Miller, J.H.; Edwards, Boyd. 1983. Kudzu: where did it come from? And how can we stop it? Southern Journal of Applied Forestry. 7: 165-169.

KUDZU: Where Did It Come From? And How Can We Stop It?

James H. Miller and Boyd Edwards

ABSTRACT. Kudzu is spreading in the South and control measures are required on large acreages. Control can be accomplished by persistent applications of effective herbicides or by overgrazing for two to three years. Soil-active herbicides containing the active ingredients picloram or dicamba are presently most effective. Herbicide sprays should be applied in a mixture with 60 to 100 gallons of water per acre; complete coverage is best achieved with double application and right-angle spray passes when using ground equipment. Repeated applications are usually required to kill every root crown. The tender nature of kudzu leaves and the large tuber roots make kudzu difficult to control.

Almost anyone living in the South today knows that kudzu can be a pest. Its rapid growth can choke out trees and rapidly overrun fields and pastures. In general, it is very difficult to control once it becomes established. However, few people know that kudzu was once regarded as a good friend and was planted throughout the South for seemingly very good purposes. It was so popular in the 1940s, that kudzu clubs were formed to expound its virtues. In fact, kudzu festivals were held and kudzu queens crowned. With this divergent background in mind, let's explore the growth habit of the plant, some of its history, and the question of possible controls.

THE PLANT

The secret of kudzu's early success was that it grew extremely fast, even on eroded and poor soils. This was partly due to its nitrogen-fixing capability from being a legume. It is not uncommon to find vines that grow 60 feet in a summer, with daily growth of up to 1-foot per day in the spring (Shurtleff and Aoyagi 1977). The plant produces pretty purple flowers in midsummer which seldom produce pods with seed. Filled pods are found most frequently above 5 feet high on draped trees. The plant spreads almost entirely by the vines that root at nodes. Each new rooted node is capable of forming an independent plant.

Kudzu roots can be big, long, and woody (Figure 1)—3 to 8 feet long, 6 to 12 inches in diameter, and up to 400 pounds in weight. Such a root system can make the plant very difficult to control.

HISTORY OF KUDZU

Oriental cultures have recognized the value of kudzu for more than 2,000 years. Of the 10 species of kudzu throughout the world, all are native to

Figure 1. Roots of tree-draped kudzu in the Piedmont.

China, Taiwan, Japan, and India. The species naturalized in the southern U.S. is *Pueraria lobata* (Willd.) Ohwi. This species originated in China and moved to other cultures by way of Japan and Korea. The early Chinese made a root tea which they used for treating fever, influenza, dysentery, and even insect bites. Cloth and paper were made from kudzu vine fibers as early as 1665. Japan imported the plant during the 1700s to make cakes from the root starch. The Japanese have continued using kudzu as a food ingredient and today it is a million dollar business. It is harvested for use as an extract powder to thicken sauces, to flour fried foods, and in making cakes and candies. In 1976, 40,000 packets of kudzu powder were imported and sold in the U.S. A U.S. harvesting and processing plant has been considered by entrepreneurs.

Kudzu first appeared in the U.S. in 1876 at the Japanese pavilion of the Philadelphia Centennial Exposition and again at the New Orleans Exposition in 1883 (Shurtleff and Aoyagi 1977). Kudzu was first used as an ornamental vine to shade porches and courtyards of many southern homes. Its fragrant flowers and rapid growth made it somewhat desirable. By the turn of the century, kudzu was being sold extensively through mail-order catalogs to a growing market. By 1905, southern farmers with depleted pastures found they could provide supplemental summer grazing for their livestock.

The real heyday for kudzu began in the 1930s when the depression, the boll weevil, erosion, and low prices for farm products caused abandonment of many farms in the South. To heal the scarred land the newly created Soil Conversation Service provided millions of kudzu plants which were quickly planted by farmers and the Civilian Conservation Corps throughout the South. Government incentives provided as much as $8 per acre for farmers to plant their land with kudzu.

In 1943, Channing Cope of Covington, Georgia, founded the Kudzu Club of America, which eventually boasted 20,000 members. Cope's numerous writings on the "miracle vine" brought him the title of the "Father of Kudzu." Because of the absence of disease or natural insect enemies, kudzu spread rapidly through the South. It thrived because of the mild winters and long hot summers. Nothing seemed to deter its growth.

In the 1950s, the need for more grazing land prompted unsuccessful attempts to eliminate kudzu. In 1953, the USDA removed kudzu from the list of permissible cover plants under the Agricultural Conservation Program. By 1962, the SCS began to limit recommendations for kudzu plantings and finally in 1970 listed it as a weed.

Today, an estimated 2 million acres (Alabama Forest Products 1974) of forestland in Alabama, Georgia, Mississippi, Tennessee, and the Carolinas are infested with kudzu (Figure 2). Although less

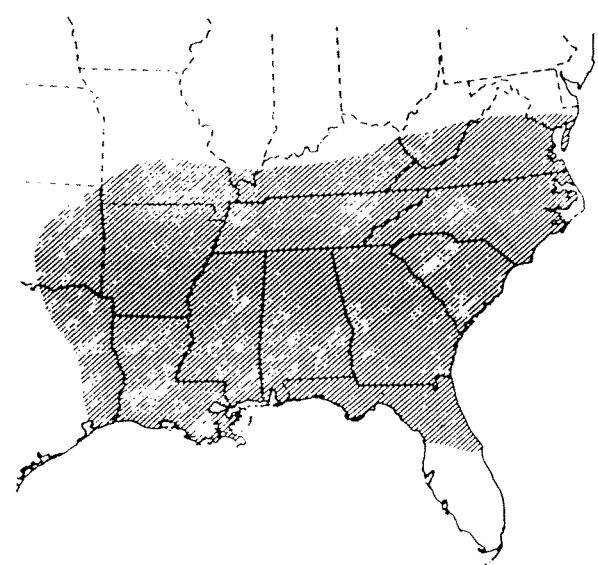

Figure 2. Current range of kudzu in the southeastern U.S.

robust in other areas, kudzu is found as far north as central Kentucky, Virginia, and Maryland, and as far west as eastern Texas and Oklahoma. It has even been reported in the states of New York and Washington. Today, only a small percentage of this coverage provides beneficial erosion control on precipitous slopes.

It should be pointed out that kudzu does serve some useful purposes and the idea of utilizing it for additional benefits has merit. Some useful ideas for kudzu are:

- Kudzu is rich in protein and phosphorus and supplies a nutritious fodder for livestock (Dalal and Patnaik 1963) even during droughts.
- Kudzu can be harvested and used on gardens as a mulch or compost, thereby improving the production of many gardens (Shurleff and Aoyagi 1977).
- A company in Atlanta is duplicating the oriental process of paper making. Kudzu fibers yield a long-lasting, mold-resistant, and nonfading paper for artists (Tanner et al. 1979).
- Vines can be burned in combination with coal to make electricity in power plants. Kudzu has approximately one-half the heating value of coal, is low in sulfur content, and is a fast-growing renewable resource (Tanner et al. 1979).

If these uses were developed and the uncontrolled spread could be limited, then kudzu would be more favorably reviewed.

CONTROL

Kudzu can be controlled by persistent applications of the right method. Every root crown on an area must be killed or all control efforts will be nullified within a short time. A stronger effort is required for older patches and around the tree-draped borders where roots grow largest and are most resistant to control. Uncontrolled root crowns will result in a reinvasion of kudzu on the area. Essentially, kudzu control must mean kudzu eradication.

Grazing and mowing can be effective control measures in certain situations. Both require vine or tree cutting around tree-draped borders. Grazing also requires fencing to surround the infested area with a watering place for cattle. Fencing should encompass the entire parth or excluded crowns must be controlled by other means. Close grazing for two successive years eliminates kudzu when 80 percent of the vegetative growth is continuously consumed (Ball et al. 1979). Kudzu provides a good-quality forage but yields are low at approximately 2 tons (g. wt.)/a/yr. Cattle grazing has been effective with claims that goats and hogs are faster at control, since more of the roots are consumed. Close mowing every month for two growing seasons or repeated cultivation are also effective (Ball et al. 1979). Rolling or dissected terrain often precludes these measures. Grazing, mowing, tillage, or prescribed burning can also prepare areas for more efficient herbicide applications. However, tillage and prescribed burning should not be used on steeply slopping lands where erosion is a risk.

The only other means of controlling kudzu, other than digging the roots out, is application of systemic herbicides. Table 1 lists agricultural herbicides presently registered for forest and noncrop lands, most specifying kudzu. All require at least one broadcast application and a follow-up spot application, while many will require perhaps up to four or more treatments (Davis and Funderburk 1964). Probably the least effective for kudzu control are amitrole, 2,4-DP, and 2,4-D, which are usually incapable of complete kill even of the foliage with one application. The most effective products are those that contain picloram, *e.g.*, Tordon 10K and Tordon 101 (Brender and Moyer 1965). Picloram is both soil and foliar active and capable of direct root kill, while amitrole, 2,4-DP, and 2,4-D must work on depleting the root reserves which can entail numerous applications. The other herbicides rank between these in effectiveness for control of kudzu. A few observations about each product may help in choosing a herbicide. Most of these observations come from our ongoing research and from discussions with others involved in operational and research control. Other important facts come from the herbicide labels.

Amitrole reportedly controls kudzu, but documented results are missing. At least three applications will probably be required. As with most foliar sprays, results vary due to leaf conditions at application. Leaves must take up the herbicide and move enough out to the stems and roots before leaf kill stops uptake. The tender nature of kudzu leaves makes this difficult. Amitrole can be applied after full foliage development and until frost kill. Adding a suitable surfactant can assist amitrole uptake. Honeysuckle and blackberry, common kudzu associates, are also specified on amitrole labels. The Cytrol T formulation contains thiocyanate to control thistle. The lower-cost powdered formulations usually require a special order through agricultural chemical suppliers.

Maintain CF125 is actually sold as a woody plant growth retardant. Thus, a kudzu patch may stay green the first year after treatment, without producing long runners; but at the higher rates, considerable kill should be evident in the second year. Honeysuckle and blackberry are also included on the label. Although not widely available,

Table 1. Registered herbicides for kudzu control.

Main ingredient	Trade name	Manufacturer	Formulation	Rate[1]/acre	Cost[2]/acre
amitrole	Amitrol T	Union Carbide	LC[3]	2 gal	$40
	Cytrol T	Am. Cyanimid	LC	2 gal	$32
	Amizol	Union Carbide	SP	4 lbs	$17
	Weedkiller 90	Am. Cyanimid	SP	5½ lbs	$25
chlorfurenol	Maintain CF125	Uniroyal	LC	3-4 qts	$71–95
2,4-D	several	several	LC	1-8 qts	$4–30
2,4-DP	Weedone 2,4-DP	Union Carbide	LC	1 gal	$17
dicamba	Banvel	Velsicol	LC	1-2 gal	$50–100
	Banvel 720	Velsicol	LC	1-4 gal	$40–80
	Banvel 10G	Velsicol	G	8-10 lbs	$160–120
dicamba + 2,4-D + MCPP or 2,4-DP	Brushkiller 875[4]	PBI Gordon	LC	1 gal	$38
	Super Brush[5]	PBI Gordon	LC	1 gal	$45
fosamine	Krenite	Dupont	LC	2-3 gal	$74–111
glyphosate	Roundup	Monsanto	LC	1 gal	$70
picloram	Tordon 10K	Dow	P	40 lb	$100
	Tordon 101	Dow	LC	1-4 gal	$28–112
trichlopyr	Garlon 3A	Dow	LC	⅓-1½ gal	$17–78
	Garlon 4	Dow	LC	1-4 qts	$17–70
—[6]	Oust Weed Killer	Dupont	DG	6-12 oz	$40–80

[1] *Label-specified rates.*
[2] *Costs based on suggested retail prices for 30 gal drums or 50 lb tubs 1982 prices.*
[3] *LC = liquifiable concentrate (mixes in water); SP = soluble powder; G = granules; P = pellets; DG = dispersible granule.*
[4] *Amine-salt formulation (mixed in water).*
[5] *Ester formulation (can be mixed in oil or water).*
[6] *Generic name not finalized.*

this product may permit spraying of pines covered by kudzu on tree-draped borders without total tree kill. This claim by the manufacturers has not been tested. Sapling pines are also tolerant to lower rates and late-season applications of 2,4-DP, but its effectiveness for kudzu control is marginal. It is not specifically registered for kudzu but for site preparation and, in numerous states, for pine release. Thus, kudzu control within an established plantation may be possible with Maintain CF125 and Weedone 2,4-DP.

Dicamba products are effective for kudzu control probably due to the soil-active nature (Miller 1982). The Georgia Department of Transportation has for some time successfully treated kudzu with dicamba. The volatile nature of certain dicamba formulations, like certain formulations of 2,4-D, and 2,4-DP, should be considered when sensitive crops are nearby. Enhanced kill has been reported with late summer (August) applications at rates greater than 1 gal/acre (Dickens and Buchanan 1971). The granular formulation of dicamba (Banvel 10G) is expensive, but, like the pelleted Tordon 10K, is convenient for hand application.

Acme Brushkiller 875 and Super Brush have dicamba mixed with phenoxy herbicides. The Brushkiller 875 is an amine-salt formulation that mixes with water and Super Brush is an ester formulation that can be mixed in water or oil. These sprays can be effective if leaf kill does not occur until after adequate uptake. Thus, it is important not to exceed the labeled rates. Claims of single-application control have been made with these kudzu-labeled products as well as complete failure. At least two or three applications will probably be required (Miller 1982).

Past mixes with dicamba have specified using less than 100 gallons of water which may account for some past failures. Thorough wetting will improve control by all foliar sprays which require at least 60 to 100 gallons of water per acre for complete coverage by ground applications. Application using two passes over the same area at right angles greatly improves coverage.

Krenite is registered for treatment of noncrop lands and prior to reforestation areas having both kudzu and hardwoods. Chappel and Link (1977) reported that 1¼ gal/a was the most effective rate in Virginia. Krenite also kills blackberries and many other woody regeneration pests. Roundup is less effective on kudzu than it is on many woody and herbaceous weeds (Miller 1982). Roundup controls blackberries as well as honeysuckle, but is marginal on kudzu in the lower southern states. At least three applications of Roundup are probably required on heavy kudzu infestations. Effectiveness apparently increases in the Carolinas from unpublished reports. Both Krenite and Roundup are best applied from mid-to late-summer as specified on the labels.

Tordon 10K, the pelleted form of picloram, is not only very effective but also convenient to apply, especially for spot applications. One tablespoon per crown is recommended for spot treatments

and can be used after any other initial broadcast treatment. Thus, an initial lower-cost broadcast treatment may result in enough control; only spot applications with Tordon 10K will be needed. Rainfall is required to activate the pellets, but too much rainfall may wash pellets from steep slopes (Brender and Moyer 1965). The mixture of picloram with 2,4-D (Tordon 101) can yield enough control so that only follow-up spot applications will be required (Miller 1982, Dickens and Buchanan 1971, Brender and Moyer 1965). Those follow-up treatments can be spot treatments, if surviving crowns are scattered more than 20 feet apart. Remember, several retreatments can occur during the same growing season. Rapid regrowth by herbaceous species can make retreatments difficult and ineffective. Thus, spot treatments and resprays should be applied soon after kudzu regrowth appears and before weeds become too tall.

Both Tordon 10K and Tordon 101 are restricted-use pesticides and can only be purchased and applied by landowners or state-certified applicators, or persons under their direct supervision. Tordon products will kill pines and hardwoods and can remain active in soils for several months. Thus, tree planting should be scheduled at least 9 months after Tordon 10K applications, because of the residual nature of picloram.

Garlon 3A is an amine-salt formulation containing 3 lbs. acid equivalent (a.e.) of triclopyr per gallon and Garlon 4 is an ester with 4 lbs. a.e. per gallon. The differences in concentration account for the different rates with same costs. These are labeled for noncrop lands and for forest site preparation. The effectiveness of these two products for kudzu control have not been fully tested. Application should be during active growth with higher rates required for late-summer and during droughts.

Oust Weed Killer is the newest herbicide that can be applied for kudzu control on noncrop lands. Initial tests are very favorable, showing substantial control and the added benefit of pine tolerance. Rates to achieve both of these results have not been well-defined. Widespread testing will probably commence in the 1983 growing season. Oust can be purchased in limited quantities now, but some on-site testing is advisable.

All labels should be read and thoroughly understood before applying these products. All label restrictions, including those pertaining to avoidance of drift to desirable plants, contamination of food or water, and washing of spray equipment should be strictly followed.

New herbicides now being tested are showing excellent kudzu control along with minor pine damage. As yet the costs and projected registration dates of these experimental compounds have not been stated. Further testing of these and the already mentioned registered herbicides are underway at the USDA Forest Service Laboratories in Auburn, Alabama and Macon, Georgia. Effective, lower-cost treatments are the goal.

The loss of productivity on a kudzu path can be reversed by tree planting after a successful eradication program.

Literature Cited

ALABAMA FOREST PRODUCTS. 1974. Convert kudzu to timber in one year? New control methods looks promising. Alabama Forest Products 17(10):10, 12, 14, 16.

BALL, D. M., R. H. WALKER and RAY DICKENS. 1979. Kudzu in Alabama—Uses and control. Forage Production Fact Sheet, Alabama Cooperative Extension Service, Auburn University, Auburn, Alabama Circ. ANR-65. 3 p.

BRENDER, E. V. and E. L. MOYER. 1965. Further progress in the control of kudzu. Down to Earth 20:16–17.

CHAPPELL, W. E. and M. L. LINK. 1977. Kudzu control on Virginia highways. *In*: Proc. South. Weed Sci. 30:299.

DALAL, S. S., and N. PATNAIK. 1963. Kudzu cultivation for soil conservation. Ind. For. 89:468–473.

DAVIS, D. E. and H. H. FUNDERBURK, JR. 1964. Eradication of kudzu. Weeds 12:62–63.

DICKENS, R. and G. A. BUCHANAN. 1971. Influence of time of herbicide application on control of kudzu. Weed Science 19:669–671.

MILLER, J. H. 1982. Kudzu control chemicals. *In*: Proc. South. Weed Sci. Soc. 35:241–243.

SHURTLEFF, W. and AKIKO AOYAGI. 1977. The book of kudzu. Autumn Press. Brookline, Massachusetts.

TANNER, R. D., S. HUSSAIN, L. A. HAMILTON, and T. A. WOLF. 1979. Kudzu (*Pueria lobata*): potential agricultural and industrial resource. Eco. Bot. 33:400–412.

WITKAMP, E., M. L. FRANK, and J. L. SHOOPMAN. 1966. Accumulation and biota in a pioneer ecosystem of kudzu vine at Copperhill, Tennessee. J. Appl. Ecol. 3:383–391.

James H. Miller is research forester, Southern Forest Experiment Station, USDA Forest Service, G. W. Andrews Forestry Sciences Laboratory, Auburn University, Auburn, Alabama 36849, and Boyd Edwards is research ecologist, Southeastern Forest Experiment Station, USDA Forest Service, Georgia Forestry Center, Dry Branch, Georgia 31020.

Portions of this article were used in the summer issue of Alabama's Treasured Forests—Ed.