STRIP CROP ROTATION IN FARMLAND MANAGEMENT: AN INNOVATIVE APPROACH TO SOIL CONSERVATION AND ENHANCING THE AESTHETIC AND RECREATIONAL POTENTIAL OF THE LANDSCAPE

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Abstract
This article describes the importance of strip crop rotation as an effective means of reducing soil erosion and as an aesthetic feature in the landscape. Strip crop rotation is an integrated approach to sustainable agriculture where different crops are systematically rotated in well-defined strips. We analyse the impact of this system on reducing water erosion, hydrological balance, and improving soil structure. We also focus on the aesthetic impact of crop grazing on the landscape and its ability to create harmonious and attractive visual elements in the landscape. This contributes to a higher aesthetic value of the landscape and enhances the recreational potential. The study presents a specific example of an agricultural area in the cadastral area of Rostěnice, where this approach has been successfully implemented in practice.

Keywords: Soil erosion, strip crop, landscape, farmland

Introduction

In the Czech Republic (CR), more than 50% of farmland is threatened by soil erosion (Podhrázská et al., 2022). The main reasons of the high erosion threat in CR were insensitive human interventions into the landscape in the second half of the 20th century. Until this period, agricultural production exploited land blocks of a mean size of 0.5 ha. Appropriate anti-erosion measures must be implemented to reduce the risk of water erosion (Karásek et al. 2022). One of these multifunctional measures is strip crop rotation.

Strip crop rotation (SCR) is an anti-erosion and soil conservation technology that uses the protective effect of vegetation cover. It is the regular alternation of strips of low-protection crops (legumes, maize, sunflowers, etc.) and strips of high-protection crops (grasses, perennial forage crops, densely sown cereals, legumes, etc.) established in a direction close to the contour lines. The crop strips with different erosion protection effect must be alternated so that water flowing in from the protected strip as well as water from precipitation falling on the strip itself is captured and infiltrated into the soil.

Strip crop rotation is an effective measure against both water and wind erosion, with the following positive effects compared to a single crop option with a low erosion control effect on the soil block:

- reduction of water erosion,
- reducing the transport of erosion products, i.e. sediment and associated nutrients and agrochemicals,
- increasing infiltration rates and soil retention capacity.

Strip crop rotation is implemented on sloping land with a moderately rugged topography, where there is no intensive concentrated runoff after rainfall.

Methods and Results

In 2023, a new type of portable infiltrometers manufactured by ADCIS s.r.o. were tested (Fig. 3). It is a measuring data station (base), equipped with a battery, valves, pumps, which can pump liquid (water) from an external container into prepared cylinders in the soil on the basis of impulses. Water is pumped on the basis of an impulse that occurs when the water level in the cylinder falls below a predefined level (Fig. 4). In our case, if the water in the cylinder becomes saturated, it is automatically pumped out by the device. In 2023, 1 set of measurements was carried out in the autumn period after harvest and waterlogging at a strip crop rotation site near the village of Bošovice (Fig. 1). The measurements were situated in selected locations within the slope (upper part – eluvial – point 1 and 3, middle part – transport – point 7 and 9, lower part – accumulation – point 13 and 15). In each of these locations, two measurements were carried out in a strip with a high protective function against erosion (in 2023 sown with spring barley) and in a strip with a low protective function (in 2023 sown with rape). Infiltration rate measurements on permanent grassland were also processed for comparison (point 25).

Fig. 1: Strip crop rotation in the study area Bošovice

Fig. 2: Measurement of infiltration characteristics in the area of interest Bošovice

Fig. 3: Set of portable infiltrometers from ADCIS s.r.o. during measurements at the site of interest

Fig. 4: Detailed view of the measuring cylinder

Each measurement starts with the maximum intensity (12 mm/min) of the water supply to the measuring cylinder (diameter 100 mm). If this water supply can be absorbed, the pump continuously pumps water at the same intensity into the measuring cylinder. If the ring is flooded with water, the level sensor stops the pump and the system waits for the level in the measuring cylinder to drop before restarting.
A total of 10 valid measurements were taken in the fall of 2023 for a total of 60minutes/1 infiltration attempt. More infiltration attempts were made, however some were subsequently assessed as inconclusive. The measurements were taken after the harvest and after the agrotechnical operations in the field.

In 7 cases, the soil infiltration rate exceeded the maximum water delivery rate of the infiltrometer (12 mm/min). In practice, this means that simulated rainfall of 12 mm/min for 60 minutes was able to infiltrate the soil profile! This indicates a very significant capacity of the soil profile to hold rainfall water. In 3 cases, the infiltration rate was lower than the maximum water delivery rate of the infiltrometer. In these 3 cases a curve of infiltration rate versus time was plotted.

Tab. 1: List of measurements and infiltration rates at the locations

Point	Locality	Intensity of infiltration (mm/min)	Volume of absorbed water (l)
13	Canola strip (after harvest and agrotechnics)	>12	5,21
13	Canola strip (after harvest and agrotechnics)	>12	5,21
15	Barley belt (after harvest and agrotechnics)	>12	5,21
1	Canola strip (after harvest and agrotechnics)	>12	6,08
3	Barley belt (after harvest and agrotechnics)	6	graf
3	Barley belt (after harvest and agrotechnics)	>12	6,08
7	Canola strip (after harvest and agrotechnics)	14,5	graf
9	Barley belt (after harvest and agrotechnics)	>12	5,21
9	Barley belt (after harvest and agrotechnics)	>12	4,63
25	Permanent grassland	5,9	graf

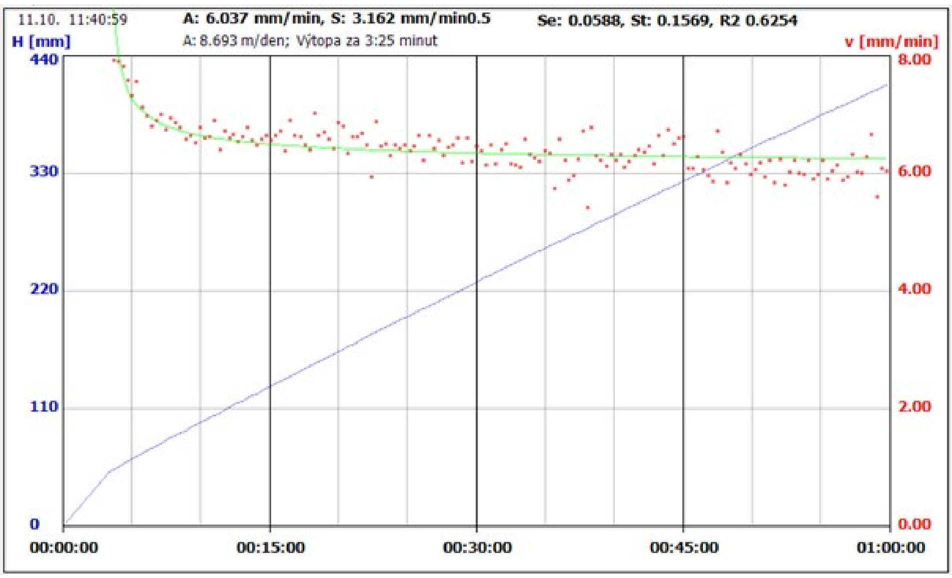

Fig. 5: Example of infiltration rate graph for measurement point 3 (barley belt)

Strip crop rotations in combination with appropriate agrotechniques showed a very good ability to retain rainfall water in simulated infiltration experiments. It was even significantly higher than that of permanent grassland.

In 2024, we plan identical infiltration experiments in spring and summer (during the field crop growing season) for comparison.

Conclusion

Strip crop rotation significantly reduces the effects of water erosion on the land and increases the soil retention potential. It also has a landscape and aesthetic effect. This specific farming regime helps to create a varied landscape mosaic. In the Bošovice area, strip crop rotation is applied to a large area of farmland and is now a destination for many tourists and photographers because of its diversity and uniqueness. It is evident that even a simple change in the farming regime can suitably enhance the tourist and recreational potential of the area. In the future, this type of farming can be expected to be extended to other areas of the Czech Republic.

References

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Souhrn
Pásové střídání plodin je integrovaný přístup k udržitelnému zemědělství, při němž se různé plodiny systematicky střídají v přesně vymezených pásech. Cílem této technologie je omezit působení eroze, zvýšit retenci srážkové vody a zvýšit biodiverzitu. Při simulovaných infiltračních pokusech byla prokázána na pozemcích s aplikovaným pásovým střídáním plodin velmi dobrá schopnost zadržovat srážkovou vodu. Intenzita infiltrace převyšovala ve většině případů maximální intenzitu dávkování vody infiltrometrem - 12 mm/min. Jedná se o stav pozemku v podzimním období (po sklizni a podmítce/strip till agrotechnologii). V roce 2024 budeme (za účelem porovnání) provádět na dané lokalitě stejné pokusy v průběhu celé vegetační sezóny.

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