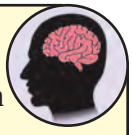
7. FORAGE PRODUCTION

Can you recall ?



1 **Why milk production is low in Indian cattle ?**
2 **Land preparation for fodder crops**
3 **Various seasons for growing different forage crops.**
4 **Different types of forages.**

India stands first in milk production in the world but, the livestock productivity is low as compared to developed countries. Deficiency in feed and fodder is identified as one of the major reason for low productivity of dairy animals in India. The shortages in dry and green fodder by 2020 will be 24.81 and 64.21 per cent compared with the requirements of 630 and 1134 million tons for the current livestock population, respectively. Therefore there is need to increase fodder production to meet nutritional requirement of livestock and for improving their productivity.

Table7.1: Projected demand, supply and fodder deficits in the country (Million tons)

Year	Demand		Supply		Deficit		Deficit as %	
Dry	Dry	Green	Dry	Green	Dry	Green	Dry	Green
2010	589	1061	451	395.2	138	666	23.46	62.76
2015	609	1097	466	400.6	143	686	23.56	63.50
2020	630	1134	473	405.9	157	728	24.81	64.21
2025*	650	1170	488	411.3	162	759	24.92	64.87
2050*	631.0	1012.7	547.7	826.0	83.27	186.6	13.20	18.43

*Figures are projections

Source: Based on Five year Plan Document, Government of India.

The term forages means the plants used for feeding domestic animals. This includes both fodder plants and pastures.

Fodders are the plants which are cultivated as forage crops and they are cut and fed to animals in the stalls whereas pastures are grassess and legumes, grown in pasture lands where the animals are lead to graze them.

Do you know ?

Various forage crops grown in your locality.

7.1 CLASSIFICATION OF FODDER CROPS

Forage crops can be grouped as follows :

1. Cereal forages
2. Leguminous forages
3. Grasses
4. Fodder trees and shrubs

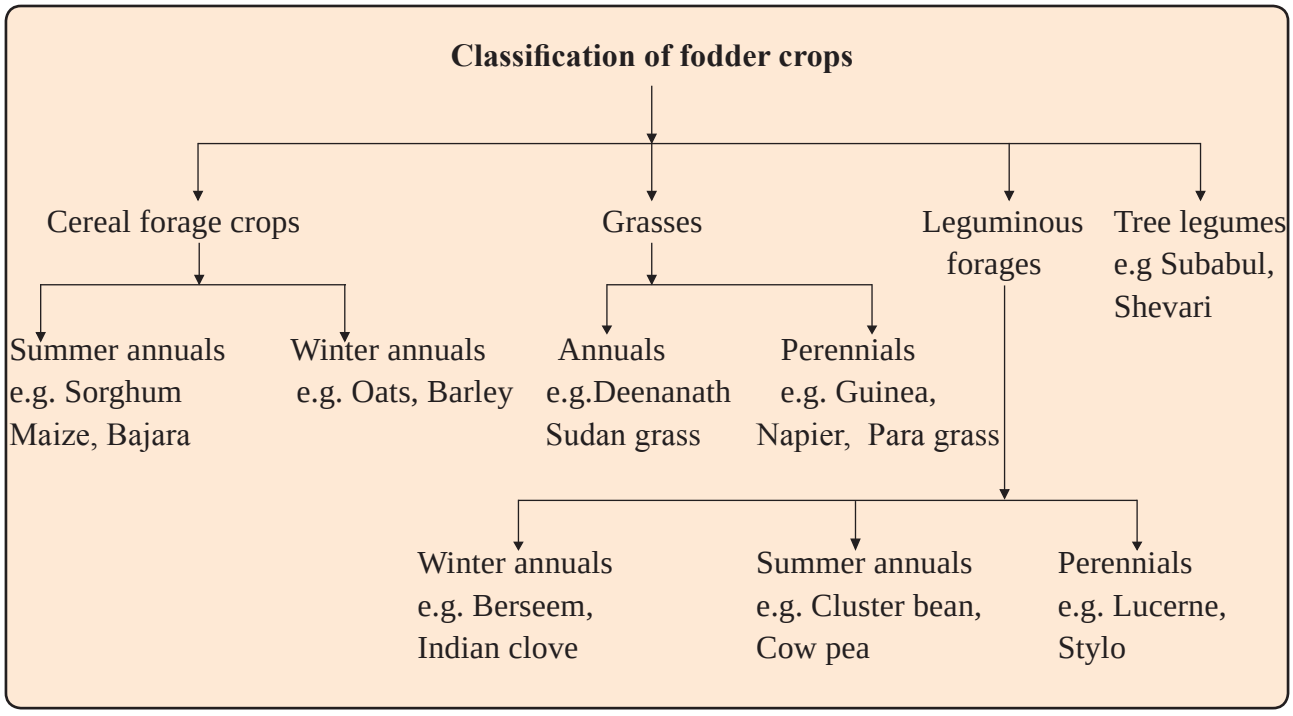


Fig. 7.1 Classification of fodder crops.

7.2 CULTIVATION PRACTICES OF COMMON FODDER CROPS

Fodder crops are the plant species cultivated and harvested for feeding the animals in the form of forage (cut green and fed fresh), silage (preserved under anaerobic condition) and hay (dehydrated green fodder).

7.3.1. Cereal forages

Can you recall ?

Terms viz. cereals, interculturing, manures and harvesting

1. Maize (*Zea mays (L)*)

Maize or corn is one of the cereal crops of the world serving as food for man and forage for cattle. It is fast growing, high yielding, highly nutritious and palatable green fodder. It is rich in carbohydrates. Its feeding stimulates milk production in milch animals. It can be cut and fed at any stage with no risk and therefore it is called as 'king of forage crops.'

Do you know ?

- **Maize is called as the king of fodder crops**
- **Maize fodder contains 9 – 11 % crude protein and 25-35% crude fiber.**

Soil: It can be grown on all kinds of soils with pH 7.5 to 8.5. It requires a good supply of moisture and warmth from germination to flowering.

Land preparation: The soil should be deeply ploughed and harrowed. Before last

harrowing 5-10 tons of Farm Yard Manure (FYM) /ha should be added .

Seeds and sowing: Maize can be cultivated in all three seasons *Kharif, Rabi, Summer* with sowing in June - July, September - October and February – March, respectively. The recommended seed rate is 40-50 kg/ha. Spacing should be 25-30 cm between rows and 10-15 cm between plants.

Fig. 7.2 Maize (*Zea Mays L.*)

Interculturing: The first weeding is given at 20-25 cm height and second weeding at about 60 cm height.

Manures and fertilizers: The crop requires heavy manuring and responds well to fertilizers. At the time of sowing, FYM@5-10 tonnes/ha and N:P:K shall be given @ 100:50:50 kg/ha. One half of N i.e. 50 kg/ha, full P & full K shall be given as a basal dose. The remaining one half of nitrogen shall be given at 30 days after sowing.

Irrigation: Maize is fairly draught tolerant and it can withstand a draught period up to 4-5 weeks. Irrigation is necessary immediately after sowing. Subsequent irrigation shall be given at 10-15 days intervals.

Varieties: African Tall, Ganga-5, Vijay Composite, Manjari Composite, Ganga-3, Ganga safed-2.

Do you know ?

African tall is a the very famous and popular variety of maize fodder.

Harvesting and storage: Cut at teaseling to wax-ripe stage for green fodder purposes. However, for silage making medium dough stage is recommended. Green fodder yield ranges from 40 - 50 tons/ha.

Observe and Record...

The cultivation practices for maize fodder crop.

2. Jowar *(Sorghum bicolor (L)*

Jowar is one of the most important cereal fodder crop of dry-land agriculture. Its grains are used both by both man as food and animals as feed.

Soil : Sorghum can be grown on variety of soils,but medium and deep black soils are suitable. This crop tolerates saline and alkaline conditions to some extent and can also thrive well in acidic soils with pH 5.5

Remember...

Jowar fodder contains 8 - 10 % crude protein and 32 % crude fiber.

Land preparation: Deep ploughing with clod crushing and 2 to 3 harrowings are required.

Seeds and sowing: Sowing is done in June-July, Sept.-Oct. and February-March for *Kharif, Rabi*, and *Summer*, respectively. A seed rate of 6-8 kg/ha is recommended. Spacing usually followed is 25-30 cm between rows and 10-15 cm between plants.

Interculturing:. For early season weed control, apply Attrazine @ 1.0 kg/ha, pre-emergence for broad leaf weed control, 2,4-D can be applied post- emergence by 4-5 weeks @ 0.75-1.0 kg/ha for the parasitic weeds.

Manures and fertilizers: For a rainfed Jowar crop, Farm Yard Manure (F.Y.M.) @ 10 tons/ha and for irrigated crop @25 tons/ha is to be applied 20-25days before sowing. Total requirements of N:P:K is 100:50:40 kg/ha. One half of nitrogen, full phosphorous and full potassium is given as basal dose and remaining one half nitrogen shall be given after 30 days of sowing .

Irrigation: The irrigated crop must be given water at least every fortnight. Usually, five to seven irrigations are required.

Varieties/ cultivars: Ruchira (R.S.-11-4), Maldandi (35-1), Nilwa, M.P. Chari, Pusa Chari, PC-6, PC-9, PC-23, JS-3, S-1049, Phule Amruta, Phule Godhan

Harvesting and storage: Fodder sorghum is very palatable, especially in flowering stage. Harvesting is normally done at 50 percent flowering stage i.e. at 60-75 days. In case of Multicut jowar, first cutting is made after 50-55 days and subsequent cutting after 40-45 days. Yield may be in the range of 35 - 40 tons/ha (single cut) and 100-150 tons/ha (Multicut jowar).

Remember...

The feeding of Jowar up to 45 days from germination is avoided in cattle due to higher content of Hydrocyanic acid (HCN).

Sorghum is one of the best crops for silage because of its high yields, sugar content and juiciness of the stalk. Sorghum is harvested at the milk or soft dough stage for silage making.

7.2.2. Leguminous forages

1. Lucerne *(Medicago sativa (L))*

Lucerne or Alfalfa is considered as the **'Queen'** of fodder crops. It is one of the most important perennial, irrigated, leguminous forage crops of India grown extensively in the R*abi* season.

Do you know ?

1. **Lucerne contains 19 – 22 per cent crude protein and 25.7 per cent crude fiber.**
2. **Saponin, a glycoside, present in lucerne is responsible for bloat.**

Soil: Lucerne is grown under varied range of soil types. It prefers a fertile soil, which is rich in organic matter.

Land preparation: Lucerne needs very fine seed bed as the seeds are small. The required tilts may be obtained by giving one deep ploughing followed by two harrowings and cross planking.

Fig. 7.3 Lucerne (*Medicago sativa (L)*)

Seeds and sowing: The best time of sowing is middle of October to end of November. The seed rate is 12-15 kg/ha. The recommended row to row spacing is 30 cm. Seeds are treated with Rhizobium culture to stimulate the crop for N-fixation

Interculturing: Lucerne is a poor competitor with weeds. In the initial stages, an interculturing especially three weeks after planting, will be effective for controlling weeds.

Manures and fertilizers: FYM @ 25 to 30 tons/ha may be given in the first year, and 10 tons/ha in the later years. Each year NPK fertilizers is given @ 20:150:40 kg/ha before sowing and for vigorous growth every four

months 20 kg N plus 50 Kg P or 100 Kg DAP is given.

Irrigation: The crop responds well to irrigation. A pre-sowing irrigation is necessary for germination. Initially, irrigation is given immediately after sowing and the seed bed is kept continuously moist. The crop requires 15 to 18 irrigations in a year with interval of 12 to 15 days in winter and 8 to 10 days in summer.

Varieties: Anand -1, Anand – 2, Anand-3, Anand-4, Anand-8, Sirsa-8, Sirsa-9, CO1,CO3 and RL 88.

Harvesting and storage : First cutting at flowering stage i.e. 45-60 days after sowing and the subsequent cuttings every 25-35 days interval. Annual total green fodder yield is 80-100 tons/ha from 10-12 cuttings.

Observe and Record...

The cultivation practices for lucerne fodder crop.

2. Berseem (*Trifolium alexandrinum (L)*)

Berseem is leguminous forage crop grown as *rabi* crop. It is highly nutritious, succulent and palatable. It is high in crude protein (20-24%) and low in carbohydrates.

Remember...

- **In Maharashtra berseem is called as "Horse grass"**
- **The best sowing time for berseem is the first fortnight of October.**
- **Berseem contains 17 - 19 % crude protein and 27.7 % crude fiber.**

Soil: The soil must be well drained. Clay loam soil rich in calcium and phosphorus are the best soil types for this crop.

Land preparation: Fine seed bed is required as berseem seed is very small. After harvest of *Kharif* crop, 3 to 4 ploughings followed by planking for breaking the clods and leveling the surface are recommended.

Seeds and sowing: Seed rate usually used is 25- 30 kg/ha. Seed treatment with *Rhizobium* strain may be made before sowing. To eliminate chicory in berseem crop, the seed should be poured in one per cent common salt solution and the floating chicory seeds should be taken out and berseem seed is cleaned with fresh water, dried under shade and then sown. The best time for sowing is the first fortnight of October. The recommended row to row spacing is 30 cm.

Fig. 7.4 Berseem (*Trifolium alexandrinum (L)*)

Interculturing: Generally 2 to 3 weedings are sufficient. Shallow hoeing may be necessary to facilitate better development of crop. Chicory is a problematic weed in berseem. Therefore, efforts should be taken to eliminate this weed.

Manures and fertilizers: FYM is to be applied @ 10-15 tons/ha. NPK fertilizers @ 20:80:40 kg/ha and @ 20kgN/ha at each cutting.

Irrigation: Entire crop needs 10-12 irrigations with interval of 10 days in October and 15 to 20 days during November to January.

Varieties: Mascavi, Wardan -4, JB-1, JHB-146

Harvesting and storage: The first cut can be taken at 50-60 days after sowing and subsequent cuttings after every 30-35 days. It yields 60 - 80 tons green fodder/ha.

Observe and Record

Is berseem fodder crop grown in your area ?

3. Cowpea (*Vigna sinensis (L)*)

Cowpea is an important leguminous pulse crop of high protein content, which can be grown as fodder crop. Cowpea is a quick growing crop, which produces tremendous quantity of bulk in short span of time. Therefore, it is esteemed as a valuable catch crop as fodder.

Do you know ?

- **Cowpea has very good feeding value as it contains 13 - 15 % crude protein.**
- **Cowpea fodder is cultivated as sole and mix crop.**
- **Cow pea is valuable catch crop for fodder.**

Soil: Cowpea can be grown on wide range of soils from sandy to well drained clays. It adapts to a wide range of pH, but prefers slightly acid to slightly alkaline soils usually with a pH range of 5 to 6.5.

Fig. 7.5 Cowpea (*Vigna sinensis (L)*.)

Land preparation: Two or three ploughings are given to produce a coarse seedbed for the crop.

Seeds and sowing: The seeds can be broadcasted, drilled or dibbled in lines. Seed rate recommended is 40 kg/ha. Typically, a row to row distance of 30 to 40 cm and plant to plant distance of 10 to 15 cm is essential. The proper sowing time is June to August.

Interculturing: Trifluralin may be applied to soil @ 0.75 kg/ha. 6-8 days before sowing. One or two weedings may be required in early growth stages to control weed problems.

Manures and fertilizers: FYM @ 10 tonnes/ha, 20 kg N and 40 kg P shall be given before sowing. Cowpea responds favorably to calcium where the pH is low.

Irrigation: A pre-sowing irrigation is important for the proper germination of the crop. If soil moisture is deficient, shallow irrigation at 3-4 cm depth once in 15 days during summer and once in a month during post monsoon period be given.

Varieties: EC 4216, *Sweta* (No-998) U.P.C -625, *Bundel lobia 2*, CO-8

Harvesting and storage: The first cutting can be given at about 50-60 days (50% flowering stage). A green fodder yield is about 40 tons/ha annually.

Observe and Record...

The cultivation practices for cowpea as a fodder crop.

7.2.3. Grasses

1. Hybrid napier (*Pennisetum purpureum x P.americanum)*

Napier grass is a native of Zimbabwe in tropical Africa. It is a tall clumped grass with thick growth, which gives the name elephant grass. Its peculiarity is its high forage yield.

Hybrid Napier is superior in quality than Napier grass and usually contains about 10.2 per cent crude protein and 30.5 per cent crude fiber.

Soil: Napier grass can be grown on a variety of soils. However, sandy loams to clay loams are preferred. Deep fertile soil, rich in organic matter and nutrients are ideal. Water logged and flood prone areas are not suitable. It can tolerate a pH ranging from 5 to 8.

Land preparation: Three to four ploughings followed by a harrowing are required. Add FYM @20 to 30 tons/ha before a month of planting.

Fig. 7.6 Hybrid Napier (*Pennisetum purpureum x P.americanum)*

Seeds and sowing: In *kharif* planting time is July to August and during summer it is February to March. It is planted with rooted stubbles of previous crops having three buds. It is planted with 2 buds below and 1 bud above the soil. The recommended spacing is 90 x 60 cm.

Inter culturing: Weeding and inter-cultivation is required in the early stages. Initially inter cultivation once or twice is necessary for better development. Later on inter cultivation may be given as and when necessary after harvest to stir the soil and to control weeds.

Manures and fertilizers: FYM or compost @ 25 tons/ha at the time of land preparation. As the grass is a heavy yielder, it responds well to nitrogen application. NPK required is 50:40:20 kg/ha. Nitrogen @ 25 kg/ ha is given after each cutting.

Irrigation: If sufficient rains are not received, about two irrigations are required for the development. During the summer regular irrigation at weekly or fortnightly interval depending on soil types is required.

Varieties: Co-1, Co-2, Co-3, DHN-6, Gajraj and Phule Yashwant, Phule Jaywant (R.B.N. -13), Phule Gunvant are some of the varieties recommended

Can you tell ?

Improved varieties of Hybrid napier cultivated in you locality.

Harvesting and storage : Hybrid Napier is commonly used in a cut and carry system. The crop will be ready for the first harvest by 75 days after planting. Subsequent cuts can be given at an interval of 30-45 days or when the plants attain a height of 1.5m. Annual green fodder yield is 200 - 250 tons/ha within 8 cuttings and near about 20-25 tons during fist cutting.

2. Marvel Grass (*Dichanthium annulatum***)**

Observe and Record...

The cultivation practices for hybrid napier as a fodder crop.

Marvel grass is an important monocot forage crop from family poaceae. It is grown for pasture purpose. It contains 6.5 to 7.5 % protein.

Soil : Marvel is grown under light to medium soil in rainfed condition while in irrigated condition it is grown in light ,medium fertile and well drained soil.

Land preparation : Marvel grass needs well pulverized soil. The required tilth may be obtained by one ploughing and one harrowing both in irrigated and rainfed conditions.

Seeds and sowing: In rainfed condition grown only in *Kharif* season and in irrigated condition grown in both kharif and summer season.

Rainfed –June to August Irrigated – Kharif - June to August Summer: February to March

Fig. 7.6 Marvel Grass
(*Dichanthium annulatum*) *(L)*.)

Seed requirement is 75000 sets per ha for rainfed as well as irrigated condition. The recommended spacing is 45 × 30 cm.

Interculturing: Only one weeding is required for rainfed condition and 1 or 2 weedings for irrigated condition.

Manures and fertilizers : Rainfed: FYM @ 5-10 tons per ha may be given . 30 Kg N , 30 Kg P and 20 Kg K should be applied before sowing. After every harvesting 30 Kg N is given.

Irrigated: 10-15 tons FYM per ha may be given. 30:40 : 20 Kg NPK before sowing and 30 Kg N after every harvesting should be applied .

Irrigation: In *Kharif* irrigation is not required, however, in summer it is given with 10-15 days interval.

Varieties: Phule marvel 06-40, Phule marvel -1(rainfed), Phule gowardhan (irrigated)

Harvesting: Only 2 cuttings should be done in rainfed condition while 6-8 cuttings in irrigated condition. First cutting should be done at 50-60 days after sowing and the subsequent cuttings at 45 days interval.

Yield: Rainfed : Green fodder 350-450 qtl /ha/year. Irrigated : Green fodder 600-700 qtl per ha per year.

Can you tell ?

1 **Crude protein content in marvel grass?**

2 **Whether marvel grass is cultivated in your area.**

3. Stylo (*Stylo hemmata*)

Stylo is an important perennial leguminous forage crop. It contains 12-14% protein.

Soil- Stylo is grown under light to medium and well drained soil.

Land preparation: The required tilth may be obtained by one ploughing and one harrowing.

Fig. 7.7 Stylo (*Stylo hemmata*)

Seeds and sowing: Sowing is done in *Kharif* season (June-July). Sowing can be done by drilling method at 30 cm distance or broadcasting method. Seed should not be covered by soil. 10 kg seed is required for 1 ha. Seed should be treated with *Rhizobium* @ 250 gm/10 kg seed before sowing.

Interculturing: Only one weeding is required.

Manure and Fertilizers: 20:40:20 kg NPK/ha before sowing and in the month of July-August 50 kg P/ha is given at every year.

Irrigation: Water is given as per the crop need.

Varieties: Phule Kranti

Harvesting: Two cuttings per year should be done.

Yield: Green fodder yield is 250 to 300 qtl/ha anually.

Observe and Record...

The cultivation practices for stylo fodder crop.

7.2.4 Fodder trees and shrubs

1. Subabul (*Leucaena leucocephala)*

Subabul is the most well known perennial legume tree in the world. It is draught resistant because of its very deep root system. It tolerates large differences or variations in rainfall, sunlight, salinity compared to other legumes. It is grown in many countries as a good source of organic manure. The wood is used as firewood and for timber purposes.

Fig. 7.9 Subabul (*Leucaena leucocephala*)

It is highly palatable and nutritious.. The leaves and seed contain uncommon amino acids, a glycoside called 'Mimosine' which is toxic to non-ruminants and its continuous feeding to ruminants results into alopecia.

Soil: Subabul is not very specific in its soil requirements, but flourishes in deep well drained neutral soils.

Land preparation: Land is prepared with help of deep ploughing and the clod crushing.

Seeds and sowing: Usual seed rate is 5-6 kg/ha. Seeds are soaked in hot water overnight and planted at 1 m x 1 m spacing. Planting is preferred in June to August.

Interculturing: Weeding or weed control is necessary during initial stages of establishment. During first three months of planting, two or three inter cultivations are needed to control weeds. Once developed, no further weeding is required.

Manures and fertilizers: Organic manures such as compost and farm yard manure (FYM) shall be applied @ 8 to 10 tons/ha before planting. A basal application of NPK @ 25:60:40 kg/ha is required.

Irrigation management: During monsoon season there is no need of water but during summer season irrigation and its interval is most important.

Varieties: Hawaiian type(K341).Salvador type(K-8) , Subabul CO-1(P),FD 1423

Harvesting: Normally first cutting is made at five to six months after planting and subsequent cuts can be made at 50-60 days interval depending on regrowth. It is commonly done at about 100 cm height.

Yield: Green fodder yield is 40-50 tons / ha annually.

Can you tell ?

Why subabul leaves and seeds are not given to ruminants continuously?

2. Dasharath (*Desmanthus virgatus*)

It is perennial crop. It contains 11-12 % Protein. It is grown throughout the year under irrigation and during June-October as rainfed crop.

Soil: All types of soils particularly well drained, light to medium are preferred.

Fig.7.9 Dasharath (*Desmanthus virgatus*)

Land preparation : Land is prepared with the help of deep ploughing and two harrowings.

Seeds and sowing: Dashrath is sown in the month of June-July(*Kharif* season). Usual seed rate is 15 kg/ha. Spacing required is 60-100 cm.

Manures and fertilizers: Organic manures such as compost and farm yard manure (FYM) shall be applied @ 8 to 10 tons/ha. NPK is applied @ 20:20:50 kg/ha.

Varieties: CO-5, Russian giant, EC-4216, UPC-287

Harvesting:4-5 cuttings per year be done.

Yield: Green fodder- 55 – 60 tons/year.

Observe and Record...

Different types of trees used for livestock feeding

3. Shevari (*Sesbania grandiflora*)

Shevari tree grows throughout the year even in less fertile and saline soils.It is drought resistant, fast growing tree suitable for all livestock. It contains 25% protein. It must constitute only 8-10% of the feed.

Soil: All types of soil especially well drained medium soil is good for cultivation.

Land preparation : Land is prepared with the help of deep ploughing and two harrowings.

Do you know ?

Shevari is highly preferred by small ruminants as a feed.

Fig.7.10 Shevari (*Sesbania grandiflora*)

Seeds and sowing: Shevari is planted preferably in the months of June-July (*Kharif* season). About 7.5-8.0 kg seed /ha is planted at 1m x 1 m spacing.

Manures and fertilizers: Organic manures such as farm yard manure (FYM) shall be applied @ 20 to 25 tons/ha before planting. NPK is applied @ 20:50:20 kg/ha.

Varieties: Local variety

Harvesting: First cutting is done at 5-6 months and subsequent cuttings are made after every 50-60 days.

Yield: Green fodder yield is 50 – 60 tons annually.

Observe and Record...

1. **The cultivation practices for Shevari fodder crop.**
2. **Identify and classify different fodder crops grown in your area.**
3. **Prepare the album of various fodder crops available in your region.**

7.4 Azolla Production

Azolla is a floating fern and belongs to the family of Azollaceae. Azolla hosts symbiotic blue green algae, *Azolla pinnata,* which is responsible for the fixation and assimilation of atmospheric nitrogen. It is rich in essential amino acids, vitamins (vitamin A, vitamin B12 and Beta-Carotene), growth promoter intermediaries and minerals like calcium, phosphorous, potassium, ferrous, copper, magnesium etc.

Fig.7.12 Azolla Production

Table 7.2 : Nutritive value of Azolla

Dry matter	Crude protein	Crude fibre	Calcium	Phosphrous
4.7%	22.48%	14.7%	1.64%	0.34%

Procedure

The following method suggested by Natural Resources Development Project (NARDEP) may be followed for its production.

1. Dig or build a pit preferably of 2 x 2 x 0.2m.
2. Cover the pit with polythene sheet to avoid percolation of water from pit.
3. All corners of the pit should be at the same level so that a uniform water level in the pit can be maintained.
4. Mix about 10 – 15 kg of sieved fertile soil in sufficient quantity of water and spread on polythene sheet.
5. Make slurry of 2 kg cow dung and 30 g of super phosphate in 10 litres of water and pour on the sheet. Pour more water to raise the water level to about 10 cm.
6. Place about 0.5–1 kg of fresh and pure culture of *Azolla* in the water. This will grow rapidly and fill the pit within 10–15 days.
7. From then on, 2 to 2.5 kg fresh *Azolla* can be harvested daily. A mixture of 20 g of super phosphate and about 1 kg of cow dung should be added once every 5 days in order to maintain rapid multiplication of the *Azolla* and to maintain the daily yield of 500 g.
8. Harvest the floating Azolla plants from pit using a scoop net to drain the water.

Remember...

- **Temperature should be around 35°C.**
- **The fodder plot is to be covered with a plastic sheet in cold regions so as to reduce the impact of cold weather.**
- **Places with adequate sunlight should be preferred (under the shade of a tree/ green shed net)**
- **pH of the medium should be between 5.5 to 7.0**

Preparing Azolla as livestock feed

- For use as a livestock feed, the fresh Azolla should be mixed with commercial feed in 1:1 ratio to feed livestock. After a fortnight of feeding on Azolla mixed with concentrate, livestock may fed with Azolla without added concentrate.
- For poultry, Azolla can be fed to egg layers as well as broilers.
- In case of severe pest attack the best option is to empty the entire bed and lay out a fresh bed in a different location.

Observe and Record...

The cultivation practices for Azolla production.

Q.1 Fill the blanks

1. Immature Jowar plan contains ..... toxin.
2. .....is the king of forage crop.
3. ..... crop is called as 'Queen' of forage crops.
4. In Maharashtra berseem is called as .....
5. .....is the popular variety of stylo.

Q.2 Make the pairs

Group A	Group B
1. Saponin	a. Shweta (No-998)
2. *Medicago sativa*	b. Perennial legume tree
3. Maize	c . Queen of fodder
4. Lucerne	d. Summer annuals
5. Subabul	e. Cereal forage crop
	f. Lucerne
	g. Responsible for bloat

Q.3 Identify the odd one out

1. DHN6, CO-1, CO-2, C0-3, Mascavi.
2. Jowar, Maize, Bajara, Oats, Subabul.
3. Anand-1, Anand-2, Anand-3, Anand-4, Anand-5.
4. M.P. Chari, PUSA Chari, Maldandi, Nilwa, CSH-1.
5. Lucerne, Berseem, Cowpea, Stylo, Jowar.

Q.4 State true or false

1. Sorghum is the cereal forage crop.
2. Deficiency of feed and fodder is identified as one of the major constraints in achieving desired level of livestock productivity in India.
3. Hybrid napier is also called as elephant grass.
4. Phule gowardhan is the variety of stylo grass.
5. Maldandi is the variety of Jowar.

Q.5 Answer in brief

1. Why maize is called as king of forage crops ?
2. Write the seed rate and sowing of lucerne.
3. Why the harvesting of jowar fodder is normally done at flowering stage?
4. Why the cow pea is considered as valuable catch crop fodder?
5. Write the soil and climatic conditions required for berseem.

Q.6 Answer the following questions

1. Complete the following table

Sr. No.	Name of the forage crop	% crude protein	% crude fiber
1	Maize		
2	Jowar		
3	Lucerne		
4	Berseem		

Q.7 Answer the following questions

1. Describe in detail the common cultivation practices of maize.
2. Describe in detail the common cultivation practices of Jowar.
3. Discuss in detail the cultivation practices of Lucerne.
4. Explain in detail the cultivation practices of Azolla production.