is proving a valuable plant for erosion control on poor clayey soil throughout the Piedmont region. Being a perennial, it can be used in situations where a permanent cover crop is needed. It can be used on slopes and banks with soil too poor to support most other common cover crops and can be used on both waste and cultivated land (fig. 10).

FIGURE 10.—A field of *Lespedeza sericea* in Tennessee. This kind of cover will prevent erosion, build soil, and furnish protection and feed for wildlife.

The annual lespedezas, both common and Korean, make efficient cover crops. Although the plants are comparatively small they form dense stands that most effectively control erosion. In rotations with winter cereals a ground cover can be grown throughout the year, and erosion thereby controlled and fertility maintained. Since these lespedezas make growth in late summer and fall they supply a green cover at a season when most other crops are mature.

NONLEGUMES

RYE

Rye is one of the best all-round cover crops in either the Corn Belt or the Cotton Belt and is more commonly used than any other grass or grain as a winter cover. Easy to grow, it has a very wide range of adaptability, germinates readily, and makes a complete cover quickly. Its stooling characteristic is valuable. On fertile soils, it makes a rapid, dense growth, as shown in figure 11, and will produce a fairly satisfactory cover on thin soils. Rye is winter-

hardy, is seldom damaged by cold weather, will furnish large quantities of organic matter, absorbs some of the soil nitrates, and tends to prevent leaching during the winter.

In the Cotton Belt and as far north as Virginia, Abruzzi is the best variety to use as a winter cover crop. In Tennessee, Balboa, a recent introduction from Italy, has given very satisfactory results. In the Corn Belt, especially on sandy soils, Rosen rye is considered one of the best varieties.

Rye or any other cover crop should not be pastured too closely, or its efficiency in erosion prevention will be reduced. If a cover crop is eaten to the ground in the winter when growth is retarded, the purpose of the cover is defeated, and erosion will occur. Rye can be seeded any time from August to November, although for erosion control the earlier seeding is preferable, especially on thin soils.

FIGURE 11.—Rye seeded at the last cultivation of corn, in Missouri. Thousands of acres of land in corn not followed by wheat or other cover crop should be protected with a rye cover crop.

WINTER OATS

Winter oats make an excellent cover crop in the South and in areas where winter freezes are not severe. Oats are less desirable than rye as a cover for two reasons: (1) They are subject to winter damage, and (2) they are more palatable than rye and because of this there is danger of stock completely destroying the value of the cover by pasturing it to the ground. Winter oats used as a cover crop can, in an emergency, be turned into a hay or grain crop the following year. Weather conditions in the spring might necessitate a substitution of crops in the rotation, in which case the cover crop could be turned into a cash or feed crop.

WHEAT

Wheat is a good cover crop and can be grown for this purpose throughout the areas to which it is adapted. Early seedings for erosion control should be avoided as there is danger of such seed-

ings being infested by the Hessian fly, which might cause damage to the main wheat crop. Wheat produces a satisfactory cover, however, and should be used for this purpose on many farms.

OATS AND BARLEY

When a temporary or rapidly growing cover crop is desirable, oats or barley can often be used to advantage, especially for the protection of newly constructed terraces, earth dams, plowed or sloped gully banks, land prepared for tree planting, etc. Oats are not winter-hardy but will hold the soil during the growing season.

REDTOP AND ITALIAN RYEGRASS

Some of the nonlegume crops serve a very important role not only in conserving but in improving the tobacco soils of the country. The importance of cover crops following tobacco for soil conservation cannot be overstressed. Without them, erosion and loss of soil fertility are sure to result. In those regions producing "bright tobacco" where the legumes are objectionable, redtop, Italian ryegrass, or rye can be safely used as winter cover. Redtop in this region is sometimes carried over as a rotation crop alternating with tobacco.

OTHER CROPS

Other crops which are used or can be used in the same way as many of the crops discussed are sourclover (yellow annual melilot), crotalaria, cowpeas, soybeans, millet, Sudan grass, sorghum, buckwheat, alfalfa, red clover, alsike clover, and many of the grasses. When used as cover crops for erosion control and soil improvement, these crops should be seeded broadcast, the same cultural practices being followed as when the crop is grown for forage. Cultural information regarding these and other crops discussed in this bulletin is available in the following publications of the United States Department of Agriculture: Technical Bulletin 367, The Use of Winter Legumes in the Southeastern States; Farmers' Bulletin 1663, Winter Legumes for Green Manure in the Cotton Belt; Farmers' Bulletin 1750, Summer Crops for Green Manure and Soil Improvement; Farmers' Bulletin 1250, Green Manuring; Farmers' Bulletin 1741, Bur-Clover Cultivation and Utilization; Farmers' Bulletin 1740, Vetch Culture and Uses; Leaflet 91, Kudzu, a Forage Crop for the Southeast; Farmers' Bulletin 1254, Important Cultivated Grasses; Leaflet 23, Sweetclover.

WHEN TO TURN UNDER

Cover crops should be turned under in the spring while there is ample moisture and before the growth reaches the point of maturity that will resist decay—usually 2 weeks before corn planting or 3 weeks before cotton planting, will be safe. For early truck crops it is advisable to select a type of cover that will form a rapid dense growth early in the fall and serve as a winter mulch that can be turned under in February or March.

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