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Vth INTERNATIONAL EURASIAN AGRICULTURE AND NATURAL SCIENCES CONGRESS

PROCEEDING BOOK

23 OCTOBER 2021

ONLINE CONGRESS

Vth INTERNATIONAL
EURASIAN AGRICULTURE AND
NATURAL SCIENCES CONGRESS

IMPRESSUM

Vth International Eurasian
Agriculture and Natural Sciences Congress
2021

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ISBN
978-605-69010-3-4

Website
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PREFACE

The International Eurasian Congress of Agriculture and Natural Sciences is a series of congresses that bring together all partners of agriculture, food and related natural sciences. The congress was held in Bishkek, the capital of Kyrgyzstan in 2017, and in Baku, the capital of Azerbaijan in 2018 and in Antalya/Turkey in 2019, and online congress in 2020. It was planned to be held in Odessa, Ukraine in 2021 but it had to be done online in 23 October 2021 due to the COVID-19 pandemic.

A total of 25 oral papers were presented at the online congress with the participation of valuable scientists from different countries. Besides oral presentations, 25 poster papers were also presented at our congress. Today, sustainable agriculture and food supply have become an essential component of the independence of governments. Although the name of our congress is Eurasia, the main purpose of our congress is to bring together scientists who are actively working with agriculture, food, and natural science. For this purpose, valuable scientists from different countries participated in our congress and shared their valuable work with the other participants. Researchers from countries such as Turkey, Ukraine, Kyrgyzstan, Chile and Pakistan took their place in our congress. In the presentations, different problems, approaches and solutions serving different areas of agriculture were discussed deeply in different sessions. From this point of view, people working in similar research fields had the opportunity to exchange ideas, solutions or experience with each other. Thus, the congress served its main mission both by bringing together scientists from various countries and was a successful convention process in developing the culture of common sense and cooperation. In other words, it was aimed to contribute to the development of the culture of common sense and cooperation between countries and to introduce the scientific wealth of our country to other scientists, and to form the basis of scientific unity in certain research areas.

In this context, we would like to thanks Prof. Dr. Cumhur COKMUŞ the Rector of Konya Food and Agriculture University, Prof Dr Metin AKSOY the Rector of Selçuk University, Prof Dr Cem ZORLU the Rector of Necmettin Erbakan University, Prof Dr Mykhailo BROSHKOV the Rector of Odesa State Agrarian University, and Prof Dr Alpaslan CEYLAN the Rector of Kyrgyz Turkish Manas University for their valuable contribution to our congress as honorary president.

Prof. Dr. Önder TÜRKMEN

On Behalf of the Organizing Committee

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SOMALI AGRICULTURAL AND LIVESTOCK NOMADIC PRODUCTION

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Abstract:

Somalia is located in the horn of Africa, the landmass of Somalia is dominated by arid and semi-arid rangelands for which pastoralism is the most appropriate form of land use. Livestock not only constitutesthe main livelihood of the pastoralists, but also represents the main component of the gross domestic product of the economy of the country. In Somalia at present, only pastoralists and agro-pastoralists are practising for that reason all basic livestock data are remaining in the hands of Nomads and agro-pastoralists. Despite the conflict and instability that has been witnessed in Somalia over the past two decades caused the collapse and destruction of livestock institutions, but the livestock sector has continuedto be the main economic activity. Somali livestock experts have passed a long period in which they have remained far from the sector, which caused a lack of modern technology and research institutions. This makes the situation more complex in order to find the actual data of the livestock sector. Animals are all dependent on rangeland resources by utilizing a free-grazing system. As with most pastoral areas, it is affected by environmental changes and rangeland degradation, mainly due to increased population pressure, overstocking, no grazing management plans (overgrazing) and vegetation removal for fuelwood (deforestation), and no apparent authority of rangeland ownership. In terms of maintaining livestock production, research needs to increase. The establishment of animal marketing, veterinary services and drought mitigation strategies is essential. The introduction of a zero-grazing system gives a chance to restore degraded pastures and reduce excessive pressure on fewer plants.

Keywords: Somali, Rengland, Livestock, Pastoralism

1. Introduction

1.1 The Environment of Somalia:

The Republic of Somalia is located in the east of the African continent; It has borders with Ethiopia, Kenya and Djibouti. Somalia has an area of approximately 638,000 km2 and has a coastline of

approximately 3333 km. the altitude increases, precipitation increase and some of the area in the western part receives as much as 20 inches of precipitation per year, equal to 9 kg(Box, 1968).

The rainy season in East Africa is divided into two distinct seasons. Long rains, from April to June (Gu); It generally accounts for more than 60% of the annual precipitation. Short precipitation occurs between September and November (Desta, 2016). Northern Somalia is usually colder, the average monthly temperature change is around 15-25°C, and in the south - around 25-35 °C.

1.2 Geographical Features

Nomadic animal husbandry, which is the most suitable form of livestock activity for the territory of Somalia, is carried out depending on arid and semi-arid pastures. In Somalia, 55% of the land is pastures, 19% is residential lands, 14% is forests and 12% is suitable for agricultural product cultivation. in 1990, the amount of cultivated land was estimated at 8.2 million hectares.

2. Livestock Productıon System In Somalia

As the livestock production system in Somalia, nomadic livestock (Pastoral) and settled livestock (Agro-pastoral) models are used.

The main herd animal species are camels, sheep, goats and cattle, with the number of livestock estimated at 7.2 million camels, 4.9 million heads for cattle, 11.5 million heads for sheep and 11.6 million heads for goats (A. Muigai et al., 2016).

Table 2.1 the number of animals in Somalia (million heads).FAOSTAT (2014–2018)

Year	Camel	Cattle	Goat	Sheep
2014	7,150,000	4,900,000	11,600,000	12,325,000
2015	7,212,732	4,890,346	11,648,453	11,974,491
2016	7,229,221	4,850,000	11,582,464	11,561,176
2017	7,225,419	4,800,000	11,576,726	11,000,000
2018	7,243,771	4,749,973	11,536,738	10,649,679

As we have mentioned in the table above, there is no big difference in the number of camels, cows and goats in the last five years. but in sheep, there is a great decrease in the number of sheep due to excessive consumption, slaughter and export.

Before the civil war that started in Somalia in 1991, there were some livestock enterprises (two important cattle farms in the south of the country, a sheep and a cattle farm in the north, and three important poultry enterprises) and while livestock was in the progress stage, the trial farms established by the state were distributed during the civil war.

Animal breeding systems in Somalia vary according to the climatic conditions of the region, labor supply, animal species and herd size, with a higher rate of nomadic livestock in the northern and central regions, and a lower rate of nomadic livestock and agricultural production in the southern regions. People migrate seasonally, seeking pasture and water-rich areas to graze their animals (White et al., 2001).

2.1 Nomadic Livestock System:

Nomadic livestock breeders; It is defined as those who migrate with the herds to graze their animals in the pasture and obtain all of their income from animals and consume the products themselves, although it varies depending on environmental conditions (KILIÇ, 2014).

In general, nomadic/animal mobility occurs during long dry periods and times of drought, while less during the rainy season (Headey, Taffesse, & You, 2014). Some factors have an effect on the animal species raised by nomads, these are; are factors such as the chance of the area to have a source of water and fodder, and the endurance of the animals as they move from pasture to pasture.

In the southern parts of Somalia, cattle breeding is common due to the abundant aridity, while the breeding of goats and camels is more common in the rainier central and northern parts (Amaha Kassahun, 2006) .

In the nomadic livestock system, all of the animals are dependent on pasture resources by using the free grazing system, although there is plenty of plantable land, they do not grow fodder, they do not apply forage storage methods (silage, hay), therefore they face a shortage of roughage in dry seasons and this situation is restrictive in the whole country. creates an effect. The yields obtained from animals are very low due to the fact that quality animal feeding methods are not applied adequately (Shire, 2015).

2.2 Settled livestock system

Farm fields, it is a livestock activity that is carried out by a family on a resident basis. there are several different types; It can be done in large herds, in small herds or with a few animals. While

this production system was used in the south and northwest regions of Somalia, it has now spread to all regions. It is seen that it is widespread even in arid and unproductive regions because natural pastures are getting worse and becoming unusable for animal husbandry (De Waal, 2007)

In the settled livestock system, there is a division of labor among family members. While most of the herd is fed off-farm, some are left on the farm to get milk. Family members staying on the farm are also engaged in agricultural work (grain cultivation). Generally, animals are taken out for grazing due to the abundance of grass in the rainy season. Roughage (wheat, barley and sorghum straw and corn product) is also produced for the dry season.

3. The Presence and Composition of Animals in Somalia

The northwest, northeast and the center of the country are largely raising camels, goats, sheep and a small number of cattle. On the Hiran side, the number of cattle is high due to the heavy rainfall. There are also sheep, goats and camels. Cattle farms in middle Shabelle and lower Shabelle are common settled livestock system(L. G. Mugunieri, Costagli, Abdulle, Osman, &

Omore, 2012) In most of the bakol herd, cattle, camels and goats are bred with an settled livestock system. Juba is the main cattle region, but also camels and goats are raised.

Number and types of animals according region (FSAU 2017 data)

Region	**Camel (Head)**	**Camel Percentage Distribution (%)**	**Cattle (Head)**	**Cattle Percentage Distribution (%)**	**Sheep (Head)**	**Sheep Percentage Distribution (%)**	**Goat (Head)**	**Goat Percentage Distribution (%)**	**Total of Number of animals (Head)**
Kuzey Bati	**1 684 702**	**4.65**	**408 960**	**1.13**	**5 837 320**	**16.13**	**6 790 000**	**18.76**	**14 720 982**
Kuzey	**1 224 142**	**3.38**	**135 890**	**0.38**	**3 448 720**	**9.53**	**3 096 180**	**8.6**	**7 904 932**
Orta	**1 179 782**	**3.26**	**461 860**	**1.28**	**109 868**	**0.30**	**370 580**	**1.02**	**2 122 090**
Güney	**1 393 912**	**3.85**	**1 340 870**	**3.70**	**707 020**	**1.95**	**1 860 110**	**5.14**	**5 301 912**
Güney doğu	**1 293 902**	**3.57**	**2 061 850**	**5.70**	**741 860**	**2.05**	**2 047 800**	**5.66**	**6 145 412**
Toplam	**6 776 440**	**18.72**	**4 409 430**	**12.18**	**11 586 648**	**29.96**	**14 164 670**	**39.13**	**36 195 328**

In Somalia, the animal species and numbers reared according to the regions mostly raise goats, camels and a small number of sheep and cattle in the northwest, the north and the middle. In the middle, the number of camels is high due to heavy rainfall. There are also sheep, goats and cattle. Cattle herds managed by the middle Shabelle and lower Shabelle settled livestock system are common in the south and southeast, the main cattle and goat areas, as well as camel and sheep raising.

4. The Indigenous Animal Breeds of Somalia (Goats,Sheep, cattle and Camels)

Indigenous animals of Somalia, a few well-known breeds cattle (Somali Boran, Surqo breed, Gasara, Dauara), camel (all camels in Somalia are single-humped Arabian camel (Camelus dromedarues)), sheep (Somali sheep black head) sheep are the dominant species), goats (the main goat species found in Somalia are the long-eared Somali goat and the short-eared Somali goat) and a wide variety of livestock species, including chickens. In Somalia, animals are grazed in a wide geography (in Somalia and Djibouti, Ethiopia and Kenya), as the nomadic livestock method is common (A. Muigai et al., 2016). Chicken farming does not occupy an important place economically among livestock branches.

5. The General Situation of the Livestock Sector in Somalia

In addition to cyclical droughts that occur every three to five years, Somalia experiences major droughts every 20-25 years. During each rainy season, loss of important livelihood animals is reported due to excessive flooding and lack of management of water resources. (Maystadt & Ecker, 2014).

In the last thirty years, due to the insecurity and civil war witnessed in Somalia, the disorganization of the trade structure, the insufficient support of livestock, the lack of animal records, the lack of strategic planning for the use of local resources, as well as the privatization of some formerly common areas by nomads, the expression of the livestock sector. it actually caused it to collapse. The main problems in the livestock sector are insufficient veterinary services and lack of disease surveillance, weakening of trade and exports, overgrazing and soil erosion in some areas, and lack of adequate water resources. There is a need for formal education and training to increase the capacity of nomadic systems, because the transition to the modern agricultural system will increase productivity and increase job opportunities. Feed industries need to be established in order to reduce the overall demands of pasture in livestock and to prevent overgrazing. Persistent policies are needed to reduce the environmental impact of animal production and to ensure that the industry makes sustainable contributions to food security and poverty reduction.

Mostly the livestock trade covers the Middle East countries. As a matter of fact, historical, geographical and cultural ties provide this. (G. L. Mugunieri, Mtimet, Enock, Costagli, & Gulaid, 2015). Livestock sales generally increase during Ramadan and Hajj. . As an example, this increase is not seen in all animal species, but only in sheep and goats. There is little change in camels and cattle. It ranks first among the countries with the most important share in the market share; While exporting live animals to Saudi Arabia (traditionally 70% of Somali animals are sold here), Kuwait, Qatar, United Arab Emirates, Oman and Bahrain, these are respectively; It is followed by Yemen, Egypt and Iraq, Jordan, Libya and Malaysia (Wilson, 2016). Livestock exports in Somalia are quite high compared to other countries in the region, and 4.5 million head of animals are exported annually (Elmi, 1989).

Since the arid and semi-arid climate structure is dominant in Somalia, the most appropriate use of the land is animal grazing (Musa, Wasonga, & Mtimet, 2020).

6. Production

Somali breeders primarily raise various animal species together for milk and meat production. Meat and milk production in different ecological regions of the country provides employment and income in both rural and urban areas, especially women. Milk is an important food source for growers, who tend to increase their household consumption during dry seasons. It also makes a significant contribution to the nutrition of the rest of the population (Zampieri et al., 2019).

6.1 Milk production

Fresh milk production in Somalia has been increasing steadily since the early 1990s.

Camel milk is the most important. In 2014, Somalia produced more than 1.1 million tons of camel milk, with a gross market value of $1.65 billion according to FAOSTAT.

It is estimated that an income of approximately 2.7 billion dollars is obtained with total milk production. (Z. Farah, Mollet, Younan, & Dahir, 2007).

Somalia has been the largest producer of camel milk in Africa, where its consumers prefer milking from cows. Camels can produce more milk from low quality feed than other animal species and provide an average yield of 2.5-3.5 liters per day. Findings from dairy value chain studies by FAO in the southern and central region of Somalia, as well as a study in several regions by the Somali Agricultural Technical Group (SATG), confirm these estimates. Milk prices are inversely proportional to the level of production; prices are low when production is high (during the Gu and

Deyr rainy seasons); Low production Hagaa and Jilaal during dry seasons, prices are high. Seasonal accessibility and availability of milk in towns is a major challenge, as most animals are kept outdoors. During dry seasons, as animals move in search of pasture and water, milk is less available and its price increases(Umphlett et al., 2019).

6.2 Meat production

The amount of meat production in Somalia is increasing due to the increase in the urbanization rate and the increase in demand due to population growth. Beef represents the largest share of production. The meat trade is almost exclusively for the local market; fresh (chilled or not frozen) meat is preferred here. Meat is sometimes provided by slaughterhouses owned and managed by local governments. The meat trade is relatively profitable in all urban markets and creates employment and income opportunities for women who dominate meat marketing (Yohannes Mehari & Gebru, 2007).

The biggest constraints to domestic meat marketing relate to the poor infrastructure and hygiene of slaughtering facilities and meat markets. 2011 study in Somalia revealed that many slaughtering facilities were in poor hygienic condition, lacking drainage facilities, roofs, running water and light. In many cases, it is reported that production is not adequately supervised due to an insufficient number of meat inspectors and the absence of a legal framework for veterinary departments to enforce regulations. Poor hygiene conditions in most meat markets have been reported to leave meat vulnerable to contamination (Rembold, Oduori, Gadain, & Toselli, 2013).

7. Livestock Feeding

The basis of Somali livestock is based on nomadic livestock. Therefore, animals naturally graze on meadows. Therefore, Somali livestock feeding system is not suitable for application. However, in some unusual situations, animals can be fed indoors by giving them hay, straw and grains. However, this is rarely seen. Somalia exports a large number of animals to Arab countries. These animals are fed at the gate at the quarantine points where they are exported and are fed with dry grass from different meadow species (Unruh, 1991).

8. Irrigation

Due to the prevalence of nomadic livestock in Somalia, animals cannot find enough water especially in dry seasons (summer and winter) when there is no rain. Therefore, they have to use water

sparingly during these periods. In dry periods; Sheep and goats are irrigated every 4 days, cattle every 2 days, and camels once every 10 days. Even in very harsh conditions, the drinking interval of camels is reduced to once a month (Unruh, 1995).

9. Agricultural Trade Sector

Somalia's foreign trade was mostly in agricultural products. Agricultural exports represented 93 percent of total exports before the war in early 2010. There has been a lot of change in export figures in the last thirty years.

The comparison between the country's exports and imports (Million USD)

	1981-85	1986-90	1991-95	1996-2000	2001-05	2006-10	2011-14	2015
Total Agricultural Exports	115	109	93.7	112.3	141.1	208.9	518.1	634
Total exports	**119.6**	**114.3**	**102.5**	**119.9**	**169.5**	**282.5**	**559.1**	**688.5**

	1981-85	1986-90	1991-95	1996-2000	2001-05	2006-10	2011-14	2015
Total agricultural imports	118.1	82	84.7	122	201.9	525.9	1,217.90	1,496.80
Total Imports	**297.9**	**279.1**	**144.2**	**167.1**	**288.1**	**719.7**	**1,674.90**	**2,358.00**

Somalia exported $198 million and received $2.23 billion in 2017, resulting in a negative trade balance of $2.04 billion In 2017, Somalia had a GDP of $7.05 billion and a per capita GDP of $478. In the pre-war period, the second largest export item was fruit, mostly bananas, mostly shipped to Italy (Somali also exported grapefruit and papaya) In recent years, fruit export has been limited to some tests made to the Gulf countries.

CONCLUSION

The aim of this study is to examine the nomadic production structure in Somali agriculture and animal husbandry. As the livestock production system in Somalia, nomadic livestock and sedentary livestock are carried out.

Livestock makes up about 60% of the income of the people of Somalia and is one of the countries that export a large amount of livestock in the world. However, it problems in animal nutrition, especially in the supply of feed.

Somalia's foreign trade mostly took place in products for agriculture and livestock sectors. Livestock, the largest export in the early 2010s, earns about $420 million a year, almost seven times the value in the late 1980s.

SOLUTİON AND SUGGESTİON

Mobility allows animals to migrate from areas with the least rainfall to greener areas or places most animals will not reach in the near future. In addition to wells, farms should be established in each village to reduce migration, which may cause disease transmission among animals.

To reduce imports, the government should establish Agricultural extension agencies that encourage farmers to adopt new and improved farming methods.

Farmers should attend all training and workshops related to crop production.

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INVESTIGATION OF PROPAGATION POSSIBILITIES OF *Thymus praecox* (Anzer Thyme) WITH TISSUE CULTURE

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Abstract

Anzer Thyme (*Thymus praecox* Opiz subsp. *caucasicus* var. *caucasicus*) is named after the Anzer plateau in Rize, Turkey, which is located in the East Black Sea region. It is a member of the genus *Thymus* (Lamiaceae family), which has 41 species in Turkey, 24 of which are endemic. Anzer tea is made from fresh and dried *Thymus praecox* Opiz subsp. *caucasicus* var. *caucasicus* leaves. It is also used as a traditional medicine to cure stomach aches, headaches, influenza, cough, and excessive cholesterol. In this study, plant propagation of *Thymus praecox* Opiz subsp. *caucasicus* var. *caucasicus* (Anzer Thyme) in tissue culture conditions was investigated. In order to induce plant regeneration 1 mg/L Kinetin and 1 mg/L Kinetin + 0.1 mg/L NAA were tested on leaf, stem and root explants. MS medium without any plant growth regulators was preferred as control group. All explants were cultured in two different incubation conditions respectively as; 16 hours light and 8 hours dark conditions at 26°C, 3000 lux light source in growth chamber and dark condition at 26°C. According to the results, the highest plant regeneration rates were found in 1 mg/L Kinetin + 0.1 mg/L NAA medium with root, stem and leaf explants respectively as 51.3%, 40% and 27.5%. The lowest plant regeneration rate was found as 5.6% in leaf explants in control medium. As a result, only 1 mg/L Kinetin treatments were efficient in inducing plant regeneration (35.7% in stem, 25.7% in root and 18.8% in leaf explants) but when combined with 0.1 mg/L NAA demonstrated higher regeneration rates.

Keywords: *Thymus praecox*, Anzer Tea, Tissue Culture, Kinetin, Naphthaleneacetic acid

INTRODUCTION

The Eastern Black Sea Region has an important place in terms of plant species. Especially medicinal and high commercial value species among these plants takes attention to the plants of the region and especially the plants belonging to the Lamiaceae family. Also, species of Lamiaceae family are used in folk medicine in the region, apart from being used in industry. In addition, its use as a raw drug in the form of condiments and spices increases its importance even more. Anzer Thyme (*Thymus praecox* Opiz subsp. *caucasicus* var. *caucasicus*) is named after the Anzer plateau in Rize, Turkey (up to 2000 m), which is located in the Eastern Black Sea region (Turumtay et al., 2014). It is a member of the genus Thymus (Lamiaceae family), which has 41 species in Turkey, 24 of which are endemic (Sekeroglu et al. 2007). The plants are widely found in the Anzer district of the Rize province, fresh and dried thyme leaves are locally called Anzer tea. Besides being used as a herbal tea, it is also well known as a traditional medicine for the treatment of stomach ache, headache, influenza, cough and high cholesterol (Orhan et al. 2009). Due to colorful and aromatic flowers, honeybees widely are visiting this plant. Local people believe that Anzer honey, famous for its healing properties, has curative effects on tonsillitis pharyngitis, ulceration, scratches and wounds (Özkırım and Keskin, 2001). Based on the above considerations, *in vitro* tissue and cell culture of *Thymus praecox* Opiz subsp. *caucasicus* var. *caucasicus* has never been studied before. Utilizing plant materials

which can ensure botanical and chemical stability over the increasing process seems to be of crucial importance. In this study, plant propagation of *T. praecox* Opiz subsp. *caucasicus* var. *caucasicus* (Anzer Thyme) in tissue culture conditions was investigated.

MATERIAL AND METHOD

Plant Material

The plants were harvested on plots located in the field trial area of the Faculty of Agriculture, Recep Tayyip Erdoğan University (Figure 2.)

Figure 2. Harvested *T. praecox* Opiz subsp. *caucasicus* var. *caucasicus* from field trial area

Sterilization

The plant materials were washed under running tap water for 1 hour after harvesting. Afterwards, the root stem and leaf parts are taken into separate containers in the sterile cabinet and it was treated with 70% ethanol for 5 minutes. Then it was kept in 20% Tween-20 for 15 minutes and rinsed with sterile distilled water. After these stabilization process, sterilization was completed using 20% NaOCl for 20, 10 and 5 minutes followed by rinsing them 3 times with sterile distilled water for 5 minutes (Figure 3.).

Figure 3. Sterilization process

Tissue Culture Medium Conditions

The explants were planted to MS medium, supplemented with 30 g/L sucrose and 7.5 g/L agar, including 5 seeds of each petri dish.

In order to induce plant regeneration, 1 mg/l Kinetin (S2) and 1 mg/l Kinetin + 0.1 NAA (S3) were used. MS medium without any plant growth regulators (S1) was preferred as control group. All cultures were incubated at two different incubation conditions to induce regeneration; First, explants incubated at 26°C, 16 hours light and 8 hours dark conditions, 300 lux light source in growth chamber. In second place, explants were exposed to dark condition at 26°C.

RESULTS AND DISCUSSION

In line with the findings; all plant parts from which the explants were taken, showed different responses to the application of plant growth regulators. Considering the percentage of plant regeneration, the highest rates among the plant growth regulator treatments were taken from S3 (1 mg/l Kinetin + 0.1 NAA) medium. While the highest percentage of plant regeneration was found to be 51.3% in root explants cultured in S3 medium, the lowest rate was found to be as 5.6% in leaf explants cultured in S1 medium (Figure 4, Table 1).

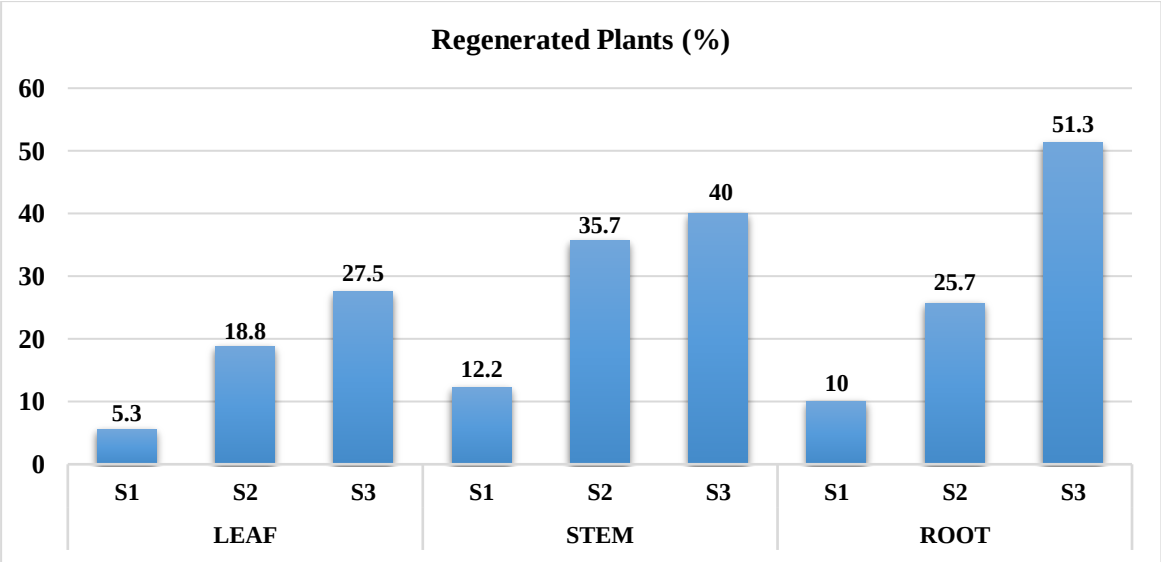

Figure 4. Effects of different Kinetin and NAA treatments on different explant parts of *T. praecox* (S1:Control, S2: 1 mg/lt Kinetin, S3: 1 mg/lt Kinetin + 0.1 mg/lt NAA)

Table 1. Effects of different Kinetin and NAA treatments on different explant parts of T. praecox (S1:Control, S2: 1 mg/lt Kinetin, S3: 1 mg/lt Kinetin + 0.1 mg/lt NAA)

Explant Type	Medium	Number of Explants	Number of Regenerated Plants	Plant Regeneration Rate (%)
Leaf	S1	90	5	5.6
	S2	80	15	18.8
	S3	80	22	27.5
Stem	S1	90	11	12.2
	S2	70	25	35.7
	S3	90	36	40
Root	S1	60	6	10
	S2	70	18	25.7
	S3	80	41	51.3

S3 medium found successful in inducing plant regeneration rate in root, stem and leaf explants respectively as 51.3%, 40%, 27.5% (Table 1.). These results are in agreement with a study conducted by Nordine et al. (2013), researchers reported that kinetin combined with NAA produced better plant regeneration results in *Thymus hyemalis* explants. Also Khajuria et al. (2020) reported that kinetin treatment enhanced plant regeneration in *Thymus serpyllum*.

As a result of our study, it is important to study the rapid reproduction techniques of the *T. praecox* (Anzer Thyme) plant, which is important in terms of active ingredient content that grows in the natural flora of Turkey. It is the first study in terms of investigation *in vitro* plant regeneration in *Thymus praecox* Opiz subsp. *caucasicus* var. *caucasicus* Also, it is thought to be, the study could be benefical in terms of reducing the duration of breeding studies and contribute to micropropagation of medicinal plants by using in vitro methods and contributing to other researchers.

Acknowledgement

The authors are grateful for funding the present TÜBİTAK-2209A project.

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INVESTIGATION OF THE ESSENTIAL OIL COMPONENTS OF *Salvia glutinosa*

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Abstract

There are about 900 species of sage (*Salvia* spp.) in the world. These species are mostly distributed in the Americas and South-West Asia continents. There are 97 Salvia species in Turkey, and 51 of these species are endemic and show a high rate of endemism. Many Salvia species exhibit some medicinal effects such as antispasmodic, antibacterial, antifungal and antioxidant activity. Moreover, many of Salvia species are used to flavor food as well as in cosmetics, perfumes and other pharmaceutical industries. *Salvia glutinos*a L. naturally grows in moist locations in deciduous forest and scrub and in Picea forests of south and south Anatolia and the flowering time is from July to October. In this study, the essential components of the *Salvia glutinosa* (L.) plants were investigated which collected from the Çat (1295 m) plateau of Rize at the time of flowering. The proportion of essential oils of the plant harvested during the full flowering period both in the nature and cultivated. Aromatic components in the essential oil of the plant were determined using the SPME (Solid Phase Microextraction) method in a Gas Chromatography (GC-MS) device. Almost 28 different components were found as a result of the analysis, while made up a significant part of the featured components. The significant part of the prominent essential compounds in the plant samples collected from the nature was found as respectively Germacrene-D (15.87 %), Neomenthyl acetate (8.2 %), Neodene (7.82 %), Isoborneol (7.54 %), α-Himachalene (7.23 %), Isovaleric acid (6.36 %) and Carvacrol (5.39 %) while essential compounds of the plant samples.

Keywords: *Salvia glutinosa*, Aromatic Compounds, Germacrene-D, Aromadendrene, GC-MS

INTRODUCTION

Apart from being their usage in industry species of Lamiaceae family have use as folk medicine in the region. In addition, its use as a raw drug in the form of condiments and spices increases its importance even more. The genus *Salvia* L. with over 900 species is presumably the largest member of the Lamiaceae family and is found in both subtropical and other temperate parts of the world (Polunin and Huxley, 1967). Many Salvia species are aromatic plants and rich in essential oils and of potential economic value besides their usage as ornamental plants. Many of these species are used to flavour food as well as in pharmaceutical industries, perfumes and cosmetics (Marin et al., 1996). *Salvia glutinosa* L. is an essential oil plant which grows in moist places in deciduous forest and scrub and in Picea forests of north and south Anatolia and the flowering time is from July to October (Hedge, 1982). The medicinal and commercial uses of these plants, which are the subject of this study, are increasing day by day. Especially the essential oil they contain and the enlightenment of the secondary metabolites in the essential oil have increased the importance of these plants. Essential oils are usually complex mixtures of natural compounds of both polar and apolar structure and consist mainly of terpenoids and their oxygenated derivatives. Essential oils, which have antioxidant and antimicrobial activities, have therapeutic properties and are the raw materials of cosmetics, as well as acting as natural additives in foods and food products (Fokou et al., 2020). In this study, the essential components

of the *Salvia glutinosa* (L.) plants were investigated which collected from the Çat (1295 m) plateau and cultivated from the field in Rize at the time of flowering.

MATERIAL AND METHOD

This experiment was conducted at Faculty of Agriculture, Recep Tayyip Erdoğan University in 2021. The plant materials were collected from Çat (1295 m) plateau in Rize/Turkey. The aerial parts of *Salvia glutinosa* were collected at the flowering time were used as plant material. The plants were cut at a height of 10-15 cm above the soil level. Dried plant samples weighed as 100 g and distilled with Neo-Clevenger apparatus. The essential oil content in herb was calculated as the volume of essential oil in 100 grams of dry sample (ml/100g). In order to determine essential oil components, Shimadzu model GC-MS (2010) Plus) present in RTEU Faculty of Agriculture, Plant Analysis Laboratory was used. SPME (Solid Phase Microextraction) method was used to determine essential oil components. Analysis results were evaluated and reported using related library.

RESULTS AND DISCUSSION

Almost 28 different components were found as a result of the analysis, while made up a significant part of the featured components. The significant part of the prominent essential compounds in the plant samples collected from the nature was found as respectively Germacrene-D (15.87%), Neomenthyl acetate (8.2%), Neodene (7.82%), Isoborneol (7.54%), α-Himachalene (7.23%), Isovaleric acid (6.36%) and Carvacrol (5.39%) (Fig. 1 and Table 1). 4 chemical classes namely monoterpene oxygenes (26.0 %), sesquiterpene hydrocarbons (34.0 %), sesquiterpene oxygenes (5.74 %) and others (32.68 %).

These results are in agreement with Tavassoli et al. (2009), researchers reported that germacrene-D content was 18.0% in the essential oil components of *S. glutinosa*. Also, these results contradicted with a study carried out by Pitarokili et al. (2006). They reported that the most abundant component in *S. glutinosa*, was butyl butyryl lactate (26.7%).

The current results revealed that essential organic compounds of *Salvia glutinosa* contains relatively different components when compared with the results of the same species grown in different places of the World (Pitarokili et al., 2006). These results reveal that different climate and soil conditions effect essential oil components even in the same species.

Chemical differentiation within the same species can occur generally as a result of the varied ecological or geographic origin as well as the genetic differentiation, collection time, climate or method of analysis.

The terpene groups of investigated essential oil components were found as sesquiterpene hydrocarbons (34%), others (32.68%), monoterpene oxygens (26%), sesquiterpene oxygenes (6%) (Figure 2, Table 1).

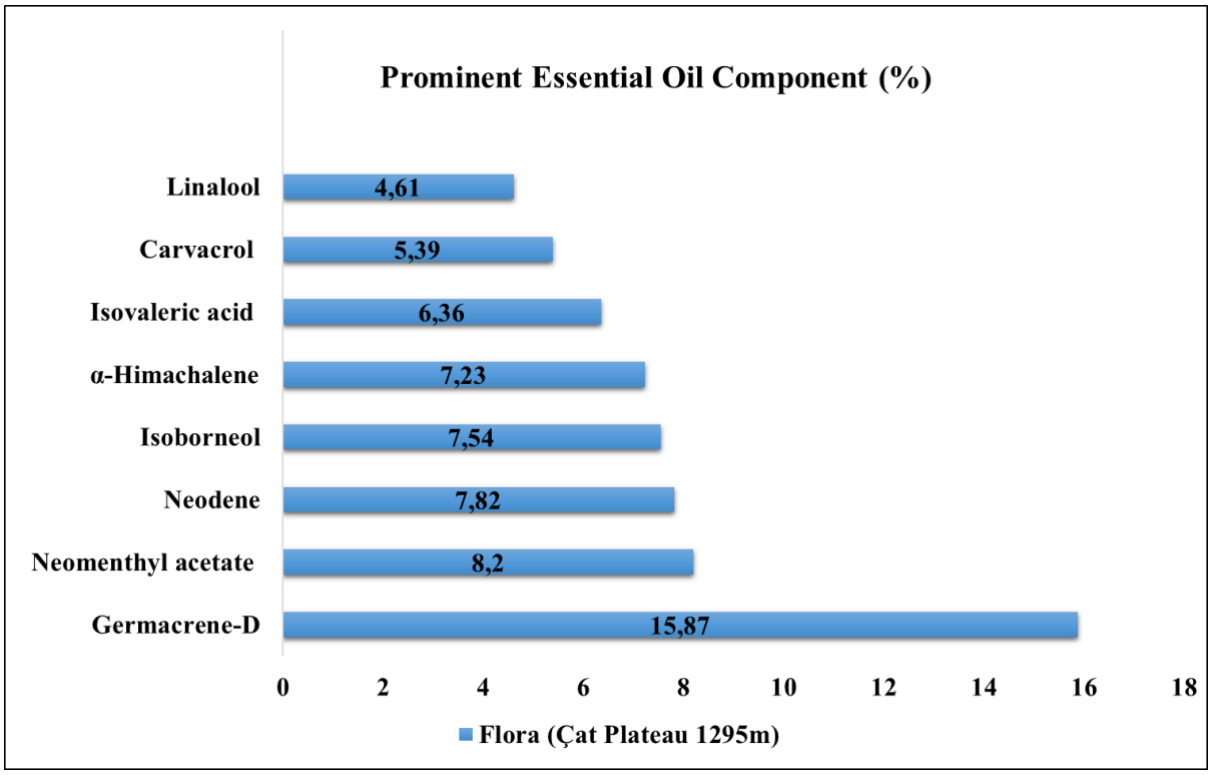

Figure 1. Essential oil components of *S. glutinosa*

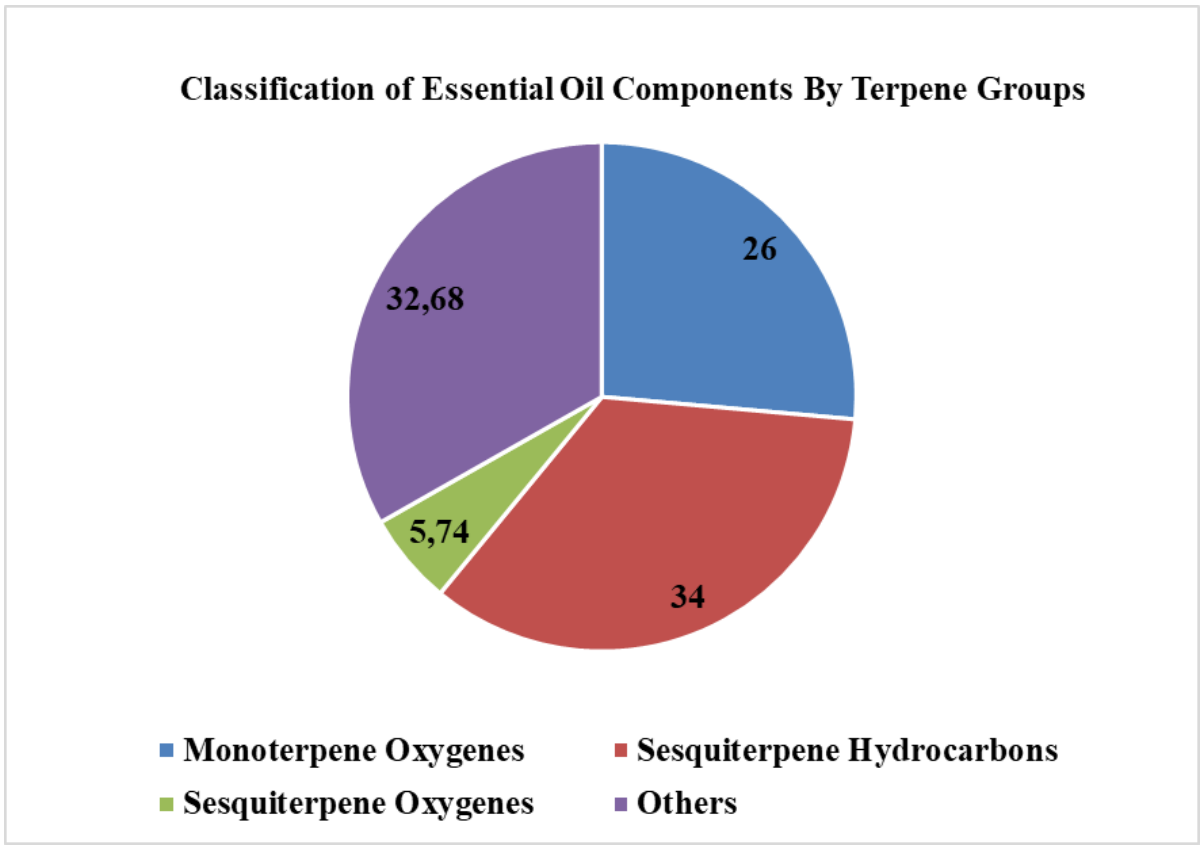

Figure 2. Classification of essential oil components by terpene groups of *S. Glutinosa*

Table 1. Classification of all detected essential oil components by terpene groups of *S. glutinosa*

Chemical components	KI[a]	Essential Oil Component (%)
Monoterpene Oxygenes		
Eucalyptol	1032	0.2
Linalool	1101	4.61
Camphor	1149	2.68
Isoborneol	1158	7.54
α-Terpineol	1198	3.16
Pulegone	1241	1.33
Carvacrol	1317	5.39
Limonene	1032	0.1
Sesquiterpene Hydrocarbons		
β-Bourbonene	1382	2.33
Pentadecane	1500	2,5
ɣ-Cadinene	1512	0.35
α-Himachalene	1445	7.23
Germacrene D	1481	15.87
α-Humulene	1453	2.59
β-Chamigrene	1464	2.84
Sesquiterpenes Oxygenes		
Spathulenol	1576	2.2
Caryophyllene oxide	1587	3.54
Others		
Amyl methyl ketone	892	0.4
Isovaleric acid	860	6.86
Neodene	1012	7.82
Neomenthyl acetate	1280	8.2
Myristic alcohol	1680	1.1
Pentadecane	1500	1.04
Terpinyl acetate	1349	2.08
Menthalactone	1501	2.68
Cedrol	1527	2.5

[a] Kovats index is determined relative to n-alkanes (C6–C39) on a DB-5 MS column; tr< 0.05%; – not detected.

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COVID 19 EPIDEMIC AND EFFECT OF LIVESTOCK SECTOR IN TURKEY

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ABSTRACT

The covid-19 outbreak has revealed the importance of the food and livestock industry. Continuation of production in the livestock sector prevented the possible food crisis. The Covid-19 outbreak has had some effects on livestock in our country. And there has been an increase in costs along with global markets. However, production has not decreased. On the contrary, it increased. Covid-19 in the epidemic process in Turkey has undergone crop and animal production cuts. Therefore, there was no serious food problem.

Keywords: COVID-19, Turkey, Livestock Sector, Effect

INTRODUCTION

Epidemics cause the destruction of many civilizations and countries and the emergence of global migrations, which have emerged throughout human history. Every new era of human history, with a new disease brings the product (Jebera, 2004). Relationships between humans and animals, the ability of microorganisms to overcome barriers between species further facilitate the emergence of zoonotic pathogens (Morse, 2012).

The New Coronavirus Disease (COVID-19) is a virus that was first identified on January 13, 2019 as a result of research conducted in a group of patients who developed respiratory symptoms (fever, cough, shortness of breath) in Wuhan Province in late December. The outbreak was initially detected in those in the seafood and animal market in this area. Later, it spread from person to person and spread to other cities in Hubei province, especially Wuhan, and other provinces of the People's Republic of China and other world countries. Coronaviruses are a large family of viruses that can cause disease in animals or humans. In humans, several coronaviruses are known to cause respiratory infections, ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The New Coronavirus Disease is caused by the SAR-CoV-2 virus. SARS-CoV-2 is highly contagious and infectious from person to person, and one infected person can infect on average six persons (Yan et al., 2020).

As of May 2020, there have been over 4 million confirmed cases and 276,000 deaths worldwide (Bonilla-Aldana et al., 2020). Compared to other viruses in the MERS family, it stands out to be a very dangerous virus with a mortality rate of approximately 6.9% (World Health Organization, 2019).

It has spread to 240 countries around the world and has been heavily affected by the USA, China, Brazil and the EU. All over the world, researchers and healthcare organizations are working hard to prevent the spread of COVID-19 by taking appropriate control measures (Ministry of Health, 2021).

In Australia, the panic buying of meat products by consumers and the COVID-19 infections in processing plant workers slowed processing capacity. These events created a cumulative effect to increase on-farm animal populations and increased costs to farmers (D'Souza and Dunshea, 2021). Scientists and industry organizations worked together to reduce consumption and slow the slaughter of animals (Gauly et al., 2021).

In a study investigating the effects of Covid 19 on animal husbandry in Czechoslovakia, it was determined that although the COVID-19 crisis had an effect on prices, it did not have a significant effect on animal breeding (Brzáková, et al., 2021).

Along with most other countries, Argentina faced the pandemic by ordering a strict nationwide quarantine and severe restrictions on human contact as a means to prevent the spread of the virus. Argentina has had a little disruption in animal agriculture, in part because of the ability to move beef products from traditional markets to other countries (Arelovich 2021).

There are more than 570 million agricultural farms and at least 500 million family farms in the world. Nine tenths of farms in the world are family farms. Family farms provide 80% of the world agricultural production. Agricultural production in Turkey; It is carried out in divided parcels in small plots, in family farm style, on property lands. Turkey's land area is 78 million agricultural hectare. Agricultural areas of Turkey area of about 1/3 is up. Irrigable agriculture is carried out in 10% of the total agricultural land. More than 2/3 of approximately 3 million agricultural owner have 10-99 acre land. Rural population in Turkey shows a continuous decrease with increasing urbanization. This situation causes a decrease in the population engaged in agriculture and naturally a decrease in employment in the agricultural sector (Akin et al., 2020).

In 2021, more infectious and dangerous mutant types of the virus have emerged, and they continue to cause major problems in human movements, logistics, agriculture and livestock industries.

Situation Analysis in the Livestock Sector

With regard to animal production in Turkey to make the overall situation analysis, you first need to examine the data in rural areas.

Table 1. Changes in the rural population of the Year in Turkey Turkish Statistical Institute, (2020).

Years	Rural Population (000)	Rural Population Rate (%)	Urban Population (000)	Urban Population Rate (%)	Total Population (000)
1990	23 124	41.00	33 276	59.00	56 400
2012	17 161	22.70	58 439	77.30	75 600
2013	6 673	8.70	70 027	91.30	76 700
2016	6 225	7.80	73 585	92.20	79 800
2019	5 987	7.20	77 163	92.80	83 150

As seen in Table 1, the population living in rural areas has started to decrease since 1990, and by 2013, a serious break occurred. During this period, the proportion of those living in rural areas decreased from 22.70% to 8.70%.

Table 2. Distribution of the sector in Turkey, according to the Active Population (%) Turkish Statistical Institute, (2020).

Years	Sectors		
	Agriculture	**Industry**	**Service İndustry**
1990	53.70	17.50	28.80
2010	23.30	21.10	55.70
2016	19.50	19.50	61.00
2018	19.70	19.50	60.80
2019	17.00	19.90	63.10

When we look at the distribution of the population by sectors, the rate of agriculture in all sectors was 53.70% in 1990, and it decreased from 23.30% in 2010 to 17% in 2019.

When we evaluate these two tables, it is striking that the rural population in our country is decreasing rapidly and there is an intense trend from the agricultural sector to the industry and service sector.

Table 3. Turkey Animals Entity, (Head) Ministry of Agriculture and Forestry (2021).

Years	1990	2010	2016	2019
Cattle	12 173 000	11 370 000	14 222 000	17 872 000
Buffalo	429 000	85 000	142 000	184 000
Sheep	43 647 000	23 090 000	30 984 000	48 481 000
Goat	11 942 000	6 293 000	10 345 000	11 205 000

When we look at Table 3, it is seen that the cattle entity has increased between 1990-2019. However, it is seen that sheep and goat breeding followed a more fluctuating process, but the increase accelerated after

2016.

Table 4. Milk Production, (Ton) Ministry of Agriculture and Forestry (2021).

Years	Cattle	Sheep	Goat	Buffalo	Total
2002	7 490 634	657 388	209 621	50 921	8 408 568
2010	12 418 544	816 832	272 811	35 487	13 543 674
2016	16 786 263	1 160 413	479 401	63 085	18 489 161
2019	20 782 374	1 521 455	577 209	70 341	22 960 379

When we examine the milk production in Table 4, there is an increase depending on the animal presence. There has been a significant increase especially in the production of cattle milk. These increases, especially in the food industry, cheese, pasteurized milk and so on. has caused an increase in the production of products.

Livestock Farms in the Covid-19 Outbreak

With the covid-19 outbreak that started in 2019, the owners of both businesses have taken necessary measures in the livestock business in Turkey, as the Ministry of Agriculture and Forestry. These measures have been taken according to the following categories;

1- Measures taken for Seasonal Agricultural Workers to continue working,
2- Measures taken for planting feed crops and providing feed raw materials,
3- Measures taken to continue production in the market and food industry in the supply chain,

In our country, there have not been serious problems in both labor and raw material supply in livestock enterprises. In this, possible problems have been prevented with the appropriate and fast measures taken by our country and government. During the epidemic period, agricultural production and animal husbandry sectors were exempted from the pandemic bans, preventing a food crisis that could occur. However, there was a decrease in consumption due to the closed restaurants and hotels and the prohibitions during the tourism season. But this recession has been causing serious problems in selling the product marketing. Production within the country has defray the consumption. However, the price increases in products such as oil seeds, chemical fertilizers, corn, soybean imports increased the costs. With the increase in production costs, the price of milk and dairy products has increased.

CONCLUSION

As a result there is an outbreak of Covidien-19 showed how important food production once again. In our country, no production problems have been experienced with the sustainability of agriculture and animal husbandry within the scope of the measures taken, but profitability has decreased with the increase of costs during the epidemic period.

Conflict of Interest

"To the best of our knowledge, the named authors have no conflict of interest, financial or otherwise."

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THE EFFECT OF BIOCHAR APPLICATION ON SOME PHYSICAL PROPERTIES OF PEPPER (*Capsicum annuum* L.) IN DEFICIT IRRIGATION CONDITIONS

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ABSTRACT

In this study, the effect of biochar, obtained from pruning waste of rose plant, application under the deficit irrigation conditions was investigated over the plant height, stem diameter, fruit length and leaf color parameters of pepper plant (*Capsicum annuum* L. cv. Tonton F1). The experiment was conducted by applying three irrigation levels (I0; 100% full irrigation as control application, I1; 25% deficit irrigation, I2; 50% deficit irrigation) and four biochar doses (B0; 0%- of biochar as control application, B1; 0.75% of biochar, B2; 1.5% of biochar and B3: 3% of biochar as w/w) with three replicates in total of 36 pots as randomized plot design. The findings showed that plant height, stem diameter and fruit length were significantly decreased in deficit irrigation ($p<0.01$). While plant height and stem diameter were significantly increased in biochar application, the values of fruit length were not varied statistically. The highest plant height (44.67 cm), stem diameter (7.34 mm) and fruit length (14.1 cm) were determined in full irrigation treatment with 3% of biochar (B3-I0). The difference between applications in terms of leaf color parameters (L, a*, b*, C*, and H^o) were also significant ($p<0.01$). B0 treatment provided the highest L, a, b and C values considering treatment means, while the h^o value was found the highest in B3. As a conclusion, it can be indicated that pepper plant development in the biochar-treated pots under deficit irrigation conditions can improved considerable levels compared to the application without biochar.

Keywords: Biochar, color parameters, deficit irrigation, pepper, plant growth

Introduction

Plant exposed to various stress factors during their growth period. Biotic and abiotic stresses cause changes in normal physiological functions in plants. One of the consequences of global warming and climate change, which affects the whole world, is the drought problem. In drought conditions, low precipitation and dry air cause difficulties in agricultural production. Drought is considered to be the most effective stress factors limiting plant growth. Recently, greenhouse gas (GHG) emissions from energy use have contributed significantly to the increase in atmospheric greenhouse gas concentrations (Edenhofer et al., 2011). The increasing atmospheric GHG reveal to environmental stress factors as high and low temperatures, drought and soil fertility caused by global warming and climate change in agricultural production. On the other hand, the world drive to new renewable energy resource for decrease carbon emissions. Nowadays, biomass energy obtained from various biomass feedstocks materials such as forest, agriculture and animal residues are used as renewable energy. Biomass feedstocks after a variety of processes, can be used to energy (Electricity, heat, esc.) as liquid (biofuel), gas (syngas) or solid (biochar) form (Spokas et al., 2012). Solid product of biomass pyrolysis is called biochar and it is obtained by heated under anaerobic conditions. Recently, biochar

amendment as a soil conditioner is gaining increasing interest. It is known that in the past, biochar was applied to the soil as a remedial and can remain in the soil for years (Graber et al., 2010; Akhdar et al., 2014). Applying biochar to the soil rather than open air burning as an energy source will reduce the amount of atmospheric carbon emission (Laird 2008; Lehmann, 2007; Graber et al., 2010).

Studies show that biochar amendment can enhance organic matter content in soil what leads to increased soil fertility (Xu et al., 2012), effectiveness of fertilizer (Asai et al., 2009) and plant yield (Chan et al., 2007). Some data show that biochar can reduce the availability of toxic elements to plants (Glaser et al. 2002; Namgay et al., 2010). In addition, biochar application change to soil structure and air capacity and increase to water retention and water holding capacity (Madiba et al., 2016; Laid et al., 2020). This situation increases water use efficiency and the resistance of the plant against limited water availability. To date, there are different studies about biochar application effect to yield and quality parameter of plant under deficit irrigation. Akhdar et al. (2014), reported that biochar applications increase the soil moisture content and improve to fruit quality under the deficit irrigation. Hafeez et al. (2017), observed that biochar application is effect positively to growth seedling in soybean. Agbna et al. (2017), reported that biochar application can improve crop productivity and water use efficiency in tomato. Mohawesh et al. (2021), indicated that the optimal rate biochar application enhances soil fertility on bell pepper in arid conditions.

Therefore, the aim of this study was to determine the effects of biochar to some physical properties including plant height, stem diameter, fruit width and length and leaf color parameters of pepper (*Capsicum annuum* L. cv. Tonton F1) under drought stress.

Material and methods

Material and plant growth conditions

In this study, Tonton F1 pepper (*Capsicum annuum* L.) cultivar was used as plant material. Biochar, obtained from pruning waste of rose plant were applied to soil. The seeds were sown in the 4-litres pots (0.22 m of diameter at the top, 0.17 m diameter at the bottom, and 0.18 m high), containing soil and biochar (B0 pots were filled just soil). The study was conducted in greenhouse of the Faculty of Agriculture, Van Yuzuncu Yil University, Van, Turkey. The mean daily temperature and relative humidity rate (recorded hourly with an automatic weather station (HOBO, Campbell scientific INC., USA) measured inside the greenhouse.

Experimental design and treatments

The experiment was conducted by applying three irrigation levels I0; 100% full irrigation as control application, I1; 25% deficit irrigation I2; 50% deficit irrigation and four biochar doses B0; 0%- of biochar as control treatment, B1; 0.75% of biochar, B2; 1.5% of biochar B3: 3% of biochar as w/w with three replicates in total of 36 pots as randomized plot design. The soil samples were air-dried and passed through a 4 mm sieve. Biochar samples were passed through a 2 mm sieve. Biochar was carefully blended with air-dried soil in pots. The biochar doses were added to pots before seeds sown and were mixed with soil. When the pepper had 4-5 true leaves, the deficit irrigation treatments were began. At the beginning of the irrigation treatments, the water content was increased to field capacity. The amount of irrigation water applied in each irrigation was calculated using the following equation:

$$I = (Wi\text{-}1 - Wi) \times IR$$

where I is the irrigation water amount (ml), $Wi\text{-}_1$ and W_i are weights (kg) of the pot a day i-1 and i, respectively, and IR is the irrigation levels (I0: %100, full irrigation; I1: %25 deficit; I2: %50 deficit). The plants were hand-irrigated with tap water (Kadayifci et al., 2005; Ekinci et al., 2015).

Measurements of growth characteristics

At the harvest time, plant height, stem diameter, fruit length, leaf color parameters were investigated. The stem diameter and fruit length of the plant were measured with a digital caliper, and the plant height was measured with a meter. L*: brightness, 0% (no reflection) for black-colored objects and 100% for white-colored objects; a*: redness, with negative values for green and positive values for red; b*: yellowness, with negative values for blue and positive values for yellow. L, a*, b*, Chroma (C*) and Hue Angle (H^o) color parameters were measured by the Minolta CR-440 Optics Chroma meter.

Statistical analysis

All multivariate analyses were performed with IBM SPSS Statistics version 21.0. One-way analysis of variance (One-way ANOVA) was performed for data comparison, and Duncan multiple comparison test was used to determine the differences between groups (Duncan, 1955).

Results and Discussion

Plant height and stem diameter

Effect of deficit water and biochar treatments were found significant ($p<0.01$) in terms of plant height. As expected, water stress caused to decreasing plant height significantly and biochar treatments applied in increasing doses had shown variable results in plant development. Increasing doses of biochar led to an increase in plant height but interaction between treatments is insignificant. When the means are examined, it is seen that the highest result is in B1 and B2 biochar treatments according to the without biochar (B0) (Table 1). Results regarding stem diameter of pepper (Table 2) showed that it was decreased significantly ($p<0.01$) under water stress in treatment I3 than control I1. Biochar treatments (B) had significant effects on the stem diameter in compared to without biochar (B0). But the means of control biochar treatment (B0) B2 and B3 applications are statistically in the same group. In this case, as a result, it is not said that biochar treatments have a positive effect on the stem diameter compare with control biochar treatments. Interaction of treatments was found insignificant and when looking in Table 2, it is seen that the highest values is in control treatments (B0 and I1). The negative effects of water stress are usually caused by inhibition of cell growth and cell division. Disruption of various metabolic and physiological processes in the cell, such as photosynthesis, growth, and respiration, may be the cause, resulting in regression of plant growth stages (Jaleel et al., 2007; Sensoy et al., 2007; Cakmakci et al., 2017). Many researchers, have reported that the applications of biochar increase water retention in the soil (Basso et al. 2013; Karer et al. 2013; Rogovska et al. 2014; Masiello et al. 2015). This may be because Biochar changes the physical structure and air capacity of the soil and increases the water holding capacity (WHC). Moreover, it is known that pepper plants with biochar application have higher N and P content there than those without biochar (Lévesque et al, 2020). In our study, the increase in crop productivity in biochar treatments compared to the control group can be explained by the better uptake of nutrients in the soil.

Table 1. Effect of biochar and irrigation treatments to plant height (cm)

	I1	I2	I3	Mean **
B0	44.33	35.67	32.33	37.44 B
B1	41.33	36.67	34.67	37.56 B
B2	43.67	40.33	37.00	40.33 A
B3	44.67	39.67	36.33	40.22 A
Mean **	43.50 A	38.08 B	35.09 C	
P_B	0.01			
P_I	0.00			
P_{B*I}	0.30			

**: The difference between the means is lettered according to the Duncan test ($p<0.01$).

Table 2. Effect of biochar and irrigation treatments to stem diameter (mm)

Plant diameter	I1	I2	I3	Mean **
B0	7.25	6.95	6.20	6.80 A
B1	6.72	6.14	6.85	6.24 B
B2	7.15	6.99	6.52	6.89 A
B3	7.34	6.87	6.21	6.80 A
Mean**	7.12 A	6.74 B	6.19 C	
P_B	0.00			
P_I	0.00			
P_{B*I}	0.519			

**: The difference between the means is lettered according to the Duncan test ($p<0.01$).

Fruit length

As seen in Table 3, a significant ($p<0.01$) reduction in fruit length of pepper had been observed under deficit irrigation treatment. On the other hand, difference of biochar treatments was found insignificant but when examining in means, it seen that biochar treatment enhance fruit length under deficit irrigation conditions. No significant interaction could be detected between the treatments and the highest fruit length determined in %3 biochar (B3) and I1 treatments. Biochar applications are known to increase crop productivity by increasing the water holding capacity and increasing the nutrient uptake from the soil (Walter and Rao, 2015; Uchida, 2000; Laird et al., 2010; Lévesque et al, 2020). Similarly, biochar applications increase plant photosynthesis capacity, N and P nutrient contents and increased photosynthesis amount in the plant can positively affect fruit yield. This may explain the positive effect of biochar applications on fruit length in our study.

Table 3. Effect of biochar and irrigation treatments to fruit length (cm)

	I1	I2	I3	Mean
B0	13.5	11.4	8.5	11.1
B1	13.3	12.1	9.8	11.7
B2	13.8	12.3	10.9	12.3
B3	14.1	11.6	10.2	12.0
Mean*	13.7 A	11.9 B	9.9 C	
P_B	0.11			
P_I	0.00			
P_{B*I}	0.61			

*: The difference between the means is lettered according to the Duncan test ($p<0.05$)

Leaf color parameters

Color parameters of pepper leaf varied under water stress and biochar treatments. Interaction was indicated significantly ($p<0.01$) in all color parameters but deficit irrigation and biochar treatments shown different effect to color value. L values varied from 32.54 to 42.15 and statistics analysis indicated that L value decrease significantly ($p<0.01$) in increasing biochar doses. As seen in Table 4, redness (a*) and yellowness (b*) and Chroma (C*) values were found the highest in without biochar (B0) applications. a* values varied from 7.76 to 13.14, b* values varied from 10.69 to 20.54 and C* values ranged from 13.22 to 24.41. However, a* value, related with redness, is negative because of green leaf measurement. So, the highest a* value was found in B1 and I1 treatments. On the other hand, H° value was affected positively by increasing biochar doses and the highest H° values were found in B3 application. H° values varied from 122.67 to 126.27. Changes in the reflective properties of plants exposed to stress have been noted in previous studies (Guyot 1990; Carter 1993; Campbell 1996). Keskin et al. (2013), were recorded that there are a positive and high correlation between leaf moisture content and brightness (L*; r = 0.91) and moisture contents and yellowness (b*; r = 0.95) in peanut plant. In our study, L value was decreased progressively subject to deficit stress. In the same study, the researchers were noted that there is a low correlation between a* and moisture content (Keskin et al., 2013). In present study, L value decreased progressively subject to deficit water stress. In expected, a* value is lower in without biochar treatments and deficit water stress affected to a* value negatively because of negative effect of stress treatments.

Table 4. Effect of biochar and irrigation treatments of leaf color treatment

		L	a (-) *	b*	C*	H°
B0	I1	42.15 a	13.14 a	20.54 a	24.41 a	123.11 f
	I2	42.05 a	12.70 a	19.76 b	23.50 b	122.80 g
	I3	41.12 b	14.41 b	17.36 c	20.79 c	123.67 e
B1	I1	36.09 g	7.76 e	10.69 l	13.22 l	126.12 a
	I2	39.78 c	10.12 c	15.15 d	18.23 d	124.08 d
	I3	38.72 d	9.17 d	13.67 I	16.47 j	124.30 d
B2	I1	32.54 h	7.82 e	10.73 k	13.29 k	126.27 a
	I2	37.52 e	9.78 c	14.24 e	17.29 e	124.80 c
	I3	37.07 ef	9.61 cd	13.86 h	16.87 h	124.80 c
B3	I1	36.19 fg	9.74 c	13.48 j	16.64 I	126.23 a
	I2	37.01 ef	9.85 c	14.04 g	17.16 g	125.29 b
	I3	38.61 d	9.73 c	14.22 f	17.23 f	125.17 b
Mean		38.24**	10.07**	14.81**	17.93**	127.72**

**: The difference between groups shown with different letters in the same column is significant ($p<0.01$)

Conclusion

Due to the increasing climate problem in the world, many water-retention materials are used in the soil to support agricultural production and increase soil fertility and water holding capacity. In the last 10 years, especially there are a remarkable drive to the use of biochar. In this study, the effects of different doses of biochar and water deficit on some physical properties of the pepper plant were investigated. At the end of the study, the highest plant height, stem diameter and fruit length values were obtained from the application where 3% biochar was mixed into the soil and full irrigated. As a conclusion, it can be indicated that some traits in pepper plant development in the biochar-treated pots under deficit irrigation conditions can be improved considerable levels compared to without biochar. Therefore, under deficit water resources, amendment of biochar might be saving the water and enhance to productivity and quality of pepper. By using the results obtained, it is recommended to investigate in detail the correlation between biochar application

and the yield quality characteristics in field conditions. Also, it should analyze that whether using biochar in agricultural production as a conditioner is affordable or not.

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SELECTIVE DEFOLIATION BY SHEEP ACCORDING TO HERBAGE MASS AND PLANT SPECIES IN A NATURAL DEGRADED PASTURE AS RESPONSE TO FERTILIZATION

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Abstract

The objective of the study was to evaluate the grazing behaviour by sheep in naturalised degraded pastures in south of Chile which had received three years of fertilisers and intensive sheep grazing. There were two treatments: non-fertilised pasture (NFP) and naturalised fertilised pastures (FP). Pasture herbage mass and selective grazing were evaluated within three randomised blocks. Pasture herbage mass was assessed using the rising plate method with a calibrated equation: y=174,76x + 232,04 (R2 0.8). The trim technique was used with a 0.1 m2 quadrat and cutting the pasture to a soil level. Three fixed transects of 15 m long were placed in each plot. Along each transect, every 0.75 m an individual tiller of *L. perenne*, *B. valdivianus*, and a plant of *L. nudicaulis* was marked using a coloured paperclip, which was attached to the soil by an eight cm nail. A total of 7 individual marked tillers or plants for each species were marked in each transect. Pre and post grazing, the nails were found using a metal detector allowing the identification of each tiller/plant marked. The highest herbage mass was during Spring in FP and the lowest in Summer and Winter in NFP. In FP, the grazing probability of *L. perenne* and *B. valdivianus* increased in Autumn and Spring, when both species had longer lamina, while in Summer, *L. nudicaulis* was the most selected specie. In NFP, the sheep selected *L. nudicaulis* over the grass species in all seasons. These results show that sheep do actively selects species to be grazed when the species increases its availability in the pasture. Selective grazing changed through the year according to pasture herbage mass.

Keywords: dry matter, grazing probability, pasture improvement, intensive grazing

INTRODUCTION

The pastures in southern of Chile are the main forage resource to livestock (Balocchi et al., 2002). There are about 1.3 million ha^{-1} of pastures (INE, 2007). A total of 48% of the naturalised pastures are under grazing, and do not receive any type of fertiliser to compensate soil nutrient deficiencies (INE, 2007). Therefore, these pastures present a degree of degradation, which is

characterised by a low annual herbage mass production (less than 5-ton DM $ha^{-1}year^{-1}$) (Balocchi & López, 2009). To alleviate these constraints, strategies such as fertilization would increase pasture production. In general, pasture improvement in south of Chile includes the application of lime and fertilisers to improve pH deficiencies and herbage mass production (Flores et al., 2017). These combined managements have a positive effect on botanical composition (Tharmaraj et al., 2008) increasing species such as *Lolium perenne* L., *Bromus valdivianus* Phil. and *Holcus lanatus* L. achieving a dry matter (DM) production close to 14 t DM ha^{-1} $year^{-1}$ (Keim et al., 2014).

On the other hand, grazing animals have a great impact on pasture productivity (Teague, 2018) because stimulate the tillering of perennial grasses and eliminate less tolerant species to grazing (Porensky et al., 2021)). Also, stimulate the mobilization of photosynthate reserves, enhancing buds development, therefore tillering, and consequently increasing biomass (Liu et al., 2012). The animal can be selective between species and part of plants (Cuchillo-Hilario et al., 2018), increasing pasture quality (Baumont et al., 2005). The selective grazing generates a pasture structure, with areas intensively grazed and others less frequently grazed (Pulido et al., 2018; Rossignol et al., 2011). The intensive controlled grazing, provide a dense herbage mass and delaying the ability of flatweeds to invade (Flores et al., 2017). Several studies have been focused in sheep grazing behaviour showed a pasture structure with a decreased in flatweeds while grasses and legume species increased (Chapman & Griffiths, 2019).

It has been shown that fertilisation and liming of a low production naturalised pasture, through spontaneous changes of the botanical composition, increases herbage production and nutritive value to similar values to that of a sown pasture (Keim et al., 2014). Selective grazing can highlight the succession of species in a pasture, stimulating the growth of some species more than others (Lopez et al., 2003). It has been reported contradictory results about sheep grazing selection. Some study showed that sheep prefer to consume high quality species than the average of the available pasture (Stuth, 1991). In other cases, sheep prefer forage with higher herbage mass than quality (Steinshamn et al., 2018).

The objective of the study was to evaluate the grazing behaviour by sheep in naturalised degraded pastures in south of Chile which had received three years of fertilisers and intensive sheep grazing.

2. MATERIAL AND METHODS

2.1 Study area

The pasture data were collected at the Santa Rosa Research Station of Universidad Austral de Chile (39º 47’ 26” S, 73º 14’ 12” W) 9 km east of Valdivia city, Chile, at 25 m a.s.l., with 2350 mm of average annual rainfall. The soils are classified as Duric Hapludand (IREN et al., 1978). There were two treatments: a) Naturalized fertilized and limed pasture (FP) composed by *Agrostis capillaris* L., *Leontodon nudicaulis* L. Banks ex Lowe, *Lolium perenne* L. and *Trifolium repens* L.; and b) Naturalized pasture without lime or fertilizer addition (NFP). Each pasture occupied 400 m^2 plots, distributed according to a complete randomized block design with three blocks.

Naturalized fertilized and limed pasture received 180 kg N ha^{-1} $year^{-1}$, 120 kg P2O5 ha^{-1} $year^{-1}$, 120 kg K2O ha^{-1} $year^{-1}$ and 2 t ha^{-1} $year^{-1}$ of lime. Each plot was grazed by 25 two years old sheep, Austral breed, live weight 55 ± 2.4 kg (average ± SEM) and body condition 2.7± 0.27 (average ± SEM). Pregrazing herbage mass target was about 2.100 to 2.300 kg DM ha^{-1}. Postgrazing residual herbage mass target was about 1.000 to 1.200 kg DM ha^{-1} (Matthews et al., 2004). The maximum length of defoliation interval was 60 days.

Pasture herbage mass was assessed using the rising plate method (Earle and McGowan, 1979) with a calibrated equation: y=174,76x + 232,04 (R2 0.8). The trim technique (Radcliffe et al., 1974) was used with a 0.1 m2 quadrat and cutting the pasture to a soil level.

The selective grazing evaluation was carried out during the second year since the pastures started being improved, from Autumn (April 2011) to end of Summer (March 2012). Selective grazing was achieved applying the technique reported by Hodgkinson et al., (2010). Three fixed transects of 15 m long were placed in each plot. Along each transect, every 0.75 m an individual tiller of *L. perenne* or *B. valdivianus*) or a plant of *L. nudicaulis* was marked using a colored paperclip, which was attached to the soil by an eight cm nail. The marked tillers and plants were in a sequence following the same pattern along each transect. A total of 7 individual marked tillers or plants for each species were marked in each transect. In grasses, 3 leaves with a leaf stage between 0.75 and 0.25 were marked. In *L. nudicaulis*, 10 vegetative leaves were marked. Pre and post grazing, the nails were found using a metal detector allowing the identification of each tiller/plant marked. Plant height of each species was measured using a meter ruler. Each lamina length was measure from the tips of its ligules (*L. perenne* and *B. valdivianus*) or petiole base (*L. nudicaulis*). The tiller or plant that had a lamina that was shorter in post grazing was considered grazed, and a new tiller or plant was marked in a similar position. The transect was evaluated one each season during April (Autumn), July (Winter), October (Spring), January (Summer).

Treatments effects were analysed according to a randomized complete block design with factorial arrangement of the treatments with 2 type of pastures (Mixture, Diverse, FP and NFP) and 3 species within each type of pasture (*L. perenne, B. valdivianus* and *L. nudicaulis*). To determine statistical differences between treatments analysis of variance (ANOVA) was performed. To further analysis, LSD was applied to compare treatment means (Steel et al., 1997).

For each pasture species within each season (Autumn, Winter, Spring and Summer), the probability of the marked tillers/plants being grazed was determined in each pasture, by dividing the number of grazed tillers/plants, as shown by a shorter postgrazing lamina length compared to pregrazing lamina length, over the total number of the marked tillers/plants. The amount of dry matter that was apparently consumed from each tiller was calculated using the lamina lengths (pre and post grazing) and the equation of best fit determined in the preliminary study. These values were compared between *L. perenne*, *B. valdivianus* and *L. nudicaulis* through ANOVA to determine whether the dry matter consumption differed between plant species within each season, using ANOVA.

3. RESULTS

3.1 Pasture herbage mass

The pastures produced a significantly different amount of herbage mass a year (Table 1). Consistently during the whole evaluation NFP had significantly lower annual herbage mass production ($P \leq 0.001$) than FP. During the first year, NFP and FP had a higher contribution of *L. nudicaulis*. In the second year, *L. nudicaulis* increased its contribution in NFP, while in FP decreased, increasing *L. perenne*. In the third year, *L. nudicaulis* increased in all pastures, while *L. perenne* and *B. valdivianus* increased significantly in FP and decrease the low condition grasses contribution.

Table 1. Pasture herbage mass production (kg DM $ha^{-1}y^{-1}$) and botanical composition (kg DM $ha^{-1}y^{-1}$) in three periods of evaluation.

Period	Pasture	Productivity	Ln	Lp	Bv	Hl	Tr	Ac	Legs	BLW	LCG	HCG
	NFP	4170[b]	810[b]	160[b]	691[a]	614[a]	704[a]	264[b]	707[a]	1369[b]	378[b]	3000[a]
	FP	8415[a]	2143[a]	459[a]	459[b]	534[b]	60[b]	2865[a]	60[b]	3815[a]	3212[a]	1329[b]
2010-2011	Sig	***	***	*	**	*	**	***	**	***	***	**
	NFP	5854[b]	1259[b]	28[b]	311	1044[b]	593[a]	2013	621[a]	1394[b]	2375	1474[b]
	FP	9443[a]	1418[a]	671[a]	343	1878[a]	444[b]	2021	548[b]	2202[a]	2572	3123[a]
2011-2012	Sig	***	*	***	ns	*	**	ns	*	**	ns	**
	NFP	6188[b]	1891[b]	95[b]	289[b]	370	143[b]	1766[a]	215[b]	3081[b]	2055	836[b]
	FP	12800[a]	3152[a]	1807[a]	841[a]	411	1130[a]	1174[b]	1302[a]	5521[a]	2286	3691[a]
2012-2013	Sig	***	**	***	***	ns	**	*	**	**	ns	***

NFP, non-fertilised pasture; FP, fertilised pasture; Ln, *Leontodon nudicaulis*, Lp, *Lolium perenne*; Bv, *Bromus valdivianus*; Hl, *Hocus lanatus*, Tr, *Trifolium repens*; Ac, *Agrostis capillaris*; Legs, total of legumes; BLW, total of flatweeds; LCG, low condition grass; HCG, high condition grass. *$P \leq 0.05$; $P \leq 0.01$; $P \leq 0.001$; ns not significant difference. Values on the same column followed by different letters present significant differences.

The probability of being grazed and the apparent intake of the mark tillers/plant were related to the type of pastures (Table 2). The grazing probability in FP was greater in *L. perenne* and in NFP, *L. nudicaulis* was the most grazed. In all pasture, *L. nudicaulis* was the most intake.

Table 2. Grazing probability and Apparent intake (mg, dry matter) per transect of the marked tillers of *L. perenne* and *B. valdivianus*, and plants of *L. nudicaulis* by the sheep in each pasture (mean ± sem) and statistical differences between species.

Grazing probability		
	NFP	FP
L. perenne	1.78±0.01[b]	2.32±0.01[a]
B. valdivianus	1.88±0.06[b]	2.26±0.01[a]
L. nudicaulis	2.51±0.05[a]	2.1±0.03[b]
sig	*	*
Apparent intake		
	NFP	FP
L. perenne	61.8±8.1[b]	125±7.9[b]
B. valdivianus	45.1±8.4[c]	100±7.1[c]
L. nudicaulis	386±32.1[a]	284±15.3[a]
sig	***	***

NF, non-fertilised pasture; FP, fertilised pasture. *P≤0.05; **P≤0.01; ***P≤0.001; ns, not significant difference.

The probability of being grazed (Table 3) of the mark tillers/plants were strongly related to the type of pasture and season. The apparently intake of Ln was significantly greater than Lp and Bv, but the probability of each species of being grazed were different between pastures. The differences between species respect to the grazing probability were not consistently. In the FP, Lp and Bv were

the more grazed during Autumn, Winter and Spring. On the other hand, Ln was the more consumed during Summer. In NFP, Ln was selected over the other two species to be grazed across the four seasons.

Table 3. Mean of grazing probability of tillers/plant from different type of pastures (non-fertilised pasture [NFP] and fertilised pasture [FP]) and species (*L. perenne*, *B. valdivianus* and *L. nudicaulis*) in each season.

	Autumn	Winter	Spring	Summer
NFP	0.45±0.04^{b}	0.48±0.01^{b}	0.52±0.03^{b}	0.45±0.01
FP	0.56±0.02^{a}	0.58±0.02^{a}	0.58±0.02^{a}	0.43±0.02
sig	*	**	*	ns
Lp	0.68±0.05^{a}	0.56±0.05^{a}	0.64±0.01^{a}	0.56±0.02^{a}
Bv	0.57±0.03^{b}	0.55±0.03^{a}	0.59±0.02^{ab}	0.52±0.03^{b}
Ln	0.60±0.02^{b}	0.48±0.09^{b}	0.56±0.02^{b}	0.57±0.01^{a}
sig	*	*	**	*
NFP Lp	0.48±0.06^{c}	0.49±0.06^{b}	0.41±0.01^{b}	0.40±0.03^{b}
NFP Bv	0.62±0.03^{b}	0.48±0.03^{b}	0.48±0.03^{b}	0.30±0.02^{c}
NFP Ln	0.70±0.05^{a}	0.67±0.02^{a}	0.60±0.08^{a}	0.54±0.01^{a}
sig	***	*	*	***
FP Lp	0.73±0.02^{a}	0.52±0.02^{b}	0.56±0.04	0.51±0.08^{b}
FP Bv	0.69±0.09^{a}	0.62±0.05^{a}	0.54±0.06	0.51±0.08^{b}
FP Ln	0.59±0.09^{b}	0.51±0.08^{b}	0.51±0.07	0.51±0.08^{b}
sig	*	*	ns	*

Lp, *L. perenne*; Bv, *B. valdivianus*; Ln, *L. nudicaulis* *$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$; ns, non-significant difference. Values on the same column followed by the same letters present significant differences.

4. Discussion

The improvement of a naturalised pasture revealed the importance of fertiliser and lime addition towards decreasing the soil fertility limiting factors to pasture growth, and also shows the relevance of grazing control to the pasture improvement process. Both, fertilisation and grazing control are responsible of providing the favour conditions to increase pasture herbage mass (Keim et al 2014; Obour et al., 2017). As a result of the soil fertility improvement, pasture botanical composition changed towards increasing the high fertility tolerant species (*L. perenne*, *B. valdivianus* and *H. lanatus*).

Considering the three years of evaluation, FP showed positive effects of managements and fertiliser, achieved 62% (6612 kg DM ha^{-1} $year^{-1}$) more than NFP. Due to FP have more available soil nutrients as consequence of the fertilization and liming the species can use the environmental resources (temperature, water and soil) and getting their potential growth (Mundim et al., 2018).

The botanical composition reflects the increase of soil nutrient availability, one of the main factors interfering on pasture production (Titěra et al., 2020). There was an increase of grasses species such as *L. perenne*, *H. lanatus* and *B. valdivianus*, while NFP maintained its original species composition conformed by species tolerant to soil acidity such as *A. capillaris* and flatweeds.

During Autumn and Spring, the probability of a specific plant being grazed by the sheep was significatively greater for *L. perenne* and *B. valdivianus* than for *L. nudicaulis*. The quantity of the grazed marked plants being consumed was also significantly greater for *L. nudicaulis* than *L. perenne* and *B. valdivianus* in both seasons. While in summer, *L. nudicaulis* was selected more than both grasses. In NFP, the sheep selected *L. nudicaulis* over the grass species in all seasons. These results show that sheep do actively selects species to be grazed when the species increases its availability in the pasture (Patkowski et al., 2019). In Summer, pasture growth rate decreases due to water stress, thus sheep expand their diet in favour to species such as *L. nudicaulis*. One consequence of this is that pasture probability *L. nudicaulis* being consumed increases. In addition, flowering stem density increased in *L. nudicaulis* being often preferentially consumed by sheep (Augustine and Frelich, 1998; Mulder and Ruess, 1998). In Winter, *L. perenne* and *L. nudicaulis* were selected over *B. valdivianus* because both had similar leaf length.

Conclusions

Fertilization and liming in a naturalised degraded pasture improved the botanical composition through the increase of high fertility tolerant species. Sheep actively select the species of plants to be grazed, with a marked preference for *L. perenne* and *B. valdivianus* in fertilised pastures and when herbage mass increased. When herbage mass was low and under water stress conditions sheep increased the grazing selection in *L. nudicaulis*.

ACKNOWLEDGEMENTS

This study was sponsored by Fund for the Scientific and Technological Development (Fondecyt), Chile, Project No. 1100957. The principal author thanks the Chilean National Council of Science and Technology (Conicyt) Doctoral Fellowship and Postgraduate Studies Direction of Universidad Austral de Chile

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INOCULATION WITH PLANT GROWTH-PROMOTING BACTERIA FOR IMPROVING NODULATION, NITROGEN UPTAKE AND GROWTH OF PEANUT (*Arachis hypogaea* L.)

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Abstract

The relationships between multi-traits beneficial bacteria and their inoculations and *Arachis hypogaea* L. have been poorly explored, despite they dominate in the peanut's rhizosphere and support plant growth, yield, nutrient uptake, and soil fertility. Inoculation with multi-traits beneficial bacteria promotes plant growth, yield and nutrient uptake. The present study assessed possible effects of mineral fertilizer (NP and P), two commercial liquid bio-fertilizer and IAA-producing, ACC deaminase-containing, N_2-fixing, and P-solubilizing bacteria based bio-fertilizers in single (*Pseudomonas fluorescens* RC512, *Bacillus subtilis* RC210, *Bacillus megaterium* RC16), dual (RC210+RC16, RC512+RC210, RC512+RC16) and triple strains combinations (RC512+RC210+RC16) on nodulation and growth parameters of peanut. Inoculations of peanut with RC512, RC210, RC16, RC210+RC16, RC512+RC210, RC512+RC16, and RC512+RC210+RC16 gave increases over control respectively of by 10.9, 11.4, 5.3, 7.4,14.6, 7.2, and 21.9 % in dry weight of root, by 7.8, 3.0, 4.0, 9.5, 15.5, 9.0, and 23.6 % in dry weight of shoot, by 21.9, 10.1, 13.6, 20.4, 27.5, 20.0, and 28.7 % in number of nodules per plants, by 16.1, 8.6, 7.3, 13.8, 25.7, 8.6, and 27.9% in weight of nodules and by 18.3, 11.0, 8.8, 13.6, 16.4, 18.2, and 24.3 % in N content of shoot per plants. NP applications, however, increased dry weight of root up to 20.3%, dry weight of shoot by 27.1 %, number of nodules by 23.6%, weight of nodules per plants by 26.1% and N content of shoot by 26.2%. In general, triple inoculations performed better than uninoculated control, single and dual inoculations in terms of growth and nodulation parameters.

Keywords: Groundnut, root-colonizing bacteria, nitrogen fixation, nitrogen accumulation, nodules number and weight, root and shoot weight

Introduction

Peanut (*Arachis hypogaea* L) is one of the important annual, self-pollinating, indeterminate, and summer oil and cash crops belonging to the legume family grown in tropical, semi-arid, sub-trophic, temperate zones and warm temperate regions. Peanuts are also known worldwide as groundnut, and their flowers above ground and pods containing one to five seeds are produced underground. Peanut is mostly grown because of its oil, protein and carbohydrates, all parts can be used for food purposes, animal feed and industrial raw materials. Although it varies according to the variety, its seeds contain 35-56% oil, 25-30% protein, 9.5-25% carbohydrates, abundant mineral elements such as K, Ca, Mg, P, S, Zn, and Fe, as well as vitamins E, A, niacin, folacin, riboflavin, and thiamine, depending on the variety (Fabra et al., 2010; Kurt et al., 2016; Asık and Arıoglu, 2020; Bakkal and Arıoglu, 2021)).

Atmospheric N can be converted into biologically useful form by symbiotic nitrogen fixation (NF) by legumes such as peanuts with specific nitrogen-fixing *Rhizobium* or *Bradyrhizobium*. Significant correlation was determined between N fixed, which contributes significantly to peanut growth, and total N yield

(Pimratch et al., 2009). Free-living plant growth-promoting bacteria enhance the growth of plants by their microbial processes such as fixation nitrogen, solubilization of inorganic phosphate and mineralization of organic matter, regulation and production of phytohormones and siderophores, promoting beneficial plant-microbial association, and facilitating resource acquisition and nutrient uptake. Phosphate solubilizing bacteria can solubilize and mineralize P from inorganic and organic insoluble sources, thus playing an important role in plant nutrition through increased P uptake by plants.

Studies using *Bacillus* and *Pseudomonas* strains in peanuts, besides rhizobia, have shown to increase seedling emergence, root and shoot length, dry weight and yield, and found to have beneficial effects on this legume (Dey et al., 2004; Fabra et al., 2010). Dey et al. (2004) found that the ability of siderophore and IAA producing, ACC-deaminase activity and P-solubilizing bacteria to increase available soil phosphorus and total nitrogen in soil were positively correlated with the number of nodules, increased pod yield, nutrient uptake and other plant growth parameters of peanut. Peanut plants inoculated with *Ochrobactrum intermedium* L115 and *Azospirillum brasilense* Az39, which showed ACC deaminase activity and were able to produce indole acetic acid and siderophore, showed an increase in shoot and root length and dry weight compared to uninoculated plants, and also tolerated high growth temperature and salinity (Paulucci et al., 2015). Co-inoculation between P-solubilizing bacteria *Serratia* sp. J260 and *Pantoea* sp. J49 in peanut plant has been reported to enhance growth, yield as well as P content values in plant and/or plant growth substrate (Anzuay et al., 2017).

In the studies conducted with microorganisms, co-inoculations of N_2-fixing rhizobia and plant growth-promoting endophyte *Bradyrhizobium* or *Trichoderma* have increased the germination, growth, development, chlorophyll and yield in peanut (Neelipally et al., 2020), increased pod number, weight and yield, protein, oil ratio of Virginia type (Halisbey) peanut under main crop conditions in Cukurova region with the co-application *Rhizobium* bacterium and fertilizer (Asık and Arıoglu, 2020), enhanced aerial dry weight of peanut plants with the inoculations of *Pantoea agglomerans* (Taurian et al., 2010), and increased the dry matter and yield, percentage of protein and oil of groundnut plants with the inoculations of phosphate-solubilizing fungi *Aspergillus niger* and *Penicillium notatum* (Malviya et al., 2011).

While the use of both symbiotic and non-symbiotic N_2-fixing and solubilizing/mobilizing microorganisms as biofertilizers is increasing, promoting P uptake, nodule formation and function with phosphate-dissolving bacteria in legumes is an important area of study for developing strategies for effective management of plant nutrients. The aim of this work was to evaluate effects of mineral fertilizer, two commercial biofertilizers, and single, dual and three strains combinations with auxin (IAA)–producing, N_2-fixing, P-solubilizing and 1-Aminocyclopropane-1-carboxylate (ACC) deaminase containing bacteria on nodulation, nitrogen uptake and growth of peanut.

Materials and Methods

A field experiment has been conducted under the main crop conditions at the Research and Experimental Field of the Balıkesir Farmer Training Center (BAÇEM), which serves in Burhaniye under the Metropolitan Municipality Rural Services Department, in 2020. The experimental soil was loamy with 1.02% organic matter and 1.19% $CaCO_3$ content (pH= 7.3). Total N and available Olsen-P were 0.038 % and 165 kg^{-1} soil, respectively. The selected three bacterial isolates that IAA-producing, ACC deaminase-containing, N2-fixing, and P-solubilizing in single, double and triple combinations were tested for growth and nodulations parameters in peanut under field conditions. The experimental design consisted of three completely randomized blocks each having 12 main treatments as (1) Control (without inoculation and any fertilizer application), (2) *Pseudomonas fluorescens* RC512, (3) *Bacillus subtilis* RC210, (4) *Bacillus megaterium* RC16, (5) RC210+RC16, (6) RC512+RC210, (7) RC512+RC16, (8) RC512+RC210+RC16, (9) BMusaVita, (10) BMusaGreen, (11) NP (120 kg N ha^{-1} + 85 kg P ha^{-1}), and (12) P (85 kg ha^{-1}).

In the experiment, 85 kg of P_2O_5 ha^{-1} in the form of triple superphosphate (41-44 % P_2O_5) was applied as phosphorus fertilizer in the spring prior to disk- harrowing. Nitrogen at the rate of 120 kg N ha^{-1} in the form of urea (46%) was applied, the first half of which before the first irrigation and the remaining half before the second irrigation. For the preparation of microorganism-based bio-formulations and commercial biofertilizers, the bacterial culture were grown in flasks containing of Nutrient Agar (NA) on a rotary shaker at 27°C for 24 hours. For single, dual and triple inoculation, equal volume (10^8 cfu ml^{-1} of each inoculant) of each cultures were mixed and then used. Subsequently, 24-h cultures were developed in a horizontal shaker incubator, inoculated into NB containing liquid culture medium previously prepared by the fermenter and sterilized by autoclaving for 20 min at 120°C (Çakmakçı et al., 2013). The final concentration of bacterial cultures was 10^8 cfu/ml. For commercial liquid bio-fertilizers, the bacteria inoculated organic liquid carrier

was incubated in the bioreactor with optimum growth conditions. The final concentration of all bacterial suspensions used were 10^8 cfu/ml.

Sowing was done with a precision drill with in to a row of 60 cm apart and a depth of 5-8 cm. In the experiment, the size of the plot was 2.4 m x 5 m (total plot area was 12 m^2), and each plot included four rows. After emergence was completed in all plots, the number of plants established was counted and the thinning process was carried out to 20 cm above the row. The first hoeing was done before flowering, when the plant height was 10 - 12 cm, and the second was done during pegging. Earthling up was done during hoeing to encourage pegging or penetration of young nuts into the soil. Thereafter, weeds were removed by hand wherever needed after the start of pegging so as not to damage the flower and gynophores, disturb the nuts, and interfere pegging. While weeds were controlled by hand hoeing, there was no disease or insect attack on the crop in the growth cycle. Sprinkler irrigation was applied to ensure germination after sowing; maintenance, hoeing and irrigation were done on time and appropriately.

Harvest was done at 75 days after sowing (DAS) during the flowering phase, excluding one side row and 0.5 m from both ends of the plots giving two rows and harvest area of 4.8 m^2 in plots. Necessary observations were made on 40 plants taken from the two side rows of each parcel at the harvest, all of remaining plants in the middle two rows were harvested, dried and weighed and yields were determined. Data on different growth parameters of peanut, namely, weight of root and shoot, total biomass, number, and dry weight of nodules per plants, fresh weight nodule, N content of nodule, root and shoot were recorded at 75 days after sowing (DAS) during the flowering phase. Nodules related parameters such as the number of nodules were counted from randomly selected 10 plants and their averages were calculated. The number of flowering period nodules was carefully dug from 10 randomly selected plants in each plot, cut at ground level to separate the plant roots from the shoot, washed with water, and counted by manually removing the nodules from the roots. Afterwards, shoots, roots and nodules were dried at 78 ±2 °C for 48 hours and their dry weight was measured. The data were subjected to analysis of variance using SPSS13.0 (SPSS Inc. Waltham MA) and the means were separated according to Duncan's multiple range test.

Results and Discussion

Field trials showed that bacterial formulations, commercial liquid bio-fertilizer, and inorganic fertilizer applications significantly affect the parameters investigated in nodulation, nitrogen uptake and growth of peanut, depending on the strains, combinations of strains and evaluated parameters, compared to control. The highest root dry weight per hectare was obtained in the combination of all three strains and NP fertilizer plots representing increases over control of 28.8% and 25.7% followed by BMusaGreen (25.2%) and BMusaVita (17.7%). Whereas the highest shoot dry weight per hectare was obtained in NP fertilizer and BMusaGreen plots representing increases over control of 26.6% and 24.9% followed by mixture of all three strains (21.1%) and BMusaVita (19.7%). Except for RC16, all treatments significantly increased root dry weight per plant in peanut; NP fertilizer, dual inoculation with RC512 and RC210, mixture of all three strains, and both of commercial liquid bio-fertilizer increased shoot dry weight and biomass weight per plant compared to control (Table 1).

In the present study, it was found single, dual and triple bacterial inoculation could increase root, shoot weight, and plant biomass. Researchers observed that co-inoculation of PSB and rhizobia could increase both growth and yield of legumes and improved the absorption of nitrogen and P in peanuts (Dey et al., 2004). In previous studies, it was shown that siderophore-producing *Paenibacillus illinoisensis* and *Bacillus* sp. bacterial strains influenced root activity, chlorophyll and active iron content in leaves, total N, P, and K accumulation and increased the quality of peanut kernels and plant biomass over control (Liu et al., 2017).

Except for RC16 inoculation, all treatments significantly increased nodule number per plant, while all treatments, except for single RC210 and RC16 inoculations, increased nodule N content and fresh weight per nodule as compared to the control (Table 1, 2). All inoculations and fertilizer applications significantly increased total root and aboveground N concentration of peanut per hectare and root and aboveground N content per plants over control. All treatments tested enhanced dry weight per nodule, whereas only the NP fertilizer, Inoculation of triple strains combinations, and commercial liquid bio-fertilizer increased the percentage of N content of the root and aboveground in peanut plant.

Table 1. Effect of bio-fertilizer and inorganic fertilizer, PGPR and their combinations on growth and nodule parameters of peanut in the field experiment

Treatments*	Root DW (kg ha^{-1}) **	Shoot DW (kg ha^{-1})	Root DW (g $plant^{-1}$)	Shoot DW (g $plant^{-1}$)	Biomass DW (g $plant^{-1}$)	Nodule number (plant-^{1})	Nodule DW (mg $plant^{-1}$)	Nodule FW (mg $nodule^{-1}$)
Control	26.7 e	5.70 e	2.37 c	29.7 d	42.0 d	159 d	283 d	2.89 d
NP	33.6 ab	7.22 a	2.86 ab	37.8 a	53.7 a	197 ab	357 8 a	3.41 bc
P	28.8 cd	5.83 de	2.55 b	31.8 cd	44.0 cd	190 a-c	323 c	3.27 bc
RC512	28.5 cd	6.13 cd	2.63 b	32.1 cd	43.9 cd	194 ab	328 bc	3.19 bc
RC210	27.3 de	5.93 de	2.64 b	30.6 cd	42.8 d	181 bc	307 c	3.13 b-d
RC16	27.4 de	5.83 de	2.50 bc	30.9 cd	42.6 d	176 cd	304 c	3.10 cd
RC210 + RC16	28.3 c-e	6.24 cd	2.55 b	32.6 b-d	46.8 bc	192 a-c	322 c	3.17 bc
RC512 + RC210	30.6 b-d	6.67 bc	2.72 ab	34.4 a-c	49.9 ac	203 a	356 a	3.29 bc
RC512 + RC16	28.8 de	6.23 cd	2.54 b	32.4 cd	44.6 cd	191 a-c	307 c	3.12 cd
RC512+RC210+ RC16	34.4 a	6.91 ab	2.95 a	36.8 a	51.9 ab	205 a	362 a	3.36 bc
BMusaVita	31.5 a-c	6.83 ab	2.84 ab	36.4 ab	50.6 a-c	199 ab	349 ab	3.46 b
BMusaGreen	33.5 ab	7.12 a	2.95 a	37.7 a	52.6 a	194 ab	359 a	4.04 a
Average	29.9	6.39	2.66	33.6	47.2	291	330	3.28

*Control: without bacteria inoculation or mineral fertilizers; NP fertilizer (120 kg ha-1 N in the form urea + 85 kg ha-1 P in the form of triple superphosphate); P fertilizer (85 kg ha-1 P in the form of triple superphosphate (41-44 % P_2O_5); *Pseudomonas fluorescens* RC512; RC210: *Bacillus subtilis* RC210; RC16: *Bacillus megaterium* RC16; DW: dry weight, FW: fresh weight; **Different letters within the same column indicate significant differences according to Duncan's Multiple Range Test ($P \leq 0.01$)

In this study, it was determined that the number of nodules per plant, which was 159 in the control application, increased by 176 in the NP application and 176-205 in the bacterial inoculations. The inoculation of PGPR had a synergistic effect on the peanut growth and significantly improved the shoot and root weights and nodule number. IAA production by PGPR might have stimulated the lateral root formation, root weight and increased nodulation in groundnut plants. These results are in accordance with those obtained by Badawi et al. (2011) who found that inoculation of *Serratia marcescens* and *Trichoderma harzianum* individually or together with effective *Bradyrhizobium* stimulated nodule number, nodule dry weight, and nodulation and N_2-fixation performance. Inoculation of different combinations of *Rhizobium*, *Pseudomonas* and *Bacillus* strains stimulated available N, P and K in soil, growth and yield parameters, and number of nodules of groundnut (Mathivanan et al., 2014).

Dual inoculation of *Bradyrhizobium* spp. and *Azospirillum brasilense* in peanut has been reported to enhance growth, chlorophyll content, dry matter accumulation, and peanut grain yield as well as root nodulation (Steiner et al., 2021). As a matter of fact, more catalase, peroxidase, polyphenol oxidase, amino acid and sugar increases were observed in groundnut with the inoculation of *Rhizobium*, *Pseudomonas fluorescens* and *Bacillus subtilis* together (Mathivanan et al., 2018). Previous studies were recorded that inoculation of *Pseudomonas aeruginosa* P4, which shows multi-traits such as P-solubilization, IAA, HCN, siderophores and pyocyanin, stimulates nutrition, plant growth, plant defence physiology, root system functions, and nitrogen fixation in peanut plants grown under gnotobiotic conditions (Gupta et al., 2020).

Among the various bio-formulations tested, co-inoculation of IAA-producing, N_2-fixing, P-solubilizing, and ACC deaminase containing *Pseudomonas fluorescens* RC512, *Bacillus subtilis* RC210, and *Bacillus megaterium* RC16 were found to be most effective in promoting the N uptake, growth and nodulation parameters of peanut. Wang et al. (2014) showed that phosphate-solubilizing *Bacillus thuringiensis* inoculation promoted phosphorus uptake, the number of nodules per plant and growth in peanut in acid soil. Inoculation of N_2-fixing, P-solubilizing ad ACCD- and IAA- producing *Agrobacterium tumefaciens*, *Klebsiella* sp., *Ochrobactrum anthropi*, *Pseudomonas stutzeri* and *Pseudomonas* sp. were able to colonize the roots and enhance the salt tolerance of the seedlings, as well as increases total plant N and promotes peanut growth under non-stress and saline conditions (Sharma et al., 2016). Inoculation of *Pseudomonas*, *Enterobacter* and *Klebsiella* isolates with the ability to dissolve phosphate and produce siderophores was found to increase several growth parameters and nodule number in peanut (Ibañez et al., 2014).

Table 2. Effect of bio-fertilizer, inorganic fertilizer, PGPR and their combinations on nodule, root and above-ground N content in peanut.

Treatments	Nitrogen content (%)			Nitrogen content (kg ha^{-1})		Nitrogen content (mg plant^{-1})	
	Root	Above-ground	Nodule	Root	Above-ground	Root	Above-ground
Control	1.56 c	2.76 c	4.19 b	4.24 d	158 d	35.8 d	1580 e
NP	1.66 a	3.04 a	4.43 a	5.43 a	201 a	45.0 a	1995 a
P	1.61 a-c	2.81 c	4.36 a	4.73 bc	167 c	40.5 bc	1674 d
RC512	1.59 bc	2.86 bc	4.41 a	5.02 ab	187 b	42.6 bc	1869 b
RC210	1.58 bc	2.84 bc	4.35 ab	4.74 bc	174 bc	39.3 c	1753 b-d
RC16	1.58 bc	2.83 bc	4.32 ab	4.63 c	173 bc	38.3 c	1720 cd
RC210 + RC16	1.61 a-c	2.86 bc	4.36 a	4.71 bc	180 bc	40.8 bc	1796 b-d
RC512 + RC210	1.62 a-c	2.87 bc	4.40 a	4.86 bc	182 b	41.3 bc	1840 bc
RC512 + RC16	1.62 a-c	2.87 bc	4.37 a	4.73 bc	187 b	42.9 bc	1868 b
RC512 + RC210 + RC16	1.66 a	2.90 b	4.47 a	5.39 a	193 a	43.4 ab	1965 a
BMusaVita	1.63 ab	2.89 b	4.41 a	5.04 ab	192 a	43.5 ab	1942 a
BMusaGreen	1.63 ab	2.90 b	4.46 a	5.40 a	199 a	43.2 a	1987 a
Average	1.61	2.87	4.38	4.91	183	41.3	1832

**Different letters within the same column indicate significant differences according to Duncan's Multiple Range Test ($P \leq 0.01$)

Conglussion

The effects of free-living and non-rhizobial PGPR inoculations on peanuts, and the mechanisms by which improving the nitrogen fixation should be adequately investigated. When *Pseudomonas fluorescens* RC512, *Bacillus subtilis* RC210, and *Bacillus megaterium* RC16 were co-inoculated in peanut, they significantly improved plant growth, nodulation and nitrogen uptake and nutrition compared to their single and dual inoculation.

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PROPOSALS FOR GROUPING AND PASSPORTIZATION OF SOILS OF URBANIZED TERRITORIES LAND

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ABSTRACT

For a city planning cadastre, organization, planning and implementation of land management, economic activity, a scheme of supplementing the list of agricultural soils of Ukraine with cadastral and economic grouping of soils of urbanized territories is proposed, which includes two associations: 1) transformed and 2) technological (artificially created) soils - all in all 14 cadastral and economic groups. A new passport of soils of the land plot of the urbanized territory, which contains information on the quantitative and qualitative condition of soils at the time of the research has been declared. Issuance of a passport is the final stage of soil research (certification), which has legal force in the implementation of land management (removal and transfer of fertile soil layer), compensation, conducting a city planning cadastre, etc.

Keywords: soils of urban areas, economic and functional zoning of the city, Odessa city, urbanozem, technological soils, urban cadaster

INTRODUCTION

There is a severe increase of urbanized land in the world in the context of a high level of technogenesis and intensive development of industrial agglomeration. In Ukraine, the area of built-up territory is 2552.9 thousand hectares, the population living in cities - 70%. An increase of the area of human settlements due to territories that have an actively functional surface and are usually represented by undisturbed natural and plowed agricultural lands, leads to a change of the ecological potential of soils on a global scale. One of the tasks of soil scientists is to predict the consequences of urbanization on global changes of the ecological functions of the soil cover. New soil-like solid and original soils form, transformation and change of the zonal soil cover take place within the settlements. Urban soils acquire specific features and properties, become a new object of research. In the world, there is an intensive development of research of urban ecosystems and the role of soils in them. Some countries at the legislative level decide on the monitoring of urban soils, their using and protection to ensure decisions and actions in the land administration system. Ukraine is currently passing the stage of development methodological principles for the study of the urban ecosystem. Regional studies of the soil cover of cities and, in general, the issues of improving the methodology of soil and soil-ecological studies, monitoring of human settlements` soils, improving methods of diagnostics and classification of soils of urbanized territories are relevant.

RESEARCH METHODS

General scientific (systematic, analysis, synthesis, generalization) and traditional (comparative analytical) research methods were used at conducting the cadastral and economic grouping of Odessa soils.

RESEARCH RESULTS

The Odessa city is located within the seaside-estuary physical-geographical region of the Dniester-Bug steppe region of the Black Sea loess accumulative lowland. The zonal soils of the subzone of the Southern Steppe of Ukraine in the area of the Dniester-Bug accumulative loess plain are southern chernozems, mainly low-humus heavy loamy (agro-industrial soil group 71e).

In 2015-2021, a comprehensive study of the soils of the Odessa city was carried out, and a classification scheme of soils of urbanized territories was proposed, by modernizing already existing taxonomic structures in terms of its compliance with the possibility of introducing city soils into the

classification scheme of soils of Ukraine (1988) [1]. To study the system "factors of soil formation - soil" there were made 43 key-plots, at which soils in 70 soil cuts and 24 diggings (the article describes the main subtypes of natural and anthropogenic soils in the Odessa city). At the field examination of soils, the morphological description was conducted, and soil samples were selected by genetic horizons (Fig.1).

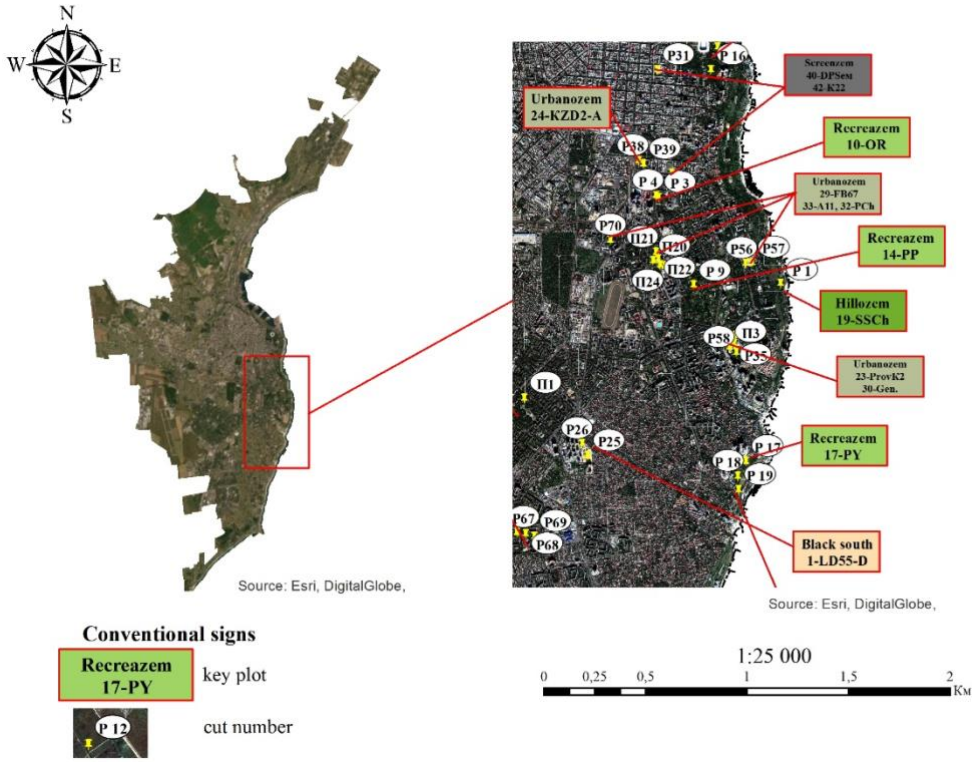

Fig. 1. Placement of main key-plots in Odessa city

The classification of soils of urbanized areas is based on profile-genetic and factor-ecological approaches. It is based on morphological features, properties, as well as the conditions of the natural and anthropogenic environment in which the soils of human settlements function, develop and transform. In the proposed classification it is used the same taxonomic units that are used in the classification of natural soils, but adapted to the soils of urbanized areas. The classification is developed for supporting the city building cadastre. Soils of urbanized territories relate to the class “Anthropogenic soils” that includes two types of soils: anthropogenically-transformed and anthropogenically-created (technological) ones.

In the data system of the urban planning cadastre, information about the ecological state of soils of land areas as an element of the natural environment of a human settlement is not covered enough, which can contribute to the acceptance of environmentally unjustified management decisions in the implementation of urban planning activities. In general, the protection of land within the city is not aimed at preserving soil fertility and its reproduction, but mainly at preventing unauthorized development and preventing the irrational use of the territory for the placement of industrial, residential and other facilities. In a critical situation in the field of environmental protection of human settlements, the need to create an ecological model of an urban planning cadastre with the provision of legal protection of soils of human settlements increases.

The proposed ecological-profile-genetic classification became the basis for carrying out the cadastral-economic grouping of these soils. At conducting the cadastral and economic grouping of settlement soils, there were taken into account not only morphologic and physical-chemical properties of soil sorts, according to which similarity groups were combined, but also the economic-functional significance of a human settlement territory.

The list of agro-industrial soil groups approved by Appendix 5 of the Resolution of the Cabinet of Ministers of Ukraine "On Approval of the Procedure for Maintaining the State Land Cadastre" dated October 17, 2012 [2] is proposed to introduce groups of transformed and technogenic (artificially created) soils of settlements and other territories with anthropogenically transformed soil cover (Table 1).

Table 1: **Cadastral and economic grouping of settlement soils**

Code	Soil group name		
Agroproduction soil group			
1-222	Names of agroproduction soil groups according to the approved nomenclature list		
Groups of transformed and technological (artificially created) soils of human settlements and other territories with the anthropogenically transformed soil cover			
223	Agrosoils (argochernozems, argomeadowzems, agroturf and so on)	230	Necrozems
224	Urbosoils (urbochernozems, argomeadowzems, agroturf and so on)	231	Intruzems
225	Recreazems	232	Industrizems
226	Culturezems	233	Dumpzems
227	Hillozems	234	Technozems
228	Urbanozems	235	Lithozems
229	Acephalozems	236	Screenzems

The group "Transformed soils" in the cadastral and economic grouping of soils of the human settlements unites soil varieties in which, under the influence of anthropogenic activity, changes in the morphological structure of the profile have occurred, while the characteristics of natural soils are preserved (anthropogenic superficially transformed soils). It also unites subtypes that are formed as a result of intensive economic activity (entire development, industrial development, transport infrastructure) (anthropogenic deeply transformed soils).

The group "Technogenic (artificially created) soils" includes subtypes that reflect purposeful changes of the soil cover by engineering, environmental guarding, organizational and other actions and sealed soils (technogenic superficially soil-like formations and sealed soils)

For conducting a city planning cadastre, it is important to take into account ecological-functional importance of a territory and also soils, spread in it. Cadastral and economic grouping of soils is based on the complex combination of morphological, agronomic, ecological, economic-functional properties of soil sorts.

Article 48 of the Law of Ukraine "On land protection" in the process of urban planning activity provides for the maximum preservation of the area of land plots with soil and vegetation cover; mandatory removal and storage of the fertile soil layer when carrying out activities related to the disturbance of the surface soil layer; prevention of changes in the hydrological regime of the land [3]. Thus, in human settlements, the main method of soil protection is the removal of the fertile soil layer during the implementation of urban planning activities. The removed fertile soil layer is stored and can be used for landscaping and improvement of unproductive land, land reclamation within the city in accordance with design documentation of land plots of any form of ownership.

The current legislation (Article 168 of the Land Code of Ukraine) provides for the procedure for landowners and land users to obtain special permission from the central executive authority, implementing state policy in the field of state control in the agro-industrial complex, to remove and transfer the soil cover of a land area [4]. Obtaining permission to convert the soil cover into the state of the soil mass is possible only if there are a duly certified land management project, an agrochemical passport of the land area and documents of title to the land area. It should be noted that the object of agrochemical certification in accordance with the Order of the Ministry of Agrarian Policy and Food of Ukraine "On approval of the Procedure for maintaining an agrochemical passport of a field, land area" dated October 11, 2011 is exclusively agricultural land (arable land, including irrigated, drained; hayfields and perennial pastures) [5].

In Ukraine, no survey of the soils of human settlements was carried out. At the same time, information about soil cover of a human settlement is necessary to provide the needs of maintaining an urban planning cadastre, carrying out economic activities, developing land management projects, including preserving the fertile layer during development, land reclamation, etc. It is important to have information about the presence of the fertile layer, its main indicators of fertility, the content of pollutants, the dynamics of these indicators for the development of proposals for land protection, preservation and reproduction of soils. This goal can be achieved provided that the soils of the lands of the human settlements are certified. Certification will

ensure control of the quality and ecological state of soils within the human settlement; protection of the soil cover of the human settlement during economic activities and obtaining permission for the development of land management projects for the removal and use of the fertile soil layer, development and other work related to the disturbance of the soil cover. The result of the certification is the production of a soil passport for the land area of the human settlement.

The soil passport of a land area is the main document, which may contain information on the qualitative and quantitative indicators of the properties of the soils of a human settlement. By analogy with the agrochemical passport of agricultural area, the passport of the soil of a human settlement may consist of two sections. The first section is "land cadastral" one, which indicates cadastral information: address of the land area, cadastral number, area, etc. The second section is “soil”. This section should include information taking into account the characteristics of the soils of the human settlement, the needs of the urban planning cadastre and economic activity in the human settlement.

The following structure of the passport for the "soil" section is proposed:

1. The code of the cadastral and economic group of soils, the name of the soil and the formula of the soil profile.

2. Characteristics of the soil (thickness of the humus layer, humus content, indicator of actual acidity (pH), particle size distribution, type and degree of salinity, solonetzicity). As a separate item, it is necessary to indicate the estimated conclusion about the presence or absence of a fertile layer.

3. The content of pollutants: heavy metals and radionuclides (according to the list of the agrochemical passport) with the mandatory inclusion of mercury and fluorine in the list. A separate item must indicate the total indicator of pollution.

Taking into account the corresponding territory of the human settlement, the composition and degree of detailing of cadastral data in the system of maintaining the urban planning cadastre, which is carried out at four hierarchical levels (state, regional, district and city), it is proposed to carry out certification of soils of urbanized territories at the lowest - the city level of the urban planning cadastre. The results of this type of work should be available to a wide range of users, so they must be added to the National Cadastral System (Public Cadastral Map of Ukraine).

CONCLUSIONS

After analyzing the legal basis for the protection of soils and lands of human settlements during urban planning activities, the need to improve legislation by creating a unified integrated system for managing the quality of soils in human settlements was determined. It is important that public administration in the field of land resources is based on the principles of sustainable development, focusing on activities aimed at preserving, reproducing fertility and soil quality within human settlements. Specialists of academic, research, design and production institutions and organizations need a clear classification scheme of these soils, methodological and diagnostic principles of their study, proper regulatory support of soil protection regulation in the field of urban planning. The practical importance of the obtained results provides widening and supplementing theoretical and methodical research bases for soils of different functional-economic zones of human settlements.

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BIOLOGICAL EFFICACY OF INSECTICIDES IN THE CONTROL OF JAPANESE GRAPE CICADA (*Arboridia kakogowana* Mats.) IN THE CONDITIONS OF THE SOUTH OF UKRAINE

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Abstract

In recent years, due to the expansion of the range and the increase in the harmfulness of leafhoppers, the study of their species diversity and the development of protective measures to control their numbers have become actual in vineyards. In the conditions of the south of Ukraine, from a large species diversity of leafhoppers that are found in vineyards, in four years of research (2017–2020), we have established an increasing activity of development and spread of the Japanese grape leafhopper (*Arboridia (Erythroneura) kakogowana* Mats.), which is an invasive (alien) species for Ukraine. Due to the annual damage to grapes by this cicada, plants are depleted, immunity and product quality are reduced. It was found that the highest number and, as a consequence, the harmfulness of leafhoppers is observed in the second half of the growing season (July–September) during the period of active growth and ripening of grapes. The greatest development of leafhoppers was recorded in thickened vineyards with the presence of vegetative weeds.

The article presents the results of studying the effectiveness of insecticides against Japanese grape cicada in the South of Ukraine. Biological preparation Aktofit (0.2%) EC and other insecticides from different chemical groups were used: Voliam Flexi (480 g/l) SC, Dursban (480 g/l) EC, Karate Zeon (50 g/l) CS, Koragen (200 g/l) SC, Proclaim (5 g/kg) SG, Engeo (247 g/l) SC. This insecticides have shown varying efficacy. The highest efficiency was obtained with the insecticides Voliam Flexy (300 g/l) SC – 89.3% and Engeo (247 g/l) SC – 86.3%, which contain two active substances with a different mechanism of actions. Very low efficiency in controlling the number of leafhoppers was obtained with the biological preparation Aktofit (0.2%) EC –

53.8%. According to the research results, we can conclude, that the most effective and basic method controlling the Japanese grape leafhopper remains the chemical. The decision about need of treatments should be made only after assessing the real phytosanitary situation, taking into account the threshold of the number of pests, harmfulness, and the degree of colonization of plants. With a low number of phytophages, continuous treatments should be abandoned, limiting themselves to spraying outbreaks of mass reproduction.

Key words: Japanese grape leafhopper, insecticides, biological effectiveness.

Introduction

Recently, in the vineyards of Ukraine and other countries, both in industrial plantings and personal farms, an increase in the number of Japanese (Far Eastern) grape leafhoppers (*Arboridia kakogowana* Mats.) has been observed due to a number of reasons. First of all, these are climatic changes, characterized as a persistent thermal anomaly, the ability of the leafhopper for mass reproduction and its high ecological plasticity to changing environmental conditions [1, 3, 4, 5, 10].

The leafhopper develops in three generations from April to October, and under especially favorable conditions gives the fourth generation. Dry weather increases the probability of mass emergence of cicadas. Migration to wintering sites begins in mid-late September. Adult insects overwinter, which leave their wintering places at an air temperature of +10...+12 °C. First, they feed on weeds, which begin the growing season earlier, and then move on to grape plants. After additional feeding, the females lay their eggs in incisions made by the ovipositor in the veins of the underside of the leaf. The larvae go through five instars in their development. The developmental cycle of one generation is approximately 35–40 days [5, 6, 7].

Adults, nymphs, and leafhopper larvae live in colonies on the underside of grape leaves along the veins, sucking out the juice. As a result of their nutrition, chlorophyll is destroyed in damaged cells and white chlorite spots are formed on the upper side of the leaf blade, resulting in discoloration of the leaves [8]. Many researchers have found that the Japanese grape leafhopper mainly inhabits varieties with intense leaf pubescence (Cabernet Sauvignon, Aligote, Saperavi, Odessa Black and many others) [9].

The basis of the modern system of protection of vineyards is the development of scientifically based schemes for the use of the highly effective preparations that ensure reliable control of the development of harmful organisms. Taking this into

account, the study of the effectiveness of a modern assortment of insecticides in order to determine the optimal timing of their use in the fight against Japanese vine leafhoppers is a topical issue and has practical significance.

Methodology

Aim. Determination the effectiveness of the insecticides used in the protection of vineyards from the Japanese vine leafhoppers and to establish the optimal timing and frequency of their use.

Materials and methods

The research was carried out on the variety Odessa black, 2008 year of planting. Planting scheme — 3 x 1.5 m. The formation of plants is a double-sided cordon with a stem height of 70–75 cm, which is severely damaged by leafhoppers. In the course of the research, the methods generally accepted in entomology and plant protection were used [11].

To identify the species of leafhoppers, the method of route surveys was used in the period from April to October. To catch insects, we used the method of collecting individuals in entomological vessels and the use of yellow glue traps, which make it possible to track winged forms. Signal traps were placed vertically in the area of the bush, inspection and replacement was carried out at intervals of once every 2 weeks.

Identification and counting of captured insects were made in the laboratory using an XY-B2 trinocular microscope and an SZM-45 T2 stereoscopic microscope. The species was identified based on the morphological characteristics of adults using generally accepted identifiers and with the involvement of an electronic resource.

To determine the effectiveness of preparations for controlling the number of Japanese grape cicada an experiment was laid, which included 9 variants. Six insecticides belonging to different chemical groups and one biological preparation were tested (Table 1). Each variant included 20 plants, which corresponded to 4 replicates of 5 plants each. The obligatory variants were: control — vines without treatments and the standard (standard) — insecticide, which is used by the farm. Placement of variants is randomized, replicates are systematic. Spraying was carried out using STIHL SR 420 when nymphs of younger age groups appeared, depending on the economic threshold of harmfulness (EPV), which, according to [6], is more than 15 individuals.

Table 1. – Scheme of production experiment to study the effectiveness of insecticides against Japanese grape cicada (*Arboridia kakogawana* Mats.) SE "DG Tairovske", variety Odessa black, 2017–2020.

Experience variant	Consumption rate of the insecticides, l, kg/ha	Development phase of vine	Date of treatment
1. Control	without protective treatments against cicadas		
2. Standard (Confidor (200 g/l) SL)	0.2	intensive growth of grapes	I- III decades of July
3. Aktofit (0.2%) EC	0.2		
4. Voliam Flexi (300 g/l) SC	0.3		
5. Dursban (480 g/l) EC	1.5		
6. Karate Zeon (50 g/l) CS	0.15		
7. Coragen (200 g/l) SC	0.2		
8. Proclaim (5 g/kg) SG	0.3		
9. Engeo (247 g/l) SC	0.18		

Observations of the change in the state of leafhopper populations after treatments were made using the method of counting the number by the moving stages of the pest with an interval of 3–5 days (3, 5, 10 15 days after treatment) with the obligatory consideration of the number of the pest before the treatment of plants. The average number of mobile stages of leafhoppers per leaf was determined according to the variants of the experiment.

The biological effectiveness of the insecticides used to reduce the number of leafhoppers relative to the initial, adjusted for control, was calculated by the Abbott's formula: $E = (x-y) / x \bullet 100\%$, where E – is the effectiveness of insecticides; x – is the number of leafhoppers in the control; y – the number of leafhoppers in the experimental version.

Results

Long-term monitoring of the flight dynamics of the imago of Japanese grape cicada with yellow glue traps, as well as accounting for the population of grape leaves by pest larvae showed that the highest number and, consequently, its harmfulness was

observed in the second half of the growing season (I–III decades of July) second generation pest. In this regard, the treatment of plantations to study the effectiveness of the insecticides according to the experimental variants, was carried out from the first decade of July to the third decade of August during the development of larvae of the younger generations of the second generation.

Observations of the biology of the pest showed that the appearance of the imago of the first generation of Japanese grape cicada in the growing seasons of 2017–2020 was observed in the first decade of April. The number was small — 5–8 individuals per yellow glue trap and an average of 1.5–2.3 larvae per leaf. Egg lying was recorded for the period of the second decade of April. Therefore, the first generation of the pest does not cause significant damage to the plantings. Most of the mass spread of the pest in the region was observed in the I–II decades of July.

Processing according to the research options was made on the day of the preliminary accounting. Further analysis of the number of pests (after treatments) was performed on day 3, day 5, day 10 and day 15. The results of the calculations showed the high efficiency of the applied insecticides with a prolonged protection period. Thus, the insecticides Voliam Flexi (300 g/l) SC and Engeo (247 g/l) SC over the years of the study helped to reduce the average number of pests to 1.7-1.9 individuals of larvae per 100 cm^2 leaf surface, at control values of 24.6 individuals (Table 2).

Experience variant	The average number of larvae per 100 cm of leaf surface				
	before treatment	a few days after treatment			
		3 days	5 days	10 days	15 days
1. Control	18.9	20.9	25.7	22.5	24.6
2. Standard (Confidor (200 g/l) SL)	22.8	9.1	4.6	3.8	3.4
3. Aktofit (0,2%) EC	16.9	14.1	11.9	7.3	9.5
4. Voliam Flexi (300 g/l) SC	21.4	3.3	2.3	2.2	1.7
5. Dursban (480 g/l) EC	19.5	4.6	3.7	2.9	2.5
6. Karate Zeon (50 g/l) CS	18.5	5.5	4.1	3.3	2.3
7. Coragen (200 g/l) SC	22.9	3.8	2.9	2.4	2.0
8. Proclaim (5 g/kg) SG	18.4	4.3	3.5	2.5	2.1
9. Engeo (247 g/l) SC	17.2	3.5	2.6	2.3	1.9

Table 2. – Influence of treatments on the number of Japanese grape cicadas (*Arboridia kakogawana* Mats.) according to the variants of the experiment, SE "DG Tairovske", variety Odessa black, 2017–2020.

It should be noted the rate of action of these drugs in the fight against cicadas: taking into account on day 3, the number was 3.3 and 3.5 individuals, with 20.9 individuals in control. Accordingly, the biological efficiency in these variants was the highest and, depending on the date of accounting, ranged from 80.7% to 94.3%.

As a result of studies in all studied insecticides, the biological effectiveness in controlling the number of Japanese grape cicada was higher than the reference version, which used the insecticide Confidor SL, which had an average efficiency of 67.4% (Fig. 1).

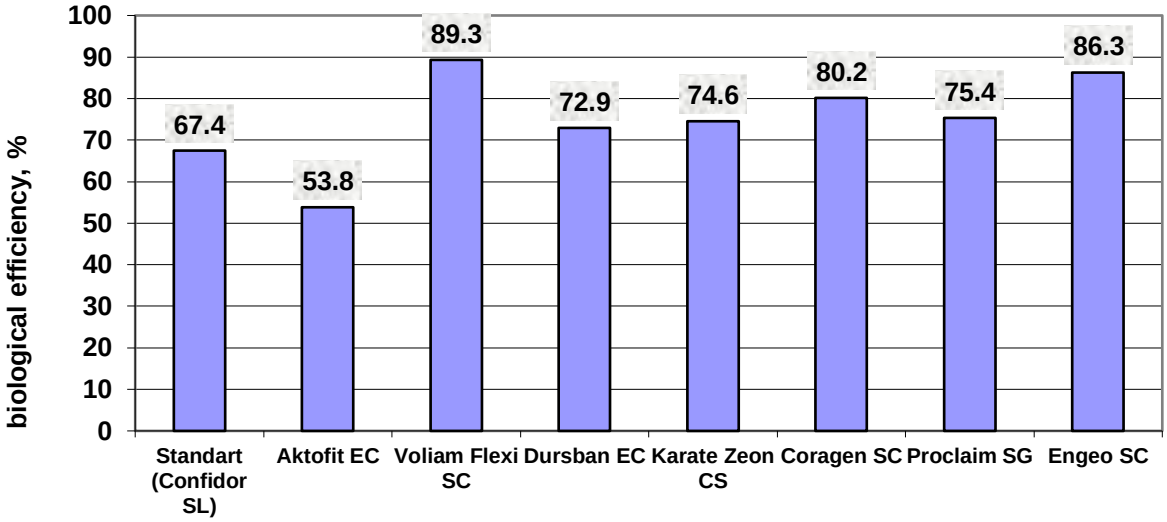

Fig. 1. The average biological effectiveness of the insecticides used against the Japanese grape leafhopper on the vineyards, DP "DG Tairovske", variety Odessa black, 2017–2020.

According to the studies, the best results were shown by two insecticides – Voliam Flexi SC – 89.3% and Engio SC – 86.3%. Slightly lower efficiency was observed for the insecticides Dursban EC – 72.9%, Karate Zeon CS – 74.6% and Proclaim SC – 75.4%. The lowest efficiency was obtained for the biological contact-intestinal insecticide Aktofit EC, which was 53.8% and was achieved with a low number of leafhoppers.

Conclusions

The greatest protective effect of controlling the number of Japanese grape leafhoppers is observed when using combined insecticides with active ingredients of different mechanisms of action — Voliam Flexi SC (thiamethoxam, 200 g/l + chloranthraniliprol, 100 g/l) with a consumption rate of 0,3 l/ha and Engeo SC (thiamethoxam, 141 g/l + lambda-cycalotrin, 106 g/l) with a consumption rate of 0.18 l/ha, which combines a powerful knockdown effect with a long period of crop protection.

The optimal period for making treatments is the period of development of the second and third generations of leafhoppers. If necessary, 2 treatments should made with an interval of 12–14 days, during the period of active growth and the beginning of ripening of grapes. The processing period is the period of mass hatching of larvae.

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GEOGRAPHIC INFORMATION SYSTEMS AS THE BASICS FOR AGRISHARING

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ABSTRACT

The study substantiates the need for joint development of higher education, science and agribusiness to ensure their harmonious development - "agrisharing" based on the Geographic Information System (GIS) platform. Problems of development the corresponding branches separately are defined. It is proved that their joint development in modern conditions of introduction the information and communication technologies is possible on condition of existence the platform which would combine as information on joint material, technical and intellectual resources, so give the chance of economic development and profit from such collaboration. Given the presence of the agricultural sector in this interaction and land as the basis of the relevant production, the use of geographic information system for researching purposes is determined by a single and optimal solution. "Agrisharing" is defined by the authors as the joint consumption of goods, natural resources, material and technical base and intellectual capital in the system of higher education, business and science interaction in the agricultural sector. The directions, functions, tasks and advantages of using the GIS platform in agrisharing system are given. Such systems for agricultural entrepreneurs, educational institutions and research institutions allow to develop the following areas: information support for decision-making; planning of agricultural operations; monitoring of agrotechnical operations and dynamics of land use; crop yield forecasting and loss estimation; planning, monitoring and analysis of the technology use, intellectual resources and scientific potential development; territorial distribution of the possibility of providing consulting services and educational facilities; optimization of joint resource usage.

Keywords: GIS PLATFORM, AGRISHARING, AGRICULTURAL ENTREPRENEURS, EDUCATIONAL INSTITUTIONS, RESEARCH INSTITUTIONS, JOINT DEVELOPMENT.

INTRODUCTION

The problem of depletion of land resources and the need to optimize their use for food and agricultural production has become extremely relevant in a constantly growing population of the globe and the need to provide them with food. The ability of global agricultural markets to correct supply disruptions and stabilize commodity prices is linked to the continued operation and depletion of land resources. Thus, for agriculture in general and agricultural producers personally, it is important to provide scientific support and staffing of the industry with innovative approaches to solving problems and agribusiness management.

Among the problems of the scientific sphere it is worth noting the main ones - insufficient funding, aging of staff and the gradual extinction of classical applied science. An impetus is needed to catalyze the development of science. This impetus can be both the state and private enterprises. Higher education, in turn, can revive human resources and interest in science among young people.

The problems of agricultural enterprises are the lack of a strategic approach to solving the problem of making a profit. Without scientific support, the use of own resources is unsystematic. Also, agricultural enterprises are constantly faced with the problem of lack of qualified personnel and the need to improve the skills of existing personnel, taking into account the constant development of new technologies in the agricultural sector.

Important problems of higher education are outdated material and technical base, lack of close ties with agricultural producers (and as a consequence - the inability to form the required specialist after obtaining the document on higher education), low interest of young people in research and problems of further employment of graduates.

The solution of the above problems is possible under the condition of joint development of three branches - science, higher education and agricultural producers as the main stakeholders in the development of the agro-industrial sector of our country.

Appropriate joint consumption and development is possible by implementing basics of the sharing economy.

Authors propose the definition of "agrisharing" as a joint consumption of goods, natural resources, material and technical base and intellectual capital in the system of interaction of higher education, business and science in the agricultural sector.

As mentioned above, each of the industries has a number of its own problems that negatively affect the economic aspect of the development of the respective areas separately. Joint development in the current conditions of introduction the information and communication technologies is possible with a platform that would combine information about common material, technical and intellectual resources, and also at the same time provide an opportunity for economic development and profit from such collaboration. Given the presence of the agricultural sector in the relevant interaction and land as the basis of the relevant production, the use of geographic information system for appropriate purposes is the only and optimal solution.

The aim of the study is to justify the advantages, features and directions of applying the GIS platform as the basis of the agrisharing system.

RESULTS AND DISCUSSION

In the 60s of the twentieth century, the pioneers of information systems for the first time put forward ideas and projects for the creation of GIS. The Harvard Computer Graphics and Spatial Analysis Laboratory has had a major impact on the development of GIS. In the 1980s, it was determined that any GIS is characterized by four functions:

1) collecting information about the territory, i.e. obtaining coordinate and semantic information about the studied objects of this territory;
2) generalization of the collected information in the form of a thematic map, plan, scheme - conditional visualization of the location and properties of objects on a cartographic basis;
3) processing and analysis of generalized information about the territory;
4) making a decision (or conclusions) based on the results of the analysis [1].

In the modern world due to integration with global IT trends - artificial intelligence, big data, VR, drones and robots - geoinformation technologies are moving away from the classical understanding of the map and turning into multipurpose solutions, covering almost all spheres of human activity: from development to the entertainment industry. High-precision 3D models of territories and VR technologies are actively used by architects, designers and game developers.

The ecosystem of geospatial technologies is a complex object with many interactive components. These technologies have evolved over the years and are broadly divided into four categories: GNSS and positioning, GIS and spatial analytics, Earth observation and 3D scanning. These four segments span various other technologies and are key components of the geospatial technology ecosystem.

GNSS and positioning. The constellation of satellites, the Global Navigation Satellite System (GNSS), transmits signals from space to users with a compatible device to determine their location, speed and time. The GNSS industry, used in many applications, is a mixture of the emerging and following GNSS markets, the surveying market, and the fastest growing indoor positioning market [2].

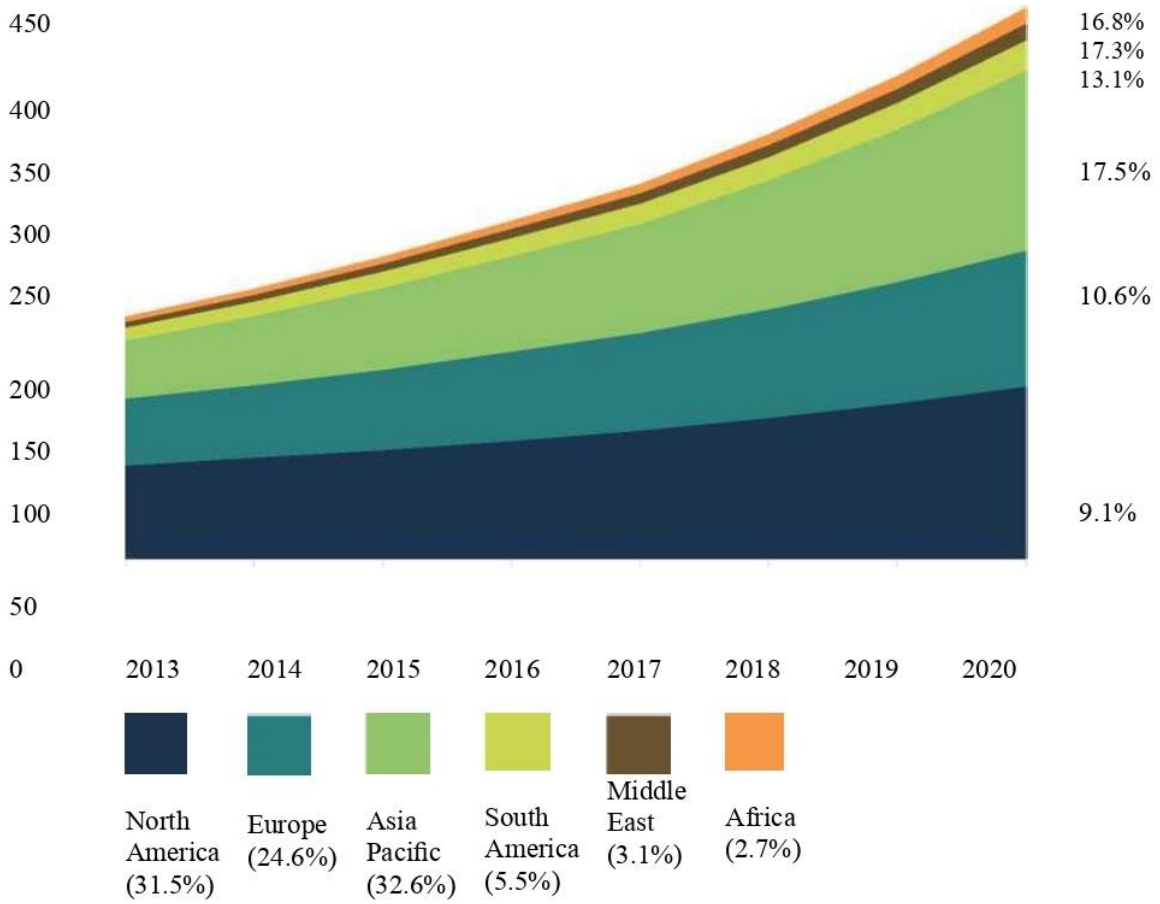
GIS and spatial analytics. Geographic information systems is a system that is designed to collect, store, manage, analyze and interpret data relationships, patterns and trends. Available to consumers in the form of software, GIS is subdivided into three types: desktop GIS running on a personal computer; Web / Cloud GIS, which allows the user to use the software in the cloud; Mobile GIS, which allows the user to use the GIS on a smartphone or tablet.

Earth Observation is a technology used to map the surface or earth from above or from space. This includes remote sensing satellites and aerial photography.

3D scanning. The scanning technology segment is currently the fastest growing segment, including LiDAR, radar and laser technology. These technologies are used to digitally capture the realm of physical objects and the environment by creating "point clouds" of data from the object's surface or environmental data.

Globally, the geospatial industry continues to gain relevance and maturity, and the overall market is expected to grow faster over the forecast period, according to the Geospatial Industry Outlook and Readiness Index [3]. However, industry growth is unevenly distributed across different regions (Figure 1). Emerging market regions are expected to grow significantly faster than regions with relatively mature markets.

Figure 1. Dynamics of development the geospatial industry in the world [3]



The cumulative geospatial industry was estimated at US $ 299.2 billion in 2017 and is projected to reach US $ 439.2 billion over 5 years, with a CAGR of 13.6%. This acceleration in growth can be attributed to continuous technological advances in the industry, democratization of geospatial information based on integration with advanced digital technologies and, as a result, innovative business models. The market size of the second largest segment of geospatial technologies - GIS / spatial analytics - is expected to grow at a CAGR of 12.4% as it finds increasing use in urban planning, utility management, e-government, applications, retail and logistics, disaster management and various other applications [3]. More and more business data integration with location information across enterprise level functions, engineering-construction-infrastructure sectors graduating to using spatial analytics, deepening integration of Big Data with GIS, the Spatial Analytics industry is poised for greater growth by the demand for adding location context to data.

Accordingly, GIS is a rapidly developing technology around the world, which, in conjunction with GNSS, earth Observation and 3D scanning, provide society with the sustainable development of geospatial technologies. These technologies should become the basis for the development of agrisharing, taking into account the need for an appropriate system in the constant monitoring of the state of land resources, spatial analytics, mapping and forecasting.

After all, the peculiarity of the use of information technologies in agriculture is that almost all the data used have a spatial (geographic) reference. And if we want, for example, to analyze the distribution of soil moisture together with yield, then both data must be in the same coordinate system and have the required coordinate accuracy. Only programs specialized in working with spatial information, namely, GIS, can process such data. The peculiarity of these systems is that they allow to integrate, maintain and jointly analyze a variety of types of spatially distributed indicators and descriptive data.

Such systems for agricultural entrepreneurs, educational structures and scientific institutions allow developing the following areas:

• information support for decision making;
• planning of agricultural operations;
• monitoring of agrotechnical operations and dynamics of land use;
• forecasting crop yields and assessing losses;
• planning, monitoring and analysis of the use of technology, intellectual resources and scientific potential;
• territorial distribution of the possibility to provide consulting services and the provision of an educational base;
• optimization of resource sharing.

Information support for decision making. To provide managers with a complex of information necessary for making management decisions, a database is created on the GIS platform containing:

• digital terrain model;
• information about remote sensing;
• information on the properties and characteristics of soils, crop maps by year, history of field cultivation, etc.
• a database of administrators of educational institutions who provide support for filling the platform;
• a base of scientific institutions providing advisory support to agricultural producers

Information support for decision making. For more efficient use, the GIS should contain a multilayer electronic map of agricultural fields, educational structures and scientific institutions, as well as an attributive database of the history of fields with information about all agricultural activities, scientific achievements and educational services. Be sure to include relief layers, information about the steepness of slopes and their exposure, microclimate, groundwater level, humus content in the soil, etc.

Thus, creation of an information support system for decision-making processes based on GIS technologies allows increasing overall efficiency by providing relevant analytical information on the entire range of necessary parameters for making optimal and timely management decisions.

Agricultural planning. Information management systems based on geoinformation technologies play an important role in planning agrotechnical operations.

Based on the attributive data of agrotechnical measures, tasks for workers can be drawn up, as well as recommendations of scientific institutions and educational structures to optimize production processes and, if necessary, make changes to them.

Planning based on GIS data allows you to reduce (or completely eliminate) downtime, optimize agricultural operations and improve agricultural performance.

Monitoring of agrotechnical operations and dynamics of land use. In the course of solving **this** problem, registration of all agrotechnical operations is carried out, scientifically reasoned recommendations for their optimization, the costs of their implementation, expert assessments of agronomists and data of remote sensing of the Earth are registered and entered into the database.

Forecasting crop yields and assessing losses. The yield forecasting system is based on the methods of monitoring the state of crops, taking into account the influence of natural and climatic conditions. This technology allows to track the dynamics of the development of agricultural crops, growing conditions, determine the timing of their ripening and the optimal timing of the harvesting beginning, conduct economic analysis at the minimum and maximum yield levels that are consistently possible for specific conditions.

As a result of forecasting crop yields and assessing losses, educational and research organizations can predict for private entrepreneurs the optimal price for equipment and materials that the enterprise will need in the future, and determine the purchase prices for agricultural products.

Planning, monitoring and analysis of the use of technology, intellectual resources and scientific potential. The technical subsystem of agricultural enterprises in the GIS system includes graphs, analytical data of attributive tables for all movements of equipment, calculation of mileage and cultivated areas, depreciation costs, determination of optimal travel routes, and the like. Also, the attributive data of educational institutions will provide analytical data on the development of various areas of service provision, scientific - scientific support.

The territorial distribution of the possibility of advisory services and the provision of an educational base will provide an opportunity to take into account the presence of an educational institution (and its capabilities in attribute tables) and research centers on the corresponding territory, and form a base of services and opportunities provided by them.

Optimization of resource sharing. In the aggregate, the use of the GIS platform and its filling jointly with agricultural enterprises, scientific structures and educational institutions will ensure the availability of constantly updated spatial and analytical information for harmonious development.

The following main functions of the agrisharing platform can be distinguished:

• maintaining an information base of the state and development of institutions and organizations involved in the system;
• accounting of agricultural land with data in connection to the map;
• conducting agrochemical monitoring of agricultural land;
• organization of rational use of land, optimization of the structure and placement of crops;
• processing the navigation data and control of equipment movements;
• planning and accounting of actual work;
• forecasting activities;
• planning of works, services and development of the sharing system;
• calculating the needs and capabilities of participants in the agricultural sharing system;
• exchange of information with external systems.

Agrisharing GIS platform allows to solve the following tasks:

• create an digital workspace for the development of the education system, scientific structures and agricultural producers;
• develop conservation and precision farming systems;
• support the operational decision-making;
• create and expand information databases of agricultural producers, educational structures and scientific organizations for their purpose and content, with the binding of information to a specific territorial location;
• fill the information platform with constantly updated attributive information;
• ensure reliable storage and keeping up to date of information databases;
• provide analytical reports on the development of the industry with visualization;
• provide the necessary information to specialists in related industries;
• work with information through personal computers, laptops, navigators, mobile phones, etc.
• use Internet technologies (WEB-portal, geoportal, geoserver) for data exchange, transmission and control [4].

The authors propose the content of GIS platforms for agricultural sharing, shown in Figure 2.

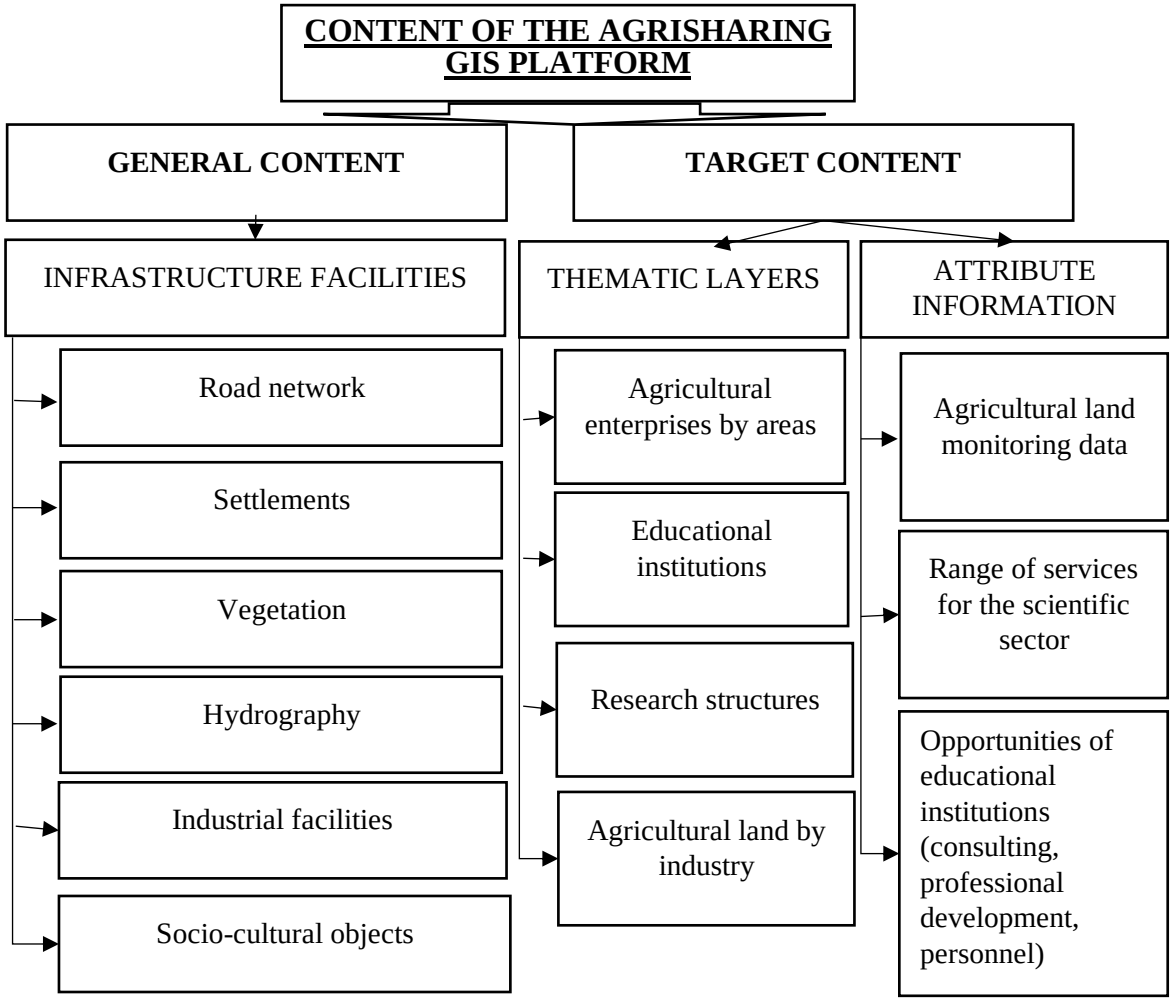


Figure 2. Content of the Agrisharing GIS platform

CONCLUSIONS

As a result of research, the use of the GIS platform as the basis of the Agrisharing system is justified. The directions of development, tasks and functions of the corresponding GIS platform, which is a tool for collecting, storing, analyzing and graphical visualization of spatial data and related information about the objects of the system "Education-Science-Production" are determined. The advantages of using GIS as the basis of agricultural sharing are: the correspondence of the volume and quality of the joint filling of the platform for the cardinal improvement of information support and services for agricultural organizations, the development of the education and science system; providing uninterrupted access to a complete database of analytical information on resources and territories; availability of online advisory support anywhere in the world; advanced training of personnel, taking into account territories of a certain agrarian entrepreneur by teachers from any university remotely at any time; providing access to domestic and world information resources; introduction of IT in the agricultural sector, which will increase the attractiveness of the sector, contributing to the retention of personnel; reduction of risks from low-quality design solutions in the field of land management, increased responsiveness to hazardous environmental situations; stabilization of the financial condition of agricultural producers, reduction of the unprofitable results risk for their economic activities through scientific support of doing business in real time.

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SUBSTANTIATION OF REQUIREMENTS FOR THE RESERVATION OF ELEMENTS OF COMPLEX TECHNICAL SYSTEMS FOR HARVESTING GRAIN CROPS

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ABSTRACT

An analysis of the reliability of complex technical systems for harvesting grain crops, taking into account their trouble-free operation, is presented. The model of functioning of harvesting machines and vehicles as a complex technical system, as a part of harvesting and transport complexes has been substantiated. A technique has been developed for the effective replacement of parts, components and assemblies of combines of technological complexes for harvesting grain crops.
Key words: system, harvester, reliability, service, parts, units, assemblies, probability, modeling.

INTRODUCTION

Reliable functioning of machines of complex technical systems - harvesting and transport complexes for harvesting grain crops - is one of the main requirements when performing the harvesting process. Practical problems associated with the smooth operation of complex technical systems during their formation and operation is solved by optimizing various ways to ensure their reliability.

THE STATEMENT OF THE PROBLEM

The method for solving the problem is determined from the conditions taking into account a large number of factors: operating conditions of machines, organization of preparation of equipment for cleaning and troubleshooting, level of operation, etc. All this requires consideration of issues from the standpoint of a systematic approach. When analyzing complex systems, we use the modeling method. The accuracy of the solutions obtained depends on the adequacy of the models and the accuracy of the initial information.

ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

Reliability will be considered as a complex property, including reliability, maintainability, durability and safety, that is, in a certain combination of these properties (Anilovich et al., 1996).

In most cases, parts, assemblies and assemblies (hereinafter elements) of harvesting machines are restored or replaced with backup ones after failure, which allows you to restore operability without a long loss of time (Kravchuk and Miller, 2009).

Recovery and preventive maintenance of machines do not exclude the possibility of failures, but significantly reduce their likelihood, i.e. increase reliability (Dumenko and Boyko, 2011).The mathematical description of failure processes taking into account recovery and prevention is called reliability modeling (Dumenko, 2010).

Determining the reliability of the machines of the harvesting and transport complex with restoration, we will consider it as a complex system, consisting of many elements. In the general case, the operation of the harvesting machines of the complex can be represented in the form of two alternating intervals: operating time – «t_{ij}» and idle time – «τ_{ij}» (Sidorchuk et al., 2011).

The functioning of a harvesting and transport complex containing "N" grain harvesters and "$N_т$" vehicles will be represented as a set of states that change and alternate in time. In this case, several options are possible. The first option, all machines work in the harvesting and transport complex - the maximum productivity of the complex. The second option, the harvesting and transport complex, works with reduced efficiency - some of the machines are out of order. The third option, the harvesting and transport complex does not work - all the machines are out of order (Enakiev et al., 2016).

PURPOSE OF RESEARCHES

Ensuring the reliability of complex technical systems for harvesting grain crops through the redundancy of elements and assemblies.

MATERIALS AND METHODS

The effectiveness of complex technical systems can be determined by assessing the impact of failures of various machines on the degree of realization of their productivity. The total number of unit failures during the time interval [0; t] is equal to:

$$n(t) = \sum_{i=1}^{n} n_i(t), \quad (1)$$

where $n_i(t)$ – is the number of failures of the i-th element during time «t».

The total running time of the unit:

$$t=T_p(t)+T_в(t), \quad (2)$$

where $T_p(t)$, $T_в(t)$ – is the total recovery time of the unit.

The number of combine harvesters in the complex N, units can be calculated as the sum of technically sound machines Np, units and faulty machines $N_в$, units for time (t), hours:

$$N= N_p(t)+ N_в(t) \quad (3)$$

Let the complex functions in the stationary mode, the distributions of failure-free operation and recovery be described by an exponential function. Then we can assume that the values of the indicators of the *probability of no-failure operation (PNO)* and the availability factor $K_Г$ are equal (Domuschi et al., 2017).

$$K_г = \left(1 + \frac{T_в(t)}{T_p(t)}\right)^{-1}; \quad K_г = \left(1 + \frac{N_{вi}}{N_{pi}}\right) \quad (4)$$

The total downtime of the combine harvester $T_{вi}(t)$ due to the i-th unit in the time interval [0; t] is defined from the expression:

$$T_в = \lim_{t\to\infty} \frac{T_{вi}}{t} = K_г \sum_{i=1}^{N} \frac{\tau_{вi}}{t_i} \quad (5)$$

The average failure time per unit of time – λ_i per machine for elements of each type is determined from the expression:

$$\lambda_i = \lim_{t\to\infty} \frac{n(t)}{t} = \frac{K_г}{t_{pi}}. \quad (6)$$

The average uptime of the combine is determined from the expression:

$$\bar{t}_p = \left(\sum_{i=1}^{N} \frac{1}{t_{pi}}\right)^{-1}. \quad (7)$$

The average downtime of the combine is determined from the expression:

$$\bar{\tau}_в = \bar{t}_p \sum_{i=1}^{N} \frac{\tau_{вi}}{t_{pi}} \quad (8)$$

To determine the PNO of combine harvesters, it is necessary to take into account all mutually exclusive ways of occurrence of failures. It should be noted that the reliability of the system increases when the operability is restored without redundancy of elements, only in the sense of the technical readiness of the system, while the PNO does not change.

Reservation of harvesting and transport complexes with complete units - combine harvesters assumes keeping Kg fluctuations within the planned value. This will ensure the completion of harvesting operations within the established agro technical terms. The element-by-element reservation provides for: individual machines in the area of use; elements (parts, assemblies) for machines; large units for the complex. With fractional redundancy, as with general redundancy, there can be always-on and cold reserves.

RESULTS

We represent the problem of optimal redundancy as follows. Let a system consisting of «N» independent subsystems or elements. Each subsystem itself can represent parallel, sequential, or some kind of connection of the same type of elements.

The system is provided with spare elements, when a link consisting of units of the same type is considered as a subsystem, the replacement of which, in case of failure, is carried out by units of the same type. With regard to the combine, assembly units, subassemblies or individual parts can be considered as elements (spare parts).

The probability of failure-free operation $P_m(t)$ of a link of combine harvesters with X reserve harvesters for any value of "m", with fractional redundancy and the assumption of an exponential law of distribution of reliability indicators, can be obtained from the expression:

$$P_m(t) = e^{-\lambda t} \sum_{i=1}^{x} \frac{(\lambda_0 t)^i}{i!} \quad (9)$$

where $\lambda_0 = N\lambda_i$ – failure rate.

Let us estimate the influence of the number of reserve combines on the readiness of the technological links of the harvesting and transport complex. In the general case, we will assume that the technological link functions effectively if the number of faulty machines does not exceed the number of reserve ones.

According to Poisson's law, the probability of occurrence of "n" failures P_n on the interval [0; t] will be equal to (Domuschi and Osadchuk, 2020).

$$P_n = \frac{(\lambda t)^n e^{-\lambda t}}{n} \quad (10)$$

In this case, the technological link will work flawlessly if not a single machine fails. Also, the technological link will require spare elements if one, two or more machines up to «X» fail.

The probability that a technological link will not fail (will work with the same efficiency) is equal to the sum of the indicated probabilities, i.e.:

$$P_m(n < x) = e^{-\lambda t} \sum_{i=1}^{x} \frac{(\lambda_0 t)^i}{i!} \quad (11)$$

Harvesting and transport complex, consisting of "m" main and "X" standby combines - N, will fail when using all main and standby (m + x) combines. MTBF will be equal to the sum:

$t_c = t_1 + t_2 + ... + t_n$,, i.e. there is a need for spare parts.

Assuming that the distributions of all values of "t" obey the same law, it is possible to determine the number of reserve elements np, od. to ensure the operation of the system with a given confidence level - A. (Domuschi and Ustuyanov 2020):

$$n_p = \left[\frac{\frac{2t_n N}{t_э}}{\sqrt{\frac{(A\nu)^2 + 4tN}{t_э}} - A\nu} \right]^2 - N \quad , \quad (12)$$

where t_n – projected service life of the elements (spare parts), hours;

$t_э$ – actual life of the elements (spare parts), hours;

N – the number of machines in the harvesting and transport complex, units;

ν – the coefficient of variation.

Using the results of experimental studies (Domushchi et al., 2018; Domushchi et al., 2019) the time for the delivery of spare parts (SP) from different storage levels was determined (Table 1).

Table 1 Distribution of delivery times for spare parts from different storage levels

Spare parts storage levels (group of complexity of refusal)	Number of refusals by difficulty groups, units	Spare parts delivery time, hours.	Time of car movement in one direction, hour.	Average distance of delivery of spare parts, km	Average vehicle speed when delivering spare parts, km / h	Spare parts delivery time, hours.	
						for one non-working state	for all non-working states
1.Warehouse complex (1 group of complexity)	18,7	0,1	0,08	1,19	15	0,13	2,43
2.Warehouse brigade or farm (2 group of difficulty)	2,86	0,1	0,26	5,77/ 3,91*; 7,62**	22	0,36	1,03
3. District or regional warehouse (3rd group of difficulty)	0,44	0,7	2,02/ 1,01	30,31/ 22,69**	30	2,72	1,19
TOTAL	–	–	–	–	–	–	4,65

*– to the warehouse of the brigade; ** – to the farm warehouse.

When calculating, the following conditions are accepted:

1) When a spare part is requested, there is always a vehicle in the warehouse.

2) In the warehouses, spare parts of such groups of complexity are stored: warehouse of the technological complex - the 1st group of complexity; warehouse of the brigade or farm - the 2nd group of complexity; district level warehouse - 3rd group of complexity.

3) The distance from the warehouse of the district or regional level was determined as the sum of the distances to the warehouse of the farm and from the warehouse of the farm.

4) Spare parts are delivered by the farm's vehicle, that is, they will move to the warehouse in one direction and back to the other.

Redundancy of individual elements of links and systems in conjunction with monitoring their condition and restoration of failed elements is a means for creating highly reliable systems from elements with relatively low reliability.

CONCLUSIONS

1. The described methodology and the results of assessing the reliability of machines of complex technical systems indicate the need for repair and technical measures and substantiation of the requirements for the reservation of elements and units of harvesting and transport complexes at various storage levels.
2. The effective operation of complex technical systems is influenced by the projected and actual service life of the elements (spare parts), the number of machines in the harvesting and transport complex, the coefficient of variation and the delivery time of spare parts from different storage levels.

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THE LEVEL OF SOILS AND CROP PRODUCE POLLUTION WITH HEAVY METALS AT THE ODESSA REGION

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Abstract.

As the result of agroecological observation, the admission of Heavy Metals (HM) to soil, and their content in plants were analyzed. The estimation concerned X research tour, 2011-2020 years. MPL exceed of lead content in soil was detected, up to 6.4 times. Lead pollution higher than MPL was detected mainly in southern districts patterns, 170 of 186 analyzed. The cadmium pollution was detected in 59 samples. The viticulture districts patterns, from the south of Odessa region, were cooper-polluted exceeding MPL, generally 23 samples. The soils pollution raise is linked besides others, with mineral fertilizers application raise up to 1.56 times. During X tour 540 plants and grain samples were analyzed, 1196 analysis done, and 2 samples were identified as polluted by cooper and zinc. These samples were vegetables from Bylyaevka district. There was not detected relationship between the soil and plants pollution. The way to decrease the HM admission to soil and plants is first of all obligate utilization of secondary produce as an organic fertilizer, together with low amounts of mineral fertilizers.

Keywords:
agrochemical pasportisation, heavy metals, soils pollution, crop pollution, fertilizers pollution.

INTRODUCTION

According to the calculations of A.I. Fateev and E.B. Smirnova [1] there are about 1606 thousand hectares of agricultural land with dangerous and very dangerous content of heavy metals (HM) in Ukraine. UN groups most dangerous chemicals for human and nature environment to HM such as mercury (Hg), lead (Pb), cadmium (Cd), arsenic (As), chromium (Cr), nickel (Ni), copper (Cu), zinc (Zn), manganese (Mn), cobalt (Co). Among the soil pollutants. one-component, as well as complex fertilizers [2] are to be considered. In phosphorites of Morocco and Jordan, which can be imported to Ukraine, the concentration of cadmium is 18.6 and 11.6 mg/kg; in addition, As, Hg, Pb, Zn are present. In nitrogen fertilizers there are determined Cd - 0,05-8,5, As 2,2-120, Co 5,4 - 12, Cr -3,2-19, Cu -1-15, Hg - 0,3-2,9, N and -0.84, Pb - 0.05 mg/kg, in potassium chloride on average Mn -1.5-140, Pb -12-20, Zn - 0.5-22, Ni -2-19, Cu -1, 5-15, Cd -4, Fe -403 mg/kg were detected. They can contain trace elements, including toxic, in nitrophosphate, nitroammophos, ammophos. According to research of N.A.Makarenko [3] only phosphate fertilizers for 1990 year in agro-ecosystems of Ukraine received highly toxic chemical elements amounted to 42023.2 tons. Negative impact HM on soils is being expressed in dehumification, decalcination violating the structural state, under compounds Cd, Pb, Zn, and changing the ratio of absorbed bases and physico-chemical properties: antagonism of Zn and P ions [4], reduction of nitrates on Cd and Pb contaminated soils, deterioration of biological properties [5]. The high buffering and absorption capacity of chernozems, the neutral and alkaline reaction of the soil solution contribute to the retention in the upper layer and the transfer of mobile forms of HM into sparingly soluble forms, which limits their movement down the soil profile. Kisil V.[6] research HM found that the level of soil contamination is below 0.5 MAC, after which plants reduce productivity and decreases products quality, but the danger is modified by polyelement pollution occurs almost always. According to LG Bondarev [7] 1t of coal dust contains about 70 elements (tin, cobalt, lead, arsenicum, uranium, zinc, nickel, etc.). That's why it is difficult to determine dangerous HM pollution level.

RESEARCH METHODS

Soil samples were taken by the Odessa branch of the State Institution "Institute of Soil Protection of Ukraine" (Odessa branch) according to DSTU ISO 10381-4: 2005, analyzes were provided in accordance

with DSTU 4770. 6:2007, D STU 4770.2:2007, DSTU 4770.3:2007, DSTU 4770.9:2007, MU - M - 1992. Research of quality of agricultural products, conducted according to actual regulatory documents: GOST 26930 - 86, GOST 30178 - 96 MU number 5178 - 90, MVI 081/12-16 – 98 [8-18]. Two five-year tours results were compared – IX tour (2006-2010) and X tour (2011-2015).

RESEARCH RESULTS

Assessment of the ecological condition of soils in the district by the content of HM is carried out by comparing their actual content in the soil with the maximum permittable concentration (MPC) and geochemical background for this type of soil.

In the 2011-2015 years HM contamination of exceedance for the copper content was detected in 23 samples from them; in soils of Artsyzsky district 14 of 769, Kiliysky - 4 of 183, Ovidiopilsky - 5 of 214. Lead contamination detected in 186 of the samples, in the soil Artsyzsky district - 48, Bilhorod-Dniestrovsky - 49 Saratsky - 8, Tatarbunarsky - 22, Kiliysky at - 37, Ovidiopilsky - 6, Lyubashivsky - 2, Velykomyhaylivsky - 4 Mykolayivsky - 9 Oknyansky – 1. Cadmium high level was detected in 59 samples from Saratsky - 2, Bilhorod-Dnistrovsky - 56 Ovidiopilsky district 1. A total of 7961 soil samples were analyzed in the district, taken in 10 research tour, from an area of 1099.9 thousand hectares. Soil contamination compared with 9 rounds significantly increased, what may be explained in our opinion, not only by increased emissions by industry and traffic, but also with increasing standards of fertilizers and pesticides content. In this case, fertilizers amount near 81.96 thousand tons on an area of 954.8 thousand hectares was posessed. That is 1.56 times more than for the harvest of 2010, and organic fertilizers amount decreased 2.6 times.

The HM admission to soil is not always indicated by the production contamination, as the result of high buffer capacity of chernozems [19], which is under the influence of neutral or close to neutral, reaction of soil solution, contributing transformation of HM from soluble forms to low-mobile with weak migration capacity. The danger of HM accumulation in soils increased because of the desire of some owners and tenants of land maximize profit by using high norms of fertilizers and pesticides. Research by O. Ylyin [10] shows that on the background of an anthropogenic impact, HM accumulated primarily in the roots, less in stems and leaves, and very rarely - in reproductive organs. According to the author, the presence of heavy metals in the soil is non-dangerous only up to a certain level, as long as the plant is able to resist them due to the protective mechanism of the root system. If plants are exposed to more severe conditions of high HM content, their productivity decreases, and the quality of plant products deteriorates. In the IX research tour, the Odessa branch analyzed 1,430 samples of food grain, 446 – forage grain, 99 - oilseeds, 92 - fresh vegetables, 211 – berries and fruits, for HM content in crop production. In summary. 9100 control testings were completed for 2,278 samples. Testing results (Table 1) revealed contamination above the MCL in oilseeds, for 2 samples from Ananyivsky district, of copper form Artsyzsky district – 2 samples, Baltsky district – 1, Saratsky- 1, Tarutinsky – 1, of Mykolayivsky district - 7, unspecified origin – 12. Zinc contamination was detected in 3 samples of fresh fruits and berries; cadmium - 1, in fresh vegetables – 1, all of them in import production. Crop products, which were analyzed in 2006-2010, were not contaminated by lead. No link has been established between soil contamination with lead and plant products.

Table 1. Content of heavy metals (HM) in crop production, comparatively to standards (mg/kg)

Production	Coper		Zinc		Mercury		Cadmium		Lead	
	Contend detected	MPL	Contend detected	MPL	Contend detected	MPL	Contend detected	MPL	Contend detected	MPL
IX research tour										
Food gain	2,9 – 8,7	10	12,7 – 50,1	50	0,0 – 0,01	0,03	0,006 – 0,105	0,1	0,0 – 0,3	0,5
Forage Grain	2,4 – 8,3	30	16,5 – 35,7	50	0,0	0,1	0,006 – 0,047	0,3	0,1	5,0
Oilseeds	5,4 – 11,3	10	6,3 – 48,7	50	0,0 – 0,01	0,03	0,019 – 0,38	0,4	0,25	1,0
Fresh vegetables	0,6 – 0,9	5	2,2 – 2,7	10	0,03 – 0,08	0,02	0,003 – 0,012	0,03	<0,01	0,5
Fresh fruits and berries	0,1 – 0,8	5	0,99 – 12,1	10	<0,01	0,02	0,001 – 0,002	0,03	0,02 – 0,03	0,4
X research tour										
Food gain	7,4 – 7,5	10	41,8 – 43,9	50	<0,01	0,03	0,012 – 0,035	0,1	0,21 – 0,4	0,5
Forage Grain	3,4 – 3,7	30	24,3 – 33,2	50	<0,01	0,1	0,008 – 0,015	0,3	<0,01 – 0,16	5
Oilseeds	9,4 – 9,6	10	44,1 – 33,2	50	<0,01	0,03	0,08 – 0,24	0,4	0,1 – 0,15	1
Fresh vegetables	1,3 – 5,06	5	5,1 – 7,9	10	0,09 – 0,15	0,02	0,02 – 0,022	0,03	<0,01	0,5
Fresh fruits and berries	1,12 – 2,9	5	2,1 – 5,5	10	0,02 – 0,08	0,02	0,002 – 0,02	0,03	<0,001	0,4

In the tenth tour, 494 samples were analyzed, and 1,196 tests carried, including 540 grain food, forage grains - 181, oilseeds – 41, fresh vegetables -114, fruits and berries - 76, and other products - 244. Pollution above the MPC was detected in fresh vegetables from Bilyaivsky district - with copper and zinc 2 samples. No connection was found between the content of HM in plant products and in soils.

According to the standards of agroecological conditions of growing crops [8], the content of HM in the soil for the majority of cultivated plants is considered optimal at the level of 1-2 Clarks (less than 0.5 MPC), acceptable - 2-3 Clarks (0.5-1, 0 MPC), inadmissible in the presence of HM 3-5 Clarks (1.0 -2.0 MPC). V. Kisil, Nadtochij P.P., et al. [20. 21] considers that the destruction environmental stability of soil may be prevented by the use of alternative technology, which reduces to a minimum the use of fertilizers and chemical plant protection from weeds, pests and diseases. Obviously, the use of environmentally friendly fertilizer that provides organic technology are most preferable. To reduce soil HM contamination, growing remediant plants [21, 22] of the Asteraceae, Fabaceae, Poaceae familias. Such technology, which presumes alternation of growing plants not only these familias.

CONCLUSIONS

In the tenth tour, a 6.4-fold increase in soil contamination with lead was recorded. Contamination of lead was found mainly in the southern parts of the Odessa region in 170 samples among 186 those totally studied, and cadmium in 59 samples, of which Bilhorod-Dniestrovsky district 56 samples. Copper contamination above the permissible level was detected for 23 samples from the areas of viticulture in the south of the Odessa region. The increase in soil pollution is due to an increase in the application of mineral fertilizers by 1.56 times.

In crop products for 2006 – 2010, 2278 samples were checked and 9100 analyzes were performed. Amongst those detected as contaminated above the MCL of IX tour, were oilseeds samples, with copper 26 and zinc - 4, including imported - 2. In the tenth tour, 1196 analyzes were performed in 540 samples. Two samples of fresh vegetables from Bilyaivsky district were found contaminated with copper and zinc above the MPC. No link has been found between soil contamination and plant products.

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FEATURES OF LAYING VINEYARDS IN PERSONAL FARMS IN THE SOUTH OF UKRAINE

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Abstract

The article presents data on the establishment of vineyards by table varieties in the farm, as well as their growth and development in the south of Ukraine. As a result of research, their development of vegetative mass (length, diameter of shoots and number of leaves), root system and percentage of seedling survival was analyzed.

Keywords*: grape, biometric indicators, weight of the bunch, leaf area, roots, harvest of bush.*

Introduction

Viticulture is one of the branches of agricultural production, which despite a number of unfavorable economic factors of the country's development and structural changes in the process of reforming the agricultural sector has not lost its investment attractiveness and remains one of the promising areas of business for small and medium farms. As a component of the agro-industrial complex of Ukraine, viticulture is of great economic importance, due to the valuable nutritional and health properties of fresh grapes and products derived from it, the unpretentiousness of grapes to the soil and its reclamation role in the development of slopes and slopes, unsuitable for other crops and high enough economic efficiency. However, along with these advantages, in the current conditions there is a situation with a decrease in the area of vineyards occupied by technical varieties of grapes, which is primarily due to the closure of such a market for wine materials as the Russian Federation, although domestic conditions, on the contrary contribute to the development of viticulture and winemaking in general.

From the standpoint of marketing research, grapes should be considered as a food product along with other foods that may act on the market as its competitors or substitute products [1, 3, 4].

The scientifically substantiated consumption rate of fresh grapes per person is 8-10 kg per year. In fact, Ukraine consumes 10 times less and is much lower than the level of consumption in other countries (Greece -16 kg, Spain -9.7 kg, Great Britain -9.6 kg, Switzerland -6 kg, France -4.3 kg, USA- 2.8 kg) [2, 5].

Accordingly, the establishment of vineyards by table varieties today is a very relevant and promising topic. But before planting such plantations, in turn, it is necessary to select the soil and climatic conditions and market demand varieties of table grapes that would fully meet these requirements.

Purpose

The purpose of our research is to create a high-yielding array of table grape varieties on an area of 10 hectares, a selecting of grape varieties based on the prepared part of the project documentation, which characterized the area: the site and its agro-climatic conditions.

Materials and methods of research

Field experiment was carried out in farm "Demetra", v. Fedorivka, the Berezansky area of the Nikolaev region. The object of research is grape varieties Arkadiya (control), Liviya, Preobrazheniye.

The experiment is embed of three repetitions, in each variant of 45 accounting bushes - 15 in one repetition. The total area of the plot with protective rows is 1 hectare. The general agrotechnical care on the experimental site was performed in accordance with the recommendations for this agroclimatic zone within the first year of vegetation, considering the climatic features of the current year. Soil retention - black steam. Rootstock Berlandieri x Riparia Kobera 5BB.

Results and discussion

As result of research, we found that the conditions of the winter-spring period 2019-2020 were in terms of temperature very favorable for the establishment of vineyards since the first decade of April.

The layout of the vines was 3 x 1.6 m. Planting of grapes was carried out in planting holes under the digger, the depth of planting holes is 50 cm.

Before planting, the seedlings were prepared according to the accepted technology, soaked in a solution to which "Biochelat" was added, and the sections were renewed.

Table 3.1. Survival of varieties in a permanent place as on November 1, 2020

Variant	Area, ha	Number of planted plants, pcs.	Number of plants that took root, pcs.	Survival, %	The required number of seedlings for repair, pcs.
Arkadiya (control))	0,95	1984	1828	92	156+10%
Liviya	1,1	2332	2053	88	279+10%
Preobrazheniye	0,95	1984	1781	89,7	203+10%

One of the most important analyzes in the year of planting is the analysis of seedling survival (Table 3.1), because the final costs and the rate of entry of plantations into fruiting depend on this indicator. Immediately after planting, a drip-feeding system was installed, so the survival rate by varieties in the laid area is quite high.

Analyzing table 3.1. we see that the highest survival rate was obtained in the variety Arkadiya, which accounted for 92% of plants, slightly lower and approximately the same was the survival rate in the varieties Liviya and Preobrazheniye 88 and 89.7%, respectively. Therefore, after the inventory, in November, the plants were planted. It should be noted that the good survival of seedlings indicates their high quality and optimal climatic conditions during the growing season, as the plants that developed from these seedlings (in the first year of the growing season) were aligned in development, formed a good one-year growth that fully matured. in the future it will allow us to form a bilateral horizontal border quickly enough.

Regarding the biometric indicators of plants, in the first year of the growing season, the number of developed shoots on the bushes, their length, diameter and the number of leaves they formed were recorded. Arkadiya grape variety was conditionally taken as a control - as one that is zoned and the most common in the vineyards, which is confirmed by the data of the Grape Cadastre.

Analyzing the development of biometric indicators (Table 3.2), namely the number of shoots per bush, all varieties formed approximately the same number of shoots, the largest was in the variety Preobrazheniye, and in the varieties Liviya and Arkadiya the number of shoots was the same 2.8 shoots per bush. However, it should be not that the leaf surface area and the volume of annual growth varieties differed from each other.

Table 3.2. Biometric indicators of development of grape bushes of a grade in a year of planting

Variant	Number of shoots on the bush, pcs.	The number of leaves on the shoot, pcs.	The area of the leaf surface of the bush, m^2	Shoot length, cm	Shoot diameter, cm	Annual growth volume, cm^3
Arkadiya (control)	2,8	8,5	0,13	93	0,51	53,23
Liviya	2,8	9,4	0,21	90	0,53	55,58
Preobrazheniye	3,1	8	0,12	98	0,48	54,94
SSD_{05}			0,09			0,76

*SSD_{05} - The smallest significant difference

The increase in the leaf surface area of the bush was significant compared to the control in the variety Liviya, and in the variety Preobrazheniye it was within the experimental error, as it did not exceed SSD_{05} = 0.09 m^2 due to the different number of leaves and their diameter. So, we see that the number of leaves in varieties is different 8.5 in the variety Arkadiya, 9 leaves per shoot in the variety Liviya, which was the best in this indicator and an average of 8 leaves per shoot in the variety Preobrazheniye. It should be noted that the leaf diameter of the studied varieties was also the highest in the variety Liviya, but the smallest in the variety Preobrazheniye, although due to the greater number of shoots per bush on the leaf surface area Arkadiya and Preobrazheniye, as we noted were almost the same 0.13 m^2 - Arkadiya and 0.12 m^2 - Preobrazheniye, due to a set of indicators of which consists of the value of the leaf surface area. The Liviya variety formed an average leaf surface area of the bush in the amount of 0.21 m^2.

By the diameter of the shoots, we also see differences. Arkadiya and Liviya grapes with the same number of shoots recorded diameters that differed not significantly 0.51 and 0.53 cm, respectively, less than half a centimeter, namely 0.48 cm was the average diameter of the shoots of the Preobrazheniye variety. However, the increments obtained by the volume of one-year growth of the bush were significant compared to the control in the varieties Liviya and Preobrazheniye, as they were 2.25 and 1.71 cm^3 at SSD_{05} - 0.76 cm^3.

Thus, summing up the analysis of the development of biometric indicators of table grape varieties, we can say that the most powerful development in the conditions of our array was in the Liviya variety.

Table 3.3. Development of the root system in the first year after planting

Variant	The diameter of the roots	Amount of roots, pcs	Root length, cm
Arkadiya (control)	up to 1 mm	12,4	5,8
	1-3 mm	4,8	8,3
	3-5 mm	-	-
Liviya	up to 1 mm	12	6,6
	1-3 mm	8,7	9,2
	3-5 mm	-	-
Preobrazheniye	up to 1 mm	13,5	5,1
	1-3 mm	11,6	10,8
	3-5 mm	0,4	7,2

A complete description of the state of plant development, the first year of the growing season, should be made not only on the basis of the assessment of the aboveground part of the bush, but also the development of the root system, which correlate with each other.

Analyzing table 3.3, it should be noted that the variety Preobrazheniye formed in contrast to the varieties Arkadiya and Liviya roots with a diameter of 3-5 mm, but the other varieties of this fraction did not have. In the first year of vegetation, all found roots that were measured in diameter and length were in the soil layer 40-60 cm.

Thus, the total length of roots in Arcadia was the smallest in the experiment; the average was in Libya and the largest in Transfiguration. This is due, to the fact that there is a mutual influence of the components of the grafted plant on each other, ie not only the rootstock affects the development of the plant, but also the rootstock exerts its influence. In our case, according to the characteristics, the Transfiguration variety is the most vigorous and prone to the formation of stepsons, due to this it has provided a stronger development of the root system, which in the next year of vegetation will allow it to develop more intensively than the other two varieties.

Conclusions

Based on the accounting, observations and analysis of research conducted in 2020-2021, we can conclude that the bushes are well developed, the selected protection system is correct, and the preparatory work carried out before laying was carried out in a timely manner, as we have a significant degree of survival and good development of above-ground and underground parts of table grape bushes.

Accordingly, in order to establish a in a short time highly productive vineyard, you need to carefully prepare all project documentation and select a site with optimal conditions for growth and development of vineyards.

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MOVING UKRAINE ALONG GLOBAL VALUE NETWORKS: CASE OF AGRICULTURE

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ABSTRACT

The relevance of the subject is explained by the place Ukraine takes in World and regional production of agricultural products. It was shown that Ukraine suffers from the fact that it produced and exports mostly raw materials and semifinished products which humpers perspectives of further development of whole sector of Ukrainian economy. Additional tension is evoked by the European legislation requirements and respective obligations taken by Ukrainian government regarding standards applied to agricultural products and general tendencies towards globalization of production. Therefore, it was stated that Ukraine should simultaneously meet two goals – one is to develop main principles on how to manage agriculture production as to protect national interests, another one is to define the role of Ukraine as an operator at the international market for the sake of international and global interests and challenges. The goal of the paper was to assess which place is given to agriculture and to global value chains by international agreements which are of most interest for Ukraine. As a result of the research it was suggested for Ukraine developing cooperation in the field of agricultural production in the framework of creation or developing of regional value chains via using potential of already ratified regional agreements with specific SCO member states, such as: Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan to makes bridges with Balkans, Baltic countries, South Caucasus, South of Africa mimicking at some extent and complementing Belt and Road Initiative. It was recommended to promote the idea of extensive regionalization of GVNs in front of Ukrainian western counterparties owing to the fact that the investment presence from western European countries (Germany, Netherlands, France etc.) remain substantial.

Keywords: agriculture, global value networks, logistics, subregionals, megaregionals, complementarity, exports, economic partnership.

INTRODUCTION

The relevance of the subject is explained by the place Ukraine takes in World and regional production of agricultural products. In the first half of 2021 its exports grew by 33,4% in comparison to the same period of 2020. Its main importers were China, Poland and Turkey, the volumes of Ukrainian exports to the latter increased by 58,6% (UkrInform, 2021). Among other things, Ukrainian commodity export structure was dominated by ferrous metals, grain crops and fat and oils. In 2021 it has already exported around 17 mln tons of grain placing 1st or 2^{d} in the world rank of grain exporters. Its other exports goods are also of high demand from outside buyers and consumers, e.g. in 2021 the overall EU quota on Ukrainian honey was totally used already in the beginning of 2021, the same is true for apple and grape juice, tomato paste, sugar etc (SlovoiDilo, 2021).

In 2017, agricultural exports generated 28% of foreign currency inflows. Moreover, in 2009-2016 Ukrainian agriculture contributed 7% to overall economic growth, while its productivity remained rather low- at 60% of total productivity in services sector computed on the base of value added. Among positive trends is that Ukrainian government started publishing information on pests and plant diseases online, which help to raise agricultural productivity (World Bank, 2019a).

At the same time, Ukraine suffers from the fact that it produced and exports mostly raw materials and semifinished products which humpers perspectives of further development of whole sector of Ukrainian economy. Additional tension is evoked by the European legislation requirements and respective obligations taken by Ukrainian government regarding standards applied to agricultural products and general tendencies towards globalization of production. Not the last is global trends towards digitalization, need for sustainable development, including sustainable consumption and sustainable production, circularity of economy, evolution of fam problem. On the other side the fast expansion of global values chains and networks demand fast reply from the side of national producers. Nowadays, the Ukrainian agricultural market is dominated by

10 largest producers and respective market operators, including those providing different support in form of farm management solutions and drone-based and remote sensing solutions.

Therefore, Ukraine should simultaneously meet two goals – one is to develop main principles on how to manage agriculture production as to protect national interests, another one is to define the role of Ukraine as an operator at the international market for the sake of international and global interests and challenges.

The goal of the paper is to assess which place is given to agriculture and to global value chains by international agreements which are of most interest for Ukraine. The logic of the study is best described as follows: the first goes studying main provisions of megaregional agreement which are potentially beneficial for Ukraine in terms of global value networks (GVN), and the second goes making the same regarding subregional unions Ukraine is part of or interested in. The accomplishment of these tasks will give an understanding of how to manage the process of Ukraine entering global production given current landscape of international agreements.

RESULTS AND DISCUSSION

Currently there are several big international agreements which cover not the only one region or continent, but several, among them are: Trans Pacific Partnership, Shanghai Cooperation Organization (SCO), Asia Pacific Economic Cooperation, Regional Comprehensive Economic Partnership, BRICS. Ukraine could be both beneficial in terms of broader international agreements which cover the wide range of issues, not only trade-related, but narrower ones- such as FTAs or regional economic partnerships.

Due to the geographical location of Ukraine, regarding the stricture of its international trade, it is feasible to consider BRICS and SCO as potential unions to cooperate with. Regarding SCO the issues of cooperation in the field of agriculture are enshrined in a separate document: the Agreement on Cooperation in the Field of Agriculture between the governments of the member states of the Shanghai Cooperation Organization. This agreement foresees a number of standard provisions, such as: knowledge exchange, disease prevention, joint conferences (Mingwen, 2018). The SCO Development Strategy until 2025 also envisages that agriculture will become one of the priority areas of cooperation. In particular, the efforts of the participating countries will be focused on the implementation of joint high-tech projects for the production and processing of agricultural products and the introduction of innovative technologies, including those in the food industry. Additionally, the problem of destructive land use, lack of water resources must be solved (SCO, 2019). At the same time, real joint projects have not been implemented yet.

According to the program documents of the organization, in addition to simplifying the procedures for trade in goods, provides for the simplification of trade in services and the development of a number of provisions for e-commerce. This, in turn, will have a positive effect on trade within the union. In general, the Organization's Development Strategy provides for the creation of industrial clusters along transport arteries and the development of logistics centers, as well as the creation of inter-regional economic projects (SCO, 2015). Additional support for future initiatives is provided by the Memorandum of Understanding and Stimulation of Cooperation within the SCO in the Field of Micro, Small and Medium Enterprises between the Ministries of the SCO Member States.

Regarding the development of global value networks in the context of the SCO, it is worth noting the defining difference of this megaregional: many member countries do not have its own access to the sea. Therefore, the development of infrastructure projects will play a significant role in the development of entrepreneurship built upon international production cooperation.

Taking into account recent trends in the development of the role BRIC(S) plays at the global economic arena it could be concluded that the BRIC(S) are actively involved in global value networks, mainly in that part of them that is characterized by a low share of value added. The main obstacle to entering the further stages of value chains is the lack of technological progress [200]. Focusing on such areas of economic cooperation as energy, transport, telecommunications, social and labor relations, the BRICS has set up its own development bank to finance infrastructure projects in the member countries. From this point of view, the BRICS Development Bank could play a significant role in shaping global value chains, but the scope is currently geographically limited. Moreover, the cooperation in agricultural production is not the top-priority in this case. However, huge attention is paid to the development of innovative technologies, digitalization, transportation, e.g. building relevant infrastructure which will help to booster economic development in whole. The major obstacle for Ukraine taking advantages of this union functioning is that it is overly dominated by Russian Federation. Moreover, despite technological progress and the digital revolution, the geographical criterion and the criterion of the economic and political complementarity in the case of the BRICS do not lose their relevance either in case of simple international economic integration or of the mega-regional integration.

The Goa Declaration states that the implementation of the BRICS Economic Partnership Strategy encourages measures to increase the participation in producing added value and mobility of participating companies in the creation of global supply chains, in particular by preserving room for maneuver for national policy aimed at promotion of industrial development.

As before this megaregional also has two economies-leaders: China and Russia which are currently conducting joint research and development in key areas of science and technology, including aerospace, nuclear energy, information and communication technologies, artificial intelligence, new energy sources, new materials, biotechnology, modern agriculture, and environmental protection. These projects help them to endure their international economic competitiveness and to save their positions as global economic leaders fixing the tri-polar global economy system.

As Ukraine is not the partner of either of these two megaregional partnerships, it is suggested to develop alternative roots for promoting Ukrainian strategic ideas at international and global landscape. We are considering major smaller integration unions the Ukraine is part of, as the platforms for further spreading country projects, e.g.: GUAM, OBSEC, Visegrad Four (Three), Eastern Partnership (EaP), and EU candidates and Southern Partnership (SP) as an addition priority area in the framework of EU initiatives.

Thus, we derive strategic priorities for Ukraine in the framework of these sub-regional formations regarding development of global value networks and agricultural production (Table 1). All strategic priorities were defined based upon program documents of above listed sub-regions.

Table 1.**Ukrainian strategic priority areas in subregional unions**

	Strategic Priorities
GUAM	Continuation of lobbying the development of transport corridors within the association in order to intensify the development of GVN Diversification of the structure of foreign trade with member countries
OBSEC	Establishing of vocational schools and colleges with the member countries of the association (Turkey) Development of e-commerce Development of the innovative Blue Economy Participation in strengthening cooperation at the SME level Creation of regional clusters and incubators incl. in the field of green production
V4	Development of cooperation in the field of agricultural production Development of cooperation in the field of security issues (e.g. Internet security, anti-fraud) Implementation of Go Highway Development of river communication Development of the digital economy (including as potentially interesting and important areas for the development of cooperation with China)
EU candidates	Cooperation in continuation of reforms and approximation of legislation foreseen by EU FTA Strengthening cooperation with the Balkans (in terms of prospects for Balkanization of European integration) and the Baltics Consideration of the possibility of concluding agreements on vocational schools and colleges with the Balkan countries
EaP	Diversification of the structure of foreign trade with member countries Security issues (especially taking into account the political situation in Belarus and Azerbaijan) Development of cooperation in the field of agricultural production, light industry, development of infrastructure projects, IT, cyber security
SP	Consideration of the possibility of establishing vocational schools and colleges with the countries participating in the sub-regional formation in order to develop cooperation on the axis Eastern Partnership-Ukraine-Southern Partnership as a complement to European integration and the formation of a new sub-mega-region

Source: developed by author

Developing cooperation in the field of agricultural production in the framework of creation or developing of regional value chains could be treated as the tool of either entering bigger megaregional agreement or counteracting negative tendencies or threats. For example, in case of SCO Ukraine can consider using potential of already ratified regional agreements with specific SCO member states, such as: Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan to makes bridges with Balkans, Baltic countries, South Caucasus, North of Africa mimicking at some extent and complementing Belt and Road Initiative bearing in mind that today main economic destinations of Ukrainian exports inside GVN are Poland, Hungary, Germany and Poland summing up to 70% of total Ukrainian GVN exports.

The need for developing respective infrastructure to promote Ukrainian participation in GVN is explained by the fact that the price of grain transportation is significantly higher in Ukraine than e.g. in Europe due to insufficient use of river or rail transport, storage facilities and high port fees (Worldbank, 2019b). General monopolization of production structure also negatively affects doing business climate. The malpractices of state support of specific enterprises in the form of subsidization, more attractive bank lending, lowering energy fees also do not correspond to the proclaimed statements about dreamed economic liberalization. FDI also remain low testifying weak interest from the side of international producers in cooperating with Ukraine within GVNs incl. However, the investment presence from western European countries (Germany, Netherlands, France etc.) remain substantial. Therefore, Ukraine could play that idea of extensive regionalization of GVNs in front of its western counterparties.

CONCLUSION

The increase of attractiveness of Ukraine as a counterparty in global value chains and networks is not possible without developing its ties and economic cooperation with smaller regional unions and agreements. Based upon the results of the research it was suggested to promote the creation of alternative roads and ways on how to transfer value added within the Western European region, South Caucasus and Northern Africa. The specific measures could be traced out in case the respective analysis of commodity and geographical structure of GVN exports movement is examined with respect to countries entering specified subregional unions and agreements. Further recommendations should go in line with general provisions and statements foreseen in National Economic Strategy of Ukraine for the period till 2030, meet the requirements and obligations related to international agreements currently in place, and correspond to Sustainable Development Goals.

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DIAGNOSTIC AND COMPLEX THERAPY OF CATS, SICK WITH PYELONEPHRITIS

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Abstract

Nephritis are common nowadays. The main causes of nephritis are toxins in food and water, use of some medication without control. Also, there are a lot of kinds of salt that may cause nephritis. Today there are a lot of methods of diagnostic and treatment of cats, sick with nephritis. However, these methods are not always effective. That is why the purpose of our work was to create the algorithm of diagnostic and complex treatment of cats, sick with nephritis.

Materials for the study were 30 cats, sick with pyelonephritis. Each cat was under exploration for 40 days. In this period every day, we made clinical exploration. Also on the first, twentieth, and fortieth day, we spent laboratory examinations of blood and ultrasound test. Cats were divided into three groups. In the first group, we used amoxiclav 12,5 mg/kg, stop-cystitis 2-3 ml orally twice a day for 30 days, liquid of Ringer 40 ml/kg intravenously once a day for 30 days. In the second group instead of stop-cystitis, we used canephron 1/2 - 1/3 of tab once a day. In the third group, we used canephron 1/2 of tab once a day and fytokit 3 ml orally twice a day.

The results of treatment showed, that complex therapy, which was used for the animals of the third group is the most effective.

Keywords: Pyelonephritis, cats complex therapy, canephron, fytokit

Introduction

The organs of the urinary system, which includes the kidneys and urinary tract, play a critical role in the body's ability to maintain homeostasis - the dynamic constancy of the internal environment. They regulate water-salt, acid-base, and mineral metabolism, excrete metabolic end-products and foreign substances products and synthesize biologically active substances [1].

Diseases of the urinary system are common in dogs and cats. The emergence of non-infectious kidney diseases is associated with the influence of genetic factors, the conditions of keeping animals, the completeness and balance of diets. In recent years, the leading role in the pathogenesis of diseases of the urinary system has been attributed to immunopathological reactions [2,3]. In case of ineffective treatment, these diseases take on a chronic course in which clinical signs are absent or mild, and therefore often go unnoticed by animal owners. Pathological processes lead to irreversible accruing changes in organ tissues, the development of renal failure, and the death of animals [3-5].

Today there are a lot of methods of diagnostic and treatment of cats, sick with nephritis. However, these methods are not always effective. That is why the purpose of our work was to create the algorithm of diagnostic and complex treatment of cats, sick with pyelonephritis.

Materials and methods

Materials for the study were 30 cats, sick with pyelonephritis. Each cat was under exploration for 40 days. In this period every day, we made clinical exploration. Also on the first, twentieth, and fortieth day, we spent laboratory examinations of blood and ultrasound test. Ultrasound tests were determined with the equipment of brand “Mindray” and microconvex chip. Explorations of morphological blood figures end content of hemoglobin were spent with using the analyzer “Mindray evolusion 3000”. Biochemical figures were determined with using the automagical analyzer “Cormay accent 300”, which works on base of photometry. The photometric analysis method can be used for a large range. Determined concentrations. It

is used both for determining the main components of various complex substances, and for determining the trace impurities in the objects. Combination with some methods of separation and enrichment - chromatographic, extraction - allows increasing the sensitivity of photometric methods by several orders of magnitude. The photometric properties of the solute are characterized by the transmittance T (τ), the reflection coefficient R (ρ), and the absorption coefficient A (α), which for the same substance are related by the relation T + R + A = 1. The determination of the dimensionless quantities T, R and A is performed using photometers (instruments for measuring a photometric value) by recording the reactions. Receiver of optical radiation on the corresponding radiation fluxes. In routine laboratory practice, it is customary to designate devices that detect the absorption of light by matter, photometers, and reflection by reflective photometers.

Sick cats were divided into three groups, 10 cats each. In the first group we used amoxiclav 12,5 mg/kg, stop-cystitis 2-3 ml orally twice a day for 30 days, liquid of Ringer 40 ml/kg intravenously once a day for 30 days.

In the second group we used amoxiclav 12,5 mg/kg, canephron ½-1/3 of tab once a day, liquid of Ringer 40 ml/kg intravenously once a day for 30 days.

In the third group we used amoxiclav 12,5 mg/kg, canephron ½-1/3 of tab once a day, fytokit 3 ml orally twice a day, liquid of Ringer 40 ml/kg intravenously once a day for 30 days.

Canephron.

Active substances:

1 tablet contains dried herbs in powder form:

yarrow (Herba Centaurii) 18 mg,

lovage root (Radix Levistici) 18 mg,

rosemary leaves (Folia Rosmarini) 18 mg.

Excipients: corn starch, colloidal anhydrous silica, lactose monohydrate, povidone, magnesium stearate, iron oxide red (E 172), riboflavin (E 101), calcium carbonate, dextrin, glucose syrup, wax, shellac, talc, titanium dioxide (E 171).

Dosage form - tablets.

Main physical and chemical properties: round biconvex tablets, coated with an orange color with a smooth surface.

Pharmacodynamics. The components of the herbal medicine show a complex activity, which is manifested in anti-inflammatory, antioxidant, antispasmodic and analgesic effects. Canephron also has antibacterial and diuretic effects, which are due to the substances contained in the plant components of the medication.

Fytokit.

1 ml of the medication contains 0.5 ml of aqueous extract (1:10) from a mixture of medicinal plant raw materials:

bird's-foot trefoil herb (knotweed) 12.5 mg

horsetail grass 7.5 mg

leaves of bearberry (bearberry) 5.0 mg

grass erva grass (pol-pala) 25.0 mg

Excipients: propylene glycol, methylparaben, propylparaben, purified water.

Pharmacological properties

The mechanism of action of the drug Phytokit is due to the activity of biologically active substances of medicinal plants in the drug. Phytocit has diuretic (diuretic), saluretic (saline) and anti-inflammatory action; dissolves stones (except oxalates).

Bird's-foot trefoil (Polygonum aviculare L., knotweed) - contains a complex of flavonoids; tannins; vitamins; silicic acid compounds, has diuretic properties; promotes the excretion of stones in urolithiasis; acts anti-inflammatory; improves the condition of the capillary walls.

Horsetail (Equisetum arvense L.) - contains water-soluble forms of silicic acid (up to 25%) and its complexes with organic compounds; flavonoids; triterpene saponins; has a diuretic; hemostatic; pronounced anti-inflammatory effect.

Common bearberry (Arctostaphylos uva-ursi L.) - contains glycosides, methylarbutin, arbutin, hydroquinone, halothanins; ursolic, gallic and ellagic acids, has a diuretic, antiseptic, anti-inflammatory, saluretic effect. Increases diuresis, has antibacterial properties in the alkaline reaction of urine.

Erva woolly (Aerva lanata L., pol-pala) - contains flavonoids, polysaccharides, mucus, organic acids, tannins, coumarins, saponins; has a diuretic and saluretic effect, accompanied by an increase in the release of sodium and potassium ions, a decrease in urea in blood plasma.

Results and discussion

During the clinical exploration we noticed such figures as pain in the land of kidneys, weakness, dysuria, pain during the diuresis. During the ultrasound explorations we saw increase in size of kidneys, swelling, uneven contours. During the treatment we saw the normalization of clinical conditions of animal. The most significant it was in the third group: in this group we noticed the shortest duration of treatment, the biggest percent of recovered animals and absence of mortality (table 1).

Table 1. Result of complex therapy

Group of animals	Duration of treatment (days)	Results		
		Total recovery	Came to chronic condition	dead
I (n=10)	30-37	5 (50%)	3 (30%)	2 (20%)
II (n=10)	27-33	7 (70%)	2 (20%)	1 (10%)
III (n=10)	25-31	8 (80%)	2 (20%)	-

During the explorations of morphological figures of blood and content of hemoglobin we noticed the increase of total number of leucocytes and the figure of erythrocyte sedimentation race. Also, we noticed the decline of the number of erythrocytes and content of hemoglobin. During the treatment we noticed the normalization of these indicators. The most significant normalization was in the group, where we used canephron and fytokit (table 2).

Table 2. Dynamic of morphological indicators and content of hemoglobin (M±m)

Indicator	1-st day			20-th day			40-th day		
	I group (n=10)	II group (n=10)	III group (n=10)	I group (n=10)	II group (n=10)	III group (n=10)	I group (n=10)	II group (n=10)	III group (n=10)
Number of leucocytes (G/l)	28 ±0,67*	23 ±0,54	21 ±0,77	17 ±0,22	14 ±0,33	12 ±0,25	12 ±0,34***	10 ±0,22***	8 ±0,31***
Number of Erythrocytes (T/l)	3,8 ±0,33◊	4,4 ±0,44*	6,2 ±0,52*	3,6 ±0,32**	5,5 ±0,21**	6,7 ±0,31*	3,7 ±0,27***	5,9 ±0,39***	6,9 ±0,42***
ESR (mm/h)	6 ±1,11	4 ±1,13	3 ±1,15	7 ±1,11	3 ±2,12	2 ±1,71	7 ±1,55	2 ±1,22	2 ±1,36
Content of hemoglobin (g/l)	56 ±3,77◊	78 ±2,63**	99 ±3,19	55 ±2,72◊	87 ±2,14	111 ±3,19◊	58 ±2,71**	96 ±2,44**	132 ±2,55**

Note ◊p<0,1; *p<0,05; **p<0,01 ***p<0,001, compared with clinically healthy animals.

During the exploration of biochemical indicators we noticed the race of creatinine, urea and a slight increase in activity of alpha-amylase ALT, AST and GGT. These changes in the biochemical figures mean, that violation of water metabolism led to a complete imbalance of metabolism and the accumulation of toxins in the organism. During the treatment we noticed tendention to normalization the biochemical figures. The most significant changes were detected in the third group (table 3).

Table 3. Dynamic of biochemical indicators and content of hemoglobin (M±m)

Indicator	1-st day			20-th day			40-th day		
	I group (n=10)	II group (n=10)	III group (n=10)	I group (n=10)	II group (n=10)	III group (n=10)	I group (n=10)	II group (n=10)	III group (n=10)
Content of glucose (mmol/l)	5,2 ±0,25	5,3 ±0,33	5,4 ±0,26	4,8 ±0,11	4,9 ±0,22	4,6 ±0,21	5,0 ±0,33	5,1 ±0,21	5,4 ±012
content of creatininum (mcmol/l)	360 ±23,7*	375 ±19,7**	353 ±17,6**	212 ±11,6	198 ±18,3	177 ±17,5***	167 ±23,3	152 ±12,6	146 ±11,4***
content of Urea (mcmol/l)	32,0 ± 2,04*	22,7 ±1,66**	12,3 ±2,38	34 ±1,66	18,6 ±1,53	10,9 ±2,17***	34 ±1,67	15,4 ±3,33	7,6 ±2,44***
Activity of Alcaline phosphatase (nkat/l)	650 ±23,13	665 ±31,12	681 ±26,22	663 ±23,46	652 ±25,13	700 ±33,42	675 ±32,15	642 ±22,12	622 ±21,11
Activity of alpha-amylase (nkat/l)	20133,33 ±76,12	20189,12 ±82,11	20165,01 ±73,12	18700,04 ±66,11	18612,07 ±44,11	18232,11 ±45,11	7212,22 ±33,22◊	7122,12 ±44,37◊	7787,32 ±33,21◊
Content of total protein (g/l)	61,6 ±3,12	62,8 ±2,22	63,6 ±1,66	64,2 ±3,12	65,5 ±2,17	63,4 ±1,44	62,5 ±2,22	64,4 ±1,66	66,2 ±1,54
content of Albuminum (g/l)	27,3 ±0,65	26,4 ±0,32	25,4 ±0,44	26,6 ±0,32	27,3 ±0,27	29,1 ±0,26	28,7 ±0,32	27,7 ±0,34	29,3 ±0,35
content of Globulinum (g/l)	34,3 ±1,88	36,4 ±2,32	38,2 ±2,65	37,6 ±3,12	38,2 ±1,12	34,3 ±2,99	33,8 ±1,71	36,7 +2,21	36,9 +1,21
a/g coefficient (units)	0,80 ±0,06	0,73 ±0,05	0,66 ±0,04	0,71 ±0,03	0,71 ±0,07	0,85 ±0,08	0,85 ±0,06	0,75 ±0,04	0,79 ±0,07
Content of total billirubinum (mcmol/l)	3,7 ±0,62	3,4 ±0,33	3,5 ±0,23	3,1 ±0,25	2,6 ±0,23	2,3 ±0,21	2,8 ±0,22	2,2 ±0,33	1,9 ±0,31
Activity of AST (nkat/l)	702,2 ±123,1◊	700,3 ±85,4	707,2 ±22,2	677,7 ±34,6	673,3 ±28,4	654,2 ±26,6	661,1 ±27,32**	455,5 ±25,12**	321,12 ±21,32**
Activity of ALT (nkat/l)	883,33 ±23,45	884,12 ±21,12◊	883,55 ±32,11◊	755,12 ±22,12	695,11 ±33,21	511,22 ±23,11◊	542,11 ±21,12**	245,12 ±28,12**	167,23 ±29,33**
Activity of GGT (nkat/l)	201,33 ±21,11◊	204,12 ±22,12◊	203,21 ±21,12◊	116,12 ±26,11**	110,22 ±23,11**	86,33 ±25,14	83,32 +23,71***	76,34 ±21,11***	66,67 ±32,11***

Note ◊p<0,1; *p<0,05; **p<0,01 ***p<0,001, compared with clinically healthy animals.

Conclusions

The results of our research explorations showed, that complex therapy, used for animals of third group, is the most effective. That is why in future for treatment of cats, sick with pyelonephritis we recommend to use complex therapy, which contains amoxiclav 12,5 mg/kg, canephron ½-1/3 of tab once a day, fytokit 3 ml orally twice a day, liquid of Ringer 40 ml/kg intravenously once a day for 30 days.

Reference

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THE SEARCH FOR NANOSCALE AND DISINFECTANTS IN VETERINARY MEDICINE

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Abstract

In the system of veterinary and sanitary measures, the search for new highly effective means for prevention, treatment and disinfection amid ecological changes in the environment remains relevant. Quality disinfection depends on the use of effective veterinary preparations. In a short time, they are to eliminate the pathogens of infectious diseases, which requires a special approach to the choice of methods (wet, aerosol, gas, foam) and means (chemical, biological, physical) of disinfection and techniques for their use. Effective disinfection requires appropriate preparations, but most of them do not meet certain requirements, namely: some of them have a high bactericidal effect, but are toxic, others – have a high effect, low toxicity, but destructive impact on the treated objects.

Keywords: disinfection, veterinary medicine, disinfectants, Ukrainian market

INTRODUCTION

Disinfection is a critical link in the system of preventive, anti-epidemic measures to ensure the welfare of animals and birds, infectious diseases, human safety, sanitary quality of products and raw materials. Chemicals and physical agents that are used to kill infectious diseases of humans, animals and plants in the environment are disinfectants. They can be: in solution, suspensions, granular, in the form of tablets.

According to the analysis of the literature, recently the process of creating new effective tools and technologies and their application has been intensified (Firsov, et al, 2018; Ivanov, et al, 2017).

Today, the most promising developments for the creation and testing of disinfectants are substances based on peroxide compounds, peroxide compounds in combination with various stabilizers and surfactants, fumigation aerosols, ultra-violet rays, ultrasound and ozone (Paliy, et al., 2017).

The need to develop and use new disinfectants is primarily due to their shortage. For practical veterinary medicine, preparations providing complex virucidal, bactericidal and fungicidal actions are of particular interest.

Recently, methods and means of disinfection have been developed and are widely used in veterinary practice. But due to the circumstances that have developed in recent years in the country, the developed disinfectants cannot be considered satisfactory. The list of inexpensive traditional disinfectants available to the mass consumer remains very limited today. In addition, in the world practice in recent years, there has been a tendency to reduce the use of traditional disinfectants that were previously widely used (caustic soda, formaldehyde-containing, chloractive substances, phenols, quaternary ammonium compounds, etc.) (Simetsky, et al., 2000).

As for Ukraine, traditional chlorine-containing disinfectants (calcium and sodium hypochlorite, chloramine and others), as well as formaldehyde and glutaraldehyde, remain on its market. The most popular chlorine-containing preparations (inorganic and organic), which are due to habitual and spent decades of use

habits and economic reasons. Chlorine-containing substances are used mainly for medical disinfection - glass, plastic, rubber and other aggressive materials. And also for disinfection of surfaces and air in livestock buildings. K. Khamraev (1980) used hypochlorous aerosols for rhinotracheitis in cattle, and Yu.I. Bochenin (2005) - for disinfection of livestock buildings in the presence of calves and pigs. Preparations from the group of aldehydes have been positively proven as effective disinfectants, including in the form of aerosols and electroaerosols, for many bacterial and viral diseases of animals and birds: formaldehyde solution with an active substance content of 37%, an alkaline formaldehyde solution prepared from paraform with the addition of 1% caustic heated.

But, despite their superiority, they also have a number of disadvantages - high toxicity with a pronounced odor, instability of working solutions, selectivity in relation to pathogenic microorganisms, corrosive activity, etc. sustainability develops. The drugs are highly toxic and carcinogenic.

In this regard, it remains relevant to create new environmentally friendly disinfectants, taking into account the achievements of domestic and foreign practice, harmless to humans and animals, environmentally safe and affordable for consumers.

Insufficient provision of the veterinary service with disinfectants and, at the same time, growing requirements for the protection of the natural environment from pollution, made it possible to give preference to compounds based on halogens and surfactants.

For more than 50 years, the disinfection preparation "Iodine monochloride" (Popov, et al, 2002; Yavnikov, N.V., 2020) has been developed and widely tested in Ukraine, which has a high bactericidal activity and versatility - the possibility of using it as an antiseptic and disinfectant. The drug is active against bacteria, mycobacteria, viruses, fungi, coccidial oocysts and helminth eggs. Iodine preparations are used for disinfection for anthrax, viral hepatitis, foot and mouth disease, tuberculosis, salmonellosis, coccidiosis, ascariasis and others. In order to prevent respiratory diseases, it is desirable to contain substances that deodorize and disinfect the air in the premises for animals and poultry, as well as the respiratory organs of animals and birds. The main antiseptics currently used in veterinary practice are elemental iodine preparations, phenols, oxidants, heavy metal salts, acids, alkalis, which can cause both local and general toxic reactions in the body. This makes them of little use in everyday use for animals, birds and people, and some of them pose a danger to humans if they get into animal products.

Among the bactericidal agents of foreign production, there are preparations (surface-active or surfactants) that contain quaternary ammonium compounds (QAC), dissolve well, there is practically no smell, have a high bactericidal effect and low toxicity. Surfactants change the permeability of the membrane of microbial cells, therefore they are widely used in combination with other disinfectants. They have bactericidal, fungicidal and virucidal activity against lipophilic viruses, but do not affect spores and are ineffective against Mycobacterium tuberculosis. And yet, thanks to these unique properties, the drugs have found application in medicine, veterinary medicine, household chemicals, cosmetology, meat and dairy processing industries.

In recent years, special requirements have been imposed on disinfectants in order to prevent environmental pollution and safety for humans and animals. Another important quality is convenience and ease of use. Thus, there remains an urgent need for effective, environmentally friendly and affordable antiseptics for veterinary medicine.

In veterinary medical practice, there are practically no environmentally friendly and safe disinfectants that can be used to sanitize various objects of veterinary and medical supervision, including in the presence of animals (birds) and people.

Unfortunately, some chemical disinfectants have a detrimental effect not only on pathogenic microflora - pathogens, but also on beneficial microorganisms that are normally always in the air. They are generally less resistant than pathogenic ones. When they die, voids are formed in the biocenosis, which are filled with more active pathogenic microorganisms. For disinfection, as a rule, substances with a wide spectrum of action are

selected so that to achieve the desired effect, a minimum amount of them would be needed, moreover, so that they quickly decompose in the environment (Maertens, et al, 2018; Jiang, et al, 2018; Paliy, et al., 2019).However, there are already up to 200 types of microorganisms, which have developed resistance during long-term use of various disinfectants. In recent years, due to the increase in the frequency of bacterial resistance to antiseptic substances, the phenomenon of microorganism resistance has been deciphered as a result of mutations in the bacterial population and the appearance of a resistance gene in a certain strain of microorganisms (Bero, 2009; Ihidambaranathan & Balasubramanium, 2017) This once again emphasizes the need for the creation and implementation of new highly effective antiseptic agents and the study of their bactericidal, toxic and biological properties and methods of application in veterinary medicine, which determined the goal of our research.

The task of disinfection is to prevent or eliminate the processes of accumulation, multiplication and spread of pathogens by destroying or removing them on objects and objects, and ensures the interruption of the pathways of transmission of the infectious principle.

Recently, many different types of quaternary ammonium compounds have been used, in mixtures or in combination with other germicidal drugs, such as, for example, alcohol, show activity against certain vegetative bacteria and viral lipids. [nine]

The most widespread use of alcohol derivatives is found as skin antiseptics for treating hands, injecting and operating fields. One of these drugs is “Hermicid BC”, which contains quaternary ammonium compounds and glutaraldehydes, and was used in our studies.

Today, along with disinfectants, the use of citrates - inorganic constituents (metals) - has acquired particular relevance. Recently, they are widely used in both veterinary and humane medicine.

According to the literature, according to a number of authors, it has been proven that silver (Ag) is considered as a metal capable of adversely affecting bacteria, and as a trace element involved in the metabolic processes of the body. It is also effective against 650 types of bacteria (Bashkirtseva, 2018; Hanif, et al, 2020; Valdez-Salas, et al, 2021).

Bismuth (Bi) - Bismuthum or bisemutum comes from the German weisse Masse, "white mass" and means tectum argenti "silver roof", while in the Middle Ages it was considered half silver. Bismuth trioxide Bi_2O_3 is widely used in medicine. In particular, it is used in the pharmaceutical industry for the manufacture of many drugs for gastrointestinal diseases, as well as antiseptics (Meija, et al., 2016; Shtareva, et al., 2019).

The **aim of the study** was to test domestic disinfectants for disinfection of livestock facilities and improve the mode of their use.

Materials and methods

During the research, bacteriological and microscopic research methods were used, a counter for counting colonies, disinfectants “Hermicid BC”, 40% formal solution dehyde, “SEFDEZVET” (working title), prototypes of silver nanoparticles (Ag) and a combination of silver + bismuth (Ag + Bi) at a concentration in the initial solution of 2.0 mg/cm^3 and 2.0 + 1.55 mg/cm^3, respectively. The bactericidal effect of Ag nanoparticles and a combination of Ag + Bi was studied both as a matrix solution (with a concentration of 2 mg/ml - Ag; 1.55 mg/ml - Bi) and in a 1:2 dilution with an exposure of 24 and 48 hours.

To determine the bactericidal properties of disinfectants, the following test cultures of microorganisms were used: ***Bacillus alvei (strain 5), Escherichia coli (strain K 99), Salmonella Dublin (strain 41), Staphylococcus aureus (strain 209)***. The cultures were incubated at 37.5 ± 0.5 °C on BCH and MPA. The studies used a turbidity standard of 500 ml of bacterial cells (GNKIBSHM., Kiev).

The bactericidal effect of the disinfectant “SEFDEZVET” on microorganisms was studied: the whole preparation (100%) and at a concentration of 50%, 10%, 5%, 1%, 0.5%. For research, 4 series of dilutions of 5 ml of disinfectant were prepared. Each dilution was added to 0.5 cm^3 of a 500 million mixture of test cultures

(***Escherichia coli, Salmonella, Staphylococcus***), kept in a thermostat at a temperature of 37.5 ± 0.5 °C, and then inoculated at 1, 2 and 4:00 on MPA, poured into Petri dishes. The result of the bactericidal action of the drug was taken into account after 24 hours.

Results

At the first stage of the research, the bactericidal effect of the disinfecting solution “Hermicid BC” was studied at a concentration of 0.1%, 0.5% and 1.0% with an exposure of 15 minutes on various test objects: glass, plastic, tiles (Table 1).

Table 1. The results of determining the bactericidal action of the disinfectant solution on test objects

Test object	Initial contamination with microorganisms before disinfection, CFM/cm^2	The concentration of the solution "Hermicid BC",%		
		0.1	0.5	1.0
	Number of colonies of microorganisms, CFM/cm^2			
Glass	5.0*10^2	4.5*10^2	3.5*10^2	2.0*10^2
Plastic	2.5*10^2	2.0*10^2	6.0*102	Not found
Tile	2.0*10^2	5.0*10^2	Not found	Not found

It was found that the highest disinfection efficiency was established when using a 1.0% solution of "Germicid BC". the use of the indicated disinfecting solution has a 100% bactericidal effect on plastic and tiles, while the efficiency of treatment on glass is only 40%.

At the second stage of the research, the quality of disinfection of boxes for keeping cats and dogs before and after disinfection was determined. In the control sample (Box №1), mechanical cleaning was carried out, followed by washing with the Santri detergent at a solution temperature of 30 °C. Experimental bucks (Box №№ 2, 3) were also mechanically cleaned before disinfection, followed by washing with the "Santri" "at a solution temperature of 30 ° C, and then disinfection was carried out with a solution of “Hermicid BC” (concentration 0.1%, 0.5% and 1.0% and exposure from 15-60 min). The processing efficiency is shown in **table 2**.

The level of contamination with microorganisms in the control boxes (Box №1) is 5.8 * 10^2 CFM/cm^2. In addition, pathogenic microorganisms are isolated in flushes from the walls of the box: Staphylococcus aureus, Proteus vulgaris, Escherichia col. With additional disinfection of the boxes with a 1.0% solution of “Hermicid BC” after an exposure of 60 minutes, the microbial pressure decreases almost tenfold in comparison with the control. According to the results of microbiological studies of washes from the surface of control boxes after disinfection with a solution of “Hermicid BC” (concentration 1.0% - exposure 60 minutes), pathogenic microorganisms were not isolated.

At the third stage of research in experimental poultry farms, the effectiveness of the use of the disinfectant “Hermicid BC” was determined. Control poultry houses are disinfected with 40% formaldehyde solution.

Table 2. Determination of the bactericidal effect of the disinfectant solution “Hermicid BC”

Object of research, %	Disinfectant concentration,%	Exposure, min				
		Initial contamination with microorganisms, CFM/cm^2	15	30	45	60
			Number of colonies of microorganisms, CFM/cm^2			
Control (Box №1)	-	$5.8*10^2$				
Box №2	0.1	$5.6*10^2$	$6.0*10^2$	$5.3*10^2$	$2.7*10^2$	$1.9*10^2$
Box №3	0.5	$6.0*10^2$	$4.5*10^2$	$3.9*10^2$	$1.8*10^2$	$1.5*10^2$
Box №4	1.0	$5.8*10^2$	$2.5*10^2$	$2.0*10^2$	$1.1*10^2$	$0.6*10^2$

At the beginning of the researching, bacteriological studies were carried out in order to determine the contamination of the poultry house by microorganisms. The microbial background was determined on various objects by the swab method: floor, window, cage lattice. According to the results of studies on the presence of pathogenic microflora isolated cultures of ***Staphylococcus aureus, Proteus vulgaris, Escherichia coli, Salmonella enteritidis*** and ***Salmonella typhimurium***.

The premises in the poultry house were disinfected with a 0.15% solution of “Hermicid BC” (0.3 liters per 1 m^2) with an exposure time of 40 minutes (room №1). Control poultry houses were treated with 40% formaldehyde solution by gassing with an exposure time of 20 minutes (room №2). The room was kept closed for three days, after which it was opened and samples were taken to determine the quality of disinfection **(Table 3)**.

Table 3. Bacterial background in the poultry houses during disinfection

Room №1	Initial contamination with microorganisms, CFM/cm^2	Room №2 (Control)	Initial contamination with microorganisms, CFM/cm^2
BEFORE DISINFECTION			
Window	› 300	Cage	$1.56*10^3$
Lattice cage	› 300	Floor	$1.41*10^3$
Floor	› 300	Walls	$0.44*10^3$
AFTER DISINFECTION			
Window	$1.58*10^3$	Cage	$1.2*10^3$
Lattice cage	$1.61*10^3$	Floor	$1.15*10^3$
Floor	$2.5*10^3$	Walls	$0.15*10^3$

How we can see from tables 3, in the poultry house after disinfection with the “Hermicid BC” agent (concentration 0.15%, exposure for 40 minutes), the bacterial background decreased several times (if we assume that disinfection was never carried out in this room and therefore it was impossible count the colonies (> 300) If we assume that there were approximately 1 million microorganisms in such a room before disinfection, then after the use of “Hermicid BC” their number decreased by, on average, 5 thousand times.

In the second room of the poultry house (control), after disinfection with 40% formaldehyde solution (by gassing), the microbial pressure decreased 1.4 times.

Bacteriological studies after disinfection with 40% formaldehyde solution revealed single colonies of cultures of Staphylococcus aureusta, Proteus vulgaris. No pathogenic microflora was found after disinfection with the “Hermicid BC” solution.

At the fourth stage of the research, the bactericidal effect of Ag nanoparticles and a combination of Ag + Bi was determined as a matrix solution (with a concentration of 2 mg/ml - Ag, 1.55 mg/ml - Bi) and in a 1:2 dilution with an exposure of 24 and 48 hours.

Determination of the bactericidal effect of nanoparticles was carried out by using daily cultures of ***Escherichia coli (strain K 99), Salmonella Dublin (strain 41), Staphylococcus aureus (strain 209)*** and their field isolates at a temperature of 26 ± 1.0 °C (room temperature) and 37.5 ± 0.5 °C. Daily broth cultures served as control.

First, the bactericidal effect of matrix solutions Ag (2 mg/ml) and Ag + Bi (2 + 1.55 mg/ml) in ***Escherichia coli (strain K 99) and Staphylococcus aureus (strain 209)*** (according to the turbidity standard of 500 million ppm) was determined. K.), which was observed only after 24 hours at a temperature of 37.5 ± 0.5 °C (Table 4).

Table 4. Analysis of the bactericidal action of nanoparticles on ***E. coli*** and ***St.aureus*** (24 hours)

№ №	Time (hour) / °C	Results				
		Ag + ***E.coli***	Ag+Bi + *E coli*	Ag + *Staphy*	Ag+Bi ***+St.aureus***	Control
1	1 / 26	+	+			+
3	6 / 26	+	+			+
4	24 /37.5	-	-			+

Note: +) the presence of culture growth; -) lack of culture growth

When diluting matrix solutions Ag and Ag + Bi 1: 2, their bactericidal effect was established after 48 hours (Table 5).

Table 5. Bactericidal action of nanoparticles on microorganisms within 48 hours

№ №	Culture	Research results							
		24 hours				24 hours			
		Ag	Ag 1:2	Ag+Bi	Ag+Bi 1:2	Ag	Ag 1:2	Ag+Bi	Ag+Bi 1:2
1	***E.coli***	-	-	+ 245 CFM/cm^2	+ 26 CFM/cm^2	-	-	-	-
2	***St.aureus***	-	-	+	+	-	-	-	-

Note: +) the presence of culture growth; -) lack of culture growth

In addition, we studied the bactericidal effect of the disinfectant “SEFDEZVET” (working name) on test cultures ***(Escherichia coli (strain K 99), Salmonella Dublin (strain 41), Staphylococcus aureus (strain 209))***. An experienced disinfectant is used in humane medicine to disinfect instruments, but its use was first tested in veterinary medicine (Table 6).

Table 6. Analysis of the bactericidal action of “SEFDEZVET” on enterobacteria

№ №	Time (hour) / 37,5 ° C	Research results						
		Drug concentration,%						control
		0,5	1	0,5	1	0, 5	1	
		E. coli		***Salmonella***		***Staphylococcus***		
1	1	-	-	-	-	+	-	+
2	4	-	-	-	-	-	-	+

Note: +) the presence of culture growth; -) lack of culture growth

According to the results obtained, it was found that the disinfectant “SEFDEZVET” exhibits a 100% disinfecting effect against enterobacteriaceae ***(Escherichia coli (strain K 99)*** at concentrations of 0.5% and 1.0% with an exposure of 1 and 4:00 at a temperature 37 5 ± 0.5 °C (Table 6, Fig. 1).

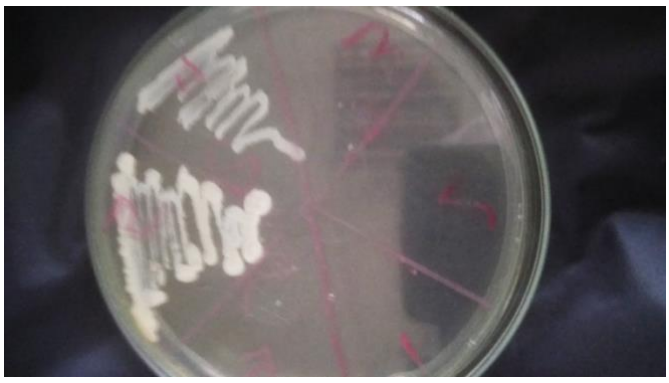

Fig. 1. A - Bactericidal effect of “SEFDEZVET” on enterobacteria
B - control (presence of culture growth)

As for ***Staphylococcus***, it was found that the disinfectant “SEFDEZVET” at a concentration of 0.5% at an exposure of 1:00 acts on the test culture of ***Staphylococcus aureus (strain 209)*** bacteriostatically - when inoculated on a Petri dish after 24 hours in the field of view, we revealed 10 colonies. At the same time, the experienced disinfectant “SEFDEZVET” at a concentration of 0.5% by exposure at 4:00 possesses 100% bactericidal action (Table 6, Fig. 2).

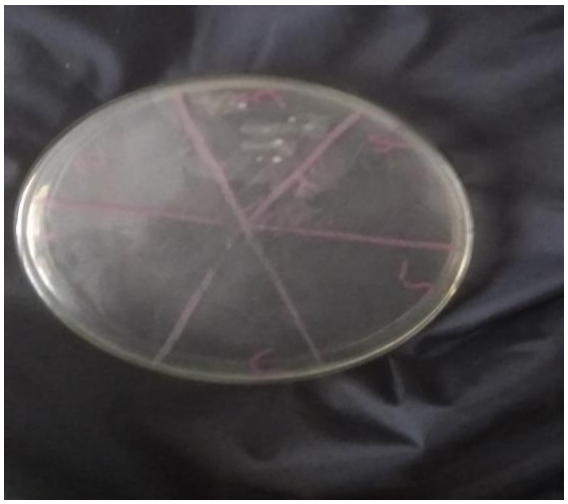

Fig. 2. Bacteriostatic effect of 0.5% solution of "SEFDEZVET" on ***Staphylococcus aureus***

Conclusions.

1. On the basis of the obtained preliminary laboratory studies, we have established the bactericidal effect of the drug "Hermicid BC" and the possibility of its use for disinfection of animal husbandry facilities. No microorganisms were found on the plastic and tiles after treatment with a 1.0% solution of "Hermicid BC" after exposure for 15 minutes, that is, the drug worked 100% compared to the control.

2. It was found that in the poultry house after using a 0.15% solution of "Hermicid BC" for an exposure of 40 minutes, the number of microorganisms decreased by almost 5 thousand times, and in the control boxes - by almost 10 times. No pathogenic microflora has been identified by bacteriological studies.

3. Established the bactericidal effect of the drug "SEFDEZVET"on the test culture of enterobacteria - at 1:00 exposure and on the test culture of ***Staphylococcus aureus*** - 4:00. Regarding Ag and Ag + Bi nanoparticles, their bactericidal action is prolonged and occurs only after 48 hours.

A promising direction for further research is the development of new modes of disinfection of the studied drugs, their concentration and economic feasibility, disinfecting properties and methods of their use at various objects of animal husbandry.

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ORGANIZATIONAL AND METHODOLOGICAL PROBLEMS OF THE RATIONAL USE AND PROTECTION OF THE KUYALNYTSKYI ESTUARY LANDS

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Abstract

The condition of the Kuyalnytskyi estuary is one of the most acute environmental problems of the Northern Black Sea coast. Scientists are discussing various measures to restore this mega ecosystem, some of which are included in regulatory state and regional documents. However, unfortunately, these measures were only partially implemented and did not solve the problem at all, and sometimes even led to dangerous local consequences. The main purpose of the study is to draw attention to the problems of estuaries of Odesa region and to develop recommendations for identifying solutions to protect environmental safety and conservation of estuaries of the Black Sea. The main objectives of the study are to generalize the current state of the Kuyalnytskyi estuary basin, consideration and assessment of environmental, social and man-made factors, determining the list of possible hazardous impacts on the environment. It is established that the aquatic and terrestrial ecosystems of the Kuyalnytskyi estuary are in a state of crisis due to climate change and the disproportional significant impact of anthropogenic pressure on the waters and the catchment area of the estuary (~ 2240 km^2). The Kuyalnytskyi estuary is rapidly losing its ability to restore its natural resource potential. The analysis of the ecological condition of the Kuyalnytskyi estuary shows that the main reasons that hinder the rational use and protection of estuary lands are the lack of scientifically sound, clearly defined development strategy; imperfection of legislative and regulatory support; imperfection of legal, organizational, economic bases for the formation of full-fledged development of the resort and recreational zone of Kuyalnyk.

Keywords: Kuyalnytskyi estuary, ecosystem, natural resources, land protection, conservation problems, ecological condition.

INTRODUCTION

Kuyalnytskyi estuary is an important recreational and balneological object of national and world importance. It is included in the list of 14 most valuable estuarine complexes of the Black Sea region of Ukraine. It contains a deposit of therapeutic mud and mineral waters. However, today the ecological state of the Kuyalnytskyi estuary can be described as a critical, due to the catastrophic shallowing of the reservoir, reducing water levels and depths, as well as the associated increase in brine salinity, which threatens the complete disappearance of the estuary and loss of unique therapeutic mud and brine, including the peculiar flora and fauna of the reservoir. Therefore, the preservation of natural complexes and objects in the basin of the Kuyalnytskyi estuary, which have a special health, historical, cultural and scientific value, is not only an ecological but also a socio-economic national task. Theoretical and practical significance, the objective need to solve these issues have determined the relevance of the topic of this study.

MATERIALS AND METHODS

The methodological basis of the work is the work of scientists in the field of research of ecosystems of the Northern Black Sea coast, in particular, the ecological state of the Kuyalnytskyi estuary basin. In addition, the work is based on the results of monitoring observations of the Department of Ecology and Natural Resources of Odesa Regional State Administration on the state of the environment of the Odesa region. In the process of research to achieve this goal, the following methods of scientific knowledge were used: induction and deduction; economic-statistical and graph analytical methods; logical generalization, synthesis, comparison, system and spatial analysis.

RESEARCH RESULTS

The Kuyalnytskyi estuary is an estuary on the northwestern coast of the Black Sea, one of a group of Odesa estuaries located north of Odesa. Its feature is the process of formation of mineral waters, which are characterized by miraculous healing properties of brine, sulfide-silt mud. The climate on the site is hot, arid with warm winters. The main element of the relief is the Black Sea lowland, which gradually decreases towards the Black Sea. The surface of the lowland is plain flat. The shores of the Kuyalnytskyi estuary and the rivers of its basin are cut by beams and ravines, the watersheds are flat. The soil cover of the Kuyalnytskyi estuary basin has its specific features, connected, on the one hand, with the considerable meridional length of the estuary and the rivers Velykyi and Malyi Kuyalnyk, on the other - with its geographical position in the middle steppe to the southern (dry). This causes a fairly significant contrast in the structure of the soil cover of the territory, within which the dominant background soils are southern chernozems, southern chernozems residual and slightly saline. Natural flora is the most important source of bioresources of the Kuyalnytskyi estuary, which performs recreational, climate-forming and sanitary-hygienic functions. According to the scheme of geobotanical zoning of Ukraine, the territory of the Kuyalnytskyi estuary basin is in the zone of transition from fescue-feathergrass to bonfire-wormwood steppes of the Azov-Black Sea subprovince of the Black Sea (Pontic) steppe province of the Eurasian steppe zone *(Burkinsky, et al., 2019).*

Researchers show that the coastal zone of estuarine complexes of the north-western Black Sea coast, due to its advantageous (unique) position, is subject to significant anthropogenic pressure. These include agricultural use, due to both favorable climate conditions and the availability of fresh water, and territorial - proximity to major settlements: Odesa, Belgorod-Dnistrovskyi, Izmail and others. However, in the current situation, this use is more extensive than intensive. This leads to a conflict between human activities, primitive nature and environmental measures aimed at maintaining a sustainable (stable) environmental situation.

The constant influence of many wellsprings located within the I and II sanitary protection zones of water bodies leads to anthropogenic pressure on the Kuyalnytskyi estuary:

- 7 villages on the right and 5 villages on the left bank of the estuary, on which territory (approximately 10 km^2 and 8.8 km^2) is inhabited and engaged in economic activities by 590 and 7800 people (according to the 2001 census), respectively;

- Kuyalnyk resort in the southern part of the estuary, where in the summer more than 6,000 patients are treated annually (about 0.5 km^2);

- agricultural lands (arable land and pastures in the plains and watershed slopes), numerous unauthorized landfills, quarries for the extraction of stone and sand, 6 cemeteries;

- thermal power plant (CHP-1), oil transshipment enterprises, Odesa oil refinery, cement plant, railway lines leading to the railway stations Odesa-Sorting and Odesa-East, Bypass road M -14, gas stations and parking lots, as well as special purpose facilities *(Stepanenko, 2013)*.

The most tense ecological situation has developed in the southern part of the water area and the coast of Kuyalnytsky estuary, where the world-famous balneological resort Kuyalnyk is located: recreational load

at certain times of the year (May-August) here is close to critical. In addition, the main one is the trampling of the coastal zone not only by pedestrians, but also by cyclists, motorcyclists and motorists, who are destroying the ground cover.

Another environmental problem of the Kuyalnytskyi estuary is the shallowing of the reservoir. The water content of the Kuyalnytskyi estuary and its salt regime depend on the ratio of the amount of precipitation that fell on the estuary water mirror and the volume of evaporation from it and regulation of river water flow in the estuary catchment basin. Global climate change has led to the estuary's water gradually evaporating, and replenishment occurs only through precipitation, which cannot even compensate for water evaporation. Numerous ponds and dams built along the Velykyi Kuyalnyk River and in the valley of rivers, streams and gullies, which impede the access of water in the estuary, played a negative role. According to Odesa State Ecological University data, obtained in 2010, it was established that in the basin of the Velykyi Kuyalnyk River there are about 135 artificial reservoirs (ponds, reservoirs) and quarries, dug. The total volume of all artificial reservoirs and quarries, ditches in the basin of the river Velykyi Kuyalnyk reaches 15.6 million m^3.

The extremely unfavorable ecological situation in the Kuyalnytskyi estuary basin is largely due to unauthorized sand mining, which led to the formation of individual lakes and actions that led to the separation of the tributary that filled the estuary with fresh water. It should be noted that the extraction of curative industrial mud by the method of depletion of the bottom of the estuary to a depth of one and a half meters. As a result, salt began to fall in the reservoir, and the water level of the estuary reached a critical level, Kuyalnyk will not be filled naturally. In 2014, a system of pipelines was launched connecting the estuary with the sea. But this gave only a temporary effect, because the estuary can be filled with sea water only in the cold season *(Annan, et al., 2015).*

The hydroecological problems of the Kuyalnytskyi estuary, which is currently a virtually drainless lake, are primarily related to the preservation of the softness of its unique recreational resources (healing brine and curative sulfide-silt mud) and the conditions of their reproduction. The critical ecological state of the Kuyalnyk ecosystem is also evidenced by the high level of pollution of its main components: brine, peloids, aquatic organisms, soil and vegetation of the coastal zone, phenols, petroleum products, sulfates, ammonium nitrogen, vanadium, cadmium, lead) and in watercourses (for sulfate, petroleum products, vanadium). In the bottom sediments and soils of the adjasent zone of the Kuyalnytskyi estuary, in the dominant plants there was an excess of cadmium, lead, zinc, copper, vanadium relative to their clarks in the lithosphere, soil, land vegetation, respectively. The soils of the coastal zone of the Kuyalnytskyi estuary have a weakly alkaline reaction. The pH values range from 7.1 to 8.1%, the humidity of the surface layer (0-30 cm) varies in the range of 2-20%, the chloride content varies from 0.6 to 3.5 g / kg, the most saline part of the coastal strip is soil of the northern edge of the estuary *(Loboda, et al., 2016).*

The bulk of the pollution enters the Kuyalnytskyi estuary with runoff from the Velykyi Kuyalnyk River, and with direct runoff from the surrounding fields. For several decades, public authorities have not been able to build sewage treatment plants around the Kuyalnytskiy estuary. Although, it is the deterioration of the ecological balance of this reservoir with valuable medical resources that leads to the pollution of the Velykyi Kuyalnyk River by untreated sewage. Sewage discharge into the Velykyi Kuyalnyk River is carried out by the housing and communal services of the village of Ivanivka, in Kuyalnytskyi estuary - "Kuyalnyk Clinical Sanatorium".

Economic activities in watersheds, coastal slopes and estuary banks have led to the degradation of small rivers flowing into estuaries. Agricultural land use in coastal and sloping areas is most often in violation of the 100-meter water protection zone. Allocation of thousands of garden plots on the banks of estuaries has led to additional land ruin along the banks of estuaries and intensification of erosion processes, the appearance of numerous garbage dumps, fires in the dry season, burning vegetation on the slopes *(Gogolev, et al., 1988).*

The main source of oil pollution of reservoirs is the washing and steaming station of the Odesa railway, which operated for 60 years and was closed in January 2000. In the storage ponds are flushing oil waste, most of which are represented by bottom sediments containing petroleum products 43.0 - 83.3%. In the water of the ponds located on the territory of the washing and steaming station, the content of oil products is 8.48 - 11.76 mg / l, and in the "remote" lakes - 0.90 mg / l. Due to the high content of petroleum products in the soil of the sanitary protection zone of the estuary and in the water of the ponds, the study area is classified as an "ecological disaster zone". Currently, work is underway to extract oil-contaminated bottom sediments from ponds, remove contaminated soils and reclamation of the washing and steaming station *(Adabovsky, et al., 2012).*

Abrasion and landslides give abrasion-landslide processes on the coastal-sloping sections of the Kuyalnytskyi estuary, which are located in the western, south-western, south-eastern and eastern parts. The lands of the Kuyalnytskyi estuary are characterized by surface planarian water erosion. In 2010, on the coastal slopes near the sanatorium Kuyalnyk, the old landslide slope was intensified due to natural and man-made factors: intensive infiltration of surface waters as a result of melting abundant snow cover and prolonged rains, waterlogging of soils that make discharge of domestic waters from the plateau near the village of Kotovka.

It should be noted that significant environmental damage to the Kuyalnyk estuary was caused by the construction of three main gas pipelines with a diameter of 0.7-0.8 m on the active erosion-landslide slope of the Malyi Kuyalnyk River. During the survey of deformation changes in the protection zone of gas pipelines it is not recognized except for insignificant surface erosion of hardness of limestone and deluvium loam on the slope unprotected by vegetation.

In 2021 The Cabinet of Ministers of Ukraine decided to approve the establishment of the Kuyalnytskyi National Nature Park in the Berezivskyi and Odesa districts. There is hope that it will solve a number of problems related to the critical ecological status of the Kuyalnytskyi estuary basin.

After analyzing the current state of the Kuyalnytskyi estuary basin, environmental, social and man-made factors influencing it, we propose measures to improve the ecological condition of its lands, their protection, rational use and reduction of anthropogenic impact.

1. The first proposal is a revision of Art. 62 of the Land Code of Ukraine on "Restrictions on the use of land of coastal protection strips along the seas, sea bays and estuaries and on islands in inland waters", supplementing the article with items on the prohibition: cattle burial grounds, filtration fields, etc .; transport access to the water body, its washing and maintenance.
2. Development of a draft detailed plan of the Kuyalnytskyi estuary basin.
3. To restore and establish water protection zones with the removal of coastal protection strips in nature and to organize nature protection control of economic activity within their borders in accordance with the legislation of Ukraine.
4. Reduction of arable land areas along water protection zones and zones with steep slopes where erosion processes develop, as well as degraded, unproductive, technogenic-contaminated arable lands with their siltation to restore the original natural vegetation.
5. Arrange the coastal protection strips and bring the coastal protection strips of the Velykyi Kuyalnyk River, Dovbok, Kubanka, Hildendorfska and Korsuntsivska baulks into nature.
6. Create protective strips of greenery along routes and slopes, as well as along route № 14 as a structural biogeo-barrier preventing the entry of toxins of various origins from the catchment area, landslides and soil erosion.
7. Analysis of water use, main sources of pollution, certification of water bodies and creation of a register of hydraulic structures and their owners in the Kuyalnytskyi estuary basin
8. Create a system for monitoring and a single database on the state of natural resources in the Kuyalnytskyi estuary basin and conducting expeditionary research on the state of resources in the basin.
9. Carrying out an inventory of landfills in the Kuyalnytskyi estuary basin and liquidation of natural and those located within the protection zones.

10. Eliminate quarries for the extraction of sand and stones, clean up the water area and the coast of the Kuyalnytskyi estuary.

11. Organize centralized cleaning of municipal sewage of the estuary.

12. Regarding the placement of "wild recreation", it would be appropriate to create official beaches in accordance with all rules and regulations. For the sake of comfortable and, most importantly, safe recreation of the population, it is proposed to equip several recreation areas on the shores of the Kuyalnytskyi estuary (excluding the beach of the sanatorium "Kuyalnyk") with appropriate conditions, and most importantly equipped entrances for transport. This would reduce the impact on the coastal lands of the estuary.

CONCLUSIONS

Analysis of the ecological condition of the Kuyalnytskyi estuary basin showed that with the current state of the hydrographic network and the estuary catchment basin, progressive economic development of coastal slopes and long-term global warming, the estuary drying processes and increasing pollution of its waters will continue. The most effective way to save the Kulnytskyi estuary from degradation is to create a regular water exchange with the sea. However, in any case, this should be preceded by detailed hydrological, hydrographic and ecological studies, which will determine the ways and nature of establishing links with the sea, which allow to restore water volumes and estuary area and avoid negative consequences for its ecosystem.

For the sustainable functioning of the Kuyalnytskyi National Nature Park, it is necessary to create an appropriate regulatory framework, which consists of a system of standards and other regulatory documents, monitoring of resource potential and regulations. This can be achieved by developing a single conceptual mechanism for quantitative and qualitative assessment of existing and maximum allowable man-made load in the catchment area of the Velykyi Kuyalnyk River and other watercourses in the Kuyalnytskyi estuary basin (Dovbok, Kubanka, Guildorf, Korsuntsivska baulks).

In its final form, such an assessment will consist of a clear sequence of actions that will determine the allowable man-made loads; which in turn will significantly reduce financial costs to ensure the stable operation of the water management complex of the Kuyalnitskyi estuary.

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AGRICULTURAL EDUCATION OF SOUTHERN UKRAINE POLICY

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Abstract

The article reveals the policy aspects of agricultural education establishment in Southern Ukraine. The contribution of leading scientists to the formation of agricultural schools has been studied.

This paper examines the stages of the agricultural education establishment in Southern Ukraine alongside the historical development of economic, social, cultural, and political life in the 19th – early 20th centuries due to reforms in the Russian Empire, including agricultural education. Our study focuses on the analysis of the agricultural education establishment in Southern Ukraine. The researched field includes materials of the archive of Odesa State Agrarian University; periodicals and electronic publications; narrative sources, in particular, the memoirs of professors of Odesa National University named after Ilya Mechnikov, Odesa Agricultural Institute, related with the agricultural education establishment in Southern Ukraine. The authors' attention focused on the history of content, forms, and methods of educational process in Odesa State Agrarian University and the agricultural education establishment in Southern Ukraine in the 19th – early 20th centuries, particularly the organizational materials of the agrarian education schools of the specified period are highlighted. The stages of the historical development of the agricultural education are clarified, historical changes in the content, forms, and methods of educational process in agricultural educational institutions in the 19th – early 20th centuries are revealed. A study of the development of the history of agricultural education in Ukraine in the 19th – early 20th centuries under the influence of changes in the socio-political, socio-economic, and cultural life of the Russian Empire, the Ukrainian Soviet Socialist Republic and modern Ukraine has been conducted. The development of the agricultural education system is illustrated. The authors trace the formation and development of agricultural education in general. The importance of the research results for use in the teaching of social sciences and humanities such as "History of Ukraine", "History of Ukrainian culture", "University Pedagogy" at Odesa State Agrarian University is proved.

Keywords: agricultural education, university, policy aspects, Odesa State Agrarian University, Southern Ukraine

INTRODUCTION

Modern Ukrainian scholars adhere to the opinion that the future of Ukrainian agricultural education is not only in the implementation of foreign models of education and science but also in the use of the historical achievements of our state. In particular, the history of establishment and development of the oldest in the Southern Ukraine Odesa Agricultural Institute (Odesa State Agrarian University) can be traced in archival sources. The significant interest in aspects of the establishment and the development of agricultural schools in Ukraine are found in the researches dedicated to the content and organization of the network of agricultural schools (Bilan L.), in particular in the Poltava region (Mykhalyuk O.) and in the Kyiv region (Rybchenko D.) [1, 4, 5].

OBJECTIVES OF THE ARTICLE

The purpose of the article is to analyze the little-known historical and political aspects of the dynamics of agricultural education in Southern Ukraine on the example of Odesa State Agrarian University.

RESULTS

The opening of the University in the south of Ukraine for the development of agriculture, animal husbandry, horticulture, viticulture, was facilitated by a strong scientific and pedagogical base of Novorossiysk University (Odesa National University) and Novorossiysk Society of Naturalists (Odesa), where outstanding Odesa scientists T. G. Tanfilev, I. I. Mechnikov,

I. M. Sechenov, M. O. Umov, O. A. Vericho, V. V. Zalensky, P. A. Spiro and others have been working.

In 1908-1914, Professor A. M. Kryshtofovich of Novorossiysk University have been developing technologies for plant evolution and historical patterns of the world flora's growth.

In 1905, V. E. Tairov established the first research institution in the Russian Empire, the "Wine Station of Winegrowers and Winemakers," in Odesa.

Biologist B.B. Grinevetsky is well known for his work on anatomy, floristics, taxonomy, and botany. Academician D. K. Tretyakov performed many works on morphology, comparative anatomy, embryology, cytology, and phylogeny of the animal world.

The science of genetics was developed by A. O. Sapegin, who was a graduate of Novorossiysk University, where he has been an associate professor since 1910, and a professor since 1917. In 1912 he organized a small breeding station at the Odesa Agricultural Research Station, which became the basis for the formation of the Genetic Breeding Institute.

The embryological direction in the biological school was continued by outstanding scientists O. O. Kovalevsky, T. I. Tanfilev, M. G. Lingau, P. M. Buchinsky, etc. [3]

A particularly important role in the organization of the Institute belongs to the outstanding scientist, doctor of agronomy, professor of Novorossiysk University at the Department of Agronomy O. I. Nabokih. It was he, a student of the famous scientist in plant physiology D. Ivanovsky and no less famous soil scientist V. Dokuchaev, who became the founder of the world-famous Museum of Soils at Novorossiysk University. O. I. Nabokykh has been teaching agronomy in this institution since 1905. He transferred the part of this Soil Museum to the Odessa Agricultural Institute.

At the first meeting of the Council of the Institute, the curriculum of the 4-year course was approved, teachers and management were elected. Professor I. Tochidlovsky became the first head of the institute. The initial management structure of the Institute was quite simple: a Head, a secretary, and a Training and Control Commission, which headed two departments: crop and animal husbandry, and a year later a department of public agronomy was opened. It was professor O. I. Nabokih who had developed a draft curriculum [2].

The study showed that the teaching staff of the Institute in 1918 was sufficiently qualified, prepared for scientific and educational, as well as methodological and pedagogical activities. Following the existing rules, the management and teaching staff were recruited on a competitive basis. The criteria for their selection and evaluation were scientific papers, doctoral and master's theses, pedagogical abilities of candidates.

For example, 1st-year subjects in 1918 were taught by professors of Novorossiysk University: morphology and taxonomy of plants – Grinevetsky B. B., Serbinov L. L.; plant anatomy, plant physiology – Borovikov G. A.; inorganic chemistry – Petrenko-Krytchenko P. I.; organic chemistry – Pavlov P. M.; physics – Tochidlovsky I. Y., Kirilov E. A.; zoology of invertebrates – Lignau N. G.; anatomy, histology, embryology of animals – Tretyakov D. K.; crystallography – Sidorenko M. D.; meteorology, climatology – Tochidlovsky I. Y. and others [5].

The organization of the educational process at the institute significantly depended on the social and educational level of students. As a rule, graduates of gymnasiums, high schools, and secondary agricultural schools had the right to enter the Institute. According to the statistics of requirements for applicants, the number of students at the Institute, their status, and age had been changing annually.

The development of Odesa Agricultural Institute in the early 20th century was complicated by the constant change of government, the beginning of the civil war and "intervention" coincided chronologically in 1918-1920: World War I (1914-1918), the February Revolution (1917), the fall of the tsarist regime (1917), the founding of the Ukrainian Central Council (1917), the October coup in Russia and hostilities in Ukraine (1917-1920). The constant change of government, lack of teachers, transfer of power and subordination of schools to the temporary rulers of the city, and then to the Revolutionary Councils of Students, as a result – the cancellation of exams and point-based grading systems – these are not the complete description of the public life of students and the state of the Institute [3].

Despite the difficulties, in the first years of its activity, the Institute became one of the leading educational institutions, which trained agronomists, land managers, land reclamation workers, livestock breeders, and since the 1930s – winegrowers, fruit and vegetable growers, zootechnicians,

and veterinarians. By the beginning of World War II, more than 1,700 agricultural specialists had been trained for the “kolkhoz” and soviet farms.

The analysis of historical and pedagogical literature and dissertation researches allows us to state that the problem of formation and development of agricultural education in Southern Ukraine at the beginning of the 20th century in national historiography has not yet been a subject of holistic study and scientific research.

Studies show that the formation of the system of agricultural education in Southern Ukraine took place in the twentieth century. Large landowners were primarily interested in solving the problem of the spread of agricultural education on Ukrainian lands, as they owned huge estates, which brought meager income. With the change of political power related to the establishment of the Ukrainian People’s Republic, then the Ukrainian Soviet Socialist Republic, which became part of the USSR, agricultural education was in high demand. Agricultural education underwent serious changes in the educational process during “collectivization”. The quality of education dropped significantly, as a large number of specialists was needed to build “collective and state farm villages”, but the Soviet government relied on ideology to recruit applicants, neglecting the general level of education of applicants. Qualitative change, both among students and teachers, we see in the second half of the 20th century. Today Odesa State Agrarian University is a leading agricultural education institution in Ukraine [4].

CONCLUSIONS

Thus, the main factors in the development of agricultural education in Ukraine in the study period were: rapid development of agriculture and industry in Ukraine, which required multi-level training of agricultural specialists; self-government, which covered the entire economic and cultural life of the southern province and united various segments of the population who owned land; educational activities of agricultural associations, public organizations, and individuals who promoted agricultural knowledge among the Ukrainian population; scientific and pedagogical activity of scientists, outstanding specialists in Novorossiysk University (Odesa National University), and a set of disciplines provided training and practice for future agricultural specialists with a university degree, initiated and promoted the development of leading agricultural school in southern Ukraine – Odesa State Agrarian University.

The research results are actively used by teachers of the Department of Philosophy, History and Political Science of Odesa State Agrarian University in the teaching of social sciences and humanities "History of Ukraine", "History of Ukrainian culture", "University Pedagogy".

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APPLIED ASPECTS OF ECONOMIC AND MATHEMATICAL MODELING OF PRODUCTION ACTIVITY OF ENTERPRISES OF THE AGRICULTURAL SECTOR

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ABSTRACT

The urgency of the problem of improving the management of production activities of enterprises in the agricultural sector is substantiated. The importance of using economic and mathematical methods in general and optimization models, in particular, in the process of ensuring the optimal correlation between crop production and animal husbandry in agricultural enterprises, in conditions of limited resources are highlighted. The economic-mathematical model of optimization of structure of production of agricultural production in the specific enterprise of agricultural sector with use of modern information technologies is developed. The purpose of this research is to generalize the theoretical and methodological principles and develop applied recommendations for the use of economic and mathematical methods in the process of modeling the structure of agricultural production in a particular agricultural enterprise. As a result of researches the optimum parameters of realization of production activity of the agrarian enterprise are justified on an example of PF "V.V. Plakushchenko" of Odessa region. The optimal structure of the sown area is found, which allows to provide the highest values of production volumes of the main types of agricultural products, in particular plant growing and animal husbandry. Labor costs and mineral fertilizers for the production of each type of product are calculated. The optimal value of the pig population is calculated and the fodder base for the development of this industry is formed. The main financial indicators of production activity of the enterprise are determined (the value of gross output, production and commercial cost, sales revenue and profit).

Keywords: economic-mathematical model, optimization, production structure, agricultural products, agricultural enterprise, agricultural sector

INTRODUCTION

Agriculture includes two large productions - crop production and animal husbandry, which are interconnected and interdependent, a certain combination of these industries in certain conditions forms the structure of agricultural production. Implementation of production activities by a specific business entity, involves the production of crop and livestock products, in combination or separately, in order to make a profit and efficient use of available resources, as well as to ensure food security, meet consumer needs in crop and livestock products, solutions problems of rural employment.

The relevance of scientific research on the application of economic and mathematical modeling in the activities of modern enterprises of the agricultural sector is due to the fact that the choice of a particular industry or their rational combination, formation of a certain ratio between types of products produced by the enterprise or the structure of agricultural production, ensuring of its optimality, is an important and quite complex task for agricultural enterprises, the solution of which greatly facilitates the use of economic and mathematical methods.

The definition of the essence of the category "structure of production of agricultural commodities" and its role and importance in ensuring the effective functioning of agricultural enterprises, identifying the factors under the influence of which it is formed and developed, attention is paid by such economists as: A. Azizov V. Ambrosov V. Andriychuk, I. Balanyuk, O. Bitte, O. Bogdanovich, R. Zatorsky and B. Brynzey, V. Zinovchuk, O. Dovganyuk, M. Domaskina and K. Yarizhk, M. Bigdan and Yu. Karlyk., P. Kaninsky, V. Kutsenko, M. Lysenko, Y. Lupenko, M. Malik, V. Nelep, P. Sabluk, T. Samilyk, V. Tkachuk, V. Shiyan, D. Shiyan, V. Yurchishin.

The development of theoretical and practical principles of modeling of agricultural production was engaged by such scientists as: M. Braslavets, Y. Brodsky, A. Gataulin, V. Dankevich, J. Danzig, L.

Kantorovich, V. Kardash, R. Kravchenko, E. Krylatykh, A. Kurnosov, S. Minyuk, S. Nakonechny, I. Popov, S. Savina, V. Sukhorukov , M. Tuneev etc.

However, the use of this tool for a particular agricultural producer, requires a separate author's approach, taking into account the maximum number of factors and conditions in which it has to operate, leading to scientific and applied interest in this study.

The object of research is the process of economic and mathematical modeling of the structure of agricultural production in an agricultural enterprise.

The subject of research is theoretical, methodological and applied aspects of the process of economic and mathematical modeling of the structure of agricultural production in PF "V.V. Plakushchenko" of Velykomykhailivskyi district of Odessa region.

The purpose of the article is to generalize the theoretical and methodological principles and develop applied recommendations for the use of economic and mathematical methods in the process of modeling the structure of agricultural production in a particular agricultural enterprise.

Achieving the goal set in the work requires the solution of the following tasks: to reveal the meaning of the concept of the structure of agricultural production; determine the importance of economic and mathematical models in general and highlight the role of optimization problems in particular, in the planning of agricultural production; to characterize organizational and legal bases and resource maintenance of functioning of the enterprise; analyze the production activities of the enterprise; evaluate the efficiency of production and economic activities of the enterprise; to carry out the economic substantiation of the set task and the criterion of optimality and to develop the structural mathematical model of the problem; to form the initial parameters of the optimization model and to build an extended matrix of the economic-mathematical problem; carry out a comparative economic analysis of the optimal plan.

RESULTS AND DISCUSSION

Market terms of management set to the leaders of agricultural enterprises the task of independently choosing the direction of their activities, choosing the leading industry - crop or livestock, in order to achieve maximum profits to ensure expanded reproduction and intensify production. It should take into account a wide range of factors regarding the choice of production direction: environmental safety and preservation of soil fertility; availability of production resources; quantity and quality of labor resources; natural and climatic conditions, etc. [1, 2, 3].

Scientists in their research apply with different categories: the production structure of the enterprise, the production and industry structure of the enterprise, the industry structure of production, the structure of production of agricultural commodities in the enterprise. Based on the generalization of scientific approaches, the essence of the concept of "the structure of production of agricultural commodities in the enterprise" is defined as a certain combination or ratio of crop and livestock industries under certain conditions, their share in the total output. The combination of different industries in agricultural production allows to eliminate the seasonality of agricultural production, to make fuller use of machinery and labor resources. However, a large number of industries in one farm is undesirable.

The term "optimal structure of agricultural production" is substantiated, as such that in an agricultural enterprise ensures the fulfillment of contractual obligations for the sale of products, allows the most complete and efficient use of available production resources, and if necessary to attract them, get the highest economic effect and increase the profitability of the enterprise.

It is determined that optimization is understood as a choice from a set of possible options of economic development such that gives the chance to use the available production, financial and other resources most effectively, and the search for the optimal structure of agricultural production is carried out in the conditions of certain requirements for crop rotation and the structure of sown areas, ensuring the rational nutrition of animals with feed and fertilizer application rates per unit of sown area.

The economic-mathematical model is an economic abstraction expressed in formal-mathematical terms, the logical structure of which is determined both by the objective properties of the objects of description and by the subjective target factor of the research for which this description is made. Structurally, each mathematical model is a set of interconnected mathematical dependencies that reflect certain groups of real economic dependencies. The type of mathematical model depends on both the nature of the system and the tasks of the study. In the general case, the mathematical model of the system contains a description of the

set of possible states of the latter and the law of transition from one state to another (the law of functioning) [4].

In-depth research was carried out on the materials of the Peasant Farm “V.V. Plakushchenko”, which is registered and located in the Odessa region of Velykomykhailivsky district in the village of Hrebenyky, carries out its activities on the basis of the constituent documents approved by the founders (participants), operates in the form of a farm, guided by the Laws of Ukraine" On Peasant Farming Economy "and “On Farming Economy”. The governing body of this legal entity is the head of the farm - Eugene Plakushchenko.

The farm has quite favorable conditions for agricultural production. The climate is moderately continental, arid. The population is enough to provide by employees all production processes in the enterprise, developed social infrastructure, represented by educational institutions, medical, financial and cultural institutions. The developed network of transport connections, which is represented by the railway Odessa - Kiev, as well as the highway E95 M05, that contribute to the competent organization of sales.

In the farm is experiencing a decrease in the level of provision of production resources, which is confirmed by a decrease in land area, a reduction in the number of employees and a decrease in the value of fixed assets. Due to the fact that after the end of the lease agreement, the owners of land shares refused to continue cooperation with the farm, also the reduction of the number of employees by 3 people, due to the instability of the economic situation of the farm in the agri-food market and dissatisfaction of these people with working conditions. It should be noted that 11 people are involved in crop production, and 4 people are involved in animal husbandry.

The decrease in the value of fixed assets by 4.2% in 2020, compared to 2018, is due to the aging of fixed assets and the write-off of their depreciation. New equipment was not purchased during this period, as unfavorable weather conditions in 2019 and 2020 led to a deterioration in the financial condition of the enterprise. The growth of indicator of capital security and capital-labor ratio is explained by the fact that the rate of reduction of the number of employees is ahead of the rate of reduction of land area and the value of fixed assets. The livestock industry has developed steadily, as evidenced by the increase in livestock of pigs by 3.6% in 2020 compared to 2018.

During 2018-2020, the entire land area that the farm had was cultivated. In PF “V.V. Plakushchenko”grew cereals and legumes (winter wheat, winter barley, corn, oats, millet, peas), the share of which in the structure of crops was 58.4% in 2018 and increased to 64% in 2020. The share of industrial crops decreased from 41.6% in 2018 to 36% in 2020. This was due to the expansion of the product range of cereals and the introduction of oats, millet and peas.

The production direction of the farm can be described as technical-grain. The reduction in the size of the enterprise and adverse weather conditions during 2019 and 2020 (no precipitation and severe drought, two years in a row, caused significant damage to crops) led to a significant decrease in yield. As a result, the decline in production of all types of products, which had a negative impact on sales. A decrease in market prices while increasing the cost of production, led to a decrease in its profitability.

The decrease in productivity of pigs is a consequence of unbalanced feeding, because with the reduction of the harvest of cereals, it was not possible to use the required amount of grain and legumes for feed purposes.

The level of efficiency of economic activity of the studied enterprise decreased, which is confirmed by a decrease in yields of all crops and animal productivity, increasing production costs and reducing its profitability, deteriorating financial results and reducing indicators that characterize the amount of financial result per unit of resource expended. a significant reduction in profitability.

The management of PF “VV Plakushchenko” focuses on the demands of the world market and grows the most popular crops, namely groups of grain and industrial crops. Ukraine is one of the world's largest producers of oilseeds. The results of cultivation and organization of sales of which affect the efficiency of the enterprise as a whole.

Thus, the analysis of production and sales activities of PF “V.V. Plakushchenko” confirms the need to optimize its production structure in order to achieve the maximum level of financial results under the available production resources and management conditions.

Carrying out economic activity in market conditions forces the heads of domestic agricultural enterprises to constantly work to ensure a high level of competitiveness in a particular market of agricultural products. Among the main measures that contribute to this is the optimization of the structure of production in the farm. This will rationally distribute the resources available to it between the main industries: crop

production and animal husbandry and ensure their best ratio, get the maximum result from economic activity and meet the existing demand for products produced in PF "V.V. Plakushchenk". To this end, we have developed and solved an economic-mathematical model, which obtained the optimal structure of agricultural production in PF "V.V. Plakushchenko"and the optimal areas of crops and livestock were determined.

This economic and mathematical model reflects a large number of conditions, the relationship between resource costs and production results, balanced production and use of resources in such a way as to ensure the rational use of available production resources.

Carrying out the economic substantiation of the set task, its following formulation is given: to define such combination of volumes of manufacture of crop production and animal husbandry production in the investigated enterprise, at optimum use of resources available at economy at which the receipt of the maximum gross profit is provided.

The criterion of optimality is chosen gross profit. When developing this model of optimization of the structure of agricultural production in the studied enterprise, the task of linear programming was used. The structural mathematical model is represented by a set of mathematical expressions, dependencies (equations and inequalities), which reflect the resources available in the farm and management conditions.

The product range in the farm for the future is represented by such types of products as: winter wheat for marketable grain and winter barley for marketable and feed grain; corn for commercial and fodder grain; oats for commercial and fodder grain; millet for marketable grain, peas for commodity and feed purposes; sunflower seeds; winter rape seeds. The farm plans to continue to develop pig farming, which involves determining the level of productivity of pigs, the need for feed, their nutritional value and fodder value.

The extended matrix of the economic-mathematical problem includes 35 variables of unknown values, of which 9 are the required values of sown areas of crops and crop rotations, livestock, which are subject to 52 restrictions. The problem is solved with the help of Microsoft Excel - "Solution Search" function.

As a result of solving the economic-mathematical problem, the optimal values of the structure of sown areas are obtained, which allow to ensure the optimal ratio between the production of crop and livestock products and contribute to increasing the profitability of management. The optimized structure of sown areas envisages an increase in the share of grain crops by 10.48 percentage points, and a decrease in the share of industrial crops by the same amount. Volumes of fodder production, which amount to 5389.50 centner of fodder units, allow to keep 357 heads of pigs and to provide production of 500 centner of increase in live weight of pigs. Among grain crops are expected to increase the production of winter wheat, winter barley, corn, oats, millet and peas. Production volumes of industrial crops will decrease by 22.28%.

According to the optimization calculations, the production direction of PF "V.V. Plakushchenko" will change from technical-grain to grain-technical with developed pig breeding. The above changes will positively affect the final results of economic activity of the farm. Thus, it is planned to increase sales revenue by 1.9 times. This will be possible through the use of effective sales channels, increase sales prices and increase sales of manufactured products. Gross profit will increase 5 times. The level of profitability of economic activity will reach 71.08%.

Thus, the proposed measures to optimize the structure of agricultural production in the studied enterprise will increase the efficiency of its economic activity.

CONCLUSION

As a result of researches the optimum parameters of realization of production activity of the agrarian enterprise are substantiated on an example of PF "V.V. Plakushchenko" of Velykomykhailivskyi district of Odesa region, namely: the optimal structure of sown areas was found, which allows to provide the highest values of production volumes of the main types of agricultural products, in particular plant growing and animal husbandry; labor costs and mineral fertilizers for the production of each type of product are calculated; the optimal value of the pig population is calculated and the fodder base for the development of this industry is formed; the main financial indicators of production activity of the enterprise are determined (the value of gross output, production and commercial cost, sales revenue and profit).

Further research on the application of economic and mathematical modeling in the management of enterprises in the agricultural sector should focus on solving software problems of management staff, study of new software products and information technology by them.

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PURIFICATION OF LIQUID VEGETABLE OILS USING ELECTROPHYSICAL FIELDS

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Abstract

Biological completeness and ecological safety of food, in particular fatty, products - the most important task in their production. In the production of vegetable oils, ecological purity is achieved by technological treatments that lead to the removal of unwanted compounds and impurities.

Keywords: vegetable oil, requirements, purification, electrophysical field, acids

INTRODUCTION

Vegetable oils are widely used in various sectors of the economy. Their extremely high nutritional value is that they are easily absorbed by the human body and are a high-energy product.

The oil is used directly in food, baking, confectionery, it is used to produce drying oil, detergents, varnishes and paints [1]. Technical vegetable fats are used in the production of plastics, linoleum, oilcloth materials.

Figure 1 shows the consumption of vegetable oils in the world.

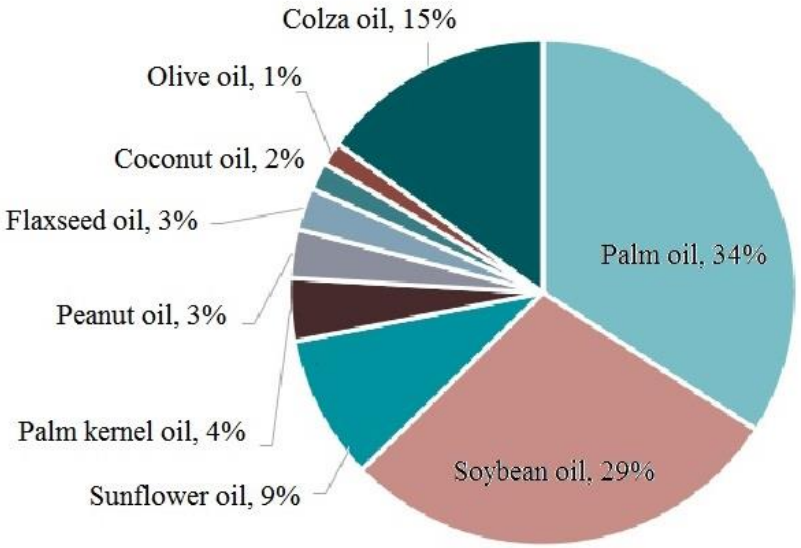

Figure. 1 The structure of consumption of oil and fat products in the world

Ukraine is a world leader in the production of vegetable oils, namely sunflower. Figure 2 shows the production volumes of sunflower oil from the world's leading producers.

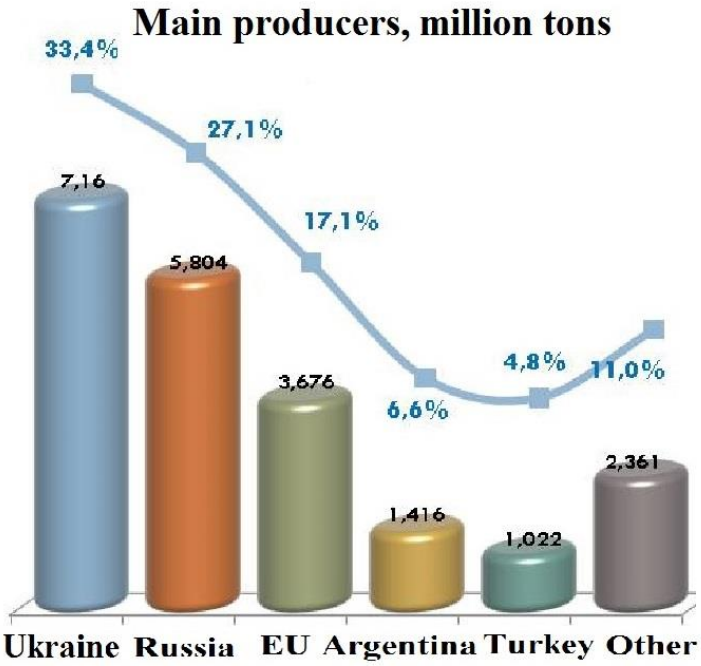

Figure.2 World production of sunflower oil

Biological completeness and ecological safety of food, in particular fatty, products - the most important task in their production. In the production of vegetable oils, ecological purity is achieved by technological treatments that lead to the removal of unwanted compounds and impurities (pesticides, toxic elements, carcinogens, etc.) [2].

It is known that the physiological properties of vegetable oils depend on the composition and ratio of fatty acids in them and their position in the triglycerides of the oil, the presence of biologically active compounds (phospholipids, sterols, tocopherols, carotenoids, etc.) [3]. However, natural fats and oils in their composition are not perfectly physiologically complete product, because almost every one of them has a deficiency or excess of one or more components. At the same time, they are a valuable source of antisclerotic and biologically active substances.

Materials and methods

All vegetable oils due to their composition of fatty acids, the absence of cholesterol have the ability to reduce the risk of cardiovascular disease. The degree of their effect on the body depends on the ratio of

fatty acids in a particular oil. The role of tocopherols, phytosterols, carotenoids, which are present in oils, is also important.

It should be noted that all types of vegetable oils, regardless of their place of production are inspected for compliance with hygienic requirements for safety and nutritional value. The content of heavy metals (lead, arsenic, cadmium, mercury), aflatoxins B_1, pesticides, radionuclides is controlled [3].

In order to create full-fledged fatty products use both a mixture of different properties of oils, and the production of products with specified properties, which is carried out by improving the purification process.

In addition to concomitant substances, in the process of obtaining oils in crude oil and impurities. By their nature, they can be organic (seed coats, parts of leaves and stems) and mineral (earth, stones, sand). Oil impurities also include pesticides, gasoline (in extraction oils), soap (in fats refined with alkali), catalyst metals (in hydrogenated fats) [3]. It should be noted that it is the concomitant substances and impurities, not triglycerides that determine the color, taste and smell of fats. In this case, some related substances (eg, phospholipids, vitamins) increase the nutritional value of fats. The presence of other substances (waxes, gossypol, etc.), on the contrary, degrades the quality of fats and complicates their technological processing.

The process of purification of vegetable oils from unwanted impurities is complex and energy-intensive, it consists of two main stages: the primary purification from suspended particles, which are in the oil after its receipt and secondary purification is more complex, called refining. chemical reagents and catalysts that ultimately negatively affect the quality of the oil, namely the environmental hazard of the finished product and require additional energy consumption. The purification of vegetable oils, the efficiency of mixing with reagents, the accuracy of reagent dosing, the accuracy of maintaining the process temperature, the efficiency of phase separation (in the field of centrifugal forces, gravitational forces or filtration), creating a deep vacuum during deodorization are technically difficult tasks.

The main difficulty is the choice of reagents, the calculation of their quantity in accordance with the quality of the treated oil, the choice of technological modes (temperature, pressure, hydrodynamics in reactors, etc.). The set of the above parameters should ensure maximum excretion of concomitant lipids, meet environmental safety requirements, contribute to the preservation of the necessary biologically active properties of raw materials in obtaining final products with high consumer properties and ensuring high economic and ergonomic production. In the refining process, the two main by-products that are harmful to the environment are the co-paste formed during chemical refining and the phosphatide emulsion formed during hydration.

Our proposed technology of obtaining vegetable oil of the highest grade by using physical fields (acoustic, electric, electromagnetic), Figure 3 [4, 5], during its primary and secondary purification, allows to remove chemical reagents from the composition of soapstock, which is obtained as a by-product.

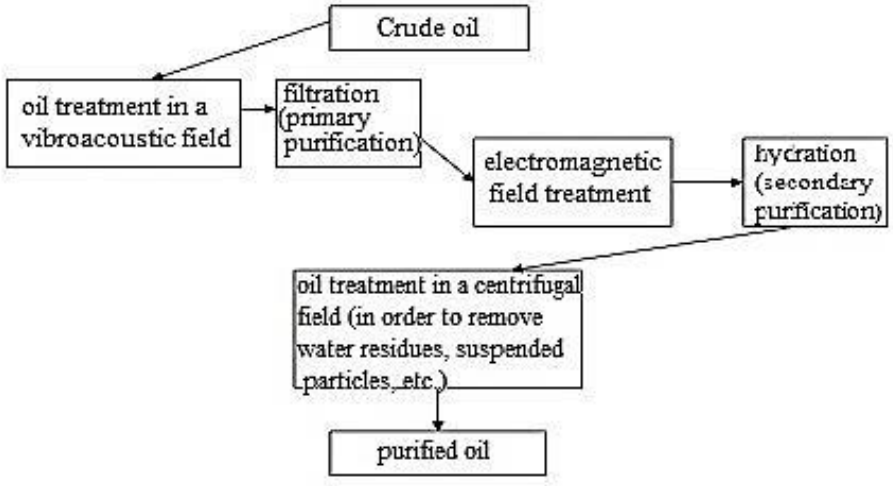

Figure.3 Innovative scheme of purification of liquid vegetable oils.

Conclusion

Due to which significantly reduce the toxicity of wastewater and thus reduce the harmful effects on the environment. Also due to the exclusion from the technological process of chemical reagents, an environmentally friendly product is obtained. While maintaining the required biologically active properties and, accordingly, high consumer qualities. This allows us to say that using the proposed technology reduces the impact of harmful factors, both on the environment and on human health when using the obtained vegetable oils.

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ECONOMIC EFFICIENCY OF COMPLETE FEED PRODUCTION PROVIDED THE USE OF PROTEIN AND VITAMIN SUPPLEMENTS FOR BROILER CHICKENS AGED 4-5 WEEKS 5 %

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UDC: 636.52 /.58.085.55: 330.131.5

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Abstract

Feeding of young poultry was carried out with complete feed for broiler chickens aged 4-5 weeks.

The nutritional value of 1 kg of complete feed is 12.5 MJ of metabolic energy. 1 kg of compound feed contains: dry matter - 860 g, crude protein - within 220 g, lysine - not less than 13 g, methionine + cystine - 9, threonine - 9, tryptophan - 2.6, crude fat - 50, crude fiber - not more than 40, sodium - not more than 2, calcium - not less than 8 and phosphorus - 6 g.

Compound feed is balanced with the content of normalized microelements and vitamins, includes enzymes, antioxidant, adsorbent and prebiotic.

The basis of complete feed for broiler chickens aged 4-5 weeks are grain feed, plant protein concentrates, protein-vitamin supplement and soya oil.

The live weight of broiler chickens at 5 weeks of age is 2210 g, with an average daily gain for the period of 90 g. Feed costs for the period of feeding broiler chickens aged 4-5 weeks - 1.89 kg, feed conversion - 1.5 kg, the cost of 1 kg of live weight gain - 16 UAH.

It is concluded that the high economic efficiency of production of complete feed with the use of protein and vitamin supplements for broiler chickens aged 4-5 weeks 5 %.

It is established that the feeding of complete feed for broiler chickens aged 4-5 weeks satisfies the need of animals for energy, nutrients and biologically active substances, provides high productive qualities of poultry and meets the requirements of intensive management of the poultry industry.

Key words: broiler chickens, complete feed, amino acids, calcium, phosphorus, feed conversion.

INTRODUCTION

The essential condition for the intensification of poultry industry is the organization of complete feeding, which ensures the formation of high productivity of modern poultry breeds and economic efficiency of production.

According to the results of the research it was established that the live weight of broiler chickens at 3 weeks of age is 950 g, with an average daily gain for the period of 45 g. Feed costs for the period of feeding broiler chickens aged 1-3 weeks - 1.17 kg, feed conversion - 1.3 kg, the cost of 1 kg of live weight gain - 15 UAH.

It is concluded that the production of complete feed with the use of protein-vitamin supplements for broiler chickens aged 1-3 weeks, 5 % and developed by us, allows to optimize the protein, amino acid, mineral and vitamin nutrition of broilers, affects on the productive qualities of animals positively, provides high efficiency of feed use, meets the requirements of intensive production, and it is characterized by positive economic efficiency [2].

To study the economic efficiency of complete feed production with the use of protein and vitamin supplements for broiler chickens aged 4-5 weeks 5 %.

MATERIAL AND METHODS

To solve this goal it was necessary to develop the recipe for complete feed and protein-vitamin supplement for broiler chickens aged 4-5 weeks, to weigh young animals at the daily and 21 days and 35 days of age, to determine the conversion of feed and the cost of 1 kg live weight gain of broiler chickens.

The research was conducted at the private enterprise Riznychuk I.F., in Odessa District of Odessa Oblast.

Broiler cross ROSS 308 (ROSS 308 BROILER), norms of concentration of energy and nutrients in 1 kg of complete feed for broiler chickens, protein and vitamin supplement for broiler chickens aged 4-5 weeks 5 %, complete feed for broiler chickens aged 4-5 weeks.

For the experiment, 100 heads of broiler chickens per day were selected.

Productive qualities of broiler chickens were determined by the dynamics of their live weight and average daily gains, the efficiency of feed use - by the cost of feed per 1 kg of meat poultry growth.

RESULTS

According to the latest developments, the feeding of young poultry was carried out with complete feed for broiler chickens aged 4-5 weeks.

The nutritional value of 1 kg of complete feed is 12.5 MJ of metabolic energy. 1 kg of compound feed contains: dry matter - 860 g, crude protein - within 220 g, lysine - not less than 13 g, methionine + cystine - 9, threonine - 9, tryptophan - 2.6, crude fat - 50, crude fiber - not more than 40, sodium - not more than 2, calcium - not less than 8 and phosphorus - 6 g.

Compound feed is balanced with the content of normalized microelements and vitamins, includes enzymes, antioxidant, adsorbent and prebiotic.

Complete feed for broiler chickens was made from crushed grain of cereals (wheat, barley, corn) – 63 %, vegetable protein concentrates (sunflower meal, soybean meal) – 30 %, soya oil – 2 % and specially designed for the production of feed 5 % protein-vitamin-mineral supplement.

1 kg of protein-vitamin supplement for broiler chickens aged 4-5 weeks contains: metabolic energy - not less than 5 MJ, dry matter - 900 g, crude protein - 200, lysine - 45, methionine + cystine - 53, threonine - 33 , tryptophan - 1, crude fat - 10, crude fiber - not more than 20, sodium - 30, calcium - not less than 130 and phosphorus - 47 g.

Protein-vitamin supplement contains plant protein concentrates, critical amino acids, calcium carbonate, monocalcium phosphate, sodium chloride, sodium bicarbonate, prebiotic and premix, which includes trace elements, vitamins, enzyme complex, antioxidant and adsorbent.

The live weight of broiler chickens at 5 weeks of age is 2210 g, with an average daily gain for the period of 45 g. Feed costs for the period of feeding broiler chickens aged 4-5 weeks - 1.89 kg, feed conversion - 1.5 kg, the cost of 1 kg of live weight gain - 16 UAH.

CONCLUSIONS

According to the results of the research, it can be concluded about the high economic efficiency of the production of complete feed with the use of protein and vitamin supplements for broiler chickens aged 4-5 weeks 5 %.

It is established that the feeding of complete feed for broiler chickens aged 4-5 weeks satisfies the need of animals for energy, nutrients and biologically active substances, provides high productive qualities of poultry and meets the requirements of intensive management of the poultry industry.

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FARMS AS A FORM OF AGRARIAN ENTREPRENEURSHIP

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ABSTRACT

The article considers the development trends of Ukrainian farms from 2010 to 2020 period. The dynamics and structure of agricultural production are analyzed. The agricultural production efficiency level in farms as a form of agricultural entrepreneurship is studied. The modern farms problems have been identified. The level of farms state support is assessed and the directions of its improvement are determined. The object of research is the economic andsocial processes of farm development as a form of agricultural entrepreneurship. Subject: The subject of the study is a set of theoretical, methodological and applied aspects of farm development as a form of agricultural entrepreneurship in Ukraine. The necessity of system measures development for increasing farms efficiency functioning is substantiated.

Keywords: farms; entrepreneurship; efficiency; profitability; state support.

INTRODUCTION

The relevance of scientific and applied research of the farms development problem as a form of agricultural entrepreneurship in Ukraine is due to: the importance of this organizational and legal form of agricultural production in ensuring the nation and the world food security; the need to increase the economic efficiency of agricultural production and strengthen its competitiveness on an innovative basis in domestic and global markets; the urgency of solving socio- demographic problems of the village and the growing role of farmers in maintaining the rural settlement network; the objectivity of the economy globalization, which includes farms in the system of world agricultural production with corresponding product quality standards; prospects for the participation of farms in foreign economic activity and ensuring foreign exchange

earnings to the state budget.

For Ukraine, the development of entrepreneurship in the agricultural sector and improving the agricultural production efficiency is of strategic importance for the national economy growth, because its successful operation creates conditions for crisis overcoming a number of related industries.

Almost 30 years have passed since the beginning of agrarian reform in Ukraine, but in scientific circles there are still discussions about the effectiveness of various forms of entrepreneurship that have developed in the agricultural sector. In our opinion, there is almost no ideal management form, each of them has its advantages and disadvantages. Therefore, a one-sided approach to the assessment of any entrepreneurship form in agricultural production does not provide an objective assessment of the economic processes taking place here.

One of the criteria for assessing the activities of various organizational and legal forms that have developed in the agricultural sector, may be the level of their operation efficiency.

Analysis of recent research shows that the basis of modern entrepreneurship in agricultural production are farms.

The scientific works of such leading economists-agrarians as V.Ya. Messel-Veselyak, MM Fedorov [1], P.M. Makarenko [2], L.Yu. Melnik [3], M.Y. Malik [4], G.V. Spassky G.V. [5] and

many others. The conducted research testifies to the prospects, high efficiency and necessity of using the experience of the world leading countries farming functioning in Ukraine agriculture.

The main advantage of farming over other management forms is that the main motive of employee labor activity is the personal interest of the farmer [5, p.51].

Farms operate on the basis of attracting mainly their own labor, this is due to the specifics of the employees motivational system in this business structure, as the main reason for participation in economic activity is not to receive income in the form of wages, but to maximization of cash inflows to increase the welfare of the farms and its members as a single socio-economic community [6, p.272].

Proving their ability and competitiveness, they have firmly taken their niche in agricultural production in Ukraine. The effective functioning of the above-mentioned subjects of agrarian business contributes to improving the living standards of the rural population: the emergence of jobs in rural areas, obtaining additional earnings, the rational use of agricultural land.

However, as noted by Biba V.A., Korinets R.Ya. [7, p.89] there are many unresolved issues, the most acute of which are: the general technical and technological backwardness of these entities; low sales prices of agricultural products in relation to prices for other industries products; impossibility of manufactured products constant sale; inflation and rising prices for means of production, mineral fertilizers, energy; insufficient level of own working capital; etc.

Among the problems faced by farms, a special place, as noted by researchers, is the problem of insufficient state support for farms [7,8].

Osipova M.M. and Dobrova N.V. [8] draw attention to a number of problems that hinder the development of farms: lagging behind current trends in the introduction of innovative agricultural technologies (new technologies and technical support are not available to most farmers due to their high cost); lack of start-up capital on the basis of which it would be possible to build efficient production.

Despite the multifaceted research of domestic scientists on identifying problems of farms efficiency, further scientific substantiation requires questions to find the main directions of effective development of farms in Ukraine, taking into account the current challenges of their operation external environment.

The purpose of the study is to analyze the level of development and efficiency of farms in Ukraine as a form of agricultural entrepreneurship and identify areas for improvement.

In the research process the following methods have used: generalization, concretization; structural,analysis of time series.

RESULTS AND DISCUSSION

Farming is a modern form of agricultural activity organization, free enterprise on land, carried out on the principles of economic benefit. It is based on private (individual) ownership of the production means, including land (part of the funds may be in use, including rent), and on a small group, mostly family, form of labor.

Farms are an integral part of the agro-industrial complex of Ukraine and take an important role in ensuring food security. As of January 1, 2020, there were 47.7 thousand farms in Ukraine. In the structure of agricultural production in Ukraine, they produce about 16% of gross agricultural output (Table 1).

Table 1. The share of farms in the production of agricultural products by Ukraine agrarian enterprises,%

Indexes	2010	2015	2017	2018	2019	2020	2020 until 2010, +, -	2020 until 2015, +, -
In the production of agricultural products, total	13.30	14.96	16.18	16.71	17.57	16.62	3.32	1.66
In the production of crop products	15.86	17.47	18.69	19.10	20.12	19.27	3.42	1.80
In the production of livestock products	4.08	3.94	4.14	4.22	4.44	4.79	0.71	0.85

Calculated by the authors using data from the State Statistics Service of Ukraine.

Farms show a steady increase in the share of agricultural production in Ukraine. In such conditions, one of the most important tasks is to increase the level of agricultural production efficiency. The food security of the country depends from this task solution.

In a set of measures to increase the economic efficiency of agricultural production, the most important is the land rational use on the basis of increasing its fertility and increasing crop yields (Table 2).

Table 2. Crop yield, h per 1 ha

Crops	2010	2015	2017	2018	2019	2020	2020 until 2010 in%	2020 until 2015 in%
Agricultural enterprises of Ukraine								
Cereals and legumes	27.9	43.8	45.6	52.2	53.7	46.4	166.31	105.94
Sugar beet factory	281.5	448.2	484.1	518.8	470.3	421.0	149.56	93.93
Sunflower	15.4	23.0	21.3	24.1	27.0	21.4	138.96	93.04
Potato	172.3	198.6	238.4	252	230.5	229.4	133.14	115.51
Vegetable crops	205.2	363.4	435.3	427.4	415.8	396.1	193.03	109.00
Fruit and berry crops	34.8	70.8	64.9	106.2	72.7	77.4	222.41	109.32
including farms								
Cereals and legumes	22	33.4	37.1	41.1	44	37.4	170.00	111.98
Sugar beet factory	250.8	422.3	499.1	538.5	502.8	445.1	177.47	105.40
Sunflower	13.4	20.8	18.8	21.9	24.5	18.0	134.33	86.54
Potato	162.1	163.2	189.2	207	196.9	196.8	121.41	120.59
Vegetable crops	161.2	316.3	348.4	330.9	368.3	373.9	231.95	118.21
Fruit and berry crops	51.6	69.8	69.4	112.9	83.7	86.8	168,22	124.36

Source: Calculated by the authors using data from the State Statistics Service of Ukraine.

The crop yields dynamics analysis revealed its growth in most crops. The exception is the decline in sunflower yields over the past 5 years. Moreover, in farms, for most crops, the yield is lower than in general in agricultural enterprises.

The problem of increasing productivity can be solved through the use of innovative technologies using scientific advances, studying the experience of advanced enterprises and ensuring high quality work. However, it should also be borne in mind that the introduction into the crops and varieties of intensive type may have negative consequences. The development of agriculture intensification without compliance with the relevant conditions leads to soil depletion.

Profitability indicators in agriculture are calculated in order to study the economic results of agricultural enterprises, the profitability of agricultural enterprises, the production of certain products.

Profitable production allows not only to recoup operating costs, but also to make a profit, which contributes to the development of both the individual enterprise and the economy as a whole and increase the welfare of rural producers. The study of production profitability level allows to identify inefficient types of products in agricultural production structure. This allows to improve its specialization, to develop measures to increase the level of products profitability that are of particular importance to the company or society.

Over the past 9 years, there has been a significant fluctuation in agricultural products profitability level by type (Table 3), which indicates its significant dependence on natural and climatic conditions of the year. In crop production, was found that the level of profitability decreased for almost all types of products for the period from 2012 to 2020.

Table 3. The level of agricultural production profitability,%

Types of products	2012	2015	2017	2018	2019	2020	2020 until 2012, +, -	2020 until 2015, +, -
Agricultural enterprises of Ukraine								
Cereals and legumes	15.8	42.6	25.0	24.7	11.8	20.0	4.2	-22.6
Sunflower	44.9	78.4	41.3	32.5	23.5	39.4	-5.5	-39
Sugar beets	15.9	27.7	12.4	–11.4	–15.4	–13.5	-29.4	-41.2
Vegetable crops	1.1	32.0	9.9	13.3	2.8	8.0	6.9	-24.0
Potato	–17.4	24.6	10.0	6.8	15.4	11.0	-6.4	-13.6
Fruit and berry crops	9.6	58.3	35.4	6.4	6.2	19.0	9.4	-39.3
Grape	71.5	92.9	51.6	22.6	–7.2	–16.2	-87.7	-109.1
Milk	1.8	12.7	26.9	16.1	20.6	20.4	18.6	7.7
Cattle for meat	–28.3	–16.9	3.4	–17.7	–27.1	–24.2	4.1	-8.0
Pigs for meat	1.8	12.6	3.5	6.9	4.7	2.6	0.8	-10
Sheep and goats for meat	–32.8	–26.6	–39.6	–16.6	–39.7	–39.4	-6.6	-12.8
Poultry for meat	-2.4	–5.4	7.0	5.7	–3.7	–0.2	2.2	7.6
Chicken eggs	52.6	60.9	–9.0	5.4	–23.5	–19.2	-71.8	-80.1
Farms								
Cereals and legumes	19.5	38.6	27.9	26.1	14.5	23.8	4.3	-14.8
Sunflower	45.4	71.5	41.2	30.3	24.7	37.3	-8.1	-34.2
Sugar beets	14.2	16.1	20	–2.2	–4.8	–11.7	-25.9	-27.8
Vegetable crops	11.7	43.8	19.5	7.6	17.8	7.7	-4.0	-36.1
Potato	–4.2	21.5	28.9	28.0	50.3	29.5	25.3	8.0
Fruit and berry crops	8.6	66.2	36.1	22.6	38.6	41.5	32.9	-24.7

Grape	62.9	38.2	51.3	17.8	0.9	–8.6	-71.5	-46.8
Milk	4.9	20.5	25.9	18.0	20.1	22.5	17.6	2.0
Cattle for meat	–7.1	3.3	–2.1	–6.4	–14.6	–9.5	-2.4	-12.8
Pigs for meat	-2.5	2.4	–6.7	1.1	1.4	1.8	4.3	-0.6
Sheep and goats for meat	–13.7	–2.9	–15.1	–3.7	–32.5	–21.2	-7.5	-18.3
Poultry for meat	13.4	10.2	3.5	6.8	13.2	10.7	-2.7	0.5
Chicken eggs	-	-	14.1	9.3	–9.8	–0.7	x	x

Source: Calculated by the authors using data from the State Statistics Service of Ukraine.

Unprofitable production of crops, against the background of increasing yields, indicates that the growth rate of costs exceeds the growth rate of producers income.

In animal husbandry, almost all types of products are unprofitable, except for milk, which requires the development of effective measures, including by government agencies, to support this industry. The development of animal husbandry contributes to the provision of rational crop rotations in crop production, and is also socially significant in the context of providing the rural population with jobs.

Improving the economic efficiency of farms, increasing their financial stability, increasing production and development of the industry resource base are impossible in modern conditions without state support. Today, financial support for agriculture is provided mainly through a set of programs aimed at improving production efficiency and ensuring profits for agricultural producers. The state has developed a program aimed at the development of agriculture in Ukraine. This is the only comprehensive strategy for the development of agriculture and rural areas for 2015-2020, it was aimed at comprehensive implementation of a number of reforms, which have long been waiting for agricultural producers, agricultural businesses and the rural population. This program provided the basis for a stable and transparent legal system aimed at improving the business climate, introducing a transparent land market and combating corruption, and encouraging investment in the modernization of the agricultural sector. It also provided the basis for the institutional reform needed to effectively monitor and implement these measures. The strategy was aimed at strengthening the competitiveness of agricultural enterprises and increasing exports, ensuring the development of rural areas and preserving natural resources with environment. On November 25, 2020, the "Food Security Strategy until 2030" was approved, the main directions of which are measures to develop sustainable agricultural production and diversification of production.

It is also necessary to note the factors that slow down the level of agricultural development in general: poorly developed infrastructure, unstable political and economic situation, depreciation, unstable and unpredictable fuel prices, imperfect regulatory framework, outdated production technology, non-compliance with crop rotation and sowing, which deplete the soil and degrade soil quality.

The main strategic directions of farms development in Ukraine should be: improvement of the regulatory framework that would ensure the stable development of agriculture; production of organic, safe and environmentally friendly agricultural products; implementation of STP achievements and innovations; involvement of young people in agriculture; ensuring decent wages in agriculture, etc.

State support should be aimed to information and consulting support development, the insurance development, the availability of credit, the development of agricultural leasing. Improving the financial and credit policy for agricultural production by farms will help to overcome the seasonal shortage of funds, increase production of agricultural machinery, mysterious accumulative production.

The development of agricultural cooperatives by farms strengthens their competitiveness, increases the economic efficiency of production and marketing activities, provides conditions for the expansion of reproductive.

CONCLUSION

It is established that farms occupy a significant share in the structure of agricultural production in Ukraine and are a promising part of the diversified agricultural sector, which has a strong resource potential. It is argued that the further development of farming in Ukraine requires their active participation in agro-

industrial integration, which allows the use of advanced methods of processing agricultural raw materials, reduces losses of agricultural products, improves the quality of food and facilitates their sale.

It is determined that intersectoral agro-industrial structures with the participation of farms should become an important market entity capable of farms ensuring stable operation, forming effective sales channels for agricultural products, optimizing costs and increasing return on investment. It is substantiated that the main priority directions of farms development as a form of agrarian entrepreneurship are: improvement of the state regulatory policy in the field of agrarian entrepreneurship; production of organic, safe and environmentally friendly agricultural products; introduction of scientific achievements and technical progress and innovations into management practice; strengthening information and consulting support; development of agricultural cooperation and public-private partnership; increasing access to loans for small and medium-sized agricultural enterprises; development of agro-leasing and insurance; increasing the prestige of labor in agriculture and involving young people in the farms development. conducting agricultural production.

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METHODS AND TOOLS OF INNOVATIVE MARKETING

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ABSTRACT

The article highlights the relevance of scientifically applied research methods and tools of innovative marketing, which is due to the importance of the impact of information technology on the socio-economic development of society and human civilization in general. The essence of innovative marketing is revealed as a type of human activity, which involves the use of research and development to identify, form and meet consumer demand through market exchange processes to achieve its own goals. The content of innovative marketing methods is established that have economic, administrative and socio-psychological nature and are manifested by a set of appropriate individual tools. The object of research is the economic and social process, the development of methods and tools of innovative marketing which takes place in the context of digital transformations. The subject of research is a set of theoretical, methodological and practical aspects of the development of methods and tools of innovative marketing. The purpose of scientific work is to substantiate the theoretical and methodological provisions and develop practical recommendations for the development of methods and tools of innovative marketing. Component and characteristic features of universal, basic and special formats of economic tools of innovative marketing are revealed. The administrative characteristics and socio-psychological tools in the context of content marketing, social networks, neuromarketing, guerrilla marketing are presented. Perspective directions of further researches of development of methods and tools of innovative marketing are substantiated.

Keywords: innovative marketing, methods, tools, social networks, neuromarketing, guerrilla marketing, target audience, market segment, content.

INTRODUCTION

The relevance of scientific research of methods and tools of innovative marketing is due to:

- the importance of the impact of information technology on the socio-economic development of domestic society and human civilization in general;
- the prospects of using digitalization in the real economy, the processes of which receive an additional positive impetus due to the timely response to dynamic changes in the internal and external environment, based on a reliable, operational and sufficiently complete information database;
- the need for innovative development of economic entities as a condition of avoiding direct competition with powerful global brands, strengthening competitiveness through permanent improvement of product offerings, increasing the number of sources of income, using the budget of the national economic complex and local governments to reimburse research costs of research work.

An additional argument for the development of methods and tools of innovative marketing is that the strategy of successful functioning of national economic complexes of countries that are leaders in world economic development is closely linked with their success in research, creation of new knowledge, high-tech production and mass production of innovative products. The combination of market principles with an innovative model of economic systems allows nations to enjoy the modern benefits of civilization, increases competitiveness through participation in the global division of labor, promotes access to international financial sources. The mechanism for bridging the existing gap between Ukraine and the countries that are leaders in world economic development is the practical use of methods and tools of innovative marketing.The purpose of the study is to substantiate the theoretical and methodological provisions and develop practical recommendations for the development innovative marketing methods and tools. The object of research is the economic and social process, the development of methods and tools of innovative marketing which takes place in the context of digital transformations. The subject of research is a set of theoretical, methodological and practical aspects of the development of methods and tools of innovative marketing.

The logic of the study of methods and tools of innovative marketing involves the consistent solution of such tasks as: clarifying the essence of innovative marketing; establishing the content of methods and tools of innovative marketing as economic categories; identification of components of economic tools of innovative marketing; disclosure of characteristic features of universal, basic and special formats of

economic tools of innovative marketing; coverage of the components of administrative tools of innovative marketing; clarifying the essence of socio-psychological tools of innovative marketing; substantiation of perspective directions of further researches of development of social and psychological tools of innovative marketing.

RESULTS AND DISCUSSION

Research shows that the system of methods and tools of innovative marketing is a kind of trigger to stimulate production and services for their withdrawal and sale in domestic and global markets. From a functional standpoint, innovative marketing is a type of human activity that involves the use of research and development to identify, shape and meet consumer demand through market exchange to achieve participants' buying and selling goals. Research and development components complement the traditional marketing chain and generate its qualitatively new essential content and properties.

The "Great Explanatory Dictionary of the Modern Ukrainian Language" defines a method as a technique or system of techniques used in any field of activity (science, production, etc.), as well as a method of action, struggle, etc. [1]. Tools are treated as tools. The set of such tools [1]. Thus, the methods and tools of innovative marketing reflect economic categories that reflect the dialectical unity and difference between the general and the individual, which are marketing phenomena of reality.

Methods of innovative marketing (as general) are manifested through a set of appropriate tools (as individual measures), which in their content have an economic, administrative and socio-psychological nature. The application of these tools is in relation to each element of the marketing system and is implemented by businesses in different scales of markets - local, regional, national, global. Thus, innovative marketing is generated by the action of basic and applied science, changes under the influence of appropriate methods and tools, manifests itself in markets of different scales.

Economic tools of innovative marketing are reflected in universal, basic and special formats. The latter relate to the direct use of innovations. The list of universal economic instruments includes: forecasting, planning, investing, financing (lending), commercial calculation of production and economic activities, pricing, accounting.

Basic economic tools of innovative marketing use modern scientific achievements at both macroeconomic and microeconomic levels. Being levers of market economy, they are united by scientific soundness, applied character, purposefulness, measurability of results. The range of basic economic is extremely wide, as it includes: taxation, budgeting, tariffs, fees and duties, insurance, subsidies, benefits, economic sanctions, penalties, material incentives, wages, bonuses, dividends, income, profits, profitability and more.

Special economic tools of innovative marketing are combined by the presence of legal protection for the results of human intellectual activity, scientific and applied novelty, economic reward for the use of the object of intellectual property rights. These instruments are issued security documents certifying the priority, authorship and ownership. Special economic tools of innovative marketing include:

- patents for inventions and utility models;
- disposal of intellectual property rights;
- lump sum payment;
- royalties;
- combined payment;
- royalties;
- know-how;
- leverage;
- goodwill;
- franchising;
- commercial concession, etc.

Administrative tools of innovative marketing reflect the measures of regulatory, standardized, instructional and methodological influence used to streamline the market activities of economic entities on the basis of the latest developments. Socio-economic effectiveness of these tools is largely determined by their consistency, quality and system. Common features of administrative tools of innovative marketing are:

- target orientation;
- hierarchy;
- linearity;
- subordination;
- obligatory;

- discipline;
- responsibility;
- diversity.

WITHsocio-psychological tools of innovative marketing are measures of social and psychological impact, aimed at market segments of consumers and address the inner world of man using the latest advances in basic and applied science and modern practice. After all, the social is interpreted as related to the lives and relationships of people in society; generated by the conditions of social life, a certain environment, system [1]. Psychological - associated with mental activity; which is based on knowledge of human psychology, its inner world [1].

Common features for social and psychological tools of innovative marketing is the appeal to man as a person with his inherent worldview, psychotype, intelligence, feelings, life values and market behavior. A person with his inner world and relationships with other people is the object of marketing influence exercised by economic entities to achieve their own market goals. As a result, the social and psychological tools of innovative marketing are closely interconnected and interdependent.

This is confirmed by content marketing, which is based on the vital need of people to be in society and communicate. This need is objective in nature, because man is a consequence of the evolution of their own socio-historical activities and culture. The innovative nature of content marketing is manifested in the creation and dissemination of communication channels (websites, social networks, etc.) relevant and valuable information in order to attract users of the target audience to the brand to obtain the desired socio-economic result.

Social and psychological tools of innovative marketing have their own features and functional purpose. Thus, the social tools of innovative marketing in Internet programs are designed to: explore the various socio-economic processes of the market environment; structure consumer communities at different levels (from households to nations and the international community in general); to influence the market behavior of target segments, taking into account such properties of the functioning of social networks as: informativeness, accessibility, common interests, communication, confidentiality, security, effectiveness, etc.

Common interests unite people into homogeneous communities (groups), the range of which in social networks in Internet programs is extremely wide, because it covers various spheres of life - family, household, management, various sectors of the economy, production, music and more. The development of social networks is facilitated by the interaction of diverse groups of common interests, as well as informativeness, accessibility, efficiency, democracy, communication, confidentiality, security, and effectiveness. Further constant strengthening in Internet programs is due to the use of mobile applications for messages in the form of texts, photos, video and audio recordings.

A wide range of users will benefit from the interaction of social and mobile networks, constantly increasing the number of their supporters. This is confirmed by the practice of the most famous social networks of the world, such as Facebook, Foursquare, Google+, imo.im, Instagram, Linkedln, WhatsApp, Twitter, LiveJournal and more. Ukrainian social networks (Folk, Connect.ua, Profeo, kozakam.com, Ukrainci.org, antiweb.com.ua, etc.), serving different social groups of the population, at the same time act as target groups of advertising influence.

Social networks provide information about products, allow users to evaluate brands, help advertise, generate demand and stimulate sales, sell and buy. As tools for innovative marketing, such networks must provide user-friendly interfaces. Simplified management of network devices encourages users to post interesting tweets, comment on them with followers and retweet in the interests of business.

Educational filters are important social tools of innovative marketing in Internet programs. Their use allows you to keep on the appropriate platform users whose appeals on certain topics are stored in the information database of the network. Due to the accumulation of such information, entrepreneurs receive target groups of advertising influence, to which users are sent thematic publications and product offers corresponding to their requests.

Psychological tools of innovative marketing use modern information technologies and technical means, addressing the inner world of man, his intellect, feelings and behavior, to solve specific problems of commercial, social, environmental, emotional and other content. The main feature of these tools is the personification of appeals through psychological technology. Their basis is:

first, the targeting of interaction on an individual basis through the development of mobile devices (phones, smartphones, tablets, laptops, smart devices of users for easy awakening, kitchen equipment management system, smart table, etc.);

secondly, the availability of digital models with the possibility of dialogue and multilateral communication through free access to content using the cloud computing service, online payment systems, digital platforms, digital services;

third, the prevalence of electronic communications, which provides both online research through targeted surveys and monitoring of market behavior of consumers, and overcoming geographical constraints and coverage of marketing communications of remote and geographically dispersed customers;

fourth, interactivity of communication and dialogue at the individual level with consumers, each of whom has the opportunity to create their own content and exchange information with representatives of this market segment, as well as go beyond the segment and specific market and influence purchasing decisions by other customers;

fifth, the ability of a person to know the world around him through thinking and reason, and the ability to access his senses both at a distance - through sight, smell, hearing, and in direct contact through taste and touch.

Thus, an important psychological tool of innovative marketing is neuromarketing. Its general idea is to purposefully influence potential consumers to obtain the desired business behavior of buyers when they decide to buy goods. Neuromarketing uses the latest scientific achievements in the field of psychology, medicine, biology, neurobiology, neurophysiology, sociology, etc.

The tools of neuromarketing practice are diverse, because they affect a person's market behavior through his consciousness and subconscious. Electroencephalography, magnetoencephalography, electroneuromyography, magnetic stimulation, etc. are used to identify factors that stimulate neurons and cause the generation of electrical oscillations in the cerebral cortex. This measures and analyzes the response of the nervous system and its basic structural units - neurons to color, aroma, sound, touch and other stimuli.

In neuromarketing, colors are used to attract attention, to distinguish the products of the market entity among the relevant counterparts, to increase brand awareness. Due to a certain selection of colors, the buyer's mood is formed regarding the emotional perception of the enterprise and its product offers. Therefore, the correct color solutions of neuromarketing for goods, corporate identity, trademarks, printing constants, site, packaging, advertising, etc. enhance the positive image of the enterprise, increase sales, increase the economic efficiency of production and economic activity. Further research on the color palette and their use in neuromarketing is associated with the presence of people with extremely different color preferences (the color and taste of friends does not exist),

Neuromarketing also uses sound as a psychological tool that serves as a factor influencing consumer behavior. Auditory perception is reflected in the human mind and activates his emotional sensuality. Therefore, musical accompaniment in retail outlets is an important component of advertising influence, sets customers up for pleasure and stimulates sales. Further research on musical accompaniment in neuromarketing is associated with different preferences of people for melody and with structural changes in this area. Because even different generations have significant differences in musical preferences.

Among the important psychological tools of innovative marketing is guerrilla marketing. It involves the promotion of goods without direct advertising, when a potential buyer does not guess that he is the object of advertising influence. At the heart of guerrilla marketing are methods of influencing customers through clacking, storytelling, travertising, commercial flash mob, non-standard marketing ("foreign hands", "classic", "judicial", "ambush", "outrageous", "just in time", "just in time", " viral "," sensitive "," trusting ", etc.). Each of them has its own zest and uses human feelings, sympathies, emotions.

Psychological tools of innovative marketing are based on the latest technical and technological achievements in the field of information transfer to the target audience. Yes, fences around football fields contain screens with advertisements. The trick is that depending on the country in which the television broadcasts a football match, the advertising on the screens is different, because it must correspond to the ethical, aesthetic and meaningful preferences of specific market segments.

Thus, the dialectical unity of innovation and marketing in the market process is that the marketing system as a holistic unity requires effective innovation of all its components - market research, production and economic activity, pricing, distribution, marketing communication. Market research involves the use of modern information technology, search engines which provide the formation of target audiences for them to

target and interactive marketing. At the same time, the further development of digitalization of the entire marketing complex is an objective basis for the implementation of extended reproduction by business entities.

Methods and tools of innovative marketing are constantly improving, because digital media channels are constantly differentiated and new technical, technological, mobile, software products appear. These processes are generated by consumers, whose number, solvency and consumption traditions form a constantly growing market demand. Its fullest satisfaction involves a balanced combination of economic, administrative and socio-psychological methods of innovative marketing.

CONCLUSION

1. The essence of innovative marketing is revealed as a type of human activity, which involves the use of research and development to identify, form and meet consumer demand through market exchange processes to achieve its own goals.

2. Methods of innovative marketing (as general) are manifested through a set of appropriate tools (as individual measures), which in their content have an economic, administrative and socio-psychological nature.

3. Special economic tools of innovative marketing are combined by the presence of legal protection for the results of human intellectual activity, scientific and applied novelty, economic reward for the use of the object of intellectual property rights.

4. The administrative tools of innovative marketing reflect the measures of regulatory, standardized, instructional and methodological influence used to regulate the market activities of economic entities on the basis of the latest scientific advances.

5. Socio-psychological tools of innovative marketing are measures of social and psychological impact, aimed at market segments of consumers and address the inner world of man using the achievements of basic and applied science and modern practice.

6. Further research of methods and tools of innovative marketing are in the plane of balancing its economic, administrative and socio-psychological components, systemic improvement of levers of influence on market behavior of consumers, active penetration into various spheres of life of digital transformation products.

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