



Use of Green Manure Crops for Sustainable Crop Production

(*Vivek Yadav¹ and Pankhil Chaudhary²)

¹Agronomist, Rice Research Station, Nagina, Bijnor

²Certification Incharge, Trace Assure Global Certification Pvt. Ltd, New Delhi

*Corresponding Author's email: vivekzrsnagina@gmail.com

India being a tropical country, the soil is deficient in carbon and nitrogen. This is because of high temperature where C and N losses due to volatilization is very high; this necessitates their loss to be minimized. Earlier the main source of organic matter was cowdung and FYM. Due to the high cost of chemical fertilizer and non-availability of FYM the only alternative is to use green manure crop.

Importance of green manure

Soil is supplied with most essential nutrients by the use of green manure crops. Plant contains C and N as main constituents. They are available from the green manure crops on their turning. By the use of green manure crops the organic content of the soil is increased which is considered to be food of biofertilizing agents. Green manures crops (GMC) have nodules in their roots in which rhizobium bacteria are found which fix atmospheric nitrogen. By planting such legumes the N₂ content of soil increases. Due to the presence of organic matter and nitrogen in the soil, the vaporization of the water is drastically reduced. The presence of organic matter (OM) facilitates air circulation in the soil. The decomposition of the green manure crop releases carbon in the soil and in the presence of CO₂ forms various carbonic acids. These carbonic acid in the presence of P, Ca, K, Mg, Fe, Mn and Zn nutrient form various organic salts and also solubilises these salts from the complex form and thus make available to the plants. These are food of microbes and thus the soil biota increase to the significant extent. In salt affected alkaline or acidic soil the pH is regularized to the desirable extent. In acid soil pH increases whereas in the alkaline soil the pH decreases and the soil become normal. By the use of OM and GMC the adverse effect of chemical fertilizer is nullified. Thus both the acidic and alkaline soils are corrected. The water holding capacity increase in the presence of OM and drainage is also regularized.

Green manure crops

Legumes as well as legume crops are used as GM. In both cases the crop should be early maturing, fast growing, should have more foliage, and branched so that per ha more biomass is made available. Vegetative parts should be soft so that when they are ploughed in the field, they can be decomposed quickly by microorganism and converted into humus. The roots should reach to a considerable distance deep in the soil and make nutrients present in the deep layers of soil available to the plant. The GM should be such that they can be grown in the low fertility soil while adopting crop sequence, the place of GMC should be included and under the adverse condition they should grow and release the nutrients. The important crops used for green manures are being listed below.

Table 1: Some important green manure crops

Crop	Seed rate kg seed/ha	Turning after	Biomass added/ha	Quantity of element added/ha
Sunhemp (<i>Crotolaria juncea</i>)	90-100	6-8 weeks	170 q/ha	75 kg N/ha
Dhaicha (<i>Sesbania aculeata</i>)	65-100	8 weeks	160 q/ha	70 kg N/ha
Cowpea (<i>Vigna sinensis</i>)	30-40		150 q/ha	74 kg N/ha
Guwar (<i>Cyamopsis tetragonoloba</i>)	30	50 days	160 q/ha	56 kg N/ha
Urd and mung (<i>Phaseolus mungo</i> and <i>Vigna radiata</i>)	25-35	60 days after plucking beans	64 q/ha	35 kg N/ha
Berseem (<i>Trifolium alexandrium</i>)	4-5	02 cuttings	155 q/ha	67 kg N/ha

The sunhemp and dhaincha could be suitable summer green manures crops for eastern Uttar Pradesh where 70 per cent cultural land remains idle during the March and June.

Turning of green manure crop

Green manure crop should be turned in the soil at particular stage of growth so that maximum quantity of biomass and N₂ is made available in early or late turning, the profit will not be the same. The proper stage is when the crop has just started flowering but immature, the vegetative parts are juicy. If the turning is delayed then the crop will absorb nutrient from the soil and will not be released then the quantity of H₂O is also reduced. This will delay the sowing of 2nd crop. After turning there should be adequate rains so that the plant parts are decomposed in the presence of moisture. Their incorporation in soils even a week earlier to sowing or planting of main crop is beneficial. Various crops used for green manure are being discussed here.

1. **Sesbania:** It is also known as Dhaincha. It is widely used in green manuring. It is grown in the area where rainfall is high and not proper drainage facility. Sesbania can be grown in salt affected soil. This is fast growing and germinating crop and carry more numbers of nodules in the roots.
2. **Lobia/Cowpea:** Lobia can be used as green manure crop in both *Rabi* as well as *Kharif* crop and gives maximum quantity of biomass.
3. **Guwar :** Gwar is used as a green manure crop in the area where rainfall is very low i.e. north-west region of India.
4. **Urd and mung:** These crops can be grown where water stagnate. After the harvest of bean (around 60 days) in the month of August the crop can be turned in the soil.
5. **Non-leguminous green crop:** These crop reduce the ill effect of chemical fertilizer, but not increase the nitrogen content, they only preserve the available nitrogen in soil and improve physical condition of soil.

These crops are oats, sorghum, maize, mustard, sunflower and sugarbeet but in India non legume crops are not used for green manuring.

Green manure crop not only increase the nitrogen and biomass content but also reduce the pathogenic microorganism and control disease. The disease which are controlled significantly include root rot, collar rot and other soil borne pathogen.

Nutrient status

The green manures contribute 30-60 kg N/ha per crop depending upon the crop. The first fraction of green manure crop supplies 60-80 per cent of total N. Release of C and N shows that the green manure decomposition and mineralization occur rapidly in the soil, about 80 per cent of N and 40 per cent of C present in the biomass are released in about 10 days time in most of the crops. Application of 10 kg urea has been recommended after the turning of plant material in soil. This application enhances the microbial activities which subsequently hasten the decomposition process.

Inclusion of green manure in crop rotation has also proved to be beneficial to soil health in so many ways, increasing the availability of the nutrients and lastly for the biological control of root and collar rot and wilt disease of crops. On the whole green manuring, a 3000 years old practice is very relevant in today's context and must be used for it is economically feasible in farmers system operation.