

# Soil Compaction under Different Tillage System on Stagnic Luvisols

---

Igor Bogunović  
Ivica Kisić  
Aleksandra Jurišić

4<sup>th</sup> CASEE Conference "Food and Biomass Production - Basis  
for a Sustainable Rural Development"

July 1 - 3, 2013



# Soil Compaction

---

- Growing limiting factor for agricultural production
- Global scale compacted soil is estimated at 68 million hectares of land only from the use of machinery (Flovers and Lal, 1998).
- 25-35% of total agricultural land affected by human-induced degradation in Croatia (Kisic, 2004)



# Soil Compaction

---

- Growing limiting factor for agricultural production
- For normal plant growth, the soil must be in such conditions that roots can have enough air, water and nutrients
- Compaction pressed larger pores in the soil and reduces the amount of air

# Tillage

---

## Croatia today

- conventional tillage system dominates
- interest in no-tillage is growing, due to increasing periods of drought in the last decade
- Tillage system simultaneously affects several factors - penetration resistance, soil water content, bulk density and soil porosity



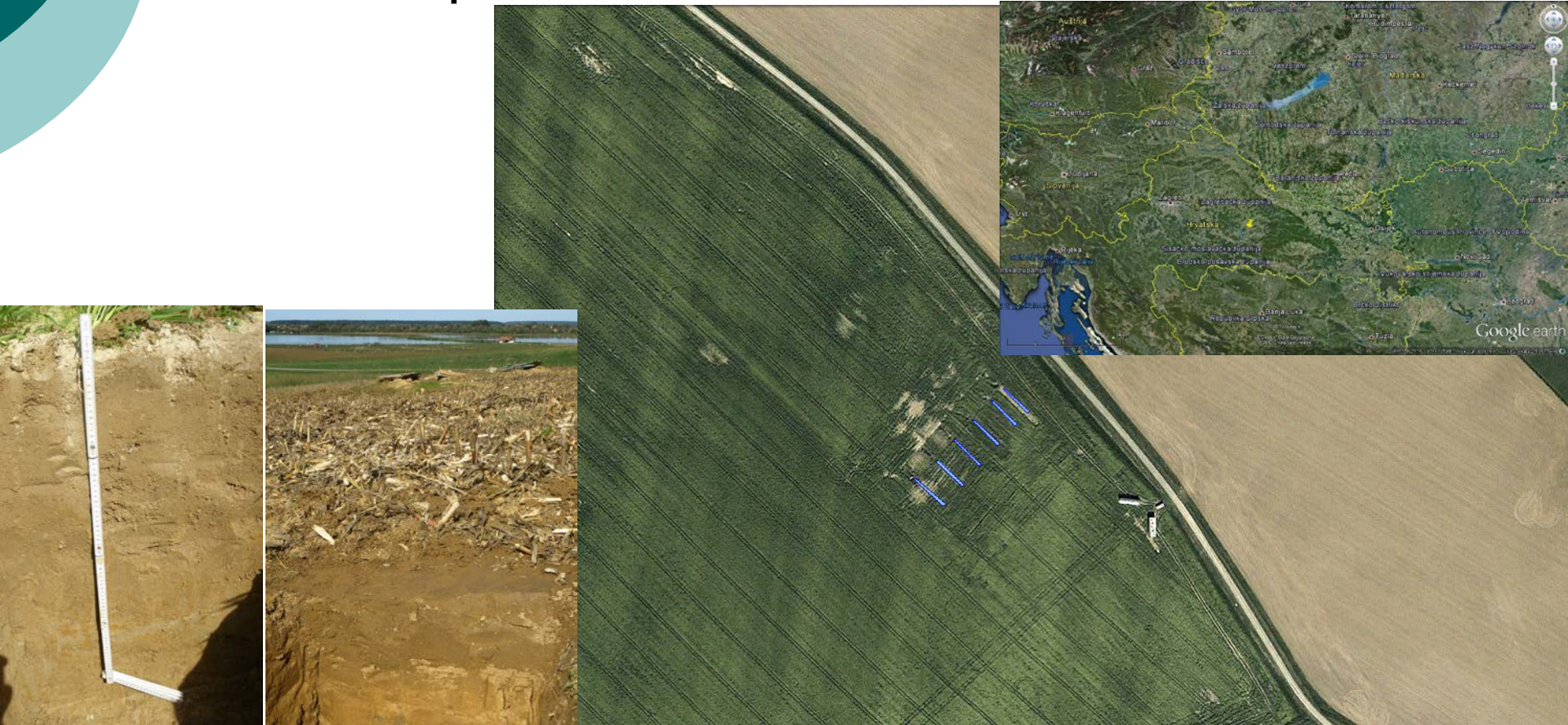
# Goal

---

Determine the impact of tillage management and frequency on soil penetration resistance, bulk density and soil porosity

# Materials and methods

- Stagnic Luvisols
- Semihumid to humid conditions (precipitation 878 mm)
- Annual temperature  $T = 10.6\text{ }^{\circ}\text{C}$



# Materials and methods

1

2

3

4

5

6

- 1) Check treatment (CT) – ploughing up/down the slope - uncultivated
- 2) Conventional ploughing up/down the slope (CP)
- 3) No-tillage system (NT)
- 4) Ploughing across of slope (PA)
- 5) Deep ploughing (50 cm) across of slope (DP)
- 6) Conventional ploughing across of slope with subsoiling to 60 cm (SUB)

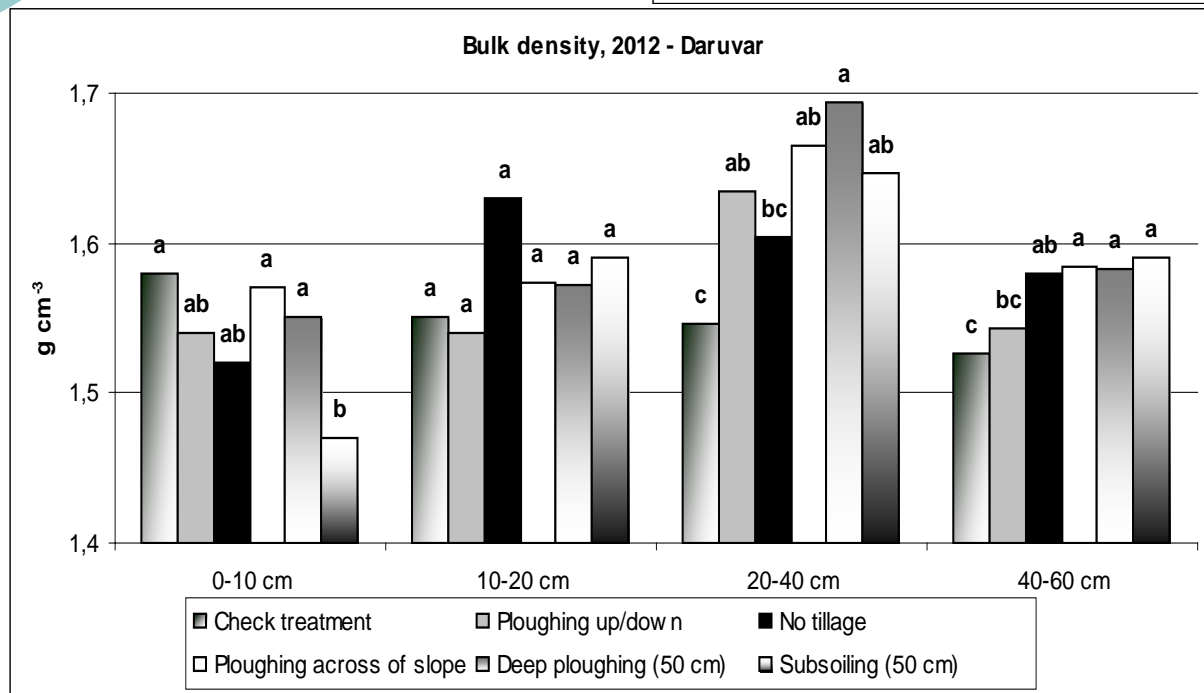
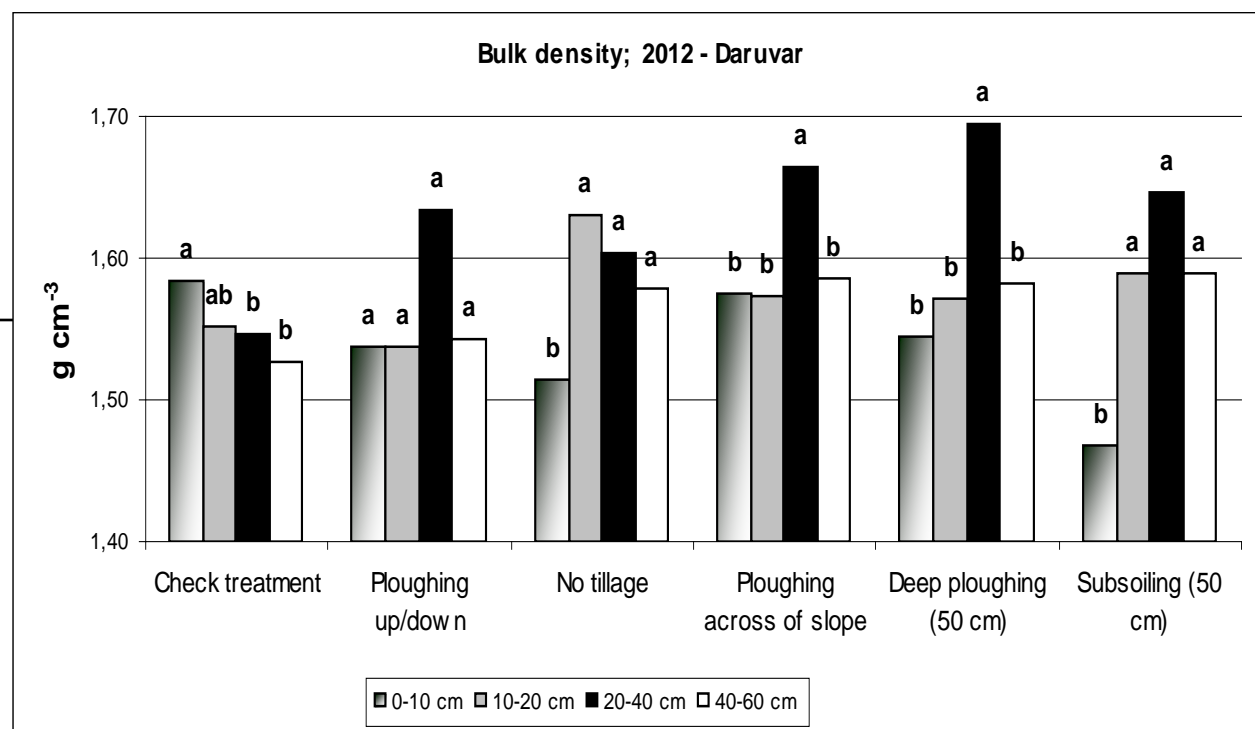
# Materials and methods



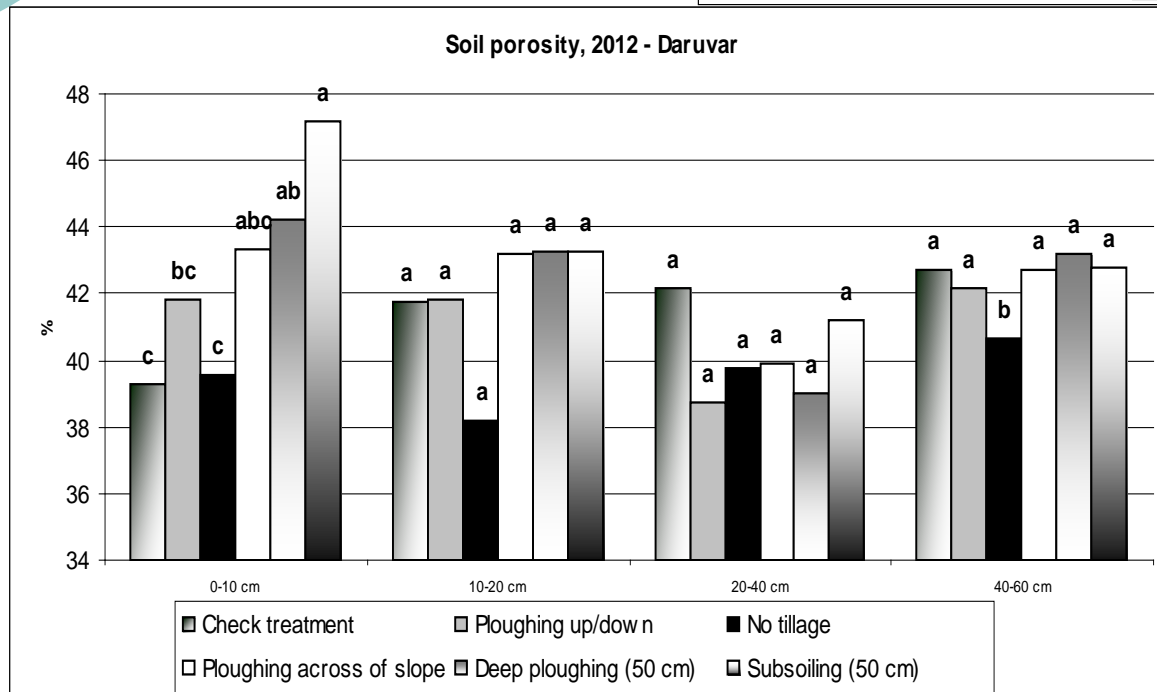
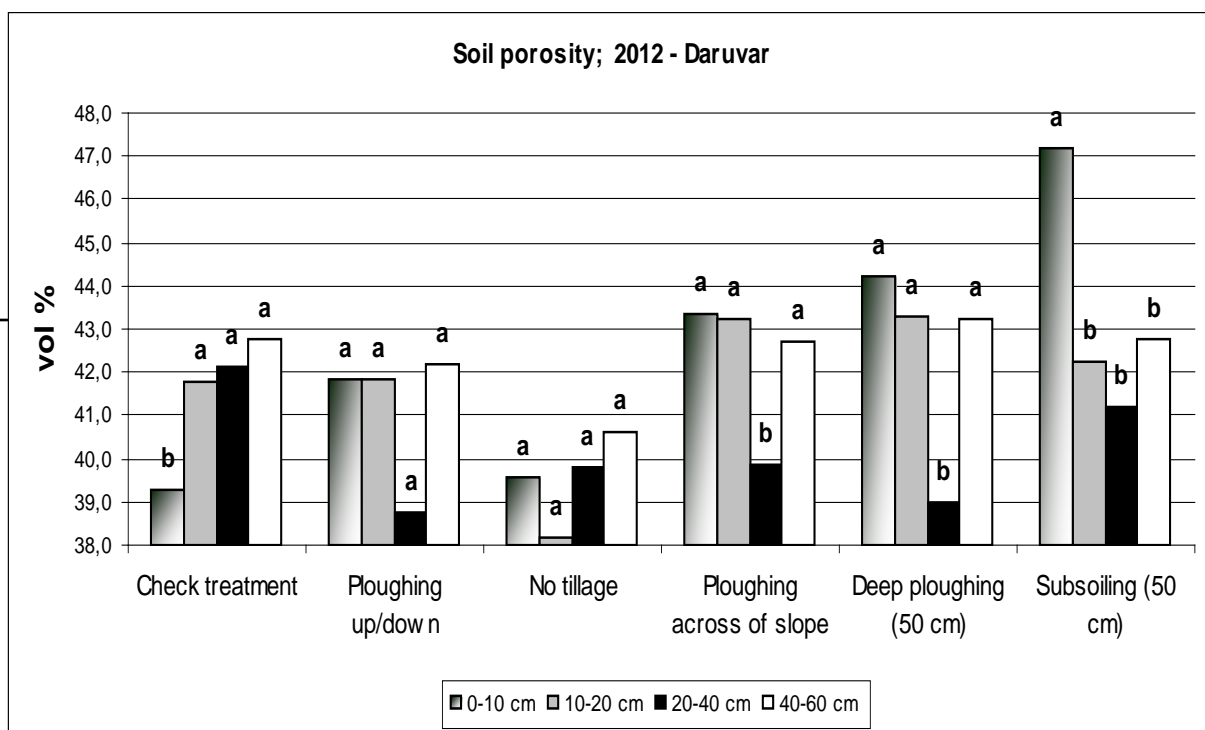
- Soil bulk density - Kopecky's cylinders
- Total porosity - calculated from bulk density and particle density
- Soil resistance penetrometer (Eijkelkamp Penetrologger) – conical point 1 cm<sup>2</sup>, point angle 60°
- Data analyzed using ANOVA (with Duncan's test). The differences were accepted as significant if  $P < 0.05$ .



# Results

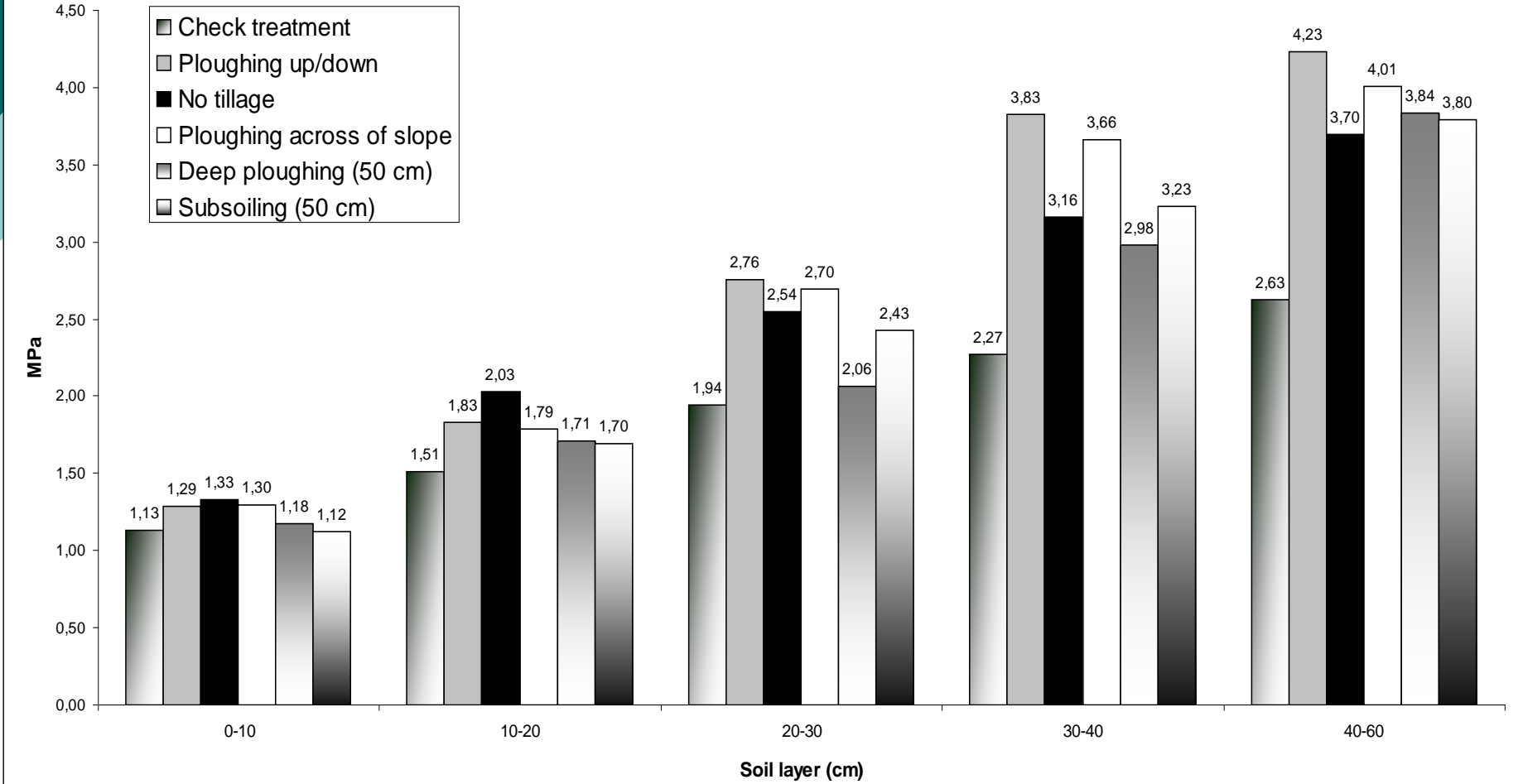


# Results



# Results

Soil Resistance MPa; Average values, 2012 - Daruvar



# Conclusions

---

- Bulk density - minimum average amount showed CT while max had PA and DP
- The highest density (all variants) at a depth of 20-40 cm indicates the existence of impermeable layer
- Soil bulk density of these soils indicates a negative effect on the growth and development of agricultural crops

# Conclusions

---

- Conversion to NT had no increase in soil bulk density and average values are not greater than other tilled variants
- Soil porosity showed significant difference between all tillage systems in surface and deepest soil layer
- The lowest average porosity was recorded at NT, while the highest was recorded at SUB

# Conclusions

---

- The lowest average soil resistance at depth 0-60 cm showed CT variant, while the largest has shown CP variant
- No significant differences in soil resistance between soil layers during dry (August) and wet (December) period
- different tillage practice significantly affected soil resistance at most of the soil layers during the year, except at highest periods precipitation surplus and deficit in layers up to 30 cm



---

**Thank you for your attention!**

**Thank you for your attention!**