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SSS9.7

# Preliminary study about soil compaction and farmers‘ awareness in grasslands in Carinthia (south Austria)

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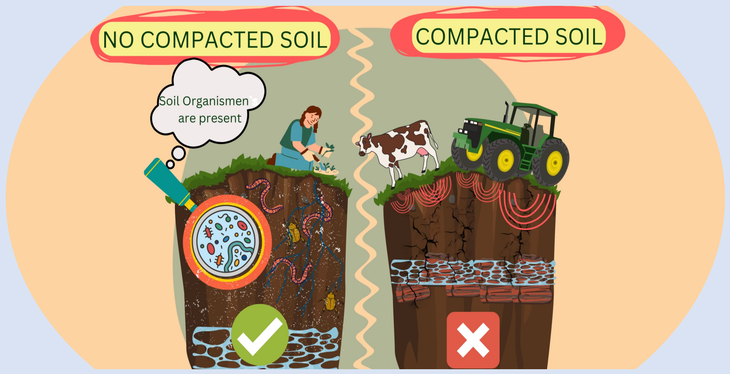
## 1. INTRODUCTION

Soil compaction is one of the main problems in today's agriculture. Different cultivations of permanent grassland are unequally loaded by heavy machinery and the number of animals on the pastures, which negatively changes the soil structure. In order to gain a better understanding towards soil compaction, permanent grassland areas with different management (mowing meadow and pasture) in Carinthia were selected and checked for soil compaction.




## 2. METHODS

### 2.1 Study area

The study areas were in Carinthia (Austria) along the Görtschitztal, Christofberg and St. Margarethen. Eight grasslands were sampled in the Görtschitztal, three at Christophberg and one at St. Margarethen. The grasslands have been splited up in different categories (hay meadow and pasture). Also the intensity of the management from the grasslands where important (extensiv, intensiv). The grasslands are permanent grasslands, which means no digging of the soil surface at least in the last 10 years.


*Figure 1: Study area marked in red created with google earth.*

### 2.2 Measurements

The studied indicators were bulk density, texture of the soil, plant indicator, water infiltration capacity, water repellence and volumetric soil water content.

### 2.3 Measurement of the bulk density

The main focus was on measuring the bulk density. In order to determine the bulk density, a ring with a volume of 98,175 $cm^3$ was taken every 5 cm till a depth of 30 cm. Afterwards the soil samples were sieved, weighed and dried in an oven at 105°C for 24h, 48h till constant weight. After the weight of the samples were not changing anymore, the process was finished. The equation used to get the bulk density was

$$\rho B = mt \,/\, Vg$$

*pB…density of the total volume*
*mf…mass dried at 105°C (dry soil)*
*Vg…total volume*

*Figure 2:*
*1. ring for taking soil samples*
*2. Samples sieved and dried in the oven*
*3. Mini disc infiltrometer*

### 2.4 Measurement of the volumetric soil water content

The volumetric soil water content was measured with the TEROS12 and repeated 9 times at each location in the first 5 cm.

### 2.5 Measurement of the water infiltration capacity

The mini disc infiltrometer was used to get informations about the soil water movement.

### 2.6 Evaluation of indicator plant species

The coverage of indicator plants were estimated on a defined area (5 x 5 m). The main indicator plants that we were focused on were Ranunculus repens, Plantago major ssp. Major and Poa annua (Bohner (2010).

## 3. RESULTS

### 3.1 Results of the bulk density

- **Extensively managed hay meadows** show an average bulk density „$p_b$“ of 0.9 g/$cm^3$ in the first 5 cm. At a depth of 10 cm, the $p_b$ increases to 1.14 g/$cm^3$, at a depth of 15 cm $p_b$ is 1.06 g/$cm^3$ . $p_b$ is at the depth of 15 cm lower than at a depth of 5 cm. At a depth of 20 cm, $p_b$ is 1.21 g/$cm^3$ and is classified as slightly compacted according to Blume et al. (2011).
- **Intensively managed hay meadows** have a $p_b$ of 1.13 g/$cm^3$ in the first 5 cm and show a steady increase to 1.47 g/$cm^3$ (30 cm) as the depth progresses, which according to Blume et al. (2011) is classified as medium compaction.
- **Pastures** showed a $p_b$ of 0.92 g/$cm^3$ in the first depth level of 5 cm. At a depth of 10 cm, $p_b$ increased to 1.10 g/$cm^3$, decreased slightly at depths of 15 cm, 20 cm, and 25 cm and at a depth of 30 cm, $p_b$ showed the same value as in the depth level of 10 cm.
- **The control fields:**

**- Ref.1** by Klinger et al. (2018) showed a $p_b$ below <1.0 g/$cm^3$ at all depth levels and is classified as extremely low compacted according to Blume et al. (2011).

**- Ref. 2** by Gehmacher (2016) showed values that are approximately similar to those of extensively managed hay meadows at depths of 5 cm, 15 cm and 20 cm. The difference between reference area 1 and reference area 2 is significant.

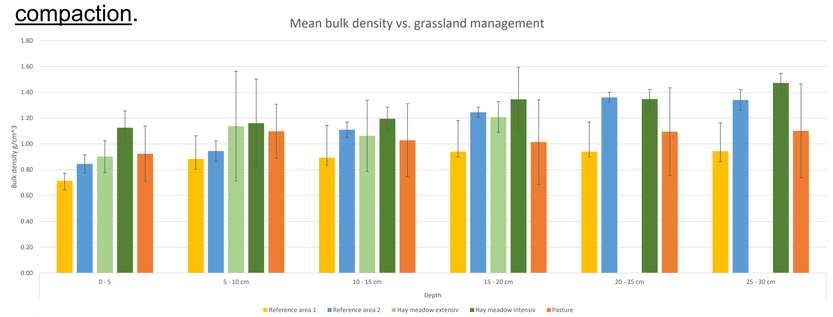



*Figure 3: The diagram shows the mean bulk density and the different grassland managements*

### 3.2 Farmers awarness

The two diagramms show the farmers‘ awarness about the possible compaction (left axis) as compared witht the results of the bulk density from the laboratory (right axis).

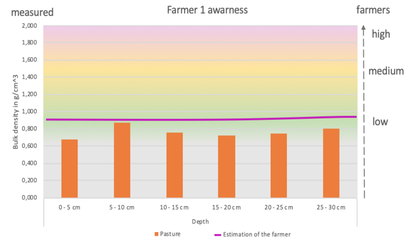
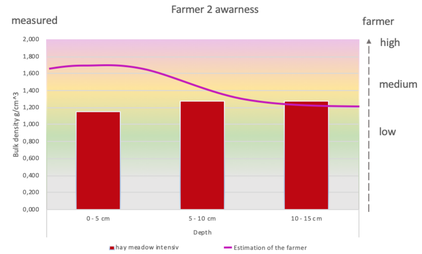



*Figure 4: The diagram shows the mean bulk density of two different grasslands, with different management with the estimation of the bulk density of the farmers on the right side and on the left side the measured values. The background of the diagrams coloured in different shades to show in which compaction level they are.*

Farmer 1 said that the grassland has a low compaction, which machted with the data obtained.




Farmer 2 said that the grassland has high compaction in the first layer of the soil and medium compaction in deeper layers. The data showed low compaction level in the first layers.

## 4. CONCLUSIONS

- The highest differences of bulk density between the different grassland management were found at the first 5 cm.
- Intensive hay meadows had higher bulk density than extensive ones.
- With increasing soil depth, the bulk density increased. Values were > 1 g/$cm^3$ at depths lower than 15 cm for intensive and extensive management and pasture.
- Differences in the management of permanent grasslands in Carinthia may have a significant effect on compaction.
- Farmers‘ awarenes are not always matching the real data.

## 5. REFERENCES

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