

Effect of different tillage on soil properties in winter rape crop

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Rationale: There is a significant increase in the concentration of greenhouse gases in the atmosphere, so global warming is a very important issue.

The research was carried out at Vytautas Magnus University Agriculture Academy Experimental Station in 2018. The soil in the experimental field was *Endohypogleyic-Eutric Planasol – Ple-gln-w*, according to FAO, moderate loam on light loam.

The aim of the research was to evaluate and compare the effect of different tillage on soil physical properties, CO₂ emission in soil in winter rape crop.

Methods: Soil tillage treatments: 1. Conventional plowing at depth of 23–25 cm (CP); 2. Shallow plowing at depth of 12–15 cm (SP); 3. Deep loosening at depth of 23–25 cm (DP); 4. Shallow loosening at depth of 12–15 cm (SL); 5. Direct sowing in stubble with 5 cm tillage (DS).



Figure 1. The experiment fields of winter oilseed rape

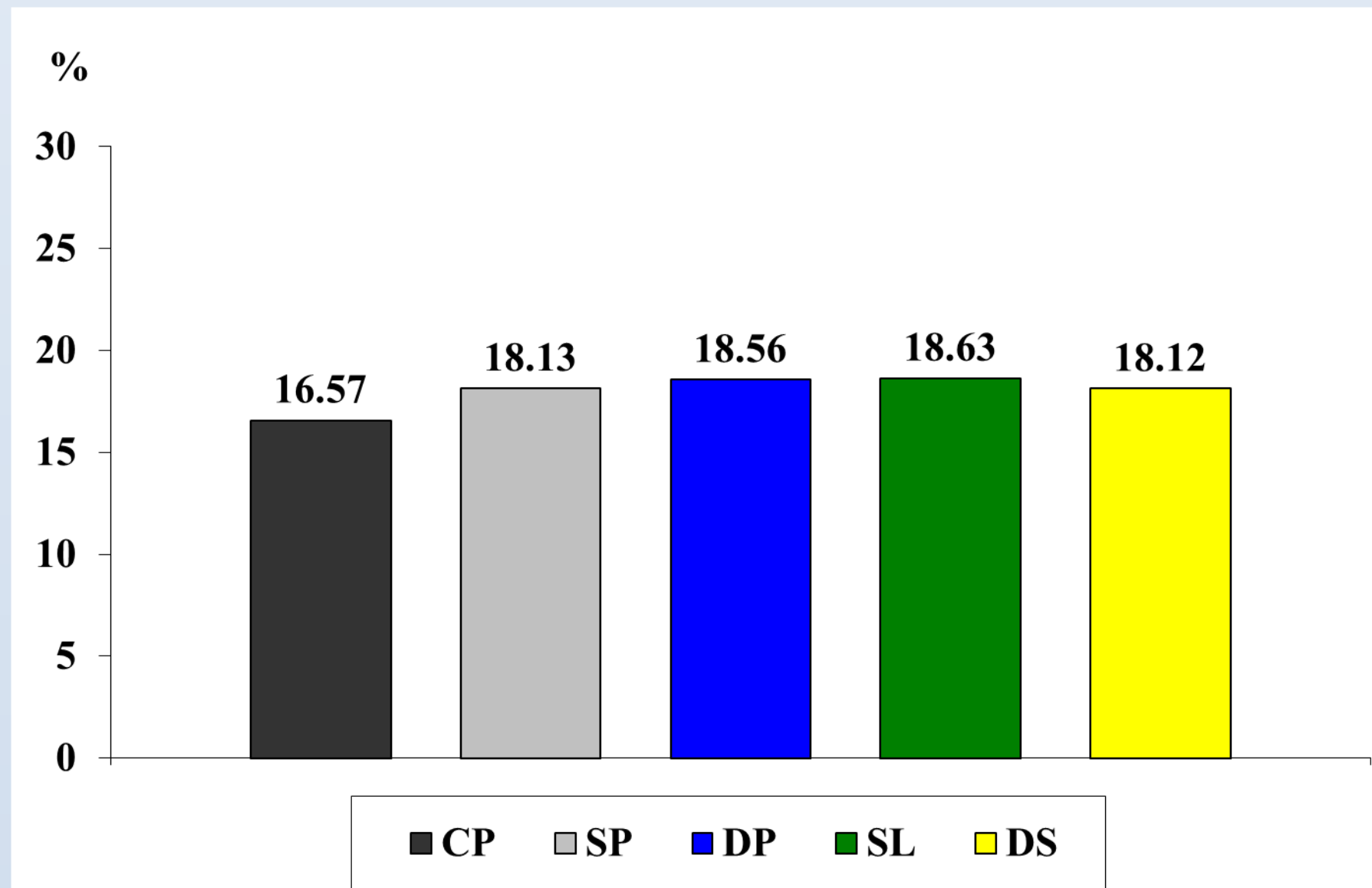


Figure 2. The impact of different primary tillage on soil moisture content in winter oilseed rape crop (04 06 2019). CP is conventional plowing, SP is shallow plowing, DP is deep cultivation, SL is shallow loosening, DS direct sowing in stubble with 5 cm tillage; no significant differences: $P > 0.05$.

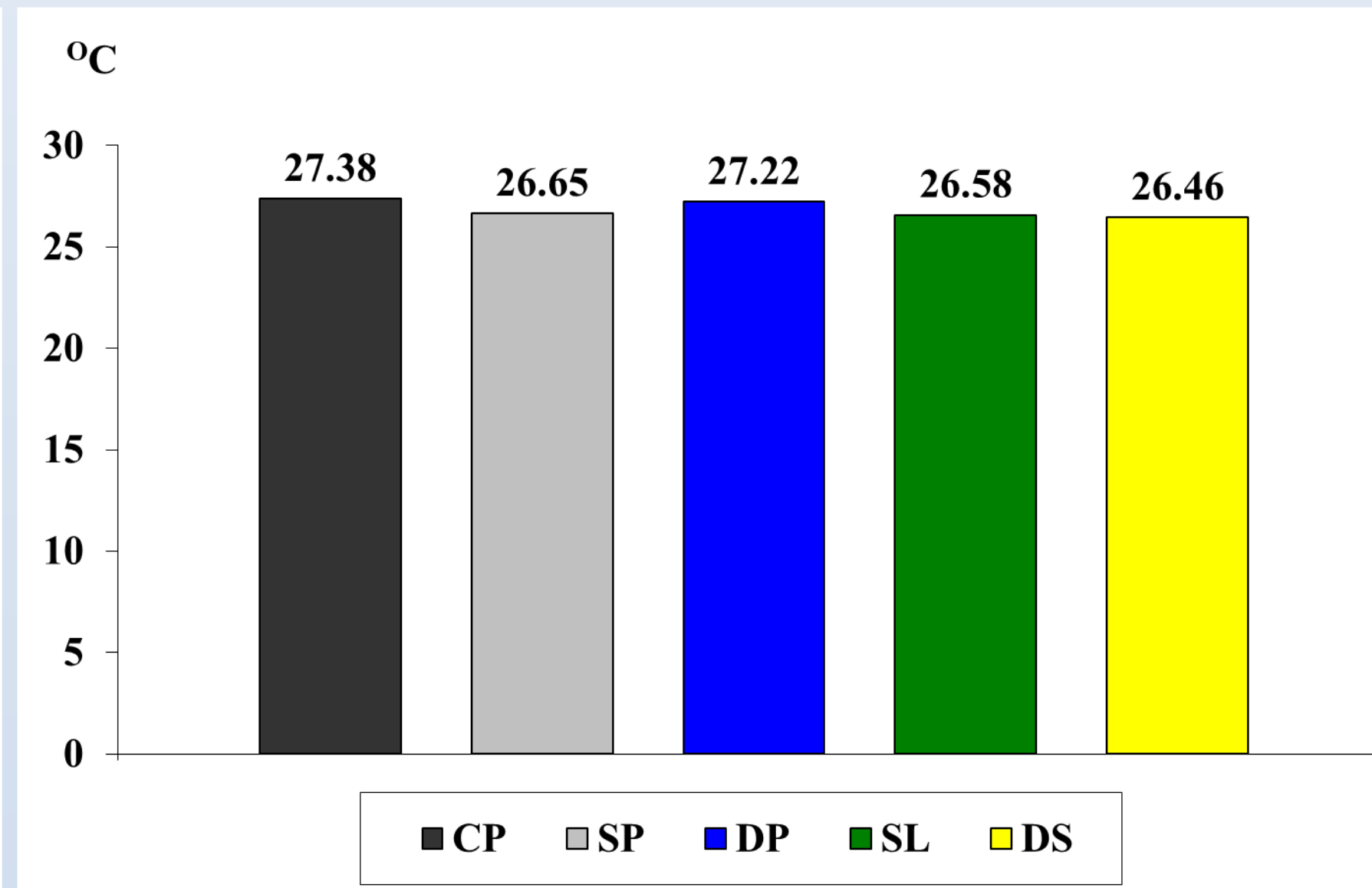


Figure 3. The impact of different primary tillage on soil temperature Content in winter oilseed rape crop (04 06 2019). CP is conventional plowing, SP is shallow plowing, DP is deep cultivation, SL is shallow loosening, DS direct sowing in stubble with 5 cm tillage; no significant differences: $P > 0.05$.

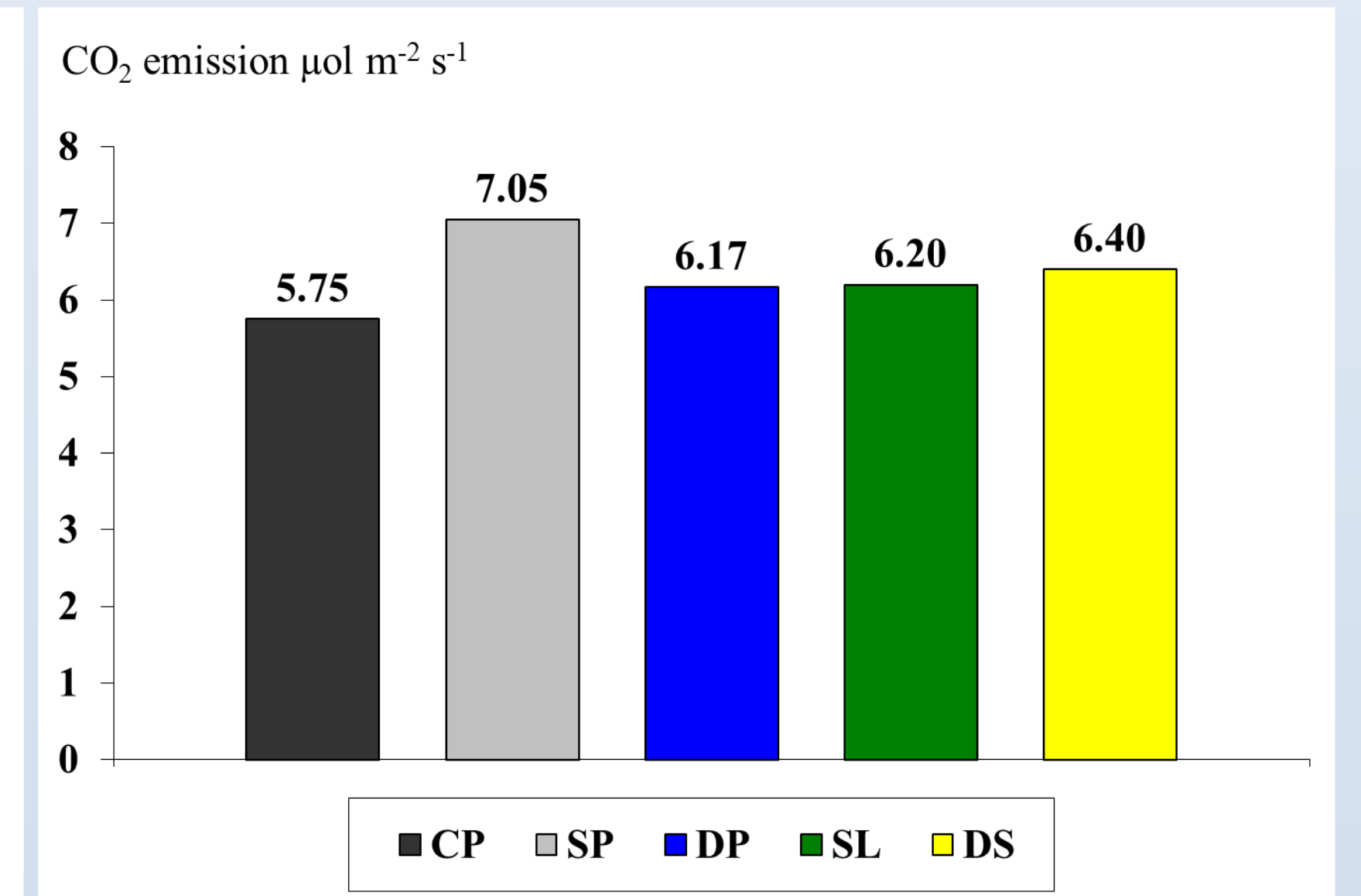


Figure 4. The impact of different primary tillage on soil CO₂ emission content in winter oilseed rape crop (04 06 2019). CP is conventional plowing, SP is shallow plowing, DP is deep cultivation, SL is shallow loosening, DS direct sowing in stubble with 5 cm tillage; no significant differences: $P > 0.05$.

Results. In summary, during the winter rape vegetation, all reduced tillage systems increased soil moisture compared to conventional tillage. After pre-harvest measurements, reduced soil tillage had no significant effect on soil moisture content (Fig. 2). With direct sowing (with tillage up to 5 cm.), the soil temperature was found to be lower compared to conventional tillage. Other reduced soil tillage's had unequal effects on soil temperature (Fig. 3).

Table 1. The impact of different primary tillage on soil air composition in winter oilseed rape crop.

Soil tillage treatments	11 05 2018		04 06 2018		09 07 2018	
	CH ₄ %	O ₂ %	CH ₄ %	O ₂ %	CH ₄ %	O ₂ %
CP	0.33	15.80	0.32	15.51	0.25	15.54
SP	0.34	15.68	0.32	15.70	0.24	15.85
DP	0.34	15.88	0.32	15.54	0.25	15.89
SL	0.35	15.80	0.32	15.35	0.25	16.10
DS	0.32	15.84	0.31	15.53	0.24	15.87

Note: CP is conventional plowing, SP is shallow plowing, DP is deep cultivation, SL is shallow loosening, DS direct sowing in stubble with 5 cm tillage; no significant differences: $P > 0.05$.

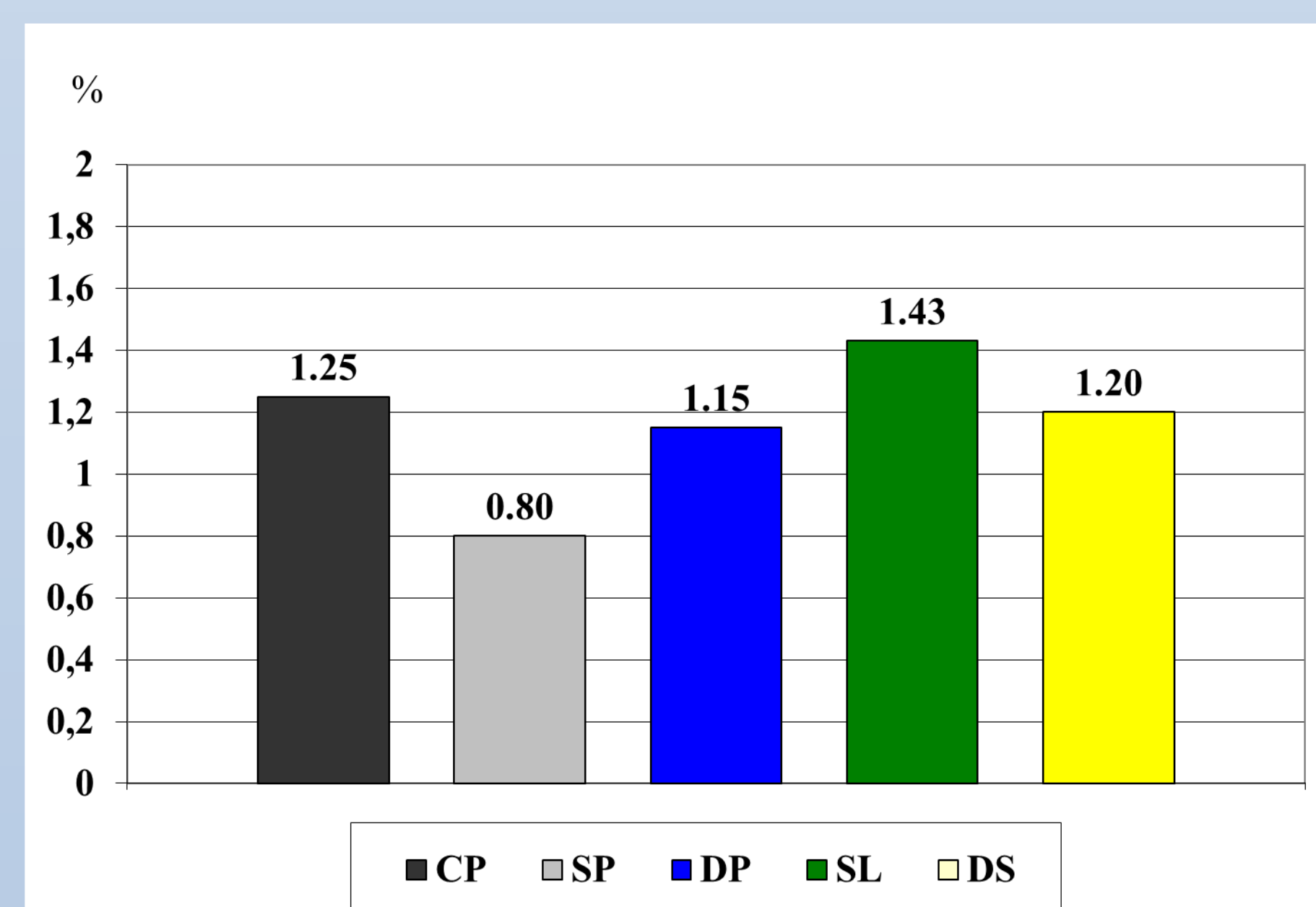


Figure 5. The impact of different primary tillage on soil CO₂ concentration content in winter oilseed rape crop (04 06 2019). CP is conventional plowing, SP is shallow plowing, DP is deep cultivation, SL is shallow loosening, DS direct sowing in stubble with 5 cm tillage; no significant differences: $P > 0.05$.

At the beginning of the vegetation, shallowly ploughing and deep cultivation fields showed lower CO₂ emissions from the soil and at the end of the vegetation, the concentration of CO₂ in the soil was lower compared to conventional tillage. Direct sowing (with tillage up to 5 cm) technology has lower methane (CH₄) content in the soil and higher oxygen (O₂) content compared to conventional tillage (Fig 4,5 and Table 1).



Figure 6. The experiment fields of winter oilseed rape

• **Conclusion:** Reduced soil tillage increased soil moisture from 3.5 to 71.7 % but soil temperature affected unevenly. Direct sowing in stubble with 5 cm tillage soil moisture increased from 9.3 to 64.8 % but decreased soil temperature from 0.2 to 7.0 % during the winter rape growing season. Direct sowing in stubble with 5 cm tillage and reduced soil tillage had an uneven effect on CO₂ emissions in soil. Reduced soil tillage decreased CO₂ emissions by 9.3-22.5 % only at the beginning of winter rape vegetation and by 23.9-32.9 % at the end of vegetation. Direct sowing (with tillage up to 5 cm) showed lower methane (CH₄) content from 3.1 to 4.0 % and higher oxygen (O₂) content from 0.2 to 2.1 % in the soil compared to conventional tillage.

• **Key words:** winter rape, reduced soil tillage, physical properties of soil, CO₂ emissions.