



AICRP-Long-Term Fertilizer Experiments (AICRP-LTFE)

Project Title

To study the changes in soil quality, crop productivity and sustainability with jute-rice-wheat

Brief introductory note

Long Term Fertilizer Experiment was started at CRIJAF in 1971 with jute-rice-wheat cropping system to identify the constraints related to this cropping sequence. This tropical site is located at 88° 26' E (longitude) and 22° 45'N (latitude) and at 9 m above MSL. Treatments undertaken were 50% NPK of recommended dose, 100% NPK of recommended dose, 150% NPK of recommended dose, 100% NPK of recommended dose + hand weeding, 100% NPK of recommended dose + ZnSO₄ @10kg/ha (in wheat only), 100% NP of recommended dose, 100% N of recommended dose, 100% NPK of recommended dose + FYM @ 5t/ha (in jute only), 100% NPK of recommended dose (-S) and control.

Objectives

- (i) To study the effect of continuous application of plant nutrients, singly and in combination, in organic and inorganic forms, on the yield performance of crops in multiple cropping system
- (ii) To study the effect of application of secondary and micro nutrients (as per the need) on crop yield and also on the assessment of the need for these elements under an intensive cropping programme
- (iii) To work out the amount of nutrient removal by the crops
- (iv) To monitor the changes in soil properties as a result of continuous manuring and cropping with respect to the physical, chemical and microbiological characteristics of the soil in relation to its productivity
- (v) To investigate the effect of intensive use of pesticides on the buildup of residues and soil productivity and
- (vi) To make an assessment of the incidence of soil borne diseases and changes in pests and pathogens under the proposed manuring and cropping programme.

Sustainable yield index

Sustainable yield index (SYI) values were higher in 150% NPK and 100% NPK+FYM treatments than others in all three crops (jute, rice and wheat). Amongst the treatments, irrespective of the crops, the highest SYI values were obtained with 150% NPK. After 49 years



of cropping the SYI of 100% N, 100% NP and control showed lower values, which suggested that imbalance fertilization over long period deteriorated soil fertility and crop productivity. Comparing the two cereal crops, SYI was greater for rice indicating better environmental condition (tropical sub-humid lower Indo Gangetic plain) for it.

Soil quality and C dynamics

Impacts of long term nutrient management on soil quality and carbon (C) dynamics were studied under rice-wheat-jute cropping system in lower Gangetic plains in Eastern India. Nutrients availability was significantly high under balanced fertilization (100% NPK+ FYM) than unfertilized control and other treatments. Application of 100% NPK either through inorganic fertilizers alone and supplemented by organics like FYM significantly enhanced soil enzymatic activities, viz. fluorescein diacetate (FDA), acid phosphatase and alkaline phosphatase. Soil organic carbon was improved in 100% NPK+ FYM treatment. Soil available P was depleted in P omitted plots. DTPA extractable micronutrients were decreased as compared to the initial status. Carbon dynamics was investigated on the basis of its distribution of labile (microbial biomass C, permanganate oxidizable C and water soluble C) and slow pools (Walkley Black oxidizable organic C), its indices (C pool index, lability index) and C management index (CMI) at different soil depths. Labile, slow and total C was also found highest in 100% NPK + FYM. Enhanced C indices under 100% NPK + FYM over 100% NPK and other treatments signified the importance of long term balanced fertilization on soil C stabilization. Lability indexes were lower at sub-soil.

Weed density and diversity in jute under long-term experiment in jute-rice-wheat cropping system

A total of 12 weed species were recorded under different fertilizer treatments. Significantly higher total weed density ($733/m^2$) was recorded in 100% NPK + FYM treatments compared to other treatments. Significant variation in weed species was also recorded in different fertilizers treatment. *Cyperus rotundus* density was comparatively higher in control, 50% NPK and 100% NPK + and hand weeding plot. *Echinochloa colona* density was higher in 150% NPK, 100% NPK + Zn and 100% NP. Comparatively higher broad-leaved weed density was recorded in 100% NPK + FYM.

Climate change and its impact

The scrutiny of long-term temperature data showed that mean temperature was in decreasing

trend in jute growing season, but it was observed reverse in both the cases of rice and wheat seasons. However, total rainfall was in decreasing trend in jute and wheat growing seasons, but it was observed reverse in rice growing season. It was observed that the productivity of jute, rice, and wheat was positively correlated with mean temperature for all the treatments except for the control plot wheat yield. When crop yields were correlated with rainfall, it was observed that jute fibre yield was positively correlated with seasonal total rainfall, but rice and wheat yields were negatively correlated for all the treatments except for the control plot yield of rice.



Field view of jute in LTFE



Field view of paddy in LTFE



Visit of LTFE Field at ICAR-CRIJAF by QRT Team of LTFE & STCR

TFE Project Team

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