

DETERMINING VARIOUS SOIL TILLAGE AND NUTRIENT LOSS IN SOIL PROTECTION METHODOLOGY

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Introduction

Soil erosion by water is a major worldwide problem with both on-site effects for agriculture and off-site effects regarding sedimentation problems (Schwertmann et al., 1987). Surface runoff influences soil erosion and the amount of nutrients and pesticides lost from agricultural fields to surface waters (Ulen, 1997). And this runoff of nutrients can reduce the yields of crops and to lower the productivity of soil. Runoff volume and intensity depend on interaction between rainfall amount, intensity and seasonal distribution, and soil hydrological properties, surface roughness and slope. Water runoff and soil erosion are also remarkably influenced by soil cultivation. Their decline is generally recognized, as no-tillage and mulch tillage systems are used more extensively on crop land (Basch et al., 1998).

In addition, runoff may represent a significant water loss and a source of pollution also when it occurs as consequence of crop irrigation (Tanji and Hanson, 1990). Therefore, agricultural practices which could help to reduce storm runoff losses, may turn out to be suitable also in the containing of water losses due to irrigation return flow and the related pollution potential (Bazzoffi, 2002).

Among the human activities that cause the degradation of the environment, the conservation of natural soil to agriculture, mechanization, irrigation and the indiscriminate use of pesticides and fertilizers are the most important factors determining the loss of natural habitats and soil degradation (WRI, 2001).

A soil through the favorable physical and biological features can simultaneously be the main factor of the cultural environment and the crop production (Birkás, 2002).

The conventional tillage system, which is based on ploughing is not the best choice, for that farmers, who like to preserve the fertility, the humus contain and the good condition of the soil. In an agronomical respect ploughing may cause risk, if it increases the erosion harm, or gives a bad quality (extremely cloddy or puddly) and increases the number of secondary operations (possible recompaction and dust formation). At the same time the cold and dust formation or increasing the erosion and compaction harms are the environment risk factors of the ploughing. (Birkás et al., 2001).

Methods

We participated in research program of the Departement of Soil Management to examine the interactions between tillage systems and soil erosion. The soil erosion was examined in Józsefmajor, in a long-term experiment, which represents two different tillage treatments: a conventional and ridge tillage in a sloping area, where maize was applied. The amount of runoff soil and water was measured on 1 m² surface in examined plots.

Results and discussion

Table 1 shows the amount of the runoff soil and water in the different tillage treatments in August 2004. The runoff soil and water was examined after rainy term in the vegetation period.

Table 1.
Soil erosion in Józsefmajor in different tillage treatments, 10.08.2004.

	Ridge tillage		Conventional tillage	
	Top of the slope	Bottom of the slope	Top of the slope	Bottom of the slope
Runoff soil (g)	7	4,4	20,2	5,7
Runoff water (l)	6,58	5,83	7,78	6,34

In sloping area the conservation tillage is subservient for the development of the agronomical texture. According to our experiences in conventional tillage the amount of runoff soil is higher than ridge tillage, both the top and the bottom of the slope. In addition the amount of the runoff soil in case of ridge tillage is lesser than in conventional tillage. The ridge tillage supports the soil protection as the conservation method could be the solution for the prevention of the erosion. It has a big importance, because soil and wind erosion endanger more than 43% of the land in Hungary.

Figure 1 - 2 shows the amount of runoff soil and the amount of runoff water in case of ridge tillage and conventional tillage in August 2005.

Figure 1 – 2 show similar tendencies as the date of 2004. The amount of runoff soil is higher in the summer 2005, because the wetter was rainier and thunderstorms were more often. For example, the amount of fall was in August in the year of 2004 as the average (50 mm) and in August in the year of 2005 the precipitation was 205 mm (137 mm more than the average). Runoff volume and intensity depend on the interaction between rainfall amount, intensity and seasonal distribution.

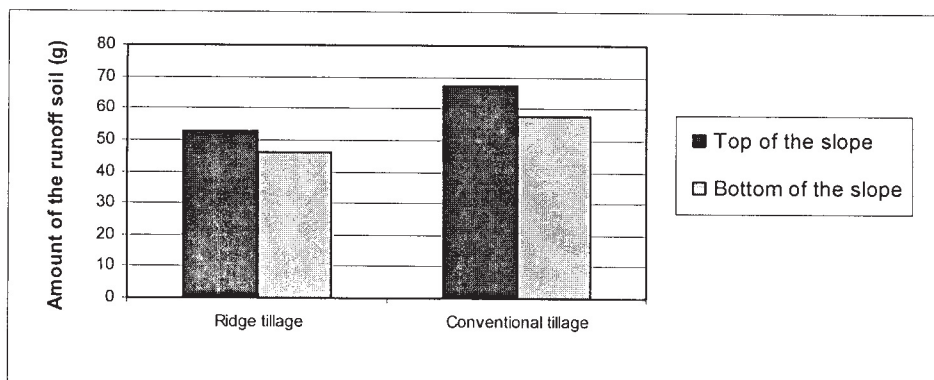


Figure 1.
Amount of the runoff soil in the ridge and conventional tillage treatment (Józsefmajor 24.08.2005.)

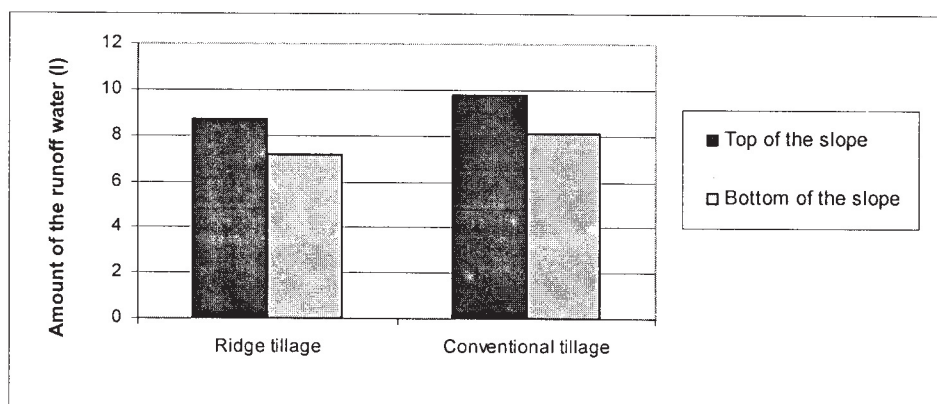


Figure 2.
Amount of the runoff water in the ridge and conventional tillage treatment (Józsefmajor 24.08.2005.)

Conclusions

High rates of soil removal on sloping area convexities due to tillage erosion can rapidly lead to significant and possibly adverse changes in soil properties. Such changes will affect soil quality and productivity and may also influence water and wind erosion rates by exposing erodible subsoil.

Finally it can be concluded that ridge tillage can reduce the amount of runoff soil and the runoff water in a sloping area. This method is soil conservation and protection tillage, because ridge tillage could be the solution for the prevention of the erosion. This tillage can provide the crop production under unfavorable field condition.

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