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Influence of soil work on soil moisture (%) and soil water reserve (m^3/ha) in grain maize in the hill area of the Timis county, Romania

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Abstract Because of the smaller and smaller water reserve worldwide and at national level nowadays we need to rationalise water. Agriculture is one of the national economy branches with large water consumption. A correct assessment of soil water evaluation methods and prognosis allows a good understanding of the soil water balance and, implicitly, the choice of cultivation technologies correlated with a high degree of suitability to produce high yields. Soil work, soil type, soil moisture an apparent density influence directly the level of productions. In Giarmata, Timis County, Romania, apparent density oscillates between 1.26 g/cm^3 (0-10 cm) and 1.70 g/cm^3 (40-50 cm). Soil moisture in the 40-50 cm horizon reaches 21.16% while soil water reserve in the 0-50 cm horizon is 1,434.95 g/cm^3. On the sole in Pişchia, Timis County, Romania, apparent density ranges between 1.27 g/cm^3 (0-10 cm) and 1.68 g/cm^3 (40-50 cm). Soil moisture in the 40-50 cm horizon reaches 20.87%, which determines, in the 0-50 cm, a soil water reserve of 1,347.26 g/cm^3. Apparent density in Sidvias, Timis County, Romania, reaches between 1.32 g/cm^3 (0-10 cm) and 1.84 g/cm^3 (40-50 cm). Soil moisture in the 40-50 cm horizon is 21.20%, and soil water reserve in the 0-50 cm horizon is 1,484.68 m^3/ha. The sole in Jupani, Timis County, Romania, is characterised by moisture levels ranging between 1.38 g/cm^3 (0-10 cm) and 1.81 g/cm^3 (40-50 cm). Soil moisture in the 30-40 cm horizon is 23.45%, while soil water reserve in the 0-50 cm horizon reaches 1,672.95 m^3/ha. In the hill area, the sole at Fârdea, Timis County, Romania, apparent density in the 40-50 cm horizon reaches 1.75 g/cm^3. Soil moisture reaches a maximum value of 23.17% in the 20-30 cm horizon. Soil water reserve in the 0-50 cm horizon was 1,593.52 m^3/ha.

Key words

water, soil, apparent density, water supply, soil works

Basic soil works and germination bed preparation works specific to the classical system of soil work aim at producing a "perfect" germination bed where plants find the best growth and development conditions (6).Soil works have a significant influence on soil physical features.

Changing soil moisture in the ploughed substrate and particularly in the germination bed is characterised by strong dynamics, and important oscillations can occur in just a few days. These changes occur particularly because of weather changes, but aridisation processes can also be favoured by the improper state of the soil or by irrational soil works (2). Soil moisture and apparent density are basic components in establishing soil water reserve.

They emphasise, nowadays, the reduction of the number of soil works. The goal is to prevent water loss through evaporation and soil setting and to allow the penetration and accumulation of larger amounts of water in the soil. These measures are research topics for many Romanian researchers (1, 3, 4, 5, 7 et 8).

Material and Method

Research was carried out in five localities – Giarmata, Pişchia, Sudviaş, Jupani and Fârdea – considered representative for the hill area of the Timis County, Romania.

Soil sampling was done on the following soil types:

-Giarmata – vertic-stagnic, moderately stagnogleyied preluvosol;

-Pischia – reddish, medium clayish preluvosol developed on slope medium fine non-carbonated materials;

-Sudriaş – pseudogleyied albic vertic, holoacid, moderately pseudogleyeid luvisol;

-Jupani – eumesobasic, gleyied-pseudo-gleyied (amphigleyied), moderately gleyied brown soil;
-Fârdea – argiloluvial, moderately levigated, extremely deep, water eroded arodisol.

We sampled soil to both determine apparent density and soil moisture, and soil water reserve over the horizon 0-50 cm.

We calculated soil water reserve in April because this is the amount of water upon sowing (also called initial reserve).

Results

The first three months of 2014 were characterised by a deficit of rainfall compared to the multi-annual mean (58.8 mm compared to the multi-annual mean of 122.7 mm).

The lack of rainfall during the cold season had a negative influence on grain production.

On the sole of Giarmata, apparent density oscillates between 1.26 g/cm^3 (0-10 cm) and 1.70 g/cm^3 (40-50 cm). Soil moisture is 17.90% in the 20-30 cm horizon and 21.16% in the 40-50 cm horizon. Soil water reserve over the 0-50 cm stratum is 1,434.95 m^3/ha (Table 1).

Table 1

Soil moisture (%) and soil water supply in grain maize (Giarmata Timiş County, Romania, April 2014)

Depth (cm)	Apparent density (g/cm^3)	Soil moisture (%)	Deep soil water supply (m^3/ha)	Soil water supply (0-50 cm)
0 – 10	1,26	18,25	229,95	1434,97
10 – 20	1,38	19,76	272,69	
20 – 30	1,49	17,90	266,71	
30 – 40	1,61	19,00	305,90	
40 – 50	1,70	21,16	359,72	

The values on the sole in Pişchia are close. Apparent density ranges between 1.27 g/cm^3 (0-10 cm) and 1.68 g/cm^3 (40-50 cm). Soil moisture is 17.37% in the 20-30 cm horizon and 20.87% in the 40-50 cm horizon . Soil water reserve in the 0-10 cm horizon is only 184.87 m^3/ha, while in the 0-50 cm horizon it is 1,347.26 m^3/ha (Table 2).

Table 2

Soil moisture (%) and soil water supply in grain maize (Pişchia Timiş County, Romania, April 2014)

Depth (cm)	Apparent density (g/cm^3)	Soil moisture (%)	Deep soil water supply (m^3/ha)	Soil water supply (0-50 cm)
0 – 10	1,27	18,36	184,87	1347,26
10 – 20	1,36	20,02	272,27	
20 – 30	1,46	17,37	253,60	
30 – 40	1,57	18,21	285,90	
40 – 50	1,68	20,87	350,62	

On the sole in Sudriaş, apparent density oscillates between 1.32 g/cm^3 in the 0-10 cm horizon and 1.84 g/cm^3 in the 40-50 cm horizon. Soil moisture is 17.72% in the 20-30 cm horizon, and 21.20% in the 40-50 cm horizon. Soil water reserve in the 40-50 cm horizon is 390.08 m^3/ha, while in the 0-50 cm horizon it reaches 1,484.68 m^3/ha (Table 3).

Table 3

Soil moisture (%) and soil water supply in grain maize (Sudriaş Timiş County, Romania, April 2014)

Depth (cm)	Apparent density (g/cm^3)	Soil moisture (%)	Deep soil water supply (m^3/ha)	Soil water supply (0-50 cm)
0 – 10	1,32	18,64	187,72	1484,68
10 – 20	1,36	19,41	263,90	
20 – 30	1,68	17,72	297,70	
30 – 40	1,72	20,07	345,20	
40 – 50	1,84	21,20	390,08	

The values recorded on the sole in Jupani are superior to those on the other soles mainly due to the soil type. The highest apparent density (1.81 g/cm^3) was in the 40-50 cm horizon, while the lowest value of apparent density was in the first 10 cm (1.38 g/cm^3). Soil moisture ahs close values, i.e. between 18.76% in the 0-10 cm horizon and 23.45% in the 30-40 cm horizon.

The highest soil water reserve (417.41 m^3/ha) was in the 30-40 cm horizon. Soil water reserve in the 0-50 cm horizon was 1,672.95 m^3/ha, which had an impact on the production (Table 4).

Table 4

Soil moisture (%) and soil water supply in grain maize (Jupani Timiş County, Romania, April 2014)

Depth (cm)	Apparent density (g/cm^3)	Soil moisture (%)	Deep soil water supply (m^3/ha)	Soil water supply (0-50 cm)
0 – 10	1,38	18,76	258,89	1672,95
10 – 20	1,40	20,58	288,12	
20 – 30	1,45	21,14	306,53	
30 – 40	1,78	23,45	417,41	
40 – 50	1,81	22,21	402,00	

On the sole in Fârdea, the values of apparent density are closer, in direct correlation with the soil type: between 1.28 g/cm^3 (0-10 cm) and 1.75 g/cm^3 (40-50 cm). Soil moisture is 19.37% in the 0-10 cm horizon and 19.26% in the 40-50 cm horizon. Soil water reserve oscillates between 247.94 m^3/ha in the 0-10 cm horizon and 369 m^3/ha in the 30-40 cm horizon. Soil water reserve in the 0-50 cm horizon was 1,593.52 m^3/ha (Table 5).

Table 5

Soil moisture (%) and soil water supply in grain maize (Fărdea Timiş County, Romania, April 2014)

Depth (cm)	Apparent density (g/cm^3)	Soil moisture (%)	Deep soil water supply (m^3/ha)	Soil water supply (0-50 cm)
0 – 10	1,28	19,37	247,94	1593,52
10 – 20	1,32	20,70	273,24	
20 – 30	1,58	23,17	366,09	
30 – 40	1,63	22,65	369,20	
40 – 50	1,75	19,26	337,05	

Conclusions

Research carried out allows us to draw the following conclusions:

1.The five locations where we sampled soil are the most representative for the field.

2.Apparent density was determined first by soil type. It ahs values ranging between 1.26 g/cm^3 (0-10 cm) in Giarmata and 1.84 g/cm^3 (40-50 cm) in Sudviaş.

3.Soil moisture oscillates between 17.37% (20-30 cm) in Pişchia and 23.45% (30-40 cm) in Jupani.

4.Soil water reserve has values ranging between 184.87 m^3/ha in Pişchia (0-10 cm) and 402.00 m^3/ha in Jupani (40-50 cm).

5.The highest soil water reserve in the 0-50 cm horizon was 1,672 m^3/ha in Jupani.

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