31ST INTERNATIONAL SCIENTIFIC-EXPERT CONFERENCE OF AGRICULTURE AND FOOD INDUSTRY

„FUTURE OF AGRICULTURE, AGRICULTURE OF FUTURE“

ECONOMIC EVALUATION OF CORN SILLAGE PRODUCTION IN BOSNIA AND HERZEGOVINA

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INTRODUCTION

Farmers/growers, along with other actors, are exposed to new challenges brought upon by globalization, market volatility, complexity, and scrutiny (Stiring et al., 2013). Besides, climate change has a strong impact on agriculture causing a wide range of problems, ranging from feed shortage/yield to the quality of products/inputs that consequently have a strong effect on production and overall farm management (Sahoo, 2018). Because of that, farmers tend to seek for solutions to minimize the aforementioned risks, and one way to achieve that is with the production of their inputs such as feed for livestock production.

Worldwide, production of corn increased by 24.58%, in the USA 15.45% (USDA, 2021), while on contrary in the EU corn production decreased by 7.6% (EUROSTAT, 2021) for the observed period 2011-2020. Major worldwide corn producers are the USA, followed by China, Brazil, and EU-27 countries. This particular crop is popular (and gaining on popularity) because of its wide range of benefits such as low harvesting cost, minimum production risks, high yields, high energy intake for livestock, increase lactation length, stocking rate digestibility, palatability, storage ability, etc. (Allen et al., 2003; Schroede, 2004; Ferraretto et al., 2018). Research aims to evaluate economic indicators of corn sillage production on two large farms in Bosnia and Herzegovina.

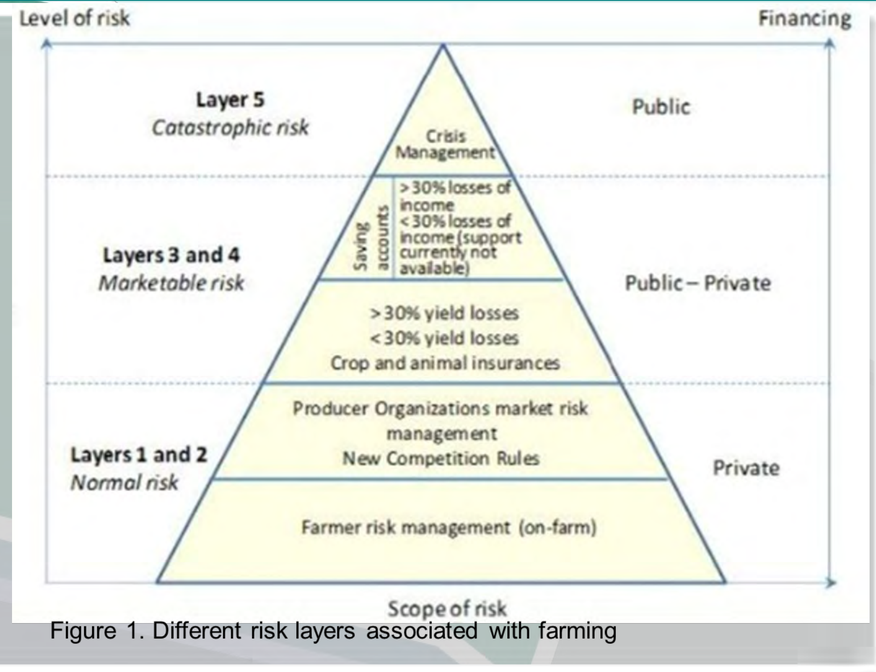

Figure 1. Different risk layers associated with farming

MATERIAL AND METHODS

Two farms were selected: (i) farm A - the private company "Farma Spreča" d.o.o. Kalesija (400ha), (ii) and farm B - public company "Poljoprivredno dobro Butmir" d.o.o. Sarajevo – Ilidža (170ha). Primary data for the survey were collected based on semi-structured interviews with farm representatives. For each farm, production and economic indicators of corn silage production in 2016 and 2017 were determined and analyzed.

RESULTS AND DISCUSSION

From figure 2 (Falan et al., 2021) it is evident a significant decrease in the use of fertilizers (-29.47%), which could have a negative impact on yields. At the same time, there was a strong increase in the use of pesticides (147.37%), which indicates problems with diseases and pests. Among other significant cost categories, a decrease in the costs of fuel (-36.27%) and services (-44.44%) can be noticed, which can be related to more efficient use of machinery. Human labor has of course increased (24.53%) which is related to the increase in harvested areas.

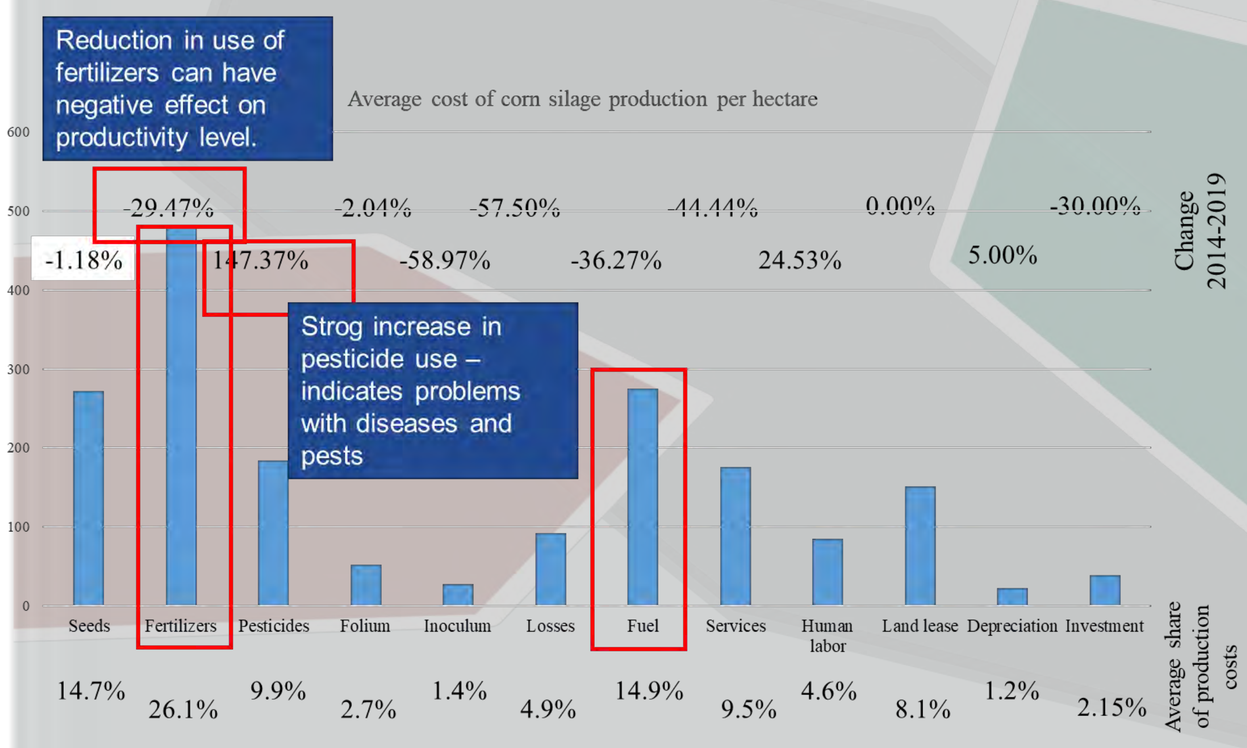

Figure 2. The average cost of corn silage production (per hectare)

Table 1. Main economic indicators for Farm A—private (400ha) and Farm B—public (170ha)

Observed indicators	Farm A (in 2016)	Farm B (in 2016)	Farm A (in 2017)	Farm B (in 2017)	Change % (2016-2017) Farm A	Change % (2016-2017) Farm B
Yields (t/ha)	29,03	34,39	25,03	30,23	-13,78	-12,10
Costs (EUR/ha)	1486	1589	1045	1554	-29,68	-2,20
Production value (EUR/ha)	2084	2645	1797	2635	-13,77	-0,38
Profit (EUR/ha)	598	1056	751	1080	25,59	2,27
Efficacy	1,4	1,66	1,72	1,69	22,86	1,81

Positive financial result were identified during observed peiord on both farms, while Farm B achieved somewhat better financial and in overall economic indicators. According to this study results, Farm B tend to have better yields and therefore achieve higher production value. As identified in other studies it could be connected with farm management (especially crop rotation, soil erosion, reduction of organic matter), diseases and pest management, general soil quality, and the choice of hybrids.

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CONCLUSION

Improving farm management practices as well as general business of agricultural producers in Bosnia and Herzegovina still remains main objective if the sector wants to achieve significant growth. Managing own inputs still remains major obstacle in most of the productions in Bosnia and Herzegovina, because of import of almost all inputs for agriculture. High dependance on imported inputs as well as suspicious quality (not adapted for local conditions) result with lower performances of agricultural producers and therefore decrease their competitiveness and chance for improvement.

State and perspectives of aquaculture in the municipality of Bužim

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Abstract

Based on natural resources, Bosnia and Herzegovina has a significant potential for aquaculture, especially for the production of freshwater fish species. The municipality of Bužim occupies the far northwestern part of Bosnia and Herzegovina and belongs to the Una-Sana Canton. The significant wealth of the cantons is natural beauty, because this area abounds with rivers, smaller and larger watercourses, warm springs, caves, forests and cultural and historical monuments. This paper analyzes the existing state of aquaculture in the Una-Sana Canton, as well as the prospects of this canton for increasing production fish.

Keywords: *Fish diversity, water streams, fish species, Bužim.*

Introduction

The objective of the ichthyological research is to examine the structure of fish populations, ie distribution of fish populations along the longitudinal profile of the investigated catchment area of the river Baštra, its tributaries and standing waters in the territory of the cadastral municipality of Bužim. Also, the paper deals with physical and chemical parameters. The first and larger sub-basin belongs of the river Bužimica and its tributaries, whose waters flow into the Sava River Glina. Approximately 1/3 of the municipal territory belongs to the sub-basin of Baštra, the Una River Basin.

Material and methods

Four places were selected for analyzing: the Baštra River (L / 1), the Pašinac River (L / 2), Lake Vrhovska (L / 3) and the Bužimica River (L / 4).

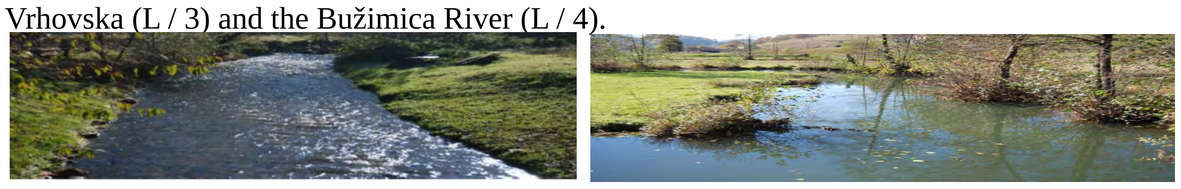

Figure 1. *Riwer Baštra L/1 and Pašinac L/2*

Results and discussion

The assessment of the quality waters of the river Baštra, Pašinac, Bužimnica and Vrhovska lake was done on the basis of physical and chemical characteristics of water on the tested profiles. Physico-chemical properties of water are one of the determining factors in assessing the quality of certain watercourses. They are also of crucial importance for the development of populations of animal and plant organisms in aquatic ecosystems, because by changing some water quality factors, the conditions of life change, which has an ecological significance for aquatic organisms, and these parameters are followed in this research. Also, the peak waters are classified in 5 classes according to the Law on Waters of the Federation of Bosnia and Herzegovina and according to the Decree on Classification of Water and Categorization of Watercourses, pH values of the tested waters are within the limits of neutral and slightly basic solutions, which corresponds to the values of natural waters. The pH value of the Baštra river was 7.43, Pašinci 7.49, Bužimnica 7.51, and the lake 7.40. The tested rivers belong to the pH values of the I class. The value of dissolved oxygen concentrations in the Baštra river (Baštra locality) was 10.77 mg / l, which corresponds to saturation and oxygen saturation of oxygen of 93.98%, while in the Pašinac river (locality Pašin Brod) 10.68 mg / l, and saturation with oxygen was 92.55%. The water of the Bužimnica River (Jabukovac site) had a slightly lower concentration of dissolved oxygen of 10.12 mg / l, as well as oxygen saturation of 88.15%, while the water of Vrhovska lake had the smallest value of dissolved oxygen (8.79 mg / l) and saturation (74.62%). Water samples of Baštra, Pašinac and Bužimnica, according to the oxygen saturation values, belong to the first class of water quality, while the samples from the Vrhovska Lake belong to the second class of water quality. The unit of measure for electric conductivity is µS / cm, ie (micro-Simens per centimeter). Electrical conductivity is a useful physical indicator since it is proportional to the concentration of total dissolved solids in dilute solutions. The investigated water of the Baštra river (Baštra locality) has a value of 397 µS / cm, Pašinac (Pašin Brod) 422 µS / cm, Bužimnica (Jabukovac site) 416 µS / cm, and the Vrhovska lake 325 µS / cm, which according to them this parameter, is classified in the first class of surface water quality. The total hardness of the water is the total amount of dissolved salts, most commonly calcium and magnesium ions. In Bosnia and Herzegovina it is most often expressed in German degrees - ° dH (German Deutsche Härte). All measured values correspond to the requirements for I class of surface water quality. According to the obtained results, the water of Lake Vrhovska has a total hardness of 13,77 ° dH, which is classified as moderately hard water. Water Baštra from the Baštra site shows the total water hardness of 15.01 ° dH, water Pašinac (location of Pašin Brod) 16.24 ° dH, and water Bužimnica (locality Begovići) 16.8 ° dH.

Places of taking fish species

Four characteristic areas were treated - sites with a total length of 450 meters and cultivated watercourse area of 1,800 m^2. Locals that have been cultivated: the river Baštra - the village of Baštra, the river Pašinac - the village of Pašin brod, the lake - the village of Vrhovska and the river Bužimnica - the village of Begovići. Four sites were selected: the Baštra River (L / 1), the Pašinac River (L / 2), Lake Vrhovska (L / 3) and the Bužimica River (L / 4). In total, 1.429 pieces of fish with a total weight of 168,847.45 grams were caught, 15 different fish species were caught.

Table 1. *Ichtiopopulation of river Pašinovac*

Fish species	No Piecess	Body weight (g)				Standard lenght (cm)			Total lenght (cm)		
		max.	min	x	∑	max.	min.	x	max.	min.	x
Brown trout	3	123,0	11,0	67,0	201,00	21,0	9,5	15,2 5	23,0	11,0	17,0
Comon dace	204	716,0	43,0	379,5	77.418	33,5	13,5	23,5	38,0	16,5	27,25
Plotica	4	145,0	122,0	133,5	534,00	20,0	18,0	19,0	22,0	19,5	20,75
Barbus balc.	3	22,0	14,0	18,0	54,00	11,5	9,5	10,5	13,0	11,5	12,25
Alburnus	66	10,0	3,0	6,5	429,00	8,5	6,5	7,5	10,0	7,5	8,75
Gaga	17	4,0	2,0	3,0	51,00	6,0	5,0	5,5	7,0	5,5	6,25
Comon Gudgeo	4	19,0	14,0	16,5	66,00	14,0	10,0	12,0	12,5	11,5	12,0
Bullhead	16	13,7	2,7	8,2	131,20	8,5	5,0	6,75	10,0	6,5	3,25
Barbus	7	6,5	1,2	3,85	26,95	8,0	6,0	7,0	9,0	6,5	7,75
Total	**324**				**78.911**						

Table 2. *Ichtiopopulation of river Baštra*

Fish species	No Piecess	Body weight (g)				Standard lenght (cm)			Total lenght (cm)		
		max.	min.	x	∑	max.	min.	x	max.	min.	x
Hucho hucho	4	62,0	62,0	62,0	248,00	16,5	16,5	16,5	19,0	19,0	19,0
Brown trout	6	108,0	8,0	58,0	348,00	19,0	8,0	13,5	22,0	9,0	15,5
Chub	63	127,5	28,5	78,0	4.914,00	19,0	12,0	15,5	22,0	14,5	18,25
Barbel	4	13,1	7,4	10,25	41,00	9,0	7,5	8,25	11,0	8,5	9,75
Alburnus	89	16,5	3,9	10,2	907,80	10,0	6,0	8,0	12,0	7,0	9,5
Gudgeon	6	18,6	18,2	18,4	110,40	10,5	10,0	10,25	12,0	11,5	11,75
Total	**172**				**6.569,2**						

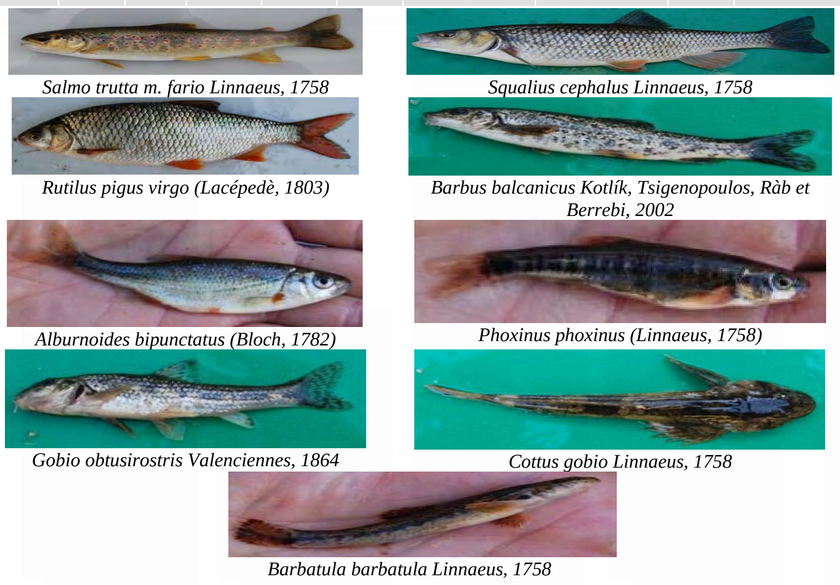

Figure 3. *Some of fish species caught at site Pašinovac (Latin name)*

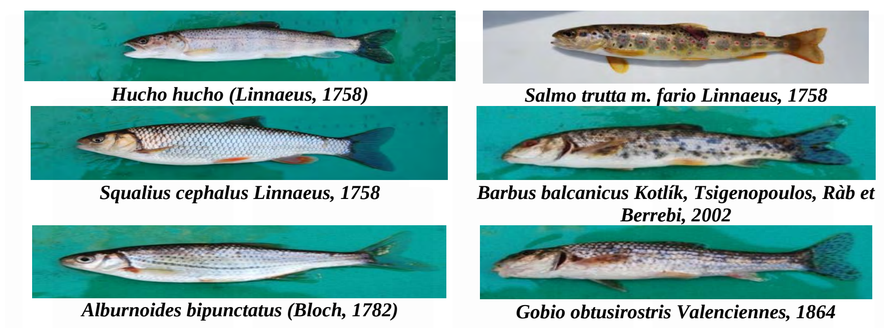

Figure 4. *Some of fish species caught at site Baštra (Latin name)*

Conclusion

From physical and chemical parameters that were examined it is easy to say that waters we used in this research work belong into first or second class of water. It means they are very clean and possibilities for fishing and fish farming in them is very good. Small problem was with some of examined stream pollution with organic material but nothing that could be bigger problem. These examinations showed us that this part of Bosnia and Herzegovina has a great potential for fish farming some of indigenous fish species for European fish market or as a fingerling for farming in other country.

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THE EFFECTS OF CHITOSAN ON QUALITY PROPERTIES OF SEAFOOD PRODUCTS

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INTRODUCTION

Seafood and seafood products are often preferred by today's consumers in a healthy diet because they are among the food groups with high nutritional value. Seafood and seafood products are known as rich sources of functional and health-supporting components that are involved in many important metabolic activities in the human body, such as vitamins that enhance the immune system, lipids with a significant amount of valuable polyunsaturated fatty acids that prevent degenerative diseases and easily digestible and high quality proteins. However, seafood and its products are highly perishable so they can deteriorate very quickly under inappropriate storage conditions. Since seafood products are susceptible to spoilage due to microbiological, enzymatic and biochemical reactions, various quality losses can occur during storage of these products. Chitosan is one of the biodegradable materials obtained from natural sources and used for the preservation of foods. In addition, chitosan is a biocompatible, environmentally friendly, allergen-free, non-toxic and low-cost biopolymer. Also, chitosan and its derivatives have antimicrobial activities on food-borne pathogens, and a strong antioxidant effect on the oxidation of lipid and protein in seafood and its products. Therefore, chitosan and its derivatives are mainly used to retard biochemical changes, enzymatic reactions and microbiological spoilage and to extend the sensory acceptability in seafood and its products.

Chitosan as a food preservative

Food preservatives are food additives that improve the quality and extend the shelf-life of perishable food products by protecting against microbial, chemical and physical deteriorations. For this reason, synthetic and natural compounds have been used. However, the use of synthetic preservatives in food products are strictly controlled due to potential side effects. Today's consumers prefer natural preservatives. Chitosan has many beneficial properties, such as being nontoxic, biodegradable, biocompatible, immunological neutral, antimicrobial, anti-inflammatory and anti-tumor with wound-healing activity (Sun et al., 2017). Chitosan-based materials are used in different forms in many food formulations such as films, nanofibers, nano/micro-particles, nanocapsules, hydrogels and beads which determines their potential applications in foods (Figure 1) (Dotto and Pinto, 2017). The properties of chitosan can allow it to be applied as support matrix for enzyme immobilization, which provides great operational stability in the food processing industry. Chitosan is widely consumed as a food complement for health in the form of capsules and tablets because of its fat-absorbing ability (Kumar et al., 2018). In addition, it is a promising natural bioactive polymer that can be used for food protection and packaging as an antimicrobial, preservative, binding agent, and texturizer (Tayel et al., 2016; Mujtaba et al., 2019). It also has antioxidant activity (Bonilla et al., 2018). The use of chitosan as an edible coating for food safety helped the food to retain sensory characteristics. It is also used as dietary supplement for humans, with the claim that it can give consumers a more attractive and healthier appearance.

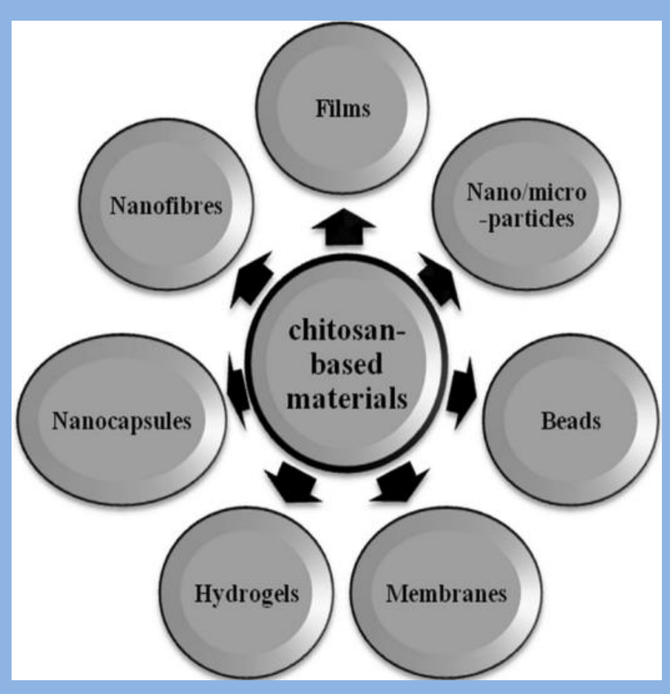

Figure 1. Various forms of chitosan-based materials.

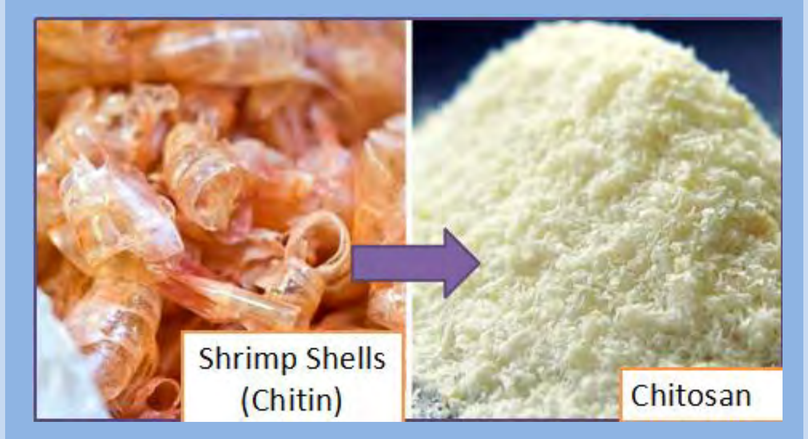

Figure 2. Shrimp Shells and Chitosan

Chitosan applications for seafood products

Chitosan is a natural carbohydrate polymer obtained by deacetylation of chitin, which is obtained from marine crustaceans such as shrimp, crab, and is the second most abundant polysaccharide in nature (Figure 2). Seafood is highly susceptible to spoilage due to microbiological, chemical and enzymatic reactions, which are the main causes of their quality deterioration (Martinez et al., 2018; Mohan et al., 2012). Therefore, greater consumer demand for high quality seafood along with a concern for the safety of the artificial preservatives currently used to prevent quality losses creates a challenge. Considerable interest towards chitosan as a new functional material in various areas has been increased in recent years. Chitosan-based materials are potential alternatives to maintain seafood quality by reducing microbial growth, increasing oxidative stability and protecting sensory properties (Ramezani et al., 2015). The different useful properties of chitosan, such as its ability to dissolve in acidic solutions, film-forming ability, gel enhancement properties and encapsulation capacity widen its applications in seafood, as an additive, film coating material and as a component of packaging material. Chitosan-based materials has been successfully applied as an antimicrobial or as an antioxidant in seafood products by formulating in different forms and combining with various materials. The studies on the different applications of chitosan on seafood and seafood products are shown in Table 1 .

Table 1. Different applications of chitosan on seafood and seafood products

Seafood Product	Chitosan-Based Material	Quality Characteristics	Study Results	References
FISH PRODUCTS				
Sardine Fillet	Chitosan as edible coating	**Sensory properties:** Appearance, colour and odour **Microbial properties:** Total mesophilic counts **Physicochemical properties:** TBA (Thiobarbutiric Acid), water holding capacity (WHC), drip loss and textural properties	• The treatment with chitosan coating preserved the sensory properties during storage period. • The chitosan edible coating decreased the microbial spoilage and prolonged shelf-life considerably. • The chitosan coating improved the drip loss, WHC and textural properties during storage period. • The chitosan coating decreased the production of oxidation products.	Mohan et al., (2012)
Silver Carp Fillet	Chitosan and nanochitosan coating (2%, w/v)	**Microbial properties:** Psychrotrophic and total mesophilic counts **Physicochemical properties:** TBARS (Thiobarbituric acid reactive substances), TVB-N (total volatile basic nitrogen), pH **Sensory properties**	• Both chitosan and nanochitosan coating maintenanced silver carp fillets, by reducing the pH and the degree of lipid oxidation, during refrigerated storage. • Nano-chitosan coating exhibited higher antimicrobial activity and inhibited the TVB-N than chitosan during the storage period. • Nano-chitosan coating extends the shelf-life and delays the spoilage of fresh silver carp fillets throughout refrigerated storage.	Ramezani et al., (2015)
CRUSTACEANS				
Oysters	Chitosan as additive	**Microbiological attributes:** Aerobic plate count (APC) **Sensory attributes**	• The chitosan coating decreased the microbial growth (APC values) and prolong the shelf-life of oysters at 5 ± 1 °C from 9 to 15 days.	Cao et al., (2009)
Shrimp	Chitosan coating combined with pomegranate peel (PPE)	**Sensory properties:** Appearance, odour, texture, flavour, and overall acceptability **Microbial properties:** Total plate counts **Physicochemical properties:** pH, TVB-N, Texture	• Chitosan coating and chitosan coating combined with PPE applied on shrimp has significantly inhibited the increase in TVB-N values, TPC, and pH. • Chitosan coating combined with PPE applied on the shrimp could enhance its sensory quality, springiness and hardness, also exhibited an inhibitory effect on the melanosis formation and the change of colour difference in shrimp during storage.	Yuan et al., (2016)
MINCED FISH PRODUCTS				
Fish Fingers	Chitosan and Chitosan nanoparticles as active coating	**Chemical attributes:** pH, TVB-N, TMA-N, TBA	• Chitosan and chitosan nanoparticles as an effective coating presented a significant improvement for quality properties of fish fingers, by reducing TVB-N and TBA during frozen storage at −18 °C.	Osheba et al., (2013)
Surimi	Chitosan as additive	**Physicochemical properties:** TVB-N, TBA, PV, WHC, Texture. **Microbiological properties:** APC	• The adding of 1.5–2.0% (w/w) chitosan provided catfish surimi gels by enhancing texture and inhibit lipid oxidation and inhibit microbial growth in the gels.	Amiza and Kang, (2013)

CONCLUSION

Seafood and seafood products are among the foods with high nutritional value. However seafood products are highly prone to microbial decays and biochemical reactions. For this reason, physical, chemical and sensory quality losses may occur during the storage period of seafood products. Therefore, seafood products should be consumed quickly or stored with the right techniques. Chitosan, which can be consumed together with food, obtained from natural sources, does not create an ecological problem, does not adversely affect human health, have antioxidant and antimicrobial properties, is among the alternative ingredients searched and used in order to maintain the quality properties of seafood products and improve their shelf life. As seen from the studies that different chitosan samples applied on seafood and its products can effectively inhibit the microbial growth, reduce lipid oxidation, and improve sensory properties. Also, combining chitosan with other preservation agents often improved shelf-life and quality more than chitosan alone maintaining the quality of seafood products.

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Isolation and Identification of Carotenoid Producing Yeast

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İntroduction

Carotenoids are naturally occurring lipid-soluble pigments that are synthesized by plants and microorganisms. They exhibit yellow, orange, red and purple colors. Carotenoids have found applications in different industries.

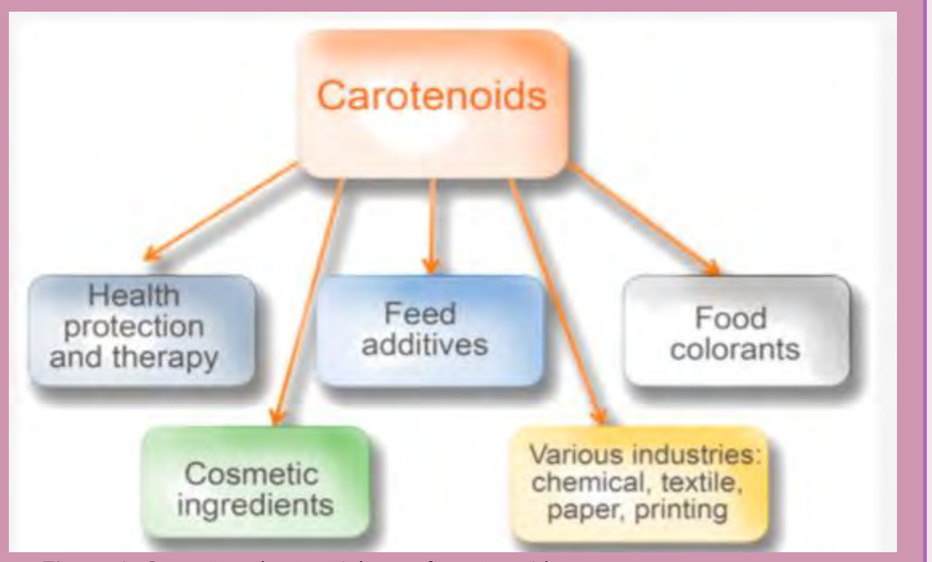


Figure 1. Current and potential use of carotenoids.

Methods

For the isolation of yeasts producing carotenoid pigment used in the research, 9 soil samples were taken from İzmir and its surrounding regions. The first isolation and purification processes were performed on MYGP (Malt Yeast Glıcose Pepton Agar) medium. After 2 days of incubation at 27°C, yeast isolates that formed pink, orange and red colonies were isolated and purified. In the study, genotypic identification of isolates identified as carotenoid producers was made by sequencing the 26S rDNA gene region.

Disscussin&Conculusion

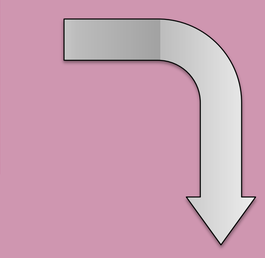
Yeast species obtained in the study are potential species that can be used in many fields such as feed, food, agriculture and health. Chemical synthesis of carotenoids is one of the most important production methods. However, recent studies have demonstrated the toxic, carcinogenic and teratogenic properties of synthetic-derived pigments. The process is also challenged by high production cost, by- product formation, and harmful environmental effects. Therefore, there is an increased interest in microbial carotenoids as a safe alternative.

Reccommendation

Pigmented yeasts have an advantage over algae, plants, and bacteria due to their unicellular and relatively high growth rate using low-cost fermentation media. Therefore, yeasts can be used as an alternative source for carotenoid production.

Purpose

The current study aimed to isolate and identify carotenoid producing indigenous yeasts that can be used as supplements in animal feeds.

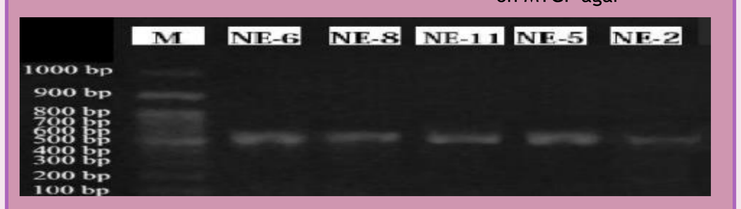


Result

13 yeast isolates were obtained from 9 soil samples taken from various regions. 5 isolates, which revealed red, orange and pinkish colorations, were selected for molecular characterization.

Fermentation of yeast isolates post images

A 3-day colony image of TEM NE6, one of the yeast isolates, on MYGP agar



Electrophoresis of 26S rDNA regions of isolates M; Marker, (Fermentas) 100 bp DNA ladder

İsolates	İdentification	Sımılarıty Rate
NE5	*Rhodotorula mucilaginose*	% 99,43
NE11	*Cystobasidium slooffiae*	% 99,45
NE6	*Rhodotorula mucilaginose*	% 98,67
NE8	*Rhodotorula mucilaginose*	% 100,00
NE2	*Rhodotorula mucilaginose*	% 99,32

26S rDNA identification results

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Feriha Karabela

INFLUENCE OF GROWTH REGULATORS (IBAs) OF DIFFERENT CONCENTRATIONS ON QUALITY ROOTING OF HARDWOOD CUTTINGS OF SELECTED VARIETIES OF CURRANT (*Ribes* L.)

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Introduction

Cutting propagation is the most important means for clonal regeneration of many horticultural crops.

The use of hardwood cuttings is one of the least expensive and easiest method of vegetative propagation. (Fourrier 1984)

Cuttings from the previous season are rooted (at least one year old) harvested during dormancy phase from the parent plant .

There are various factors that can change the rooting potential of cuttings; juvenility and condition of stock plant; the source, position, and type of cutting taken, leaf removal; stock plant etiolation and girdling; cutting date; or is influenced by growing conditions such as media, mist, bottom heat, hormones, fertilizer, and supplemental lighting (Hartmann *et al*., 2002)

Purpose

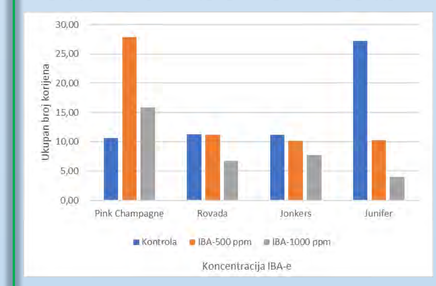
The aim of this study was to determine the effect of different growth hormones (IBA) on different concentrations, of 500 ppm and 1000 ppm on the ability to form roots in hardwood cuttings of different currant varieties, including the control variant (without hormone application).

Methods

At the end of February 2021, 100 pieces of mature cuttings of 4 varieties of currants, the same length of 15 cm, were taken from the currant plantations from the experimental field of the Faculty of Agriculture and Food sciences. The lower part of the cutting is shortened with a straight section just below the bud, and the upper part with a slight slope that falls opposite to the bud. Planting cuttings was done on March 1, 2021. year., in a mixture of peat and perlite substrate, outdoors. The study was performed on four varieties of currant: Pink Champagne, Rovada, Jonkers and Junifer for two treatments of IBA hormones of different concentrations (500 ppm and 1000 ppm) and a control variant without hormonal treatment.

Results

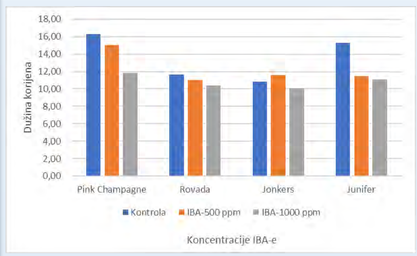
Total number of roots



Graph 1. Total number of roots

Graph 1 shows the influence of IBA on the total number of roots in currant cuttings. In the Pink Campagne variety, the significantly best result was achieved with the use of 500 ppm IBA, a good result is also with the use of 1000 ppm IBA concentration, while the control variant had a smaller number of roots. In the Rovada variety, equal results were achieved without the use of IBA and with the use of 500 ppm concentration, while the cuttings produced a significantly smaller number of roots when using 1000 ppm concentration. In the Jonkers variety, the results were approximately the same without the use of IBA and with the use of 500 ppm concentration, while the cuttings produced a smaller number of roots when using 1000 ppm concentration. In the Junifer variety, a significantly better result was achieved with the control variant, a good result was achieved when using 500 ppm IBA concentration, while the cuttings produced a significantly smaller number of roots when using 1000 ppm IBA concentration.

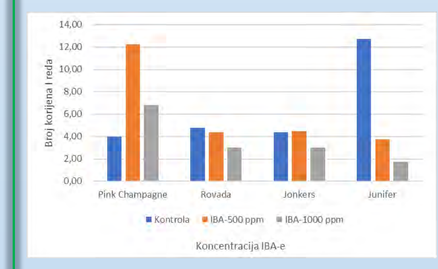
Length of root cuttings



Graph 2. Length of root cuttings

Graph 2 shows the effect of IBA on root length in currant cuttings. After the test results and graphical display, we can see that the Pink Champagne and Junifer varieties achieved better results without the use of IBA, while the Rovada and Jonkers varieties achieved approximately the same results without the use of IBA and with the use of both concentrations of IBA.

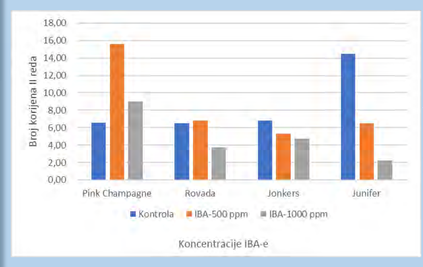
Number of roots of the first order



Graph 3. Number of roots of the first order

Graph 3 shows the influence of IBA on the total number of first-order roots in currant cuttings. After the test results and graphical display, we can see that there is no statistically significant difference in first-order root formation between the control and 500 ppm IBA, while the use of 1000 ppm IBA caused statistically significantly weaker first-order root development in currant cuttings.

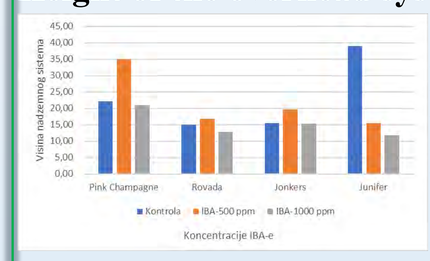
Number of roots of the second order



Graph 4. Number of roots of the second order

Graph 4 shows the influence of IBA on the total number of second-order roots in currant cuttings. After the test results and graphical presentation, we can see that there is no statistically significant difference in the formation of second order roots between the control and IBA concentration of 500 ppm, while the use of 1000 ppm IBA caused statistically significantly weaker root II development in currant cuttings.

Height of the overhead system



Graph 5. Height of the overhead system

Graph 5 shows the influence of IBA on the height of the aboveground system in currant cuttings. After the test results and graphical display, we can see that there is no statistically significant difference in the height of the aboveground system between the control and IBA concentration of 500 ppm, while the use of 1000 ppm IBA caused a statistically significantly lower height of the

Discussion &Conclusions

Based on the obtained results and conclusions, it can be said that the use of hormone for rooting mature cuttings of selected varieties of red currant used in the experiment is not necessary, because there is no statistically significant difference between control cuttings and cuttings treated with 500 ppm IBA concentration. treatment with 1000 ppm IBA concentration caused statistically significantly weaker root development in all red currant varieties. In the selected varieties of red currant, none of the used concentrations of IBA hormone gave better results than the control for rooting, which used only a substrate that is a mixture of peat and perlite with water. In the case of Pink Champagne, the use of IBA growth hormone with a concentration of 500 ppm is justified, because the cuttings treated with this concentration achieved better results in the total number of roots, in the total number of roots of the first

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Application of Different Urea Concentrations in Protection of Greenhouses and Polytunnels from Snow

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Introduction

According to Castila and Hernández (2004), the energy crisis of the 1970s can be considered a major reason for the development of production in sheltered spaces. As energy prices rose, the area of the greenhouses remained stable or decreased in countries with low winter temperatures, whereas in the areas with lower heating requirements it significantly increased. According to Karić et al. (2014) many producers opt for this production, because this is labor, but also the most economically viable production for small farms (most in BiH are like that). The size of the greenhouse is from 100 to 1000 m2. Sudden and large amounts of snow often cause great damage to protected areas.

The objective of this paper is to examine the possibility of protecting sheltered spaces (greenhouses and polytunnels) from snow, through the application of appropriate solutions. The obtained results will point out the importance of preventive actions, and provide recommendations to producers concerning the optimal way of melting snow on their sheltered spaces.

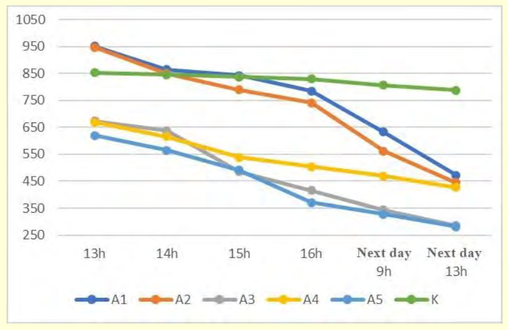
Material and method

The research was conducted at the Faculty's experimental site Butmir, during the winter period (2020 and 2021). Agricultural plastic containers (120 pcs) of standard dimension, filled with natural snow were used for the experiment. Urea solutions in various concentrations (A1-5%, A2-10%, A3-15%, A4-20% and A5-30%) were prepared in special containers. The measurement of the mass of melted snow was performed by using a digital scale, and the accuracy of the measurement was to two decimal places.

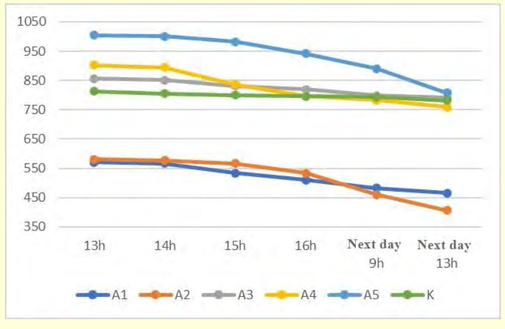
The examination was performed at two different outdoor temperature intervals, one ranging from 00 to 50C, and the other from 00 to -50 C. The mathematical method, mass measurement method, and statistical method were used in the study.

Results and discussion

The action of urea solutions A1, A2, A3, A4 and A5 are shown here. All solutions were compared with the control (K) that was not treated. The results of snow melting (in grams) are shown through time dynamics, as shown in Graph 1., which can visually show the trend of snow melting at temperatures ranging from 0^0 to 5^0 C.



Graph 1. Dynamics of melting of snow mass at temperatures from 0^0 to 5^0 C (g)



Graph 2. Dynamics of melting of snow mass at temperatures from 0^0 to -5^0 C (g)

Graph 1 shows that the slowest trend in snow melting was recorded in the control group of snow that was not treated with solutions, which is the expected result. Observing urea as a solvent, at temperatures above zero, the slowest melting dynamics was recorded in solution A4, while solutions A1 and A2 were the most effective with the largest drop in snow mass.

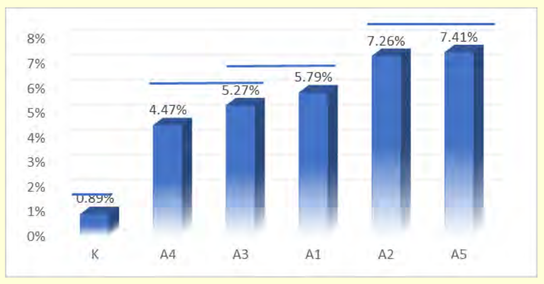
Table 1. Average change in snow mass (in percent) at temperatures from 0^0 to 5^0 C

Solution	Average per 1 h (%)	Average per 24 h (%)
A1	5,79%	50,38%
A2	7,26%	53,11%
A3	5,27%	57,71%
A4	4,47%	36,07%
A5	7,41%	54,75%
K	0,89%	7,68%
ANOVA	F=294,4 P=0.000***	F=1527,8 P=0.000***

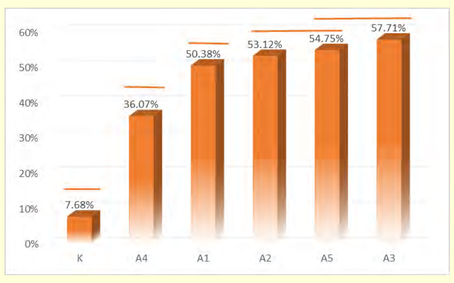
A1- 5% urea solution, A2- 10% urea solution, A3- 15% urea solution, A4- 20% urea solution, A5- 30% urea solution, K- control

Table 1 shows the average percentage change in mass of snow melted by different solvent concentrations and comparison with the control group. Melting of the mass expressed as a percentage was monitored through one hour of action and through 24 hours.

Table 2 shows the average changes in snow mass for all concentrations of urea solutions and the control group, monitored over a period of 1 hour and 24 hours, at sub-zero temperatures. Table 2 provides the average percentage changes in the snow mass decrease, monitored over a period of 1 hour and 24 hours, i.e. one day, when treated with different concentrations of urea solution at temperatures ranging from 00 to -50C.



Graph 3. Differences in snowmelt rate per 1 hour at temperatures from 0^0 to 5^0 C



Graph 4. Differences in snowmelt rate per 24 hours at temperatures from 0^0 to 5^0 C

The blue lines above each column on the graph represent the result of the Tukey test, which compares all tested urea concentrations to the control sample. Columns below these lines show no statistically significant difference (sig>0.05), while others show no statistically significant differences between them (sig<0.05). Graph 4 shows the changes observed over a period of 24 hours. The lines in graph 4, located above each column, represent the result of the Tukey test, which compares all solvents used to the control sample. The graph shows that the statistically significantly best result in snow melting per 24 hours was achieved through the application of solutions A3 and A5 (which do not differ significantly), over 54% of the snow mass in one day. They are followed by solution A2 which showed a significantly weaker result compared to solution A3, but not compared to solution A5. A significantly weaker result than the aforementioned solutions was produced by solution A1, followed by solution A4. Statistically significantly, snow melted most slowly in untreated control samples, only 7.68% of snow mass per day.

Table 2. Average changes in snow mass (in percent) at temperatures from 0^0 to -5^0 C

Solution	Average per 1 h (%)	Average per 24 h (%)
A1	3,46%	18,28%
A2	2,69%	29,93%
A3	1.31%	7,81%
A4	1,27%	15,71%
A5	1,66%	16.28%
K	0,68%	3,78%
ANOVA	F=45,4 P=0.000***	F=249,7 P=0.000***

A1-5% urea solution, A2- 10% urea solution, A3- 15% urea solution, A4- 20% urea solution, A5- 30% urea solution, K- control

Conclusion

- At temperatures from 0^0 to 5^0 C or from 0^0 to -5^0 C, the slowest dynamics of snow mass melting was recorded in the control group that was not treated with solutions. 5% and 10% urea solutions showed the best snow melting effect, providing the fastest decrease in snow mass.
- The statistically significantly best results in melting snow at temperatures from 0^0 to 5^0 C, and over a period of 1 hour, were achieved by the application of urea solutions with a concentration of 10 and 30%, which on average melted over 7% of snow mass per hour. Significantly weaker result was achieved by the application of urea solutions with a concentration of 5%, 15% and 20%.
- When it comes to the effect of the solutions at temperatures ranging from 0^0 to -5^0 C, examined through the melting of the snow mass per hour, different results were recorded. A 10% urea solution proved to be the best, melting on average about 3.5% of snow mass per hour.

31st International Scientific - Expert Conference of Agriculture and Food Industry "Future of Agriculture, Agriculture of Future"

MORPHOLOGICAL CHARACTERISTICS AND YIELD OF CUCUMBER DEPENDING ON GRAFTING

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INTRODUCTION

Talking about a widespread type of vegetable - cucumber (Cucumis sativus L) means that we should immediately emphasize how widespread it is in our country, both in food and production. Based on that, there is an urgent need for quality and disease-resistant varieties / hybrids of technological production, which reduces the possibility of disease. When it comes to the method of growing cucumbers, in recent years in our areas there is a grafted method of cultivation as a relatively successful method of cultivation. The example of the grafted method will be comparatively analyzed with the non-grafted one, in order to, on the basis of morphological and productive differences, successfully record the main characteristics - both of them. The experimental analysis was based on the CHARTA hybrid. The examined parameters are: number of lateral roots, number of root hairs, roots mass, individual size, leaf length, yields.

The results of this study show that the cultivation of grafted cucumber in relation to ungrafted achieves a higher yield compared to non-grafting morphological characteristics of statistically significant differences were observed only in the number of lateral roots.

RESULTS AND DISCUSSION

It can be concluded that there are significant differences in the number of lateral roots of grafted and ungrafted seedlings. Based on the results, a significantly higher number can be seen in grafted seedlings.

t can be concluded that there are no significant differences in the number of root hairs between grafted and ungrafted seedlings. Furthermore, there is a slightly higher number of root hairs in grafted plants.

The root mass of grafted seedlings is slightly higher than the root mass of ungrafted ones.

Based on the leaf length measurements, it can be concluded that there are no significant differences or deviations between grafted and ungrafted seedlings.

There are also no significant deviations in the crop length between grafted and ungrafted seedlings.

Based on the results, it can be concluded that there are statistically significant differences in the fruit yield of grafted and ungrafted plants.

Table 1. Measured parameters for grafted and ungrafted seedlings

	The number of lateral roots	The number of root hairs	Root mass	Crop length	Leaf length	Yield
GRAFTED SEEDLING	18± 2.65	3.58± 0.29	10.60± 1.48	20 ± 1	19.83 ± 1.04	106.62± 20.82
UNGRAFTED SEEDLING	10.67± 1.53*	3.08± 0.63	8.31± 4.28	19 ± 0.5	18.17 ± 1.26	161.67± 17.56*

* The mean difference is significant at the 0.05 level between grafted and ungrafted seedling.

MATERIALS AND METHODS

The studied hybrid is CHARTA, which belongs to the family of cucurbits. The hybrid has dark leaves throughout the whole season and long and juicy cucumber fruits. The fruits are usually 21 to 24 cm in length, and they have a high fruitfulness potential. The hybrid is of medium exuberance.

The experiment took place in an experimental field in Butmir (Sarajevo, Bosnia and Herzegovina), a part of the Faculty of Agriculture and Food Sciences of University of Sarajevo, from June to September of 2019. This area has a moderate continental climate with warm summers and cold winters. The year 2019 was quite warm, and it had fewer rainless days than rainy ones.

The following parameters were studied:

- The number of lateral roots;
- The number of root hairs;
- The root mass;
- The individual size;
- The leaf length;
- The yield.

The number of lateral roots and root hairs was determined by ***visual observation***. By using the microscope, this method was used for determining the number of root hairs and counting. This method does not require reagent preparation any other steps. The determination of dry matter was done by using the desiccator at 40 degrees for 24 hours. A certain amount of cucumber was chopped up into smaller pieces and placed in a separate plastic container. A filter paper was placed earlier in the container, then it was soaked with distilled water and put to dry.

The data were processed in Excel using the independent t-test, as two samples were analyzed.

CONCLUSIONS

Moreover, we can see greater resistance of grafted plants compared to ungrafted plants. Due to the weight of the root system, grafted plants are much more resistant to drought, and they have a 20% lower need for water. They have also shown greater resistance and adaptation upon grafting than ungrafted plants.

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INFLUENCE OF PYROPHYLLITE AS A SOIL CONDITIONER ON PRODUCTIVITY AND ACCUMULATION OF NITRATE IN LETTUCE (*Lactuca sativa* L.)

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INTRODUCTION

Lettuce (*Lactuca sativa* L.) is a leafy vegetable rich in vitamins, especially vitamin C, minerals, and other biologically active substances with high antioxidative properties. On the other side lettuce is considered to be a high source of nitrate. Nitrate itself is relatively nontoxic, but it may be endogenously transformed to nitrite, which can react with amines and amides to produce N-nitro compounds that have been related to an increased risk of diseases. It can grow year-round and produce a large quantity of yield. However, produced lettuce receives large applications of mineral fertilizers. Nowadays consumers are more concerned about food quality than yield alone. Besides, fertilization-related environmental problems are also big concerns of society. The aim of this study was to evaluate whether the application of pyrophyllite could reduce the use of mineral fertilizers in lettuce production without adverse effects on its yield and quality.

MATERIALS AND METHODS

The research was conducted in winter 2019/2020 in a greenhouse without a heating system, in the region of Srebrenik, Bosnia and Herzegovina. The experiment was set on split plot method with three repetitions with substitution of fertilizers with pyrophyllite in amounts of 25% (T_2), 50% (T_3), and 75% (T_4) of recommended fertilizer compared to the control treatment i.e. 100% recommended fertilizer rate (T_5). Soil pH in KCl, organic matter, available phosphorus (P_2O_5), and potassium (K_2O) contents in the 0-30 cm studied soil layer before lettuce planting were 5.1, 3.83%, 15.1 mg/100g, and 31.3mg/100g, respectively. The size of each plot was 2 m^2. The pyrophyllite materials used in this study came from deposits in Parsovići-Konjic, Bosnia, and Herzegovina. Fertilizers and pyrophyllite material were applied ten days before lettuce planting.

The lettuce (*Lactuca sativa* L. var. Shangore) was produced from seedlings planted on black PE foil, at a spacing of 20 x 20 cm.

During the production cycle, all standard measures for the cultivation of lettuce on foil were employed.

At technological maturity, lettuce samples were collected for analysis. Lettuce heads were weighed on digital scales. The average weight of heads and yield per square meter were calculated from the measured values.

The content of nitrates and phosphorus was determined using the colorimetric quick test procedure HACH. Fresh leaves were chopped and pressed in a hydraulic press to express plant sap.

Average values of the parameters in the study were statistically processed with a computer, using software SPSS. Data analysis was performed using the Analysis of Variance (ANOVA) and Dunnett t-test.

RESULTS AND DISCUSSION

Table 1. shows the effect of pyrophyllite material as a soil conditioner on productive characteristics and concentrations of NO_3^-, P, PO_4^- of lettuce. As presented in Table 1. the application of pyrophyllite material in any variant did not negatively affect the mass of the formed head of cultivated lettuce in relation to the control, moreover, the mass of the head of lettuce, and thus the yield was generally higher in variants where pyrophyllite material was applied as a substitute for part of the fertilizer. The highest yield was obtained in treatment T_2 and T_3 where pyrophyllite material was applied as a replacement for 25% and 50 % of recommended fertilizer rate. The treatment (T_4) where 75 % of recommended mineral fertilizers are replaced with pyrophyllite material did not show a positive effect on lettuce yield. On the other side, the lowest waste of lettuce leaves was achieved with treatment T4. Based on the obtained results, we can conclude that the variants in which pyrophyllite ore was applied in larger quantities had a positive effect on reducing the% of waste leaves in lettuce. The nitrates content ranged from 396,66 to 800,00 mg per kg (Table 1), it shows that the lettuce produced in this research had a significantly lower level of nitrate than the upper limit allowed by the Ordinance of BiH (Official Gazette of BiH, No. 68, page 39). The results of this study also showed that treatments with pyrophyllite, to a greater or lesser extent, decreased the content of nitrate of lettuce, especially where pyrophyllite material was applied as a replacement for 75% of recommended fertilizer rate (T_4).

Table 1. Productive characteristics and concentrations of NO_3^-, P, PO_4^- (mg/kg dry mass).

Treatment[1]	Leaf yield plant (kg)	Waste leaves (%)	Commercial yield (kg/m^2)	Nitrate concentrations NO_3^-	Concentrations of P, PO_4^-
T_1	0,43 ± 0,50	6,19 ± 0,68	6.57 ± 0,65	800,00 ± 11,55	826,67 ± 5,77
T_2	0,60 ± 0,08*	5,74 ± 0,92	9,02 ± 0,75*	793,33 ± 0,00	820,00 ± 17,32
T_3	0,57 ± 0,08*	5,36 ± 1,10	8,77 ± 0,40*	500,00 ± 0,00*	833,33 ± 5,77
T_4	0,43 ± 0,09	4,60 ± 6,16	6,50 ± 1,32	396,66 ± 5,77*	773,33 ± 25,16*

* The mean difference is significant at the 0.05 level.
Dunnett t-tests treat one group as a control (T_1), and compare all other groups against it.

CONCLUSIONS

The results of this study showed that substitution of fertilizers with pyrophyllite in the amount of 25% (T_2) and 50% (T_3) of recommended fertilizer rate under experimental conditions increase lettuce yield and quality compared to the control treatment i.e. 100% (T_4) recommended fertilizer. Accordingly, this approach to fertilization with reduced use of mineral fertilizers makes an immeasurable contribution to environmental protection. Also, the possibility of leaching nutrients from the zone of the root system of the plant into the lower layers of soil and groundwater is reduced, which gives great ecological significance to this type of fertilization. The obtained results indicate that the application of pyrophyllite in the appropriate ratio with mineral fertilizer can increase the yield without a proportional increase in the accumulation of nitrate in lettuce leaves, which is reflected in the quality of lettuce.

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EFFECT OF APPLİCATİON OF DİFFERENT AMOUNTS OF NİTROGEN AND STAGES OF PLANT DEVELOPMENT AT CUTTİNG ON YİELD AND FORAGE VALUE OF GRASSLANDS

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Introduction

Grasslands in Bosnia and Herzegovina (natural and sown) account for over 50% of the total agricultural land. However, although grasslands occupy large areas they are not optimally used. Inadequate use without the application of nitrogen fertilizer as well as cutting in the late stages of plant development have a negative impact on producing good quality forage and achieving high and stable yields. As the quality of biomass and grassland productivity largely depend on soil fertility, botanical composition, and stage of plant development at cutting, the aim of the research was to determine the influence of the application of different amounts of nitrogen fertilizer and the stage of plant development at cutting on dry mass yield, crude proteins and grassland microbial activity.

Materials and methods

The experimental trial was set up in early April 2018 on a grassland that was previously sown in 2011, located at the Butmir agricultural estate near Sarajevo, using a random block system, in four replications. The size of the plot was 5 m².

The experiment area was fertilized in early spring with nitrogen fertilizer. The experiment examined the effect of applying different amounts of nitorgen 0 (N0 control), 50 (N50), 70 (N70), and 90 (N90) in two phases of cutting (cutting at the grass earing phase and cutting at the grass flowering phase) and microbial activity of the soil. The total dry mass yield was determined on the basis of the green mass yield obtained at cutting, and the dry matter content. The content of total nitrogen in plant mass was determined by the Kjeldahl method.

Results and discussion

Table 1. Impact of nitrogen application and plant development stage on dry mass yield (t/ha^{-1})

Variant	Cutting regime	
	Earing	Flowering
Control (N_0)	7,54 c	8,95b
Fertilization N_{50})	8,95bc	11,86a
Fertilization (N_{70})	10,06ab	12,28a
Fertilization (N_{90})	11,07a	13,19a
Average	9,40	11,57

Table 2. Impact of nitrogen and plant development stage on crude protein yield (kg/ha^{-1})

Variant	Cutting regime	
	Earing	Flowering
Control (N_0)	789,18c	767,11c
Fertilization (N_{50})	1071,30b	1125,18b
Fertilization (N_{70})	1072,80b	1079,35b
Fertilization (N_{90})	1504,32a	1152,95a
Average	1109,40	1031,14

Table 3. Total number of bacteria in the soil under the grassland fertilized with different doses of nitrogen in the grass earing phase

Variant	Actinomycetes CFU x 10^3/g	Fungi CFU x 10^2/g	Total number of bacteria CFU x 10^5/g	Total number of ammonifiers CFU x 10^4/g
Control (N_0)	7,2	404,4	915,5	9,4
Control (N_0)	11,1	373,3	922,2	8,9
Fertilization (N_{50})	7,5	231,1	862,2	10,4
Fertilization (N_{50})	7,5	211,1	675,5	10,8
Fertilization (N_{70})	13,3	202,2	568,8	6,7
Fertilization (N_{70})	15,5	198,8	604,4	6,6
Fertilization (N_{90})	18,3	182,2	553,3	4,0
Fertilization (N_{90})	20,5	173,3	462,2	3,8

Table 4. Total number of bacteria in the soil under the grassland fertilized with different doses of nitrogen in the grass flowering phase

Variant	Actinomycetes CFU x 10^3/g	Fungi CFU x 10^2/g	Total number of bacteria CFU x 10^5/g	Total number of ammonifiers CFU x 10^4/g
Control (N_0)	20,3	255,5	1244,4	10,6
Control (N_0)	20,8	242,2	1280,5	10,2
Fertilization (N_{50})	22,2	120,1	977,7	12,7
Fertilization (N_{50})	24,4	107,7	995,5	13,1
Fertilization (N_{70})	17,7	98,2	623,3	9,5
Fertilization (N_{70})	20,6	89,4	686,4	8,8
Fertilization (N_{90})	22,5	70,7	584,1	6,3
Fertilization (N_{90})	26,6	60,8	575,5	5,9

Conclusions

Based on the results of research on the effects of the application of different doses of nitrogen and the phase of plant development at cutting on the yield and forage value of grasslands, the following conclusions can be made.

Dry mass yield in the earing and flowering phases was the highest in the variants that were fertilized with 90 kg N ha^{-1}, and the lowest in the control variant.
A statistically significantly higher dry mass yield was achieved when cutting was performed in the grass flowering phase compared to the grass earing phase (except for the control variant N0).
A statistically significantly higher crude protein yield was achieved in variants (N0 and N90) compared to the yield achieved with the cutting regime in the grass flowering phase.
The application of nitrogen on grassland had a positive impact on increasing the yield of dry mass and crude proteins, particularly the applied doses of above 50 kg N ha^{-1}.

The examined parameter of soil microbiological activity, the number of ammonifiers, showed the dependence on the phenophase of the plant and the amount of applied N fertilizer. The application of smaller amounts of N fertilizers increased the number of ammonifiers, while large amounts of N fertilizers had an inhibitory effect.

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Phenological Characteristics Of Sweet Cherries Varieties On GiSelA 6 Rootstock In Herzegovina Region

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Introduction

In the last 20 years, in Herzegovina area, has been working to increase the intensity of sweet cherry production by introducing new cultivars in combination with low to medium vigor rootstocks, such as Gisela 5 and Gisela 6, Colt, et cetera. However, these cultivars/rootstocks combinations have not yet been sufficiently researched in this area.

The phenological characteristics (flowering and harvest date) of sweet cherry depend on the combination of cultivars/rootstocks, type of soil and agroecological growing conditions (Šupljeglav–Jukić et al., 2020). Knowledge of phenological characteristics is important for the correct choice of species, cultivars and pollinators (Lisandru et al., 2017).

Key words: cherry, ecological conditions, phenology of flowering

Purpose

The aim of this study was to research the phenological characteristics (flowering and harvest date) of sweet cherry (Prunus avium L.) cultivars Early Lory, Kordia and Regina grafted on rootstock Gisela 6 colluvium soil type in Submediterranean Herzegovina (the southern part of Bosnia and Herzegovina).

Methods

A field experiment was conducted in commercial field „Jaffa komerc" Blagaj (43°16' 58.44" N 17°50' 45.16" E; 45 m above mean sea level) in Herzegovina during the period of two years (2020–2021). Flowering was recorded by recommendations of the International Working Group for pollination: start of flowering – 10% open flowers, full bloom – 80% open flowers, end of flowering – 90% of the petal fall (Wertheim, 1996). The maturation period (start and end of maturation) was considered when fruits developed adequate quality characteristics (color parameters, soluble solids contents, firmness) for the consumption.

Meteorological data and characteristics of soil

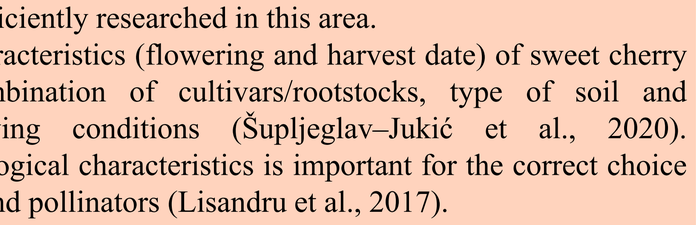

Figure 1. The average of multi-year (1971–2000), average monthly temperature (left) and precipitations (right) (January–June (2020–2021))

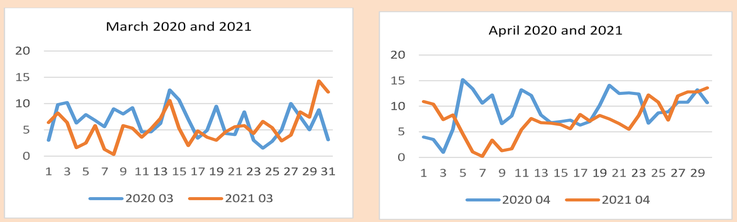

Figure 2. Absolute minimum daily temperatures of air for March and April (2020–2021)

Table 1. Textural composition of the soil at the experimental orchard in Blagaj

Depth (cm)	Textural composition of the soil %			Texture mark (USDA)
	Sand	Clay	Silt	
0–30	69	23	8	Sandy Loam
30–60	66	25	9	Sandy Loam

Table 2. Chemical properties of soil at the experimental locality Blagaj

Soil type	Colluvial soil	
Depth (cm)	0–30	0–60
pH in H_2O	8.04	8.16
pH in KCl	7.35	7.39
Total $CaCo_3$ (%)	42.32	39.73
Active Ca (%)	4.25	4.25
Humus (%)	5.12	3.78
Total N (%)	0.34	0.31
Active P_2O_5 (mg/100 g)	9.49	9.21
Active K_2O (mg/100 g)	47.76	44.90

Results

Phenological phase of flowering

Phenological phases of flowering	Early Lory		Kordia		Regina	
	2020	2021	2020	2021	2020	2021
Start	18.3.	20.3.	6.4.	1.4.	10.4.	3.4.
Full	21.3.	24.3.	9.4.	5.4.	13.4.	6.4.
End	28.3.	1.4.	21.4.	17.4.	22.4.	18.4.
Duration (days)	10	12	15	16	12	15

The start of flowering depends on the cultivar and climatic characteristics of the growing area, can vary from year to year. The beginning of flowering is also influenced by air temperatures before flowering, as well as temperatures during the period of winter dormancy.

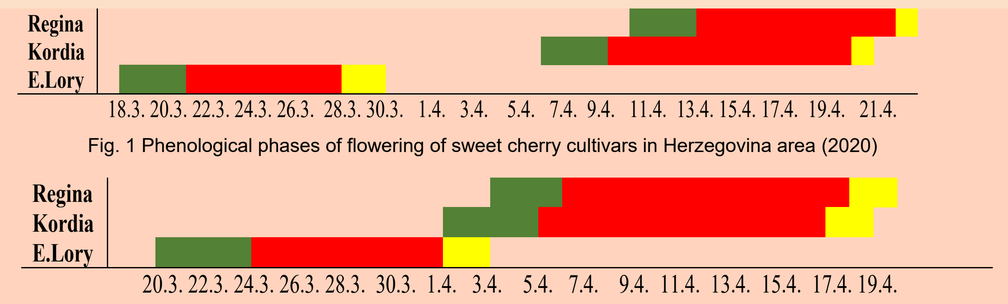

Fig. 1 Phenological phases of flowering of sweet cherry cultivars in Herzegovina area (2020)

Fig. 2 Phenological phases of flowering of sweet cherry cultivars in Herzegovina area (2021)

Phenological phase of maturation

Phenological phases of maturation	Early Lory		Kordia		Regina	
	2020	2021	2020	2021	2020	2021
Start	1.5.	12.5.	15.5.	27.5.	18.5.	29.5.
End	19.5.	29.5.	2.6.	12.6.	6.6.	18.6.
Duration (day)	18	17	18	16	19	20

Discussion & Conclusions

The start of flowering in 2020 was from 18.3. (Early Lory) to 10.4. (Regina), while in 2021 it was from 20.3. to 3.4. The variation of the start of flowering between the cultivars in 2020 was 23 days, and in 2021 was 14 days. The variations by years were 2–7 days.

The start of maturation in 2020 was from 1.5. (Early Lory) to 18.5. (Regina), while in 2021 it was from 12.5. to 29.5. The differences in the start of maturation between the years were 11–12 days. Namely, a significant influence of the year was established, because the weather conditions were significantly different in the years of the study.

•Conclusions

•Based on two–year studies of the phenology of flowering and maturation of sweet cherries, we can conclude the following:

- Sweet cherry is a species that is very sensitive to temperature of ait in the period before flowering and during flowering;
- The phenosase of flowering was influenced by cultivar and meteorological characteristics in the years of study;
- Also, climate change is evident, which includes warmer winters and a greater possibility of late spring frosts, and knowledge of the phenology of flowering of the introduced cultivars in the given ecological conditions is of exceptional importance.

Recommendation

These cultivars have not yet been sufficiently researched in Herzegovina area, so it is recommended to investigate their adaptation to the Herzegovina area, as well as compatibility with different rootstocks.

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Conflict of Interest

The authors have no conflict of interest to this paper.