

CHAPTER-4

Packages of Practices for Production of Different Fodders

Objectives

1. To study the package of practices (sowing time, land preparation, fertilization, irrigation etc.) of common fodder crops.
2. To acquaint with agroforestry system to augment feed resource base.

Introduction

Growing forage crops has several advantages. Forage crops build up fertility of the soil, reclaim alkali soils and increase animal production greatly. Forage production enhances efficiency of crop production, soil and water conservation and proper utilization of land. Growth, reproduction and production are adversely affected when cattle or other ruminants are reared either without green or with poor quality forage even though they may be provided with quality concentrates. Green forages have cooling effect on the body as they are easily digestible, palatable, slightly laxative in action and provide nutrients in most natural form resulting in efficient utilization of the feed. A vast majority of our ruminant livestock thrive mainly on crop residues and naturally growing vegetation. For better growth and production, however, they should be supplemented with cultivated fodders and/or concentrate feeds. However, availability of concentrate feeds is quite low because of low production and high demand for the burgeoning human population. Therefore, the animals compete with the human beings for food items. For more efficient animal production, availability of green fodders round the year is very important. Feeding of good quality green forages can support an animal yielding 10 litres of milk per day.

Commonly grown annual fodder crops: package of practices

A. Gramineous crops

1. Maize

Botanical name : *Zea mays*, Linn.; Family: Poaceae

Maize is also called corn in English and makka/makki in Hindi. Maize is almost an ideal

cereal forage crop because of its quick growing, high yielding, palatability and nutritious qualities. It is one of the most important cereal crops of the world both as food and feed. It can be safely fed at any stage of growth. The crop can be grown round the year with almost uniform yield and herbage quality. Maize is a tall annual, 1.5 to 6 m high. Leaf blades are 30-150 x 5-15 cm. Maize is a cross pollinated plant. The male inflorescence (tassel) is a terminal panicle with the female inflorescence (cob) borne on the leaf axil as an ear. The central axis of the ear (30-40 cm long) called cob is thickened modified stem which bears paired spikelets in longitudinal rows. Grains/kernels are borne in an even number of rows along the length of the cob.

Varieties: Vijay composite, African tall, J-1006, Ganga-5.

Sowing and seed rate: Maize prefers fertile well drained alluvial soil. The normal spacing for forage maize is 25-30 cm between rows and 10-15 cm between plants within the row. The seed rate varies from 40-60 kg/ha. Fodder maize can be grown in mixture with rice bean and cowpea. To check weeds, 2-3 intercultural operations are required up to 30-40 days of growth. The most suitable temperature for germination is 21°C and for growth 32°C.

Fertilization: At sowing time FYM/compost is required @ 10 t/ha. NPK should be given at 90:30:30 kg/ha. Two third of N and full P and K are given at basal dose. Remaining 1/3 N should be given 30 days after sowing. Provision of drainage is must during rainy season.

Irrigation: 4-5 irrigations are required during winter at 10-15 days interval, otherwise it can be raised as rainfed crop.

Harvesting and forage yield: Maize can be harvested at 50-80 days after sowing. As a green fodder, harvesting can be started at tasselling and continues up to wax-ripe stage. After tasselling, CP content goes down. For silage making harvesting should be done at soft dough stage. Green fodder yield could be 300-500 q/ha depending on season and variety. The yield is higher during rainy season. Intercropping with cowpea increases the nutrient yield and also provides fodder of balanced nutrients. After removal of cobs, stovers can be fed to the animals. After harvesting of cobs, partly green stovers can also be used for making silage.

2. Sorghum/jowar

Botanical name: *Sorghum bicolor* (Linn.) Moench.; Family: Poaceae

The forage sorghum is characterized by quick growth, high yield and dry matter content, leafiness, wider adaptability and as material for excellent silage. It can withstand heat and drought better than maize. Sorghum has adapted to wide range of soils except very

sandy ones. It tolerates poor soils and can withstand moderate salinity. A temperature of 25-30°C is required for its best development.

The plant is 5-6 m tall. The leaves are 30-100 cm long and up to 12 cm wide and normally waxy. It is a cross pollinated crop. The inflorescence is a terminal panicle, 8-50 cm long spikelets are borne in pairs. The grain is rounded, pointed and 4-8 mm in diameter.

Varieties: PC-9, PC-6 (single cut), MP Chari (multicut)

Sowing and seed rate: As a rainfed crop sorghum is usually sown from May-August. It is sown by 'Kera' method i.e., by dropping seeds by hand in a furrow. A spacing of 25-30 cm between rows and 10-15 cm between plants with in row is desirable. Seed rate varies from 40-50 kg/ha. Usually seeds are road broadcasted. As fodder, it can be conveniently grown in staggered sowings in different months for cutting and feeding as green fodder. Sorghum is usually sown as a single crop but intercropping with cowpea can also be followed. Sorghum (25 kg/ha) and cowpea (20 kg/ha) may be sown either in crosswise lines or two lines of sorghum alternated with 2 lines of cowpea. The mixture will reduce the DM yield, however, CP content and yield per ha will be higher.

Fertilization: For rainfed crop, FYM is applied at the time of @ 10t/ha. For single cut types, total requirement of nitrogen and phosphorus is 90 and 30 kg/ha. Two third of N and full P is applied as basal dose while 1/3 N is applied 30 days after saving.

Irrigation: Fodder sorghum is often grown as a rainfed crop. However, with irrigation the crop can be grown at any time of the year except winter. During hot dry months, irrigation is given fortnightly. Water stagnation should be prevented in rainy season.

Harvesting and forage yield: The crop should preferably be harvested after flowering but never before 40-50 days from the date of sowing. This is because in the early stages, the fodder contains cyanogenic glycoside called '*dhurrin*' which is toxic to the animals. In water deficit conditions there are more chances of accumulation of *dhurrin* in the plants. On enzymatic hydrolysis, *dhurrin* yields aglycon (methylglucosinolates) which dissociates to hydrogen cyanide and aldehyde in the rumen. Such compounds are toxic and affect the palatability of the fodder. The optimum time for harvesting is, therefore, at or up to 50% flowering with a yield of 300-500 q/ha. Beyond this stage, CP content and digestibility of nutrients declines rapidly but CF content increases. The Ca and P content also decreases. Here, 2 cuts could be obtained with a forage yield of 500-600 q/ha. For silage making, sorghum is harvested at milk or soft dough stage. It can be ensiled along with leguminous crops like cowpea in order to increase CP content. In multicut type (MP chari), first harvest is taken after 2 months and subsequent cuts at 30-40 days intervals. The yield ranged from 550-800 q/ha.

3. Bajra/pearl millet

Botanical name: *Pennisetum americanum* (Linn.) K. Schum. Family: Gramineae

It is a quick growing short duration crop. Plants are erect and 1.8-2.4 m tall. Leaves are long (90-120 cm) and broad (2.5-5 cm) with thick midribs and the margins are serrated. The stem is solid about 2.5 cm thick. The inflorescence is a cylindrical spike densely packed with spikelets. Panicle is spike like and very dense (10-90 cm long). It grows well on light loam and sandy soils.

Cultivars: Avika Bajra Chari, Rajasthan Bajra Chari-2 (RBC-2)

Sowing and seed rate: The seeds are dribbled using a spacing of 30-40 cm between the lines. The seed rate is 8-12 kg/ha. It can be combined with legumes like cowpea, guar etc.

Fertilization: In addition to FYM @ 10-15 t/ha at the time of land preparation, 30 kg N and 20 kg P₂O₅ may be applied as basal dose.

Irrigation: Two or three irrigations are usually sufficient. In the hot season, however, more irrigations may be required. Standing water is harmful, hence avoid waterlogging. It is advisable to give frequent but light irrigation.

Harvesting and fodder yield: The crop is harvested at boot stage or 50% flowering stage (60-70 days). A fresh yield of 250-325 q/ha could be obtained. Two cuts can also be obtained with better yield. Silage can be prepared from bajra fodder. As it contains oxalates, therefore, supplementation with Ca (leguminous fodders, GN cake, dicalcium phosphate) is advocated.

4. Oats/Jai

Botanical name: *Avena sativa* Linn Family: Poaceae

The green forage is well relished by all ruminants and rabbits as well. It can be fed as green forage, silage or hay. It is a *rabi* crop. It requires cold climate and assured irrigation for its good growth. Along with maize, oat can prove to be good fodder resource during winter because the cultivated perennial grasses normally undergo dormancy mainly due to low temperature and moisture scarcity. It can be cultivated as sole or mixed crop with Chinese cabbage.

It is a sub-erect annual growing to height of 1.0-1.5 m producing 5-8 tillers with drooping leaves. Inflorescence is loose and much branched panicle. The spikelets occur at the end of branches. Each spikelet consists of 2 or more flowers.

Varieties: OL-9, Kent, OS-6, OS-108

Sowing and seed rate: It can be sown during Oct.-Nov. For small seeded varieties, a seed rate of 75-80 kg/ha is to be followed while for bold seeded variety like Kent 80-100 kg seed/ha is needed. The spacing between lines may be 25-30 cm. Line sowing is better in order to facilitate weeding. The land must be prepared thoroughly for a fine and firm seed bed.

Fertilization: N-90 kg/ha; P₂O₅-30 kg/ha for single cut (60 kg N as basal and 30 kg N for top dressing). If two cuts are desired, then apply 80 kg N and 40 kg /ha as basal dose and the rest of 40 kg N after the first cut.

Irrigation: 4-6 irrigations at 10-12 days intervals.

Harvesting and forage yield: For single cut, the crop should be harvested at 50% bloom stage. For two cuts, the first should be taken 50 days after sowing followed by second at 50 per cent flowering. In case of single cut, the yield of fresh forage has been recorded to be 300-375q/ha and for two cuts, 250-425 q/ha. It can meet the maintenance requirement of the ruminant when harvested at right time. Oat plants have the tendency to accumulate nitrate particularly under the conditions of heavy nitrogen fertilization, low temperature, cloudy weather and water scarcity. The nitrate is toxic to the ruminants after its conversion to nitrite in the rumen and thus causing asphyxiation. The fodder is highly nutritious and palatable.

B. Leguminous crops

1. Berseem/Egyptian clover

Botanical name: *Trifolium alexandrinum* Linn. Family : Leguminaceae

It is succulent, nutritious, palatable and multicut crop. This fodder is more popular in north India. Longer duration of cool temperature promotes the growth and yield. It has been described as king of the fodders. Apart from being nutritious, the crop has a remarkable capacity to build up soil fertility.

It is an annual low shrubby plant growing 60-90 cm high. The main succulent stem gives off branches terminating in 2-3 leaves. Stems are succulent and hollow. Leaflets are small, oblong, bright, slightly hairy at the upper surface and rounded at extremities. Flower heads are rounded and white. Seeds are yellow to brown.

Varieties: Mescavi, Pusa Giant, BL -1, BL -2, IGFRI-S-54, IGFRI-S-99-1, Jawahar-1.

Sowing and seed rate: A good crop is raised on land which has been properly prepared, leveled and free from weeds. It can grow on all types of soils except very sandy but thrives best on well drained medium loam/clay loam. It requires well drained conditions. Sowing is done from mid October to mid November. The seed is soaked overnight in water and

broadcasted @ 25-30 kg/ha. Rhizobial (*Rhizobium trifoli*) inoculation of seeds is required where berseem was not grown previously. It is often convenient to mix an equal quantity of fine soil with seed to increase the bulk and ensure uniform sowing. Berseem responds well to P application. The seeds are broadcasted in irrigated field.

Manuring: Apply 15-20 tonnes FYM/compost at the time of land preparation preferably 2-3 weeks before sowing. Also apply 25 kg N and 75 kg P₂O₅/ha.

Irrigation: The crop should be irrigated frequently. It requires irrigation after 10-15 days intervals after sowing. 12-15 irrigations are needed.

Harvesting and forage yield: The crop is ready 50-60 days after sowing for first cut. Subsequent cuts are taken after 30-35 days intervals. Watering should be given 10 days before a cutting so that growth can restart immediately after cut without any irrigation. The plant should be cut when about 25-30 cm high. Cutting is done 5-6 cm above the ground. Four to six cuttings could be obtained. The fresh herbage yield is 500-1000 q/ha. It should be fed along with dry roughages like straws. Usual precautions against bloat should be taken.

2. **Lobia/cowpea**

Botanical name: *Vigna unguiculata*, (Linn.) Walp. Family: Leguminaceae

Cowpea is the most important or cultivated leguminous fodder crop in Tripura and has the ability to grow under not-so-severe winter condition of this State. However, the growth is quick during summer and rainy seasons. It can be grown on a wide range of soils from sandy to well drained clay. Proper drainage is required. The leguminous organic residues left after the harvest of the crop enrich the soil fertility. It is adapted to a wide range of soils and performs better at 5-6.5.

Cowpea is an annual bushy, trailing in climbing herb. Stems are 1-3 m long, glabrous but slightly hairy. Inflorescences are axillary on stalks (15-30 cm long). Pods are linear and cylindrical, 10-20 cm long. Leaves are trifoliate. Flowers are usually greenish or yellow.

Varieties: Bundela Lobia-1, Bundela Lobia-2, C-152

Sowing and seed rate: When raised as sole crop, the row to row distance of 30-40 cm and plant to plant distance of 10-15 cm is desirable. A seed rate of 35-40 kg/ha may be followed. Cowpea can be raised along with cereal fodder crops like maize on sorghum or other grasses like napier hybrid. The seed rate is halved (20 kg/ha) when raised with other cereal fodder crops. For better establishment of the crop, 2-3 intercultural operations should be carried out in the initial stages of growth.

Manuring: FYM/ compost is applied @10 t/ha at the time of land preparation. A basal dose of N-20 kg and P₂O₅-40 kg/ha is applied.

Irrigation: Fodder cowpea can be grown at any time of the year provided that irrigation facilities are available. 3-4 irrigations are required during winter otherwise raised as rainfed crop.

Harvesting and fodder yield: It can be harvested at 60-75 days after sowing. Green fodder yield was recorded to be 250-350 q/ha. Fodder cowpea is mainly used for green feeding, however, it can be used for making hay or silage in combination with other cereal fodder crops.

C. Non graminaceous-non leguminous

1. Chinese cabbage

Botanical name: *Brassica pekinensis* (Laur.) Rupr. Family: Crucifereae

It thrives best under cool and moist climate and is a *rabi* crop. It serves as a fast growing catch crop.

Sowing and seed rate: It is sown from mid October to mid December for better results. The seeds are sown at 1.5-2.0 cm depth in lines spaced at 25-30 cm. The seed rate is 6-8 kg/ha.

Manuring: N-40; P₂O₅-40; K₂O-40 kg/ha which could be met using 7.5-10 t FYM/ha.

Irrigation: 4-5 irrigations are required at 10-12 days intervals.

Harvesting and forage yield: The crop can be harvested at 50% flowering stage (50-60 days after sowing). A fresh yield of 200-350 q/ha could be obtained. Herbage yield is increased when grown with oat.

The fodder should not be fed in large quantities for prolonged period. Hungry animals should not be fed this as sole feed particularly on dewy mornings. Otherwise, it may produce symptoms of respiratory, nervous, digestive and urinary disorders or photosensitization to the animals. It should be fed with other grasses or leguminous fodders. As it taints and produces a pungent smell in milk, it should be fed only after milking. Glucosinolates present in the fodder gives a pungent smell and may also hyperthyroidism interfering with iodine utilization.

Agro-forestry including silvipastoral system for augmentation of feed resource base

India has achieved self sufficiency in food production. Now attention is being focused more on the problems of acute shortage of fodder, fuel and other products. Therefore, agro-forestry has vast scope in meeting these requirements. The role of fodder trees and shrubs in providing highly nutritious green fodder is of great significance to livestock

production especially during lean period when grasses are not available or are of very low nutritional value. Therefore, silvipastoral type of agroforestry system is superior in terms of forage production, forage quality and period of forage availability and minimizes the seasonal variation in nutrient availability. Agro-forestry is a blend of forestry and agriculture ecosystems. It is basically a land use system serving two major functions i.e., production and service roles. For production roles, agroforestry is famous for '5F' viz., production of food, fuel, fruits, fodder and fertilizer from the system while for service roles natural resource management is the major one. Out of the total geographical area of the country, 97 million ha is under rainfed agriculture and 200 million ha under degraded lands. Agro-forestry has the ability to conserve soil and moisture and thus prevents land from further degradation.

There are 3 basic components of agroforestry

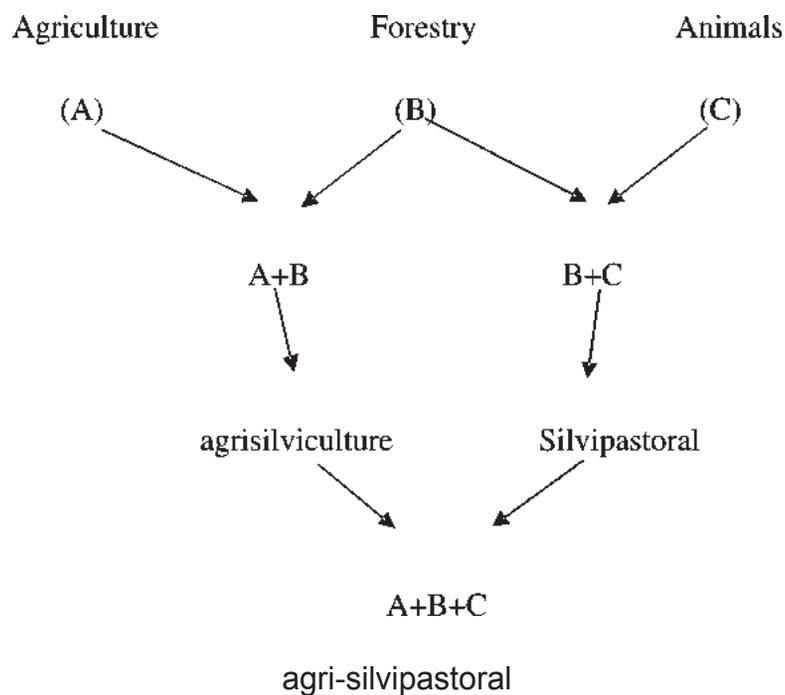


Fig. 4.1. Basic components of a agroforestry

The other systems are: horti silviculture system, agri horticulture system, agri horti silviculture system and multipurpose tree production. The most ideal agro-forestry systems should comprise productivity, sustainability and adaptability.

Agro-forestry can be adopted on agricultural lands (field boundaries, bunds, alongwith farm roads, old fallow lands, site of pump houses, cattle shed), marginal and submarginal wastelands, lands not presently available for cultivation of arable crops etc. The key features of agro-forestry system are:

- Utilization of cultivable wasteland, farmland, use of crop rotation etc. and planting of nitrogen fixing trees to reduce the need for purchasing fertilizer.
- Production of resources to fulfil local as well as national needs by suitable adoption of silvi pastoral, agri silvi pastoral and multi cropping systems.
- Provision of animal feeds / fodders on sustainable basis.
- Suppression of weed growth.
- Recycling of available resources.

Economic rehabilitation of poor farmers by creating perpetual income opportunities through quick and sustained returns from agricultural crops, fruits and vegetables.

Review Questions

1. What are the commonly cultivated forage crops?
2. What is the proper stage of harvesting of forages?
3. Write the forage yield of the crops.
4. What is agroforestry?
5. Explain silvipastoral system of agroforestry.