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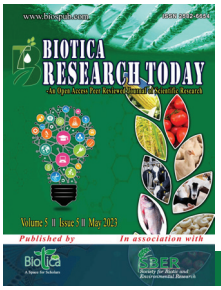

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Green Manuring - A Great Boon for Organic Agriculture

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Abstract

Green manuring has been a promising practice for ages, serving as a vital tool in maintaining soil fertility and productivity. It is the process of soil incorporation under any green plants either by raising them in the field itself or grown on bunds wastelands, and neighboring forests brought into the soil. The age of incorporation of green manure is at the time of flowering. It aims to provide the soil with the most crucial and deficient nutrient, nitrogen, by adding organic matter to the soil. This can be achieved through two methods of incorporation: *in-situ* incorporation and *ex-situ* incorporation. By minimizing the cost of fertilizers and safeguarding productivity, green manuring proves to be a low-cost and effective method. Soil health degradation is one of the most important problems faced by farmers therefore green manuring helps in reducing leaching losses, suppression of weeds and improves soil fertility and productivity.

Keywords: Green manuring, Nitrogen fixation, Organic farming, Organic matter

Introduction

Green manuring involves the incorporation of legume and non-legume green plants into the soil through agronomic practices. This can be done locally or by utilizing plants that have been established elsewhere and naturally integrated into the soil to improve its fertility (Maitra *et al.*, 2018). For thousands of years, traditional agricultural practices have utilized certain methods, but the increasing use of fertilizers and pesticides in conventional farming systems caused them to fall out of favor. Modern organic farmers often underutilize these practices, despite their numerous valuable uses. Leguminous crops used for green manuring, such as sun hemp, dhaincha, green gram and black gram, are highly valued for their ability to grow rapidly and produce large amounts of biomass. With their ability to fix atmospheric nitrogen and root nodules, these plants make excellent cover crops. These crops are planted specifically for the soil's benefit and are crucial for increasing fertility. By incorporating green manure directly into the soil, it is possible to increase food production without the use of extra chemical fertilizers. When leguminous green manure is used, it decomposes rapidly due to its high nitrogen concentrations and low C/N ratios. As a result, the highest amount of net nitrogen mineral accumulation in the soil is usually observed around 2-4 weeks after the green manure is incorporated. The utilization of green manure crops is known to contribute to the improvement of the physical and microbiological properties of the soil, while simultaneously increasing the quantity of soil-available plant nutrients. Furthermore, it can contribute to reducing soil erosion, improving soil structure, and minimizing leaching losses. Additionally, these crops can help to decrease weed growth and mitigate insect and disease issues. Finally, green manure plants have the potential to function as a forage source for animals.

Green Manuring in Relation to Organic Farming

Organic farmers often utilize green manuring, which involves adding organic elements to the soil to enhance its fertility. Organic matter is essential for maintaining soil fertility and is widely considered as one of the most important components. The breakdown of organic waste plays a crucial role in making nutrients available to the soil. Green manuring has been a long-standing practice; however, it has only gained popularity among farmers in recent times. An approximately 40-50 days old green manure crop can yield an estimated 80-100 kg N ha^{-1}.

Need of Green Manuring

The total productive capacity of soils in the East, South and

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Southeast Asia is declining, and the cost of manufacturing chemical fertilizers required to provide nitrogen to these soils is increasing. Additionally, these soils have low levels of organic matter and nitrogen. To address all of these constraints, green manuring is the ideal solution.

Subsidiary Objectives of Green Manures

• **Catch crops:** Farmers inter-sow legumes with the main crop just before or after harvest to utilize any nitrates that may develop during the off-season or the residual moisture present in soil profile. These subsidiary crops are known as "*catch crops*."

• **Shade crops:** These crops are sown in young orchards to provide shade to the soil surface and minimize temperature rise. One example of a shade crop is Glyricidia.

• **Cover crops:** Farmers use these crops during the early growth stage to prevent soil erosion caused by wind and water, especially on mountainous slopes. Later, they utilize these crops as green manure.

• **Forage crops:** The cultivation of these crops involves harvesting a few rounds of green fodder in the early stages, after which they are utilized as green manure.

Reminders before using Green Manure

• After harvesting, the seeds can be broadcasted or sown.

• After the green manure has flowered, the greens can be cut and plowed under the soil.

• 1-2 weeks after incorporating the green manure into the soil as organic manure, the next crops can be sown or transplanted.

Criteria for Selection of Green Manure

Farmers can reap various benefits by incorporating green manure crops into their agricultural practices. These crops can be grown using residual soil moisture or with less rainfall, following the primary cropping season. Furthermore, they are not hosts to pests and diseases associated with crops, thus contributing to a reduction in pest and disease populations. The production of abundant seed and useful by-products like fodder and wood is another advantage of green manure crops. In addition, integrating animal husbandry and forestry can also be achieved through the utilization of green manure crops.

Importance of Green Manuring

• Green manuring can supply 40-80 kg ha^{-1} of nitrogen to the field and can increase rice yields by 20-30% when combined with high-yielding rice varieties.

• Green manure helps prevent the loss of nitrogen due to leaching and erosion and improves soil structure by binding soil particles together.

• Dhaincha, in particular, mobilizes soil phosphorus, potassium and other trace elements that are often deficient in surface layers, leaving them in a readily available form.

• Green manuring is useful for reclaiming saline and alkali soils as the decomposition of the manure releases organic acids that help neutralize the soil's pH.

• Certain green leaf manure crops can provide both nutrients and fodder for animals, such as perennial legume plants that can be used for green leaf manuring and fed to cattle during the off-season.

• Rapid growth of green manure crops such as dhaincha and sun hemp can accumulate 6-10 tonnes of biomass ha^{-1} within 40-50 days, but their high nitrogen content causes quick decomposition.

Green Manuring Crops

Trifolium alexandrium

Berseem is a versatile crop that can be used both as a fodder crop and as a green manure crop. Due to its high protein content, farmers can grow it as a green manure crop to enhance soil fertility by increasing nitrogen levels, although it is commonly used as poultry feed in the South. It was introduced from Egypt in the early 20th century and can produce 25,000 to 37,000 kg of green fodder $acre^{-1}$ in four to six cuttings.

Sesbania rostrata

This Manila Agathi imported from the Philippines fixes up to 50-65 kg ha^{-1} of atmospheric nitrogen. *Sesbania rostrata* is another interesting plant with nodules on its stem that fix atmospheric nitrogen. It grows well in wet soil as mentioned in figure 1.

Figure 1: Stem nodules of *Sesbania rostrata*

Sesbania aculeata

Dhaincha or Sesbania is a commonly used green manure crop in Bangladesh that possesses resistance against water-logging and alkalinity. It also can resist drought if germination is successful. This crop is particularly beneficial for rice-growing soils and grows rapidly to a height of 1.5 to 1.8 m in wet regions. Even after being submerged for around a week at a depth of 60 cm, it can still survive, showcasing its water-logging resistance. Moreover, it grows well in alkaline soil and can aid in restoring saline and alkaline soil.

Sesbania speciosa

Sesbania speciosa, which resembles dhaincha in terms of appearance and performance, is commonly used as a green manure crop in paddy fields. To cultivate the crop, two methods can be employed: broadcasting 17 kg of seeds ha^{-1} or sowing in a small plot and transplanting seedlings on bunds with a 1-meter distance between plants. The

seeds can be harvested once the crop reaches full maturity at the end of the fifth month. Planting the seedlings at a spacing of 5-8 cm between plants during the first crop can result in a yield of 2,200 to 3,200 kg of green leaf ha^{-1}. Moreover, *Sesbania speciosa* has the added benefit of being unappealing to cattle.

Phaseolus mungo

This quick-growing annual herb is cultivated mainly for its edible seeds, which can be harvested within 60-70 days. Farmers usually sow it at the beginning of the monsoon season, typically during the first week of July. The crop can be harvested twice, and the ripe pods are ready for picking by the first week of September. On average, it yields 3-4 q ha^{-1}. After the pods are harvested, the remaining crop can still be used as green manure for wheat, without the need for heavy ploughing. This crop is easy to turn under, and an average farmer with bullocks can manage the process.

Further Research Highlights

Influence of Green Manure on Soil Health

Nandhini *et al*. (2022) state that the application of green manure @ 6.5 t ha^{-1} + Split application of vermicompost in four equal splits @ 4 t ha^{-1} as basal, at active tillering, panicle initiation and flowering stages + Panchagavya @ 3% as foliar spray twice at active tillering and panicle initiation stages to Rice-Blackgram cropping system resulted in improved soil health.

Influence of Dhaincha (Sesbania aceulata) on Quality Parameters of Rice

According to Alagappan and Venkitaswamy (2016), the application of 100% RDN through Dhaincha (*Sesbania aceulata*) at the rate of 6.25 tons ha^{-1} has improved the quality parameters of rice is concerned (milling %, hulling %, head rice %, and co-efficient of shelling). The green manure treatment with 100% RDN had a greater impact on these quality parameters than inorganic treatments such as the recommended dose of fertilizer (RDF) and integrated nutrient management (INM) practices. The study also revealed that 100% RDN through green manure had a significant influence on volume expansion, water absorption, the cell elongation ratio, amylose and protein content of the rice kernel, followed by RDF and INM practices.

Influence of Green Manure Application on Soil Microbial Population

Alagappan and Venkitaswamy (2016) reported that the application of 100% RDN through Green manure (Dhaincha) recorded more grain yield and higher Microbial populations such as (Bacteria, Fungi, Actinomycetes) in 3 years of Rice-Greengram cropping sequence.

Influence of Green Manure Application on Rice, DMP, Grain and Straw Yield

Vijayakumar *et al*. (2006) stated that the experiment on different sources of organic manure such as green manure (Dhaincha), vermicompost, FYM and poultry manure. The results showed that the application of 100% RDN through green manure resulted in higher rice grain yield, straw yield, and DMP when compared to other organic manure treatments.

Influence of Green Manure Application on Soil Enzymatic Activity

Santhi and Palaniappan (1986) reported that the application of 100% RDN via Dhaincha produced higher soil enzymatic activity such as soil urease activity, soil dehydrogenase activity, and soil phosphatase activity, compared to other sources of organic manure (FYM, VC and PM).

Conclusion

Green manure are fast growing and provide more green biomass to the field; it also helps in improving crop yield and subsequent residual crop yield; it improves soil microbial populations; it improves soil enzymes and soil hormonal activities on decomposition; it improves organic acids and ultimately helps in soil fertility and productivity; and it also helps in improving soil health management so that soil fertility and productivity can be improved. Organic farming's ultimate motto is to feed the soil rather than the crop, hence green manure applications are a boon to organic agriculture.

References

Alagappan, S., Venkitaswamy, R., 2016. Impact of different sources of organic manures in comparison with TRRI practice, RDF and INM on growth, yield and soil enzymatic activities of rice-greengram cropping system under site-specific organic farming situation. *American-Eurasian Journal of Sustainable Agriculture* 10(2), 1-8.

Maitra, S., Zaman, A., Mandal, T.K., Palai, J.B., 2018. Green manures in agriculture: A review. *Journal of Pharmacognosy and Phytochemistry* 7(5), 1319-1327.

Nandhini, D.U., Thiyagarajan, M., Somasundaram, E., 2022. Soil fertility of rice-blackgram cropping sequence as influenced by different organic sources of nutrients. *Bangladesh Journal of Botany* 51(2), 289-296. DOI: https://doi.org/10.3329/bjb.v51i2.60426.

Santhi, S.R., Palaniappan, S.P., 1986. Effect of Neem leaf (*Azadirachta indica* L.) on growth and yield of low land rice. *Journal of Agronomy and Crop Science* 157(2), 114-117. DOI: https://doi.org/10.1111/j.1439-037X.1986.tb00056.x.

Vijayakumar, M., Ramesh, S., Prabhakaran, N.K., Subbian, P., Chandrasekaran, B., 2006. Influence of system of rice intensification (SRI) practices on growth characters, days to flowering, growth analysis and labour productivity of rice. *Asian Journal of Plant Sciences* 5(6), 984-989. DOI: https://doi.org/10.3923/ajps.2006.984.989.