CEREAL RESIDUE MANAGEMENT THROUGH CONSERVATION TILLAGE IN SEMIARID ARAGON (NE SPAIN)

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INTRODUCTION

- Information on residue incorporation into the soil and rates of residue decomposition is essential to evaluate effective management strategies for soil and water conservation.
- The purpose of this study was to evaluate the effects of conservation and conventional tillage systems on the dynamics of crop residues during the long fallow period (16-18 months) of the cereal-fallow rotation in semiarid Central Aragon.
- Values of residue cover reduction by specific tillage operations were determined and two simple residue decomposition models (Douglas and Rickman, 1992; Steiner et al., 1999) were tested.

MATERIALS AND METHODS

- The study was conducted over a 4-yr period (Jun 1999-Dec 2003) on the long-term tillage experiment established in 1989 at the dryland farm of the EEAD-CSIC in Zaragoza. The soil has a loam texture and mean annual rainfall is 390 mm. Four long-fallow periods of a barley-fallow rotation were considered.
- Three tillage systems were compared: conventional tillage (**CT**) and reduced tillage (**RT**), with mouldboard ploughing and chiselling as primary tillage operations, respectively, and no-tillage (**NT**).
- Surface barley residues (flat and standing) were collected and soil cover estimated (line-transect method) just after harvest and before and after any soil disturbing practice.

RESULTS

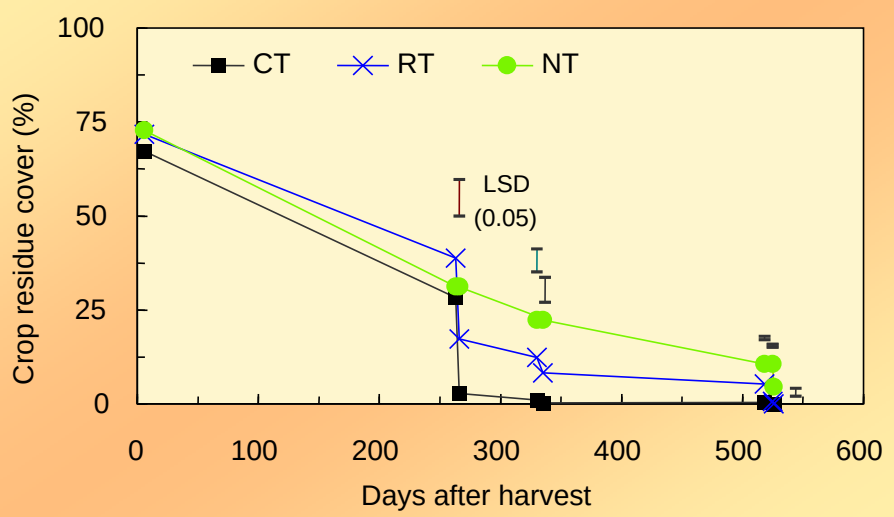
- Average dry mass of barley residues at harvest was 1456, 855, 1828 and 1709 kg ha^{-1} in 1999, 2000, 2001 and 2002, respectively. Primary tillage operations had the major influence on residue incorporation, with cover reduction of 90-100% in CT and 50-70% in RT (Table 1).

Table 1. Influence of field operations during fallow on barley residue cover reduction for different fallow management systems

Tillage treatment	Percentage of residue cover reduction after			
	Primary tillage	Secondary tillage	Seedbed preparation	Sowing
CT	90-100	100†	-	-
RT	51-72	34-50	61-73	90-100†
NT	-	-	-	52-60

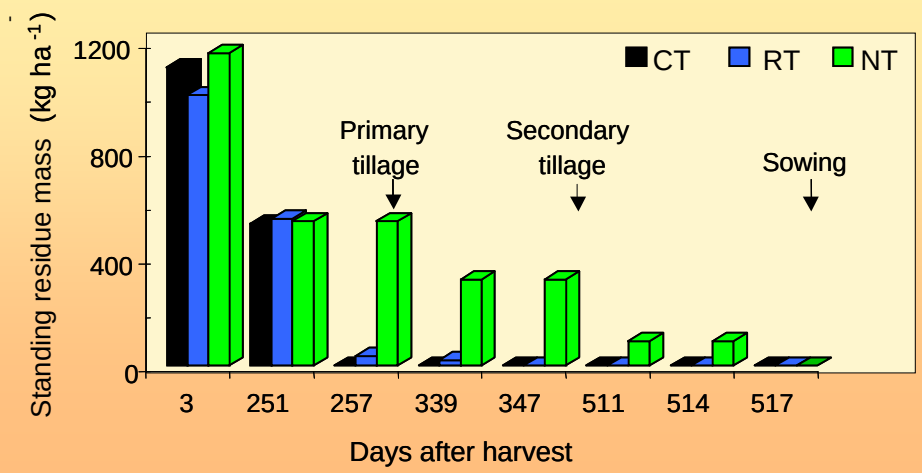
† Initial residue cover is null or negligible (<2%)

Fig. 1. Barley residue cover during the 2002-2003 fallow.



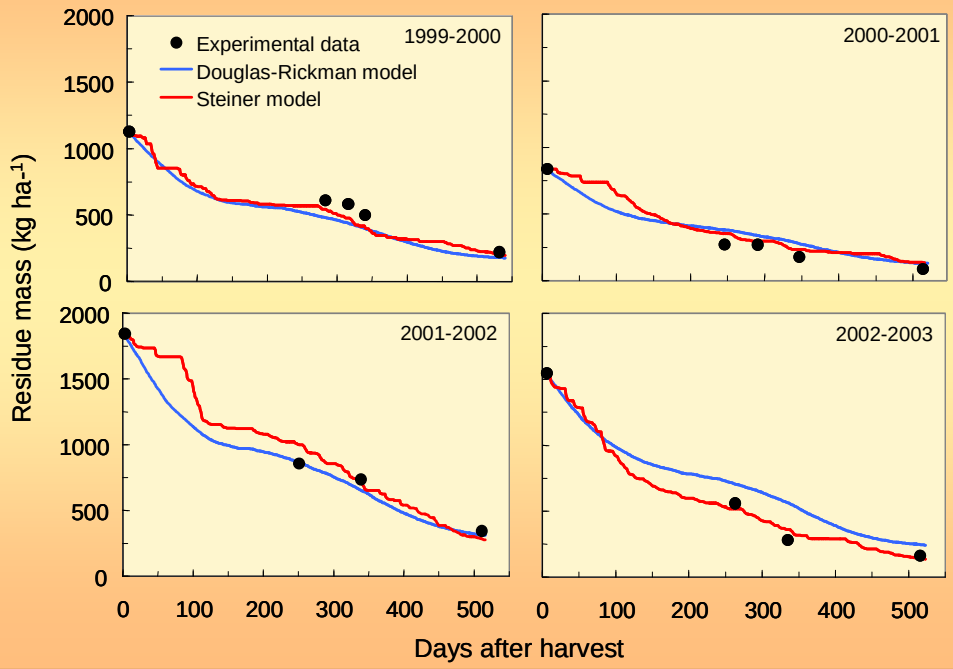
- In contrast, NT still conserved a residue cover of 10-15% at the end of fallow (Fig. 1) and percentages of standing residues of 20-40% of the total mass after the first 11-12 months (Fig. 2).

Fig. 2. Evolution of standing residues during the 2001-2002 fallow.



- The two decomposition models simulated adequately the decline of surface residue mass under NT (Fig. 3). However, the *Steiner* model (*cumulative decomposition days* function) gave more accurate estimations than the *Douglas-Rickman* model (*cumulative degree days)*. The model predicted that 80-90% of the initial mass was lost after 17-18 months and that 60-75% of this lost occurred during the first 9-10 months, in agreement with the experimental data.

Fig. 3. Measured and estimated mass loss of surface barley residues under NT during four fallow periods.



CONCLUSIONS

- The lack of residue-disturbing operations in NT makes this practice the best strategy for fallow management in semiarid Aragon.
- The *Steiner* decomposition model appears a simple and adequate tool for predicting persistence of surface barley residues during fallow for the study region conditions.

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