Freistaat Thüringen

Thüringer Landesanstalt für Landwirtschaft

an innovative combination of sustainable agriculture and water protection

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Introduction

The multiple advantages of short rotation coppices (SRC) such as sustainable energy wood production, income diversification, and ecological services are well known. Additionally, strips of SRC present an innovative instrument to reduce the input of nutrient and pesticide into watercourses induced by soil erosion. Through extensive management, provision of permanent plant cover, improvement of soil quality, and long rotations, SRC strips on arable land can help to achieve the goals of the EU Water Framework Directive (e.g. the reduction of nutrient contamination of water bodies). Simultaneously SCR provides monetary benefits to farmers. The project "Short rotation coppices along watercourses" investigates the retention capacity of SRC strips and its economical benefits.

Study site

The study site, established in 2011, is situated in the northwest of Thuringia on the edge of a field, slightly sloping towards a little stream called Bennebach (Fig. 2). The experiment compares the retention capacity of three management options (Fig. 1):

(i) arable land
(ii) grassland
(iii) SRC with willow hybrid Tordis.

The annual mean temperature (1961-1990) of the region is 8.2 °C and precipitation 547 mm.

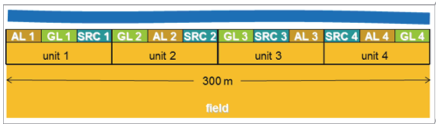

Figure 1: The study site is subdivided into 4 units. Within each unit, the management options (AL) arable land, (GL) grassland and SRC are implemented.

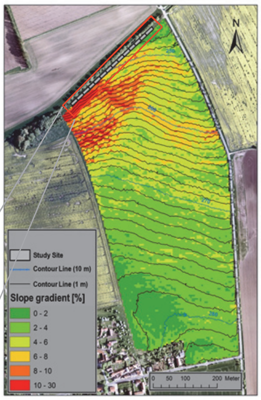

Figure 2: Study site and stream are situated in the north of the field.

Methodes

Field Study

For each plot at the study site, the retention capacity of nutrients is estimated with qualitative and quantitative measurement techniques. One aspect is the analysis of soil samples taken at a distance of 2 and 10 meters from the border between field and study site. The following soil parameter are analysed in spring and autumn 2012 to 2014 at a the depth of 0 to 5 cm, 5 to 10 and 10 to 30 cm: particle size, plant available and total phosphorus content, total nitrogen and total organic carbon content.

Modelling of Potential Erosion Exposure

Average soil loss and gullies of the adjacent field were simulated using the model AVErosion and ACCUMPlus. The calculation of water induced soil erosion in this model is based on the Universal Soil Loss Equation. To evaluate possibilities to reduce soil erosion on the field, different management options were compared, such as:

(a) current crop rotation (maize, wheat, rape, wheat, barley)
(b) fragmentation of the field with buffer stripes and current crop rotation
(c) adapted crop rotation (abandonment of maize)

Results

Modelling of Potential Erosions Exposure

The potential annual mean soil loss under the current management is 5.96 t x ha^{-1} x a^{-1} (Fig. 3a). Implementing buffer stripes within the field reduces slope length and decreases the risk of soil erosion by about 15 % (Fig. 3b). The abandonment of erosion prone cultures, in this case maize, offers another effective method to reduce potential soil loss (Fig. 3c). But due to a low number of marketable crops the farmer has limited options to give up maize cultivation.

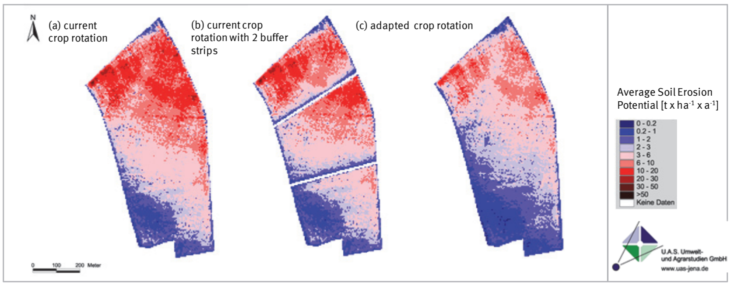

Figure 3: Site-specific avarage soil erosion potential (gird size 5 x 5 m) in t ha^{-1} a^{-1} under three management options (a – c).

Results

Field Study – Soil Analysis

Under conventional field management the content of total phosphorus (P_t) at a distance of 10 m from the bordering field was between 0.89 and 1.06 g x kg^{-1} and showed no significant chances over time (Fig. 4a). A different development was observed in the SRC plots. Starting with similar initial conditions, P_t content increased over time in the upper soil layer (Fig. 4b).

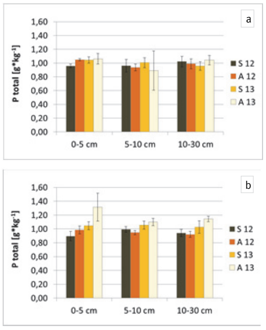

Figure 4: Development of total phophorus content betwenn spring 2012 (S12) and autumn (A13) under arable land (a) and SRC (b). Bars display standard error.

Conclusion

There are different management options to reduce soil erosion directly on the field, but neither can completely prevent erosion. An last option to prevent erosion induced soil loss and nutrient input into watercourses are buffer strips. The first results of the project show that SCR strips can act as nutrient buffer already three years after establishment. Nevertheless the long term development of the retention capacity of SCR has to be further observed.

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