



Kudzu

as a farm crop

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KUDZU—

a perennial leguminous viny plant,
well suited for forage production,
soil improvement,
and erosion control
in the Southern States.

ADVANTAGES:

- Makes good and easily handled hay.
- Makes good pasturage.
- Increases soil fertility.
- Has no serious diseases.
- Reduces soil erosion.

REQUIREMENTS:

- Establish new plantings with rooted runners from old fields or with seedling plants grown in nurseries.
- Plant while crowns or seedlings are dormant.
- Protect plants from drying during planting.
- Add superphosphate and manure at time of planting on low-fertility soils.
- Firm soil about plants.
- Cultivate plantings at least the first year.

PRECAUTIONS:

- Do not cut or graze it until well established.
- If it is continuously grazed, use lightly.
- Rotate pastures for maximum production.
- Do not cut oftener than twice each season.
- Delay second cutting as long as possible, but cut before first frost.

This Farmers' Bulletin is a revision of and supersedes Leaflet No. 91, Kudzu, a Forage Crop for the Southeast.



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KUDZU¹ was brought into the United States from the Orient and exhibited at the Philadelphia Centennial in 1876. By 1945, 500,000 acres of it was planted on farms in this country. It is recognized as a valuable forage, a good crop in rotations for soil improvement, and an excellent plant for erosion control on hillsides and gullies.

Kudzu is one of the few perennial legumes adapted to the Southeastern States and useful both for forage and for soil improvement.

¹ *Pueraria thunbergiana* (Sieb. and Zucc.) Benth.

The plant is of special interest to this region, since locally grown kudzu hay can be used to replace alfalfa or other hay that must be hauled long distances. It also increases soil fertility and lessens the need for commercial nitrates.

WHAT IT IS

Kudzu is a rapid-growing, long-lived, perennial viny plant having a comparatively large taproot and exceedingly long stems or runners that with age become woody at the base.

In the more northern part of its range the runners, or stems, kill back to the crown each winter but renew growth in spring from crown buds. In the South, where winter temperatures are comparatively mild, the old runners, or vines, for at least a part of their length survive and renew growth the following season.

In the early stage of growth kudzu vines are soft and pliable and have a fuzzy or hairy appearance. The leaves are abundant, very large, and more or less circular. In general, they look like grape leaves. (See illustration.)

The large purple flowers are produced in relative abundance late in the season and precede the clusters of densely hairy pods, which are about 2 inches long and usually contain few or no seed.

Because kudzu vines root readily at the nodes or joints when in contact with moist soil, new plants are formed, which are the source of much planting material.

SEED CHARACTERISTICS

The seed of kudzu is small in comparison with most other forage-crop seeds. It weighs between 50 and 60 pounds per bushel and has from 40,000 to 45,000 seeds per pound. It is not available commercially in the United States. Formerly a limited supply was imported from Japan.

Kudzu plants set seed sparingly and apparently only where supported on trees, fences, or banks. (See illustration.) Under such conditions, a small quantity of seed will be produced each year. Wherever old kudzu plantings are available the seed can be gathered for local use. In the kudzu area of the Eastern States, enrollees of the Civilian Conservation Corps gathered some seed for use in connection with the soil conservation program.

Kudzu has a high percentage of hard seed, and for best results the seed should be scarified. An average germination of about 50 percent is usual after scarification, although in some cases 70 percent germination has been attained. The seed can be scarified mechanically or by acids. The former method is the more practical, but the latter can sometimes be used on small lots of seed when an acid is at hand and a mechanical scarifier is not available.

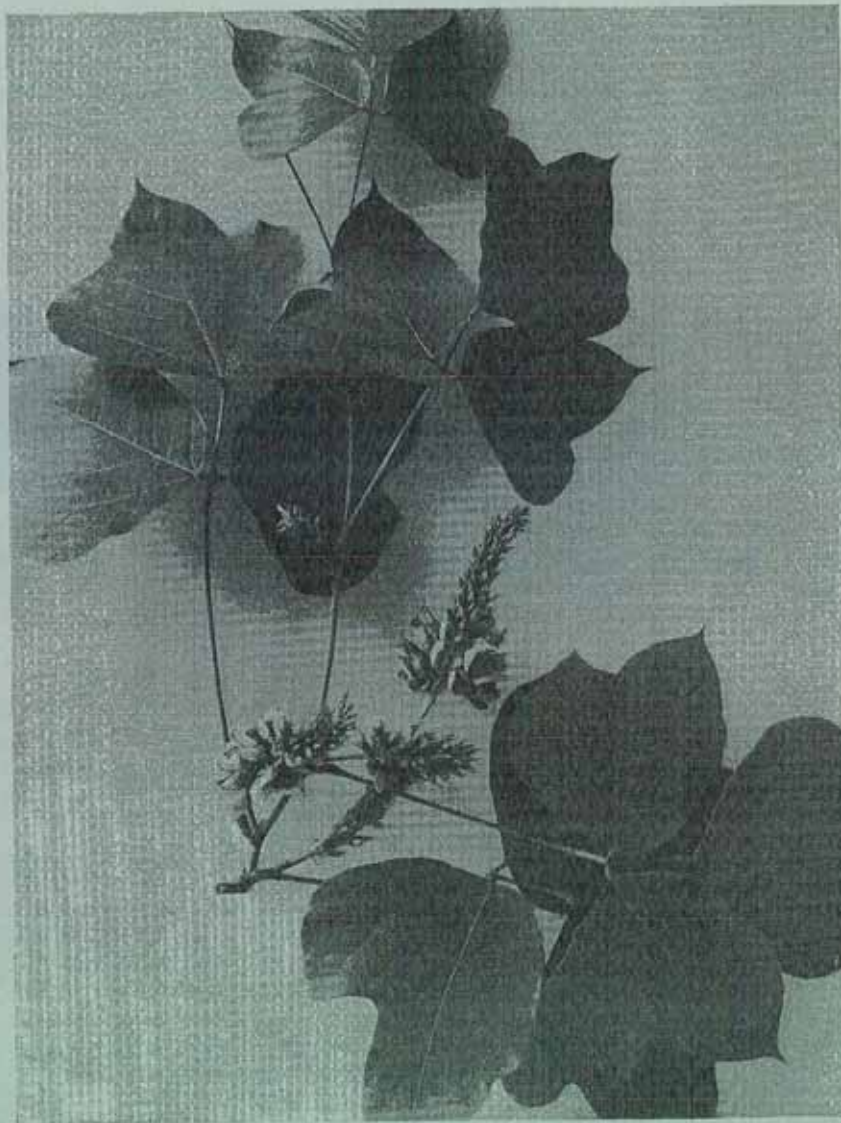
The fact that a high percentage of kudzu seed is not viable accounts in part for the low germination percentage and the necessity for heavy seeding in nursery planting.

VARIETIES

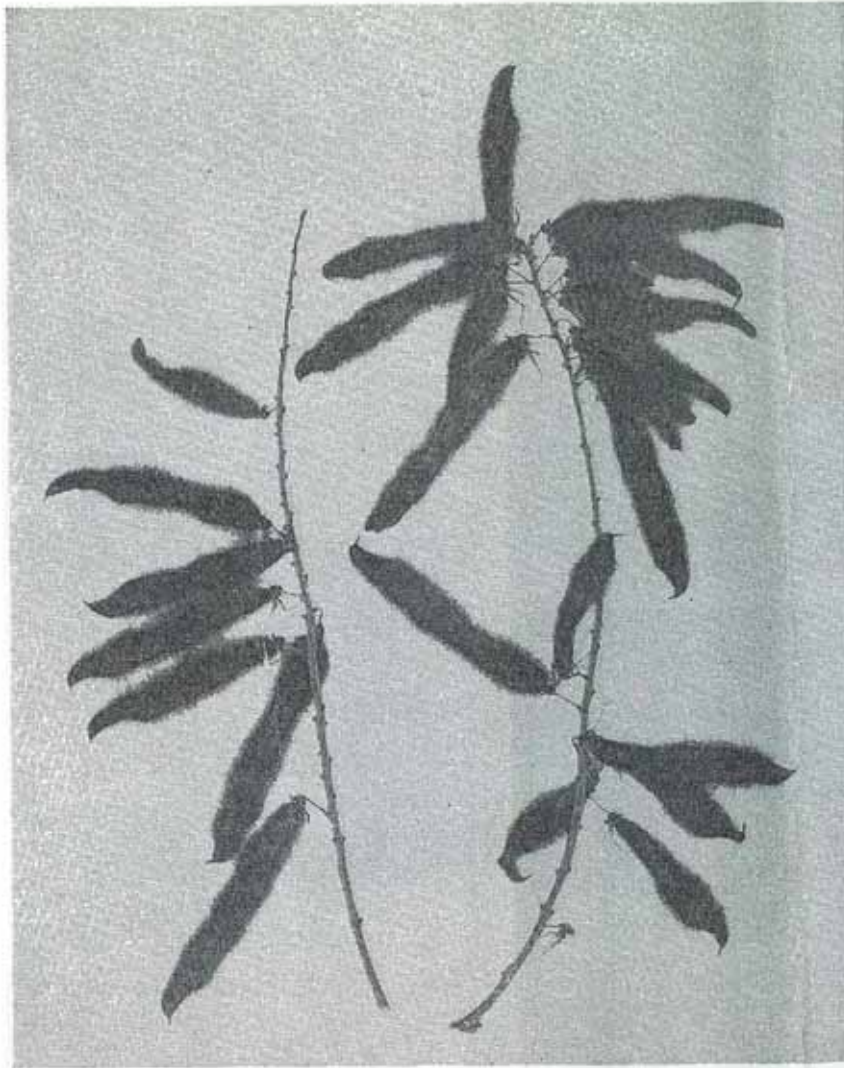
No strains or varieties of kudzu have been established commercially, though individual plants show wide variation in pubescence, leafiness,

length of nodes, and vigor. Since kudzu is easily propagated or increased vegetatively, however, it would not be difficult to establish and maintain varietal strains.

Some improvement in varieties could be accomplished by observing plants in foundation plantings and selecting for propagation only those having desirable characteristics. Plantings that have been increased by the use of crowns will not show the variation noted in seedling plants and therefore do not offer the opportunity for improvement by selection that is possible with seedling plantings. Until



Kudzu leaves and racemes of flowers.



Pods of kudzu.

improved varieties are developed, planting material should be taken from the best plantings available.

ADAPTATION

Kudzu can be grown over an extensive area. It thrives in the humid Southeastern States and, when irrigated, grows reasonably well in the more arid climate of the Southwest.

Although not entirely winter-hardy in the northern part of the United States, it has survived in somewhat protected situations as far north as New York in the East, and as far as Lincoln, Nebr., in the Great Plains area.

In the Pacific Northwest it survives where the winters are mild and the summers cool, but growth is slow and slight.

In the Atlantic coastal area in the latitude of Maryland, kudzu survives the winters but does not produce so heavily as farther south. In the same latitude farther west the plants sustain more winter injury, and stands are more difficult to maintain.

Kudzu is best adapted in the Eastern States south of Virginia and Kentucky and west to eastern Oklahoma and Texas.

SEASON OF GROWTH

Kudzu is a warm-weather plant. In Georgia and adjacent territory, its growth starts about the first of April and continues until checked by cold weather.

Flowering occurs in the South late in August or in the early part of September, whereas in the latitude of Virginia it occurs about the middle of September. The seed usually matures before frost.

Farther north growth starts later, in keeping with the difference in seasonal advance, the most rapid growth occurring during the early summer and midsummer months, with some growth continuing until frost.

FERTILITY REQUIREMENTS

Kudzu will grow on a wide range of soil types and under varied conditions, but it has its preferences. It does not make good growth on very light poor sand or on poorly drained heavy clay. Unsatisfactory results have followed plantings on the poorly drained black lands of Alabama and Mississippi and on poorly drained acid soils of lighter texture. Where rock, hardpan, or other unfavorable conditions exist just below the surface soil, it will not succeed. Kudzu grows best on well-drained loam soil of good fertility, but it can be grown on poorer soil by proper use of fertilizers and manure. On soils of low fertility liberal use of manure and a light application of superphosphate about the plant when it is first set will go a long way toward insuring success. Although a complete fertilizer might be advisable on some soils, in general superphosphate is what is most needed. Boron has given good results in a few instances, and where plants are not doing well with a complete fertilizer borax at the rate of 20 pounds per acre might be used.

Many attempts to establish stands have failed, because proper attention was not given to fertilizing and manuring the plants at the time of setting. On poorer soils each plant should be well fertilized and manured at that time. This will insure establishment of the plants, and these in time will supply sufficient litter of leaves and stems to raise the fertility of the surrounding soil and make possible the establishment of new plants from the spreading runners. In this way kudzu will help improve soils otherwise too poor for crop production. Established stands used for grazing or from which a hay crop is removed should receive 400 to 600 pounds per acre of superphosphate every second or third year or, if available, 10 tons of good stable manure. When stable manure is limited, lighter applications supplemented with mineral fertilizer will suffice.

PLANTING MATERIAL

When kudzu seed is available, seedlings grown in nurseries for 1 year are satisfactory planting stock and can be handled more easily and at less expense than crowns. Kudzu crowns, by which is meant the plants established by the rooting of runners at the nodes, have been the stock most commonly used in establishing commercial plantings.

Very large crowns usually are not satisfactory for planting. Their bulk also makes extra work in handling and planting. Likewise, small plants should be discarded, as they are likely to be weak and are more exacting in planting requirements. The use of broken, bruised crowns also should be avoided, as these are naturally weakened by such bruising and would be subject to decay. Best results with crowns have been attained by the use of 2-year-old plants of moderate size. (See illustration.)

PLAN OF PLANTING

Circumstances should determine to some extent the width of row to use and the spacing of plants within the row. If it is desirable to have the ground covered quickly to prevent erosion or to insure an early income, spacing should be closer than when time of establishment is of less importance. When the field is to be left more or less permanently for hay or pasture, the relative width of row is less important than when the field is to be regularly planted or rotated to some other crop.

If the kudzu is to be grown in alternate strips with corn and renewed each year from runners extending from the kudzu row across the corn strip, it should be spaced accordingly. By increasing the distance between the rows and spacing the plants closer in the rows, the strips of interplanted crops will be wider and insure less interference with and from the kudzu and facilitate handling both crops. On ordinary good land, kudzu will make sufficient growth in 1 year to extend across a 40-foot corn planting.

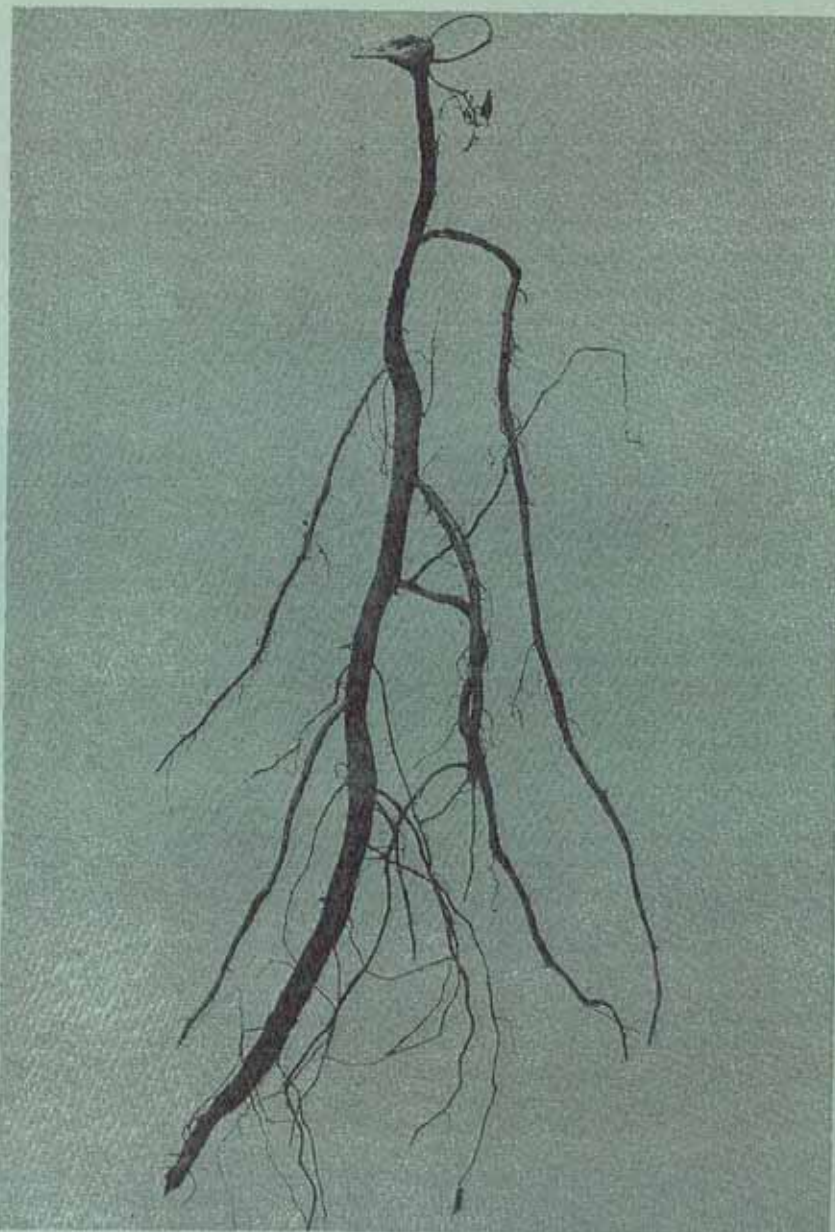
The following table gives the number of plants required for planting an acre when rows of different widths from 10 to 30 feet are used and plants are set 4 to 10 feet apart in the rows.

Kudzu plants required to plant 1 acre in rows of specified widths and distances apart of plants in row

Width of rows (feet)	Plants at different distances apart in rows (feet)						
	4	5	6	7	8	9	10
10	1,089	871	726	622	545	484	436
15	726	580	484	415	363	323	290
20	545	436	363	311	272	242	218
25	436	348	290	249	218	194	147
30	363	290	242	207	182	161	145

DATE OF PLANTING

Kudzu may be planted at any time from December to April, the best time depending upon the latitude and the moisture content of the soil at the time. On well-prepared land with ample moisture, plantings can be made at any time during the dormant season. In



Desirable planting stock.

the South the best time is in February and early in March; farther north planting should be done late in March and in April.

Transplanting is possible after the plants have started into growth, or even when in active growth, but unusual care must be exercised in lifting or digging and again in setting the plants. Even with such precautions considerable loss will result if the planting is done on a large scale, and such a practice is seldom, if ever, to be recommended.

SETTING THE PLANTS

For best results in setting it is important to protect the plants from drying during the process and to firm the moist, well-prepared soil about them to prevent drying after they are planted.

A spade, shovel, mattock, or similar tool can be used in digging holes and returning the soil around the plants. The holes should be deep enough to allow the roots to spread out to full length. The crown buds of the plant should be on a level with the ground surface and very lightly covered with soil.

Short-cut methods in planting, such as the use of a moldboard plow for making furrows to receive and to cover the plants, usually result in poor stands. Strict attention to covering the plants and firming the soil will insure good survival and ultimate success.

CARE OF NEW PLANTINGS

For the first year or two after planting, kudzu should be cultivated to keep down weeds, to insure good growth of the plants, and to make the soil surface condition favorable for the pegging-down or development of new plants at the nodes of the runners. Covering the vines at the nodes with soil will insure rooting, greatly increase the number of plants, and help thicken thin stands.

A cultivated crop, as corn, can be grown between the rows, so that a cash return may be obtained from the land the year the kudzu is being established.

Kudzu should not be cut the first year and should be cut only once the second year or grazed lightly, unless an unusual stand and growth have developed. It is most important to realize that success depends on the establishment of a good stand before the crop is used.

MAINTAINING STANDS

Kudzu will not stand frequent close clipping or heavy grazing. Stands are easy to maintain, however, when once established, if properly cut or grazed and fertilized.

The crop should not be cut oftener than twice each season and should never be closely pastured. One cutting in June or early in July and another in fall just before frost usually can be safely made. If one cutting only is made, this should be before August.

When the crop is being removed from the land it is necessary to supply fertilizer, particularly superphosphate and manure, in order to maintain high production. Sometimes working the soil by plowing or disking is advisable to insure new plant establishment and more effective use of the fertilizer.

ERADICATING STANDS

Kudzu is sometimes a nuisance when growing in places where not wanted. It is not hard to kill, however, although it takes a lot of work to remove it from places that cannot be mowed and plowed. It will not stand continuous close cutting and can be killed by mowing four or five times a year or by close pasturing throughout the growing season. Where these methods cannot be practiced, cutting by hand must be resorted to or some chemical weed killer used. Removal of first growth in spring severely checks development and, if repeated, will kill the plants.

VALUE FOR HAY

Experimental data regarding the relative feeding value of kudzu hay are meager, but limited trials and extensive and favorable use indicate that it has high feeding value.

Kudzu makes a rather coarse hay but is moderately leafy and of good texture. Average good hay contains about 50 percent leaf; carefully handled and early cut hay will have as much as 60 percent. Under adverse conditions or with advance of season the growing kudzu plant seldom sheds its leaves in quantity as many other legumes do. It is therefore possible to defer cutting in rainy weather or when rushed with other work, without too seriously sacrificing the quality of the hay from loss of leaves. Kudzu leaves also are retained well after the crop is cut, and in this respect the hay is superior to that of most other legumes. The hay is palatable to all kinds of livestock and can be fed with very little waste.

Although kudzu hay is little known in the commercial markets, no difficulty has been experienced in selling hay of good quality.

HARVESTING FOR HAY

The heavy viny growth of kudzu makes it difficult to harvest, especially when a new stand is cut for the first time. The long vines are caught by the divider board of an ordinary mower, making it necessary to stop mowing. To overcome this difficulty the Alabama Agricultural Experiment Station has developed a specially made iron rider bar, which, when attached to the end of the cutter bar, divides and frees the vines as the swath is cut. Stub guards on the mower will also help to prevent clogging.

Kudzu stands should be 2 years old before being harvested for hay and should not be cut oftener than twice each season. The first cutting should be made in June and the second just before frost. Harvesting should be done when the vines and ground are dry. The hay should be left in the swath for several hours before windrowing. The following morning when the dew is off, the kudzu should be put into small stacks or the windrows should be turned, and in the afternoon it should be put in the barn or baled. (See illustrations.) Yields of 2 tons per acre can be expected from good stands on fertile soil.

VALUE AS PASTURE

Experience of farmers shows that kudzu makes good pasture, and cattle make as large seasonal gains on it as on any other kind of plant.



Shocks of kudzu protected with waterproof canvas caps.

(See illustration at top of p. 1.) At Tifton, Ga., during an 8-year period, gains per steer ranged from 1.25 to 1.62 pounds per day and from 74 to 346 pounds per season. The average seasonal gain was 237 pounds. The acre gain per season for the same period ranged from 124 to 346 pounds, with an average of 243. No case of bloat on kudzu has been reported, but it is possible that under certain conditions bloat may occur. Kudzu can be pastured from May until frost or even



Capping kudzu shocks in the field.

later. It is especially valuable as a reserve feed for periods of drought.

MANAGEMENT OF PASTURE

Kudzu plants should not be grazed until the third year. If they are grazed the second year, it should be very lightly. When once well established, fields of kudzu will withstand continuous grazing if pastured lightly, but for maximum production a field should be divided into two or more pastures and grazed alternately or in rotation. In fall, rye or oats or a winter legume, as crimson clover, bur-clover, or vetch, should be seeded in the kudzu pasture to prevent loss of plant food by leaching during the winter months and to supply late-winter grazing. Livestock, however, should be taken from the pasture before the kudzu growth starts in spring.



A kudzu pasture that has been closely grazed.

If pastured continuously, the plants should not be grazed closer than 12 to 18 inches high. If alternate or rotation grazing is practiced, the plants can be grazed to 6 to 10 inches. (See illustration.)

VALUE FOR SILAGE

Good silage can be made from kudzu. For best results kudzu and grass should be used in a mixture containing about 60 percent of moisture. The total moisture content of the kudzu plants at time of cutting is about 75 percent. This means that the kudzu must be handled as rapidly as is possible. Although no data from feeding trials with such silage are available, cattle readily eat good kudzu silage.

SOIL IMPROVEMENT

Kudzu has been used but little in rotations. Crops following a kudzu planting, however, have been greatly benefited and continue to give heavier yields for several years. When corn is grown between the strips or rows, it is possible to let the vines extend into the corn rows and thus establish the kudzu during the season in which the corn is grown. In this manner a short rotation can be established and increased yields, as well as improvement in the soil fertility, obtained.

When land that is suitable for growing corn, cotton, or other standard crops has been occupied by kudzu for a term of years, the kudzu can be plowed under, greatly to the benefit of subsequent crops.

EROSION CONTROL

Kudzu is being used in erosion-control work for holding banks, stopping washing in gullies and diversion channels, and reducing soil losses on slopes where a permanent planting can be used to advantage. Such uses of kudzu are discussed in Farmers' Bulletin 1840, *Kudzu for Erosion Control in the Southeast*.

GROWING PLANTS FROM SEED

Laboratory tests and field experience show that low germination of kudzu seed must be expected. Scarified seed usually germinates only 50 percent, and subsequent loss will so reduce the stand that only about a fifth of the germinable seed can be expected to become established nursery plants. The seed can be scarified by rubbing with an abrasive, as sandpaper or emery cloth. Putting the seed in commercial sulfuric acid for about 30 minutes and then thoroughly washing the seed with water is effective. If not immediately planted, the seed should be dried.

In the South toward the Gulf, seed can be sown at any time from April to June; farther north seeding should be delayed a week or two, depending upon the latitude.

Circumstances must govern the rate and method of seeding. When seed is plentiful, as much as 20 pounds per acre in double rows, 3 feet apart, will give satisfactory results. If it is scarce, more plants for a given quantity of seed can be obtained by light rates of seeding—as low as 5 pounds per acre—but the number of plants per acre will naturally be less.

The seedbed should be thoroughly worked and well firmed; about 500 pounds per acre of superphosphate should be added at the time of preparation; the seed should be covered lightly; and the weeds should be controlled by hand or by cultivation. Plants intended for sale should be grown if possible in nematode-free soil. The vines should not be removed until after the plants have become dormant in fall.

GROWING PLANTS FROM CUTTINGS

Both soft-wood (early growth) and hard-wood (mature wood) cuttings of kudzu can be rooted under favorable conditions, but such methods of propagation are not practical on the farm.

Soft-wood cuttings require greenhouse or similar conditions, and cuttings of harder wood, although rooting under less favorable condi-

tions, require some protection and a uniform moisture condition that is not found on most farms.

The specialized nurseryman may sometimes use cuttings to increase planting stock, if he has insufficient seed and crowns for the purpose.

PROCURING PLANTS FROM ESTABLISHED STANDS

Under general field conditions kudzu runners root readily at nodes that are in contact with moist soil, and this is the common source of increased planting material. The starting of new plants at the nodes is largely dependent on soil conditions. When the soil is packed and hard, the nodes develop roots very slowly, if at all; but when the soil is loose and moist, they form roots readily. A shovelful of dirt thrown on the nodes of the runners will often greatly facilitate the formation of new plants.

About 10,000 plants, or crowns, can be harvested from an ordinarily well-established kudzu planting of 1 acre, and under ideal conditions twice that number can be obtained. (See illustration.)

CARE OF PLANTING STOCK

Seedling nursery stock and field-grown, vegetatively propagated plants and crowns should be left in the field or nursery row until time for permanent planting, to insure the plants being in the best condition at that time.

When a field is once established and is supplying material for limited new plantings, the handling of stock direct from the field is entirely practical. If, however, large numbers of plants are being handled for commercial sale it may be necessary, on account of limitations on time and equipment, to dig them before the planting season and store them for later use. If this is necessary, the plants should be stored in a cool, well-ventilated place and should be heeled-in in moist sphagnum moss or in soil that contains ample moisture but is not too wet.



Plowing an established field for crowns.

INOCULATION

To insure maximum production, kudzu plants should be inoculated at time of planting. In the past two decades (1928-48) new facts have been learned about the root-nodule organisms commonly called legume bacteria. Formerly, when nodules were found on legume plant roots the crop was considered to be inoculated—the legume became a soil builder, because the bacteria fixed air nitrogen in a form that the plants could use for their growth. Now, it is known that there are strains of legume bacteria for a given legume that fix varying quantities of nitrogen—some are high nitrogen fixers, some good, some poor, and some form nodules but do not fix any nitrogen. Farmers have no quick way of telling whether the legume bacteria living over in their soils are of the most effective type or whether they are ineffective.

Some farmers have had varying degrees of success in using soil for inoculating new seedlings of legumes. This practice is not generally recommended because it is not known whether the soil contains the most effective legume bacteria in sufficient numbers to produce maximum benefits and because of the danger of spreading plant diseases and weed seeds from field to field.

One fundamental purpose of legume inoculation is to add a fresh culture of effective strains of legume bacteria to the seed so that when the young plant begins to grow the bacteria will be right there to enter the tiny root hairs and begin fixing nitrogen in the early stages of the plant's growth. Farmers can now purchase legume inoculants prepared with superior and selected strains of bacteria for different legumes, and therefore the simplest, easiest, and most economical way to insure successful growth is to inoculate legume seeds with these cultures before each planting. For additional information on legume inoculation, see Farmers' Bulletin 2003, Legume Inoculation: What It Is, What It Does.

DISEASES AND INSECTS

No serious diseases have so far affected kudzu. Halo blight² and angular leaf spot³ are not uncommon but have not yet become a limiting factor in the production of kudzu.

Nematodes attack the plants and may sometimes do damage, but no serious losses are known to have occurred. In the lower South, every few years in September and October, caterpillars eat the leaves; this reduces the hay and pasture value.

INSPECTION OF PLANTING STOCK

Certain States have laws that govern the handling and shipping of kudzu plants both within and outside their boundaries. These laws usually require inspection by an authorized inspector and the issuance of an inspection certificate to accompany the plant material in transit. Information regarding inspection can usually be obtained from a local inspector or a county agricultural agent.

² Caused by *Pseudomonas phaseolicola*.

³ Caused by *Mycosphaerella pueraricola*.

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