Effect of maize mulch decomposition on glyphosate fate in no-till mulch amended soils

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INTRODUCTION

✓ **Mulch residues on soil surface** practiced in conservation agriculture may greatly modify pesticide fate through increased **microbial activity and diversity of their community composition**. Microbial activity and diversity is mainly associated to biochemical composition of residues and it changes with their decomposition. Since pesticides are mostly degraded by co-metabolism, changes associated with residue decomposition may modify their fate.

✓ **Readily available pools of C** tend to deplete rapidly whereas **recalcitrant fractions** like lignins degrade slowly during residue decomposition. **Relationship** between the changing biochemical composition of mulch residues with decomposition and evolution of microbial biomass and their combined effect on pesticide fate is still poorly understood and described in pesticide fate model.

✓ It is **hypothesized** that mulch residues with different degree of decomposition will show specific pattern of carbon mineralization due to different biochemical quality and this will further modify pesticide fate.

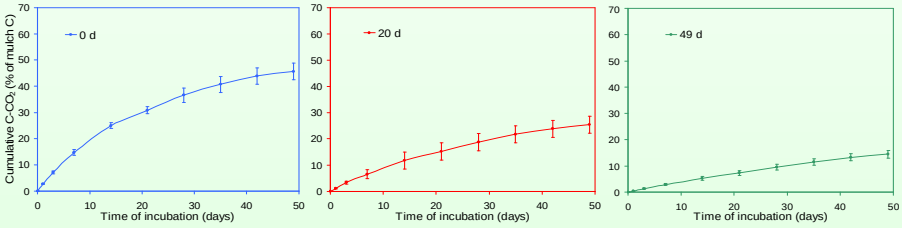
Objectives

❑ **To characterize the biochemical composition of different mulch residues during their decomposition and to monitor dynamics of C mineralization**
❑ **To evaluate the effect of decomposition degree of residues on the fate of glyphosate intercepted on the mulch**

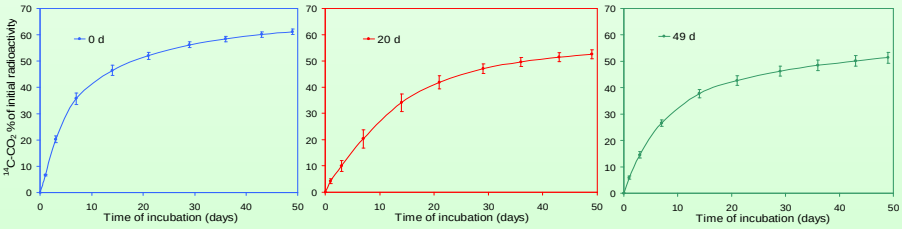
Results and discussion

Fresh residues | **Pre-incubated residues**

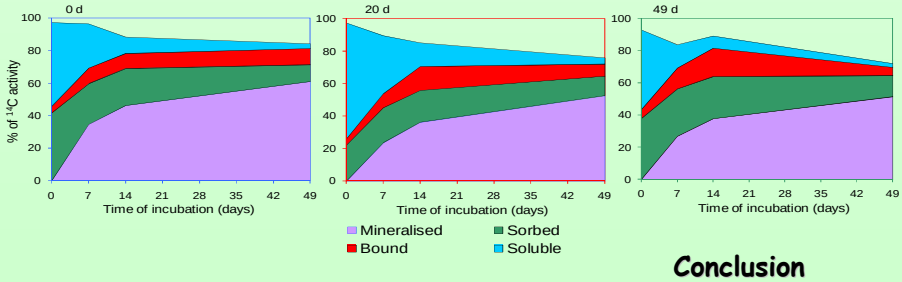
❖ Mulch C decomposition



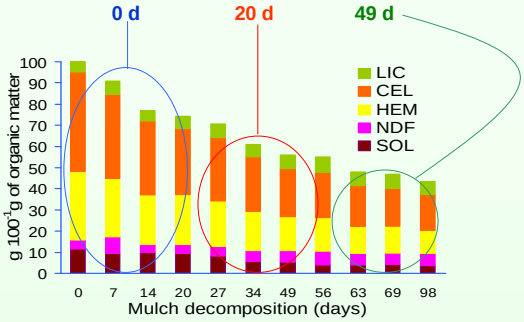
❖ ^{14}C-Glyphosate mineralization



❖ Availabaility of glyphosate



❖ Biochemical composition of mulch C



➢ Mulch residues due to differences in their initial composition exhibited different dynamics of C mineralization. Fresh (0 d) residues with high labile fractions and less recalcitrant fractions decomposed at higher rate than already decomposed (20 and 49 d) residues containing more recalcitrant (lignin and cutin) contents.

➢ Readily available fractions degraded quickly during incubation followed by more recalcitrant lignin fractions. Thus there is increase in lignin contents during mulch decomposition.

➢ Significantly higher cumulative mineralization in 0 d treatment is attributed to higher microbial activity. In contrast to C mineralization, glyphosate mineralization was not reduced to a significant extent in pre-incubated residues and it may suggest possible involvement of different microbial communities in three treatments.

➢ Formation of bound residues in three treatments was not significantly different. However they tended to deplete faster in pre-incubated residues than in fresh residues.

➢ Radioactivity of 0 d extracts as analyzed by HPLC was mostly due to glyphosate whereas that of pre-incubated (20 and 49 d), it had more proportion of metabolites than that of glyphosate and this proportion increased with degree of mulch decomposition.

Conclusion

• The biochemical composition of mulch residues has a significant control on their decomposition.

• Lignin fraction is the most significant parameter of mulch quality that affected their decomposition along with other parameters like C/N ratio and holocellulose (cellulose and hemicellulose) fractions. However, quality of mulch as described by its decomposition did not show significant effect on glyphosate behaviour.

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