



ROLE OF GREEN MANURING IN SOIL HEALTH MANAGEMENT

Dr. Kiran K. Khokhar,
 DES, (Soil Science), Incharge, Regional Soil Testing Laboratory, KVK, Karnal
 Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana

Green manuring is the practice of ploughing and turning into the soil, the undecomposed green plant tissue for the purpose of improving soil fertility and productivity. It increases the soil fertility by direct addition of nitrogen to the soil through symbiosis and it also improves the soil structure, water holding capacity and microbial population of soil by addition of humus or organic matter. Dhaincha (*Sesbania aculeata*) is the most commonly used green manure among the farmers, although cultivation of sun-hemp and guar is also in vogue. Leguminous crops should be preferred as a green manure crop since it adds a lot of nitrogen into soil due to Rhizobium symbiosis. Incorporation of leguminous crop producing 8 to 25 tons of green matter per hectare will add up about 60 to 90 kg of N/ha, which is equivalent to application of three to ten tones of farmyard manure on the basis of organic matter and its nitrogen contribution. Crops which are most commonly used for green manuring in our country are Dhaincha (*Sesbania aculeata*), Sunn hemp (*Crotalaria juncea*), senji (*Melilotus parviflora*), berseem (*Trifolium alexandrinum*) etc. Sunn hemp is dominant among green manure crops and is well suited in almost all parts of the country; it also fits in well with the sugarcane, potato, garden crops and the second season paddy in southern India and with irrigated wheat in the north. Dhaincha as a green manure crop does well performs well in the waterlogged and alkaline soils.

Biomass production and N accumulation of green manure crops

Crop	Incorporation Age (Days)	Dry matter (t/ha)	N accumulated (kg/ha)
<i>Sesbania aculeata</i>	60	23.2	133
Sunn hemp	60	30.6	134
Cow pea	60	23.2	74
<i>Pillipesara</i>	60	25.0	102
Cluster bean	50	3.2	91
<i>Sesbania rostrata</i>	50	5.0	96

Characteristics of an ideal green manure crop:

An ideal green manure crop should have following characteristics:

1. It must have deep rooting system, facilitating nutrient mining from subsurface soil.
2. They should have less nutrient requirement so that the main crop does not face the deficiency of nutrients.
3. They should have quick growth so that abundant biomass is produced
4. They should have less water requirement so that it does not compete with the main field crop for water uptake.
5. The biomass produced should have low fibrous material to facilitate quick decomposition.
6. Most preferably we must prefer leguminous green manure crop so that they may facilitate atmospheric N fixation.
7. It should produce more biomass so that more organic matter and more organic acids can be produced in the soil after the decomposition.



Some important facts to be kept in mind while taking a green manure crops:

1. The green manure crop should be sown in the month of April-May and they must be ploughed down in the June.
2. Mostly higher seed rate is recommended for green manure crops.
3. Green crops should be incorporated into the field at the stage just before the flowering which is mostly at the age of 6-7 weeks. The time interval between the incorporation of green crops in the main field and the sowing of the succeeding crop depends on the weather conditions of the area and the nature of buried material. Mainly warm and humid weather is more favorable for the decomposition of the green crops.
4. Sunnhemp and dhaincha are suitable for growing in April-May and can be buried in June-July before planting of main kharif crop.
5. Rhizobium species has the capacity to fix the nitrogen into the soil according to the nutrient demand of the plant.

Important Green Manuring Crops:

Green manuring crop must grow rapidly on varieties of soil and must decompose quickly enough to release the nutrients they contain in the soluble form, for the growth of crops.

A few most important green manure crops are as follows:

(i) Sunn hemp (*Crotalaria juncea*):

Sunn hemp is most suitable green manure crop for loamy soils. It is sown in May or June when the monsoon breaks. It grows very fast and attains a height of one to two metres. It can grow even on poor soils and add about 20 to 25 tons of fresh green plant material per hectare to the soil. Sunnhemp is the most outstanding green manure crop. It is well suited to almost all parts of India and can be accommodated in the growing seasons of sugarcane, potato and garden crop, irrigated wheat in north India and second season paddy crop in South India.

(ii) Dhaincha (*Sesbania aculeate*):

It can tolerate water logging, salinity and dry

conditions if the germination has been good. It grows up to a height of 1.5 to 1.8 meters in water logged paddy fields within a very short period of time. It is best suited for loamy or clayey soils where it adds about 10 to 20 tons of green material per hectare.

(iii) Moong (*Vigna radiata*):

Moong which is sown in the first week of July matures and yields about 3 to 4 quintals of seed per hectare by the first week of September. After picking the pods, the crop is ploughed down as green manure and wheat may be sown in the first week of November.

(iv) Gaur (*Cyamopsis tetragonoloba*):

It is a good fodder cum green manuring crop in the dry regions of north-western India where it grows even on poor soils.

(v) Other pulse crops like horse gram, cowpea etc. can also be grown as green manure crops.

Technique of Green Manuring:

The seeds of green manure crop can be sown in May to June and ploughed down in July. Wheat fields in the north India can be green manured with sunhemp, dhaincha, cowpea, green gram, black gram, etc. Generally a higher seed rate is recommended for green manuring. Fertilization of green manures with phosphatic fertilizers can be done by broadcast, because it improves the availability of phosphorus to the succeeding crop as compared to phosphorus applied to succeeding crop.

Usually the field in ploughed, a little fertilizer i.e. 10 kg of nitrogen and about 30 kg of phosphorus (P_2O_5) per hectare is added to the soil. The fields are again ploughed and about 50 to 60 kg sunn hemp or Dhaincha seeds are sown in June when the monsoon breaks. An 8 week old green manure crop is succulent enough to be turned into soil for



best response under rice. Various reports conclude that a green manure crop should be turned under at 7 to 8 week age, which coincides with flowering and maximum growth stage for most of the green manure crops. Dhaincha and sunn hemp add about 75 kg of nitrogen per hectare to the soil.

Time Interval between Burial of Green Manure Crop and Sowing of Next Crop

The time interval between the ploughing down of green manure crop and the sowing of the next crop depends on weather conditions and nature of the buried green material. The warm and humid conditions favor rapid decomposition of plant material. If the green manure crop is succulent, then paddy transplanting can be done immediately after turning over of the green manure crop. In case of the woody plant material, sufficient time interval should be allowed for proper decomposition of green plant material before paddy transplanting,



e.g. when succulent green manure crop of around 8 weeks to be buried then paddy can be planted immediately without having any adverse effect on the yield. But when dhaincha become woody (12 weeks), it is necessary to bury it about 6 to 8 weeks first before transplanting paddy for its proper decomposition.

Advantages of Green Manuring

1. They absorb nutrient from the deeper soil layers and leave them in the surface soil.
2. The amount of green plant material buried stimulates the activity of the micro-organisms inhabitant to the soil. They respire and decompose the organic matter CO_2 , which help in producing carbonic acid. The carbonic acid decomposes the soil minerals to release plant nutrients bind in them
3. Green material on decomposition also produces certain organic acids which enhance the availability of certain plant nutrients like phosphorus, calcium, potassium, magnesium and iron.
4. It improves the soil structure, moisture holding capacity and infiltration of water, thus decreasing the runoff and erosion.
5. Leguminous green manuring crop harbor N fixing bacteria, rhizobia in their root nodules and fix atmospheric N @ 60 to 100 kg N/ha in the soil which becomes available to the succeeding crop.
6. Regular practice of green manuring may increases the yield of the succeeding crops by 15 to 20 %
7. Increase the solubility of phosphates, trace elements etc., through the activity of the soil microorganisms and by producing organic acids during decomposition.
8. *Sesbania aculeata* (daincha) applied to sodic soils continuously for four or five seasons improves the permeability and helps to reclaim the sodic soils.



Some disadvantages of green manuring

Some disadvantages are also associated with green manuring mentioned as under:

1. Under rainfed conditions, proper decomposition of the green plant material and satisfactory germination of the succeeding crop may not take place if sufficient soil moisture is not available.
2. A satisfactory stand and growth of the green manure crops cannot be produced, if sufficient rainfall is not available.
3. The practice of green manuring may be uneconomical, especially in the regions where irrigation facilities are available along with easy availability of fertilizers. As it is more economical to add the quantity of N in the form of fertilizer which the crop is expected to fix from the atmosphere.
4. Green manure crops may also harbor some of the insects, pests and nematodes which could harm the succeeding crop.

CONCLUSION:

Green manuring is one of the best alternatives to improve the soil health and meet the nutritional requirement of the succeeding crop. The loss of nitrogen can be prevented by the incorporation of green manure crops in the soil. Green manure crops are mostly leguminous crop because they help in the fixation of the nitrogen by the use of Rhizobium. The green manure crops improve physico-chemical properties of soil, biological and provide plant protection. By the use of green manuring we can helps in the restoring the soil quality and prevents the degradation of the land. Application of green manure supplements the chemical fertilizers and restores soil fertility. Therefore, it is an eco-friendly low cost technology to conserve the natural resources besides maintaining environmental quality in a sustainable manner.