**MODULE 1**

**GRAMINEAE (POACEAE) (10,000 SP.)**

1.0 INTRODUCTION

2.0 OBJECTIVE

3.0 MAIN CONTENT

3.1 Botany of Gramineae

Habit—herbs, rarely woody, as bamboos. They are very widely distributed all over the earth. Stem cylindrical with distinct nodes and internodes (sometimes hollow), called **culm**. **Leaves** simple, alternate, distichous, with sheathing leaf-base which is split open on the side opposite to the leaf-blade; there is a hairy structure at the base of the leaf-blade, called the **ligule**. **Inflorescence** usually a spike or panicle of spikelets (FIG. 74); each spikelet consists of one or few flowers (not exceeding 5), and bears at the base two empty bracts or **glumes**, (G₁; G₀), one placed a little above and opposite the other; a third glume called **lemma** or flowering glume stands opposite glume II; the lemma encloses a flower in its axil; it may have a bristle-like appendage, long or short, known as the **awn**; opposite the flowering glume or lemma there is a somewhat smaller, 2-nerved glume called **palea**. The spikelet may be sessile or stalked. Flowers usually bisexual, sometimes unisexual, monoecious. Perianth represented by 2 or 3 minute scales at the base of the flower, called the **lodicules**; these are regarded as forming the rudimentary perianth. Androecium—stamens 3, sometimes 6 as in rice and bamboo; anthers versatile and pendulous. Gynoecium—carpels generally considered as (3), reduced to 1 (according to some authors) by their fusion or by suppression of 2; ovary superior, 1-celled, with 1 ovule; styles usually 2 (but 3 in bamboos, and 2 fused into 1 in maize, rarely 1), terminal or lateral; stigmas feathery. Fruit a caryopsis. Seed albuminous. Pollination by wind is most common; self-pollination in a few cases, as in wheat. **Floral formula**—<$ PLodicules 2<3A₃₀ré G(3)ₚₙ Gramineae.** FIG. 74. A, spikelet of a grass; B, floral diagram of the same. Gj, first empty glume; Gₙ, second empty glume; FG, flowering glume; P, palea; L, lodicule; stamens and carpels of the florots are apparent.

**Examples.** [The larger genera are: *Panicum* (over 500 sp.), *Digitaria* (over 350 sp.), *Aristida* (over 300 sp.), *Eragrostis* (300 sp.), *Paspalum* (250 sp.), *Poa* (over 200 sp.) *Stipa* (over 200 sp.), *Andropogon* (200 sp.), *Agrostis* (over 150 sp.), *Sporobolus* (150 sp.), ...}
allow production even when the flood waters subside very early, and it manifests dormancy at maturity, thus preventing germination under water if the flood water subsides late. However, because of poor response to nitrogen fertilizer and little resistance to shattering, its yield is not high.

The maturity for rice varieties grown in West Africa ranges from 80 to 200 days and they are classified as short duration (90-120 days), medium (120-150 days) and long (more than 150 days) duration rice. The main types grown are swamp, upland and floating rice.

(i) Swamp Rice

Varieties of swamp rice are grown in mangrove, inland swamps or under irrigation. The recommended varieties with high yields are:


**For Drip Flooded Conditions** D52-37 in Niger, Mali and Senegal; Ebendioulaye and Bentoubala B in Senegal; Oma Rosso and L78-9148 in Ivory Coast; FARO 11iv Nigeria, -and Sigadis, HFG — 98 and Gambiaka Kokum in Mali, WARDA recommends AA8A and Phar Com En.

**For Mangrove Swamp Condition**

ROK5, Mange 2, BD2, CP4, RH and SR26 in Sierra Leone; and SR26 and XA228 in the Gambia. These varieties can be grown on normal farmland with adequate rainfall. The best varieties are Agbede, E-425, Oshodi and OS6 (Ofada) in Nigeria, -Anethoda in Sierra Leone, LAC23 and LAC5 in Liberia, Palawan, OS6, and C21 in Ghana, Moroberekhan, Iguape Cateto and Dourado Precoce in Cote d’Ivoire, - 63-83 and Ikong Pao in Senegal; and Dourado Precoce in Burkina Faso. WARDA recommends IRAT 10,

3.1.2.2 FLOATING RICE

Grows in water which is 1 50 cm or more deep. This type of rice is particularly important in Mali, Niger and Nigeria. The best varieties are Malobadian, Nang Kiew, Khao Gaew and Mali
This is followed by the removal of the trees which are left after the undergrowth has been cleared. The trees can be cut down with an axe or a chain saw. The stumps that are left are uprooted with a hand-operated mechanical winch or a tractor-mounted winch. Uprooting the tree with hand-operated winch is slow, but is much faster than uprooting with a cutlass or an axe. The operation takes about \( \frac{1}{5} \) minutes as compared with half a day if a tree is to be uprooted without the assistance of a which. The tractor-mounted winch accomplishes the task faster, taking a maximum of two minutes.

### 3.1.2.6 TERRESTRIAL OR EARTH WORK

The operations include: land levelling, construction of irrigation canals and construction of bunds.

**Land levelling** The conventional way of levelling is a process whereby the topsoil is first moved, the land then levelled and the top soil moved back with a grader. The levelling is done by man using a hoe or levelling board, small tools or a tractor winch levelling board. The levelling of the land is a tedious, intricate operation. Two types of levelling boards are used. The first type has no skid. This is used to move the land first, as it is able to move more earth than the board leveller with a skid. The board leveller with a skid is used towards the end of the operation, as it moves less, as it acts as a float.

Levelling can also be done by using a power tiller. Many problems have been encountered when using a power tiller at, for example Suakoko, Liberia. For instance, the power tiller sinks in the soil, particularly when there is no hardpan. Similarly, the wheels of the tractor easily get stuck in the mud. Ideally equipment is needed that can float in water. It has been found that in places which are completely flooded, a locally-made drum wheel will assist the power tiller to do a good job. The only disadvantage of this drum wheel is that it is heavy and tends to reduce the mobility of the power tiller.

### 3.1.2.7 CONSTRUCTION OF INFRASTRUCTURE

When the land is completely levelled, irrigation canals are constructed and bunds are made to demarcate the plots. Access roads, bridges, etc. must also be constructed.

**Cost of Development:** Preliminary figures assembled from the Suakoko project in Liberia in 1972-1973 indicate that 192 dollars per 0.4 ha was spent to develop the first plot, while 131 dollars per 0.4 ha was spent on the other plot. The difference in cost of development was due to
3.1.3.3 DISEASES

Loose or open smut: This is a fungus disease which will turn the grains black. Seeds should be treated with copper carbonate to prevent infection. Infected heads should be cut off and burnt before the fungus shed spores. Crop rotation helps to reduce this disease. C Irait or covered

Grain or cover smut: This is the most common fungus disease in West Africa. It attacks individual grains causing spore masses to cover the grains. Treating seeds with Copper carbonate, Fernosan D, minimizes the attack.

Downy mildew: This is another fungus disease causing yellow streaks on the leaves and turning them brown. Infected heads should be burnt.

Weevils: These pests damage stored grains. Control is achieved by fumigating stored grains with D.D. Force.

3.1.3.4 PESTS

Stem borers: these pests can cause serious damage in young plants if the attack is severe. Crop rotation and field sanitation helps to reduce attack. Control may be achieved with Phostoxin.

Birds: Birds are a menace during the period of harvest and efforts should be made to scare them off. Varieties such as BR-100, with resistance to bird damage, should be planted.

Midge Larvae: The larvae of the species can reduce yield by 50 per cent. Control is achieved by planting early or by spraying the crop at flowering or ten days later with 0.8 per cent Sevin mixed at the rate of 43 gm in 4.5 litre of water: 110 litre will spray 2 ha.

Parasitic weeds

Striga spp. These are parasitic plants growing on the roots of guinea corn. They should be weeded out to give a high crop yield.

4.0 Conclusion

5.0 Summary

6.0 Tutor marked assignment

7.0 Referencing and further reading
lomentum (indehiscent). This is the second biggest family among the dicotyledons (being second only to Compositae), with varying characters, and as such it has been divided into the following sub-families: Papilionaceae, Caesalpinieae and Mimoseae (see footnote). The division is primarily based on the characters of the corolla and the stamens (see PIGS. 2-4). All these sub-families are well represented in India. From an economic standpoint this 1

The order Rosales according to Bentham and Hooker and also Engler includes both Rosaceae and Leguminosae; while Hutchinson has separated Leguminosae from Rosales and raised it to the rank of an order with three families—Ca.esalpiniaceae, Mimosaceae and Papilionaceae. It may also be noted that Leguminosae is the biggest family in India.

3.2.1 PULSES (GRAIN LEGUMES)

Cowpea (Vigna sinews or Yijua unijuailala (Walp.)
The cowpea or bean as it is popularly called is indigenous to West Africa. It is an important item in the diet of West Africans, as it is a rich source of plant protein. It is eaten in various ways, either alone or mixed with maize, rice, fish or Bean flour is made into fried cake or boiled cake called . Cowpeas are sometimes grown as cover crops. Because the cowpea is a leguminous plant, it is valuable for improving soil fertility. It plays an important part in crop rotation, and can be dug into the soil when it is green. The major producers of cowpea in Nigeria are the States of Borno, Zamfara and Kaduna.

Cowpea grows best on fertile, loamy soils with a rainfall of 760-1520 mm during the growing months. It grows best in the dry areas of the northern parts of West Africa.

Many varieties are grown in West Africa. They differ in the colour of their seeds which can be either white, black, brown or variously mottled; or in their plant form, which is either dwarf, prostrate, creeping or climbing. In Nigeria the recommended varieties are Mala, Nigeria-67, Ayi, Kwarra,Alabama Black-eye, Prima, Farin Juda C, Kudi and Dinner (FARV-13), while Black-eyed cream seeded variety is recommended in Ghana. A new cowpea variety — Ife brown — was released by the Institute of Agricultural Research and Training (IAR & T), Obafemi Awolowo University, He Ife. It flowers 35 days after planting, is erect and day neutral. It is acceptable to consumers because of its brown, wrinkled seed coat. Dinner is used primarily as a green vegetable. Its succulent green pods are harvested for eating 8 — 10 days from the date of flower opening.
hollyhock (*Althaea rosea*); shade tree: Portia tree (*Thespesia populnea*); other common plants: *Sida cordifolia, S. rhomboidea, Urena lobata, Hibiscus vitifolius* (B. fe H. BAN-KAPAS), Indian mallow (*Abutilon indicum; B. PETARI; H. KANGHI), *Malachra capitata* (B. & H. BAN-BHINDI) and *Malvastrum spicatum*—common weeds of waste places. Family 11 *Sterculiaceae* (*700 sp.—75 sp. in India*)

Habit—shrubs or trees, rarely herbs. Leaves—leaves and stipules are like those of *Malvaceae*. Inflorescence cymose, often complex. Flowers (see FIG. 1/95(7) regular, sometimes zygomorphic, bisexual, rarely unisexual (as in *Sterculia*), hypogynous. Calyx and Corolla as in *Malvaceae*, sometimes corolla absent; no epicalyx. Androecium—stamens usually 5 (but varying from 5-25), typically in two whorls, the outer whorl opposite to sepals and often reduced to staminodes or absent, while the inner whorl opposite to petals, fertile and often branched; all stamens more or less united below into a tube; sometimes on gonophore; an-

**FIBRES**

3.4.1 COTTON (*Gossypium* spp.)

Cotton is a seed fibre whose exact origin is not known. It probably originated in the drier parts or even in the desert areas of the world. Some cotton however is indigenous to Africa. Cotton is an important cash crop in Nigeria, Ghana and Sierra Leone. The two most important commercial cotton species are *G. bisutum* (American Upland Cotton) with relatively short fibre, 1.2-2.5 cm staple length; and *G. barbadense* (Egyptian or Sea Island Cotton) which produces the finest lint (the hairs which grow from the seed coats) with a staple length of 5 cm or more.

Cotton lint is used in the manufacture of textiles. Many textile factories, using mainly locally-produced lint, exist in Nigeria, Ghana and Cote d’ Ivoire. The cotton lint requirement of these factories is so great that ’some West African countries, e.g Nigeria, have become net importers of cotton. Even before the advent of European traders, locally-woven attractive cloths using West African cotton flourished in Nigeria, Ghana and Sierra Leone. The lint was spun into long threads which were dyed, before being woven into ‘Kente or ‘Aso-oke’ cloths. The short hairs, called fuzz or linters, which are removed after further ginning, are used for making cellulose acetate, rayon, carpets and in the manufacture of upholstery.
Cotton seed oil forms about 25 per cent of the seed. It is a semi-drying oil used after refining as cooking oil or in the manufacture of soap and margarine. The residue after oil removal is called cotton seed cake. It contains up to 5 per cent nitrogen and is rich in protein. It can be fed to livestock as a concentrate for milk production or used in the manufacture of nitrogenous fertilizers.

Raw cotton seed contains a poisonous substance called *Gossypol*. It should therefore not be fed to livestock, especially the young ones which are more susceptible to this poisoning.

### 3.4.1.1 CLIMATIC AND SOIL REQUIREMENT

Cotton will grow well on a wide range of soils but is better on fertile, well-drained deep loams and clay loams with pH of 5.7-8.0. Water and nitrogen are two important factors which affect the yield of cotton. Its water requirement varies with the spacing, temperature and soil conditions. It requires little water during the first two months, when its leaf area is small, but its need increases at flowering, reaching a peak some six weeks later. Thereafter, the water requirement declines. Inadequate water supply during the third, fourth and fifth months in the field can lead to premature shedding of leaves, flowers, buds and bolls and to the development of short immature lint. High rainfall is undesirable as it encourages increased disease and pest attack and discoloration of the lint.

### 3.4.1.2 VARIETIES GROWN

Most cotton introduced to West Africa belongs to the short staple American Upland Cotton type. The best known of these is the Alien type from which the improved Nigerian Alien (N.A.) 26C was bred. It is the commercial cotton of the northern areas of Nigeria, has a short fibre and yields up to 560 kg cotton seed per ha on government farms but only 112-224 kg per ha on small farm holdings.

The recommended varieties in Ghana are BJA 592 and Alien 333. Nigerian Ishan (N.I.) is an indigenous cotton with short fibre selected from cotton in the Ishan district of Benin in Edo State of Nigeria. Botanically, it is *G vitifolium*. It is a tall, bushy plant (shrub) with deep yellow flowers and has a longer and silkier fibre than the average locally grown cotton of southern Nigeria, e.g. the Meko type (*G. peruvianum*). It performs better than the Alien type when intercropped.