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Green Manure in Crop Production and Soil Health

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ABSTRACT: Sunnhemp green manure showed maximum nitrogen content 0.75% when compared with Cowpea (0.71%), Dhaincha (0.62%), Berseem (0.43%) and Cluster bean (0.34%).

KEYWORDS: Cowpeas, Green manures, *Sesbania bispinosa*, Sunnhemp, *Trifolium alexandrinum*

I. INTRODUCTION

Organic manures were considered as the cheap and chief source of plant nutrients and soil amendment. Complete dependence on chemical fertilizers is making the soil unfertile and less productive in absence of organic material besides soils. Among the different organic manures, green manuring is the most important. Green manuring may be defined as a practice of ploughing or turning into the soil un decomposed green plants or their residue for the purpose of improving physical structure and fertility of a soil (Pandey & Singh 2016). The practice of green manure provides many improvements in chemical, physical and biological characteristics, through increases in organic matter content and microbial activity, nutrient cycling, disruptions of compacted layers, decreased erosion, incidence of pests and diseases, and suppression of weed plants for sustainable fruit production system (Zaccheo 2016).

II. GREEN MANURING

The most common green manure crops are Sunnhemp, Dhaincha, Cowpea, Cluster bean, Berseem, Horse gram, Lentil etc. The leguminous crops whose growth rate is fast add more quantities of biomass within short time. Generally green manure crops add 10 to 15 tonnes green matter/ha. The positive role of green manuring in crop production has been known since ancient time. Importance of this soil ameliorating practice is increasing in recent years because of high cost of chemical fertilizers, increased risk of environmental pollution, and need of sustainable cropping systems. Green manuring can improve soil physical, chemical and biological properties and consequently crop yields. Furthermore, potential benefits of green manuring are reduced nitrate (NO₃⁻) leaching risk and lower fertilizer N requirements for succeeding crops (Fageria 2007).

III. ROLE OF GREEN MANURING

The capacity to supply the nutrients required by a crop during its active growth period depends on fertility status of the soil. Besides this, favourable environment is also required for optimum plant growth, which is created by the presence of organic matter in the soil. Thus, it is essential to use the practice of green manuring in the soil. Nitrogen, Phosphorus, Potash and other plant nutrients and micronutrients are released during mineralization of organic material in the soil. Besides its own stock, a number of other elements present in the mineral compounds of the soil are also

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converted into available forms by the organic acid produced during decomposition of green manure crops. The temporary reductions in soil pH increases the rate of release of plant nutrients. Green manures represent a promising approach to maintaining sustainable nutrients for crop growth.

Improved soil structure helps in raising a good crop, because it influences porosity and regulates soil – air – moisture regimes in the soil. Addition of organic matter further improves soil structure and maintains favourable condition for aeration and permeability in the soil. Green manuring improves water – holding capacity of the soil, especially in sandy soils, where losses of nutrients occur due to fast downward movement of water. Green manures increase soil microbial biomass and activity and cause distinct changes in soil microbial populations that may be partially responsible for suppression of diseases (Larkin, 2013).

The effect of drought is reduced and irrigation interval may be prolonged and the loss of water and costly nutrients are minimized.

IV. CHARACTERISTICS

Green manure crops should be preferably from leguminous family, so that atmospheric nitrogen can be fixed; should have quick initial growth, so as to suppress the weed growth; should yield large quantity of green material in a short period; should have a deep rooted system, so that it would penetrate deep layer of soil and thus aid in creating good soil structure; and should have more leafy growth than woody, so that its decomposition will be rapid (Meisheri *et al.*, 2001).

V. METHODS

The practice of green manuring is adopted in various ways, according to soil and climatic conditions. The following 2 Types of green manuring can be adopted.

Green manuring in situ: Green manure crops are grown and buried in the same field, which is to be green manured, either as pure crop or as intercrop with the main crop eg. Sunnhemp, Dhaincha, Cluster bean, Cow pea, Berseem, Horse gram etc.

Green leaf manuring: Green leaf manuring refers to turning into the soil green leaves and tender twigs collected from shrubs and trees grown on farm bunds, wastelands and nearby forest areas. The common shrubs and trees used are Glyricidia (3% N), Wild Dhaincha (2.2% N), Wild cassia, Karanj etc.

VI. ADVANTAGES

The green manuring adds organic matter to soil. This stimulates the activity of soil micro-organisms. The other advantages are as follows:

- a) Green manuring concentrates plant nutrients in the surface layer of the soil.
- b) It improves the structure of the sub-soil by deep rooting system.
- c) It facilitates the penetration of rainwater, thus decreasing run-off and soil erosion.
- d) Green manuring crops hold plant nitrogen that would otherwise be lost by leaching eg. Nitrogen.
- e) When leguminous plants, like Sunnhemp and Dhaincha are used as green manure crops, they added nitrogen to the soil for the succeeding crop.
- f) It increases the availability of certain plant nutrients like P_2O_5 , Ca, K, Mg and Fe.
- g) Green manuring checks weed growth by quick initial growth.
- h) Green manuring crops aid in the reclamation of saline and alkaline soil by the release of organic acids.
- i) It increase the water holding capacity of the soil.
- j) It increase bulk density of the soil

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Table.1 Nutrient content and nitrogen added by green manure crops

Crops (Scientific names)	Nutrient content (Fresh weight basis)			Nitrogen added (kg/ha)
	N (%)	P (%)	K (%)	
Sunnhemp <i>Crotalaria juncea</i> Linn.	0.75	0.12	0.51	75
Dhaincha <i>Sebania bispinosa</i> W.F. Wight	0.62	0.10	0.42	70
Cow pea <i>Vigna unguiculata</i> (Linn.) wall	0.71	0.15	0.58	50
Clusterbean <i>Cyamopsis tetragonoloba</i> (Linn.) Taub.	0.34	0.08	0.35	58
Berseem <i>Trifolium alexandrinum</i> Linn.	0.43	0.09	0.38	55

VII. LIMITATIONS

The green manure crops may fail, if sufficient rainfall is not available. The other limitations of green manuring are as follows:

- Under rainfed condition, it is feared that proper decomposition of the green manuring crop may not take place, if sufficient rainfall is not received after burying the green manure crop.
- For green manuring of wheat crop, green manuring crop has to be grown only in *kharif*, thus the practices of green manuring may not be economical as it loses one season for cultivation of the commercial crop.
- Sometimes the cost of green manure crops may be more than that of the commercial fertilizers.
- Sometimes it increases disease, insect and nematode problems.

VII. GREEN MANURING AND SOIL BORNE DISEASES

The management of soil borne plant pathogens is complex due to these particular organisms living in the dynamic environment of the rhizosphere and can frequently survive long periods in soil through the formation of resistant survival structures. Soil borne pathogens cause crop yield losses in many plants (Blum *et al.* 2004). Effect of Green Manuring on Fungal Diseases: The rhizoctonia root rot disease of bean was caused by *Sclerotinia* spp. and it was reduced by the decomposition of green plant materials (Pung *et al.* 2004). Biological control against nematodes could also be possible by green manure (Agbenin *et al.* 2011). Green manures increase pathogen inhibitory activity within the streptomycete community in soil in conjunction with crop rotation, to control soil-borne plant pathogens (Wiggins and Kinkel 2005).

IX. CONCLUSION

Crop yield, soil nutrient content, amount of agricultural production and their environmental effects are all influenced by the use of fertilizers. Organic fertilizers have an important role in improving soil fertility. One option is to use green manure. It may be concluded that the positive role of green manuring in crop production has been known since ancient times and its use is increasing due to the high cost of chemical fertilizers as well as the increased risk of environmental pollution. Green manuring can improve soil physical, chemical, and biological properties and consequently crop yields. Green manures increase water holding capacity and bulk of soil. Organic acids that help in reclamation of saline and alkaline soil and utmost increased productivity of the soil.

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