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Effect of crop residue management on microbial biomass accumulation in the soil

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The present study was undertaken to evaluate the influence of applications of straw and chemical fertilizer on the soil microbial biomass under reduced tillage, dryland conditions. Straw incorporation in combination with chemical fertilizer resulted in the greatest microbial biomass level, which is the source for nutrients in the soil.

For developing countries, residue management is especially important because the amount of nutrients in crop residue is several times higher than the quantities of these nutrients applied as high cost fertilizers. In the present study, four treatments with three replicates each were established in randomized block design using a plot size of 5 m × 4.2 m in the dryland experimental farm of the Institute of Agricultural Sciences, Banaras Hindu University (25° 18′ N lat. and 80° 1′ E long., 76 m above msl) using a rice-lentil crop rotation. The treatments were: (a) control; (b) chemical fertilizer–NPK (80 kg N ha^{-1}, 40 kg P ha^{-1}, 30 kg K ha^{-1}; for N urea, for P single super phosphate, and for K muriate of potash); (c) wheat straw (C = 37.8%, N = 0.48%, P = 0.09%) – 2 kg m^{-2} (the amount of N was equivalent to that under treatment b); (d) wheat straw (1 kg m^{-2}) + fertilizer (50% of b). Applications of inputs to plots were made on 24 June 1990 and again on 30 June 1991. Straw was lightly incorporated into soil while chemical fertilizer was applied on the soil surface. Rice (*Oryza sativa* var. Akashi) was sown on 17 July 1991 and harvested on 26 October. Lentil (*Lens esculenta* var. Pant 209) was sown on 20 November 1991 and harvested on 17 March 1992.

Two soil samples were randomly collected to a depth of 10 cm from each plot, sieved through a 2 mm mesh screen, and mixed together into composite samples. Microbial biomass in field-moist samples was determined by chloroform fumigation extraction method[1]. All the results are expressed on oven dry soil (105° C, 24 h) basis. Statistical analysis was done by using SPSS/PC statistical software on an IBM compatible microcomputer[2]. Significant differences between means were examined by using ANOVA and LSD range test.

Microbial biomass C was maximum in the straw + fertilizer treatment (408–420 $\mu g\ g^{-1}$) followed by straw (360–392 $\mu g\ g^{-1}$) and fertilizer treatments (272–357 $\mu g\ g^{-1}$). The values for control were minimum (238-246 $\mu g\ g^{-1}$). With time straw+fertilizer treatment accumulated more microbial biomass C in the soil (77% over control), followed by straw treatment (51% over control) (Figure 1). The effect of treatments was significant at $P < 0.01$. However the effect of fertilizer was transient in nature with the microbial C value at the end of the experiment not being statistically different from the control (Figure 1).

Microbial biomass was maximum in straw + fertilizer treatment because limitations due to nutrients as well as carbon were overcome by combined exogenous application of chemical fertilizer and plant residue.

A very large and rapid increase is reported in the size of the microbial biomass following straw incorporation[3]. The

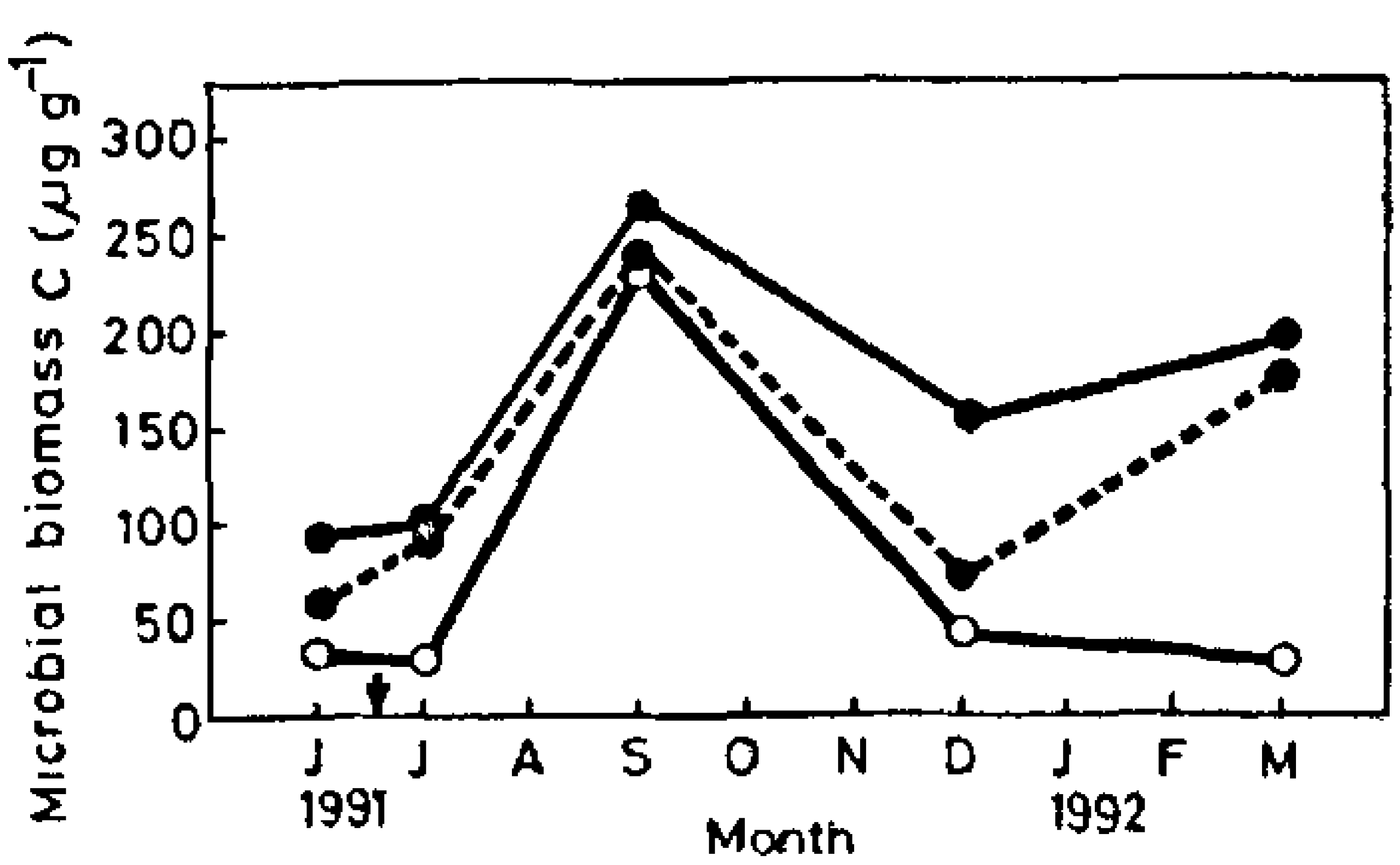

Figure 1. Effect of applications of straw and fertilizer, singly and in combinations (arrow indicates time of second application), on microbial biomass C($\mu g\ g^{-1}$). The values for control have been subtracted from the treatment values. Solid circles connected by solid line are for straw + fertilizer; solid circles connected by broken line are for straw and open circles connected by solid line are for fertilizer.

initial flush of microbial activity probably results from rapid catabolism of simple soluble-carbon compounds initially present in the wheat straw[4]. After an initial immobilization of N from the added straw, mineralization of previously immobilized N occurs, resulting in a net release of N (ref. 5). The widely fluctuating moisture and temperature at the soil surface induces a variable half-life for the microbial biomass[6]. The recycling of nutrients is the eventual outcome of this microbial growth, death and regrowth. In this process, microbial biomass as an agent of nutrient cycling process serves a dual role: as sink and source for nutrients[7,8].

In a straw managed system, microorganisms may be the primary source of mineralizable nutrients in soil[9] and much of the native soil mobile N may be derived from the dead microbial biomass[7,10]. The amount of N held in microbial biomass may indeed correspond to potentially mineralizable N (refs. 11, 12). In the present study the rate of N-mineralization was greatest in the straw + fertilizer treatment[13].

Results of the present study thus indicate that a combined input of plant residue and fertilizer is a better option for agriculture in the developing countries as it helps build up the active soil organic matter pool for sustained high nutrient supply. The incorporation of residue under reduced tillage will additionally conserve soil moisture[14].

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The life-cycle of potato vector, *Myzus persicae* (Sulzer) in India

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Eggs of the potato main vector, *Myzus persicae* were collected for the first time from India. This aphid was earlier known to reproduce parthenogenetically. Its different morphs showed 11 and 12 chromosome numbers.

MYZUS PERSICAE is the chief aphid vector of several potato viruses[1], the most important being potato virus Y (PVY) and potato leafroll[2]. Due to these viruses, potato yields are reduced by 40 to 85 per cent. A complete knowledge on its complicated life-cycle is very essential, so as to have effective control[3]. Males and oviparous females of this aphid were earlier described from India[4] which otherwise mostly reproduces asexually.

Mating and egg laying have now been observed for the first time on peach trees (*Prunus persica*) at Modipuram, Meerut, during February and March 1992. The mating lasted for about 5 minutes. The eggs were laid in the crevices of axillary buds in clusters. Some eggs were also laid on the twigs. These were first greenish in colour and later turned shining black.

Cytological studies of the sexual forms collected from peach trees and asexuals from potato crop were carried out by subjecting them to air-dry Giemsa stain method[5]. The results are presented in Table 1. These morphs either had chromosome numbers $2n = 11$ or 12. Males were formed on the secondary host plants like potato and flew to the primary host plant (peach) for mating. The gynoparae (which form oviparous females) also fly to peach trees. Here males are X0 and are produced parthenogenetically through a specialized meiosis in which only X chromosome undergoes

Table 1. Chromosome numbers in different morphs of *M. persicae*

Peach	Potato
Males $2n = 11$	Clone Asexual female (apterous) $2n = 11$
Asexual female $2n = 12$ (alate)	Clone Asexual female $2n = 12$ (apterous)
	Asexual female $2n = 12$ (alate)