HRZZ (Croatian Science Fundation) project:
*"Assessment of conservation soil tillage as advanced methods for crop production and prevention of soil degradation"*
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# Cost-benefit analysis of conservation soil tillage

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# Introduction

- Problems of modern agriculture due to climate change: soil erosion, loss of biodiversity, reduction of plant production, insufficient feed production, reduced availability and quality of water, loss of soil fertility and organic carbon, soil salinization

➢ Conservation agriculture aims to mitigate climate change and enable sustainable food production

➢ Conservation soil tillage improves soil quality, optimizes yields and increases profits

- **Aim: to determine the costs and benefits of conservation soil tillage in corn production on experimental plots**

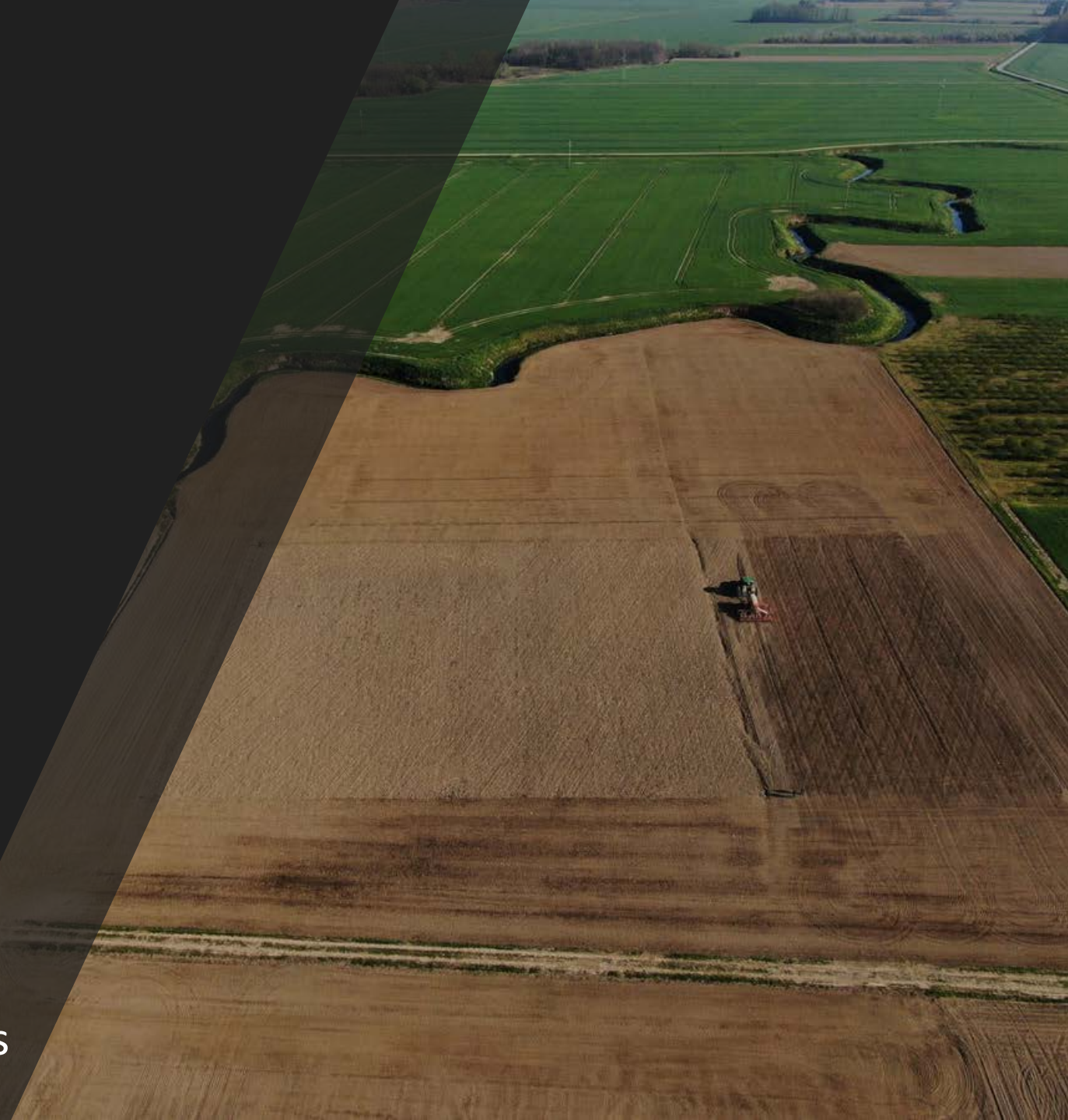
- different agrotechnics and fertilization were carried out in combination with the application of soil conditioners and calcification

# Methodology

- **Incomes** calculated according to the yield levels and the average sales price (harvest time) plus average direct payments for crop production (298.63 EUR/ha)
- **Costs** shown in real amounts according to market prices (TISUP data base) and used material and labor
- Material costs (seeds, plant protection and mineral fertilizers) were obtained from experiments
- Labor costs were obtained from standards (technological norms) from previous researches according to the technological requirements of the crop and the technical characteristics of the mechanization

Calculations were made for the yields recorded in the experiments (2 locations), according to different tillage and fertilization systems

- 3 different tillage systems:
  - conventional tillage by ploughing,
  - with replacement of plowing by deep loosening
  - with shallow loosening of the soil
- 2 ways of fertilization:
  - conventional
  - twice less than conventional
- combined with the application of soil conditioner (Geo2) and calcification
- The cost of calcification calculated as ¼ of the total cost, since the effects of calcification are supposed to last for 4 years



# The cost of working hour per agricultural operations

| |
|---|
| A: the price of a new mechanization |
| B: the price after depreciation period |
| C = (A – B) |
| D: depreciation period |
| E: depreciated cost (C / D) |
| F: average working hours per year |
| G: depreciation per working hour (E / F) |
| H: annual interest on invested capital (7%) |
| I: interest per working hour (H / F) |
| J: the price of blue diesel |
| K: fuel consumption per hour |
| L: fuel cost per working hour (J * K) |
| M: maintenance cost (30% of fuel costs) |
| N: the cost of working hour (G + I + L + M) |


# Results

The data refers to the prices of seeds at the time of sowing, mineral fertilizers and chemicals for the plant protection at the end of the first quarter of the current year, and sales prices immediately after the harvest in the current year

# Incomes, costs and gross margins at the location A

| Plots | Yield | Production value | Incentive | Income | Variable cost | Gross margin |
|---|---|---|---|---|---|---|
| | t/ha | EUR | EUR | EUR | EUR | EUR |
| 1 | 9,46 | 1.820,83 | 298,63 | 2.119,46 | 1.661,11 | 458,34 |
| 2 | 8,76 | 1.685,69 | 298,63 | 1.984,32 | 1.440,19 | 544,13 |
| 3 | 7,54 | 1.450,15 | 298,63 | 1.748,78 | 1.784,54 | -35,76 |
| 4 | 7,05 | 1.356,73 | 298,63 | 1.655,36 | 1.563,62 | 91,74 |
| 5 | 8,47 | 1.629,91 | 298,63 | 1.928,53 | 2.592,71 | -664,18 |
| 6 | 8,58 | 1.652,15 | 298,63 | 1.950,77 | 2.371,79 | -421,02 |
| 7 | 9,76 | 1.878,38 | 298,63 | 2.177,00 | 2.716,14 | -539,14 |
| 8 | 9,32 | 1.793,60 | 298,63 | 2.092,23 | 2.495,22 | -403,00 |
| 9 | 7,42 | 1.428,56 | 298,63 | 1.727,18 | 1.655,28 | 71,90 |
| 10 | 4,69 | 901,80 | 298,63 | 1.200,43 | 1.434,36 | -233,93 |
| 11 | 7,06 | 1.358,89 | 298,63 | 1.657,51 | 1.778,71 | -121,20 |
| 12 | 4,86 | 935,47 | 298,63 | 1.234,10 | 1.557,79 | -323,69 |
| 13 | 8,37 | 1.609,90 | 298,63 | 1.908,53 | 2.586,88 | -678,35 |
| 14 | 6,38 | 1.228,65 | 298,63 | 1.527,27 | 2.365,96 | -838,69 |
| 15 | 8,84 | 1.700,76 | 298,63 | 1.999,39 | 2.710,31 | -710,93 |
| 16 | 6,61 | 1.272,05 | 298,63 | 1.570,68 | 2.489,39 | -918,71 |
| 17 | 7,57 | 1.456,94 | 298,63 | 1.755,57 | 1.634,25 | 121,32 |
| 18 | 6,49 | 1.249,73 | 298,63 | 1.548,35 | 1.413,32 | 135,03 |
| 19 | 8,21 | 1.580,29 | 298,63 | 1.878,92 | 1.757,68 | 121,24 |
| 20 | 5,94 | 1.143,50 | 298,63 | 1.442,13 | 1.536,76 | -94,63 |
| 21 | 9,23 | 1.775,77 | 298,63 | 2.074,40 | 2.565,85 | -491,45 |
| 22 | 8,75 | 1.683,01 | 298,63 | 1.981,63 | 2.344,92 | -363,29 |
| 23 | 7,59 | 1.460,72 | 298,63 | 1.759,34 | 2.689,28 | -929,93 |
| 24 | 6,69 | 1.286,82 | 298,63 | 1.585,44 | 2.468,36 | -882,91 |

- Differences in yields (4.69 to 9.76 t/ha) directly determines the value of production
- The biggest influence is of the cost of mechanization, but technological differences do not significantly affect the total cost
- In most plots (10 out of 12) where Geo2 was applied, this additional cost caused negative gross margin
- In all experimental fields where calcification is applied, the production is unprofitable

# Incomes, costs and gross margins at the location B

| Plots | Yield | Production value | Incentive | Income | Variable cost | Gross margin |
|---|---|---|---|---|---|---|
| | t/ha | EUR | EUR | EUR | EUR | EUR |
| 1 | 12,37 | 2.379,94 | 298,63 | 2.678,57 | 1.928,35 | 750,22 |
| 2 | 8,37 | 1.611,21 | 298,63 | 1.909,83 | 1.706,37 | 203,46 |
| 3 | 15,25 | 2.935,43 | 298,63 | 3.234,05 | 2.051,78 | 1.182,27 |
| 4 | 13,04 | 2.509,84 | 298,63 | 2.808,47 | 1.829,80 | 978,67 |
| 5 | 12,66 | 2.435,81 | 298,63 | 2.734,44 | 2.151,08 | 583,35 |
| 6 | 10,43 | 2.007,31 | 298,63 | 2.305,94 | 1.929,10 | 376,83 |
| 7 | 13,27 | 2.553,25 | 298,63 | 2.851,88 | 2.274,52 | 577,36 |
| 8 | 13,71 | 2.639,22 | 298,63 | 2.937,84 | 2.052,53 | 885,31 |
| 9 | 14,81 | 2.849,85 | 298,63 | 3.148,48 | 1.922,52 | 1.225,96 |
| 10 | 12,39 | 2.384,36 | 298,63 | 2.682,99 | 1.700,54 | 982,45 |
| 11 | 15,67 | 3.015,98 | 298,63 | 3.314,60 | 2.045,95 | 1.268,65 |
| 12 | 12,11 | 2.331,44 | 298,63 | 2.630,07 | 1.823,97 | 806,10 |
| 13 | 14,63 | 2.814,84 | 298,63 | 3.113,47 | 2.145,25 | 968,22 |
| 14 | 11,93 | 2.296,82 | 298,63 | 2.595,44 | 1.923,27 | 672,17 |
| 15 | 11,4 | 2.193,28 | 298,63 | 2.491,90 | 2.268,68 | 223,22 |
| 16 | 13,05 | 2.511,02 | 298,63 | 2.809,65 | 2.046,70 | 762,95 |
| 17 | 12,03 | 2.314,34 | 298,63 | 2.612,96 | 1.901,49 | 711,48 |
| 18 | 11,92 | 2.293,21 | 298,63 | 2.591,84 | 1.679,50 | 912,33 |
| 19 | 10,61 | 2.041,41 | 298,63 | 2.340,03 | 2.024,92 | 315,12 |
| 20 | 11,54 | 2.220,39 | 298,63 | 2.519,01 | 1.802,94 | 716,08 |
| 21 | 12,49 | 2.404,34 | 298,63 | 2.702,97 | 2.124,22 | 578,75 |
| 22 | 9,85 | 1.895,23 | 298,63 | 2.193,85 | 1.902,24 | 291,62 |
| 23 | 11,49 | 2.211,43 | 298,63 | 2.510,06 | 2.247,65 | 262,41 |
| 24 | 10,36 | 1.994,08 | 298,63 | 2.292,70 | 2.025,67 | 267,03 |

- In all plots at the location B, regardless of the agrotechnics applied, positive gross margins were achieved, which is mostly determined by higher yields (8.37 to 15.67 t/ha), 60-80% higher compared to the location A.

# Conclusion

Based on the results achieved in the first year of the project, it can be concluded that conservation soil tillage can be a good measure to mitigate climate change in modern agricultural production, but the efficiency of its application depends on the ability to achieve above-average yields in the conditions of the Pannonian subregion of the Republic of Croatia. Otherwise, some measures applied (calcification and application of Geo2 soil conditioners) represent an additional cost that results in production losses.

# Thank you