KIKUYU GRASS
IN HAWAII

EDWARD Y. HOSAKA
Specialist in Pasture Management and Agronomy

UNIVERSITY OF HAWAII AGRICULTURAL EXTENSION SERVICE
CIRCULAR 389—OCTOBER 1958

ACKNOWLEDGMENT

I wish to thank Mr. A. Hartwell Carter of Parker Ranch for encouraging me to write this paper, and Mr. Richard Penhallow and Mr. Charles A. Rice for giving me information on the forage value of kikuyu grass.

Cooperative extension work in Agriculture and Home Economics
College of Agriculture, University of Hawaii
United States Department of Agriculture cooperating

TABLE OF CONTENTS

COVER

The drawing on the cover, done by the author, shows the terminal flower-bearing stem of kikuyu grass. (Except where indicated, all drawings and photographs are by the author.)

FIGURE 1. Kikuyu grass (*Pennisetum clandestinum* Hochst.).

KIKUYU GRASS IN HAWAII

By Edward Y. Hosaka
Specialist in Pasture Management and Agronomy

INTRODUCTION

Kikuyu grass is native to tropical Africa. The common name comes from the Kikuyu tribe, which inhabits a comparatively small area in the highlands of Kenya. The area is situated at elevations from 6,000 to 10,000 feet; and its main soil type is a deep lateritic loam, derived from volcanic rock. The annual rainfall varies from 40 to 60 inches, but the mountain mists supplement the actual precipitation to some extent. The mean temperature of this region is between 55° and 64°F.

Kikuyu grass has been introduced into most tropical countries and into some temperate regions for forage. In October 1925, kikuyu was first introduced into Hawaii, and in 1938 the Kabete strain of the kikuyu was brought in from Kenya, Africa, by the Hawaii Agricultural Experiment Station.

GENERAL DESCRIPTION

Kikuyu grass is a strong, long-lived grass. It has a stout surface and underground runners which branch and root freely at the nodes (Fig. 1). Some of the runners go down 4 feet or more into the ground, depending on the texture of the soil. The plant forms a dense mat in a few months. The stems are horizontal to weakly upright and they produce abundant leaves. These leaves are covered with soft, short hairs throughout and are somewhat flattened near the tips. They are narrow, 5–15 inches long, and spread outward stiffly at the ends of the stems. The light-colored sheaths are more hairy than the leaves, and the ligule is a row of hairs.

The flowering stems of the kikuyu are topped with 2–4 flowers which bloom on short, side shoots. These side shoots are almost entirely or partially enclosed in the terminal leaf-sheath. The topmost flower is on a short stalk; the others are without flower-stalks. Each flower contains a single, perfect floret ⅜–⅞ inch long. Below the perfect floret is a single, sterile floret. The entire flower is partly or completely surrounded by 15 or less delicate bristles. These bristles are of various lengths, but not as long as the flowers.

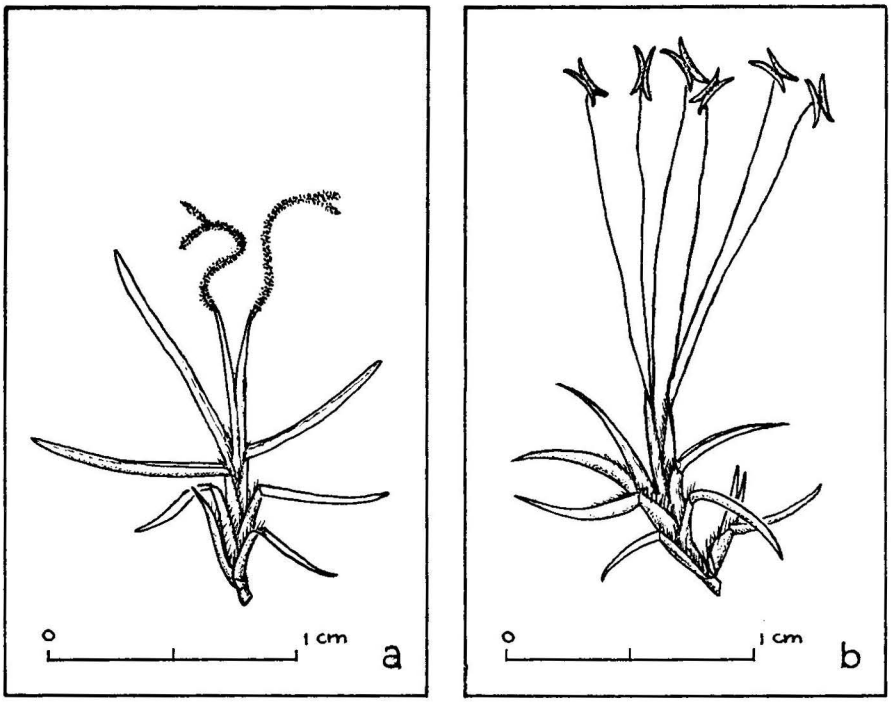

FIGURE 2. Kikuyu flower; *a*, female flower; *b*, male flower.

There are 3 stamens in the kikuyu flower. In normal flowers the stamens are borne on long, slender filaments about 1¾ inches long. The conspicuous single stigma (female organ) is parted in two near the end. The male and female parts on the same flower do not appear together; the female part precedes the male part. Both the stigma and anther (male organ) are produced during the night. By about noon they are shrivelled by the sun. Some of the stigmas may persist longer because they are partially protected by the leaves. In contrast to the partially hidden stigmas, the anthers are borne on long filaments far above the leaves.

SEED SETTING

There is a belief that kikuyu grass does not produce seed because the flower is almost completely enclosed in the leaves. D. J. Carr and Eng Kok Ng, working in Australia, have found that some strains of kikuyu are functionally female while others are hermaphrodites, such as the seed-forming Kabete strain. Since male-sterility has been observed in a wide variety of climates, one may conclude that it is genetically determined and is inherited. Generally, the kikuyu in Hawaii flowers profusely, producing female parts. The male parts, however, are produced only

occasionally, except under particularly adverse conditions, and have little chance to pollinate the flowers (Fig. 2; a, b). If the floret is cut vertically, anthers are found with well developed pollen grains.

In Hawaii, kikuyu seeds are frequently produced at elevations about 3,000 feet and above. D. C. Edwards, working in Kenya, Africa, noted that flowering, seed production, and seed dispersal of kikuyu are largely dependent upon the maintenance of short herbage, and that prolific flowering takes place only when the grass is moderately short, either naturally or by grazing or cutting. The caryopsis, or grain, is dark brown in color, flat-ovoid, about ⅛ inch long and about 1/16 inch broad. It is pointed at the end of its attachment, and the short style is persistent at its apex (Fig. 3; a, b, c, d, e). Some 20 years ago, the late Arthur Greenwell found some kikuyu seeds in Kona at about 4,500-foot altitude.

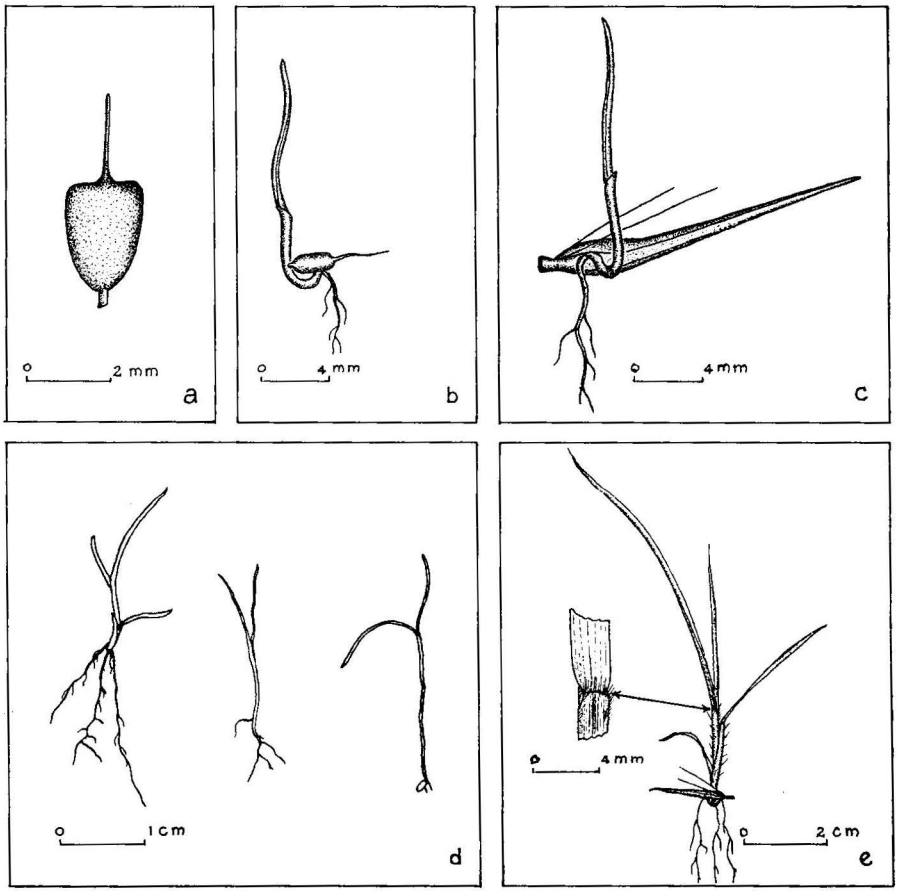

FIGURE 3. Kikuyu; *a*, seed; *b*, and *c*, germination; *d* and *e*, seedling.

It is believed that organisms tend to reproduce and perpetuate their kinds. In certain environments, when an organism is abused, seed setting is encouraged, in order to perpetuate its kind. This seeding under adverse conditions occurs in the strain of kikuyu grass found in Hawaii. Also in other plants, such as in feather fingergrass (*Chloris virgata*), all the stored plant food is made available to the plant for seed production when unfavorable conditions come.

SEED DISPERSAL

Kikuyu grass seeds are dispersed in the manure of cattle. Also, broken sprigs are carried some distances within the split hooves of cattle. Other animals, such as horses, might pass the seeds through their digestive systems, but there is no direct evidence for this. Seedlings developing on cattle manure were first pointed out by A. Lester Marks on the McCandless Ranch located at 6,000-foot elevation in Kona, Hawaii (Fig. 4; a, b). Also, seedlings were grown in a petri dish from seeds collected in the Parker Ranch pasture at 4,200-foot elevation (Fig. 4; b). With some seeds, the outer flower parts were removed, leaving only the caryopsis, and then planted; with others, the complete flower was planted.

GROWTH HABIT

The extensive underground stems of the kikuyu produce new plants. Being below the surface of the ground, these stems are capable of withstanding intensive grazing, heavy trampling, and defoliation. If they are not closely cropped, however, they have the tendency to become dry and woody beneath the profuse top growth. The high forage yield of kikuyu, as much as 35 tons of fresh material per acre per year, and its ability to recover quickly make this grass highly suitable for pasture planting. In swampy locations, kikuyu forms a solid mat and protects the animals from sinking in the soft mud. The rhizomes spread rapidly, covering steep slopes, and are extremely useful in controlling soil erosion.

In recent years earth-water-holes have become popular in Hawaii. The banks and slopes of many of these reservoirs are planted with kikuyu grass to hold the soils. Willie Kaneho, foreman at the Parker Ranch Humuula Sheep Station, is greatly responsible for popularizing this type of water-hole.

KIKUYU GRASS STRAINS

In discussing certain strains of kikuyu grass peculiarly adapted to Africa's habitat, Edwards states that there are three distinct types, and he segregates them as:

(1) *Molo*—leaf, light green, narrow; plant has an appearance of fineness; creeping stem, slender.

(2) *Rongai*—leaf, dark green, broad and course; creeping stem, heavy.

(3) *Kabete*—leaf, intermediate (characteristics between those of Molo and Rongai); creeping stem, also intermediate.

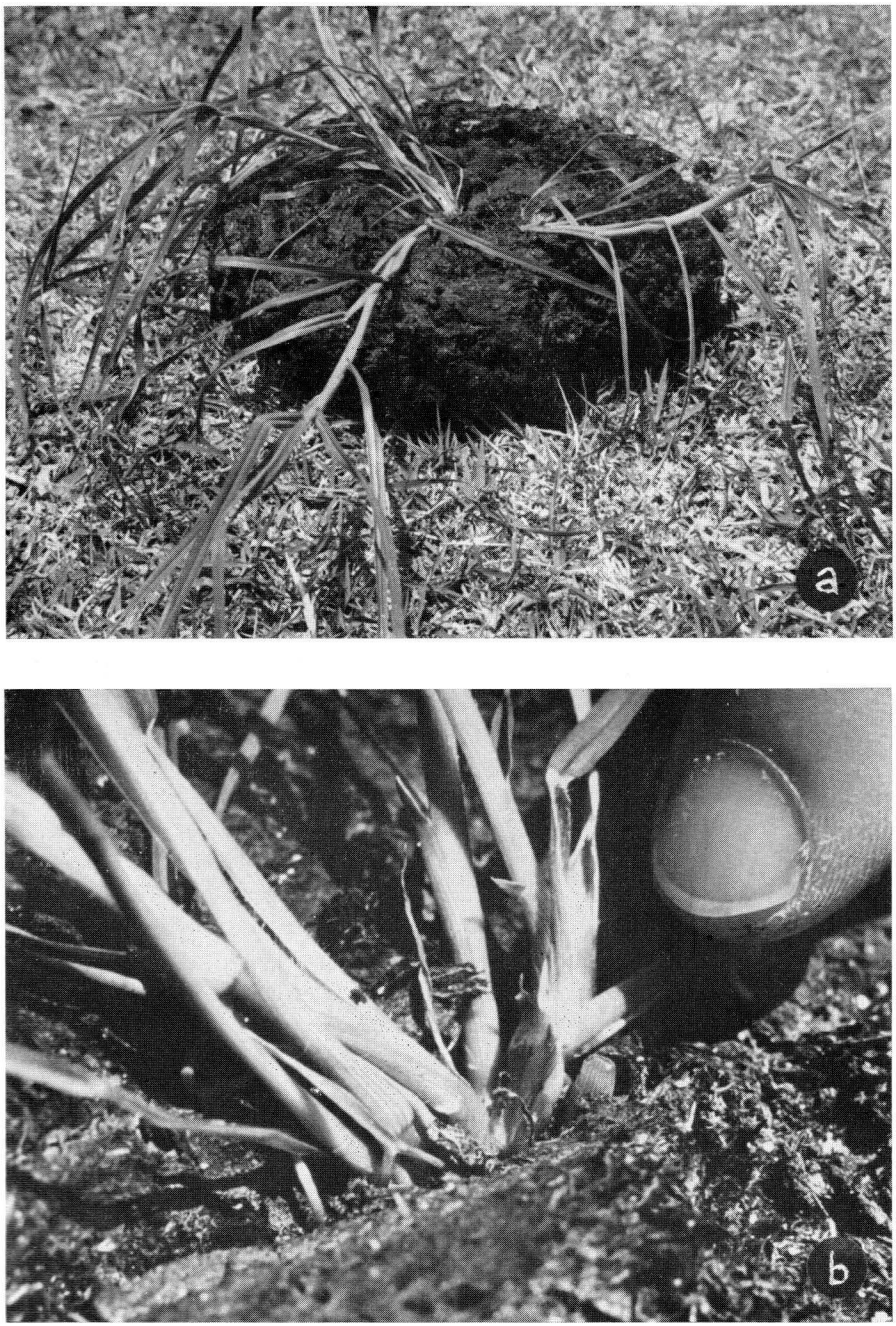

FIGURE 4. Kikuyu seedling; *a*, growing on cattle manure; *b*, basal portion of a seedling. Photo by Edward J. Britten.

In regard to the growth habits of these strains, Edwards states that the Molo shows maximum growth near the center of the plant, in the region of the original rooted cutting. The Rongai strain shows more rapid growth toward the ends of the creeping stem, resulting in a scooped-out appearance. The Kabete strain grows somewhat uniformly throughout the whole plant. It is believed that the Rongai and Molo strains produce more forage than the Kabete strain. Apparently, the Kabete strain is growing in Hawaii.

DISTRIBUTION AND PROPAGATION IN HAWAII

Kikuyu is found on all of the islands. Much credit should be given to Dr. F. G. Krauss and to the late Dr. C. M. Cooke, Jr.,[1] for distributing the planting material to many ranchers. Dr. Krauss sent cuttings to some ranchers on the different islands for planting in increase plots. Most of the kikuyu grass on Maui was propagated from the many bags of cuttings that Dr. Cooke sent to Harold Rice during the period from 1926 to 1929, when kikuyu was first introduced here. On Kauai, Charles A. Rice propagated kikuyu and gave vegetative planting materials to the ranchers.

Kikuyu is especially adapted to grow in high-rainfall areas from sea level to about 4,000-foot elevation. It grows at higher regions and can withstand moderate frost, but low temperatures retard optimum growth. Because of kikuyu's fast growth under ideal conditions, some ranchers allow animals to graze it within six months after planting.

There are several ways of planting kikuyu in the pasture. One method is to plant the cuttings in shallow holes dug a few feet apart with a pick. This method is most adaptable to hillsides and to rocky lands. The other method is to broadcast the plants over a plowed field and then to disk them into the prepared soil with a disk pulled by a tractor (Fig. 5). Still another method is that used by Sherwood Greenwell of Kealakekua Ranch in Kona, Hawaii. Recently, Mr. Greenwell successfully planted chopped kikuyu stems (Fig. 6). The stems were chopped into 2- to 3-inch lengths by passing them through a grass chopper, then these were broadcast over a prepared field and disked lightly into the ground. This system is successful in areas where the rainfall is high and dependable. In low-rainfall regions, short propagating stems are more likely to dry up than long stems.

Kikuyu does well in the semi-dry Pahoehoe rangeland of Kona, which is situated at elevations of 5,000 feet and above and is generally covered with a thin layer of soil (Fig. 7). Natural distribution of kikuyu over these rangelands has been greatly accelerated by the dispersal of seeds in cattle droppings.[2]

The ability of kikuyu grass to stand long drought has been noted by Charles A. Rice, B. M. Sumner, Frank Greenwell, Richard Baldwin, and other ranchers.

---

[1]Personal communication with the late C. M. Cooke, Jr.

[2]Personal communication with Roy Wall of Kona.

FIGURE 5. Spreading kikuyu sprigs on a disked pasture.

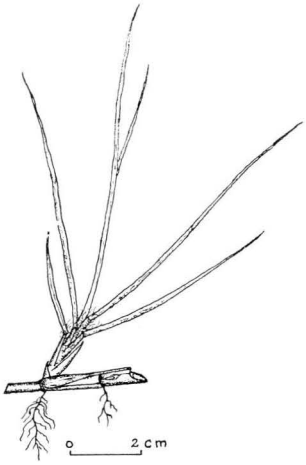

FIGURE 6. Sprouting of a chopped kikuyu stem.

FORAGE VALUE

Ranchers of Hawaii disagree on the value of kikuyu grass as forage. Some say that it is poor in its carrying and fattening capacity because it becomes woody and the animals avoid it. Another objection made by some cattlemen is that kikuyu is too "aggressive." It crowds all other forage plants in a mixture and the pasture becomes a "one-grass" pasture (Fig. 8). The difference of opinion is principally due to a lack of knowledge concerning management of kikuyu on the range. In judging the quality of this grass, management and soil fertility are important factors to consider.

A rancher should certainly hesitate to plant kikuyu on lands capable of supporting a mixture of more desirable species, such as rye (*Lolium spp.*), cocksfoot (*Dactylis glomerata*), white clover (*Trifolium repens*), Kentucky blue (*Poa pratensis*), Yorkshire fog (*Holcus lanatus*), black medic (*Medicago lupulina*), red clover (*Trifolium pratense*), and paspalum (*Paspalum dilatatum*). Kikuyu should be avoided especially if such areas are relatively free of serious plant pests, such as guava, lantana, pamakani, emex, and elephantopus. When the aggressive kikuyu is planted in areas where better species can be cultivated, it takes over the

FIGURE 7. Kikuyu growing on pahoehoe (smooth lava) at 5,000-foot elevation.

FIGURE 8. Kikuyu replacing a good mixture of cocksfoot, rye, brome, and black medic in a semi-dry pasture at 5,000-foot elevation. The matted grass is kikuyu.

land by crowding out the more desirable species. Often the carrying capacity of the pasture is reduced, especially in large paddocks.

Many ranchers who were indifferent to kikuyu in the past are beginning to appreciate its value as a forage, especially in high-fertility soils. From the nutritional standpoint, kikuyu has a moderately high protein content. A. J. Taylor states that results of analysis done in South Africa indicate high protein and phosphoric oxide contents (25 percent and 1 percent respectively), based on the oven-dry matter of the herbage. In general, the average protein content of vigorously growing, green kikuyu grass is about 2.0 percent and about 8.1 percent, based on dry weight. Table 1 compares the nutrient content of kikuyu with that of paspalum and Rhodes grasses. It indicates that the young leaf has a high protein content.

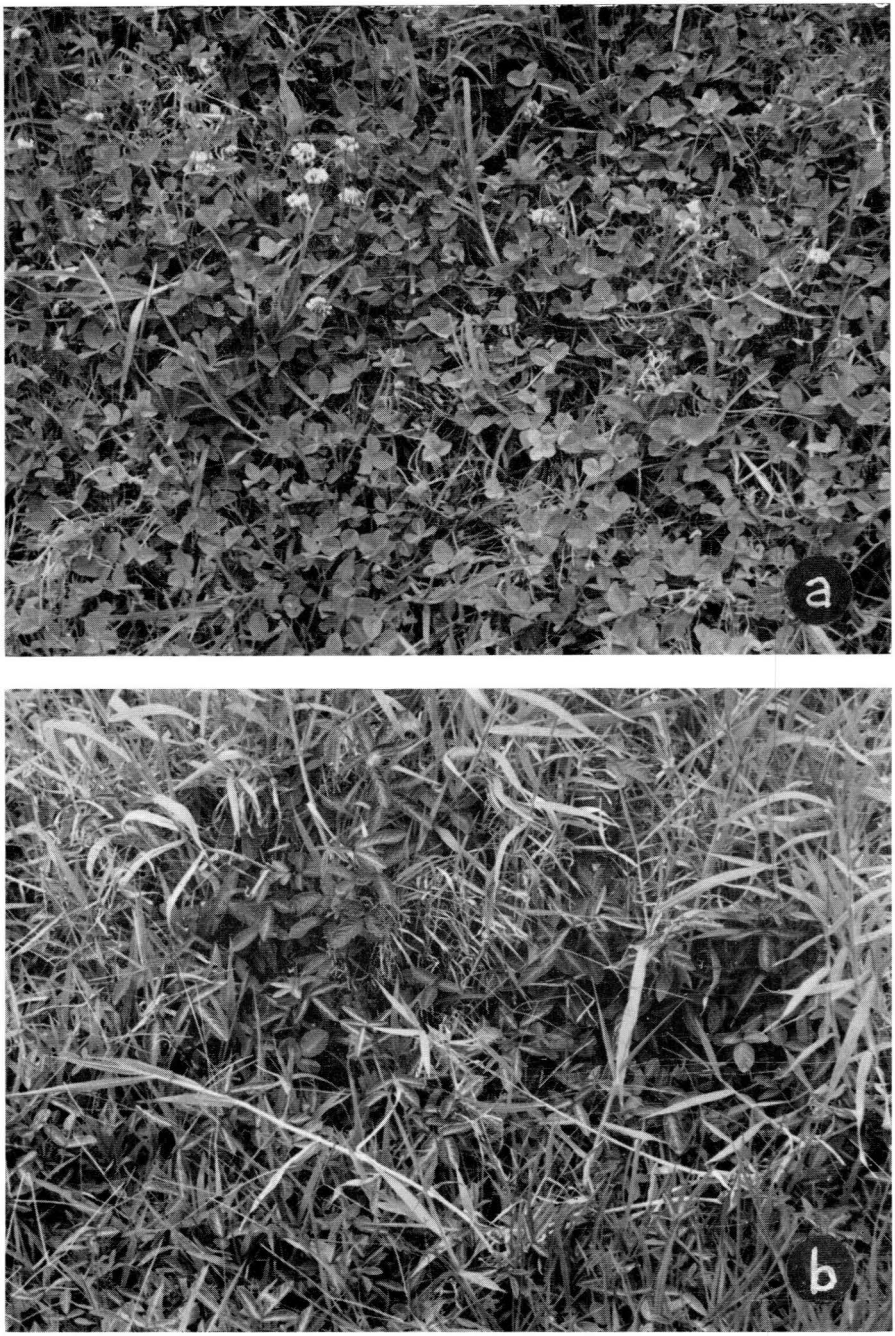

FIGURE 9. Kikuyu mixed with other grasses; *a*, white clover growing with kikuyu at 3,500-foot elevation; *b*, Kaimi clover growing with kikuyu at 500-foot elevation.

Table 1. Chemical composition of kikuyu, paspalum, and Rhodes grasses on an air-dry basis*

Grass	Crude protein %	Crude fat %	Crude fibre %	Lime %	Phosphoric acid %
Kikuyu, young shoots	16.7	1.4	31.2	0.436	0.884
Kikuyu, old plant	8.8	1.4	27.1	0.416	0.697
Paspalum, young shoots	20.6	1.6	23.7	0.412	0.618
Paspalum, old stemmy growth	4.1	0.9	41.4	0.239	0.139
Rhodes, young leafy growth	16.4	1.7	27.1	1.999	0.724
Rhodes, old stemmy growth	5.8	1.2	33.3	0.579	0.604

*After *Queensland Agr. Jour.* 79(2): 68, August 1954.

MANAGEMENT OF KIKUYU

A good stand of established kikuyu can be grazed nearly yearlong under proper management.

Kikuyu branches freely near the cut end of a stem and this process goes on after each grazing. If the old stems are not grazed or mowed, they tend to become woody and unpalatable. Therefore, keeping kikuyu short is important in the maintenance of high palatability and nutrition. The experience of many Hawaiian ranchers has been that white clover (*Trifolium repens*), kaimi clover (*Desmodium canum*), black medic (*Medicago lupulina*), Spanish clover (*Desmodium uncinatum*), and birdsfoot trefoil (*Lotus spp.*) develop well with kikuyu if the grass is kept low (Fig. 9; a, b). Also, the common vetch (*Vicia sativa*) grows well in a kikuyu stand during February to June. These legumes supply some of the nitrogen required by kikuyu for quality and high production.

The size of paddocks, the size of the herd, and the number of grazing days desired are important factors to consider in managing kikuyu grass. A small paddock system rotated with a large number of animals is desirable because a small paddock of kikuyu is easy to manage effectively. A large paddock is difficult to graze uniformly and results in wasted forage. Occasional mowing, if the land permits, is an excellent way to destroy woody stems and encourage companion legume growth. When kikuyu forms a thick mat, a musty condition develops and stock often will not graze it readily.

Running a drag of some kind, such as a spike-tooth harrow, a chain, or an angled iron bar, to break up old stems and scatter the manure, is good pasture management. An experiment conducted in Africa by H. W. Dougall indicated that the use of a plow to destroy the thick mat of kikuyu and undecomposed plant residue is a good practice. This practice is also recommended for the correction of plant nutrient deficiencies. Burning off the thick mat of coarse stems by controlled fast burning when the ground is moist might be practiced to an

advantage in some kikuyu ranges. Some ranchers have had good results in rejuvenating an old stand of kikuyu by intensive grazing with old cows and horses.

FERTILIZATION

A high level of soil fertility is an important factor to developing a good stand of kikuyu. D. Meredith, working in subtropical Africa, found that a fertilized kikuyu pasture gives a high carrying capacity.

Kikuyu grass responds to fertilizers, especially to nitrogen. An experiment to determine the response of kikuyu to nitrogen in applications of 100, 200, 400, and 800 pounds of ammonium sulfate per acre was conducted at the Haleakala Branch of the University of Hawaii Agricultural Experiment Station. This experiment indicated that the green forage, dry matter, and protein contents increase with each increment of ammonium sulfate fertilizer used (*1948-1950 Biennial Report*). Thus, the use of fertilizer with adequate moisture is an excellent way of raising the forage yield and the nutritional value of kikuyu. Kikuyu grass adequately fertilized with animal or chicken manure or commercial fertilizer has a dark-green color, but an old stand growing in low-fertility soil takes on a distinctly pale, yellowish-green color.

In pasture where white clover, kaimi clover, birdsfoot trefoil, or other legumes grow, lime and phosphate fertilizer stimulates the legume growth.

ERADICATION OF KIKUYU

Kikuyu along a fence line, farm boundary, and in cultivated crop land may be eradicated by disking or by treating it with a chemical weed killer, such as TCA, CMU, and Dalapon, but the cost of the material is the controlling factor (Fig. 10). At the Hawaii Agricultural Experiment Station's Haleakala Branch, kikuyu was eradicated from a field by disking it three times during the dry season of about three months' duration. The stems and the underground runners were loosened from the soil and exposed to drying.

SUMMARY

There is little doubt that a kikuyu-legume mixture produces a desirable pasture if properly grazed, periodically rested, and adequately fertilized. If good grazing methods are practiced, kikuyu will not become rank and unpalatable, especially if the small paddock system is used. Often a good stand of kikuyu grass in a moderate-rainfall zone may be grazed almost yearlong. Some Hawaiian ranchers have planted kikuyu to crowd out undesirable plant pests, such as pamakani (*Eupatorium adenophorum*), guava (*Psidium Guajava*), and lantana (*Lantana Camara*), and excellent results have been achieved. Taking all things into account, kikuyu is considered a good forage grass in Hawaii, Africa, and in other tropical regions. It has its place in pasture composition, and it should not be disregarded because of its aggressive characteristics.

FIGURE 10. County agent M. Matsuura demonstrating the use of herbicide to kill kikuyu grass on farmland.

Terminal branch of an old kikuyu plant.

REFERENCES

1) CARR, D. J. and ENG KOK NG. 1956. Experimental Induction of Flower Formation in Kikuyu Grass (*Pennisetum clandestinum* Hochst.). *Australian Jour. Agr. Res.* 7(1):1–6.

2) DOUGALL, H. W. 1953. Kikuyu Grass—Seasonal Variation in Composition of Degenerate and Productive Pastures. *East African Agr. Jour.* 19(2):74–83.

3) ———. 1954. Kikuyu Grass II—An Attempt to Improve a Worn-out Pasture. *East African Agr. Jour.* 19(4):212–218.

4) EDWARDS, D. C. 1937. Three Ecotypes of *Pennisetum clandestinum* Hochst. (Kikuyu Grass). *Empire Jour. Exptl. Agr.* 5:371–376.

5) ———. 1940. The Reaction of Kikuyu Grass (*Pennisetum clandestinum*) Herbage to Management. *Empire Jour. Exptl. Agr.* 8(30):101–110.

6) *Hawaii Agricultural Experiment Station Biennial Report 1948-1950.* Univ. of Hawaii. Pp. 42–43.

7) HOSAKA, E. Y. 1953. *Feather Fingergrass.* Univ. of Hawaii Agr. Ext. Serv. Cir. 340. Pp. 1–4.

8) ———. 1957. *Palatability and Nutritive Value of Forages.* Univ. of Hawaii Agr. Ext. Serv. Cir. 381. Pp. 1–8.

9) MEREDITH, D. B. D. 1947. *The Effect of Fertilizers on Grasses in Certain Areas in South Africa, with Special Reference to Nitrogen.* Thesis, Univ. of Witwatersrand, Johannesburg. Pp. 90–110.

10) MEREDITH, D. (ed.) 1955. *The Grasses and Pastures of South Africa.* Central News Agency, Cape Times, Ltd., Parow, C. P. 771 pp.

11) OFFICERS OF AGRICULTURAL BRANCH. 1954. Kikuyu Grass. *Queensland Agr. Jour.* 79(2):63–70.

12) PARKER, D. L. 1941. Strain Variation and Seed Production in Kikuyu Grass (*Pennisetum clandestinum* Hochst.). *Jour. Dept. Agr. So. Australia* 45(1):55–59.

13) TAYLOR, A. J. 1941. *The Composition of Kikuyu Grass under Intensive Grazing and Fertilizing.* Dept. of Agr. and Forestry, Union of So. Africa Bul. 203. Pp. 1–18.

14) WHITNEY, L. D., E. Y. HOSAKA, and J. C. RIPPERTON. 1939. *Grasses of the Hawaiian Ranges.* Univ. of Hawaii Agr. Expt. Sta. Bul. 82. Pp. 100–101.

ABOUT OTHER GRASSES IN HAWAII

Sound pasture management requires knowledge of the latest information on the forage value of the various types of grasses growing in Hawaii. Edward Y. Hosaka, the University of Hawaii Agricultural Extension Service's specialist in pasture management and agronomy, has written circulars dealing with other grasses suitable for the Hawaiian ranges. These include:

Circular	340	*Feather Fingergrass* October 1953
	342	*Pangola Grass in Hawaii* (with Dale Goodell) February 1954
	353	*Pangola and Colonial Guinea Grass Management* May 1956
	367	*Trefoils in Hawaii* February 1957
	369	*Kenya White Clover in Hawaii* (with Minoru Matsuura) June 1958
	380	*Buffelgrass for Hawaiian Ranges* (with Norman K. Carlson) June 1957
	381	*Palatibility and Nutritive Value of Forages* September 1957
Bulletin	59	*Mollasses Grass on Hawaiian Ranges* (with J. C. Ripperton) June 1953
	62	*Noxious Plants of the Hawaiian Ranges* (with Alan Thistle) June 1954

Send your name and address to the College of Agriculture, Library, Gilmore Hall Room 103, University of Hawaii, Honolulu 14, Hawaii, for a free copy of any of these publications.