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Comparative experiment of various irrigation technologies in maize (Zea mays L.)

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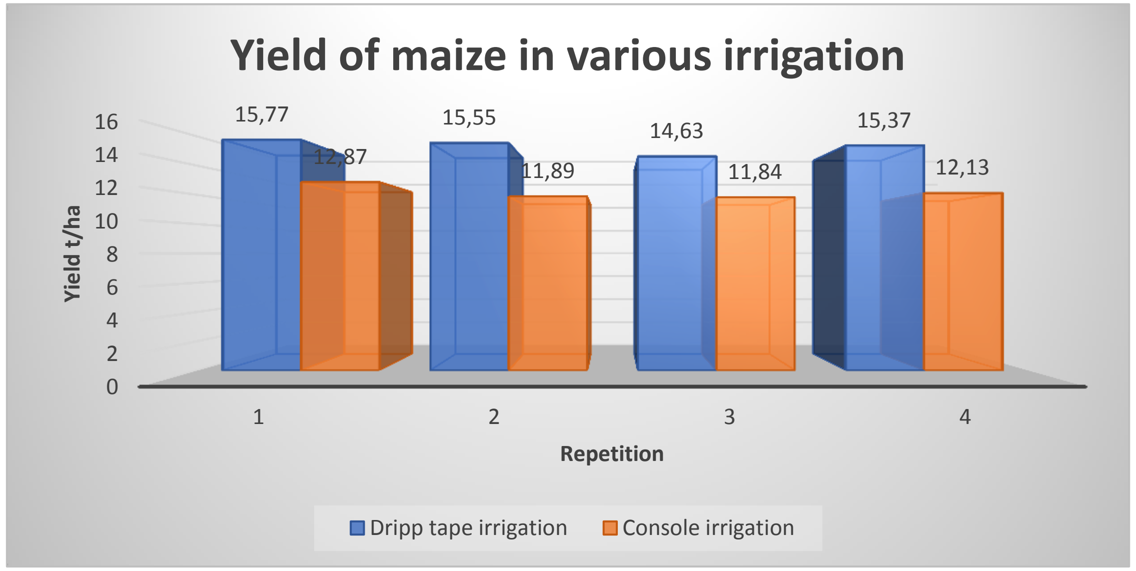
Introduction

Development of domestic maize cultivation largely depends on the applied agrotechnics. In keeping the increase in crop increases, the goal is to minimize crop fluctuations, and there is also an important role in the proper water supply. In our country, the yield of maize is a good water supply. The yield of maize can be significantly increased by improving the water supply of the plant. In many areas there are only very few water available for professional irrigation, so it is increasingly need to focus on modern, most water-saving irrigation technologies.

Material and method

In our experiment, we compare two irrigation techniques. The rain-like watering with console and the solenoid valve-controlled tape drip irrigation. Our examinations extend to mapping the properties of maize that can cause changes in the effect of irrigation and, of course, to develop crop quantities available by various irrigation technologies, since these results provide the proper income for the producer. The research was carried in Szarvas, at the school experimental field of the Hungarian University of Agriculture and Life Sciences, Department of Irrigation and Melioration, in 2020.

In our research, we investigated the height of the plants, leaf area, crop-forming elements, crumbling rate and yield results. Harvesting is done with manual force. In the experimental area, a 30 m width irrigation console was used, which was moved with a rewinding device. In the drip tape irrigation mode, we used the Aquatraxx tape drip system marketed by Metra Kft. The water conservation was carried out from a controllable hydrant with solenoid valve.

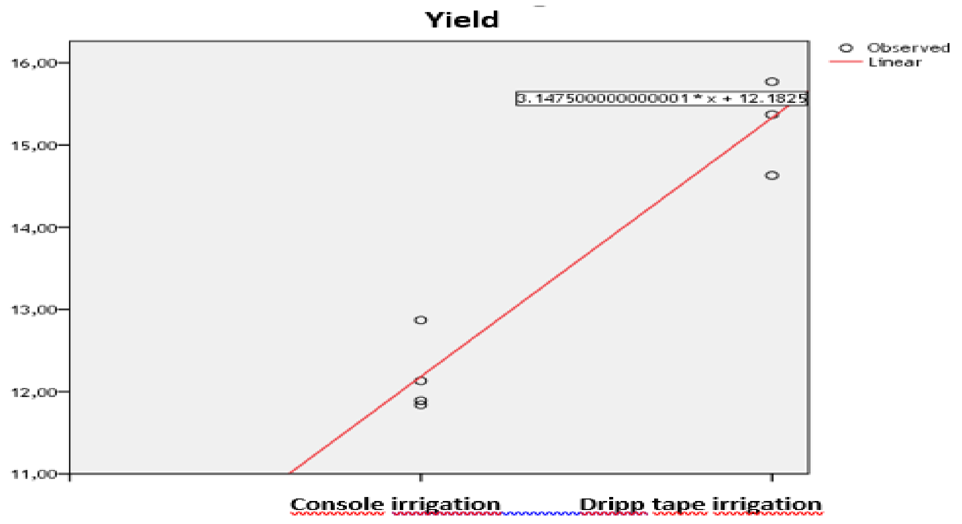


Correlations betwen maize's yield and irrigation technologies			
		Irrigation tech.	Yield
Irrigation tech.	Pearson Correlation	1	**,966****
	Sig. (2-tailed)		**,000**
	N	8	8
		,966**	1

Results and conclusion

At almost every level of the tests, dripping tape watering brought a better result and these differences were statistically justified. Even so that the experimental area has equally nutritional replacement. If we consider that the use of drip irrigation tape provides an opportunity for continuous dispensing medium in which the plants can receive ongoing and targeted nutrient supply growth is likely to further shift in a positive direction. It is not insignificant that the amount of water used in micro irrigation technology was almost 30-40% less than for traditional rain-like irrigation console. This is the fact that significantly greater crops can be achieved in a vintage that can be ideal for a precipitation that it is economically recovered by dripping tape irrigation under conventional arable fields and arable plants, so it should be applied to a greater extent in the future .

Linear regression of maize's yield and irrigation technologies



ASSESSMENT OF SOME MORPHOLOGICAL AND PHYSIOLOGICAL PARAMETERS IN LETTUCE (*LACTUCA SATIVA* L.) CULTIVATED IN HYDROPONIC SYSTEM

AUTHOR(S)

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Introduction

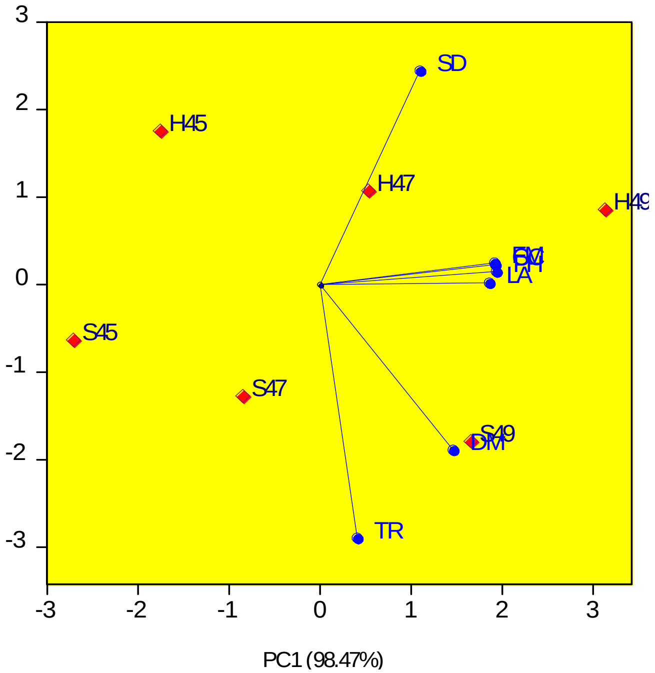
Lettuce is a valuable leaf vegetable for a well-balanced diet, since it is rich in nutrient elements, has low calories and provides dietary antioxidants. Compared to soil-based cultivation, the hydroponic system is an alternative associated with a shortening of growing cycles and a reduction of wasted water amount.

Material and method

The aim of this study was to analyze the growth of lettuce plants (Regina di Maggio) under hydroponic and soil cultivation systems, during three phenological growth stages (45; 47 and 49) according to BBCH scale.

The research was carried out using a complete randomized design with a 2 × 3 factorial arrangement of cultivation system and phenophases.

During the study different morphological and physiological parameters were evaluated: Plant height (PH); Stem diameter (SD); Fresh mass (FM); Dry mass (DM); Leaf area (LA); Chlorophyll content (CC); Transpiration rate (TR).



S45-Soil BBCH45; S47-Soil BBCH47; S49-Soil BBCH49;
H45-Hydroponic BBCH45; H47- Hydroponic BBCH47; H49- Hydroponic BBCH49;
Biplot for morphological and physiological parameters of lettuce under soil and hydroponic systems

Fresh mass for lettuce under two cultivation systems during three phenophases

Cultivation System (CS)	Fresh mass (g) Phenophase (P) BBCH45	BBCH47	BBCH49	Cultivation system mean
Soil	y 196.0±10.1 a	y 249.1±15.6 b	x 317.2±17.2 a	254.1±12.7 B
Hydroponic	y 227.4±12.3 a	x 311.9±20.8 a	x 361.9±23.5 a	300.4±18.2 A
Phenophase mean	211.6±8.6 Y	280.5±15.8 X	339.6±20.5 X	277.2±3.6
CS- $LSD_{5\%}$ = 34.8 g (A,B); P- $LSD_{5\%}$ = 42.6 g (X,Y,Z); CS x P-$LSD_{5\%}$ = 60.2 g				

(a, b, for vertical comparisons; x, y, z, for horizontal comparisons).
Data represents mean ± SE. Different letters indicate significant differences ($p < 0.05$)

Results and conclusion

Under hydroponic system, the plants generally achieved a significantly higher FM by 18.11%. The effect of the culture system on this trait was higher in the phenophase BBCH47 where an increase of 25.30% was registered. In BBCH47 and BBCH49 phenophases, the FM was significantly higher by 32.08-53.51% than in the first phenophase.

Under hydroponic conditions, the plants generally achieved a significantly lower TR by 19%. Regardless of the culture system, a significant intensification of transpiration by 6.45-9.41% from one phenophase to another was observed. Significantly higher values of CC and LA were recorded under hydroponic culture, due to higher variations in BBCH47 and BBCH49

Plants grown in hydroponic system presented higher values of most parameters, except for DM and TR. The cultivation system had the highest effect on PH, SD and LA. The highest variation between phenophases were observed for PH, LA and CC. Finally, we can conclude that lettuce plants cultivated under hydroponic system, presented better growth parameters associated with higher head weight and yield.

EFFECT OF PRECIPITATION ON THE NUTRIENT REACTION OF TRITICALE VARIETIES

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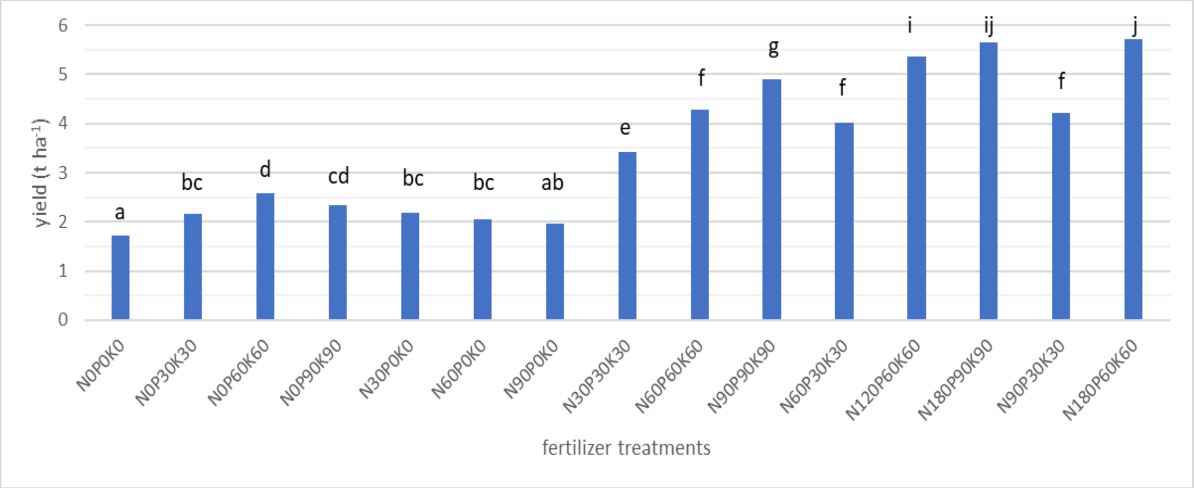
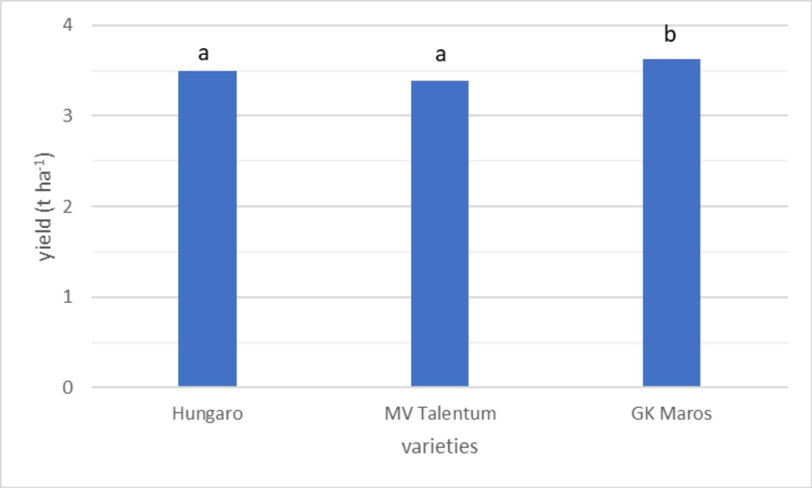
Introduction

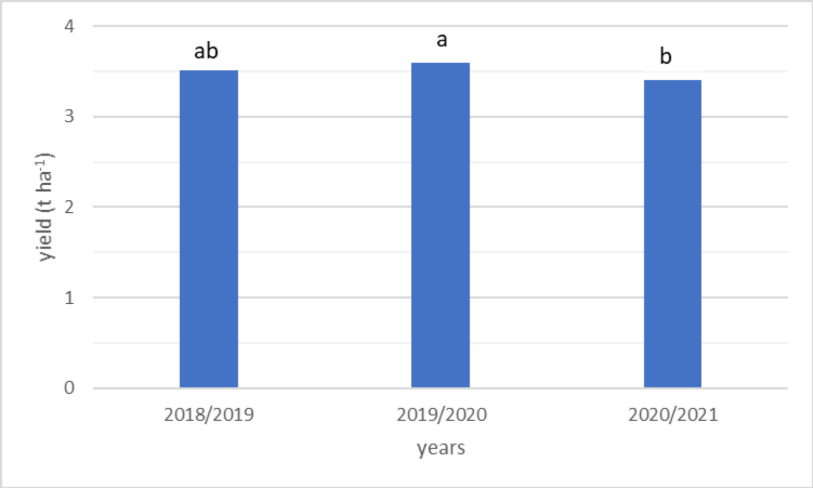
Triticale is the first man made genus hybrid of wheat and rye. The basic aim of its production was to combine yield potential and grain quality of wheat with the disease and environmental tolerance of rye. In the past decades, triticale crop area has been increasing in Hungary, which climate change has also contributed. The triticale is produce well in dry climatic conditions, so it becomes more and more popular among farmers. Our country is the one of the top 10 triticale producing countries in the World.

Material and method

In the long-term fertilization experiment, at Fülöpszállás, on calcic meadow chernozem soil we carried out experiments in three growing seasons (2018/2019, 2019/2020, 2020/2021) with three winter triticale varieties (Hungaro, Mv Talentum, GK Maros,) in 4 replications, on 20 square meter random layout plots. In our experiment, we examined 15 different fertilization treatments, in every year, which can be used as different fertilization strategies.







Results and conclusion

The aim of our study was to determine how the yield of triticale is affected by variety, nutrient supply, and year of cultivation. We were also interested in the extent to which the amount of precipitation at different times of the growing year affects the yield.

From the results of our experiments, we concluded that the yield of triticale is largely determined by genotype and nutrient supply, which is strongly influenced by the average annual precipitation. In the drier year, the relative effect of nutrients on yield was greater than in the rainy growing season.

Investigation of different nutrient levels applied during irrigation in the self-rooted and grafted watermelon production

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Introduction:

Irrigation is becoming increasingly important these days, mainly for the cultivation of vegetables in the field, due to extreme weather and prolonged periods of low rainfall. In addition, the importance of nutrients applied during irrigation is widespread. That's why, my work in the form of water-soluble fertilizers for self-rooted and grafted watermelon cultivation, applied simultaneously with irrigation, it concentrates on examining different nutrient levels during the growing season. Within that, I focused on the application of macronutrients - nitrogen, phosphorus, potassium. Therefore, I set up 4 different nutrient levels for both types of seedlings, in two replicates, of which I developed a phosphorus, a nitrogen, and a potassium overweight nutrient level, and a nutrient level in which all three nutrients were in equal proportions. The latter formed the control. For both self-rooted and grafted seedlings, I wondered whether changes in nitrogen, phosphorus, and potassium would affect, and if so, the positive or negative direction of plant development, or the quantity, quality or weight of the crop.

Material and method:

I performed my experiment in 2020-2021 in an area of 1000 m^2 in Medgyesegyháza. The experiment took place in the same area for both years. In the experiment, in the case of self-rooted and grafted seedling types, I also examined the Rubin F1 watermelon variety included in the Syngenta variety selection list.

I developed a total of 16 experimental plots of 20 m^2 in the whole area. Each plot consisted of 2 adjacent rows. I examined 3-3 seedlings in both rows, so a total of 6 seedlings were placed in one plot. The distance between the seedlings within the plots was 120 cm between each seedling. From the product of the seedling distance and the 250cm row spacing, it can be stated that one plant had 3 m^2 of growing area. The 16 plots were distributed in the area by examining the grafted seedlings in 8 plots and also the self-rooted seedlings in 8 plots. The 8 plots were composed of a control, a phosphorus overweight, a nitrogen overweight, and a potassium overweight nutrient level, which I examined in duplicate. The markings of the 16 experimental plots are illustrated in **Table 1**.

The area did not receive basic fertilization in any of the years to avoid inaccuracy in the experiment. Nitrogen, phosphorus, and potassium applications were also performed in the most appropriate phenological phases of the plant. Phosphorus application after planting, before and during the first flowering period; nitrogen application after fruit set during crop growth; and potassium application was taken during the ripening period. Each excess active ingredient was administered in several smaller doses, for better absorption and utilization. I used various water-soluble fertilizers to apply the active ingredients, which I applied simultaneously with irrigation. The total amount of NPK active ingredients applied to the treatments during the whole growing period is shown in **Table 2**. I dispensed the uniform and optimal amounts of fertilizers for the treatments through a drip belt using an irrigation system. However, the application of the additional active ingredients was carried out in several smaller doses with a watering can, watered at the watermelon stems. The measurements, tests and calculations performed during the experiment are illustrated in **Table 3**.

Table 1: Treatments and their labeling

	Repeat 1	Repeat 2
Grafted seedlings, **control** treatment	O/1/I.	O/1/II.
Grafted seedlings, **phosphorus overweight** treatment	O/2/I.	O/2/II.
Grafted seedlings, **nitrogen overweight** treatment	O/3/I.	O/3/II.
Grafted seedlings, **potassium overweight** treatment	O/4/I.	O/4/II.
Self-rooted seedlings, **control** treatment	S/1/I.	S/1/II.
Self-rooted seedlings, **phosphorus overweight** treatment	S/2/I.	S/2/II.
Self-rooted seedlings, **nitrogen overweight** treatment	S/3/I.	S/3/II.
Self-rooted seedlings, **potassium overweight** treatment	S/4/I.	S/4/II.

Table 2: Amount of total NPK active ingredients applied per plot during the growing season 2020-2021

	Control plots (S/1/I., S/1/II., O/1/I., O/1/II.)	Phosphorus overweight plots (S/2/I., S/2/II., O/2/I., O/2/II.)	Nitrogen overweight plots (S/3/I., S/3/II., O/3/I., O/3/II.)	Potassium overweight plots (S/4/I., S/4/II., O/4/I., O/4/II.)
N	24,93g	66,63g	144,58g	63,67g
P	21,48g	132,48g	60,52g	59,25g
K	21,35g	59,05g	65,64g	136,35g

Table 3: The measurements, tests and calculations

▶ Measurements related to shoot length increase (+cm)
▶ Counting female and male flowers (pc)
▶ Yield measurements (kg/treatment ; kg/m^2)
▶ Number of crops per treatment test (pc/treatment)
▶ Calculation of the average weight of the crops per treatment (kg/crop)
▶ Refraction measurement (Brix°)
▶ Sensory examination (score)
▶ Crop weight loss test (%)
▶ Cost calculation

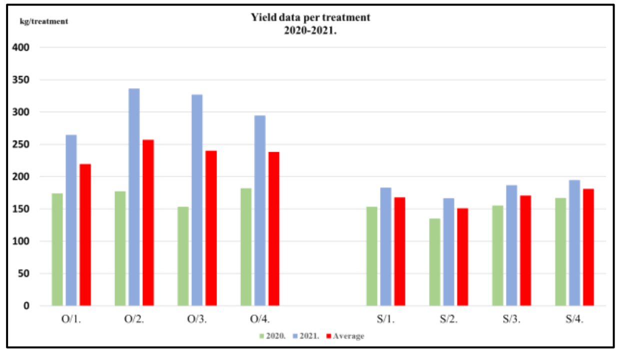

Figure 1: Average yield data per treatment (2020, 2021) and average of data for two years

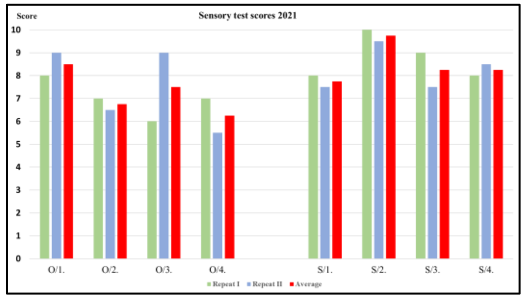

Figure 2: Sensory test scores (2021) and mean scores for replicates

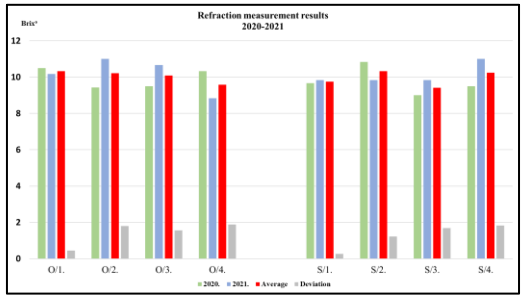

Figure 3: Results of refraction measurements (2020, 2021) and the mean and standard deviation of the data for the two years

Table 4: Calculation of the cost of different grafted treatments in an area of 20 m^2

Cost description	Prices (broken down by treatments)			
	O/1.	O/2.	O/3.	O/4.
Soil work costs (autumn basic cultivation, spring combinatorization)	100 Ft	100 Ft	100 Ft	100 Ft
Ground cover foil	134 Ft	134 Ft	134 Ft	134 Ft
Tunnel foil	240 Ft	240 Ft	240 Ft	240 Ft
Line spacing foil	240 Ft	240 Ft	240 Ft	240 Ft
Drip tape	145 Ft	145 Ft	145 Ft	145 Ft
Costs of machine laying of ground cover foil and drip tape	100 Ft	100 Ft	100 Ft	100 Ft
Seedling (seed + cultivation)	1 020 Ft	1 020 Ft	1 020 Ft	1 020 Ft
Irrigation costs (eg.: petrol, mixed oil, irrigation system parts)	650 Ft	650 Ft	650 Ft	650 Ft
Fertilizer	171 Ft	416 Ft	266 Ft	349 Ft
Costs of plant protection (pesticides, application costs)	778 Ft	778 Ft	778 Ft	778 Ft
Harvesting and transport costs	950 Ft	950 Ft	950 Ft	950 Ft
Stock liquidation costs	400 Ft	400 Ft	400 Ft	400 Ft
Other cultivation costs	130 Ft	130 Ft	130 Ft	130 Ft
Total expenses:	**5 058 Ft**	**5 303 Ft**	**5 153 Ft**	**5 236 Ft**
Total revenue:	**13 165 Ft**	**15 417 Ft**	**14 406 Ft**	**14 289 Ft**
Profit:	**8 107 Ft**	**10 114 Ft**	**9 253 Ft**	**9 053 Ft**

Table 5: Calculation of the cost of different self-rooted treatments in an area of 20 m^2

Cost description	Prices (broken down by treatments)			
	S/1.	S/2.	S/3.	S/4.
Soil work costs (autumn basic cultivation, spring combinatorization)	100 Ft	100 Ft	100 Ft	100 Ft
Ground cover foil	134 Ft	134 Ft	134 Ft	134 Ft
Tunnel foil	240 Ft	240 Ft	240 Ft	240 Ft
Line spacing foil	240 Ft	240 Ft	240 Ft	240 Ft
Drip tape	145 Ft	145 Ft	145 Ft	145 Ft
Costs of machine laying of ground cover foil and drip tape	100 Ft	100 Ft	100 Ft	100 Ft
Seedling (seed + cultivation)	420 Ft	420 Ft	420 Ft	420 Ft
Irrigation costs (eg.: petrol, mixed oil, irrigation system parts)	650 Ft	650 Ft	650 Ft	650 Ft
Fertilizer	171 Ft	416 Ft	266 Ft	349 Ft
Costs of plant protection (pesticides, application costs)	778 Ft	778 Ft	778 Ft	778 Ft
Harvesting and transport costs	950 Ft	950 Ft	950 Ft	950 Ft
Stock liquidation costs	400 Ft	400 Ft	400 Ft	400 Ft
Other cultivation costs	130 Ft	130 Ft	130 Ft	130 Ft
Total expenses:	**4 458 Ft**	**4 703 Ft**	**4 553 Ft**	**4 636 Ft**
Total revenue:	**10 082 Ft**	**9 045 Ft**	**10 244 Ft**	**10 852 Ft**
Profit:	**5 624 Ft**	**4 342 Ft**	**5 691 Ft**	**6 216 Ft**

Results and conclusion:

Figure 1 illustrates the average yield data per treatment (2020, 2021) and the average of the two-year data. **Figure 2** shows the scores for sensory examinations (2021) and the average of the scores for the replicates. **Figure 3** shows the results of the refraction measurement (2020, 2021) and the mean and standard deviation of the data of the two years.

My experiment showed that at the beginning of the breeding season, before or during the first flowering period, higher amounts of phosphorus applied simultaneously with irrigation have a positive effect on the development and yield and quality of grafted plants throughout the growing season. Higher phosphorus content applied by irrigation before and during the first flowering period also promotes flowering of self-rooted plants and improves their crop quality. But in their case, the higher potassium active substance applied during the ripening period has the most positive effect on their yield results. All of this proves that it is really necessary to use different nutrient replenishment in the cultivation of self-rooted and grafted plants, and that the nutrients applied during nutrient solution are of great importance for plant development and the quantity and quality of the crop. My experiment also pointed to the fact that grafted seedlings result in higher yields, higher yields per treatment, and average weight compared to self-rooted plants. As a result, they are more profitable **(Table 4, Table 5)** to grow, despite their higher cultivation costs.

STUDY OF EFFECT OF ADDED FERMENTED CHICKEN MANURE PRODUCTS ON WATER AND NUTRIENT UPTAKE OF TOMATO IN SMALL POT EXPERIMENT

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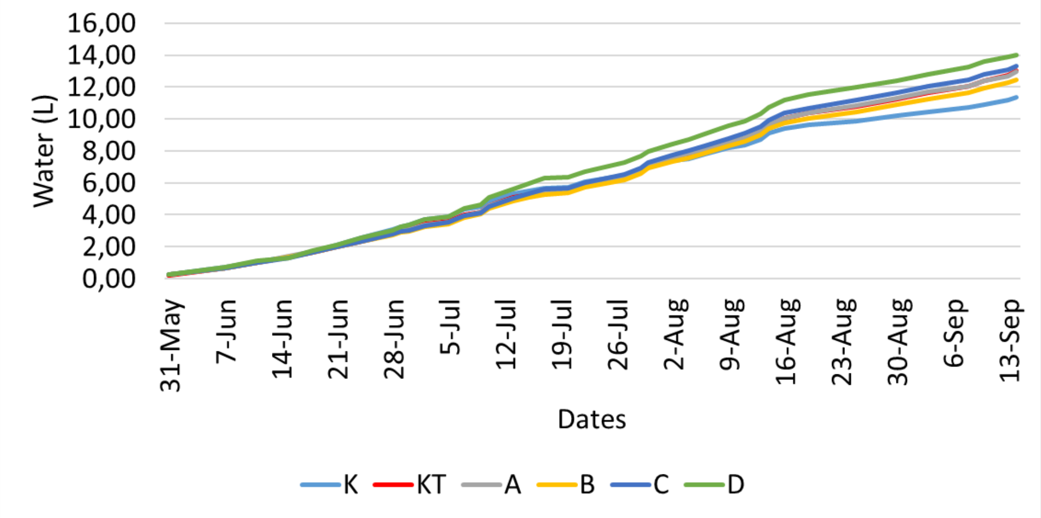
Introduction

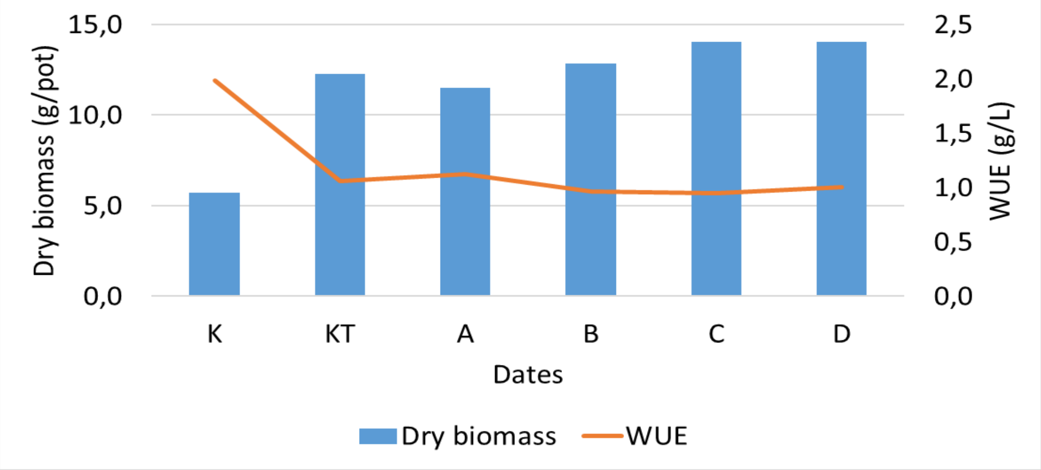
The two main challenges facing agriculture today are optimising soil water management and increasing the organic matter content of soils. Our aim is to develop products that are suitable for achieving these objectives.

Material and method

To get information about the effects of developed product on water management of soil, small pot experiment was carried out. In this experiment, SAPs (in different forms: SAP1-2 and doses: D1-2) and clay minerals (CM) are mixed with fermented poultry manure (NEX) to study their combined effects on the water consumption, the nutrient supply and the yield. In the experiment, sandy soils were used at a W_C=60%, provided by daily irrigation. Water consumption, and biomass production were investigated at tomato plant (cv. Mano).



1. Figure: Total water requirements for each treatments



2. Figure: Effects of treatments on dry biomass production and water use efficiency

Legend:
K-control; KT-control+NEX; A-NEX+CM+SAP1D1
B-NEX+CM+SAP1D2; C-NEX+CM+SAP2D1;
D-NEX+CM+SAP2D2

Results and conclusion

Compared to the control, all treatments increased the dry biomass production, which resulted higher water demand. However, treatments reduced the specific water uptake due to better water utilisation.

The highest yields were obtained by the SAP2 treatments. Moreover, the WUE value was reduced by about half compared to the control.

Acknowledgements

Our research was supported by GINOP 2.2.1-15-2017-00043 project.

Yield stability of winter wheat in intercrop makes better adaptation to climate conditions

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Introduction

Negative effects of global climate change significantly tested adaptive capacity of our cultivated plants. In Hungary the most dominant cereal is winter wheat. In most cases there is no crop rotation, pre-crop effect remains unused. Intercrop is a special kind of plant association, where the combination of winter wheat and winter pea complement each other. With a suitable variety may appear a yield advantage, thereby they could be more resistant against extreme meteorological events.

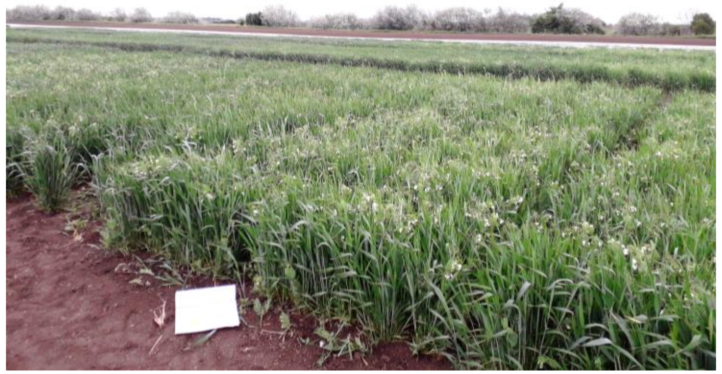

Figure 1.: Flowering peas in plant associated plots

Material and method

Our experiments were made in one growing season (2020/2021), with 3 winter wheat varieties (GK Szilárd, Cellule, GK Csillag) and one field pea variety (Aviron), in 4 repeats, on 10 square meter random layout plots in the research station of Szeged-Öthalom. We used 3 different seed density in every varieties in every combination. All of the parcels were sown on 21 October 2021, and havested on 2nd July 2022. Data from field experiments were analyzed by two-way analysis of varience.

Table 1: Grain yield of winter wheat and pea together (t/ha)

		Applications			
		pure wheat	Aviron 0,5 million seed ha^{-1}	Aviron 0,75 million seed ha^{-1}	Aviron 1 million seed ha^{-1}
GK Szilárd	2,5 million seed ha^{-1}	4,73	5	5,06	5,03
	3,75 million seed ha^{-1}	5,55	4,98	5,4	5,12
	5 million seed ha^{-1}	5,51	5,45	5,85	5,48
Cellule	2,5 million seed ha^{-1}	5,76	5,5	5,63	5,45
	3,75 million seed ha^{-1}	6,35	5,88	5,8	5,67
	5 million seed ha^{-1}	6,59	6,03	6,21	6,15
GK Csillag	2,5 million seed ha^{-1}	5,25	5,69	5,71	5,47
	3,75 million seed ha^{-1}	5,65	6,05	6	6,01
	5 million seed ha^{-1}	5,47	6,49	5,88	6,08

Results and conclusion

In intercrop cereals and legumes makes better overall use of resources than when grown separately. Intercrop provides greater yield stability, weed supression and natural nitrogen supply for wheat. It cannot achieve this benefits on its own. We supposed, that higher seed density of wheat makes higher yield regardless of pea (table 1). Increasing pea ration in mixture, wheat yield decreased. Except of GK Szilárd and Cellule at a sowing desity of 75% and 100% with Aviron 75% represented higher values. Which means, that these mixtures are more ideal for the two varieties mentioned before. Yield of winter wheat and pea together almost reached the results of the control plot, and in many cases surpassed them in all combinations of GK Csillag variety, all mixtures of GK Szilárd in the sowing density of 50%, and in association at the sowing density of the same variety of 100% and pea 75%.

Future opportunities of crop production are likely to be expanded or limited by the level of adaptation to climatic conditions. Plant association is a possible response to climate change that increases diversification, provides surplus, and co-cultivation allows more adaptive crop production for winter wheat and pea.

THE EFFECT OF SALINITY ON THE CHLOROPHYLL CONTENT OF WHEAT

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Introduction

Wheat is one of the most important crops and is usually grown with the right amount of nitrogen to get a great deal of production. Therefore, nitrogen content is an important indicator of the level of plant nutrition for autumn wheat (Aranya, et al. 2003).Studies have shown that chlorophyll content in plants has been positively correlated with nitrogen content (Filella et al.1995). Thus, the value of leaf chlorophyll content can help understand the nutrient status of the plant and scientifically guide fertilization management to ensure good crop quality and yield (Grattan et.al. 1998, Menesattiet.al 2010). This practice is of great importance for modern precision agriculture. The use of physiological traits as an indirect selection would be important in increasing the effectiveness of yield-based selection procedures (Kiani-Pouya et al.2014).To study the effects of biotic and abiotic stress on plant growth and productivity, numerous physiological parameters can be exploited in various fields of plant science, such as agriculture, agronomy, forestry and horticulture. Some physiological aspects, such as plant photosynthetic efficiency, have begun to be investigated in plant breeding programs to assess crop performance when grown under unfavourable environmental conditions. The chlorophyll fluorescence is one of these parameters indicating the plant's ability to convert light energy into biochemical energy during the photosynthetic process. The advantages of this technique are that it is non-invasive, non-destructive and quickly measured using extremely portable equipment (Hazem et.al.2008). Studies on relative chlorophyll content in non-destructive testing are mainly focused on measuring the value of chlorophyll (SPAD and Spatial Development Analysis, SPAD), which estimates the relative chlorophyll content by collecting the mean of all values of a SPAD from a point repeatedly measured. The SPAD values express the relative amounts of chlorophyll in the crop leaves and have been demonstrated in several studies. (Camen et al.2017, Huang et al.2010, Huang et.al. 2014, Shi et.al.2011, Yang et al.2009). Direct and indirect methods may be used to investigate primary ecological production. In practice are often used indirect methods for an approximate estimate of the value of organic production, because it is quite difficult to get uses direct methods. Using indirect methods, it is possible to monitor and measure all phenomena and processes related to productivity (Aranya et al.2003, Kof et al.2004, Raynolds et al.2000). Chlorophyll content is one of the clues in photosynthetic activity (Larcher,et al.1995). Has special significance for agriculture being considered an indicator of photosynthetic activity. During the growing period, significant changes are associated with the crop reflection spectra with the accumulation and destruction of plant pigments, mainly chlorophyll (Jorgensen et al.2006, Broge et.al.2002).

Material and method

The biological material was represented by a collection of wheat which had different origins, from Romania and from different European countries, to have as much genetic variation as possible. The varieties were chosen from those cultivated in the area over time. Some of them have been remarked by good productivity, others by the good quality of production. In the laboratory, using saline stress (with NaCl), it is possible to test plant salinity tolerance. Seeds of wheat were cultivated in pots containing soil, peat and sand in the ratio of (1:1:1) and grown under green house conditions. Temperature in the green house was 30 ± 2oC during day and 25 ± 2oC at night with relative humidity 50% and a photoperiod of 14 h. The plants were grown under normal conditions (V0-water) and stress conditions (V1-.150 mM NaCl, V2-200 mM NaCl, V3-240 mM NaCl). To determine the chlorophyll content of the leaves was used the portable chlorophilmeter SPAD-502 (Konica Minolta), which measures the absorbance at 650 nm, this being a non-destructive method. Three readings were made on each leaf, the results being expressed in SPAD units. The chlorophyll content of the leaves was determined after 7 days, 14 days and 21 days from stress induction.In order to determine the difference between varieties, the statistical processing of the data obtained was done by variance analysis and the t test, for bi- and trifactorial experiences. The meanings of differences between varieties and other graduations of the factors were represented both by symbols (*; **; *; 0; 00; 000) and by letters; the differences between variants marked with different letters**

Table 1.Average chlorophyll content for several periods after the salt stress salt stress on chlorophyll content for different wheat varieties

Period	*chlorophyll content* (SPAD)		Relative Value (%)	Difference/ Signification
14 days – 7 days	32.78	33.15	98.88	-0.37
21 days – 7 days	29.07	33.15	87.69	-4.08^{000}
21 days – 14 days	29.07	32.78	88.68	-3.71^{000}
		$LDS_{5\%}=1.13$	$LDS_{1\%}=1.88$	$LDS_{0.1\%}=3.51$

Table 2.The effect of salin treatment concentration on the chlorophyll content in wheat

Treatment (mM NaCl)	*chlorophyll content* (SPAD)		Relative Value (%)	Difference/ Signification
150 - 0	31.89	32.70	97.52	-0.81^{0}
200 - 0	31.30	32.70	95.72	-1.40^{000}
240 - 0	30.78	32.70	94.13	-1.92^{000}
200 - 150	31.30	31.89	98.15	-0.59
240 - 150	30.78	31.89	96.52	-1.11^{00}
240 - 200	30.78	31.30	98.34	-0.52
		$LDS_{5\%}=0.74$	$LDS_{1\%}=1.01$	$LDS_{0.1\%}=1.37$

Table 3.Average chlorophyll content for studied wheat varieties

No	Varieties	*chlorophyll content* (SPAD) $\bar{x} \pm s_{\bar{x}}$	$s_{\%}$	Relative Value (%)	Signification of difference
Average of experience		31.67±0.22	15.74	100	Control
1	**Alex**	32.50±0.80 bcd	14.70	102.63	0.83
2	**Glosa**	34.02±0.85 a	15.05	107.43	2.35***
3	**Esperia**	29.11±0.78 f	16.10	91.93	-2.56^{00}
4	**Capo**	29.48±1.32 f	26.85	93.10	-2.19^{00}
5	**Josef**	32.05±0.57 cd	10.62	101.21	0.38
6	**Cerere**	30.00±1.03 f	20.51	94.74	-1.67^{0}
7	**Genesi**	31.61±0.46 de	8.65	99.82	-0.06
8	**Apache**	32.46±0.96 bcd	17.80	102.51	0.79
9	**Soissons**	30.38±0.46 ef	9.11	95.94	-1.29
10	**Exotic**	33.18±0.89 abc	16.19	104.78	1.51*
11	**Solehio**	33.60±0.58 ab	10.43	106.11	1.93**
12	**Zephyr**	30.39±0.67 ef	13.20	95.97	-1.28
13	**Cubus**	33.16±0.71 abc	12.81	104.72	1.49*
14	**Calisol**	31.39±0.67 de	12.89	99.13	-0.28
			$LDS_{5\%}=1.38$	$LDS_{1\%}=1.81$	$LDS_{0,1\%}=2.32$

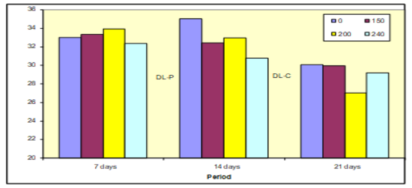

Fig.1. The chlorophyll content in wheat under different period and concentration of salin stress

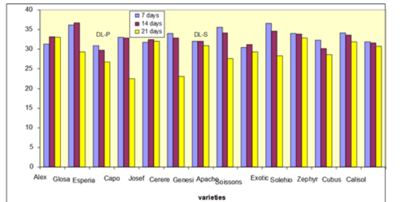

Fig. 2. The chlorophyll content of wheat varieties for several periods after salin stress

Results and conclusion

Considering the analysis of variance components , it is observed that the three sources, namely the period, the concentration of saline stress and the variety, showed a real and statistically assured influence on the chlorophyll content. The period of stress had the highest contribution (41.72%) to the variability of the chlorophyll content, followed by the saline (10.88%) and the varieties 7.63% respectively. The simple interactions between the three factors manifested distinctly significant influences on this character, emphasizing the combined effect of duration and concentration of saline stress (5.28%). The sources of variation related to the studied factors showed a combined influence of 72.45% on the variability of the chlorophyll content. Also, significant variations in chlorophyll content were found in different portions of the foliage, since the upper parts of the leaves were higher than in the basal part of the leaves. At the level of the whole experiment it is observed that the chlorophyll content decreased progressively as saline stress prolongation (table.1). Thus, during the first period there was a small and insignificant variation (-0.37) of the chlorophyll content, equivalent to a rate of -0.053 / day. In the second period, with the prolongation of stress, the salinity effect is increased resulting in a very significant decrease of chlorophyll with an intensity (0.53 / day) net superior to the previous period. Considering the unilateral influence of saline treatment (tab.2), mean values of chlorophyll content were recorded between 32.70 for untreated variants and 30.78 for the 240 mM concentration, with an amplitude of 1.92.The NaCl concentration had a negative effect on the chlorophyll content, causing a gradual and significant reduction of it at a rate of 0.005 / mM between the first two treatments to 0.048mM between the last two treatments. As such, the intensity of stress action on this property was proportional to the increase in NaCl concentration. Average values of chlorophyll content recorded by the 14 varieties (Table 3) showed an amplitude of 4.91, with the limits of 29.11 in the case of Esperia variety up to 34.02 in the Glosa variety, amid a medium interpopulation variability (15.74%). The most common values of this characteristics were 30-32.5. Compared to the average of the experience, the Glosa, Solehio, Cubus and Exotic varieties showed significantly higher chlorophyll of 1.49-2.35. For Capo and Cerere varieties, the values of this attribute were significantly lower. The Glosa variety has accumulated a significantly higher amount of chlorophyll than 10 of the varieties, associated with relative spores ranging from 1.52 to Alex and 4.91 relative to Esperia. It is also noted that the Solehio, Exotic and Cubus varieties showed significantly more photosynthetic capacity than eight of the remaining varieties. Against a lower tolerance to saline stress, Cere, Capo and Esperia varieties recorded significantly lower chlorophyll content than most other varieties. Considering the effect of the period and concentration of saline treatment on the chlorophyll content (Fig.1), it was observed that with the use of concentrations of 150 and 200 mM NaCl the photosynthetic capacity of plants was progressively reduced with prolonged stress duration. Thus, at the end of the experiment after 21 days of stress the content of chlorophyll was significantly lower than the values recorded in the first two weeks. The effect of stress duration was more intense when using 200 mM NaCl. In the absence of saline stress, there is a significant change in chlorophyll content from one week to another, with the highest value after 14 days and the lowest at the end. Due to the use of the 240 mM NaCl concentration, an intense stress action is observed during 7-14 days, resulting in a significant reduction in chlorophyll content, after which the intensity of the stress diminishes so that the photosynthetic capacity varies insignificantly. After seven days of saline stress, the chlorophyll content ranged between 32.36 for the 240 mM concentration and 33.94 for the 200 mM NaCl concentration, with an insignificant variation up to a stress level of 200 mM NaCl. The negative salinity effect was more pronounced by altering the NaCl concentration from 200 to 240 mM, resulting in a significant reduction in chlorophyll content. Stress extension up to 14 days caused an increase in its effect on plant photosynthetic capacity, given the high amplitude (4.26) of the four variants. Thus, there is a significant reduction in the chlorophyll content under conditions of use of 150 mM NaCl. Subsequently, increasing the concentration to 200 mM caused an insignificant variation of this property. The change in the concentration from 200 to 240 Mm showed the highest influence on this property, materialized by a significant decrease in photosynthetic capacity. At the end of the study, the amplitude of the treatments was intermediate for the other two periods, with the limits of 27.02% for the 200 mM to 30.08 concentrations for saline untreated variant. The differences between the four treatments were lower than in the previous period, but statistically ensured. Saline stress led to a significant reduction in chlorophyll content when applying a 200 mM concentration, while deviations from the other variants were lower and statistically uninsured. Regarding the effect of the period of the treatment and the variety on the chlorophyll content, (Figure 2), it was observed that after seven days between varieties a variation amplitude of 6.11 was recorded with values between 30.5 for Soissons variety and 36.61 in Exotic, on the background of a medium interpopulation variability. Most of the varieties (71%) presented statistically undifferentiated values of this characteristic of 30.5-34.The Exotic variety presented a photosynthetic capacity significantly superior to the other varieties with over 4.64. A high value of this characteristic was also observed in the Glosa variety (36.12), associated with significant increases of 4.32-5.62 compared to the Josef, Alex, Experia and Soisons varieties. After two weeks of stress, the 14 varieties showed chlorophyll content ranging from 29.72 to Esperia and 36.68 to Glosa, with an amplitude of 6.96 and an intergenotipic variability of 13.55%. The Glosa variety manifested the highest tolerance to saline stress at this time, recording significantly higher chlorophyll content than Genesi, Calisol, Soissons, Zphyr and Esperia. At the end of the experiment, the variability (18.41%) and the amplitude (10.46) of the chlorophyll content of the varieties were superior to the previous periods, on the background of a more distinct differentiation of varieties in terms of their tolerance to saline stress. Regarding the effect of the period of saline stress on the chlorophyll content in each variety, it is observed that in most of them the prolongation of the stress period did not cause significant variations in the photosynthetic capacity. From the point of view of the combined effect of salin stress concentrations and variety on chlorophyll content(fig.2), the highest amplitude variation between genotypes (9.58) was recorded at the 240mM concentration, while amplitude was lower compared to the concentration of 200mM (4.78).

Conclusions

-The NaCl concentration had a negative effect on the chlorophyll content, causing a gradual and significant reduction of it at a rate of 0.005 / mM between the first two treatments to 0.048mM between the last two treatments

- The use of the 240 mM NaCl concentration, an intense stress action is observed during 7-14 days, resulting in a significant reduction in chlorophyll content, after which the intensity of the stress diminishes so that the photosynthetic capacity varies insignificantly.

-The duration of saline stress was the highest contribution (41.72%) to the variability of chlorophyll content, followed by the salinity (10.88%) and the variety (7.63%) respectively;

Examination of water and salt stress for five different maize hybrids

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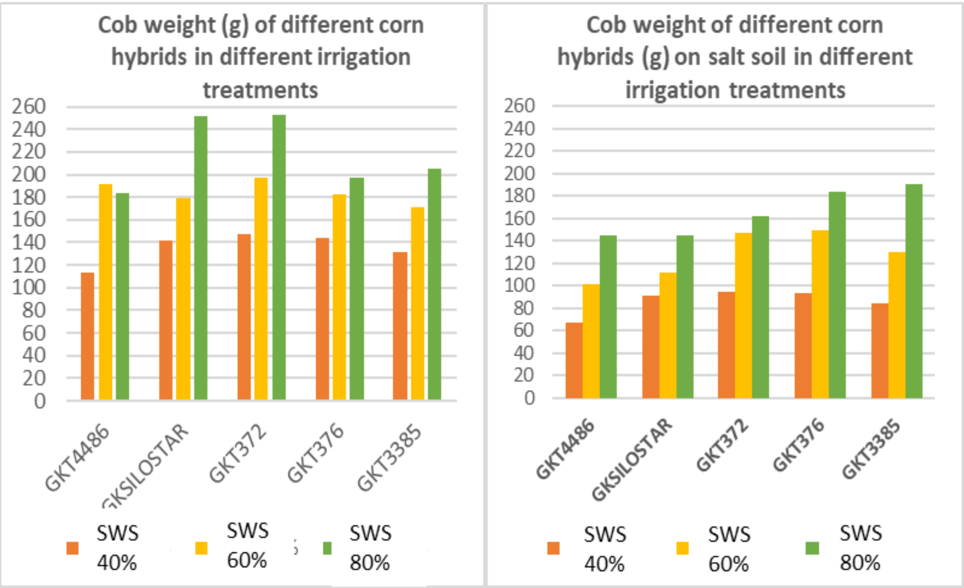
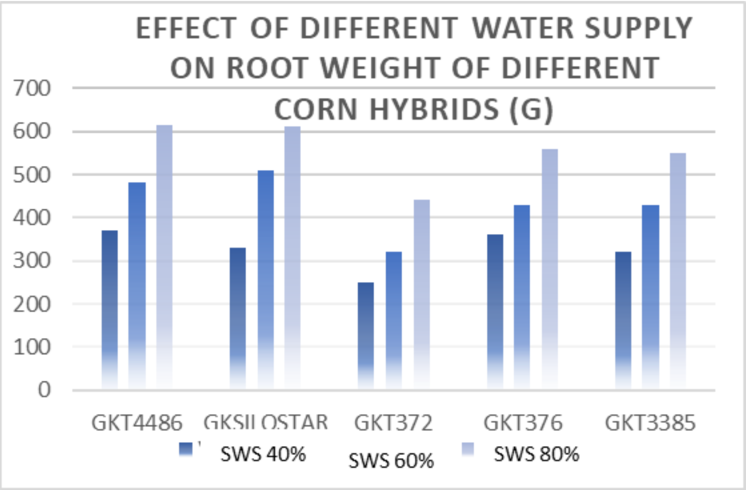
In the course of the research, we examined the responses of different maize hybrids to drought and salt stress. If we can reduce the negative effects of climate change with a properly chosen hybrid, we can also have a major impact on crop loss and production economy. During the experiment, 5 different maize hybrids were tested, with drought-sensitive and drought-tolerant hybrids among them. The experiment was performed in culture vessels isolated from external precipitation. The first step was to determine the natural water capacity (SWS) of the soil that the soil was able to hold back against gravity and set up 3 different water doses (SWS 40%, SWS 60%, SWS 80%). Secondarily, we also measured salt stress in the experiment, so we also performed treatments where the same water doses are set on moderately saline soils

The GK 4486 hybrid was able to achieve the highest root weight (370g) in dry conditions (40% SWS), which may be an advantage over other hybrids in a drier vintage. GKT 376 hybrid, despite its poor irrigation reaction. At a medium (SWS 60%) water dose, GK SILOSTAR showed that it can achieve significant root mass if present, as it has reached the highest root mass, indicating a good irrigation response.
At the beginning of the vegetation, the treatments do not show differences in the development of the leaf area index, but as the vegetation progresses, they are better able to explain the negative effects of salt stress, which cause drastic leaf area index declines (between 14.9% and 26.8%). the result of a faster leaf drying.

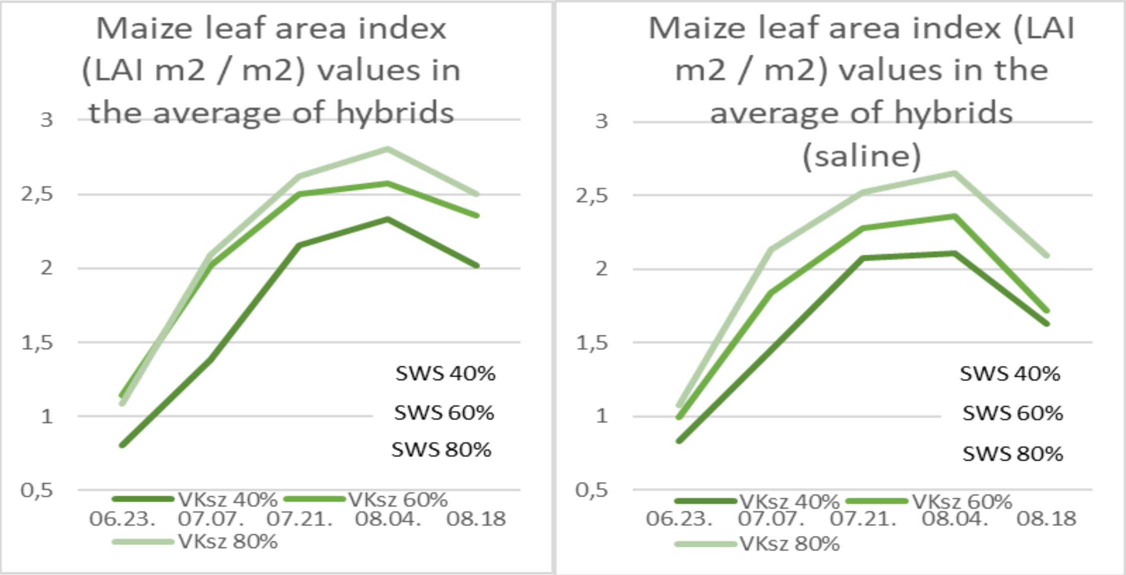


Cob weight of corn hybrids at different water supply levels and this in the saline soil



Root mass of different maize hybrids at different water supply levels.

The effect of salt stress on drought-sensitive hybrids was more pronounced in terms of yield loss. On the other hand, despite the salt stress, the drought-tolerant hybrids showed less reduction compared to themselves, that the stress-reducing effects of salt stress and drought are well tolerated.
The GKT 3385 hybrid performed best in terms of pipe weights (190g), so it can be said to have good resistance to drought stress as well as salt stress (only 15g).
Under the effect of salt stress, significant yield loss can be realized, but the experiment shows that a significant hybrid selection can reduce significant yield loss.



Development of leaf area index (LAI) values on simple soils and saline soils in different water supply treatments.

Irrigation Techniques and their Performance in Tanzania Agricultural Sector

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5th International Scientific Conference on Water 2022, Szarvas, Hungary

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Introduction

- Population: 43.6 million in 2012
- Land area (sq. km): 945,087 km²
- Agricultural land: 44.76%
- Tanzanian agriculture primarily relies on seasonal rainfalls

Data collection

Data in this poster were collected from published research papers from 1994 to 2022, Tanzania government reports, and research projects.

References

1) URT. (2014). *The United Republic of Tanzania Agriculture Climate Resilience Plan. September*, 1–76. http://extwprlegs1.fao.org/docs/pdf/tan152483.pdf

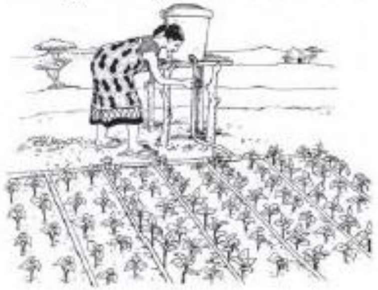
2) Oates, N., Mosello, B., & Jobbins, G. (2017). *Pathways for irrigation development : policies and irrigation performance in Tanzania*. 60.

Irrigation techniques & performance

1. Traditional smallholder irrigation

USAID/Tanzania, 2020

2. Modern small scale holder/ village irrigation schemes



3. Large-scale irrigated private/public farms

Performance is fragmented and done mainly during the construction phase

Challenges facing the Irrigation sector

- Unreliable logic in project design and weak linkages between purpose and outputs of projects
- Inadequate planning, design, and construction supervision standards and manuals
- Lack of human resources and active participation of irrigation development
- indicating that water availability is not perceived as a key constraint

Conclusion

- Tanzania's irrigation expansion has strengthened national food security over the last 20 years
- Irrigation plays a significant role to improve the economy of the farmers
- Traditional, improved traditional and farmer-led irrigation still dominate the sector.
- Challenges in the irrigation sector are complex, the result of various technical, political and factors

SOIL WATER RETENTION OF VERTISOLS UNDER DIFFERENT LAND USES IN KOSOVO

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Introduction

Vertisols are heavy clay churning soils, with high agricultural potential. One of the major challenges of cultivation and/or land use of Vertisols is to increase or maintain different soil functions like biomass production, water retention, and purification, etc. in Kosovo.

In this research, we investigated the effects of different land uses of Vertisols on soil chemical and physical parameters and also on soil water retention capacities.

Three different locations were selected, mainly in the central part of Kosovo, including Kosovo plain and Dukagjini plain regions, representing the most common and dominant land uses such as arable land (winter wheat, maize), apple orchard, horticulture, pasture and forest. At each location, representative soil profiles were described according to the Guideline for Soil Description (FAO, 2006) and classified based on World Reference Bases for Soil Resources (WRB, 2015) and genetic horizons were sampled. Disturbed and undisturbed samples were collected to determine selected chemical and physical soil parameters (among others soil organic matter content [SOM], texture, bulk density [BD].

Our hypothesis is that the different land use systems have a more dominant effect on the behavior of water in soils, than the inherited soil chemical and physical properties.

Material and methods

Study area

This study was conducted in three different locations, mainly in the central part of Kosovo, including

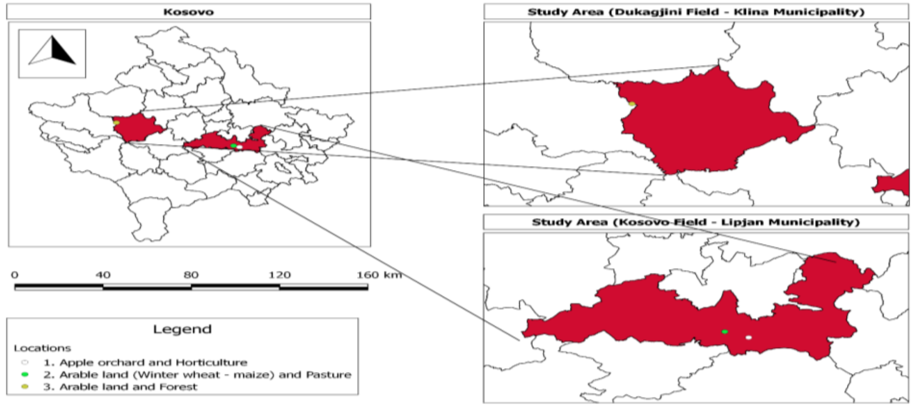

Fig 1. The study area

Study area

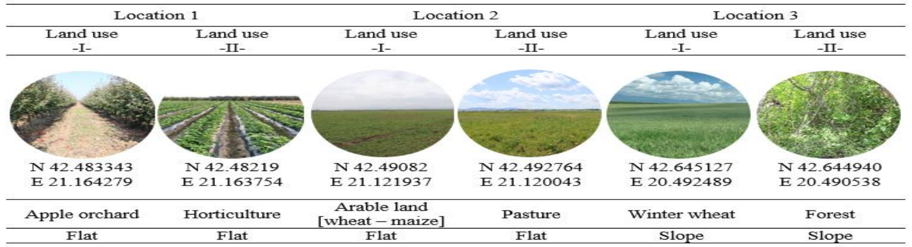

Fig 2. The land uses

Soil analyses

Soil parameters	Unity	Methods
Physical parameters		
Particle size distribution Fine sand [2 – 0.063 mm] Silt [0.063 – 0.002 mm] Clay [<0.002 mm]	%	Pipette method
Bulk density	g/cm^{-3}	Blake and Hartge, 1986
Field capacity	%	Cassel and Nielsen, 1986
Chemical parameters		
Soil Organic Carbon [SOC]	%	Walkley and Black, 1934
pH		ISO 10390, 2005
Calcium carbonates [$CaCO_3$]	%	Allison, 1965

Tab 1. Physical and chemical characteristics of the soil and their representative methods and standards

Results and discussion

The soil of the studied areas was classified as Endocalcic Pellic Vertisols for the first location, Pellic Vertisols for the second location, and Bathycalcic Pellic Vertisols for third location, according to World Reference Base - WRB (WRB, 2014) published by Food and Agriculture Organization of the United Nations – FAO, Figure 3. The experiment was developed in six Agroecosystems Figure 2.

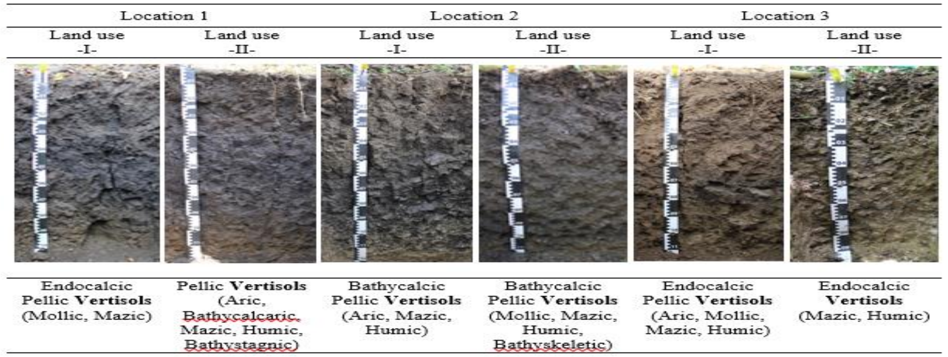

Fig 3. *Soil classification according to World Reference Bases for Soil Resources*

Name	Location	RSG	Land use	Topography	Horizon	Upper	Lower	OC		pH	$CaCO_3$	Texture [mm] [%]			Texture class	BD	FC
						Boundary											
City_RSG_Landuse						cm		H_2O	KCl		[%]	2 – 0.063	0.63 – 0.002	<0.002		[g/cm3]	[%]
LLVAO	1	Vertisols	Apple orchard	TS - Toe slope	Ap	0	30	1.22	6.15	5.02	-	11.36	45.86	42.78	SiC	1.59	29.9
					Ai1	31	45	0.73	6.25	5.16	-	16.47	25.68	57.85	C	1.49	34.52
					Ahi2	46	57	0.55	6.45	5.46	-	18.73	18.95	62.32	HC	-	-
					ABi	58	72	0.32	6.95	5.8	-	15.59	20.85	63.56	HC	1.52	43.4
					Abi2	72	88	0.13	7.48	6.34	1.5	19.23	36.25	44.52	C	1.72	47.26
					Bik	88	120	0.23	7.78	6.61	1.8	22.5	41.25	36.25	CL	-	-
LLVH		Vertisols	Horticulture	TS - Toe slope	Ap	0	25	1.91	6.16	5.25	-	12.55	45.86	41.59	SiC	1.3	39.69
					Ai2	26	40	1.46	5.96	5.12	-	15.67	25.68	58.65	C	1.49	33.64
					Ahi3	41	65	1.04	6.1	5.13	-	17.81	18.95	63.24	HC	1.59	40.33
					Ahi4	66	80	0.51	6.1	5.22	-	17.63	20.85	61.52	HC	1.6	49.26
					ABi	81	100	0.51	6.27	5.35	1.6	21.14	36.25	42.61	C	1.65	46.16
					Bik	101	120	0.28	6.59	5.75	1.8	24.61	39.65	35.74	C	1.66	38.1
KVA_2	2	Vertisols	Maize - Winter wheat - Alfalfa	BO - Bottom	Ap	2	25	2.13	7.65	6.57	-	9.2	36.54	54.26	C	1.36	48.29
					Ai2	26	45	0.73	7.97	6.86	1.5	8.05	23.91	68.04	HC	1.61	43.88
					Ai3	46	60	0.41	7.98	6.92	1.9	7.57	22.85	69.58	HC	1.7	47.24
					ABhik	61	90	0.36	8.35	7.25	7.2	6.48	23.57	69.95	HC	1.6	43.96
					BAhk1	91	110	0.36	8.57	7.46	14.9	12.08	38.95	48.97	C	1.71	37.43
					BAk2	111	120	0.13	8.68	7.56	17.4	15.55	41.87	42.58	SiC	1.8	27.46
KVP_2		Vertisols	Pasture	BO - Bottom	Ah	0	15	1.86	6.59	5.75	-	11.32	36.54	52.14	C	1.33	41.4
					Ai2	16	40	0.89	6.62	5.96	-	9.97	23.91	66.12	HC	1.49	53.82
					ABi	41	65	0.44	6.9	6.06	6.9	11.33	22.85	65.82	HC	1.52	46.7
					ABik	66	95	0.35	7.22	6.42	1.6	8.98	23.57	67.45	HC	1.52	53.03
					BCkr	96	120	0.05	7.33	6.49	17.6	39.05	28.54	32.41	CL	-	-
KVA_1	3	Vertisols	Winter wheat	UP - Slope	Ap	0	25	1.45	6.12	5.14	-	17.79	38.65	43.56	C	1.48	40.49
					Ai	26	43	1.45	6.14	5.02	-	13.85	24.56	61.59	HC	1.6	36.13
					ABi	44	68	0.36	6.58	5.1	-	12.89	23.54	63.57	HC	1.6	38.59
					ABi2	69	82	0.45	6.54	5.62	1.85	8.81	24.65	66.54	HC	1.63	43.96
					Bik	83	120	0.36	7.61	6.45	18.53	16.97	39.45	43.58	C	1.66	41.21
KVF_1		Vertisols	Forest	UP - Slope	Ahi	0	25	0.82	5.97	5.12	1.4	19.25	39.51	41.24	C	1.57	40.43
					Ai2	26	38	0.67	5.63	4.75	1.5	18.22	34.25	47.24	C	1.57	47.78
					ABi	39	60	0.45	5.76	4.88	1.9	14.44	31.24	54.32	C	1.62	46.46
					ABik	61	70	0.45	6.82	5.95	7.8	16.55	32.21	51.24	C	1.51	37.14
					Bik	71	100	0.44	7.19	6.32	18.6	18.98	31.71	49.31	C	1.56	53.03

In the first location, in topsoil horizon, when the soil organic carbon was higher in the horticulture land use with 1.91 % compared to the apple orchard land use with 1.22 %, the soil field capacity was 39.69 % in horticulture land use compared to 29.9 % in the apple orchard, while, bulk density was lower in horticulture land use with 1.3 g/cm^3, compared to 1.59 g/cm^3 in the apple orchard. Except for the topsoil horizon, in deeper horizons the field capacity was affected by the bulk density and soil texture more than soil organic carbon, thus, soil organic carbon was decreasing with the depth, while field capacity was increasing with depth associated with bulk density.

As it was in the first location, based on the correlation of soil organic carbon and field capacity, almost the same results were obtained in the second location. In the topsoil horizon were the soil organic carbon was higher in arable land with 2.13 % compared to pasture land with 1.86 %, the field capacity was higher in arable land use with 48.29 % compared to 41.40 % in pasture land, while bulk density was lower in arable land with 1.36 g/cm^3 compared to 1.33 g/cm^3 in pasture land. In the deeper horizons, the field capacity of the arable land use was decreased and was in correlation with soil organic carbon, while in the pasture land use field capacity was increased with the depth, which was in correlation with the clay content and bulk density.

In the third location, topsoil horizon was not in strong correlation with soil organic carbon of both land uses, moreover, arable land use which has higher soil organic carbon with 1.45 % and 40.49 % field capacity compared to forest land use which has 0.82 % soil organic carbon and 40.43 % field capacity. In the arable land use the percentage of field capacity decrease with the depth as soil organic carbon does, at least to the depth of 82 cm, while the opposite was found in the forest, therefore, bulk density had a greater influence on the field capacity

Conclusion

1. Relationship between soil field capacity and land use is that the land use had a dominant effect mostly in the topsoil horizon on field capacity and the behavior of the water in the soil.
2. In uncultivated lands, such as pasture and forest, the field capacity was mostly dependent on soil texture and bulk density.
3. In the cultivated land use, such as horticulture, apple orchard, arable land use the field capacity was influenced by soil organic carbon.
4. The field capacity of uncultivated lands and apple orchard increases in relation to depth while in arable lands it is the opposite

Reference

FAO. (2006): *Guidelines for soil description*. 4th edition. Rome.

IUSS Working Group WRB. (2015): World reference base for soil resources 2015. FAO, Rome

Acknowledgment

This study was supported by the STIPENDIUM HUNGARICUM SCHOLARHIP

IMPACT OF INTENSIVE AGRICULTURE SYSTEM ON DEPTH WATER QUALITY

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Introduction

The polluting potential of wastewater resulting from animal husbandry complexes is due both to their composition (nitrate content) and especially to their volumes, depending on the animal numbers. Frequent management of wastewater from intensive livestock complexes in the irrigation of agricultural land has depreciate the quality of groundwater in the area. Regarding the depreciation of the groundwater, it is especially noticeable in the areas adjacent to the industrial complexes or farms with a low groundwater table, a stronger depreciation of the groundwater characteristics at a shallow level compared to the deep ones.

Material and method

Water samples were collected from wells and drillings located in Banat County (figure 1), in areas adjacent to industrial complexes or agricultural farms, mostly having the groundwater table close to the soil surface. The nitrate content (STAS 3048/1-77 SR ISO 7890/1-98) was determined by spectrophotometry at 538 nm using the GRIESS method (SR EN 12014-7:2001). The obtained results are discussed regarding the highest level of nitrates in drinking water (Rule-458/2002), in order not to exceed, by daily intake, the acceptable level of nitrates in human body

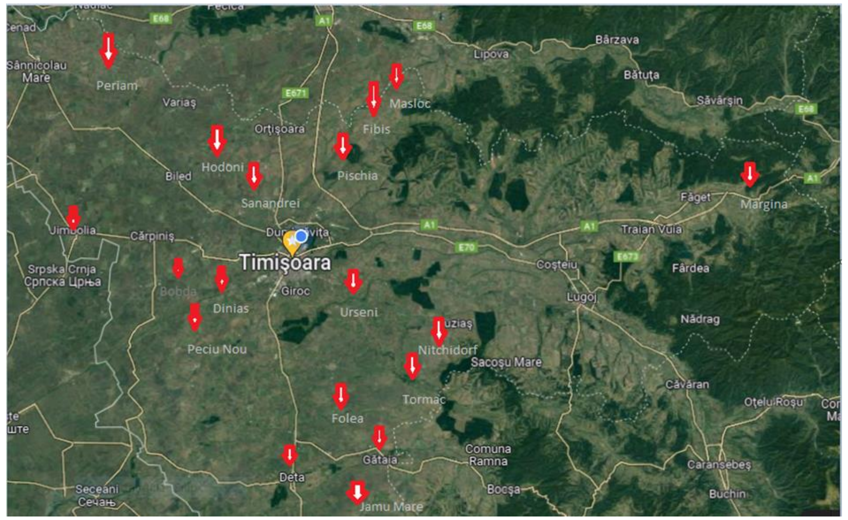

Figure 1. Localizations of water samples

Results and conclusion

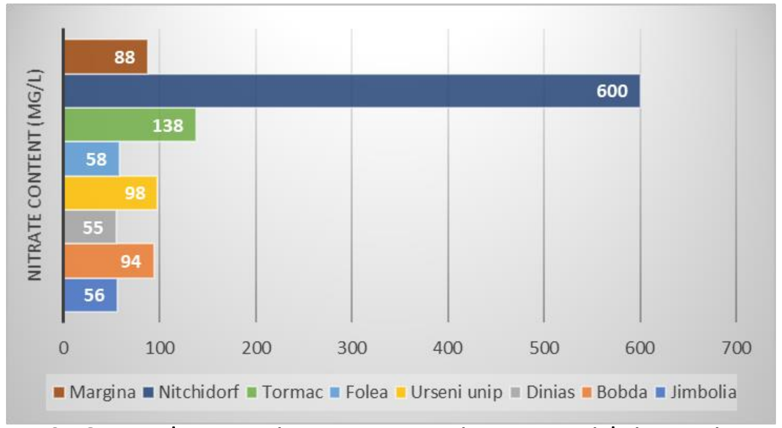

Figure 2. Groundwater nitrate content in areas with intensive agricultural activities

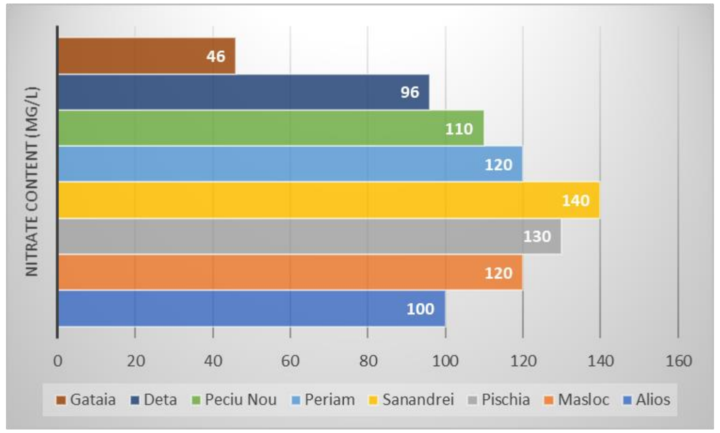

Figure 3. Groundwater nitrate content due to intensive animal breeding

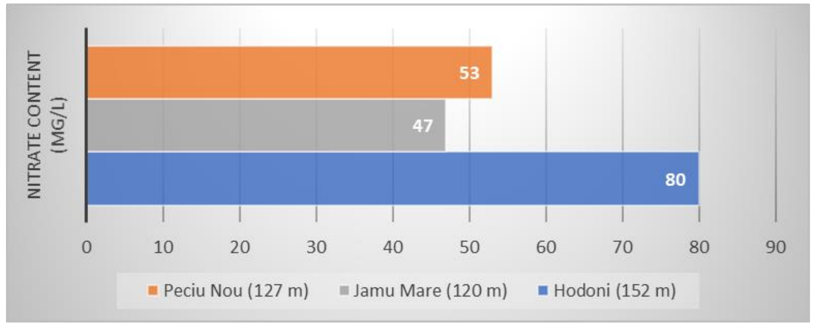

Figure 4. Groundwater nitrate content in the areas adjacent to the industrial complexes of farms

Nitrate contamination in the upper layers of depth waters in areas with intensive agricultural activities in Banat County show an exceed of nitrate content in drinking water altering between 10-1100 % (well water).Water samples taken in 3 localities covering the western county show through the determined nitrate content the compromise of the drinking water reserves even at great depth. Thus, drillings made at a depth of 152 m, shows in water samples a nitrate content which exceeds the allowed level in drinking water by 60 %.

THE EFFECT OF CEREAL-LEGUME PLANT ASSOCIATIONS ON THE SOIL MICROBIAL COMMUNITY

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PLANT ASSOCIATION

A plant production method where two or more plant species or varieties are grown in the same area at the same time.






At the same time, ***sowing*** and ***harvesting*** different cereals (winter wheat, winter barley, winter triticale) and field peas with different seed counts.



Öthalom is located near Szeged, in the southeast part of Hungary, its soil is deeply salty meadow chernozem soil.

Fülöpszállás is located between Kecskemét and Dunaföldvár, in the central part of the country, its soil is calcareous meadow soil.

Plant associations were examined in four replicates on random block plots of 10 m^2.


RESULTS

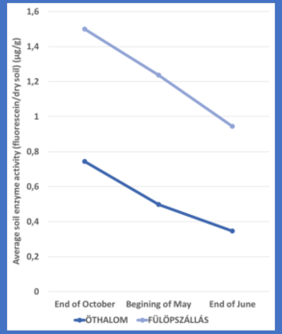

Figure 1: The change of the soil enzyme activity at different times

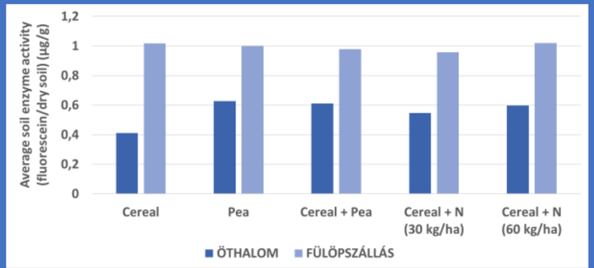

Figure 2: The effect of sites and different treatments on the total microbial activity in the soil

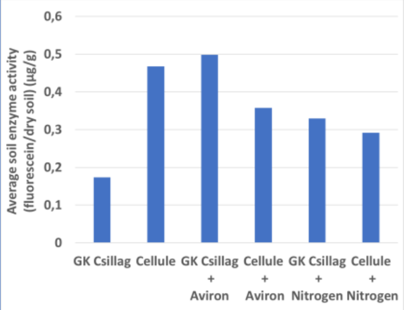

Figure 4: The effect of different winter wheats (GK Csillag, Cellule) on soil enzyme activity in plant associations

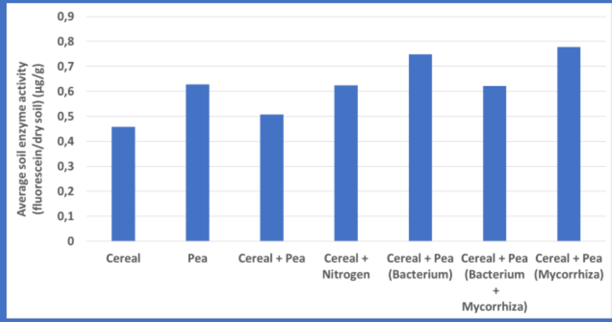

Figure 3: The effect of the microbial products on soil enzyme activity

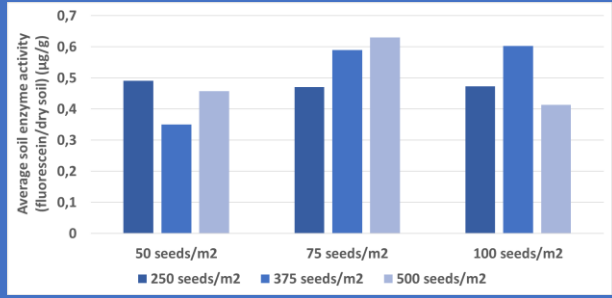

Figure 5: The change of the soil enzyme activity in different seed counts of GK Csillag and Aviron

DISCUSSION

- From our results, it can be stated that of the two production sites, the calcareous meadow soil of Fülöpszállás is more active of soil enzyme activity than the chernozem in Öthalom.
- The total microbial activity of our soils can be increased by using various plant association combinations.
- In plant associations, peas stimulate the microbial enzymatic activity of the soil, which can be further enhanced by the use of microbial preparations (bacterium inoculant, seed treatment with mycorrhizal fungi).

EFFECT OF IRRIGATION AND WATER QUALITY ON THE PHYSIOLOGICAL STATUS OF SUGAR BEET AND FODDER BEET USING SPAD-502 CHLOROPHYLL METER

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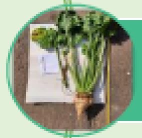
The main aims of the study were

- To determine the nitrogen status of the sugar and fodder beets under different water quality irrigation



- To examine the chlorophyll content in different growing periods

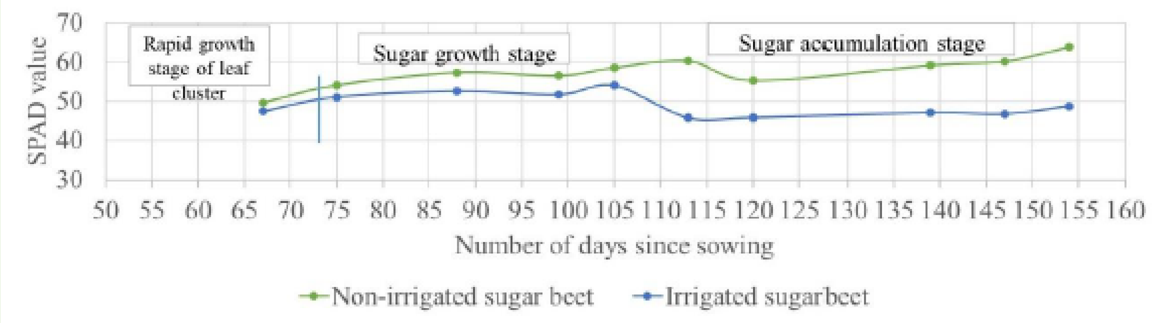
- To compare two fodder and two sugar beet cultivars based on SPAD values.

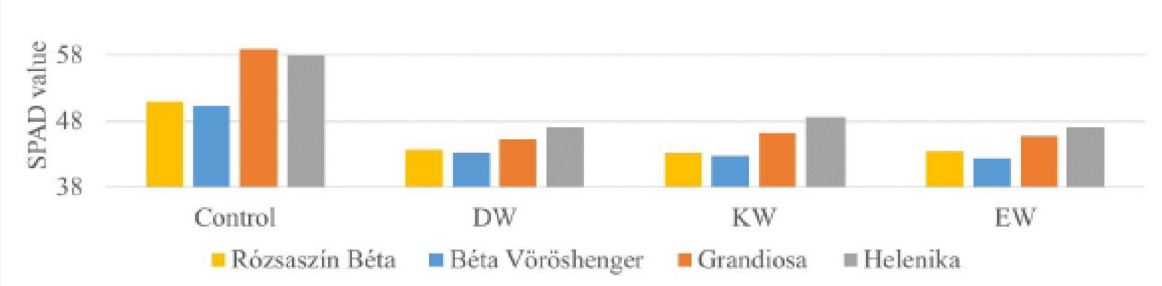
Materials and methods

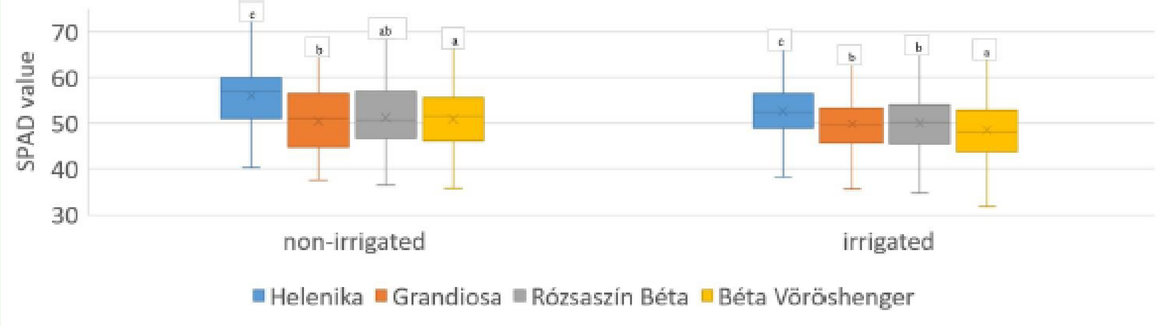
The experiment was carried out at the Lysimeter Research Station (Szarvas, Hungary). The soil properties were clay loam texture, 0.03% total salinity, 2.1% total carbonate content, and 1.31% total organic carbon content. In the two-year-experiment (2020, 2021), two sugar beet (‚Helenika', ‚Grandiosa') and two fodder beet (‚Rózsaszín Béta', ‚Béta Vöröshenger') cultivars were grown.

The year of 2021 was dry, the total precipitation was only 433.9 mm while in the year of 2020, 611.6 mm was measured. The annual average temperature was 12.1 °C in 2020 and 11.6 °C in 2021. In addition to the effluent water of the fish farm, the water of the Körös oxbow lake and a mixed water type (1:3 effluent and Körös water, added gypsum) were used for irrigation (sprinkler irrigation methods, 4 replications). SPAD values (Konica Minolta SPAD-502) were measured on a weekly basis during the growing seasons

Results







Key findings

- In the case of sugar beet, the shifts of the phenological phases due to irrigation were well observed based on the SPAD values.
- Based on the SPAD values, the quality of the irrigation water had no verifiable effect on the chlorophyll content of the beets.
- The differences between the varieties could be described with great certainty in one vegetation period in 2021 where Helenika differed from the studied varieties.

Discussion

According to Zhang et al. (2021) SPAD value of sugar growth stage was relatively higher than the rapid growth stage of leaf cluster and the sugar accumulation stage. Based on their results and the number of days since sowing in our experiment, developmental stages can be distinguished in both years using SPAD values. According to Wang (2021) chlorophyll content was higher in irrigated treatments than in rain-fed treatments in sugar beet. In contrast, in 2021 SPAD value were lower in irrigated treatment throughout the analyses periods in case of all beet cultivars. Irrigation water quality had significant effect on SPAD values only in rapid growth stage of leaf cluster in case of sugar beet "Grandiosa" in 2020. We hypothesized that the nitrogen content of the water caused the higher chlorophyll content, several researchers found that a strong correlation could be described between the N content of the soil or fertilizers and the the chlorophyll a, b and total content, petiole NO_3-N of the sugar beet (Ghasemi et al. 2017, Tsialtas and Maslaris 2008).

Acknowledgements

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References

Ghasemi H., Esmaeili M. A., Mohammadian R. (2017): Effects of nitrogen on chlorophyll fluorescence and the relationship between chlorophyll content and SPAD values in sugar beet (Beta vulgaris L.) under drip-tape system. Journal of Agricultural and Biological Science. 12: 3. 107-122.

Tsialtas J.T., Maslaris N. (2008): Sugar beet response to N fertilization as assessed by late season chlorophyll and leaf area index measurements in a semi-arid environment. International Journal of Plant Production. 2: 1. 57-69.

Wang. M., Fu f., Wang H., Wang P., He S., Shao H., Ni Z., Zhang X. (2021): Effects of irrigation and nitrogen on chlorophyll content, dry matter and nitrogen accumulation in sugar beet (Beata vulgaris L.). Scientific Reports. 11: 16651. https://doi.org/10.1038/s41598-021-95792-z

Zhang J., Tian H., Wang D., Li H., Mouazen A.M. (2021): A novel spectral index for estimation of relative chlorophyll content of sugar beet. Computers and Electronics in Agriculture. 184: 106088. https://doi.org/10.1016/j.compag.2021.106088

5TH INTERNATIONAL CONFERENCE ON WATER
MATE SZARVAS
22-24 March 2022

MACRO-, MESOELEMENT AND SODIUM CONTENT OF PLANT PARTS OF ENERGY WILLOWS IRRIGATED WITH EFFLUENT WATER OF AGRICULTURAL ORIGIN

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INTRODUCTION

renewable energy sources

alternative water sources in agricultural

The aim of our study was to determine the effect of the macro-, mesoelement and sodium content of the plant parts of the short-rotation energy willows irrigated with the effluent of intensive fish farming.

high content of organic matter and macronutrients

the integration of aquaculture and crop production

MATERIALS AND METHODS

HUALS IES ÖVKI

- Year of planting: 2014
- 2,7 ha
- 'Naperti' variety
- Weekly irrigation doses: 15, 30, 60 mm
- Sample collection: end of the growing season

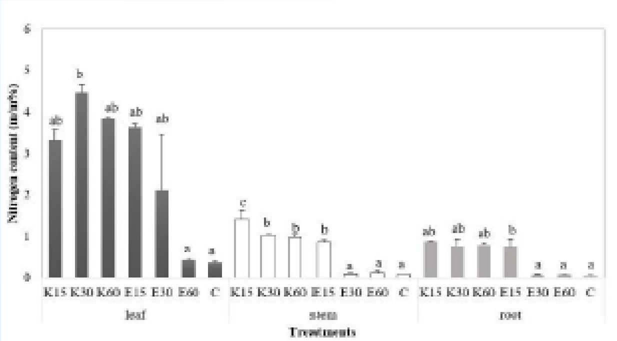
Micro-sprinkler irrigation system

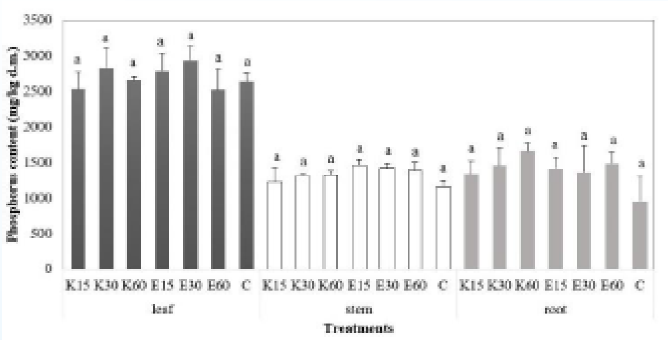
- 7 treatment (3 replication)
- 2 different water types
- Körös River oxbow lake (K)
- Fish farm effluent water (E)(thermal contetnt)
- Non-irrigated control (C)

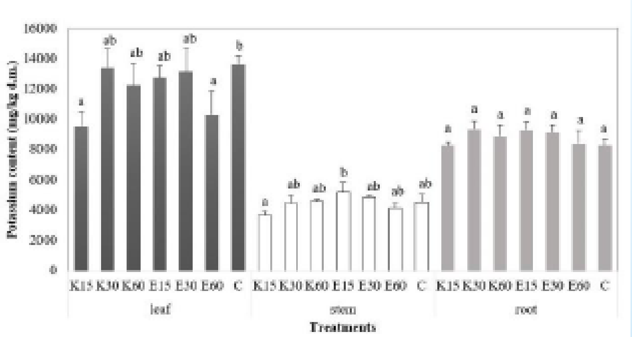
Mineral content

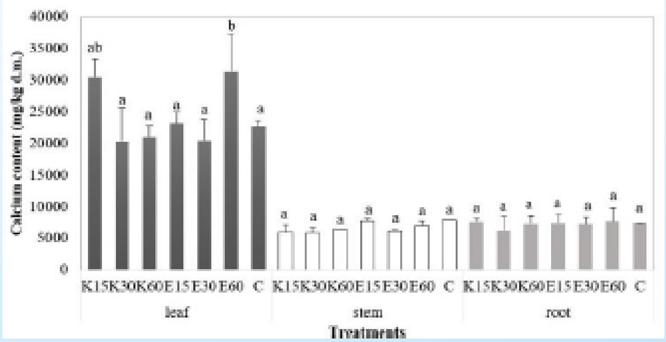
- Macroelements: N, P, K
- Mezoelements: Ca, Mg
- Sodium contetn
- Sampling of plant parts: leaf, stem, root
- Hungarian and ISO standard methods

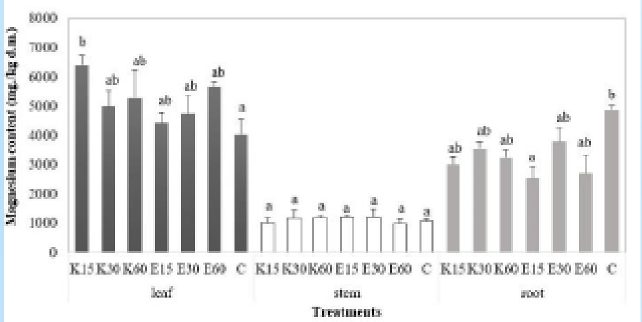
RESULTS

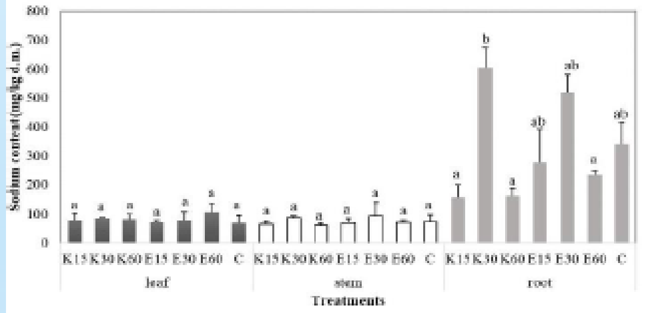












References

- Akter, M. and Oue, H. (2018) Effect of Saline Irrigation on Accumulation of Na+, K+, Ca2+, and Mg2+ Ions in Rice Plants. *Agriculture*, 8 (10), p. 164.
- Gierth, M. and Mäser, P. (2007) Potassium transporters in plants - Involvement in K+ acquisition, redistribution and homeostasis. *FEBS Letters*, 581 (12), pp. 2348–2356.
- Kolozsvári, I., Kun, Á., Jancsó, M., B. Oncsik, M., Bozán, C. and Gyuricza, C. (2021) Silócirok (Sorghum bicolor L. Moench) öntözéses termesztési lehetőségeinek üzemi vizsgálata egy intenzív halnevelő telep elfolyóvizével. *Növénytermelés*, 70 (1), pp. 81–103.
- Mansour, R.B., Dakhlaoula, S., Msahli, W., Kaouri, R. and Ksouri, W.M. (2018) Differential Responses of Cakile maritima at Two Development Stages to Salinity: Changes on Phenolic Metabolites and Related Enzymes and Antioxidant Activity. *Medicinal Chemistry* [Post-print], 08 (04). Available from https://www.omicsonline.org/open-access/differential-responses-of-cakile-maritima-at-two-development-stages-to-salinity-changes-on-phenolic-metabolites-and-related-enzyme-2161-0444-1000500-101191.html. [Accessed 10th March 2022].
- Ranty, B., Aldon, D., Cotelle, V., Galaud, J.-P., Thuleau, P. and Mazars, C. (2016) Calcium Sensors as Key Hubs in Plant Responses to Biotic and Abiotic Stresses. *Frontiers in Plant Science* [Post-print], 7. Available from http://journal.frontiersin.org/Article/10.3389/fpls.2016.00327/abstract. [Accessed 18th March 2022].

DISCUSSION

In the case of nitrogen, it can be observed for all parts of the examined plants that the C treatments and the samples irrigated with 30 and 60 mm effluent water had significantly lower N content. In the former case this decrease was caused by water shortage and in the latter case by salt stress. Similarly as a nitrogen, phosphorus is an essential macronutrient for all plants. During the measurement the leaf samples had the highest phosphorus value. Potassium is the most abundant cation in plants, the amount of which can reach vegetation periods (Gierth and Mäser 2007). The highest concentration was measured for leaf samples.

Mg^{2+} and Ca^{2+} are essential for plant growth because magnesium is a structural component of chlorophyll and calcium is a component of the cell wall and a receptor for environmental stimuli (Ranty et al. 2016). According with the study of (Akter and Oue 2018) the magnesium content measured in the root samples irrigated with high salinity was significantly lower for the root samples of the non-irrigated C treatment. In the case of calcium, leaf samples irrigated with 60 mm of effluent had the highest concentration.

High salinity can induce nutrient deficiencies in plants. (Mansour et al. 2018). Under the study, there was a significant difference between the treatments for the root samples. During which the highest Na concentration reached 606 mg/kg d.m. The same result as in our previous study was obtained during effluent water irrigation of silage sorghum (Kolozsvári et al. 2020).

CONCLUSION

In summary, in areas where irrigation water is not available or we have poorer quality soil, the effluent of the intensive fish farm we studied can be a suitable alternative. At the same time, it is necessary to monitor the irrigated area, in particular to monitor changes in soil parameters

Acknowledgements
This work was supported by the Hungarian Ministry of Agriculture under Project no. OD001.

CHARACTERISTICS OF GROUNDWATER LEVEL IN THE SZARVAS-BÉKÉSSZENTANDRÁS OXBOW SUBBASIN

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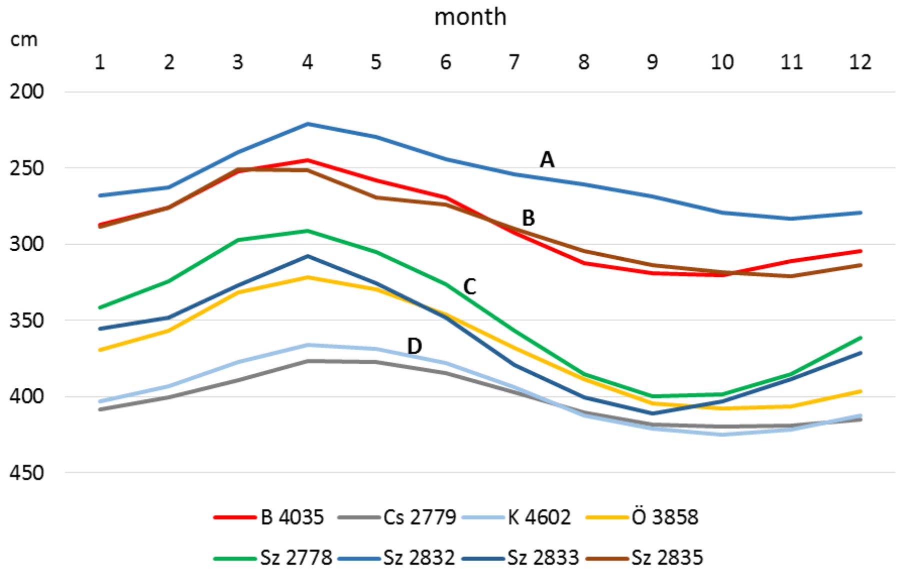
Introduction

Climate change can modify hydrological conditions such as subsurface water reservoirs. Many studies found significant decrease of groundwater level in Hungary.

Material and method

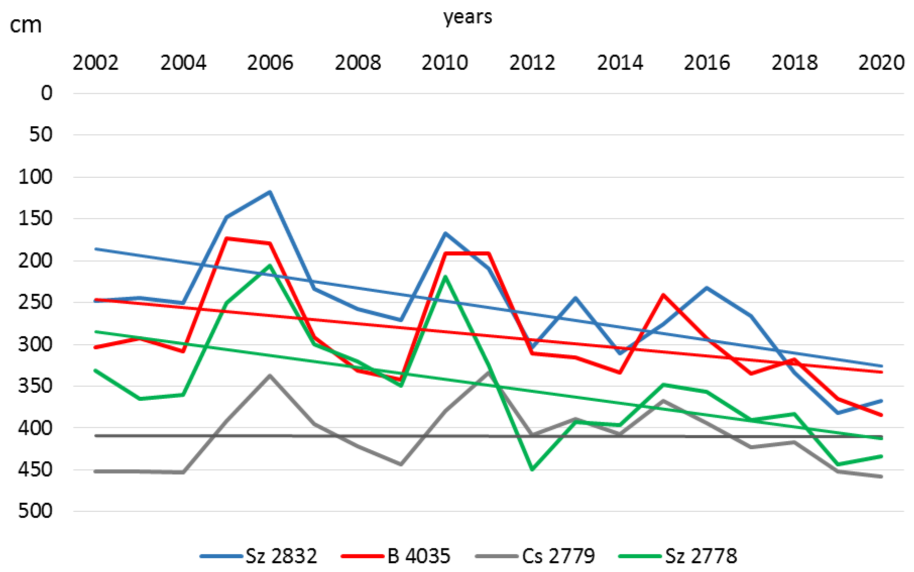
Our research area is the subbasin of Szarvas-Békésszentandrás oxbow, which located in the middle of Hungarian Great Plain. We analysed near 20 years time series of groundwater level of eight monitoring wells. Long term tendencies, short term variability and average annual course of groundwater level were examined.

Results and conclusion



Average annual course (2005-2020) of groundwater level of the monitoring wells

- 4 typical groups of groundwater level annual courses can be identified based on 16-year-average.



Course of the yearly average groundwater level at 4 monitoring stations (2002-2020)

- The trends of yearly average values show the decrease of groundwater level in most cases (sign. at p= 5% or 1% level, largest rate of 7.6 cm/year).
- Station with deepest GL level shows no significant trend in groundwater level during the 2002-2020 period.

Development of a GIS based decision support toolset for flood crisis management

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Introduction

Floods caused by extreme rainfall events are major threats to the population living along the rivers, because the floods endanger their lives, property and the infrastructure. The possibilities provided by GIS can contribute to the prevention and reduction of the damage caused by large flooding events.

The target area of the research was the Hernád watershed.

The work was carried out in Hungarian-Slovak cooperation within the framework of the Floodresc project (SKHU / 1601 / 4.1 / 187).

Material and method

The aim of our work was to develop a GIS based decision support modeling toolset that aims to support the work of disaster management authorities by raising their effectivity and by minimizing the damage of the floods.

To achieve the aim, all the necessary Hungarian and Slovakian spatial data layers had been collected, harmonized (both spatially and thematically) and integrated into a GIS database.

A new, GIS based flood modeling tool had been developed to estimate the extent of the floods.

A logistical modeling tool had been created to support the activities of the disaster management authorities.

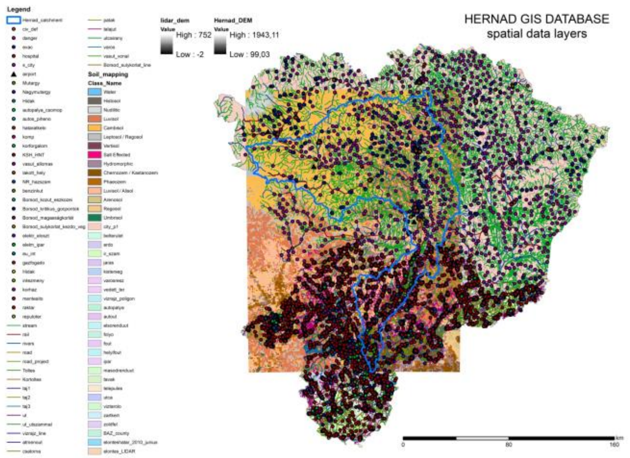

Fig. 1.: The data layers of the GIS database

Fig. 3.: The modules of the logistical model

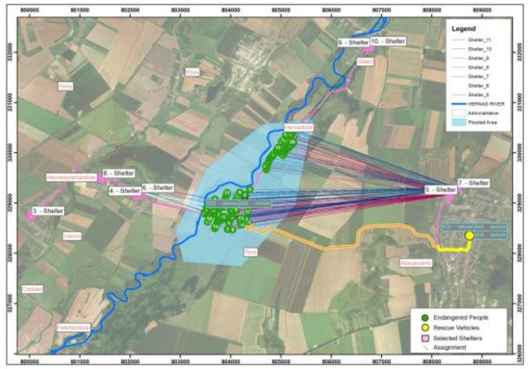

Fig. 4.: Capacity planning module

Fig. 2.: Operator window of flood modeling tool and results of model running

Results and conclusion

The result of the project are the following:

- **Multi purpose GIS database** (Fig.1): this database provides all the relevant input data layers for the developed models, covering the area of Borsod-Abaúj-Zemplén and Kosice counties.
- **Flood model** (Fig.2): knowing the exact location of a potential dike failure and the topographic conditions (DEM), this tool is able to predict in advance the spatial extent of the flooded area.
- **Logistical model** (Fig.3): based on the results of the flood model, we have developed an ArcGIS based logistical modeling tool that can be used as a decision support tool to assist the logistics tasks required for flood management. The modules of the model can be used to
  - determine the endangered values (inhabitants, buildings, infrastructure, etc.) affected by the flood,
  - plan the capacities (Fig.4) to optimize any transportation tasks of the disaster management authorities.
  - create routes for the vehicles.
- **Environmental impact assessment study**: to take into account all those factors (hazardous materials, pollutants, etc.), that can harm the physical environment.
- **Disaster-medicine protocol**: to manage the epidemic effects of floods on the public health.

Applying the developed GIS decision support toolset, the efficiency of the prevention-protection activities can be increased, while their costs can be decreased.

The results and more details are available at the project website: www.uni-miskolc.hu/~floodresc

Demonstration of a drainagemodel: testing the capacity of an urban rainwater drainage system

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Introduction

When sizing municipal rainwater drainage systems a number of factors (natural, hydrological, physical, soil, etc.) must be taken into account. Present study deals with a survey material related to a municipal rainwater drainage project implemented in 2017, Sajószentpéter, Hungary (Fig.1.).

Material and method

The methodology combines the latest GIS procedures with data obtained from the materials of traditional field survey. During the method with the help of DEM: flow accumulation, watershed and other hydrological layers were created as well as Sentinel satellite images to create land use maps (Fig.2.). With the above-mentioned GIS layers, the load capacity (street-level resolution) of the municipal water drainage network and also the water transport capacity of the related hydraulic structures were determined (Fig.3.).

Results and conclusion

As a result all necessary geographical description of the small catchment were defined which are related to the settlement, as well as hydrological and hydraulic calculations required for modeling and their GIS processing. The main objective of the project was the modelling of the run-off processes over time and introduce result with hydrographs (Fig.4.) and to assess soil properties and infiltration aspects of the catchment area (Fig.5.).

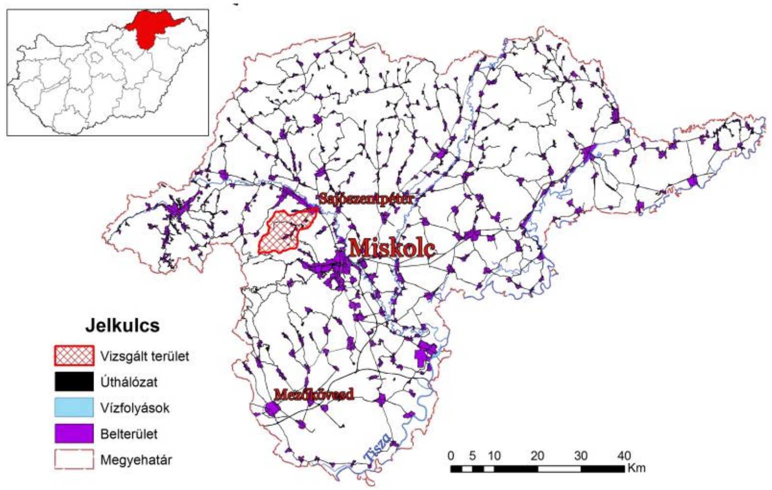

Fig.1: Location of study area

Input features:

- Digital Elevation Model (DEM) + derived maps by DEM for run-off model
- Sentinel multispectral satellite images for landuse map
- Precipitation and field survey data for define infiltration

Fig.2: Table of input features

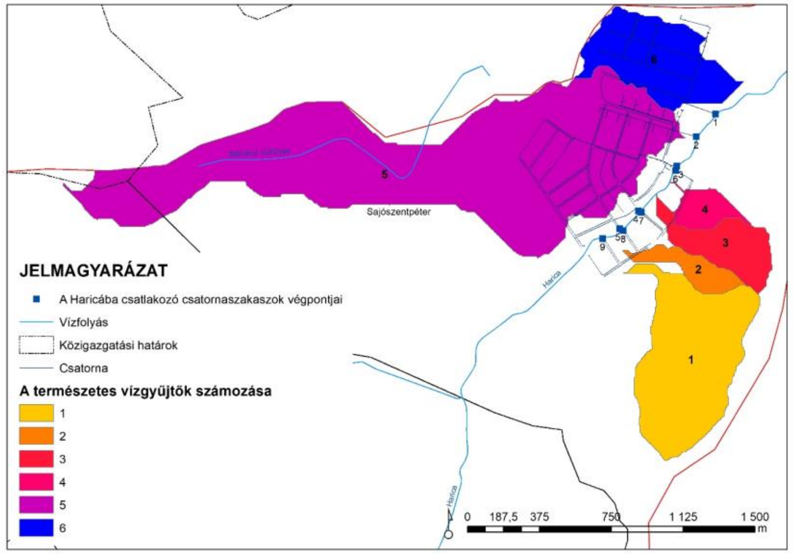

Fig.3: Small catchments of study area

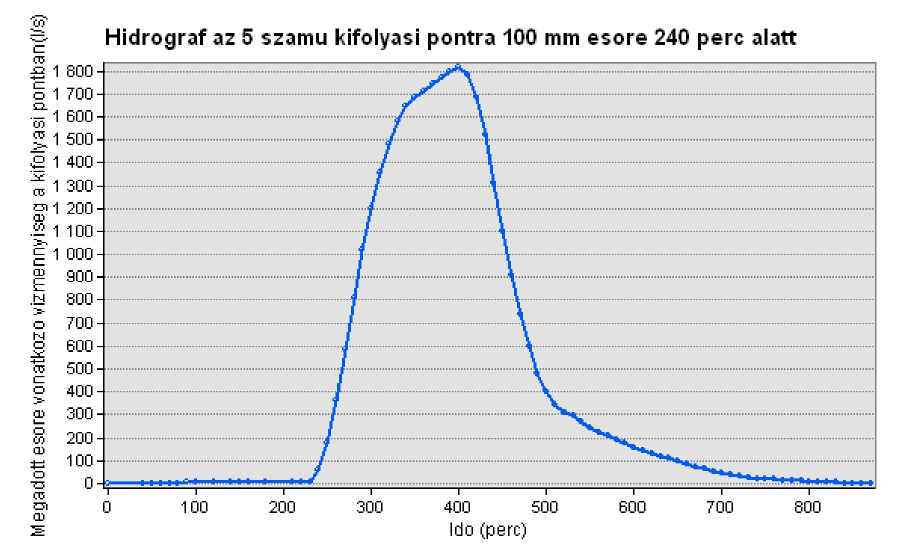

Fig.4: Model result on a hydrograph

Csapadékintenzitás (mm per óra)	1.+ 2. vízgyűjtő határérték elérésének időtartama (perc)	3.+ 4. vízgyűjtő határérték elérésének időtartama (perc)	5. vízgyűjtő határérték elérésének időtartama (perc)	6. vízgyűjtő határérték elérésének időtartama (perc)	Hány perc alatt éri el az eső a 100 mm-t
5	nem éri el	nem éri el	nem éri el	nem éri el	1200
10	800	nem éri el	810	nem éri el	600
15	530	nem éri el	540	520	400
20	420	420	410	390	300
25	330	330	330	310	240
30	280	280	280	270	200
40	210	210	210	210	150
50	170	170	170	170	120

Fig.5: Precipitation intensity - infiltration property of small catchments

Calculation of soil moisture infiltration intensity using high-tech Sentek sensors

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Introduction

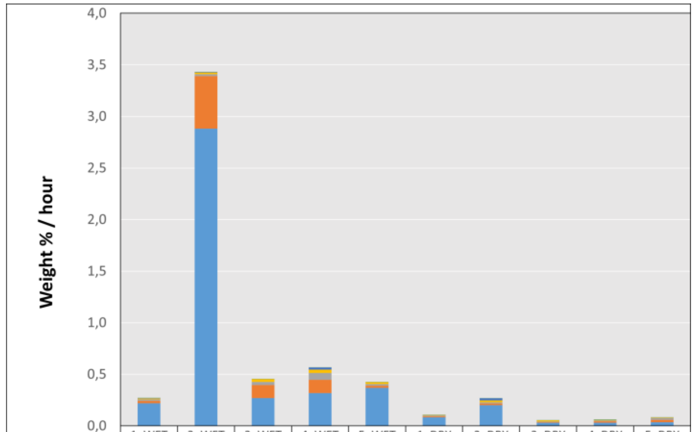
Sentek monitoring sensors are capable to collect soil moisture (SM) data. It's useful for determine water demand values for an agricultural field. Different type of soils reacts in different ways to the replenishment water coming from above. Some soil characteristics, like the intensity of infiltration, can be used to determine how much rain fallen around the sensor area.

Material and method

The goal is a methodological development to support VRI irrigation and the calculation of the aforementioned variable from multi-depth soil moisture value collecting devices, installed on different environmental and soil conditions. After data mining, several types of drying and wetting cases were identified.

Results and conclusion

Three types of preliminary results were made: first, the calculation of different index values using the time duration of drying and wetting cases and the SM data. (Fig.1) Second, the differences in soil moisture values at multiple depths within the case, which gave the total amount of precipitation around the sensor. (Fig.2) Third, the case-by-case determination of the starting (Fig.3) and ending (Fig.4) soil moisture values that created additional time intervals. These intervals will be used to derive new SM data.



	1_WET	2_WET	3_WET	4_WET	5_WET	1_DRY	2_DRY	3_DRY	4_DRY	5_DRY
INDEX_100_CM	0,001	0,001	0,001	0,002	0,001	0,000	0,001	0,001	0,003	0,001
INDEX_60_CM	0,003	0,003	0,002	0,020	0,002	0,002	0,021	0,001	0,004	0,001
INDEX_40_CM	0,009	0,017	0,026	0,033	0,018	0,004	0,020	0,011	0,004	0,003
INDEX_30_CM	0,013	0,016	0,031	0,065	0,017	0,007	0,011	0,003	0,007	0,018
INDEX_20_CM	0,023	0,511	0,126	0,129	0,020	0,010	0,015	0,008	0,013	0,024
INDEX_10_CM	0,220	2,881	0,271	0,318	0,369	0,084	0,202	0,031	0,031	0,036

Fig. 1: Index values (Weight % / hour) of sensor ID 2

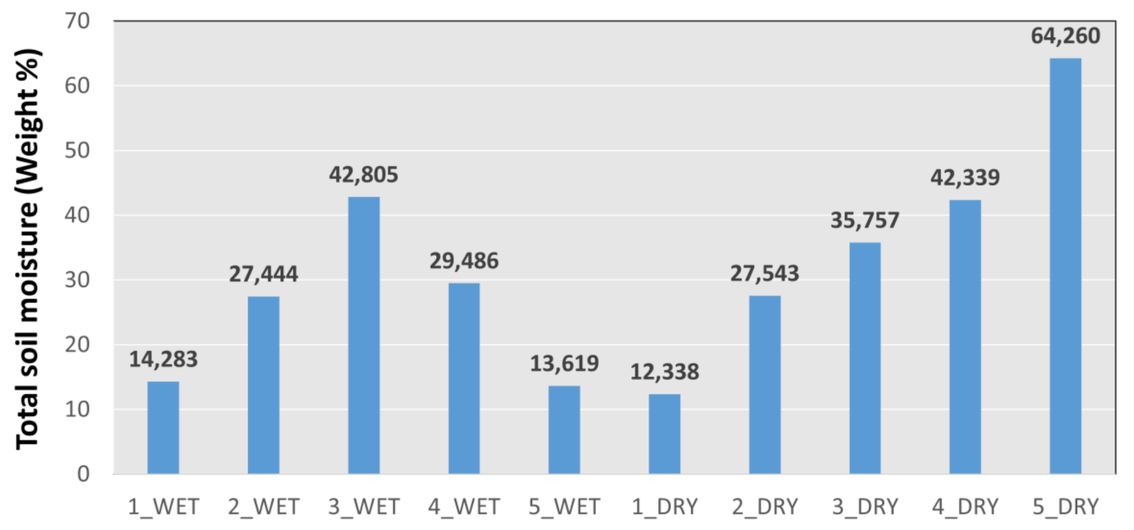
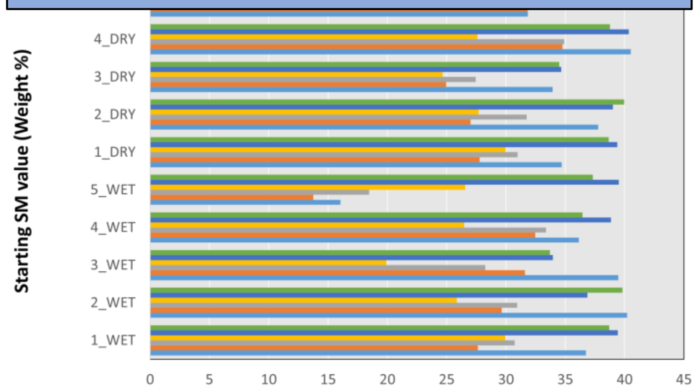
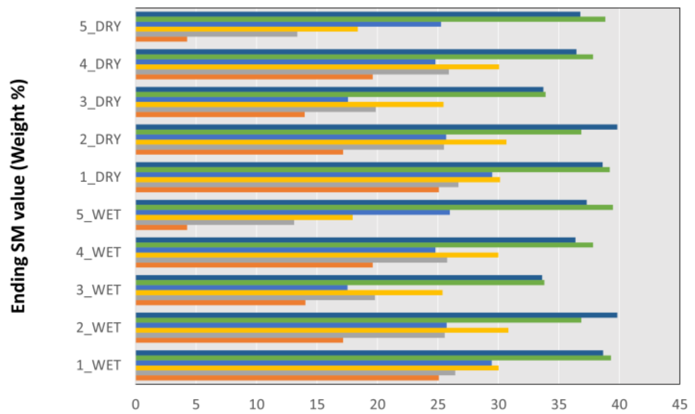


Fig. 2: Total soil moisture values of sensor ID 2



	1_WET	2_WET	3_WET	4_WET	5_WET	1_DRY	2_DRY	3_DRY	4_DRY	5_DRY
STARTING_VALUE_100	38,696	39,823	33,707	36,444	37,317	38,658	39,959	34,486	38,773	37,298
STARTING_VALUE_60	39,429	36,870	33,962	38,854	39,506	39,391	39,017	34,662	40,361	39,680
STARTING_VALUE_40	29,937	25,855	19,925	26,472	26,549	29,971	27,684	24,662	27,580	27,892
STARTING_VALUE_30	30,720	30,938	28,260	33,377	18,464	30,982	31,733	27,453	34,910	32,540
STARTING_VALUE_20	27,634	29,641	31,589	32,473	13,752	27,783	27,019	24,965	34,756	31,822
STARTING_VALUE_10	36,735	40,207	39,459	36,144	16,044	34,688	37,766	33,925	40,516	31,839

Fig. 3: Starting SM case values of sensor ID 2



	1_WET	2_WET	3_WET	4_WET	5_WET	1_DRY	2_DRY	3_DRY	4_DRY	5_DRY
ENDING_VALUE_100	38,658	39,813	33,610	36,352	37,289	38,601	39,823	33,707	36,435	36,759
ENDING_VALUE_60	39,295	36,843	33,786	37,812	39,458	39,199	36,843	33,891	37,822	38,825
ENDING_VALUE_40	29,439	25,717	17,513	24,774	25,977	29,472	25,679	17,550	24,774	25,239
ENDING_VALUE_30	30,009	30,807	25,372	29,992	17,934	30,130	30,650	25,442	30,035	18,368
ENDING_VALUE_20	26,412	25,552	19,791	25,749	13,107	26,678	25,481	19,839	25,892	13,374
ENDING_VALUE_10	25,056	17,158	14,023	19,598	4,247	25,056	17,158	13,967	19,598	4,247

Fig. 4: Ending SM case values of sensor ID 2

Soil depths		0-30 cm	40-60 cm	75-110 cm	110-170 cm
>0,25 mm	% (m/m)	0,84	0,72	0,56	1,15
0,25-0,05 mm	% (m/m)	6,39	15,6	6,68	11,5
0,05-0,02 mm	% (m/m)	19,1	23,8	30,6	34,5
0,02-0,01 mm	% (m/m)	29	17,1	19,2	12,4
0,01-0,005 mm	% (m/m)	8,17	5,1	7,9	8,1
0,005-0,002 mm	% (m/m)	10,9	9,86	9,37	7,58
<0,002 mm	% (m/m)	25,6	27,8	25,7	24,8
Texture		V (IV)	V	V	V
Sand (%)		26,33	40,12	37,84	47,15
Silt (%)		48,07	32,06	36,47	28,08
Clay (%)		25,6	27,8	25,7	24,8

Fig. 5: Physical soil attributes of sensor ID 2 based on the adherent soil excavation

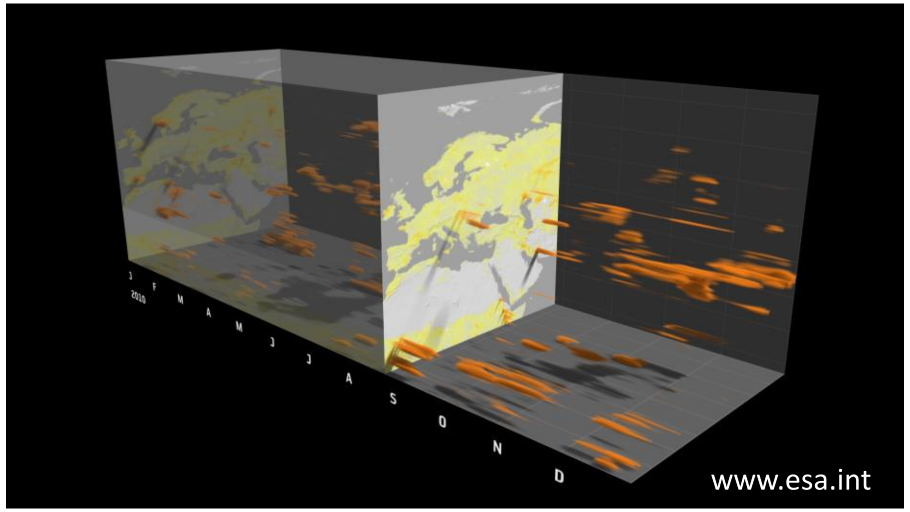
WATER MANAGEMENT DATA CUBE

Zoltán Vekerdy[1], Márton Tolnai[2], Zita Bihari[3], István Waltner[1], Gerhard Triebnig[4], Bálint Alföldy[5], Boudewijn van Leeuwen[6], Egri Péter[7], Katalin Takács[8], Florent Demelezi[1], Yohannes G. Mariam[1] & Csaba Bozán[1]

[1]MATE, [2]CropOM, [3]OMSZ, [4]EOX, [5]Lechner TK, [6]SZTE, [7]4iG, [8]ATK TAKI. Correspondence: vekerdy.zoltan@uni-mate.hu

Introduction: In water management, challenges are large data volumes, differences in measurement methods, etc. A cloud-based ICT solution for these problems is the satellite data based *DATA CUBE*, which supports water-related info service users and providers.

Danube Data Cube (DDC): In sync with the Euro Data Cube (EDC) of the European Space Agency, DDC is under construction. The main characteristic of this cloud-based information service, *to be available at the beginning of 2023* for the users, is that the data processing facilities are located close to the data. In this way, quick big data analysis methods become accessible for several stake-holders of diverse water management fields.



Two use cases:

- ***A regional drought analysis service*** (implemented at the national level but extendable to the Danube Basin) with a spatial resolution of 1 km. It supports spatio-temporal analysis of agro-meteorological extremes of selected areas for decisions in agricultural water management and can provide freely accessible information for individual farmers too.
- ***A field-level irrigation-support service*** with 10-20 m spatial resolution. It provides data about the actual water availability and, based on the weather forecast, gives advice for irrigation planning. Considering the actual water availability and the related costs, the user can optimise the irrigation plan.

DANUBE DATA CUBE

The relationship between the drainage network and geological structures in the northern foreland of Bükk Mountains

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Introduction

In this study we performed a directional statistical analysis of the drainage network running in the northern foothills of the Bükk Mountains to compare the results with the direction of geological structural elements mapped in the area.

Material and method

The valleys were extracted from a DEM, with two critical source areas (0.2 km^2; 1 km^2 Fig.1-2.). The directions and direction frequencies of valleys and structural elements were calculated and plotted using RockWorks.

Results and conclusion

According to our results, the direction of sections with the highest order (4th, 5th order in case of 0.2 km^2 critical source area (CSA), 3rd and 4th in case of 1 km^2 CSA) fits well with the main direction of the geological structural elements mapped in the area (Fig.3). Some of the lower order (2th order in case of 0.2 km^2 CSA, 1rd in case of 1 km^2 CSA) valley sections can be associated with transverse and diagonal fractures.

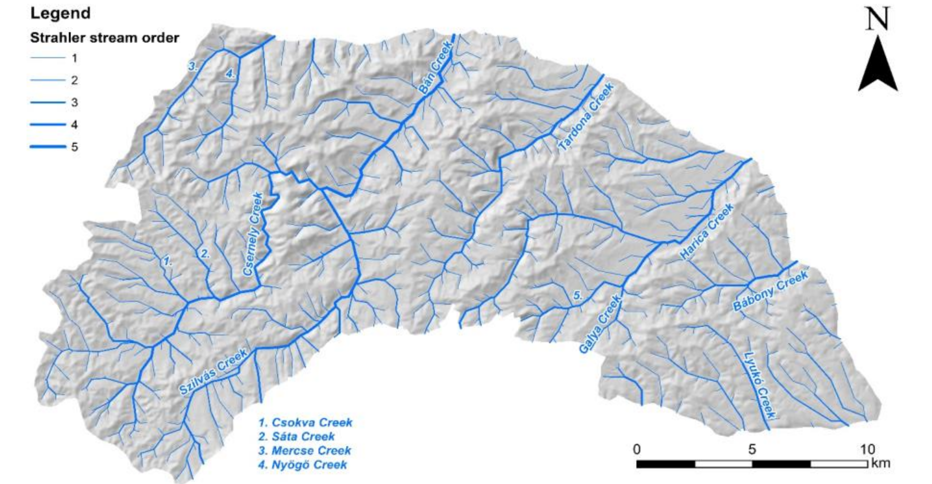

Fig.1: The valley network of the northern foreland of Bükk Mountains with critical source area of 0.2 km^2

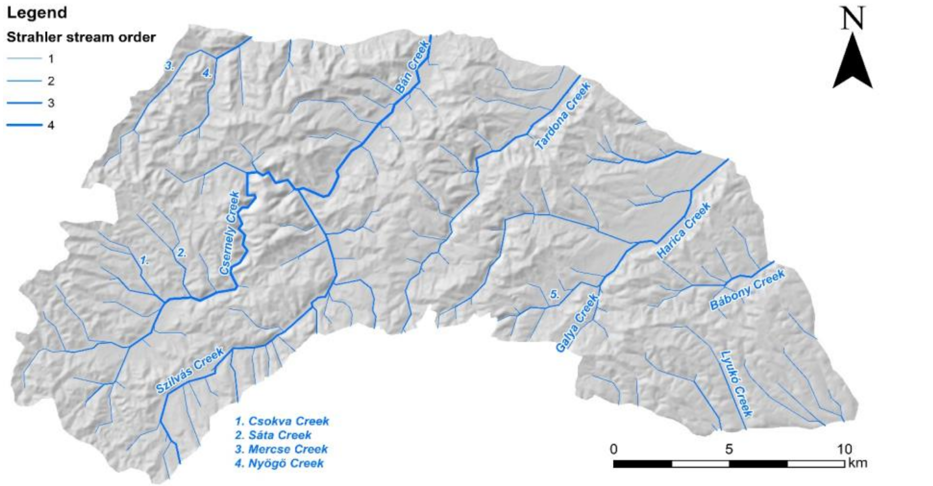

Fig.2: The valley network of the northern foreland of Bükk Mountains with critical source area of 1 km^2

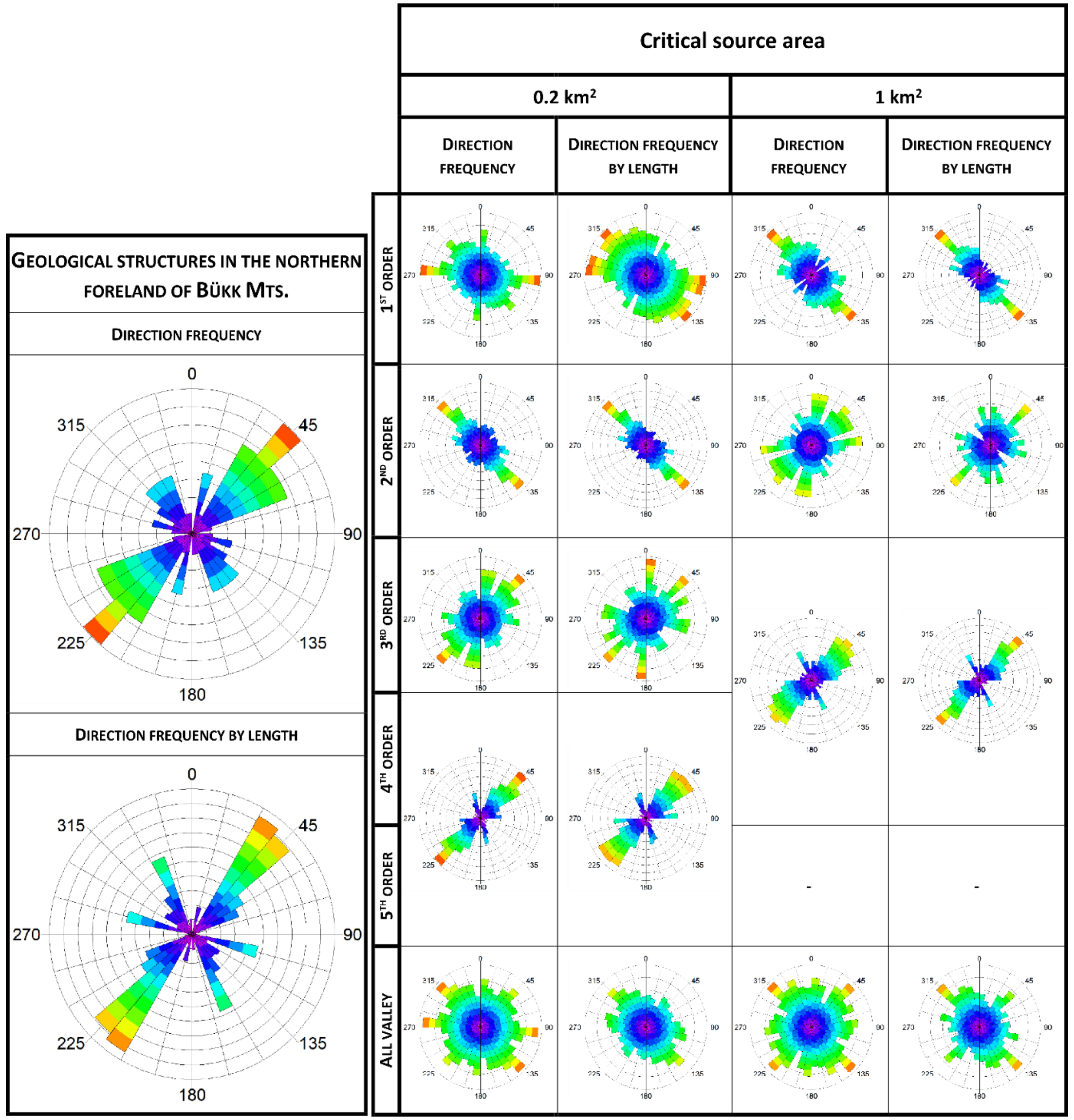

Fig.3: Direction frequency and direction frequency by lenght of structural elements and valleys

Acknowledgements

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Új Nemzeti Kiválóság Program

Nemzeti Kutatási, Fejlesztési és Innovációs Hivatal

The effects of land use and landcover on water quality in the Rákos catchment, Hungary

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2 Hungarian University of Agriculture and Life Sciences, Institute of Environmental Sciences, Department of Water Management and Climate Adaption, 2100 Gödöllő, Páter K. u. 1.

Introduction

Investigation of the relationships between land-use allocation and water quality preservation within a catchment is an essential issue for sustainable watershed management. The land use and land cover of the Rákos catchment have been changed gradually over the last few decades. Changes in land use and land cover (LULCCs) can have significant effects on water quality particularly on surface water quality and degradation, which can be caused by surface runoff from artificial, agricultural areas, and sewage discharges from urban sprawl and agro-industry.

Material and method

This research aims to evaluate the impact of LULC on surface water quality in the Rákos catchment. In this regard, the assessment of the LULC changes was performed using the CORINE land cover dataset of Hungary, and the water quality data was obtained from the water quality monitoring of Rákos stream along seven sampling points, starting from its source in Gödöllő to the outskirts of Budapest in a semi-urbanized area.

Figure (1) shows the geographic location of the study area and the location of the sampling points.

The entire land cover data set was analyzed first in QGIS to obtain the area of each category of land uses of the study area in 2018.

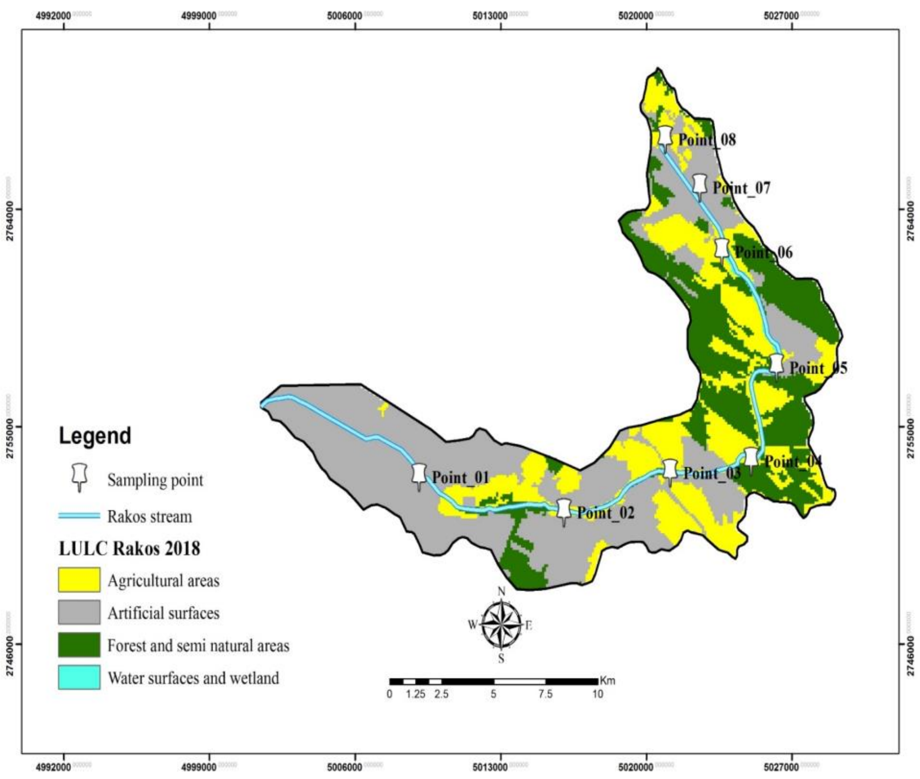

Figure (1): Geographic locationan land cover of the study area

Results and conclusion

The findings show that there are increases in NO_3 and PO_4 concentration in the third sampling point which is surrounded by more agricultural areas. These results in the Rákos catchment demonstrate that the importance of addressing water quality impacts caused by land use should be considered in the environmental planning process to reduce water resources issues.

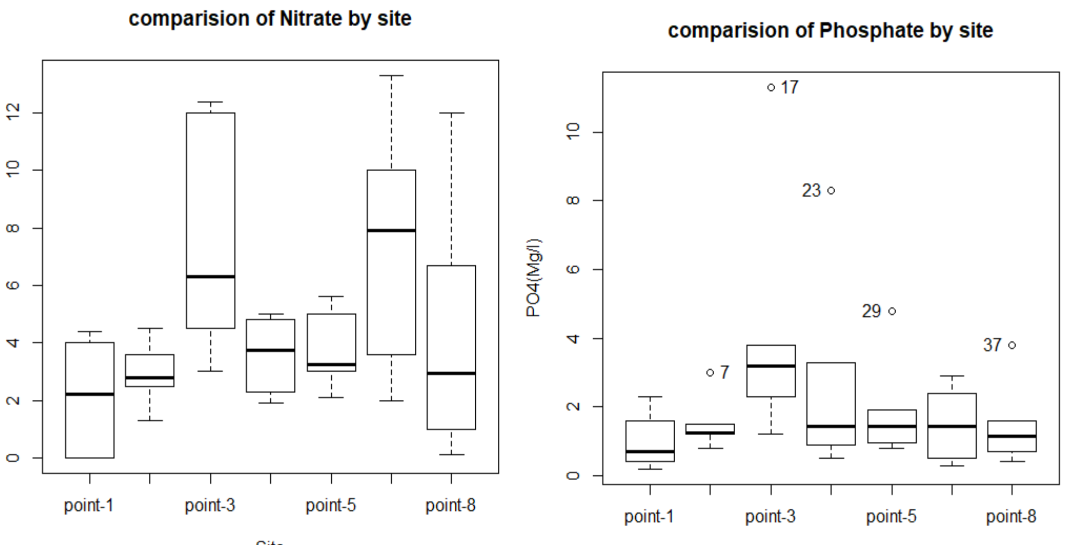

Figure (2): Concentration of NO_3, PO_4 in different sampling points

Analysis of vegetation dynamics and geomorphometric variables in the Rakos watershed, Hungary.

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[2] 2. Hungarian University of Agriculture and Life Sciences, Institute of Environmental Sciences, Department of Water Management and Climate Adaption, 2100 Godollo, Pater K. u. 1.

Introduction The purpose of the study is to represent the changes of vegetation cover in Rakos stream with the Remote Sensing satellite imagery dataset with the application of GIS tools. The calculation and assessment of the data is processed to explore the wetness index with Topograohy Wetness Index TWI and vegetation index level with NDVI (Normalized Difference Vegetation Index). The aim of the study is calculate the collective data analysis based on the results of Sentinel 2 of S2A satellite images and DEM analysis of SRTM, OSM & Natural Earth source.

Material and method Rakos stream watershed is considered to be one of the most beautiful streams near the city of Budapest. Rakos stream is 44.3 km long with 185 km2 catchment area. The stream of Rakos watershed flows across Godollo, Isaszeg till Danube river in Budapest.

Collection of Sentinel 2A images and DEM. Sentinel 2A images data processing. NDVI images data acquisition. DEM and TWI data processing from OSM & Natural Earth dataset. DEM and TWI maps and data acquisition for further analysis.

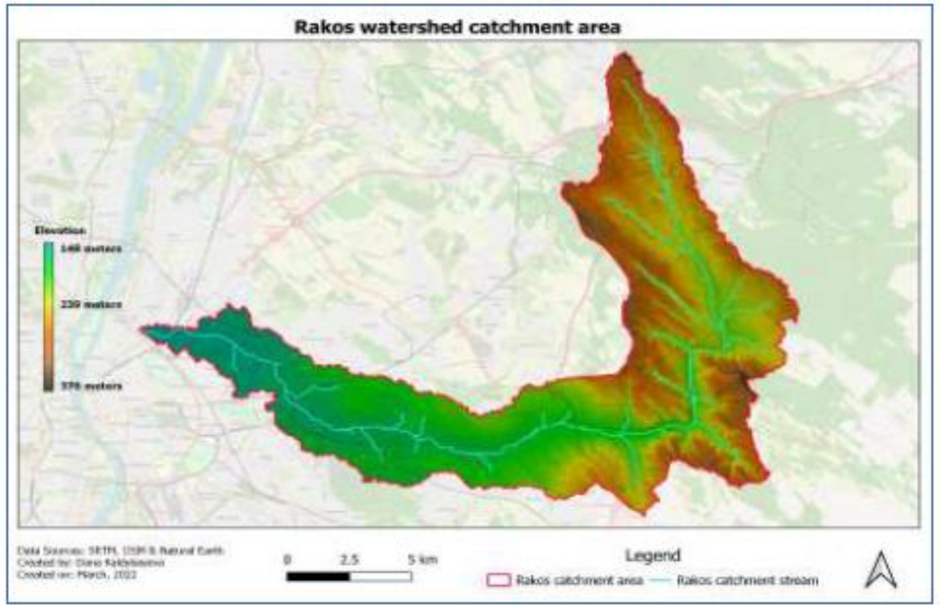

Figure (1): DEM map of study area

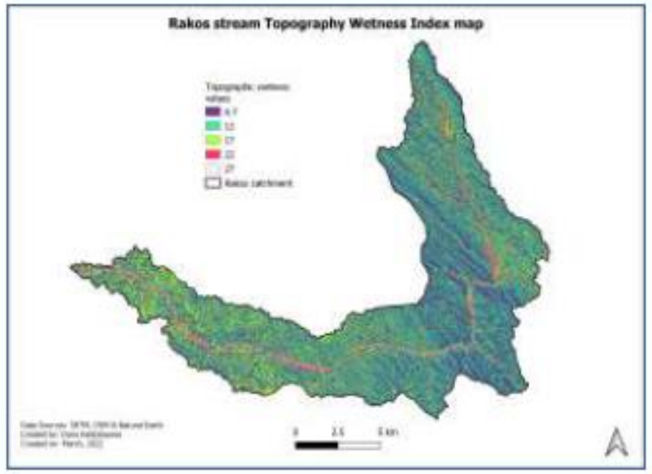

Figure (2): TWI map of study area

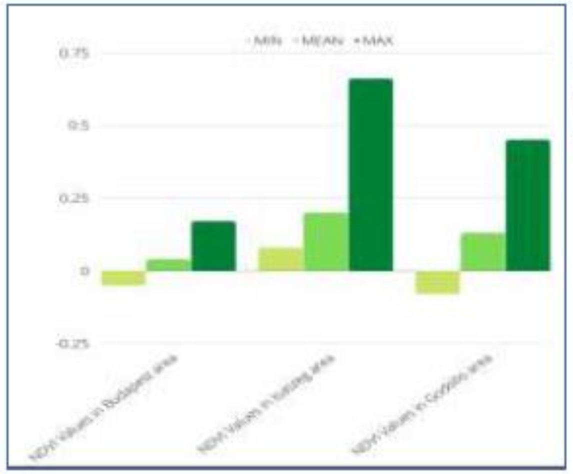

Figure (3): NDVI values graph of study area

Results and conclusion

The diagram extracted from NDVI images in 2019, 2020, 2022;

DEM level map;

TWI level map;

NDVI classes vegetation classes visual maps for summer of 2020 and 2021;

Higher wetness index according to TWI in the area of Isaszeg of Rakos stream according to index dataset.

Higher vegetation cover in the area of Isaszeg on Rakos stream according to NDVI index dataset.

Desertification Conditions and its Management in Gombe State Northeaster Nigeria: A Review

AUTHOR(S)

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Introduction

Introduction.

Nigeria is one of the countries south of the Sahara that is experiencing fast desert encroachment, with significant consequences for the country's northern region.

Desertification is a global environmental phenomenon that affects both developed and developing nations in many parts of the globe, where the necessary causative synergistic climate fluctuations and human inputs exist.

Objectives

The objectives of the study are to;

Identify the causes of desertification in Gombe North Eastern Nigeria

Identify the management strategies of desertification in Gombe North Eastern Nigeria

Material and method

- Study area

Gombe State is located in the North eastern Nigeria, with land area of 17,100km^2 approximately, it has a population of 2,365,040 according to 2006 Census.

Tables and Figures

Desertification conditions and Tree Plantations to curb the menace

State	Geographical Region	Land Area		Population (2006)		Rate of Desertification
		(km^2)	% of Nigeria	Number	Density (/km^2)	
Sokoto	North West	27,825	3.06	3,702,676	133	Severe
Zamfara	North West	37,931	4.17	3,278,873	86	Severe
Katsina	North West	23,561	2.59	5,801,584	246	Severe
Jigawa	North West	23,287	2.56	4,361,002	187	Severe
Kano	North West	20,280	2.23	9,401,286	464	Moderate
Kebbi	North West	36,985	4.06	3,256,541	88	Severe
Kaduna	North West	42,481	4.67	6,113,503	144	Moderate
Borno	North East	72,609	7.98	4,171,104	57	Severe
Yobe	North East	46,609	5.12	2,321,339	50	Severe
Bauchi	North East	41,119	4.52	4,653,066	113	Moderate
Gombe	North East	17,100	1.88	2,365,040	138	Moderate
Adamawa	North East	38,700	4.25	3,178,950	82	Moderate
Taraba	North East	56,282	6.19	2,294,800	41	Moderate
Niger	North Central	68,925	7.58	3,954,772	57	Moderate
Plateau	North Central	27,147	2.98	3,206,531	118	Moderate
Total		**580,841**	**63.83**	**62,061,067**	**107**	

Source: National Bureau of Statistics, 2010; National Population Commission, 2006. *Moderate: 26 to 50% of plant community consists of climax species, or 25 to 75% of original topsoil lost, or soil salinity has reduced crop yields 10 to 50%. *Severe: 10 to

Results and conclusion

Causes of Desertification

- Climatic Variability
- Deforestation
- Overgrazing
- Extensive Cultivation
- Bush burning
- Urbanization

Management of Desertification

- Planting Trees (afforestation)
- Improving soil quality
- Water Management

Conclusion

Desertification has a disastrous effect or frontline state, with major consequences for supply, which is aggravated by the re declining water levels in dams and other irrig bodies.

Integrating climatic factors with human actio the transformation of fertile land into a region might help to enhance environm conditions and increase agricultural outpu livestock production. With the northern facing desert conditions immediate actio

AQUACULTURE GROWTH RATES CORRELATE WITH QUANTITY OF RENEWABLE WATER RESOURCES AT COUNTRY-LEVEL

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Introduction

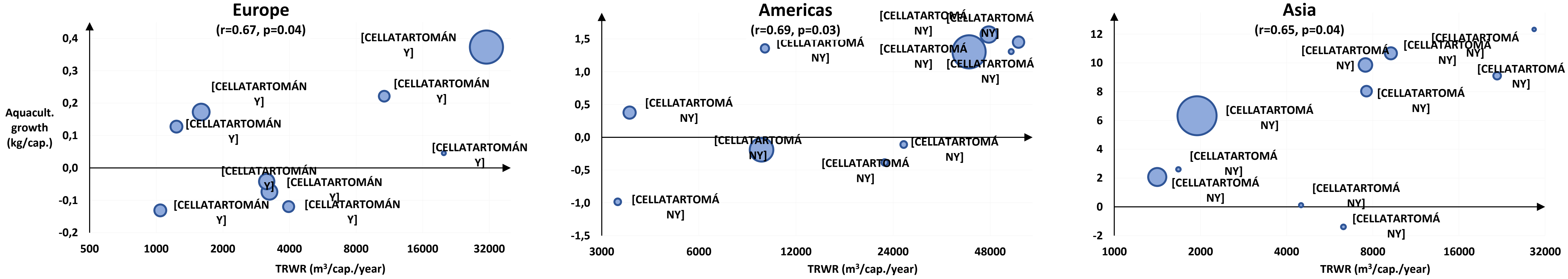
Water endowment is a crucial factor in aquaculture development of individual countries. The objective of this study was to test whether there was a correlation between country-wise data on annually renewed water resources and growth in fish production over the past 10 years.

Material and method

Data for Total Renewable Water Resources (TRWR) and aquaculture production were extracted from FAO Aquastat and FishStat J, respectively. Per-capita growth in freshwater aquaculture production between 2008 and 2018 was matched with per-capita TRWR for 10-10 largest producer countries of Asia, Africa, Americas and Europe.

Results and conclusion

Pearson-correlation between the two variables was found to be positive and significant (p<0.05) among Asian, American and European countries, while for the African continent there was no statistical evidence for the positive relationship between water resources and aquaculture growth. Results suggest that strategies for expansion of freshwater aquaculture must be aligned with resource endowments.



Bubble plot of the Total Renewable Water Resources (TRWR, 2018-22) versus per capita growth of freshwater aquaculture production over a 10-yr period (2008-2018) for major producer countries. The size of the bubble relates to the freshwater aquaculture production (2018) of the corresponding country. Note that the x-axis is log-scaled.

PARALLEL STUDY ON THE LEVEL OF AGRICULTURAL DEVELOPMENT IN THE WESTERN DEVELOPMENT REGION FROM ROMANIA AND THE NORTH WEST ZONE OF NIGERIA

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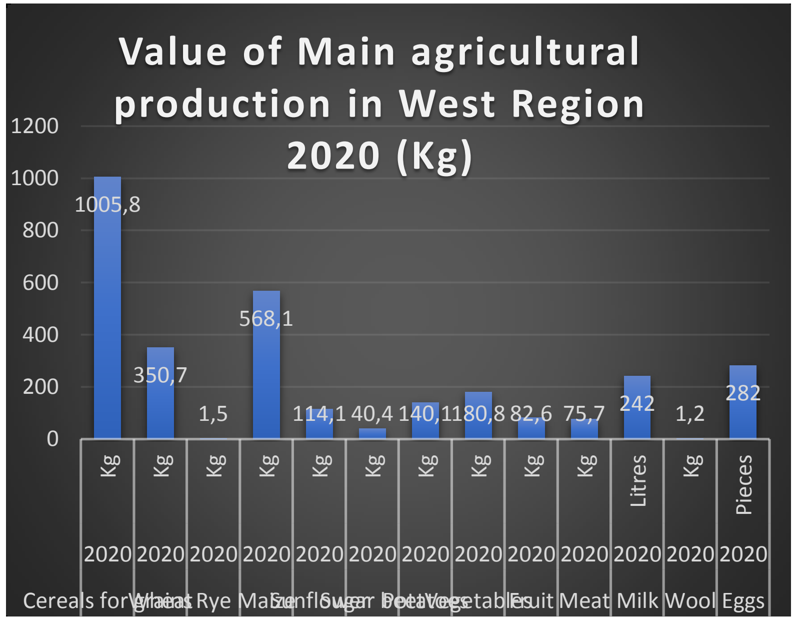
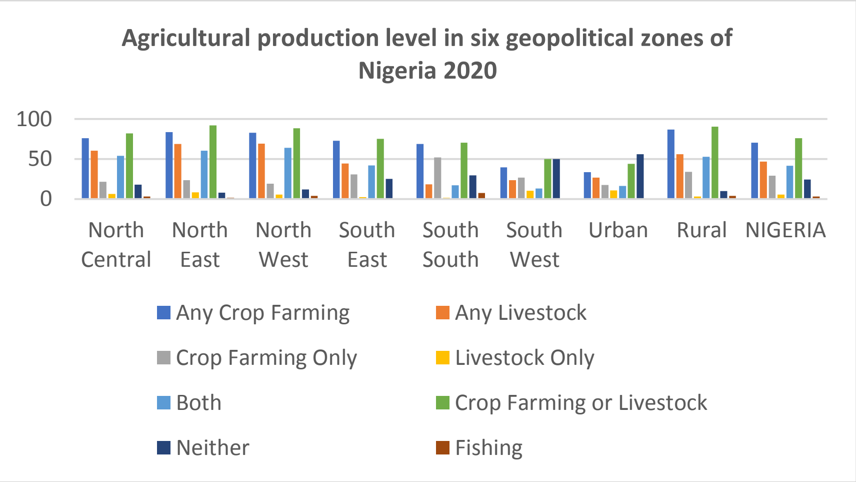
[2]Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timisoara

Introduction: Western Region (Romania) has 13.4% and North West Zone (Nigeria) has 26% total area of the country's surface and Agrarian inhabitants. Both have enormous agricultural resources and diverse agro-ecologies that support productivity growth of the home cultivated crop, livestock, fishery, and forestry sub-sectors, the crop production and animal production follow an up-growing trend, but these have not been fully exploited. Small size farmers dominate production with at an average of 3.66 ha and 1,8 ha per holding outdated land tenure system. Population declining constantly in WR while rapid increase of inhabitants NWZ. This has unpleasant implications for food insecurity, widespread poverty, and sustainable economic development.

Material and method: works of literature studies, articles, and statistical data reports from NIS, RDAWR, NBS, SRD, FAOSTAT, World Bank among others. Fundamental research, theory development & applied research were used, oriented towards the analysis of problems and finding solutions, contributing to making decisions.





Results and conclusion: The findings of the study are: Romania: 0.495 ha arable land/inhabitant; Crop production of 70% & animal production of about 30% in WR, while in the NWZ about 70.3% of households engaged in crop farming activities, and 46.9% of households owned and raised livestock. Both have high land productivity that goes far beyond the productivity of world land in either continent. Romanian economy has witnessed solid growth over the recent years, ranking among the fastest-growing in Europe results in its products being exported worldwide, while Nigeria is a global leader in agricultural production, palm oil crops +1M MT, cassava, at 59MT, making it the world's largest producer (approximately 20% of global production).

In conclusion, the potentials of this sector are far being realized from the downstream to the upstream areas of the agricultural value chains compared to the developing and developed world. Boosting the strategic agricultural sector policies by triggering the process of large-scale production & commercialization of agricultural commodities with a competitive advantage that directly offers to lead economic, social, and environmental gains in the long run is much necessary.

ASPECTS REGARDING THE TRADING OF WHEAT ON THE ROMANIAN GOODS EXCHANGE IN 2021

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Introduction

The important link of the market economy, the commodity exchange is an institution organized and supervised by the state, through which commercial exchanges (transactions) with goods are carried out, without the presentation, delivery and simultaneous payment of the object of the transaction.

Material and method

In order to have a correct image on the situation on the Romanian wheat market, we analyzed the following aspects:

- analysis of the main indicators related to wheat supply (cultivated areas, total and average
- production, average market price, export / import balance), for the period 2018-2021;
- short presentation of the Romanian Commodity Exchange(RCE);
- the evolution of the quotations within the RCE for the wheat support asset in 2021

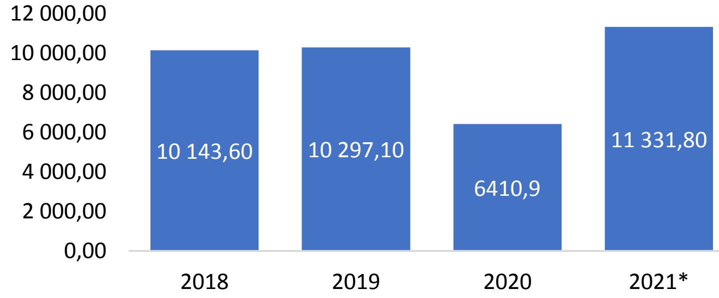

Figure 1: Total Romanian wheat production (thousand tonnes)

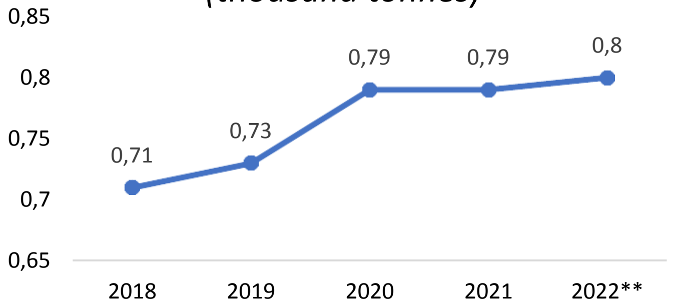

Figure 2: Average prices of wheat traded in the Romanian market (lei/kg)

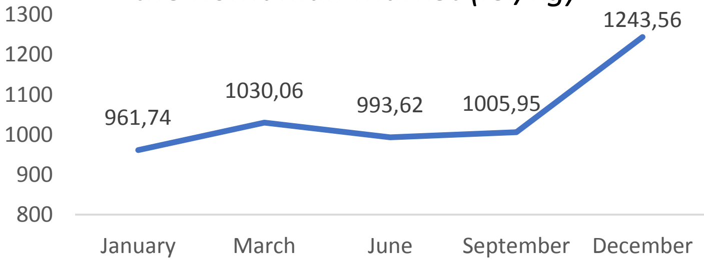

Figure 3: The evolution of the average monthly quotations for wheat within the RCE - January-December 2021

Results and conclusion

The volume of transactions within the RCE for wheat is influenced by fluctuations in the area of cultivated land, wheat production and average productivity per hectare. According to the operational data of the Ministry of Agriculture and Rural Development, the total wheat production harvested in 2021 was 11.33 million tons, the highest production recorded since Romania's accession to the European Union in 2007.

Considering the agricultural year 2021-2022 we estimate that wheat prices will not decrease, mostly due to international political and trade factor. As such, we consider that US problems will be balanced by Australia, demand from the Middle East, East Asia and China will remain strong and steady. The ongoing conflict in Ukraine will also adversely affect the wheat market.

The price of grains in Romania will continue to be influenced by the global and European context and a number of factors, including natural factors (extreme drought in some areas, excessive rains at harvest, etc.), interventionist policies and trade bans imposed by Russia (the largest wheat exporter in the world), excessive money supply in the financial markets, creating in turn a leverage effect affecting wheat trade. There are also influences related to the Euro/USD exchange rate, interest rates, general inflation rates. Lastly, the cost of sea transport has tripled in the last year, fuel prices increased as well, generating further costs.

MONEASA, A SPA OF THE AUSTRO-HUNGARIAN MONARCHY

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Introduction

- 1597 Monyásza - thermal spring
- 1860 spa was established, (Menyháza – in Hungarian)
- 1893- Wenckheim Frigyes – built narrow gauge steam locomotive and railway (Sebis – Moneasa)
- Villas – for the elite of Arad
- Nowadays it is still a place for recreation

Material and method

The paper is based on the experiences of the author and his personal visit in Moneasa town. The material was supplemented by information received from Romanian colleagues and literature data.

Results and conclusion

- Bath house – Vila Nufar. It was divided into cabins in which guests could take a bath in bathtubs covered with local red marble.
- Drilling of 5 thermal wells. Mezzo-thermal water (24-31°C) was found with bicarbonate, calcium, magnesium and sodium content. It was/is used to treat musculoskeletal, nervous, gastrointestinal and gynecological diseases.
- Significant improvements were made
- Retro elements remained
- Pleasant atmosphere to relax
- Several sights for active tourism
- Destination marketing: “Perla Muntilor Apuseni”
- Twinning – Békésszentandrás – Moneasa is the closest mountain resort to our county.

Dearth of Water: Threat to Human Health in Bangladesh and Nigeria

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Introduction

Water is life and clean water means health. This is because it acts as both a solvent and a delivery mechanism, dissolving essential vitamins and nutrients from food and delivering them to cells. Nigeria and Bangladesh, one of the most densely populated countries, facing severe water pollution and scarcity. In this countries, majority of the common fresh water sources such as, taps, wells, streams and springs have been polluted, resulting to serious outbreak of typhoid, dysentery, cholera, hepatitis and many more not discussed in this study.

Causes of Water Polution

- Inadequate Sanitary Facilities
- Arsenic Contamination of Ground Water
- Oil Spill Based Water Pollution
- Home Based Water Pollution
- Local Market Induced Water Pollution

Figures

Effects of Water Polution

- Cancer
- Hormone disruption
- Altered brain function
- Damage Trusted Source to immune and reproductive systems
- Cardiovascular and kidney problem
- Rashes
- Pink eye
- Respiratory infections
- Hepatitis

Solutions and conclusion

- Inventing new water conservation technologies
- Recycle wastewater
- Address pollution
- Introduction of bio-sand water filters

STUDY OF DRINKING WATER CONSUMPTION PATTERNS OF CONSUMERS

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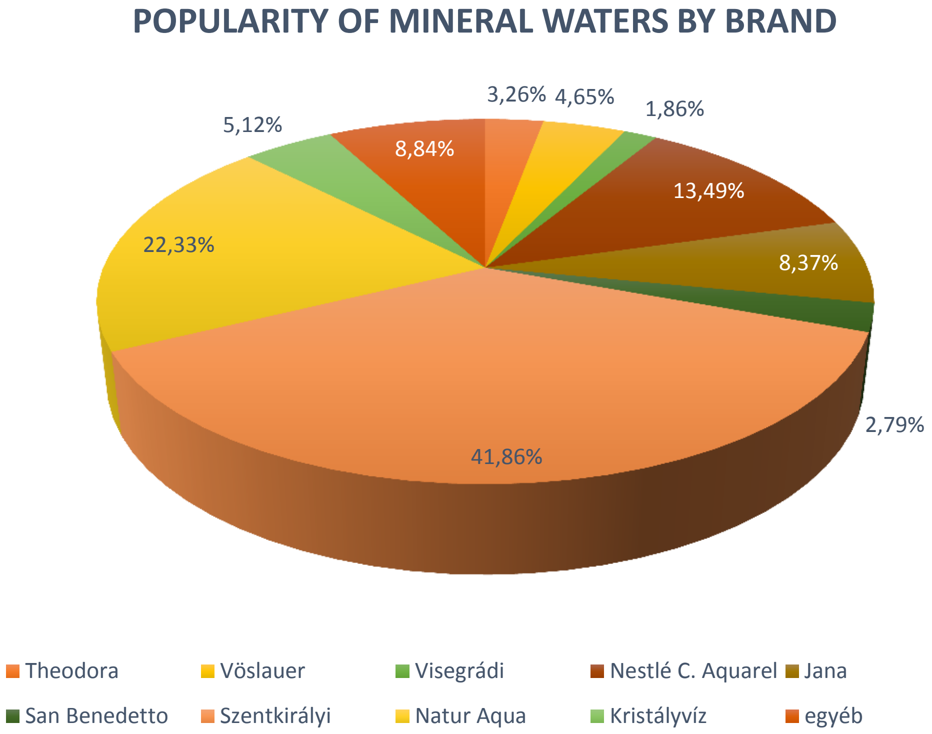
Material and method

- A questionnaire survey was conducted among the Hungarian population. The online questionnaire contained 20 questions, 6 of which related to demographics and the rest to drinking water consumption patterns. The responses received were filtered for 3 age groups and 5 counties, so the data of 215 fully completed questionnaires were processed.
- The preliminary study was limited to presenting the distribution of responses. Statistical analysis is possible after reaching a larger number of samples after continuing the work.



Acknowledgement

I would like to say thanks to Nemcsényi-Melis Brigitta for the assistance in distributing the questionnaires.

Results and conclusion

- The results are not representative.
- Based on the results, it can be concluded that the population does not consume enough water, as 8.84% of consumers drink less than 1 liter of water per day, and the vast majority, 56.28%, drink between 1-2 liters per day. Only 34.88% of them have a water intake in excess of 2 liters per day.
- The factors most influencing water consumption are ambient temperature and physical activity,
- women consume more mineral water than men,
- sparkling waters are much more preferred by people than still ones,
- mineral water selection considerations are primarily price and taste.

5Th ISCW

INVESTIGATION OF SOME FACTORS INFLUENCING THE WATER INTAKE BY DAIRY COWS

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Introduction

The problems of the heat stress affect nowadays not only tropical, subtropical and Mediterranean climates, but are becoming more common during the summer months also under the temperate climate. A high milk production puts a considerable strain also on the water circulation of cows.

Material and method

The study was conducted on 20 Hungarian Simmental cows. The correlation of daily water intake (WI) with dry air temperature (Td), relative humidity (H), wet air temperature (Tw), different temperature-humidity indices (THI1 and THI2), external body temperature (BT) and milk production (MP) were calculated (Pearson).

r (WI, Td)	0.87	$p \leq 0.001$
r (WI, H)	-0.10	$p > 0.1$
r (WI, Tw)	0.80	$p \leq 0.001$
r (WI, THI1)	0.84	$p \leq 0.001$
r (WI, THI2)	0.88	$p \leq 0.001$
r (WI, BT)	0.51	$p \leq 0.01$
r (WI, MP)	-0.91	$p \leq 0.001$
r (WI, MP · THI1)	-0.70	$p \leq 0.001$
r (WI, MP · Td)	-0.58	$p \leq 0.001$
r (ratio*, Td)	-0.93	$p \leq 0.001$
r (ratio*, Tw)	-0.79	$p \leq 0.001$
r (ratio*, BT)	-0.61	$p \leq 0.001$

*Ratio of water excreted into milk to drinking water intake

Results and conclusion

The intake of drinking water was highly dependent on meteorological factors, especially on dry air temperature. There is also a strong correlation with the wet air temperature and with the two types of temperature-humidity indices (THI1 and THI2), but there is no direct correlation with the relative humidity of the air.

The water consumption was less related to (external) body temperature than to ambient temperature.

The ratio of water excreted into milk to drinking water intake decreased sharply with increasing temperature. This ratio was mostly determined by the dry air temperature.

AQUACULTURE GROWTH RATES CORRELATE WITH QUANTITY OF RENEWABLE WATER RESOURCES AT COUNTRY-LEVEL

5th ISCW

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Introduction

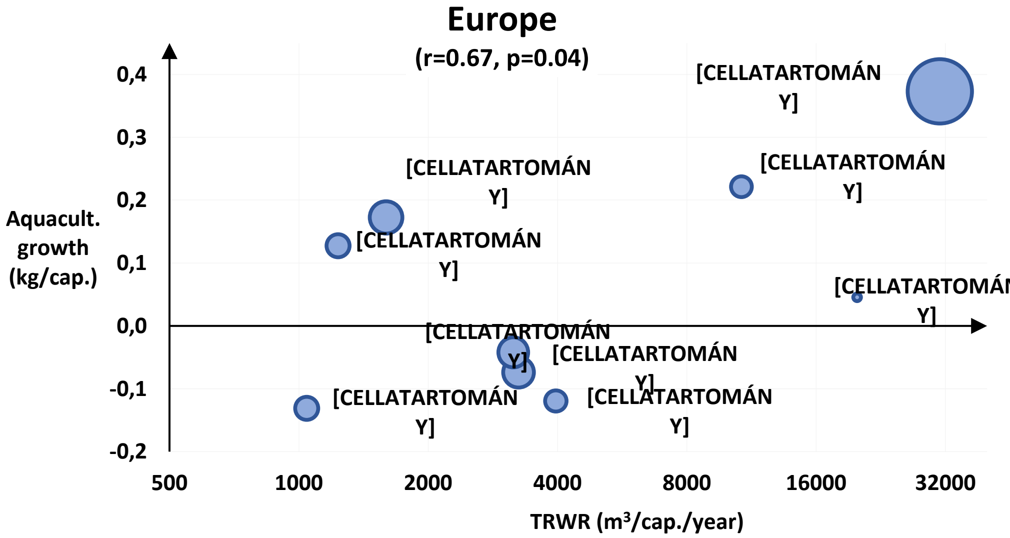
Water endowment is a crucial factor in aquaculture development of individual countries. The objective of this study was to test whether there was a correlation between country-wise data on annually renewed water resources and growth in fish production over the past 10 years.

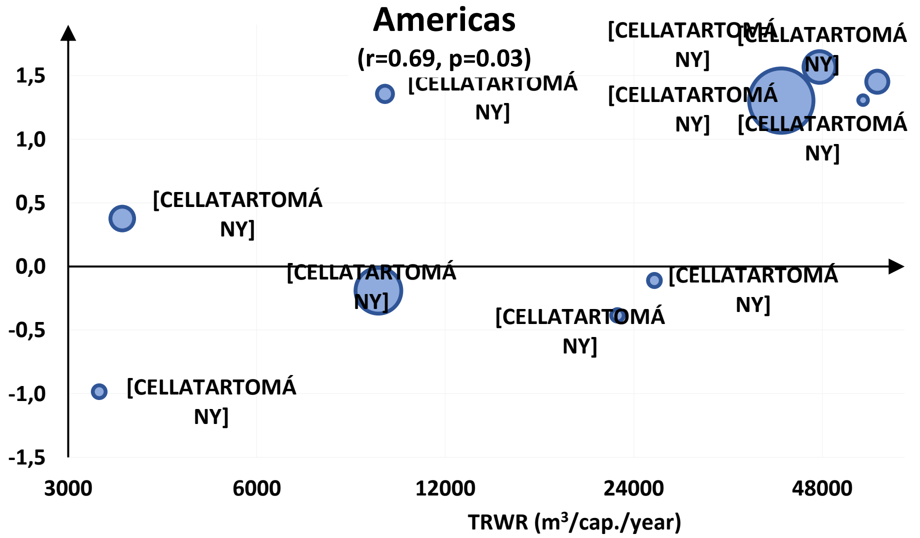
Material and method

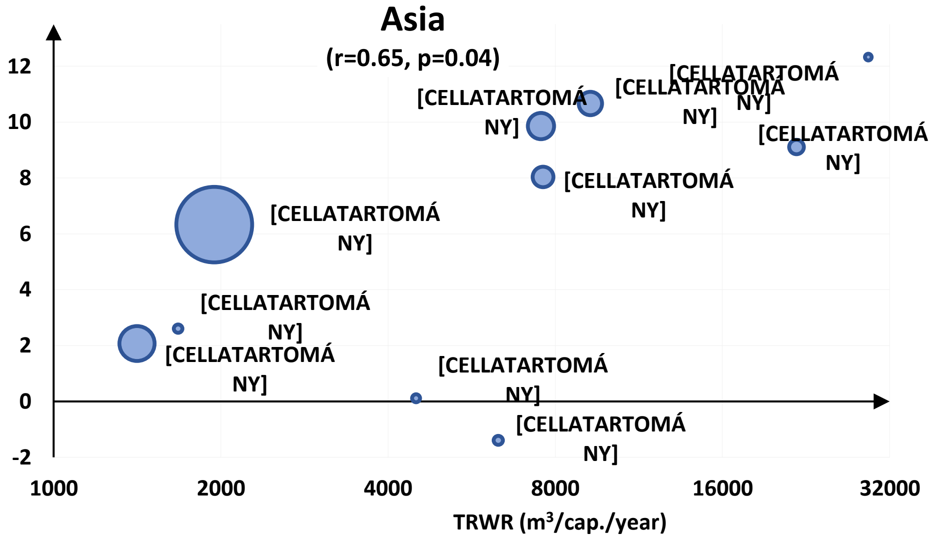
Data for Total Renewable Water Resources (TRWR) and aquaculture production were extracted from FAO Aquastat and FishStat J, respectively. Per-capita growth in freshwater aquaculture production between 2008 and 2018 was matched with per-capita TRWR for 10-10 largest producer countries of Asia, Africa, Americas and Europe.

Results and conclusion

Pearson-correlation between the two variables was found to be positive and significant (p<0.05) among Asian, American and European countries, while for the African continent there was no statistical evidence for the positive relationship between water resources and aquaculture growth. Results suggest that strategies for expansion of freshwater aquaculture must be aligned with resource endowments.







Bubble plot of the Total Renewable Water Resources (TRWR, 2018-22) versus per capita growth of freshwater aquaculture production over a 10-yr period (2008-2018) for major producer countries. The size of the bubble relates to the freshwater aquaculture production (2018) of the corresponding country. Note that the x-axis is log-scaled.