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Hrvatska zaklada za znanost

Does conservation tillage, in synergy with liming and fertilization, can affect selected soil properties?

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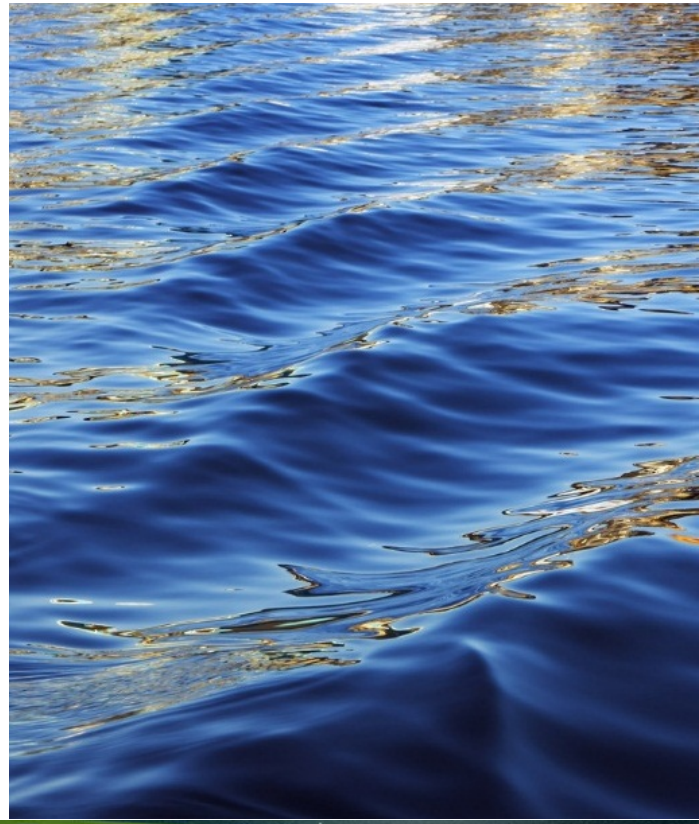

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Aim

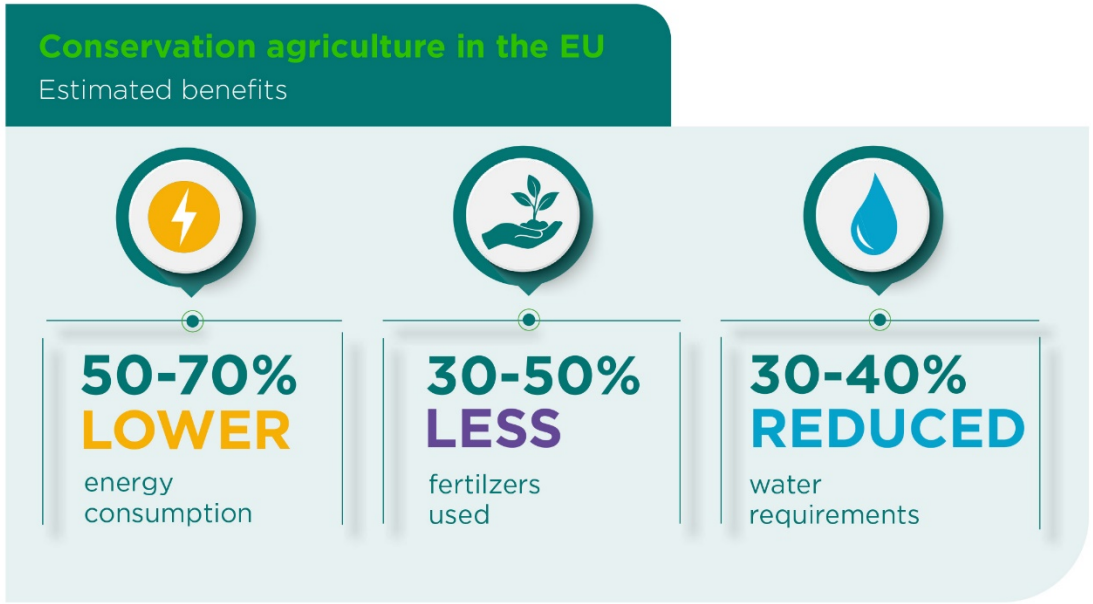
- The aim of this study is to determinate effect of **Conservation Tillage**, liming and soil fertilization on **pH, SOC – soil organic carbon and CEC – cation exchange capacity**

Conservation tillage (CT)

- It represents a critical step towards the sustainable future of agriculture.

CT

- soil health
- reduces erosion
- mitigates climate change
- significantly contributes to soil fertilization (cost savings for farmers)



Conservation tillage (CT)

Material and methods

- The research was conducted in the eastern part of Croatia (location Čačinci - 17° 86' 36" E, 45° 61' 32" N) on Stagnosol.
- The experiment was carried out on 24 plots (4 fertilisation treatments x 2 liming treatments x 3 tillage treatments) x 3 repetitions.

Material and methods

First factor :

Conventional/ Tillage (ST) - ploughing up to 30 cm depth,

Conservation **T**illage **D**eep (CTD) - loosening up to 30 cm depth with a minimum of 30% soil coverage with crop residues

Conservation **T**illage **S**hallow (CTS) - loosening up to 10 cm depth with a minimum of 50% soil surface coverage with crop residues.

Second factor :

Liming (LY) 4375 kg ha-1 CaO

Without **L**iming (LN)

Third factor:

FR - N_40 kg : P_2O_5_150 kg : K_2O_94 kg; **FD** - N_20 kg : P_2O_5_75 kg : K_2O_47 kg;

GFR - N_40 kg : P_2O_5_150 kg : K_2O_94 kg + 150 kg Geo2; **GFD** - N_20 kg : P_2O_5_75 kg : K_2O_47 kg + 150 kg Geo2_soil microbial biomass activator).

Material and methods

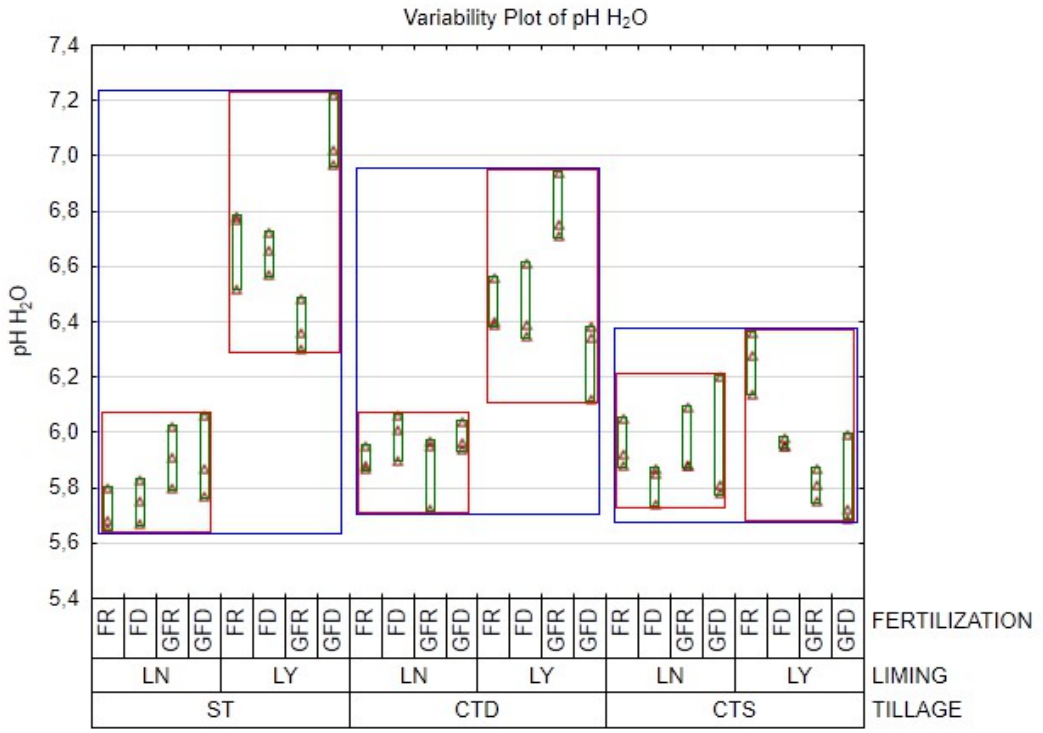
- Results in this paper include research of the second year 2022 where the impact of different tillage systems, liming and soil fertilization practice on key soil health indicators was investigated.
- The basic tillage treatment plot size was 160 m2 and the size of the fertilization/liming plots was 80 m2.

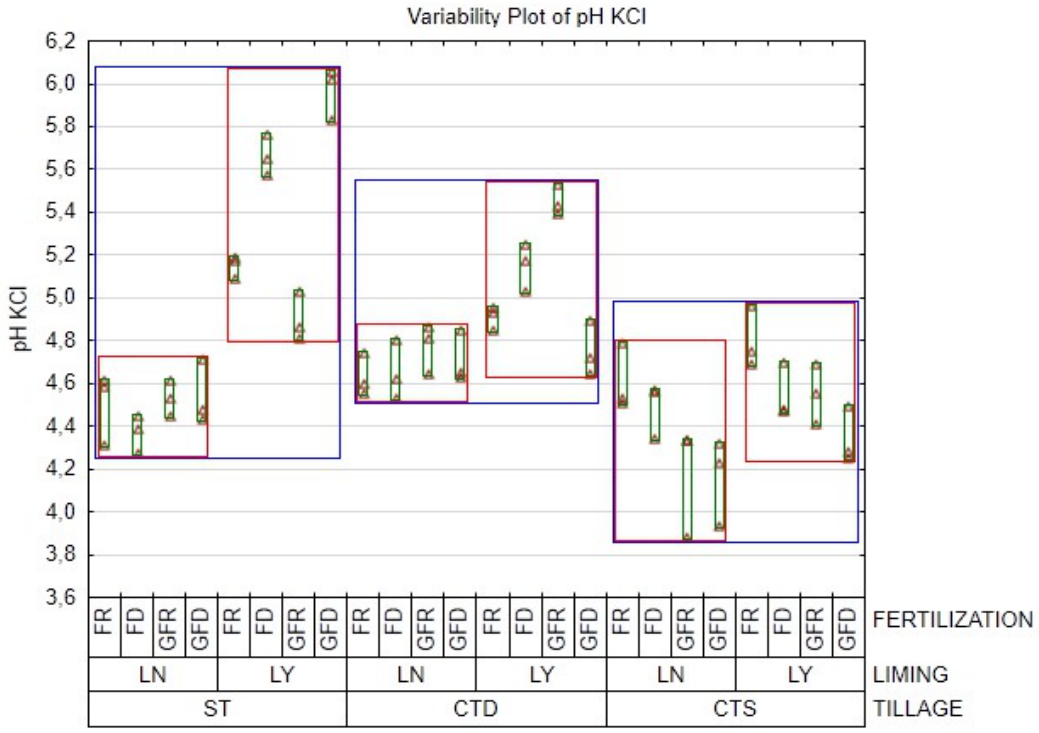
Results 0-15 cm

The results show that active and exchangeable acidity were significantly affected by soil tillage and liming with average values of 6.13 (pH-H2O) and 4.76 (pH-KCl).

The highest measured values of active (7.07) and exchangeable acitity (5.97) were observed on conventional tillage with liming on the GFD fertilization, while the lowest value of active acidity was observed on conventional tillage without liming on the FR fertilization (5.71).

The exchangeable acidity was lowest on CTS tillage without liming and on the GFD fertilization (4.16)

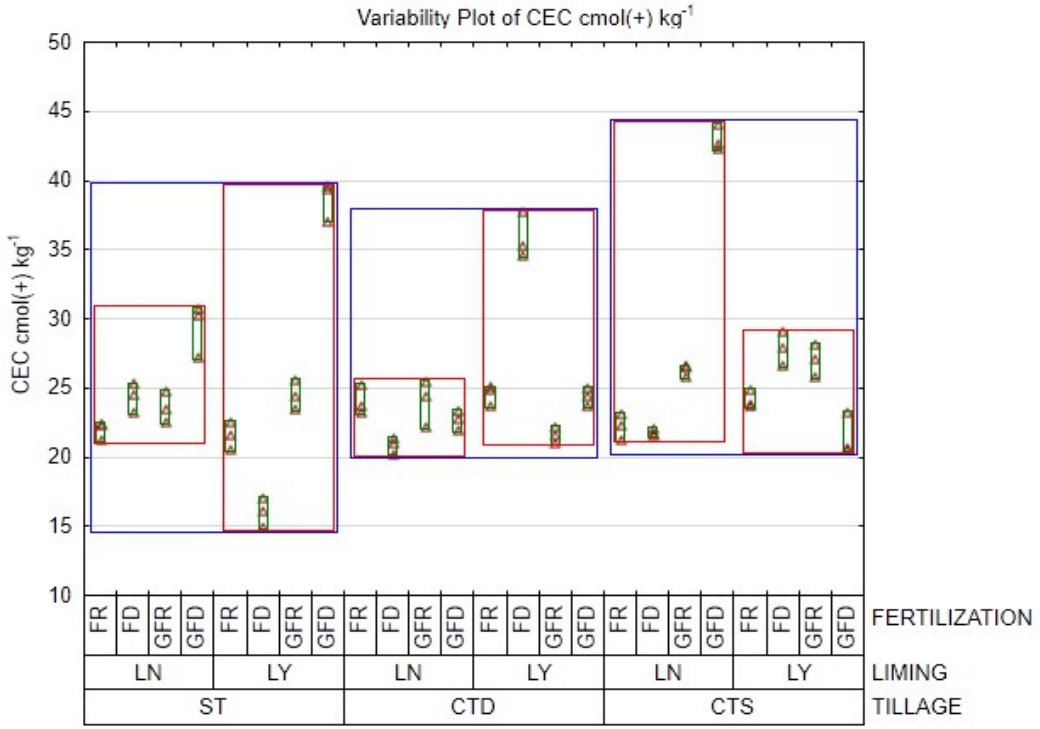


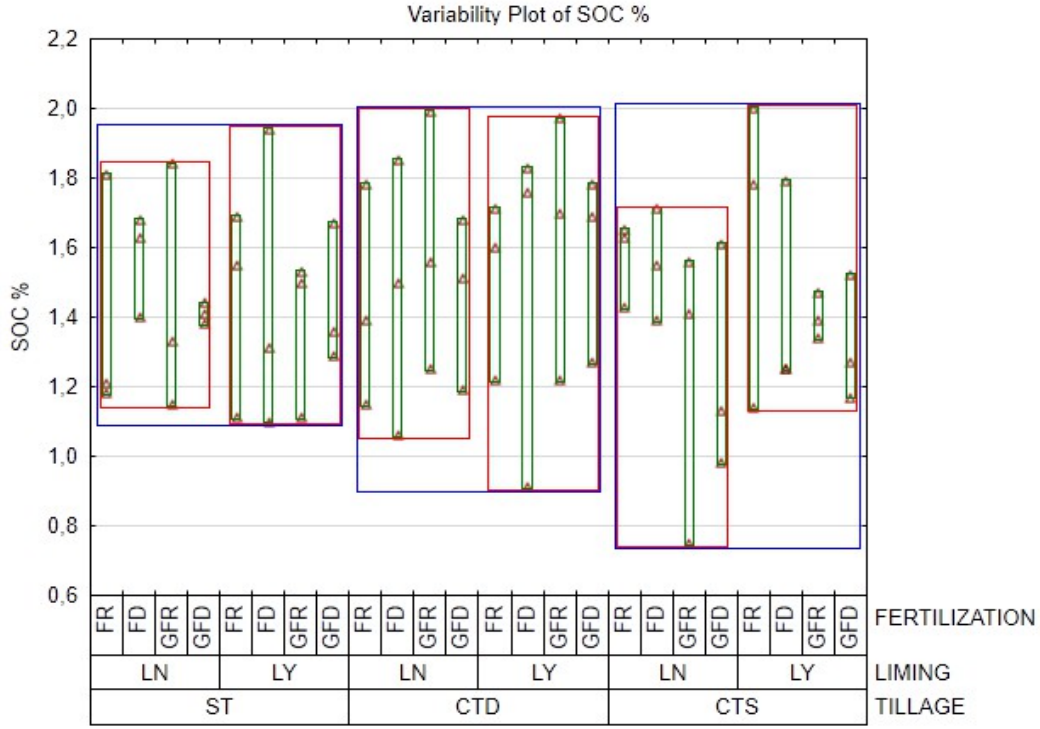


Results 0-15 cm

The average CEC was 25.48 cmol(+) kg^{-1}, and its variation was significantly affected by soil tillage and fertilization. The highest CEC value was measured on CTS tillage, without liming on the GFD fertilization (42.99 cmol (+) kg^{-1})

None of the tested treatments had a statistically significant effect on the value of soil organic carbon.

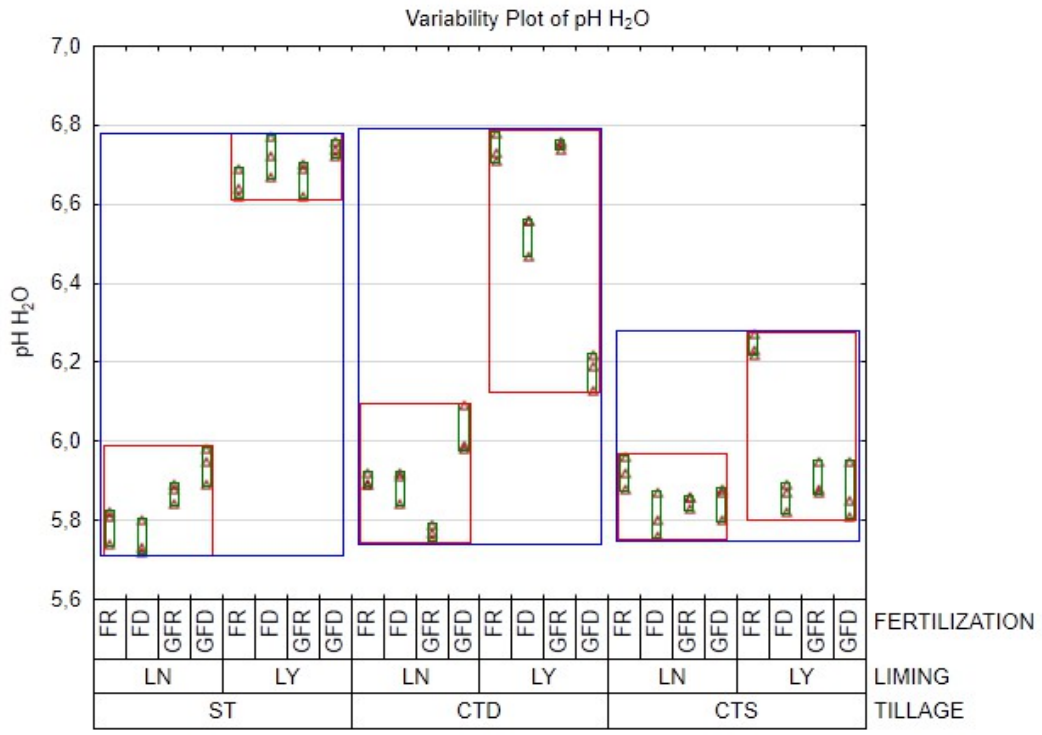


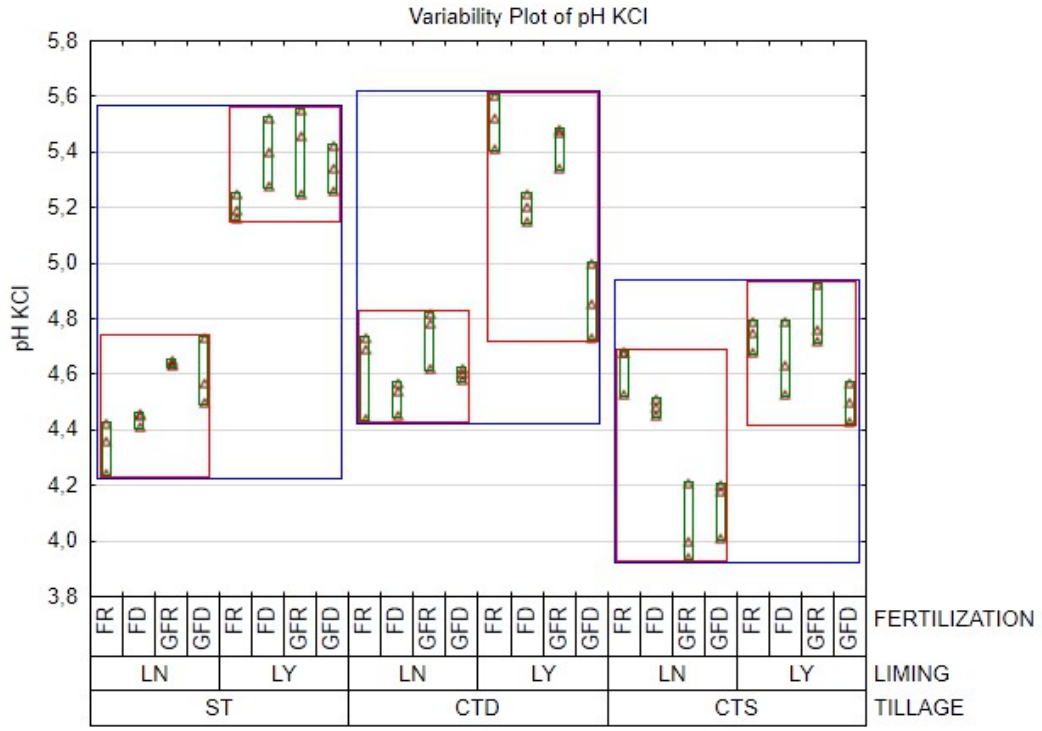


Results 15-30 cm

At a depth of 15-30 cm, all the parameters tested were significantly affected by the treatments.
The average active acidity was 6.13 and was significantly affected by soil tillage, liming, and fertilization.

The highest value of active acidity was measured on the CTD, LY, GFR treatment and was 6.75, while the lowest value was measured in soil samples on the ST, LN, FD treatments and was 5.75. The average exchangeable acidity was 4.86 and the highest value (5.51) was measured in soil on the CTD, LY, FR treatments, while the lowest value (4.05) was measured on the CTS, LN, GFR.

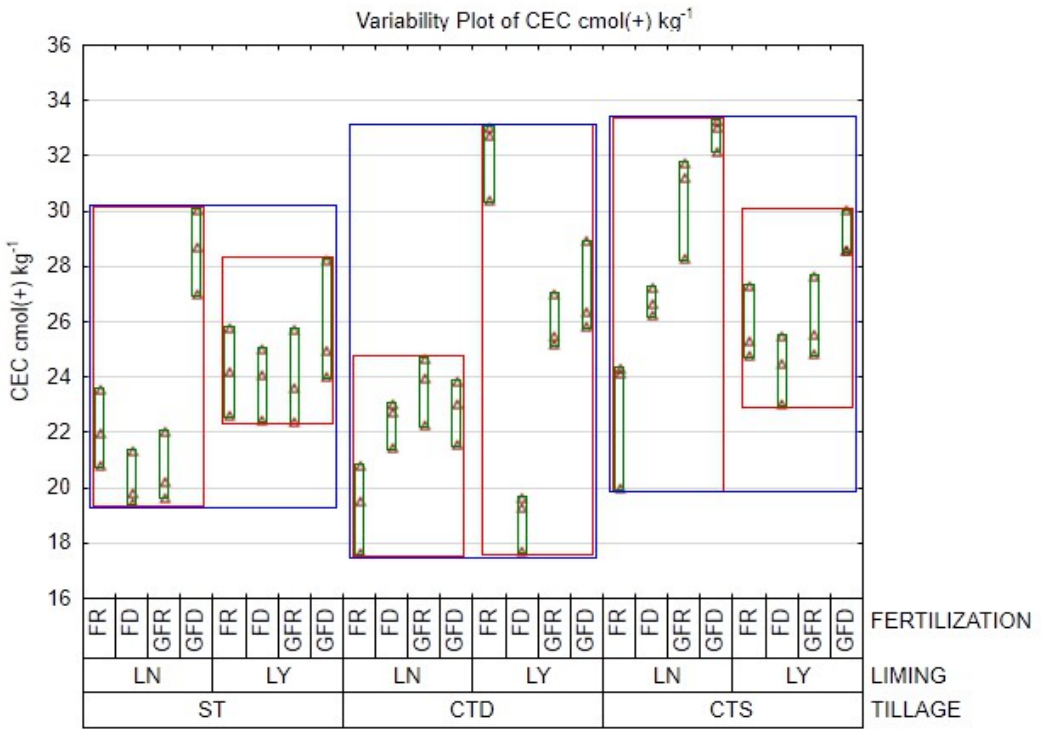


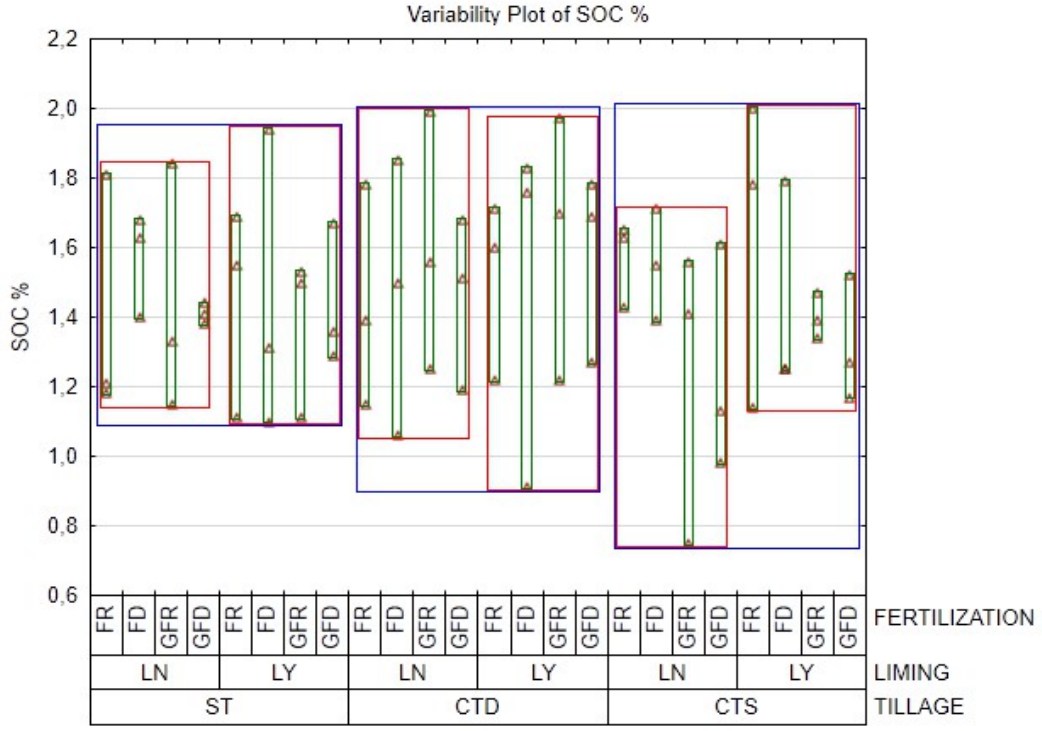


Results 15-30 cm

Cation exchange capacity was significantly affected by tillage, liming and fertilization and averaged 20.64 cmol(+) kg^{-1}. The highest CEC was measured on the CTS, LN, GFD treatment (32.81 cmol(+) kg^{-1}), and the lowest (18.87 cmol(+) kg^{-1}) on the CTD, LY, FD treatment.

The average organic carbon content in the soil was 1.44% and was significantly affected by fertilization and liming. All interactions of the investigated treatments were statistically significant. The highest organic carbon content was measured in soil samples on the ST, LN, FD (1.76%), and the lowest on the CTD, LN, GFD (1.19%)





Conclusions

- The effect of tillage, liming, and fertilization on selected soil properties varied depending on the soil depth.
- At a depth of 0-15 cm, tillage and liming had a significant effect on pH, with the highest pH measured in conventional tillage with liming and the lowest pH measured in conservation tillage without liming.
- Tillage and fertilization had a significant effect on CEC, with the highest CEC measured in conservation tillage.
- At a depth of 15-30 cm, all of the parameters tested were significantly affected by the treatments. Soil reaction was significantly affected by tillage, liming, and fertilization, with the highest active acidity measured in conventional tillage and the lowest active acidity measured in conservation tillage.
- CEC was significantly affected by tillage, fertilization, and liming, with the highest CEC measured in conservation tillage.
- Soil organic carbon content was significantly affected by fertilization and liming.
- It is important to note that the effectiveness of conservation tillage practices in synergy with liming and fertilization may vary depending on the specific soil type, climate, crop type, and local conditions. **Therefore, further research, especially long-term trials, is needed.**

Thank you for your attention!

Acknowledgement

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