



## Maximization of Seed Yield In Green Manure Crops Through Low Input Practices

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### Importance of green manure crops in agricultural eco system

Agriculture in India is an age old traditional practice providing the largest source of livelihood to about 70% of the rural households in India ([www.fao.org](http://www.fao.org)). Intensive agricultural practices such as tillage, high land use intensity, changing cropping patterns, high and inappropriate use of inputs like chemical fertilizers, herbicides and pesticides, have resulted in soil degradation. Soil degradation is a change in the physio-chemical and biological properties of the soil leading a poor soil health status. This attributes to a decline in in productivity of the crops per unit area while escalating the cost of cultivation (Bhattacharya et al., 2015). Reviving the soil health for better productivity and profitability is a growing concern for sustainable agriculture.

Green manure crops such as sunhemp and daincha are essential components for restoring and maintaining soil health and fertility in agricultural ecosystems. Sunhemp (*Crotalaria juncea*) is primarily used as green manure crops for garden land and irrigated crops ecosystem. Approximately 10 tonnes of green biomass is added to the soil. Daincha (*Sesbania aculeata*) is grown essentially under wetland ecosystem suitable for paddy crop. It comes up well in saline and waterlogged soils.

### The beneficial effects of green manure crops

1. Decomposition of biomass increases the soil organic matter and improves the soil fertility
2. Biological nitrogen fixation in the root nodules adds available nitrogen through roots to the tune of 40 Kg per acre which is a valuable input for successive commercial crops
3. Green manuring improves physical properties of soil such as porosity, water holding capacity and soil aeration.
4. Green manure crops contribute for increased nutrient availability in native soils. Upon decomposition, they release organic acids which solubilize the carbonate and bicarbonate ions, thereby reducing the calcareousness and salinity of soils. This results in gradual release of fixed nutrients like phosphorous, zinc and iron and makes them available to successive crops.
5. Green manuring increases the population and diversity of beneficial soil microbes
6. Addition of humus which is the end product of microbial decomposition is a primary parameter of soil fertility which enhances nutrient availability.
7. Green manures with attractive flowers and release of volatiles attract pollinating agents such as butterflies, honey bees and bumble bees in the ecosystem which helps to increase the pollination in fruit and plantation crops and other cross pollinated crops.
8. Green manures help in suppressing weeds through various modes such as competing with weeds for sunlight, space, water etc., exhibiting allelopathic effect, or by disrupting the growth pattern of weeds
9. Crop rotation with green manure crops not only restore the soil fertility but also maintains the productivity of the land
10. It is a low input practice for yield maximization in any crop ecosystem



### **Issues associated with green manure crops**

1. The foremost drawback in raising green manure crops comes from the timely non- availability of quality seeds
2. Seeds often have poor germination standards . The presence of higher percentage of hard seeds, seed dormancy, high frequency of ill filled are other constraints. Hard seeds are formed due to water stress during reproductive and seed filling stage, as well as poor management practices. Poor filling is attributed to the compartmentalization of photosynthates to the vegetative parts than to the seeds. Seed dormancy is another hindrance in green manure cultivation.
3. While green manure crops are known to reduce the incidence of a few soil borne pests such as nematodes, they are also known to be a habitat for slugs, snails and other pests

Lack of standard seed production techniques has been a major challenge in maximizing the production of good quality seeds of green manure crops. Based on the experiences gained during seed production by the author, the following package of practices described below have been rewarding for sunhemp and daincha.

### **Seed production technique in sunhemp (*Crotalaria juncea*)**

1. *Seed rate* : Although the seed rate to raise sunhemp as a green manure crop is 20Kg/acre, the recommended seed rate for seed production purpose is 8-10 Kg/acre.
2. *Seed treatment*: Mixing one litre of freshly prepared panchagavya in 100 litres of water and soaking the seeds overnight helps to improve germination and vigour. The solution should be decanted and the seeds should be shade dried before sowing.
3. *Field preparation*: Previous crop residues particularly those belonging to graminaceae family such as sorghum, pearl millet, ragi and maize should be incorporated by disc ploughing as primary tillage. Cultivator ploughing should be done as secondary tillage. Symbiosis between plants and nitrogen fixing organisms has evolved as a mechanism to combat the deficiency in mineral nitrogen limiting plant growth (Freiberg et al., 1997). Incorporation of less nitrogen containing monocot crop residues result in temporal nitrogen deficiency in soil which can stimulate the colonizing of nitrogen fixing Rhizobial strains and formation of nodules
4. *Sowing* : Treated seeds can be uniformly broadcasted. If sown in seed drills they have to be placed at a depth of 3-4 cm with an approximate spacing of 45 cm between rows.
5. *Fertilizer application*: Application of 110 Kg enriched micro nutrient mixture preferably pulses micro nutrient mixture in the following proportion (10 Kg MN mixture + 100 Kg of well decomposed FYM or vermi compost, 1:10 ratio
6. *Irrigation*: Irrigation is required for the germination processes immediately after sowing followed by life irrigation after 1 week. As sunhemp is sensitive to water logging, adequate drainage facilities are to be provided. Three to four irrigations are required during vegetative phase, flower initiation and maturity phase. Crop should not be exposed to water stress.
7. *Foliar sprays*: Suitable foliar sprays that can arrest vegetative growth and induce prolonged flowering, can increase the seed yield. First foliar spray with 0.5% Mono ammonium phosphate (5 g per liter) + 0.2% water soluble and fertilizer grade MN mixture (2 g per liter) given at approximately 35-45 DAS, (when the plant reaches 150cm height) helps to arrest the excess vegetative growth and induce flowering. The second foliar spray with **all 19 (19:19:19)** at 0.5% concentration 10-15 days after first spray, when the seed set has initiated helps in improving the seed filling.
8. *Harvesting, seed processing and storage*: Matured pods can be harvested around 90-100 DAS. The stalks with pods are harvested manually, when the leaves begin to defoliate. The harvested stalks are dried in threshing floor and pods are threshed with tractor/ mini tractor/ or multi crop threshers. Clean seeds free of debris are obtained by winnowing. Ill filled seeds can be separated by sieving. Quality seeds should undergo seed testing. Seeds with the prescribed germination standards seeds can be stored for distribution. The expected seed yield is 250-300 Kg per acre.



## **II Seed production in Daincha (*Sesbania aculeata*)**

The package of practices for seed production such as seed rate, seed treatment, micro nutrient mixture application, foliar sprays, harvesting and seed processing in Daincha are similar to sunhemp, except for field preparations.

### **Field preparation**

Previous paddy crop and straw should be completely incorporated into the field by disc ploughing. The soil should be puddled well with cage wheel after submerging the field with water. Treated seeds should be sown in puddled soils with thin film of standingwater followed by application of enriched micro nutrients mixtures. Seeds would begin to germinate a week after sowing. Field should be allowed to dry and after germination, irrigation should be done. Irrigation scheduling is lesser than sunhemp as the wetland system has more water holding capacity. No water stress should be allowed during seed maturity phase. The expected seed yield is 150-200 Kg per acre.

### **Conclusion:**

Although a number of leguminous crops have been identified as suitable for green manuring, these two crops have attained more focus due to their impact and suitability in cropping systems. Considering the beneficial effects of green manuring, exploring diverse potential crops and exploiting them to revive the soil health is essential for sustainable and profitable agriculture in future.

