FODDER CROPS

GUINEA GRASS *(Panicum maximum)*
(Ad hoc recommendation)

Guinea grass is a popular fodder grass of the tropics suited to the agro-climatic conditions of Kerala. It can be profitably grown as a component of agro-forestry systems and comes 'up well under coconut and other trees. As an excellent fodder it is much valued for its high productivity, palatability and good persistence.

It is a perennial bunch grass; 0.5 to 4.5 m high. The stem is stout to slender, erect or ascending; glabrous or hairy. Leaves are 10 to 100 cm long and 3.5 cm wide. Panicle loose and much branched, the lower most branches being in a distinct whorl. The small seeds are enclosed in smooth glumes. The seeds shatter. The root system is deep, dense and fibrous. \

The imp,Qrtant varieties are Makueni, Riv ersdale, Hamil, PGG-4, FR-600, Haritha, and Marathakom. Mak'ueni is a drought re- ' sistant cultivar suited to rainfed situations in the state.

Guinea grass thrives well in warm moist climate. It can grow from sea level to 1800 m altitude. It is frost sensitive. It thrives between a temperature range of 15 to 38 °C. The grass tolerates shade and grows under trees and bushes and is best suitable as an intercrop in coconut gardens. The grass is adapted to a wide range of soils. It usually grows on well-drained light textured soil, preferably sandy loams or loams, but is better suited to medium to highly fertile loams. It cannot tolerate heavy clays or prolonged waterlogging.

Under Kerala conditions, the best season of planting is with the onset of southwest monsoon during May-June. As an irrigated crop planting can be done at any time of the year.

Seeds and slips can be used as planting ma terial. Since seed germination is poor vege

tative propagation is preferred. To obtain slips for planting, old clumps are uprooted and slips with roots are separated. For planting one hectare, 1.25 lakhs of slips are required. If seeds are used (3 kg/ha), it should be sown in nursery and the seedlings transplanted in the main field.

The grass requires thorough cultivation to prepare a weed-free seedbed for establishment. For this, two or three ploughings and one levelling are sufficient. In the prepared field, trenches of 10 cm width and 20 cm depth are made. In these trenches, FYM should be applied along with phosphorus and potassium fertilizers. Mix with soil and cover the trenches and form ridges of 15 cm height for planting slips. In acid soils, application of lime @ 500 kg/ha in alternate years is desirable.

Slips are planted on ridges at the rate of three slips per hill. The spacing of 40 x 20 cm is followed when grown as an intercrop. For a pure crop, a wider spacing of 60 x 30 cm is required.

A basal dose of 10 tonnes of FYM, 50 kg PzOs and 50 kg KzO per ha (applied in trenches) is recommended. For topdressing, use 200 kg N per ha in two split doses, the first dose immediately after-first cutting and the second dose during the northeast monsoon period. If irrigation facilities are available, topdressing can be given in more splits. The fertilizer may be applied on either side of the plants, along the row and earthed up.

At planting two irrigations are required within seven to ten days for quick establishment. The

crop should be subsequently irrigated depending upon the rainfall and soil type. Usually irrigation once in 7-10 days is required. Irrigation with cowshed

washing or sewage water within 3-4 days after cutting gives better growth.

The delicate seedlings or newly emerged shoots from slips or cuttings require protection from weeds in the first two months. Two intercultivations should be given during this period. Later, intercultivation may be necessary after three or four cuttings.

The crop is ready for harvest when it reaches 1.5 m height. Cutting at 15 to 20 cm above the ground level is advised. The first cut is usually ready in 9-10 weeks after planting and subsequent cuts are taken at 45

to 60 days intervals. About six to seven harvests can be made in a year.

Approximately 80-100 t/ha of green fodder is obtained per year.

Guinea grass can be grown mixed with leguminous fodder crops such as cowpea, stylo and siratro.

The grass is nutritious, palatable and free from oxalates. It makes good hay and silage. The crude protein and the crude fibre content of this grass vary from 8 to 14% and 28 to 36%, respectively.

GAMBA GRASS *(Andropogon gayanus)* (Ad hoc recommendation)

Gamba grass is also known as 'Sadabahar'. It is a tufted perennial grass and the stems are usually 1-2 m high. The inflorescence is a large spathe or panicle.

The grass tolerates drought and suits areas where dry season lasts for five months or so. In areas with less severe drought it can remain green throughout the year. It tolerates deep seasonal flooding. The grass avoids heavy soil, is resistant to grass fires and develops new leaves and shoots a few days after buming. The crop comes up well in

partial shade and is a good intercrop in coconut gardens. The crop can be propagated through rooted slips or seeds lightly drilled.

Cultural operations and management are similar to that of guinea grass.

In general about 50 to 80 t/ha of green matter is produced in the first year. From the second year onwards there is a slight increase in green fodder yield. The grass has excellent palatability with 5.5 % crude protein and 32.6 % crude fibre.

SET ARIA GRASS *(Setaria anceps)* (Ad hoc recommendation)

Setaria anceps is also called as Golden Timothy. The grass comes up well in the medium rainfall areas in the tropics and subtropics.

Important varieties are Nandi, Narok and Kazungula.

The grass is a tufted perennial with erect stems and grows 1-2 m in height. Leaves are about 40 cm long, 8-20 cm wide and

green to dark green in colour. Panicle is dense, cylindrical, about 10 to. 30 cm long and orange to purplish in colour. Spikelets are two in number, the lower one is the male or sterile and the

upper one is bisexual.

Usually the grass grows under an annual rainfall of over 750 mm. It grows vigorously under high annual rainfall ranging from 1000 to 1500 mm. It can also survive long, hot and dry seasons. The grass grows

well at 20 to 25 Dc. It is more cold tolerant than most of other tropical and subtropical grasses. It can come up in a variety of soil types.

This perennial grass requires thorough land preparation; two or three ploughings / diggings followed by one levelling. The land should be free from weeds.

Propagation is through rooted slips as well as through seeds. Seedlings can be raised in nursery and transplanted during rainy season under rain fed conditions. If irrigation facilities are available, planting can be done at any time between February and November.

As a pure crop it is planted at 50 x 30 cm spacing. The row-to-row distance may be increased to 60-70 cm when the soil is poor and irrigation facility is absent. For intercropping with legU{lles, 100 x 30 cm spacing is followed. If seeds are used, seed rate varies Horn 3.5 to 4.0 kg/ha. In case of rooted slips, the number of slips required varies from 33500 to 67000 per ha.

Organic manure, either FYM or compost @ 10 tlha may be applied at the time of land preparation. The crop responds well to application of fertilizers especially N. The fertilizer requirement depends on the initial nutrient status of the soil.

The grass flourishes in moist, but not wet soils. *Setaria* plots should be well drained

during rainy season. At establishment, the crop requires two successive light irrigations in 7-10 days interval. Subsequent irrigation should be given as and when necessary.

One or two weeding or intercultivation is given in the first 2 to 3 months. To control weeds and to encourage fresh sprouts, one or two intercultivation has to be carried out every year.

The crop is ready for harvest by 9-10 weeks. Subsequent cuts can be taken after every 40 to 60 days depending on the crop growth. At harvest, a stubble height of about 8 to 10 cm is left for good regeneration.

Generally, about 25-40 t/ha of green fodder can be harvested per year under rainfed situation. Irrigated crop yields about 75-150 tlhalyear.

The grass can be used as green cut fodder, silage and hay. The grass gives satisfactory silage with molasses. The crude protein and crude fibre content of the grass range from 4.8 to 18.4 per cent and 24 to 34 per cent, respectively.

Seed yields are low due to prolonged emer"
gence of panicles, prolonged flowering of the same panicle, early shedding of spikelets, bird damage etc. Denser stands give more uniform panicle emergence than widely spaced plants. Fertilizer application is compulsory in seed production.

HYBRID NAPIER *(Pennisetum typhoides* x *P. purpureum)* (Ad hoc recommendation)

Napier grass is also called as elephant grass due to its tallness and vigorous vegetative growth. The plants tiller freely and a single clump may produce 50 tillers under favourable climatic and soil conditions. Unfortunately, the grass is coarse-textured, the leaf blade and sheaths hairy, leaf mar

gins sharply toothed and stems less juicy and fibrous. In 1953, a cross was made in India with bajra which is more succulent, leafy, fine textured, palatable, fast growing and drought resistant than Napier to combine these qualities with its high yielding potential.

Compared to Napier grass, Hybrid Napier produces more tillers and numerous leaves. It grows faster and produces more herbage but the stems are hard and the plants less persistent. Pusa Giant Napier has larger leaves, softer and less persistent hairs on leaf blades and sheaths and less sharp leaf edges. The stems are also less fibrous than Napier. The tillers are more numerous and grow faster.

The grass grows throughout the year in the tropics. The optimum temperature is about 31°c. Light showers alternated with bright sunshine are very congenial to the crop. Total water requirement of the grass is about 800-1000 mm. Hybrid *Pennisetum* can grow on a variety of soils. Light loams and sandy soils are preferred to heavy soils. The grass does not thrive well on waterlogged and flood prone lands. Phenomenal yields are obtained from very deep fertile soil rich in organic ma_ter. It tolerates pH ranging from 5 to 8.

Hybrid Napier requires a deep, thorough weed free and compact seedbed. Three or four ploughings followed by disc harrowing is ideal.

The popular hybrids are Pusa Giant Napier, Gajraj, NB-5, NB-6, NB-21 and NB-35.

Planting is done with the onset of southwest monsoon. Being a sterile hybrid, the grass is planted by rooted slips or by stem cuttings. Cuttings of moderately mature stems (3 months old) and preferably from the lower two thirds of the stem length sprout better than the older stems. The cuttings with three nodes are stuck into the soil with the basal end down, either vertically or at an angle to such a depth that two nodes remain within the soil and one above the soil surface. The under ground nodes develop roots and shoots while the upper ones develop shoots only.

A spacing of 60 x 60 cm is recommended for pure crop of Hybrid Napier. In intercropping system, spacing is adjusted to accommodate the companion crops. The planting rate depends upon the spacing and the weight of the cuttings or rooted slips used. It is modified in crop mixtures or intercropping with other forage crops.

Farm yard manure @ 25 t/ha, and P2Os and K2O @ 50 kg/ha each may be applied at the time of land preparation. Apply N @ 200 kg/ha in two or three split doses followed by gentle raking, if possible.

The field should be provided with good drainage during the rainy season, as the crop cannot withstand water stagnation. Frequency of irrigation depends upon the rainfall and weather conditions.

Early intercultivation once or twice is necessary before the plants establish and grow vigorously. Subsequently, intercultivation should be given as and when necessary.

The first cut is taken 9-10 weeks after planting. Subsequent cuts are taken after four to six weeks or when the plant attains a height of 1.5 m. Annually at least six to eight cuts are possible. In order to encourage quicker regeneration from the basal buds, stubbles of 10-15 cm is left out at harvest.

Green fodder yield ranges! 200-250 tlha per year from 6-8 cuttings.

The grass can be intercropped with legumes such as cowpea, *Calapogonium, Centrosema* and *Glycine* legumes. Intercropping with legumes improves the quality of fodder.

Hybrid Napier is superior in quality than Napier grass and contains about 10.2% crude protein and 30.5% crude fibre. The leaves are larger and greener, the sheaths are softer and the margins less serrated and hence the herbage is more palatable. It is juicier and succulent at all stages of growth. It is less fibrous and more acceptable. The oxalate content of some of the varieties may

be high. It can be mitigated if harvested at longer intervals (45 to 60 days).

The grass is ideal for green fodder, silage and hay.

The fodder can be chaffed and ensiled. Legume fodders may be mixed with the

grass in tIIe ratio of 1:2 to produce betterbalanced silage. The fodder can also converted into hay during the dry summer periods. The chaffed material is exposed to the sun only for a day. Further drying is done under the shade to preserve the colour. The quality of the silage or hay remains more or less the same as green fodder.

PARA GRASS *(Brachiaria mutica)* (Ad hoc recommendation)

This grass is also known as buffalo grass, water grass, Angola grass, Mauritius grass etc. The crop responds well to sewage irrigation and is usually grown near large sewage disposal f_rms.

It is a coarse, trailing perennial that spreads by surface runners which root profusely at the nodes with flowering stems I to 2 m high. The culms are erect, leafy, hollow, succulent and glabrous with hairy nodes. The leaf blades are dark green in colour, 25 to 30 cm long and 1 to 2 cm broad. Inflorescence is a panicle. Flowering is hastened in shorter photoperiods.

The grass prefers hot and humid climate of
the tropics and subtropics with high annual rainfall ranging between 1000 and 1500 mm. It can withstand short term flooding and waterlogging but cannot be grown in dryland in arid and semi-arid regions. It is sensitive to cold. It makes no growth during winter months.

The grass grows in moist, but not in highly wet soils. It thrives best on highly fertile clay loam to clayey textured soils with high moisture retention capacity. It can be grown even on sandy soils with good irrigation facility. It tolerates slightly acid to alkaline soils. It is highly tolerant to saline or sodic soil conditions. So it is an excellent grass in soil reclamation. It grows well on field bunds, banks of streams and canals, lowlands and soils too wet for normal farm crops.

Prepare the land thoroughly by three or four ploughings and remove weeds.

Planting can be done at any time other than winter months. The rainfed crop is planted with the first monsoon showers.

Stem cuttings or pieces of creeping shoots 15 to 30 cm long with about three joints are generally planted in a slanting position. In order to save time and labour, the planting materials are scattered in the field and covered by ploughing crosswise during monsoon season. Seeds can also be used for direct sowing or sowing in nursery for transplantation. But poor seed setting usually discourages seed propagation.

Slips can be planted 50 to 60 cm apart both ways between plants and rows. The growing

runners quickly root at the joints, tiller profusely and cover the field.

The requirement of slips for planting ranges from 27000 to 40000 per ha. The seed rate recommended is 2.5 to 3.5 kglha.

The crop is highly responsive to irrigation with cattle-shed washing or sewage water. Forty tonnes ofFYM or compost along with 30 kg P2Os and 30 kg K;O per ha is to be given as basal' dose. Topdressing N 40 kg/ha after each harvest is found to enhance the forage production.

Two or three light irrigations are to be provided for the initial establishment of the

.crop. Later on, irrigation once in 10 to 15 days in summer is advantageous.

The land should be kept weed free for the first two months. Since it is a sturdy and aggressive grass, once it gets established, the weeds that appear later are suppressed.

The competitive vigour of para grass inter_ feres with the co-existence of legumes.

The first harvest takes about three months after planting when the grass attains a height of about 60 to 75 cm. Subsequent cuts are taken at 30 to 40 days interval. Annual yield of about 70 t/ha is obtained.

The para grass herbage dries slowly when
. cut. So it is hardly suitable for hay-making. This is mainly used for ensiling. It is a nutritious high. yielding and palatable forage grass. The grass appears to be free of any toxic effect. Nutritive value is comparatively less. The crude protein. ranges from 2.8 to 16.1 per cent and crude fibre from 28 to 34 per cent.

Seed yields are generally low. It is observed that shorter or longer day lengths hasten flowering. The correct stage of harvest is soon after the end of anthesis. Germination is affected if the seed is harvested late. There is no post-harvest dormancy for seed.

CONGOSIGNAL GRASS *(Brachiaria ruziziensis)*

Congosignal can be grown as a sole crop in open areas and as an intercrop in coconut gardens. It is a creeping perennial with dense foliage and therefore can be used for soil conservation purpose as strip crop. It grows to a height of about 50 to 100 cm and produces 30 to 40 tillers on an average.

It prefers a warm moist tropical climate. It can be grown in almost all types of soils but cannot tolerate waterlogging. It also tolerates shade. So it is recommended as an intercrop in coconut garden. It can be grown either as a pure crop or mixed with other grasses and legumes.

The crop is generally planted in May-June and September-October with the onset of rains.
Prepare the land by ploughing one or two times, remove weeds and level the land.
Both seeds and slips can be used. A seed rate of2-5 kglha is recommended. For sowing, a fine seedbed is required and seeds are

broadcast at 1-2 cm depth. To protect the seeds from ants, dusting carbaryl 5% DP at the time of sowing is effective. When slips are used, they are planted at a spacing of 40 x 20 cm.

Basal application of 5 t/ha of FYM along with 50 kg/ha each of PzOs and KzO is recommended. Nitrogen @ 100-150 kglha . may be applied in two or three splits.

Intercultivation during early growth stage is advisable to check weed growth.

It can also be grown as a crop mixture with leguminous fodder crops.

The first harvest can be done 50 days after planting and subsequently at 30-40 days interval. The rainfed crop yields about 35-45 t/ha of green fodder whereas the yield will be increased to about 50-100 t/ha under irrigated conditions.

FODDER TREES SUBABUL *(Leucaena leucocephala)*

Subabul is also known as leucaena or ipilipil. It had its origin from Mexico and is

now widely spread throughout the tropical and subtropical countries of the world.

It is a perennial hardy evergreen shrub. It has deep and strong taproot and even the seedlings are deep rooted. The leaves are bipinnate, 15 to 20 cm long with 10 to 15 pairs of pinnate leaves. Inflorescence is globular and the flowers are white. There are four types of subabul.

Hawaiian *type:* The plants are short bushy and remarkably drought tolerant. It is suited to hilly terrains in drought prone areas. It is a prolific seed producer and is good for fodder purpose. K-341 is a Hawaiian variety.

Salvador *type:* Tall, tree like and fast growing having maximum annual biomass production. Possesses large leaves, pods and seeds than Hawaiian types. Responds to high fertilization. Variety K-8 is useful for fodder.

Peru: Tall and extensively branching type and is ideal for fodder purpose.

Cunningham: It is a cross between Salvador and Peru types.

Subabul is best suited for warm regions and grows well between 22 and 30°C in regions of 500 to 2000 mm annual rainfall. Because of its strong and deep root system, the tree is highly drought resistant. It is restricted to elevations below 500 m but it withstands variations in rainfall, sunlight, windstorm, slight frost and drought. It cannot withstand waterlogging. It requires a deep well drained neutral soil and can tolerate saline and acid soil. It can also be grown in steep slopes, hilly terrains, gravelly areas and sandy loams.

Planting of seedlings can be done with the onset of rains in May-June or Sept-October.

Seed viability is high, but the hard seed coat posses dormancy. To hasten germination seeds are to be dipped in concentrated sulfuric acid for four minutes and then washed or put in hot water at 80°C for four minutes.

Sundry the seeds afterwards for about one hour before sowing.

A seed rate of 3-4 kg/ha is recommended. Sowing is preferably done during February March in a nursery or polythene bags or *in situ* at 2-3 cm depth. Give irrigation if there is no rain. Seedlings (1.5 to 3 months old with 6-8 leaves) are planted in the main field. A spacing of 1 x 0.1 m is recommended for a pure crop of fodder, 1.5 x 0.2 m for planting in boundaries and borders of coconut gardens and 2 x 0.2 m when raised along boundaries.

It can grow under a wide range of conditions as a range plant, roadside plant, in pastures etc. The land should, however, be cleared of bushes, ploughed and levelled before sowing.

A basal application of N :PzOs:KzO at the rate of 20:50:30 kg/ha is recommended.

Since the early growth of the crop is slow, the tender plants are to be protected from aggressive weeds. Two or three inter-row cultivation is essential to check weeds in early life. Once established, even vigorous grasses seldom smother the plants.

Leucaena combines well with many grasses like guinea, pangola, dinanath, Hybrid Napier etc.

Subabul is a highly nutritious leguminous tree fodder with 27-34 per cent protein. The fodder is rich in carotene and vitamin A. Pro-vitamin A content is the highest among all plant species. The foliage contains an uncommon amino acid, mimosine, which is toxic to non-ruminants at levels of about 10% of the diet.

Subabul starts flowering at 125-150 days after planting: First cutting is done after 5-6 months at a height of 70-80 cm from the ground level at a time when the plants reach a height of 1.5-1.75 m. Subsequent harvests

can be made at 50-60 days interval depending on the re-growth. When planted in boundaries, the main shoot is not cut; only side branches are cut for fodder, leaving the top three branches.

In gravelly soil and in low rainfall areas, a yield of 25-30 tonnes per ha per year may be obtained. The irrigated crop may produce 100 t/ha of green fodder per year in seven to eight cuttings.

HEDGE LUCERNE *(Desmanthus virgatus)* (Ad hoc recommendation)

It is a small shrub, 2 to 3 m tall and roughly resembles leucaena. It is a native of tropics and subtropics of the new world, palatable, aggressive, persistent and tolerant to heavy grazing. It has 22 per cent protein in leaves and 10-15 per cent in stems. It is highly

productive, yielding about 40 to 70 tonnes of green fodder per ha per year. No poisonous principle is observed in the foliage. Because of its pithy stem, the harvesting is easier. It is an ideal plant for wasteland development.

AGA THI *(Sesbania grandiflora)* (Ad hoc recommendation)

The outstanding feature is its extremely fast growth rate, especially during the first three to four years. Average wood yield of 20 to 25 m3 per ha is commonly achieved. It is easy to propagate by direct seeding. Prolific nodulation and extremely large nodules are its characteristic features. Cattle relish both its leaves and pods. After cutting, shoots resprout with vigour. It is not toxic to cattle.

It can be planted very densely at the rate of 3000 stems per ha. It has been viewed as a source of pulp for paper industry. Leaves contain 36 per cent crude protein. Agricultural crops continue to grow well when intercropped with S. *grandiflora* whose open crown allows sunlight to pass. It is adapted to the moist tropics with annual rainfall in excess of 1000 mID.

SHEVRI *(Sesbania aegyptica)* (Ad hoc recommendation)

It is a promising perennial fodder shrub for both dry and wet areas. The sub-marginal lands that are not suited for agricultural purposes can be used for growing this fodder plant. The leaves and young twigs form nu

tritious forage to the livestock. The plants can be sown at a spacing of 100 cm x 50 cm. When cut at 50 cm height at 60 days interval, green fodder yield of 12 tonnes per ha per year can be obtained.

FODDER LEGUMES FODDER COWPEA *(Vigna unguiculata)*

Cowpea is the most important leguminous fodder crop suitable for both summer and rainy seasons, mainly due to its- quick growing habit and high yielding ability.

Cowpea is indigenous to Africa and India. It has been cultivated from very early times for human consumption. Fodder cowpea can be profitably grown as a summer crop in

rice fallow of sandy loam soils where water is not available to raise a subsequent crop. It can be considered as a complementary crop in the rotation sequence of rice-ricecowpea because of the leguminous organic residues available for fertility enrichment.

Cowpea can be an annual or perennial, bushy, trailing or climbing herb. Stems are 1 to 3 m long, glabrous or slightly hairy. Leaves are trifoliate, inflorescence auxiliary having a few to several flowers. Pods are linear and cylindrical.

A number of varieties like Kamataka local, RS-9, UPC-1956, UPC-5287 and UPC-9805 are recommended for cultivation for fodder purpose.

Cowpea is best suited for moderately humid areas of the tropics and subtropics. It usually grows in latitude between 30° Nand S and up to 1500 m elevation. The plant cannot withstand frost, excessive and prolonged waterlogging, while some varieties are resistant to heavy rains. The optimum temperature required for its growth varies from 15 to *2rC.* Cowpea can be grown on a wide range of soils from heavy to sandy loam with a pH range of 5.0 to 6.5. Saline, alkaline or waterlogged soils should be avoided. Heavy clays encourage vegetative growth with less seed produCtion.

Cowpea for fodder purpose can be grown in any month provided irrigation facilities exist. In Kerala, it is raised as a rainfed crop during May and also as summer crop in rice fallows.

Two to three ploughings are required to produce a coarse seedbed for the crop. Shallow furrows at 3 m apart for leading irrigation water may also be provided. It can be broadcasted or drilled in lines. For seed crop, line sowing is preferred. Seed rate recommended is 40 to 50 kg/ha for a broadcast crop and 15 to 40 kg/ha for drill sown crop. For drilling, spacing of 30 to 40 cm

between rows and 6 to 15 cm between plants is recommended.

For rainfed crop, at the time of land preparation, FYM @ 10 t/ha is applied and basal application of N, P2Os and K2O @ 25, 60 and 30 kglha is recommended. For ilTigated crop in addition to the basal dose of 40: 30: 30 kg N: P2Os: K2O / ha, topdressing ofN and K2O ea.ch at 10 kg/ha after each cut is to be given.

A pre-sowing irrigation is important for the proper germination of the crop. If there is lack of soil moisture, shallow irrigation at 3-4 cm depth once in 15 days during summer and once in a month during postmonsoon period is good.

One or two weeding may be required in the early growth stages to combat weed problems. Usually high seed rates are effective in smothering weeds.

Cowpea is tolerant to moderate shade. So it can be successfully grown as intercrop with maize, sorghum, bajra, guinea grass, Napier grass etc to get high yields. In Kerala cowpea is also raised as an intercrop in coconut gardens.

As a fodder crop, the first cutting can be given 45 days after planting and subsequent two cuttings at 30 days intervals. A single cut crop yields 25 to 30 t/ha whereas green matter yield

of 40 t/ha is obtained from multi-cut cowpea.

Cowpea is used as fodder crop for green feeding, hay-making, grazing and also for ensiling in mixtures with sorghum or maize. The grains are used as human food as well as animal feed. Cowpea is also used as green manure crop and as cover crop in plantations..
The feeding value of cowpea forage is high. It is superior to other legumes like soybean because of its low fibre content and minimum wastage in feeding livestock. It has about 16 per cent crude protein and 20 per cent crude fibre.

Cowpea is a self-pollinated short day plant. Though the seed is well fonned, harvesting is

difficult. The percentage of hard seed is low and viability under storage lasts for 3 years.

STYLO *(Stylosanthes* spp.)

Stylosanthes is a genus of summer growing perennial pasture / fodder legumes. Most of its species are native of south and central America and the Caribbean Islands. This is a fodder cum leguminous cover crop, which is suited for intercropping in coconut gardens, either alone or in combination with other fodder grasses. The crop controls soil erosion by giving a protective soil cover. It also helps to smother weed growth.

Stylosanthes consists entirely of herbs and small shrubs. Usually they have a crown of growing points near the soil surface. This enables the plants to overcome the excessive damage caused by grazing animals. They have indehiscent. seeds, regulating dormancy. The seed has hooks for dispersal through animals. The seeds can also pass through the digestive system of animals. In some species due to the presence of viscid
hairs, they are not eaten in some seasons of the year. The plant thrives well in light soils due to its deep rooting system.

The crop is suited for growing in wann, humid tropical climate. It is fairly drought resistant and shade tolerant. It can be cultivated in areas receiving less than 1000 mm of rainfall and in less fertile soil, acid soils, gravelly sandy soils and also in ill-drained soils.

In humid tropical environments, S. *gllianensis* thrives very well and can withstand flood and drought lasting for short periods. Germination and growth are favoured at high temperatures.

In less fertile soils like sandy coastal soils, phosphorus fertilizer should also be added along with sowing of seeds so as to help the development of root nodules.

Sowing is to be done with the onset of southwest monsoon during May-June. Irrigation is required if there is no proper soil moisture at the time of sowing.

The following are the perennial types of stylosanthes, ideally suited for growing in the state.

Brazilian lucerne (Stylosanthes gllianensis): This is used as a pasture legume in a number of tropical countries; recently been introduced in the pastures of India. Varieties are usually erect to semi-erect. They are generally not profusely branched at the base. It can grow up to 1.5 m in height, particularly when it gets support from the associate grasses. The trifoliate leaves are long, rather narrow and pointed. The stems are coarse and hairy. In some of the varieties the leaves are sticky. The flowers are small and yellow producing single seeded pods. It does not tolerate. shade and can grow very well in areas receiving 900 to 4000 mm of
rainfall. It is very tolerant to low fertility, but responds well to phosphate and is sensitive to copper deficiency. Stylo seed should not be sown below 7 to 13 mm. A seed rate of 2 kg/ha is usually satisfactory. Although Stylo is usually nodulated by naturally occurring *Rhizobium* strains, these however, will not be as effective as the commercial strains. The main variety commercially grown is Schofield_ This is an erect variety and very late in flowering. Other

varieties are Cook, Endeavour and Graham.

Townsville stylo (Stylosanthes hllmilis): This annual type stylo is also found suitable for growing in Kerala.

Caribbean stylo (Stylosanthes hamata cv. Verano): This is a short-lived perennial leg

legume similar to Townsville stylo. It is slow *growing* and develops a flat crown under grazing. Erect stem may grow up to 80 cm. The stems of Verano are smooth. As against the bristly stems of Townsville stylo it has a line of very fine, short white hairs on one side only. The flowering spike of Verano produces double seeds; the upper has a reduced hook about 3 to 5 mm long, while the lower seed has no hook. Verano combines many of the virtues of both annuals and perennials.

Shrubby Stylo (Stylosanthes scabra): This is a perennial shrub. Its deep root system enables the plant to remain green even in very dry season. The recommended varieties of shrubby stylo are Seca and Fitzroy.

Seeds of stylo are very small. The seed rate is 2 to 3.5 kg/ha when grown as an intercrop in coconut gardens. For grass legume mixtures, 1.5 kg/ha is sufficient. Seeds are soaked in water overnight and mixed with rhizobium culture before sowing.

Prepare a fine seedbed. Seeds are mixed with sand when sown as a pure crop or mixed with grass seeds for mixtures. Seeds are sown broadcast and covered with thin layer of soil or dibbled at a spacing of 30 cm between rows. The depth of sowing should be 5-10 mm. Seeds germinate within a week.

For seed production, the variety Cook can be recommended. A seed rate of 5 kg/ha is better for seed production. Apply phosphorus @ 120 kg and lime @ 375 kg per ha for maximum yield. For seed production, irrigate with 33 mm of water once in 9 days during summer months from January to March. A total of 10 such irrigations are required during the period.

Recommended dose ofN, P2Os and K2O for both annual and perennial stylosanthes are 20, 80 and 30 kg per ha, respectively. For perennial crops, phosphorus @ 80 kg/ha and potash @ 30 kg/ha may be applied in subsequent years. Application of lime @ 375 kg/ha is also recommended in acid soils.

Gap filling may be done 15 days after sowing. First weeding is given 45 days after sowing. A second weeding and hoeing may also be done after the first harvest. Gentle raking of the interspace after the application of fertilizers in the subsequent years may be done.

First harvest is taken 3-4 months after sowing and subsequent harvest at 45 days intervals or according to the growth of the crop. A maximum of 4-5 harvests can be taken in a year for a perennial crop, which will remain in the field for 3 years. The crop yields 25-30 tlha green fodder per year.

FODDER CEREALS FODDER MAIZE *(Zea mays)*

Maize grows best in warm climate where the day temperature is fairly light. Heavy rains and dry hot winds are not suitable. Favourable annual rainfall is 60-100 cm. The crop comes up well in soils with good drainage and fair moisture status.

The optimum season for sowing is the last week of June to second week of July and September to October. The crop can be raised throughout the year in areas where ir

rigation facilities are available. The land is ploughed two or three times and beds and channels are formed. Seeds can be either broadcasted or dibbled at a spacing of 30 cm between rows and 15 cm between plants.

Hybrid varieties are Deccan, Ganga-5, Ganga safed-2, and Ganga-3 and composite variety Vijay.

Seed rate for broadcasting is 80 kg/ha and

for dibbling 40-60 kg/ha (to be dibbled at 5-6 cm depth @ two seeds per hole).

Farm yard manure @ 10 tlha may be ap- . plied at the time of preparation of land as', basal dressing. N, P2Os and K2O at the rate of 120, 60 and 40 kg/ha respectively, may

be given as topdressing. Weeding may be done according to necessity.

First cutting of maize can be taken after 60 days of planting or at the milky stage of the crop., A second cut can also be taken if there is sufficient moisture in the soil.

FODDER SORGHUM *(Sorghum* sp.)

Fodder sorghum is an ideal tropical forage crop. It is fairly drought resistant and suited for areas where moisture is a limiting factor for crop growth. The crop can be raised during both monsoons. All soils except

sandy soils are suited for the crop. Apply N, P2Os and K2O fertilizers at the rate of 60, 40 and 20 kg per ha, respectively. Important varieties are M.P.Chari, MPK V-I, JS-20, S-1O49 and JS-3.