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Green Manuring: A Biological Approach to Maize Nutrition

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Maize is a highly nutrient demanding crop and its continuous cultivation leads to depletion of soil nutrient reserves and deterioration of soil health. In this context, green manuring serve as an ecofriendly and sustainable approach for improving soil health and ensuring nutrient availability in maize-based production systems. Green manure crop fixes atmospheric nitrogen and add to soil after incorporation, release nutrients and organic carbon through decomposition and mineralisation. They also improve soil physical, chemical and biological properties and promote nutrient cycling, enhancing nutrient use efficiency and help suppressing weeds. Thus, integrating green manure along with chemical fertilizers reduces excessive dependence on external inputs while maintaining soil fertility and supporting sustainable maize production.

Introduction

Global climate change, together with the increasing food demand, is placing considerable pressure on agricultural systems to sustain high productivity while simultaneously maintaining environmental sustainability. At present, intensive agricultural systems rely heavily on external inputs, particularly irrigation water and chemical fertilizers, to achieve higher crop yields. Excessive application of nitrogenous fertilizers has not only failed to produce proportional increases in crop productivity but has also resulted in several detrimental environmental consequences, such as soil degradation, deterioration in crop productivity and product quality, and reduction in biodiversity. Simultaneous improvement in crop yield and nutrient use efficiency is challenging due to the increasing demand for food and intensifying environmental issues. Several agricultural management strategies have been formulated and implemented in order to address this challenge. Certain practices such as integrating the use of synthetic with organic fertilizers, optimizing water-nitrogen coupling and incorporation of straws or plant residues into the soil in order to achieve dual benefits of reducing the use of synthetic fertilizers while enhancing crop productivity, has led to widespread adoption in modern agricultural systems. Green manures, also known as cover crops, has evolved as an efficient strategy for improving the soil physical, chemical, and biological properties, as well as increasing the diversity of soil microorganisms. Green manure crops refers to nitrogen-fixing or nutrient-specific crops that are cultivated specifically to be incorporated into the soil while still green with the intention of increasing its organic matter content in soil, thereby, countering soil degradation and decreasing biodiversity that results from prolonged use of inorganic fertilizers. Incorporation of leguminous green manure within gramineae crop rotations has gained popularity as a sustainable approach in integrated ecological agriculture systems.

Green Manuring

Green manuring is the practice of enriching the soil fertility and productivity by incorporating undecomposed green plant tissues, particularly legumes while they are green or soon after they start flowering.

Green manuring is of two types-

Green manuring *in situ*: It refers to the practice of growing and incorporating or burying of a green manure crop (e.g., cowpea, sun hemp, dhaincha) in the same field as the one to be manured.

Green leaf manuring: It refers to turning into the soil green leaves and twigs collected from shrubs and trees growing on bunds, wastelands or nearby forest areas.

Need For Integrating Green Manures With Maize

Maize is a highly nutrient demanding and exhaustive crop having a greater requirement for nitrogen and other essential nutrients. Continuous cultivation of maize, particularly with heavy reliance on chemical fertilizers results in depletion of soil organic matter and deterioration of soil physical, chemical, and biological properties. Therefore, instead of completely relying on chemical nutrient application, green manure crops in maize-based systems serve as a sustainable alternative by improving soil fertility and sustaining crop productivity.

Fig. 1: Maize and dhaincha intercropping

Fig. 2: Maize and ricebean intercropping

Fig. 3: Maize and cowpea intercropping

Fig 4: Maize and blackgram intercropping

Importance of Green Manuring

- Green manure crops particularly legumes fix atmospheric nitrogen through symbiotic biological nitrogen fixation.
- Their biomass, when incorporated into the soil, undergoes decomposition and mineralization, thereby releasing plant-available nutrients and contributing organic carbon.

- The addition of organic residues can improve soil aggregation, porosity, water-holding capacity, cation exchange capacity, microbial biomass, and enzymatic activity, while also promoting nutrient cycling within the soil–plant system.
- Furthermore, the synchronized release of nutrients from decomposing green manure biomass may improve nutrient-use efficiency and reduce nutrient losses.
- A dense canopy of green manure suppresses early season weeds before the actual crop-weed competition starts.

Method To Practise Green Manuring In Maize

A suitable variety of green manure is selected depending on its ability to adapt to local conditions and its suitability for intercropping. The crop should be fast- growing and should produce abundant biomass along with fixing atmospheric nitrogen. It should be sown as an intercrop along with maize crop along the inter-rows. The success of green manuring in maize is mainly dependent upon when, how and at what stage the green manure crop is incorporated into the soil. Green manure crops are grown for short period in maize until it produces soft, succulent biomass. It is incorporated into the soil at 30-40 DAS, before the commencement of flowering. Incorporation should be done before the plants become matured and fibrous, otherwise the decomposition process would become slower and the release of nutrients gets delayed.

Suitable Green Manure Crops For Maize

- Sunhemp (*Crotalaria juncea*)
- Dhaincha (*Sesbania aculeata*)
- Sesbania (*Sesbania rostrata*)
- Cowpea (*Vigna unguiculata*)
- Ricebean (*Vigna umbellata*)
- Cluster bean (*Cyamopsis tetragonoloba*)
- Blackgram (*Vigna mungo*)
- Greengram (*Vigna radiata*)

Conclusion

Green manuring serves as an economical, environment friendly and sustainable approach in maize production. Although green manuring cannot completely replace chemical fertilizers, but its integration with chemical fertilizers lead to improvement in nutrient use efficiency, maintenance of soil fertility and reduction in excessive dependence on external inputs. As the agriculture moves towards achieving sustainability, green manure can be viewed as an important component of integrated nutrient management and climate-resilient maize production.

References

1. Vijay Kumar, S., Madhu Bindu, G. S., Padmaja, B., Kiran Reddy, G., & Latha, P. C. (2023). Growth of maize in response to in-situ green manuring. International Journal of Environment and Climate Change, 13(10), 2476–2484. https://doi.org/10.9734/IJECC /2023/v13i103103
2. Devi, K., Babu, S., Rathore, S. S., Rai, R., Yeasin, M., Krishnan, V., Sudesh, Pandey, A., Gairola, A., Kumar, V., & Yadav, D. (2025). Effect of legume integration and nitrogen levels on selected ecosystem services and soil biological indicators in maize farming under humid subtropics. *Proceedings of the Indian National Science Academy, 91*, 1512–1525. https://doi.org/10.1007/s43538-025-00160-z
3. Ruangsanka, S., Sanfan, S., &Chaiong, U. (2020). Does intercropping of baby corn (Zea mays L.) with pulse legumes improve soil fertility, crop productivity and profitability? *The Journal of Agricultural Science*, 15(1), 9–17.http://doi.org/10.4038/jas.v16i1.9180

4. Wang, P., Yu, A., Huo, J., Wang, Y., Shang, Y., Pang, X., & Jiang, K. (2025). Effects of nitrogen reduction with green manure incorporation on maize photosynthetic performance and yield. Journal of Agriculture and Food Research, 24, 102320. https://doi.org/10.1016/j.jafr.2025.102320
5. Yang, L., Luo, J., Gu, C., Huang, W., Dai, J., Liao, P., Chang, H., Yao, X., Gao, Y., Hu, W., Li, Y., & Qin, L. (2026). Preceding intercropped leguminous green manure shifts microbial life strategies to regulate soil organic carbon in low-nitrogen input maize–rapeseed rotations. Soil and Tillage Research, 256, 106841. https://doi.org/10.1016/j.still.2025.106841