Straw as organic matter in rice culture with special reference to soil biology

A thesis submitted for the Degree of
Doctor of Philosophy

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May 2008

ABSTRACT

A long term investigation on the influence of rice straw application on grain yield, yield components and growth parameters of rice with special reference to soil organic matter and microbiology in rain-fed wetland rice fields with different yield levels in the Low Country Intermediate Zone of Sri Lanka was carried out. Makandura and Wariyapola were selected as the experimental sites. The cut off point to separate high and low yielding environments was taken as 1.50 t/ha. An experiment with six treatments laid out in a randomized complete block design with two replications was conducted over eight consecutive cultivation seasons of *yala* and *maha* from 1996 to 2000 at both sites. All *yala* seasons at Wariyapola were considered as low yielding environments. The plot size of the experiment was 6 m x 3 m. The treatments included in the experiment were: (i) straw (2 t/ ha) with inorganic fertilizer 'a', (ii) straw (3 t/ ha) with inorganic fertilizer 'b', (iii) only straw 2 t/ ha, (iv) only straw 3 t/ ha, (v) only inorganic fertilizer and (vi) the control (neither straw nor inorganic fertilizer). Application of straw alone increased rice yield only in environments with yield levels higher than 1.5 t/ ha. Application of inorganic fertilizer in addition to straw could further enhance grain yield due to increase in number of filled grains per panicle and 1000 grain weight as a result of increase in crop growth. Application of rice straw together with inorganic fertilizer initially increased microbial growth which in turn may have increased the decomposition and release of native nutrients in the soil organic matter. Long term application of rice straw did not deplete soil N and P levels but improved the soil K level over time irrespective of the yield level of the environment. A relatively high level of soil organic matter content could be maintained even in deeper layers of soil when the soil was incorporated with straw. Increase in the organic matter content in the soil resulted in increase in grain yield in a field which was free from inorganic fertilizer. The soil microbial activity increased with the increase in straw level irrespective of the season and the yield level of the environment. No association was found between microbial activity and grain yield and soil microbial activity was reduced by the application of inorganic fertilizer. The soil microbial activity was measured by CO_2 emission caused by soil respiration. The total soil bacterial population increased with the increase in straw level irrespective of the season and yield levels of the environment. Strong associations of soil bacterial population with grain yield of rice and soil organic matter content were found in an environment free from inorganic fertilizer. What was interesting here was that application of straw resulted in increase in bacterial population in rice soils, which in turn resulted in increase in grain yield of rice under an inorganic fertilizer free environment. Soil organic matter content governed the density of soil microbes hence may have increased microbial activity and nutrient recycling.