Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(2): 655-657
Received: 08-01-2020
Accepted: 12-02-2020

P Ahmed
Assistant Professor, Department of Agronomy, SCS College of Agriculture, Assam Agricultural University, Rangamati, Dhubri, Assam, India

RK Nath
Assistant Professor, Department of Entomology, SCS College of Agriculture, Assam Agricultural University, Rangamati, Dhubri, Assam, India

R Sarma
Professor, Department of Horticulture, SCS College of Agriculture, Assam Agricultural University, Rangamati, Dhubri, Assam, India

Corresponding Author:
P Ahmed
Assistant Professor, Department of Agronomy, SCS College of Agriculture, Assam Agricultural University, Rangamati, Dhubri, Assam, India

Cultivation of green manuring crops for improving soil health and increasing yield of rice in Tinsukia district of Assam- A case study

P Ahmed, RK Nath and R Sarma

Abstract
An experiment was conducted at Tinsukia district of Assam during the *Kharif* season of 2015-2016 and 2016-17 to evaluate the soil properties, nutrient availability and productivity of rice as influenced by cultivation of green manuring crop dhaincha in acidic soil condition. The study revealed that the change in soil physical properties and nutrient availability was significantly increased under the green manuring practiced plot. On an average, incorporation of green manuring crop dhaincha increased 7.8% in paddy yield over the plots where dhaincha was not grown as green manure crops. Moreover, Dhaincha as green manure improved the soil physical environment, made the soil softer indicated by reduced bulk density, increased porosity and the availability of major nutrients and ultimately favoured in increased yield of rice (5400 kg/ha) with B: C ratio of 1.87 and a net profit of ₹ 27780.00/ha.

Keywords: green manuring, dhaincha, soil health, rice productivity

Introduction
The inadequate and imbalanced fertilizer use coupled with no addition of organic manures has led to the emergence of multi-nutrient deficiencies in many areas. The integrated nutrient supply system envisaging conjunctive use of chemical and organic fertilizers is, therefore, the most ideal system of nutrient management. The system enhances nutrient-use efficiency, maintains soil health, enhances yields and reduces cost of cultivation. There is need to augment the supplies of organic manures (farm yard manure, green manure, and compost/vermicomposting) and fortified & customized fertilizers supplying secondary and micronutrients to have IPNS on a sound footing. There is a huge scope of introduction of Dhaincha as green manure crop in rice based cropping system during the pre *kharif* season.
Soil fertility is an important consideration in the development of double cropping systems. Double cropping cereals with leguminous species have potential implications for the nitrogen requirement and usage by the cereal component(s) (Hargrove *et al.*, 1983; Narwal *et al.*, 1983) [2, 3] and less frequently on phosphorus use efficiency. Paddy is the major cereal crop grown in Assam by taking two crops in a year. This is exacerbated by continuous mono-cropping of cereals without replacing nutrients lost by crop harvest. Moreover, chemical fertilizers are costly for most subsistence farmers to correct the deficiency. Hence, alternate nutrient management technologies like green manuring which could supplement the required nutrients to the soil. Tinsukia district of Assam produces a huge quantity of vegetables in different pockets.
Thus, the present investigation attempted with objective to increasing the soil fertility and to increase the yield of the poor soils by adding green manure crop dhaincha in consistently grown paddy under acidic soil conditions of Tinsukia district of Assam.

Green Manuring
Green manuring can be defined as a practice of ploughing or turning into the soil undecomposed green plant tissues for the purpose of improving physical structure as well as fertility of the soil. It's a very good way of increasing the fertility of the soil, and can give huge benefits for farmers.

Benefits of Green Manures
1. Reduce the need for chemical fertilizers: By using green manures the need to bring in fertilizers is reduced. By not using fertilizers, costs are saved and production can be increased to feed the family for longer, or excess produce can be sold.

2. Increase biomass production in the fields: Green manure can produce 50 tons to 140 tons of extra biomass per hectare. This is the equivalent of carrying up to 3000 loads of leaf litter. By this way Green manuring can increase the biomass production in the field.

3. Increase in micro-organisms and their activity in the soil: Beneficial micro-organisms live and work around the roots of green manure plants in the soil. They help the plants to catch and create nutrients in the soil. The fertility isn't just for the plants; it helps to make the soil rich. The microorganisms help the plants and the soil, and in return the green manures help to protect the microorganisms from being damaged by the sun, wind, rain, leaching, etc.

4. Increase Farm production: Using green manures can increase the production of grains, pulses, vegetables, fuel, etc. grown on the farm.

5. Decrease work and expense: After using green manures, the soil becomes loose and easier to plough or dig thus it reduces work and expense.

6. Reduce weed: Green manures cover the ground thus it reduce the weed growth in the field.

7. Protect the soil: By covering the soil, green manures protect it from the damaging effects of hot sun, wind and hard rain.

8. Improve the soil: Green manures improve the physical characters of soil by decreasing the bulk density, increasing the porosity and increasing the water holding capacity of soil.

9. Improve the quality of crops: Crops grown with green manures are more tasty and nutritious than those grown with chemical fertilizers.

Types of Green Manuring

There are two types of Green manuring

Green Manuring *In Situ:* In this system, green manure crops are grow and buried in the same field which is to be green manured. The most common green manure crops grown under this system are sunnhemp, *Dhaincha* etc.

Green Leaf Manuring: Green leaf manuring refers to turning into the soil green leaves and tender green twigs collected from shrubs and trees grown on bunds, waste lands and nearly forest area. The common shrubs and trees used are: Glyricidia, Sesbania, Subabul etc.

Selection of green manuring crops: There are many plants which can be used as green manures. In particular, the type of green manure should be selected according to the type of crop it is growing with or in between. For a large plant like maize, a large green manure like velvet bean or *Sesbania* should be used. For a short crop like many vegetables, smaller green manures such as mustard or buckwheat can be used.

Criteria for selection of green manuring crops

- Plants should be fleshy and soft,
- They should be fast growing;
- They should be fast to decompose;
- They should be leguminous,
- They should not attract pests and diseases;
- They should not compete with crops.
- They should provide nutrients needed in the soil

Examples of winter-grown green manures

Low altitude-mustard, peas, broad (fava) bean, fenugreek, tobacco, buckwheat, etc.
Mid altitude-mustard, peas, broad bean, fenugreek, buckwheat, etc.
High altitude-mustard, peas, broad bean, buckwheat etc.

Examples of summer-grown green manures

Low altitude: Amaranth, sunhemp (*Crotalaria spp.*), *Sesbania*, *Chenapodium*, fenugreek, lab lab, velvet bean, jack bean, tobacco, etc.

Mid altitude: Amaranth, sunhemp (*Crotalaria spp.*), *Sesbania*, *Chenapodium*, fenugreek, lab lab, velvet bean, jack bean, tobacco, hemp, etc.

High altitude: Amaranth, sunhemp (*Crotalaria spp.*), *Chenapodium*, fenugreek, tobacco, hemp, etc.

A case study on green manuring at Tinsukia district of Assam

Paddy is the major cereal crop grown in the Tinsukia district of Assam by taking two crops in a year. This is exacerbated by continuous mono-cropping of cereals without replacing nutrients lost by crop harvest. Moreover, chemical fertilizers are costly for most subsistence farmers to correct the deficiency. Hence, alternate nutrient management technologies like green manuring which could supplement the required nutrients to the soil. So, there is a huge scope of introduction of green manuring crops.

KVK, Tinsukia conducted an experiment at Kakopothar area during the year 2015-2016 and 2016-17. Soils of the experimental site was sandy clay loam in texture (62-65% sand, 18% silt, 16-17% clay) and acidic with a pH of 5.30. The soil was medium in organic carbon content (0.73%), medium in available nitrogen (284.23 kg/ha) and phosphorus (20.65 kg/ha) and medium in available potash (157.65 kg/ha). The two treatments (T_1: Dhaincha, T_2: Control) were selected and replicated three times.

At the beginning the green manuring dhaincha crop were grown and they were chopped before they attaining the flowering stage and mixed in the soil by ploughing the land. Then the land was left for 24 days to allow for decomposition. In the beginning and at the end of the green manuring the soil samples were collected randomly in the fields and analysed the soil samples following standard methods.

The total biomass of dhaincha was incorporated in the soil in the fourth week of June. Rice crop was harvested in the second week of November at full maturity. For data collection of rice, ten hills from each plot were sampled randomly. The crop was cut at the ground level. Threshing, cleaning, and drying of grain were done separately plot-wise. The weights of grain were recorded plot-wise. Pre and post-harvest soil parameters are given in table 1.

Table 1: Effects of Cultivation of Dhaincha on different soil parameters

Soil Properties	Values/Description (Before Dhaincha Cultivation)	Values/Description (After Dhaincha Cultivation)
Soil Texture	Sandy clay loam	Sandy clay loam
Bulk Density (g cm^{-3})	1.31	1.26
Particle Density (g cm^{-3})	2.45	2.41
Porosity (%)	43.07	47.83
Soil pH	5.3	5.0
Organic carbon (%)	0.73	0.86
Available N (kg/ha)	284.23	294.12
Available P_2O_5 by Bray's method (kg/ha)	20.65	23.63
Available K_2O (kg/ha)	157.65	159.34
Sali rice yield (kg/ha)	4980	5400
Net profit (₹/ha)	25430.00	27780.00
B:C ratio	1.54	1.87

Yield and Economics

On an average incorporation of green manuring of dhaincha in the paddy has given more yields over the plots where dhaincha was not grown as green manure crops. Moreover, Dhaincha as green manure improved the soil physical environment, made the soil softer indicated by reduced bulk density, increased porosity of soil, increased the availability of major nutrients and ultimately favoured in increased yield of rice. This practice of in-situ incorporation of dhaincha can bring about reduction of excessive use of urea in paddy fields which results in greenhouse gas emissions and air pollutions. The farmers of Kakopothar area cultivated dhaincha at around 0.4 ha of land before growing paddy. Following green manuring practice and the application of soil test based nutrient management they got remarkable paddy yield of 5400kg/ha with Ranjit as a high yielding variety with B: C ratio of 1.87 and a net profit of ₹ 27780.00; Moreover soil health also improved with the use of dhaincha as green manuring crop. Whereas, the fallow paddy cropping sequence gave them a yield of 4980 kg/ha with a B: C ratio of 1.54 and a net profit of ₹ 25430.00 with fertilizer cost. The incorporation of biomass released nutrients to soils, improved physical environment of soil and enhanced crop uptake and thereby increased crop yields (Reddy *et al*., 2004). The above study is an agreement with the study done by Singh and Shivay (2005) [5]. They revealed that the incorporation of *Sesbania aculeata* (dhaincha) resulted in significantly higher grain and straw yield of basmati rice and increased yield in wheat respectively. These findings are in conformity with the findings of Dey and Nath (2015) [1]. They reported that the cultivation of green manuring crop dhaincha improved soil health and productivity of rice in Khowai district of Tripura.

Conclusion

Inclusion of dhaincha in rice based cropping systems has the potential to improve the soil physical, chemical and biological environment and ultimately soil health and at the same time increased yield of rice can be obtained. Green manuring of dhaincha in paddy has given more yield over control and significant changes brought in soil fertility as well as improved physical characters under acidic soil condition of Tinsukia district of Assam. Recommending the Dhaincha as a green manure crop is still holding good under the agro climatic condition of Tinsukia district where paddy is consistently growing by chemical farming.

References

1. Dey D, Nath, D. Assessment of change in soil properties, nutrient availability and yield of paddy as influenced by cultivation of green manuring crop. Asian J Soil Science. 2015; 10(1):158-161.
2. Hargrove WL, Touchton JT, Johnson JW, Previous Crop Influence on Fertilizer Nitrogen Requirements for Double-Cropped Wheat. Agronomy J. 1983; 75(6):855-859.
3. Narwal SS, Malik DS, Malik, RS, Studies in multiple cropping II. Effects of preceding grain legumes on the nitrogen requirement of wheat. Expl. Agric. 1983; 19:143-151.
4. Reddy KR, Khaleel R, Owerchash MR, Changes in soil physical properties due to organic waste application. A Review. J Environ. Qlty, 2004, 10-141.
5. Singh A, Shivay YS. Relative Efficiency of Zinc Sources and Green Manure Crops in Improving the Productivity of Basmati Rice (*Oryza sativa*), Division of Agronomy, Indian Agricultural Research Institute, New Delhi 110 012, India, 2005.