"ROLE OF GREEN MANURES IN ORGANIC FARMING – A Review"

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Abstract

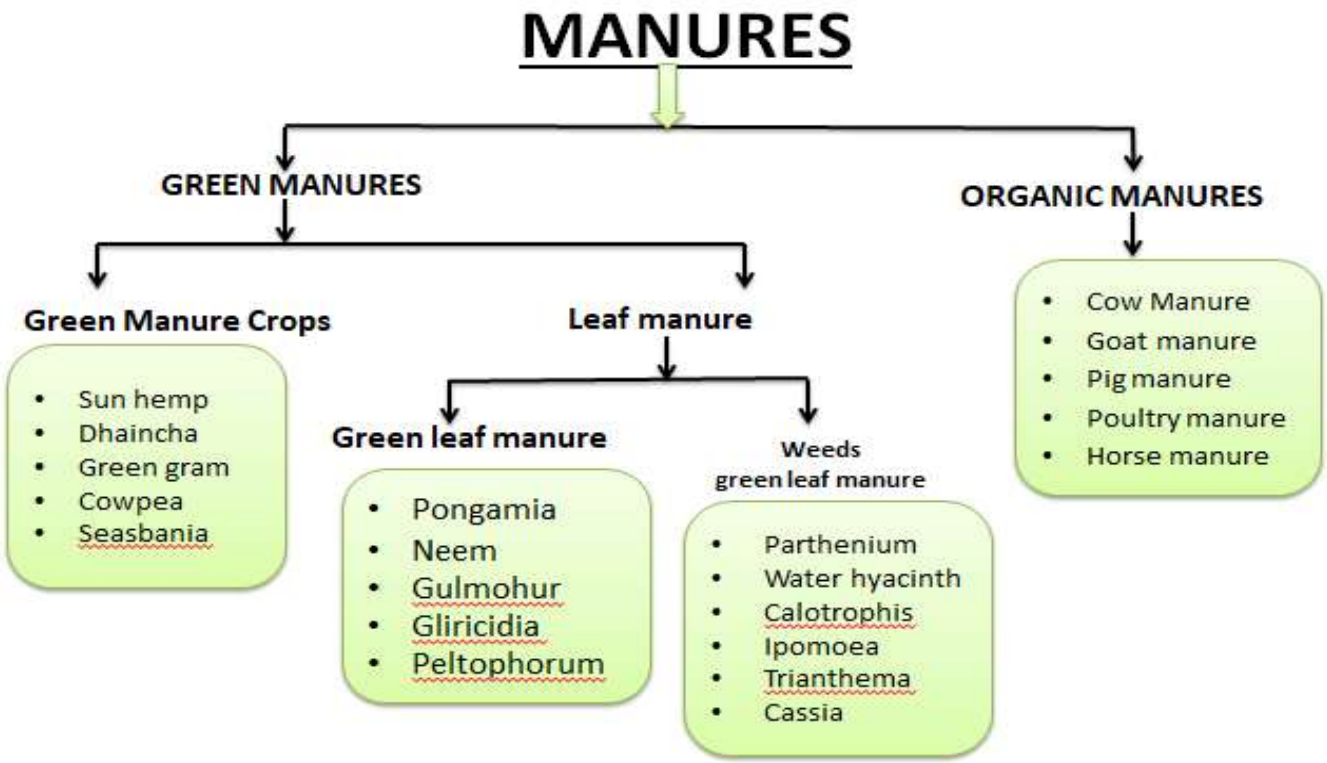
Soil health degradation is one of the most important problem faced by the farmers. Due to it the land is becoming barren. Therefore, to overcome this problems the concept of organic farming came into existence. Therefore, green manuring is one of the most important type of manure used in organic farming. Green manures are fertility building crops and may be broadly defined as crops grown for the benefit of the soil. The green manuring crops improve the humus, organic carbon, nitrogen and soil microbial growth. Green manuring can bring a number of advantages to the grower. It leads to the addition of organic matter to the soil. Green manuring crops increase the biological activity in the soil. These crops improve soil structure. Green manure crops helps in reducing soil erosion. They help to increase the supply of nutrients available to plants. These crops help in reducing leaching losses. It is also reported that green manuring crops help to suppress weeds, reducing pest and disease problems, providing supplementary animal forage.

key words: Organic farming, green manuring, organic matter, organic carbon, soil organic matter.

Introduction

National nature production is the mechanism by which synthesised fertilisers, growth regulators and livestock feed additives are not or partially omitted by this system. It uses crop rotations, green manures, vegetables, crop residues, animal fumes, organic waste from the field and elements of organic pest management to sustain soil fertility and provide plant nutrients and control insecticides, pests and diseases and weeds. Green manure is an organic farming part. Green manure is the method of soil enrichment by ploughing under or soil some green manure plant when it is green or shortly after it begins to bloom. "Wort of the Green manures are due to the inclusion of organic matter in the soil." Organic matter in the soil is known for its genuine soil fertility as one of its most important elements. The disintegration of this organic matter affects the soil nutrient availability. Green manure crops are classified as crops produced for green manure. Our farmers have been doing green manuring lately for decades. It is estimated that up to 80-100 kg may be supplied with green manure, 40-50 days old. N/ha. - N/ha. While half of this N can be used, the crop can cover 50-60 kg of green manure. N/ha fertiliser (Sharma *et al.*, 2013). Any of the likely green manures are sunhemp, dhanicha, cowpea, mung, bean, guar, berseem and so on. Dhanicha, sunhemp, mung bean and guar cultivated during the kharif season, with 8-21 tones of green and 42-95 kg of the green manure crops

recorded. N/ha. N/ha. Similarly, the rabi season can include 12-29 tonnes of green and 67-68 kg N/ha in cowsari, cowpeas and berseems (Mishra and Naik, 2004).



GREEN MANURING

It is a practice of plugging in the green plants tissue grown in the field or adding green plants with tender twigs or leaves from outside and incorporating them into the soil for improving the physical structure as well as fertility of the soil.

- **Turning off these crops directly in the field by plugging the field**

IMPORTANCE OF GREEN MANURING

- Green Manuring contributes 40 to 80 kg nitrogen per ha.
- Besides supplying nitrogen, it prevents loss of nitrogen by leaching and erosion.
- Vigorous root system of green manure keeps the soil particles bound together.
- Green manure reclaims saline and alkaline soils.
- Some green leaf manure crops serve as fodder.
- The growth of green manure crops is very fast.

Characteristics of an Ideal Green Manure Crop

*An ideal green manure crop should have following characteristics

* It must have deep rooting system, facilitating nutrient mining from subsurface soil.

* It should have low water and nutrient requirement.

* It should be quick growing to produce abundant biomass.

* The biomass produced should have low fibrous material to facilitate quick decomposition.

*Should have high capacity to fix atmospheric nitrogen.

THE DESIRABLE CHARACTERISTICS GREEN MANURE CROPS

For green manure crops to be agro-nominally attractive and economically viable, the plants should have the following characteristics:

- Rapid and aggressive initial growth and efficient soil cover.
- Producing large amounts of bio-mass (green and dry matter)
- Capacity to recycle nutrients

- Ease of establishment and management in the field
- Resistance to attacks by pests and diseases and not act as a host
- A deep penetrating and well developed root system
- Easy to manage during establishment and during incorporation into the soil.
- Potential for multipurpose use on the farm . .
- Tolerance or resistance to drought and/or frosts
- Tolerance to low soil fertility and be adapted to degraded soils
- Ability to produce seeds in sufficient quantities to increase the areas under the crop
- Not invading and causing difficulties for the succeeding crop in the crop rotation.
- Capacity to re-sprout in the event that parts of the area are cut down.

Green Manure is of two types:

- **Green leaf manure**
- **In-situ Green manure**

GREEN LEAF MANURE

- Green leaves and tender plant parts of the plants are collected from shrubs and trees growing on bunds, degraded lands or near by forest and they are incorporated or mixed into the soil 15-30 days before sowing of the crops depending on the tenderness of the foliage or plant part.
- Forest tree leaves are the main sources for green leaf manure.
- Plants growing in wastelands, field bunds etc., are another source of green leaf manure.
- The important plant species useful for green leaf manure are neem, mahua, wild indigo, Glyricidia, Karanji *(Pongamia glabra)* calotropis, avise*(Sesbania grandiflora),* subabul and other shrubs.

In-situ Green manure

- In this system the short duration suitable crops are grown in a field prior to crop cultivation and then cut and buried in the same site when approximately 50 percent of all plants are flowering.
- The most important green manure crops are sun hemp, Dhaincha, *Pillipesara*, Clusterbeans and *Sesbania rostrata etc.*

Representing the content of green manure crop and weeds on dry basis

S. no.	Plant	Botanical name	Nutrient content (%) on air dry basis		
			N	P	K
	Green manure crop				
1.	Sunnhemp	Crotolaria juncea	2.30	0.50	1.80
2.	Dhaincha	Sesbania aculeata	3.50	0.60	1.20
3.	Sesbania	Sesbania speciose	2.71	0.53	2.21
4.	Cowpea	Vigna sinensis	1.70	0.28	1.25
5.	Mungbean	Vigna radiate	2.21	0.26	1.26
	Green leaf manure				
6.	Gliricidia	Gliricidia sepium	2.76	0.28	4.60
7.	Pongamia	Pongamia pinnata	3.31	0.44	2.39
8.	Neem	Azadiracta indica	2.83	0.28	0.35
9.	Gulmohar	Delonix regia	2.76	0.46	0.50
10.	Peltophorum	Peltophorum ferrugenum	2.63	0.37	0.50
	Weeds				
11.	Parthenium	Parthenium hysterophorus	2.68	0.68	1.45
12.	Water hyacinth	Eichhornia crassipes	3.01	0.90	0.15
13.	Trianthema	Trianthema partulacastrum	0.64	0.43	1.30
14.	Ipomoea	Ipomoea	2.01	0.33	0.40
15.	Calotropis	Calotropis gigantean	2.06	0.54	0.31
16.	Cassia	Cassia fistula	1.60	0.24	0.20

Representing the biomass production and Nutrient accumulated by green manure crops.

S. no.	Crop	Dry matter in 45-60 DAS (q/ha)	Nutrient accumulation						
			Major nutrients (kg)			Total micro nutrients (g)			
			N	P2O5	K2O	Zn	Fe	Cu	Mn
1.	*Sesbania rostrata*	50.00	131.0	18.5	62.5	200	9840	180	1050
2.	*Sesbania speciosa*	30.00	119.4	07.2	39.0	150	1440	132	330
3.	*Gliricidia maculata*	35.00	125.6	125.6	46.8	108	1980	68	540
4.	*Eichhornia crassipes*	70.00	198.1	63.0	125.3	350	3290	133	2940
5.	*Crotolaria juncea*	52.50	150.2	47.3	93.9	262	2467	100	2205
6.	*Trianthema spp.*	25.00	58.5	07.5	28.7	75	4980	47	500
7.	*P. hysterophorus*	40.00	106.4	35.2	51.6	280	1880	76	640

Advantages

- Green manuring improves soil structure, increases water holding capacity and decreases soil loss by erosion.
- Growing of green manure crops in the off season reduces weed proliferation and weed growth.
- Green manuring helps in reclamation of alkaline soils.
- Root knot nematodes can be controlled by green manuring.
- It increases the availability of certain plant nutrients like P2O5, Ca, K, Mg and Fe.
- Improves soil structure
- Increases water holding capacity and bulk density of the soil
- Decreases soil loss by erosion
- It improves the structure of the sub-soil by deep rooting system.
- It facilitates the penetration of rainwater, thus decreasing run-off and soil erosion.
- Green manuring checks weed growth by quick initial growth.
- Green manuring crops aid in the reclamation of saline and alkaline soil by the release of organic acids

Benefits Green Manure Crops

- Supply of Organic Matter:
- Addition of Nitrogen:
- Nutrient and Soil Conservation:
- Increases the Biochemical Activity:
- Green Manuring Increases Crop Yield:
- Building of Organic Matter and Improved Soil Structure:
- Improvement in Soil Physical Properties:
- Benefits of Rooting Action:
- Weed Suppression:
- Soil and Water Conservation:

Criteria for selection of green manures include :-

- Plants are fleshy and soft
- fast growing;
- fast to decompose;
- leguminous;
- don't attract pests and diseases;
- don't compete with crops;
- provide nutrients needed in the soil

Techniques of green manure in the field

The maximum benefit from the green manure crop.

cannot be obtained without knowing the.

1) Right time of growing, Green manures and undersowing.
2) Right time of incorporating in the soil.
3) Time required for decomposition.
4) Stage of burying of green manure crop.
5) Method and depth of burial of green manure crop.
6) Time interval between burial of green.
7) manure crop and the sowing of the next crop.

Effect of green manuring and nitrogen treatments on organic matter concentration (g kg ^{1}) of soil under rice and wheat

Treatments	Nitrogen level	At 65 DAT of rice		At Rice harvest Soil depth (cm)	
		(0-15)	(15-30)	(0-15)	(15-30)
Fallow	N0	8.65	5.84	8.63	8.10
	N60	8.74	5.97	8.71	8.19
	N120	**8.86**	**6.12**	**8.81**	**8.48**
	mean	8.75	5.98	8.72	8.26
S. rostrata	N0	9.98	7.12	9.03	8.61
	N60	10.33	7.28	9.19	8.89
	N120	**10.60**	**7.54**	**10.28**	**9.14**
	Mean	10.30	7.31	9.50	8.88
S. aculeata	N0	9.61	7.10	8.78	8.48
	N60	10.06	7.19	9.08	8.80
	N120	**10.19**	**7.22**	**10.19**	**9.11**
	Mean	9.95	7.17	9.35	8.80
Green gram incorporation	N0	10.12	7.31	9.00	8.44
	N60	10.31	7.46	9.06	8.78
	N120	**10.55**	**7.73**	**10.14**	**9.02**
	Mean	10.33	7.50	9.40	8.75

Source: Uttam Kumar Mandal *et al.*, 2003

Effect of green manure and urea application on N uptake by rice

Treatment	Grain		Straw	
	1984	1985	1984	1985
	N uptake, kg/ha -~			
Without Green Manure				
N 0	28.7	26.9	20.3	15.8
N60	43.1	41.7	31.2	25.5
N120	55.0	56.2	51.1	33.6
With Green Manure				
N 0	49.5	46.9	42.6	34.7
N60	60.2	59.7	58.2	45.1
N120	**63.2**	**69.2**	**60.1**	**52.7**

Source: R.S. Rekhi *et al.*, 1992

Effect of nutrient management practices on soil chemical properties

Treatment	Organic carbon(%)	Available N (kg ha-1)	Available P (kg ha-1)	Available K (kg ha-1)	B:C Ratio
100% NPK	**0.86**	**357**	**9.4**	**171**	**0.87**
50% NPK + FYM	0.90	370	10.0	182	0.88
50% NPK + GM	0.91	369	10.2	176	1.42
75% NPK + GM	0.94	384	10.8	191	1.40
100% NPK + GM	**0.96**	**401**	**11.4**	**208**	**1.49**
SEm±	0.02	5.2	0.3	3.5	0.03
CD (P = 0.05)	0.06	16.1	0.8	10.9	0.09

Source: Narendra Kumar et al., 2011

Growth and yield attributes under different nutrients management in upland rice (pooled mean of 3 years

Treatment	Plant height (CM)	Tillers m-1	Ears m-1	Ear length (cm)	Grain weight m^{-1} (g)	Grain weight ear^{-1} (g)	Test weight (g)	Harvest index (%)
100% NPK	62.5	62	51	16.5	24.2	0.48	24.6	23.0
50% NPK + FYM*	65.8	72	62	15.3	28.0	0.73	26.0	24.2
50% NPK + GM**	65.0	73	66	16.1	38.1	0.82	26.5	27.0
75% NPK + GM	79.5	85	78	17.1	41.0	0.82	25.3	29.2
100% NPK + GM	79.3	80	75	17.1	45.2	0.83	26.3	29.9
SEm±	2.8	2.0	2.5	0.5	2.4	0.04	0.3	1.3

CD (P = 0.05)	8.6	6.2	7.8	1.6	7.3	0.11	0.9	3.9

Grain and straw yield under different nutrients management in upland rice

	Grain yield (t ha^{-1})				Total above ground biomass (t ha^{-1})			
Treatment	2004	2005	2006	Mean	2004	2005	2006	Mean
100% NPK	**1.21**	**0.83**	**1.52**	**1.19**	**5.22**	**3.54**	**4.98**	**4.58**
50% NPK ? FYM*	1.36	0.92	1.63	1.30	5.55	3.69	5.56	4.93
50% NPK ? GM**	1.66	1.48	2.23	1.79	5.99	5.05	6.72	5.92
75% NPK ? GM	1.75	1.51	2.53	1.93	6.13	5.30	6.90	6.11
100% NPK ? GM	**1.88**	**1.86**	**2.64**	**2.13**	**6.29**	**6.09**	**7.27**	**6.55**
Mean	1.57	1.32	2.11	1.67	5.84	4.74	6.29	5.62
SEm±	0.12	0.11	0.11		0.17	0.20	0.26	
CD (P = 0.05)	0.36	0.34	0.34		0.53	0.61	0.79	

CONCLUSION

Green manuring technology is gaining importance due to increasing emphasis on soil health. minimize environmental pollution and cut down the use of chemical in agriculture. Application of green manure crops 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.

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