
Green Manuring

Green manuring can be defined as the growth of a crop for the specific purpose of incorporating it into soil while green, or soon after maturity with a view to improving the soil and benefiting subsequent crops or Practice of ploughing or turning in to the soil un decomposed green plant tissues for the purpose of improving physical condition as well as fertility of the soil.

Objectives of green manuring:

1. Increasing organic matter content of soil
2. Maintain and improve soil structure
3. Reduce the loss of nutrients, particularly nitrogen
4. Provide a source of nitrogen for the following crop
5. Reduce the soil loss by erosion

Types of green manuring:

The practice of green manuring is adopted in various ways in different states of India to suit soil and climatic conditions. Broadly speaking, the following two types of green manuring can be differentiated.

Classification of Green manuring: Classified into two groups as

I. Green manure *in situ*

II. Green leaf manuring

I. Green manuring *in situ*:

In this system, green manure crops are grown and buried in the same field which is to be green-manured, either as a pure crop or as intercrop with the main crop. This is most common green manure crops grown under this system are sunnhemp (*Crotalaria juncea*), daincha (*Sesabania aculeata*), Pillipesera (*Phaseolus trilobus*) and guar (*Cyamopsis tetragonoloba*).

The green manure crops are mostly legumes, which are fast growing and yield substantial succulent vegetation. There is little or no preparatory cultivation. Sowing is effected by broad cast adopting a heavy seed rate. Green manuring can be safely adopted for irrigated and irrigated dry crops viz., rice, sugarcane, tuber crops, vegetables and orchards. In case of dry crops it is unsafe because of limiting moisture. But when rains are sufficient and evenly distributed green manuring could be followed even under rain fed conditions when the rain fall is above 900 mm (Application of lime is suggested to neutralize organic acids that are formed during decomposition Bone meal preferred).

Green manure crops:

Sunnhemp (*Crotalaria juncea*):

1. It is a unique crop possessing, fiber, fodder and green manurial value with nutrient composition of 2.3 % N, 0.2 % P and 1.4 % K.
2. It can be raised beneficially for irrigated dry conditions
3. Under high rain fall conditions it is grown in dry lands
4. Grown in medium fertile soils
5. Seed rate is 45 kg ha⁻¹
6. Green matter yield 9-17 tonnes ha⁻¹

Daincha (*Sesbania aculeata*) and (*Sesbania speciosa*)

1. They are erect growing deep rooted crops and useful to open soil and improve drainage in heavy soils.
2. Nutrient composition (%) [3.5N,0.3P and 1.0K]
3. These crops are grown on heavy soils
4. They are non fodder crops and non palatable
5. They correct sodic soils specially *S. speciosa* as it is less woody and less fibrous ,which gives heavy foliage and easily decomposable
6. Seed rate 30 kg ha⁻¹
7. Yield 5 tonnes ha⁻¹
8. Seeds require scarification for easy germination (Scarification means lightly pounding with sand).

Indigo (*Indigofera tinctoria*):

1. Slow growing, deep rooted drought resistant crop
2. It is not relished by cattle
3. Can be grown in fruit gardens and plantations during non –monsoon
4. Seed rate is 20 kg ha⁻¹
5. Yield is 5 tonnes ha⁻¹

Wild indigo (*Tephrosia purpurea*)

1. It is suited for hard coarse gravelly textured soil and poor soils.
2. It is used as a green leaf manure also
3. Self grown crop when sown once
4. Suitable for unirrigated orchards like mango, sapota
5. Nutrient composition (%) crop : 1.8N , 0.1 P and 0.3 K ; leaf : 3.2 N, 0.1 P and 1.2 K

Pillipesara (*Phaseolus trilobus*)

1. Regular green manure , minor pulse crop and fodder crop (triple purpose crop)
2. Popular green manure crop for black and alluvial soils
3. It has good ratooning capacity
4. The crop could be incorporated in to the soil after two cuttings for fodder
5. Yield : 3-5 tonnes ha⁻¹
6. Seed rate : 35 kg ha⁻¹
7. Chemical composition (%): 3 N,0.1 P and 0.3 K

Horse gram (*Dolichus biflorus*)

It is suitable as green manure crop for poor and hard soils. It can also with stands drought. Seed rate is 35 kg ha⁻¹ and yield a green matter of 3.5tonnes ha⁻¹

II. Green leaf manuring:

Green leaf manuring refers to turning into the soil green leaves and tender twigs collected from shrubs and trees grown on bunds ,waste lands and near by forest areas. The common shrubs and trees used are Glyricidia, *Sesbania speciosa*, Karanj (*Pongamia pinnata*) etc.,

Plants used as a source of green leaf manure are as follows

Scientific name

Aeschynomene aspera

Azolla filiculoides
Azolla pinnata
Calotropis gigantea
Cassia auriculata
Cassia siamea
Cyamopsis tetragonoloba
Ipomea carnea
Glyricidia maculata
Leucaena leucocephala
Pongamia glabra
Sesbania rostrata
Sesbania cannabina
Tephrosia purpurea
Tinctonia diversiflora

Advantages of green manuring (*in situ*):

1. Green manure crops can be chosen to suit the soil, season, water facility and cropping pattern
2. Reduces expenditure on collection and transportation of green leaf
3. It is easy to incorporate the green manure crop in right time
4. It reduces the loss of nitrogen from the soil

Limitations of green manure crops (*in situ*)

1. There must be sufficient time available for growing the green manure crop, nearly 2-3 months
2. Extra expenditure has to be incurred for growing green manure crop
3. Some of the green manure crops are of fodder value, they are liable for cattle tress pass
4. They are susceptible for pests and diseases as such they may harbour them as alternate hosts.
5. Need timely rainfall or irrigation etc., for growing
6. Seeds may not be available in time

Advantages of green leaf manuring:

1. All the quantity of green leaf applied is entirely an addition to soil –neither the moisture nor nutrients are utilized from the soil
2. There is no fear of spread of pests and diseases
3. It can be adopted at any time irrespective of the season

Limitations of green leaf manuring:

1. The green leaf is not available every where except in forest regions and waste lands
2. Green leaf which ever is available has to be used without choice
3. Green leaf may not be available sufficient quantity in all seasons
4. Extra expenditure on collection and transport has to be incurred

Criteria for green manure crop:

1. Capacity to fix atmospheric N in good amounts in symbiosis with micro organisms
2. Plethorcity of vegetative growth (heavy foliage)
3. Succulent vegetation with limited fibrous material
4. Deep root system to open the soil-for recycling of nutrients

5. Short duration with maximum and faster vegetative growth.

Advantages of leguminous crops:

Legumes have the capacity to fix nitrogen and generally decompose more easily than others. Legumes come up better in poor soils where non-leguminous may fail to put satisfactory growth.

Organic materials act as binding agents:

Organic materials acts as binding materials for holding soil particles as aggregates. There are three groups of binding agents as identified by TISDELL and OADES (1981)

1. Transient binding agents: These are plant and microbial products, rapidly decomposed, having more polysaccharides. They are produced by plant roots as mucigel or by bacteria as extra cellular components
2. Temporary binding agents: Fine plant root and fungal hyphae, mycorrhizal hyphae. They accumulate in soil over a period of time and persist for months or even years.
3. Persistent binding agents: Microbially resistant humic polymers derived from decomposition of plant residues, bacterial cells and fungal hyphae associated with Fe and Al in soils.