Case Study of Soil Fertility Improvement by Practising Green Manure Crop in Different Soil Conditions

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Organic farming plays an important role in maintaining the soil fertility status. Because of the excess use of chemical fertilizers, fungicides and insecticides, we are facing a lot of issues concerning health and malnutrition status in the country. With the growing population of the country, we need to produce food and sustain food security. Every year there is always an increasing trend in the population and also the land suitable for agricultural production is decreasing. This forced us to use new innovative technologies in agricultural production and the use of chemicals in the production cycle is drastically increasing.

Eliminating synthetic or chemical-based inputs is, however, only one aspect of the organic production system. More importantly, it emphasizes a whole-system approach in which all the individual components (soil minerals, organic matter, micro-organisms, insects, plants, animals, and humans) create a sustainable and self-regulating ecosystem.

The government of India has introduced several schemes concerning organic farming. Schemes like the National Project on Organic Farming (NPOP), Paramparagat Krishi Vikas Yojana (PKVY), Mission Organic Value Chain Development for North Eastern Region (MOVCDNER), Capital Investment Subsidy Scheme (CISS) under the Soil Health Management Scheme, National Horticulture Mission (NHM) and One District-One Product (ODOP).

Paramparagat Krishi Vikas Yojana promotes cluster-based organic farming with PGS (Participatory Guarantee System) certification. Cluster formation, training, certification and marketing are supported under the scheme. The assistance of Rs. 50,000 per ha /3 years is provided out of which 62 per cent (Rs. 31,000) is given as an incentive to a farmer towards organic inputs.

Rameshwara and Santhebennur clusters from the Davanagere district were selected by ICAR Taralabalu Krishi Vigyan Kendra, Davanagere to implement the components of Paramparagat Krishi Vikas Yojana. One of the components is increasing soil fertility by growing green manure crops in the field and incorporating them into the soil.

Fig 1: Green Manure Velvet beans as intercrop in Arecanut garden

Velvet bean (*Mucuna pruriens* (L.) DC. var. *utilis* is a leguminous vine. It is an annual or sometimes short-lived perennial. Velvet bean is vigorous, trailing or climbing, up to 6-18 m long. It has a taproot with numerous, 7-10 m long, lateral roots. The stems are slender and slightly pubescent. The leaves are generally slightly pubescent, alternate, and trifoliate with rhomboid ovate, 5-15 cm long x 3-12 cm broad, leaflets. The inflorescence is a drooping axillary raceme that bears many white to dark purple flowers. After flower pollination, the velvet bean produces clusters of 10 to 14 pods. They are stout, curved, 10-12.5 cm long, with between two and six seeds, covered with greyish-white or orange hairs that may irritate the skin. The velvet bean seeds are variable in colour, ranging from glossy black to white or brownish with black mottling. Seeds are oblong ellipsoid, 1.2 to 1.5 cm long, 1 cm broad and 0.5 cm thick.

Velvet bean is a valuable fodder and feed legume. Vines and foliage can be used as pasture, hay or silage for ruminants while pods and seeds can be ground into a meal and fed to both ruminants and monogastrics. Pods with their seeds can be ground into a rich protein meal and can be fed to all classes of livestock though in limited amounts in monogastric.

Each farmer is provided with 5 kg of velvet beans to grow as intercrop in the existing Arecanut garden (50 Farmers), maize fallow field (50 Farmers) and Onion fallow field (50 Farmers). Soil testing was done for each farmer's field for parameters like pH, EC, and NPKS before sowing of velvet beans crop. The crop was sown during the Kharif season to enable it for good establishment in the season. After 120-130 days of sowing the crop is mulched in the field by ploughing in the disc harrow. After two months of incorporating again the soil testing was done for the same crops to know the any improvements in the soil fertility status.

The pH of the soil ranged between 7.21 to 7.48. The three different demonstrations under the study. The pH of the soil remained unaltered irrespective of either following farming or intercropping with Velvet Beans. In the same way, the electrical conductivity of the soil in all three demonstrations was found reduced but not affected significantly. The EC ranged between 0.16 to 0.36 ds m^{-1} among three different demonstrations.

The organic Carbon of the three demonstration plots ranged between 0.53 to 0.61%. There will be an increasing trend in the organic carbon status after the incorporation of Velvet Beans in all the demonstrations.

The Mean available nitrogen before the sowing of velvet beans was 192.1 kg ha^{-1}, whereas it ranged between 216.4 kg ha^{-1} to 239.1 kg ha^{-1} in three demonstration plots. The soil's available Nitrogen content is significantly influenced by the intercropping with velvet beans.

The mean available phosphorus content before the sowing was 11.85 kg ha^{-1}. Whereas the highest per cent accumulation was noticed on velvet beans intercropped Arecanut plot (16.8) and lowest in onion fallow field. There has been significant improvement in potassium uptake in the soil in all three demonstrated plots. The increase in the content is on par with all the demonstrations. The range of improvement was from 536.1 kg ha^{-1} to 583.4 kg ha^{-1}. The available sulphur content in the initial soil sample was 13.5 kg ha^{-1}. However, the sulphur content also showed an increasing trend in all three demonstrations with a mean value of 15.2 kg ha^{-1}.

Conclusion and Future Aspects

It is concluded from the above study that, growing green manure crops and incorporating them with the soil will certainly help in restoring the soil fertility status. Also, the physicochemical changes in the soil will improve drastically to facilitate the easy availability of nutrients to the plants. Green manures thus play a vital role in improving the soil ecosystem and also improving soil microflora.

Table 1: Soil chemical parameters as influenced by Velvet Beans cultivation

Sl. No	Demonstration	pH		EC		OC		N		P		K		S	
		Before	After	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
01	Arecanut + Velvet Beans	7.81	7.43	0.32	0.16	0.41	0.61	184.6	216.4	13.48	16.8	484.1	536.1	14.1	16.8
02	Maize Fallow field	7.74	7.21	0.56	0.31	0.34	0.53	198.1	241.6	11.26	15.1	416.7	583.4	13.8	14.9
03	Onion fallow field	7.96	7.48	0.68	0.36	0.31	0.59	193.6	239.1	10.81	14.8	456.9	568.7	12.6	13.9
04	Mean	7.83	7.37	0.52	0.27	0.34	0.57	192.1	232.3	11.85	15.56	451.5	562.7	13.5	15.2
05	SEM (+)		0.04		0.01		0.03		5.1		0.9		6.1		0.3
06	DCP=0.05		NS		NS		0.11		16.8		1.9		21.8		1.4

EC-Electrical Conductivity (ds m^{-1}): OC-Organic Carbon (%): N –Nitrogen, P-Phosphorus, K-Potassium, S-Sulphur (kg ha^{-1})

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