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KIKUYU GRASS—Establishment, management and utilisation in the south west

By R. Sprivulis, Bunbury office

Kikuyu grass (Pennisetum clandestinum), kikuyu for short, is a summer growing turf-forming perennial. In the absence of winter frosts and with sufficient summer moisture it remains green all year round. It is a vigorous and aggressive grass spreading by means of prostrate above and below ground stems rooting at the nodes. Some selections and recent introductions of this species are fertile and produce seed. The seeds, when eaten by stock, can be widely spread in their droppings.

Kikuyu originated on the highland plateau of eastern central Africa characterised by high rainfall (1000 to 1500 mm), mild temperatures (range of means: 2 to 8°C min, and 16 to 22°C max.) and lateritic loamy soils.

It was introduced to W.A. farms in the early 1920's. Since then kikuyu has spread throughout the South West Irrigation areas and on summer-moist land in the 750 mm and higher rainfall districts. Along the south coast, where annual rainfall exceeds 1000 mm and where summer coastal showers are common, kikuyu has completely colonised some of the red loam karri hills.

AGRONOMIC CHARACTERISTICS

- Kikuyu has a long growing season. In the areas of low frost incidence the active growth period is between early October and the end of June. In the more frost prone districts it is capable of active growth between October and May. It is well suited for irrigation pastures.
- Kikuyu has considerable drought and waterlogging tolerance and responds rapidly to the late spring and early autumn rains.
- Kikuyu persists under severe and continuous defoliation. Over a wide range of grazing pressures the herbage eaten is predominantly leaf. As a pasture species it helps to achieve high stocking rates.
- In summer irrigated pastures it responds readily to nitrogen applications. Pasture dry matter yields of up to 15,000 kg/ha were recorded in the west coastal irrigation area during October to April. The average daily growth rates ranged from 33 kg/ha without nitrogen to 71 kg/ha when 400 kg/ha of nitrogen was used.
- In the dry land pastures of south coastal districts, kikuyu blends well with winter growing annuals such as subterranean clover and annual ryegrass to give high all year production.
- On summer-moist land, kikuyu and perennial lotus species pasture swards can be maintained.
- In irrigation pastures, kikuyu can be grown in association with perennial white and strawberry clovers, particularly with cultivars that have pronounced winter growing characteristics.
- Kikuyu can be established by seed or vegetatively using rooted sprigs or stems. It prefers light textured fertile soils, but provided moisture and temperatures are not limiting, kikuyu can be established on every type of soil in the South West, except for saline soils.
- Because of its aggressiveness, kikuyu is a serious weed of cultivation, but with modern implements and chemicals it can be kept under control.
- Under lax grazing it may become too spongy, suppress legumes, become nitrogen deficient and produce poorly.
- It harbours insect pests and in moist situations facilitates reinfestation of stock with internal parasites. At times it can support fungi harmful to grazing animals. Kikuyu has lower sodium uptake than the temperate grass cultivars. If grown together with temperate species then sodium deficiency is unlikely to occur.

ENVIRONMENTAL REQUIREMENTS

For optimal growth, kikuyu has certain temperature, moisture and soil fertility requirements.

Temperature
Kikuyu is frost susceptible. The first autumn frosts cause yellowing of the above ground parts and cause the plant to become dormant.
Active growth starts again when the minimum night temperatures start to exceed 8°C and day temperatures reach over 20°C. Consistently high temperatures, in excess of 40°C can also cause growth reduction.

Moisture
Although kikuyu is able to survive dry periods, its growth rate is very susceptible to moisture stress. Kikuyu is most productive in the west coastal irrigation areas. It also performs well along the south coastal strip in the 1 000 to 1 500 mm rainfall area where considerable summer rainfall occurs.
Kikuyu is often found in localities with less than 750 mm annual rainfall but in this zone only the irrigated stands and stands located on summer-moist land have useful economic value.

Soils
In W.A. kikuyu has spread over a wide range of soils. It is spreading more readily on the well fertilised lighter textured soils. Its establishment on heavy clay soils takes more time. Actively growing kikuyu responds readily to nitrogen dressings. It is essential that the extra feed produced is properly utilised. Normal nitrogen dressings for market milk irrigation farms are between 50 and 100 kg N/ha applied at six weekly intervals from October to March. The phosphorus and potassium requirements of pastures are currently under review.
In this bulletin the scientific symbol for some chemical elements have been used; N for nitrogen, P for phosphorus and K for potassium.
For pasture analysis, the tops of kikuyu stands should not fall below 0·25 per cent of P and 1 per cent of K in the pasture dry matter that animals consume.

ESTABLISHMENT
Kikuyu can be established either by seed or by sprigs. Before the seeding cultivars were developed, planting by sprigs was the only propagation method.

Sowing
Kikuyu seed is now commercially available and several plantings by seed have been very successful.

Time of planting. Soil temperatures and moisture availability determine the most suitable times of planting. The optimal germination rates and percentages have been recorded at temperatures between 20°C and 30°C. October to November plantings coincide best with the normal growing period of irrigated pasture swards.

On dry-land farms, seed must be planted earlier, say about the end of August or by early September, to achieve good strike of plants before the hot and dry weather sets in. Alternatively, planting can be done at the break of the season in the autumn before soil temperatures become too low. The choice of planting time on dry land depends largely on whether winter or summer growing weeds are the main problem.
Autumn plantings might be the safest when kikuyu is sown on summer-moist flats.

Seeding rate. Sowing at a rate of 1 kg/ha will give about 35 seeds/m². The seeding rate will depend also on the germination percentage which is claimed for commercial seed to be in excess of 75 per cent.
In most situations seeding rates of 1 to 2 kg/ha will be sufficient. For very quick ground cover or in soil stabilisation projects seeding rates of up to 5 kg/ha are used.

Depth of seeding. The optimum depth of seeding does depend on the type of soil. Light textured soils dry out more quickly and are better aerated than heavy soils.

<table>
<thead>
<tr>
<th>Soil</th>
<th>Recommended depth of planting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandy soils</td>
<td>2 to 3 cm</td>
</tr>
<tr>
<td>Loams</td>
<td>1 to 2 cm</td>
</tr>
<tr>
<td>Clays</td>
<td>0.5 to 1·5 cm</td>
</tr>
</tbody>
</table>

Sowing method. When drilled, the seed bed must be fine and firm to ensure uniform seed burial. Few drills provide sufficiently accurate depth control and in most cases it is better to broadcast the seed on harrowed ground and then to roll it down with a tyre roller. Heavy wet soils must not be rolled as they can set hard and reduce aeration and germination.

Fertiliser requirements. The success of kikuyu establishment depends to a large extent on soil fertility. The fertiliser requirements will vary according to previous fertiliser history. In most situations newly planted stands will require N, P and K fertilisers. As a general guideline the following fertilisers should be used for establishment.

<table>
<thead>
<tr>
<th>Fertiliser</th>
<th>Rate kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superphosphate</td>
<td>150 to 200</td>
</tr>
<tr>
<td>Nitrogenous fertilisers as actual N</td>
<td>50</td>
</tr>
<tr>
<td>Muriate of potash</td>
<td>50 to 100</td>
</tr>
</tbody>
</table>
a. White clover
b. Kikuyu
c. Annual (wimmera) ryegrass
d. Strawberry clover
**Weed control.** When kikuyu is planted by seed, common weed competition can be reduced by the “spray-seed” technique. The rate of “spray-seed” application varies from 1.5 litres/ha for freshly germinated weeds to 2 litres/ha for weeds four to six weeks old.

**Spreading by animals.** Many kikuyu patches have started from undigested seed contained in animal droppings. With more and more prolific seeding cultivars being grown, the “voluntary” spreading of kikuyu in favourable conditions will be accelerated.

**Sprig Planting**

This planting method involves planting of 15 to 20 cm long pieces of stems with three to four well rooted nodes. A planting density of one sprig/square metre under adequate moisture and nutrient levels can give complete ground cover within twelve months.

**Time of planting.** In irrigation areas the time of planting is not so critical but October to November planting is preferable.

When kikuyu is planted on dry land it is essential for it to strike before soil becomes too dry in the spring and too cold in the autumn.

High rainfall dry-land plantings strike best if planted in late August or early September.

Plantings on summer-moist land are best done at the break of the season but not later than April.

**Planting method.** The sprigs are taken from vigorous stands of kikuyu which have been kept short by grazing or mowing with a slasher or forage harvester. The turf is then rotary hoed and harrowed to produce sprigs and shake off excess soil. For large scale operations the cut up material can be raked into windrows, picked up by front-end loaders, loaded onto trucks and taken to the area to be planted. If sprigs are plentiful they can be forked out on top of the seed bed and then buried with a disc cultivator or a rotary hoe followed by rolling with a tyre roller.

With a limited amount of sprigs, they should be planted in rows or open furrows.

On light textured soils where kikuyu spreads rapidly, the row or strip planting method has the advantage of little disturbance and restriction of annual pasture production.

**Fertilisers.** The fertiliser requirements are the same as for kikuyu sown by seed.

**Weed control.** Weed control is necessary but it is not as important as for planting by seed. In most situations cultivation before planting will give satisfactory weed control.

**CULTIVARS**

Kikuyu is a variable species with narrow-leafed and wide-leafed forms and fine and coarse stemmed types. Some produce a very dense turf, others form an open pasture sward. Some produce an abundance of seed, others seed poorly or not at all.

The commonly found kikuyu which was propagated from the first introduction to Western Australia is comprised of male sterile and fertile bisexual plants. This type is narrow leafed and forms very dense swards. In some areas non-seeding kikuyu has developed due to original plantings of vegetative male sterile sprigs. In other districts bisexual fertile plants are present and under certain environmental and management conditions, seed is produced.

In recent years kikuyu has received a lot of attention in N.S.W. where seed production of this grass has been developed on a commercial scale. The two registered cultivars are Whittet and Breakwell.

**Whittet**

This cultivar was developed at the Grafton Agricultural Research Station from seed introduced from Kenya in 1960. The seed of this cultivar was released in 1969.

It is a uniformly bisexual cultivar and is characterised by more open, taller growth habit, broader leaves, thicker stems and longer internodes than the common types. In N.S.W. it is claimed to produce more dry matter than the other cultivars.

**Breakwell**

This cultivar was also developed at Grafton Agricultural Research Station from bisexual common kikuyu plants and certified seed was released in 1972. Approximately 80 per cent of plants grown from seed of “Breakwell” are bisexual. In all other characteristics it is similar to the commonly occurring type, having a prostrate growth habit, narrow leaves, thin stems short internodes and dense tilling habit.

**Local Selections**

In W.A. seed has been selected from two locally occurring ecotypes at Como and Denmark. These two selections are currently being compared with the commercial cultivars Whittet and Breakwell at Denmark Research Station. Grown on a semi-summer-moist site at Denmark Research Station so far Whittet and Breakwell have been equally productive or more productive than the two W.A. selections.
KIKUYU IN PASTURE SWARDS

In its natural habitat kikuyu is claimed to grow in association with Kenya white clover (Trifolium semipilosum). This clover cultivar, as yet, is not locally available, but with proper management techniques, kikuyu and locally available clover cultivar swards have been established and maintained.

Irrigation pastures

In the irrigation areas of the South West, kikuyu is spreading over pastures originally planted to white clover (Trifolium repens), strawberry clover (Trifolium fragiferum), paspalum (Paspalum dilatatum) and perennial ryegrass (Lolium perenne) cultivars.

The winter active perennial clovers such as Palestine strawberry and Louisana white, persist well in kikuyu based pastures. In N.S.W. Haifa white clover is proving successful.

The persistence of clovers in W.A. irrigated pastures depends largely on the level of pasture utilisation, soil nutrients, use of nitrogenous fertilisers and soil salinity. Lax grazing in summer and generous use of nitrogenous fertilisers usually will lead to kikuyu dominance. Adequate P, K and S fertiliser dressings ensures better persistence of clovers.

When soil salinity levels build up to 0.2 per cent, white clovers disappear or act as annuals. As salinity keeps building up strawberry clover is the next pasture component that is lost.

Summer-moist land

Many summer-moist flats along the south and west coasts support kikuyu, Palestine strawberry clover and Lotus spp. stands. The harder the pastures are grazed in summer the higher is the legume content.

Dry land pastures

It has been demonstrated at the Denmark Research Station and on many South Coastal farms that kikuyu and sub. clover, ryegrass mixtures are complementary. Kikuyu based pastures grazed hard at the end of summer reduce the need for fodder conservation and revert to sub. clover-ryegrass dominance in the autumn-winter growing period.

KIKUYU MANAGEMENT

The basic principle in successful kikuyu grass management is hard grazing. Lax grazing leads
to matting, exclusion of legumes, fall in soil nitrogen level and poor production. Kikuyu is extremely tolerant of hard grazing.

Hard grazing from February to April is particularly important. On irrigated pastures it will favour stronger persistence of winter growing perennial clovers; on dry land it will promote better germination and growth of sub. clover and winter growing grasses. On rough, steep and wet ground it is the only practical way to keep kikuyu under control and in a productive state.

Nitrogen fertilisers must be used with discretion. Any increased production must be matched by a corresponding increase in grazing pressure. Irrigated kikuyu stands are very responsive to nitrogen treatments.

The response of dry land stands are dependent on seasonal conditions. Late spring and autumn applications usually fail either because of moisture shortage in the spring or low temperatures in the autumn.

**Renovation techniques**

**Hard continuous grazing.** This method was developed in the south coastal districts in the early 1960's. It involves stocking of overgrown kikuyu paddocks with dry sheep. Sound mouth shorn whethers are purchased at the beginning of summer and are set-stocked at high stocking rates (up to 30 head/ha) until the pastures are eaten down. The sheep can then be sold in wool at the break of the season. This method ensures high pasture utilisation and improves soil fertility.

**Slashing.** The slashing of overgrown patches of kikuyu leads to higher clover content and growth of fresh and leafy kikuyu. At Wokalup Research Station, a flail type forage harvester is used to trim the overgrown kikuyu to ground level. Once slashed the desired composition can be maintained by proper grazing intensity.

**Cultivation.** When legume and winter growing species introduction is required, complete cultivation of the existing stands becomes necessary. Whenever possible the matted growth is best removed at ground level by forage harvester. Then the power driven scalloped disc plough or rotary hoe are the best implements for breaking up of the rhizomatous sod.
The trace elements used to maintain the pasture legume component are usually sufficient for kikuyu.

Nitrogen is usually applied to produce feed for a specific purpose or at a particular time. In general dry land and summer-moist pastures receive dressings in the order of 50 to 100 kg of nitrogen per ha.

**Table 1. General annual fertilisers recommendations for established kikuyu based pastures in the South West of Western Australia.**

<table>
<thead>
<tr>
<th>Situation</th>
<th>Fertiliser</th>
<th>kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry land pastures*</td>
<td>Superphosphate</td>
<td>150 to 200</td>
</tr>
<tr>
<td></td>
<td>Muriate of potash</td>
<td>50 to 100</td>
</tr>
<tr>
<td>Summer-moist land*</td>
<td>Superphosphate</td>
<td>200 to 250</td>
</tr>
<tr>
<td></td>
<td>Muriate of potash</td>
<td>50 to 100</td>
</tr>
<tr>
<td>Irrigated pastures for milk production</td>
<td>Superphosphate</td>
<td>250 to 350</td>
</tr>
<tr>
<td></td>
<td>Muriate of potash</td>
<td>50 to 100</td>
</tr>
<tr>
<td></td>
<td>Nitrogenous fertilisers as actual nitrogen</td>
<td>200 to 400</td>
</tr>
</tbody>
</table>

* Nitrogen is usually applied to produce feed for a specific purpose or at a particular time. In general dry land and summer-moist pastures receive dressings in the order of 50 to 100 kg of nitrogen per ha.

The trace elements used to maintain the pasture legume component are usually sufficient for kikuyu.
ANIMAL PRODUCTION

Animal production from kikuyu based pastures has been studied at Denmark and Wokalup Research Stations. Results so far are summarised in the table below.

Though no direct comparisons have been made, the safe year-in year-out stocking rates for yearlings on dry land annual pastures are about two animals/ha.

The B.F. production/ha at Denmark is more than twice the district average.

The Wokalup trials clearly demonstrate the value of nitrogen on irrigated kikuyu based pastures during the summer months.

The highest dairy production was achieved at a stocking rate of 5·5 cows/ha. Though the production per cow is not very high, the production/ha is good particularly since it was achieved from pasture alone.

SEED PRODUCTION

Lush, actively growing, ungrazed and uncut kikuyu stands seldom flower and produce seed.

Short mowing or grazing encourages dense tillering, prolific flowering and seed setting.

In the South West, kikuyu normally flowers between October and May. In an experiment

Table 2. Animal production from kikuyu based pastures at Denmark on dry land pastures.

<table>
<thead>
<tr>
<th>Type of animal</th>
<th>Duration of trial</th>
<th>Stocking rate (animals/ha)</th>
<th>Production (kg/ha)</th>
<th>kg/animal</th>
<th>kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Live weight</td>
<td>B.F.</td>
<td>Live weight</td>
</tr>
<tr>
<td>Beef weaners</td>
<td>1968/69</td>
<td></td>
<td>12 months</td>
<td>3·7</td>
<td>162</td>
</tr>
<tr>
<td>Hereford</td>
<td></td>
<td></td>
<td>12 months</td>
<td>3·7</td>
<td>148</td>
</tr>
<tr>
<td>Hereford x Guernsey</td>
<td></td>
<td></td>
<td>12 months</td>
<td>1·4</td>
<td>106</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>68/69</td>
<td></td>
<td>12 months</td>
<td>1·6</td>
<td>123</td>
</tr>
<tr>
<td>(G &amp; Gx) 69/70</td>
<td></td>
<td></td>
<td>12 months</td>
<td>2·1</td>
<td>80</td>
</tr>
</tbody>
</table>

Table 3. Animal production from kikuyu based pastures at Wokalup on irrigated pastures.

<table>
<thead>
<tr>
<th>Type of animal</th>
<th>Duration of trial</th>
<th>Stocking rate (animals/ha)</th>
<th>N = (kg/ha)</th>
<th>Production (kg/ha)</th>
<th>kg/animal</th>
<th>kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Live weight</td>
<td>Milk</td>
<td>B.F.</td>
</tr>
<tr>
<td>Beef heifers</td>
<td>68/69</td>
<td></td>
<td>8 months</td>
<td>7·5</td>
<td>7·5</td>
<td>Nil</td>
</tr>
<tr>
<td>Hereford</td>
<td>(Oct. to May)</td>
<td></td>
<td></td>
<td>300</td>
<td>300</td>
<td>101</td>
</tr>
<tr>
<td>Yearling steers</td>
<td>70/71</td>
<td></td>
<td>7 months</td>
<td>12</td>
<td>300</td>
<td>82</td>
</tr>
<tr>
<td>Angus X</td>
<td>(Oct. to May)</td>
<td></td>
<td></td>
<td>12</td>
<td>300</td>
<td>124</td>
</tr>
<tr>
<td>Friesian X</td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>300</td>
<td>91</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>(FX) 74/75</td>
<td></td>
<td>6 months</td>
<td>4·1</td>
<td>4·1</td>
<td>5·5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Nil</td>
<td>Nil</td>
<td>1 895</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 364</td>
<td>2 364</td>
<td>1 996</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>467</td>
<td>467</td>
<td>500</td>
</tr>
</tbody>
</table>

8
Precautions

The fungal toxin apparently only appears in the autumn on actively growing kikuyu during periods of warm and humid weather. When cattle are introduced on lush kikuyu they must be closely watched for the first two to three days. Cattle may recover if they are removed upon first signs of toxic symptoms. At this stage treatment seems to be of little use.

A trial is in progress at Denmark Research Station which involves spraying of kikuyu pastures with fungicides.

In N.S.W. where commercial kikuyu seed production is well established, seed yields vary from 20 to 55 kg/ha for first year and from 100 to 450 kg/ha for established stands.

Management commences with the kikuyu stand being mown to a height of 2-5 to 3 cm above ground level. As growth and flowering proceed, the sward is mown regularly at increasing height for each subsequent cut. Unlike most grasses, kikuyu does not shed its seed but holds it close to the stem. The regular cuts stimulate the development of new seed heads during the flowering period.

The leaf clippings are removed after each mowing. At harvesting time the pasture is mown as close to ground level as possible and the seed bearing material is dried, either in windrows on the ground or in racks or artificial driers. The dried material is then threshed in a hammermill or by an "all-crop" harvester adapted for picking up the windrows.

OTHER USES

Kikuyu is one of the easiest lawn grasses to grow and will make an excellent lawn but because of its aggressiveness and invasion of flowerbeds and ornamentals it is not very popular. Kikuyu has been used for some playing fields and for racing tracks.

In the high-rainfall areas it is used for soil conservation, e.g. stabilisation of road banks, dam walls, spillways and reclamation of erosion gullies.

DISEASES AND PESTS

As yet no damaging kikuyu pasture diseases have been reported. Up to date the only serious pest affecting kikuyu in pastures and lawns is the black beetle (Heteronychus arator). The main damage is done by the larvae. They hatch in the root zone of the turfs and swards. These larvae, known as "white grubs" or "curl grubs" damage plant roots and under heavy infestations can cause dead patches in kikuyu stands. Even in most severe cases, kikuyu usually recovers and the damage is usually temporary. At present there are no permissible effective chemicals for black beetle control in pastures grazed by dairy cattle or stock being finished for slaughter.

KIKUYU AS A WEED

If uncontrolled, kikuyu can block drains and channels or cover fences, footpaths and the like. Though kikuyu is hard to eradicate, good control can be obtained with 2,2-DPA (Dalapon) by mixing 1.5 kg of Dalapon with 100 l of water and applying it at a rate of 14 l/100 m² and repeating this treatment three weeks later. The optimum time of spraying is during active growth in spring and summer. Further follow up sprays are used when necessary.

KIKUYU POISONING

This disorder is believed to be caused by fungi of the Myrothecium spp. which can occur in lush kikuyu pastures. This disorder was first noted in New Zealand but since 1973 it has been reported from Denmark and Wokalup Research Stations. Cattle slobber and stagger within up to 72 hours of being introduced to highly toxic pastures. They show excessive thirst, swollen abdomen and sunken eyes. They appear to be in intense pain and violent struggling may precede death. An autopsy will show the rumen full of watery green feed and the lining of the rumen wall freely peeling away.

It is suspected that in a milder form the disease causes illthrift and some scouring.

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