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THE EFFECT OF DIVERSIFICATION ON THE PRODUCTIVITY OF SOME CROP VARIETIES UNDER THE SAME CULTIVATION CONDITIONS

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ВЛИЯНИЕ ДИВЕРСИФИКАЦИИ НА ПРОДУКТИВНОСТЬ НЕКОТОРЫХ СОРТОВ СЕЛЬСКОХОЗЯЙСТВЕННЫХ КУЛЬТУР ПРИ ОДИНАКОВЫХ АГРОТЕХНИЧЕСКИХ УСЛОВИЯХ

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Abstract. Sustainable farming practices include a variety of approaches. The most important approach to sustainable agriculture is crop diversification. This allows farmers to use biological cycles to minimize costs, conserve the resource base, maximize crop yields, and reduce environmental risk. It serves as an important opportunity to augment income and employment generation for rural communities. In contrast to specialized agriculture, crop diversification can be defined as an attempt to promote crop diversity through crop rotation, perennials or mixed cropping with the aim of improving crop performance, sustainability and supply of ecological systems. This can be a step towards more sustainable production systems, value chains for small crops and socio-economic benefits. Expanded agricultural diversity, better crop rotations, mixed cropping, cultivation of grain legumes in systems that are generally dominated by cereals, perennials, and regionally adapted (specialized) varieties are all examples of crop diversification strategies. As a result of the research carried out in the article, it can be noted that by carrying out the crop diversification under the irrigation and the same cultivation conditions, it is possible to obtain high and quality grain products from the varieties of feed peas Azerbaijan 1508 (green mass), wheat Gobustan and barley Jalilabad-19. This method is considered to be efficient both economically and cultivatically.

Аннотация. Устойчивые методы ведения сельского хозяйства включают различные подходы. Наиболее важным подходом к устойчивому развитию сельского хозяйства является диверсификация сельскохозяйственных культур. Это позволяет фермерам использовать биологические циклы для минимизации затрат, сохранения ресурсной базы, максимизации урожайности, а также снижения риска, связанного с экологическими факторами. Это служит важной возможностью для увеличения доходов и создания рабочих мест для сельских общин. В отличие от специализированного сельского хозяйства, диверсификацию сельскохозяйственных культур можно определить как попытку содействовать разнообразию культур за счет севооборота, многолетников или смешанных посевов с целью повышения продуктивности, устойчивости и снабжения экологических систем. Это может стать шагом на пути к более устойчивым производственным системам, цепочкам добавленной стоимости для мелких культур и социально-экономическим выгодам. Расширение сельскохозяйственного разнообразия, лучший севооборот, смешанные посевы, выращивание

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зернобобовых культур в системах, в которых, как правило, преобладают злаковые, многолетники и адаптированные к региону (специализированные) сорта или сортообразцы, все это примеры стратегий диверсификации. В результате проведенных исследований можно отметить, что проводя диверсификацию сельскохозяйственных культур в условиях орошения и такого же агротехнического ухода, можно получать высококачественную зерновую продукцию из сортов кормового гороха Азербайджан 1508 (зеленая масса), пшеницы Гобустан и ячменя Джалилабад-19. Этот способ считается эффективным как в экономическом, так и в агротехническом отношении.

Keywords: diversification, crop rotation, continuous cropping, crop yield.

Ключевые слова: диверсификация, севооборот, длительная культура, урожайность.

Introduction

The most important threat to food security and the environment is the decline of natural resources per capita, as well as resource depletion and land degradation. Current intensive technologies are showing signs of obsolescence. Biodiversity loss, groundwater depletion, mine water extraction, groundwater pollution, and rising atmospheric CO_2 levels are serious risks to sustainability. Various methodologies are used in sustainable manufacturing practices. To develop agriculture based on specific strategies, the specificity of sustainable farming indicators should be taken into account.

A reduced reliance on monocultures can provide better sustainability to agricultural development and reduce overall system failure attempts, which is essential for achieving long-term sustainable agricultural development [1, 9].

Improving agricultural productivity and sustainability requires better management of natural resources such as soil, water, soil and genetic resources. These are, in particular, conservation agricultural practices that can produce a variety of positive outcomes: reduced soil erosion, better soil water retention, availability of nutrients for crops; accumulation of organic matter in soils; higher productivity [7].

Increasing soil fertility, development of new soil cultivation technologies, increasing plant absorption coefficient from soil and fertilizer, as well as productivity and quality indicators are the current issues.

The main reasons for the decrease in easily assimilated forms of the main nutrients in the soil and the decrease in fertility are intensive use of land, improper selection of plants placed in rotation crops, improper observance of soil cultivation, and not providing mineral fertilizers according to demand.

According to the researchers, in order to ensure the formation of a high and quality product, soil fertility should be increased, along with organic and mineral fertilizers given to plants, innovative technologies should be used [3, 4].

In recent years, ecological, soil-protecting, resource-saving, as well as biological diversity problems have been identified as important priorities in Azerbaijan, and serious efforts are being made in this area. A lot of work has been done to solve these problems, the State Program "On Genetic Resources of Plants", the National Action Plan on "Environmental Protection", and the National Program on "Ecologically Sustainable Socio-Economic Development" have been adopted.

According to these programs, ensuring the development of biological diversity in the protection of agricultural plant species, land improvement, efficient use and protection is carried

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out. Because biological diversity is one of the most important means of ensuring sustainable development and food security [5].

Currently, the rapid development of the agricultural sector is related to the development of promising scientific fields. It is necessary to develop modern technologies of production of agricultural products in scientific-research institutions and to widely apply them in agrarian industry [1, 6]. The basis of these technologies should be the production of high-quality products, environmental safety and competitiveness. For this, there is a need to consider the issues of drought resistance, defining a specialized crop rotation system, applying cultivation technology with high adaptability for regions, and organizing elite and reproduction seed production of selected varieties of agricultural plants that are resistant to the stress effects of climate change in the regions [2, 7].

Currently, scientific research on the issues of intensity of biological processes and changes in zonal ecosystems in the country, determination of quantitative and qualitative indicators of organic substances and the directions of biochemical and humus balance maintenance and recovery and increasing the productivity of agricultural plants in the transformation of plant residues entering the soil work continues [2].

Researchers in Azerbaijan are studying a system of measures that positively affect soil fertility, its biological activity and the productivity of cultivated plants.

In the intensive farming system, the soil fertility is increased by giving the necessary amount of organic and mineral fertilizers, its proper cultivation and taking the necessary meliorative measures, and most importantly, by diversifying the plants that serve to increase farm income [8].

Material and methods

In order to study the effectiveness of short rotation crop rotation in the recovery and protection of soil fertility in Absheron Auxiliary Experimental Farm of the Scientific Research Institute of Crop Husbandry, an experimental study was conducted in two schemes (rotational and continuous cropping schemes) and three replicates under irrigation conditions. As the object of the study, the main plants of rotation crops with high feed value, considering the importance of being used as a siderate (green fertilizer) as a good predecessor for cotton, tobacco and grain crops, fodder pea ("Azerbaijan 1508" variety) and wheat "Gobustan" and barley "Jalilabad-19" varieties were used [9].

In order to monitor how each plant develops in short rotation crop rotation and continuous crops, observations were made in the development phases [5], weed rate of the field [8], structural elements of the crop [6] were determined and the economic efficiency of the mentioned plants was calculated.

It is important to conduct statistical analysis to determine the dependence between various parameters studied during the said research. The data recorded for the various parameters showed mean values (n = 10), standard error (Sx), and correlation (r) analysis. Statistical analysis employed the Excel and Statistica (v.7.0) software packages.

Results and their discussion

The results of our research show the effect of cropping schemes on the degree of weeds of the experiment, productivity indicators and economic efficiency of plants.

In the work of increasing the productivity of agricultural plants and raising the agricultural culture, weeding the fields is of great importance. As a result of the damage caused by weeds to grain crops, farms lose a large amount of crops every year.

During the study, the amount of weeds in the cultivated fields was studied in two replicates for all three plants (Figure 1).

Structural elements of cereals are considered the main indicators of productivity. Favorable conditions for crop formation are created by the combined effect of cultivation factors included in the cultivation technology. Timely and quality soil cultivation creates conditions for the formation of nutrients in the soil, the timely decay of roots, plant residues and siderate left in the soil after harvesting, the efficient use of mineral fertilizers, and the improvement of the activity of beneficial microorganisms, which are the main factors that increase productivity [1, 10].

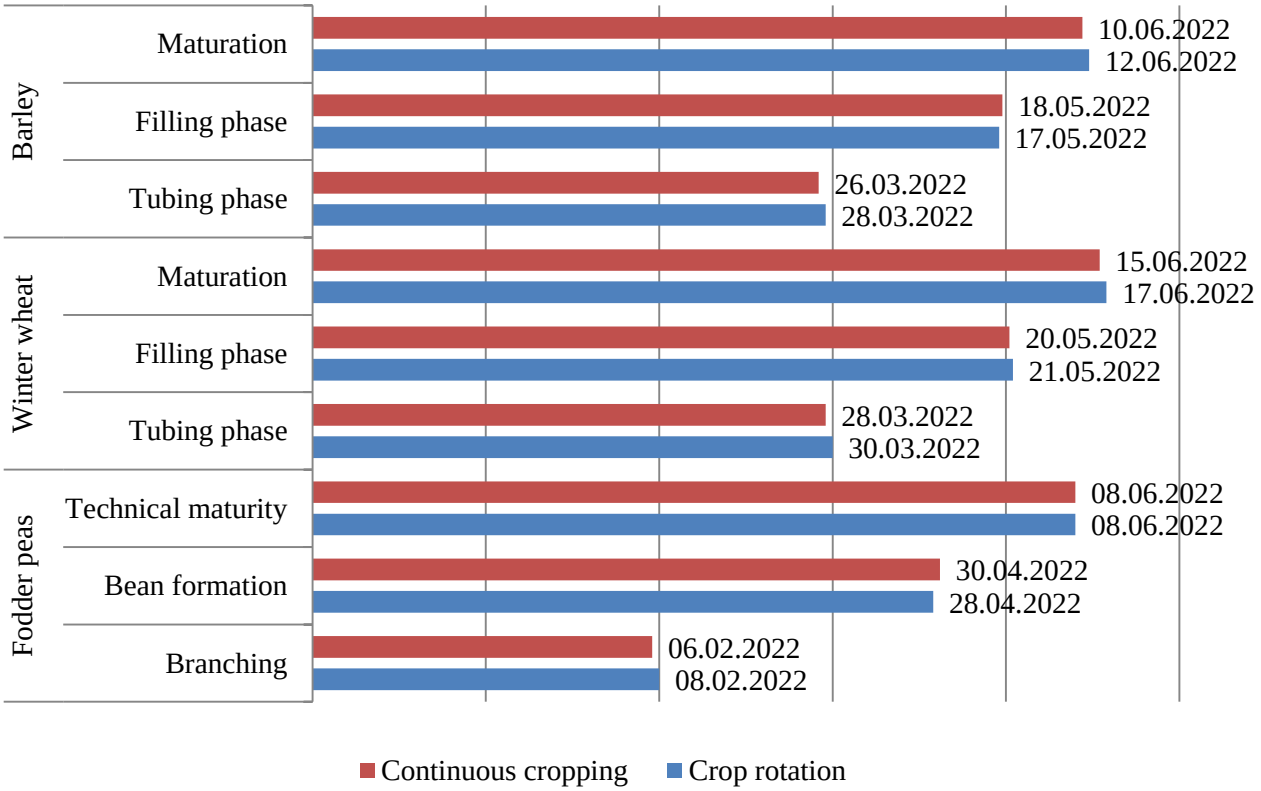

Figure 1. The dynamics of development stages of crop samples grown in different planting options (2021-2022 average)

During the study, it was determined that the productivity of cereal plants depends on the number of plants and productive stems located in a single area, the mass of grain produced by those plants, the height of plants and other structural elements. The effect of crop rotation and continuous cultivation on the structural elements of cereal crops is given in Table1.

Table 1

EFFECT OF CROP ROTATION AND CONTINUOUS CROPPING ON STRUCTURAL ELEMENTS OF WINTER WHEAT AND BARLEY CROPS (2021-2022)

Types of planting	*Total biomass from 1m², (grams)*	*Plant height, (cm)*	*Number of productive stems per (1m²)*	*Spike length, (cm)*	*Number of grains*	*The mass of the grain, (grams)*	*The mass of the grain in the area of 1 m²*
Crop rotation (winter wheat/barley crops)	1633	104.4	336.1	9.1	50	1.47	496
	1256.3	95.4	293.8	10.2	26	1.45	427
Continuous cropping (winter wheat/barley crops)	1607	95.4	335.0	8.4	46	1.43	475
	1179	70.4	281.8	9.7	24	1.44	404

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These indicators are the total biomass from 1m^2 area of barley plant 16333 g, plant height 104.4 cm, number of fertile stems in 1m2 area 336.1 number, length of spike 9.1 cm, number of grains in one spike 50 number, per spike the mass of the grain 1.47 grams, the mass of the grain in the area of 1 m2 is determined 496 grams.

These indicators are the total biomass from 1m^2 area of barley plant 1256.3 grams, plant height 95.4 cm, number of fertile stems in 1m2 area 293.8 number, spike length 10.2 cm, number of grains in one spike 26 number, one the mass of the grain in the spike 1.45 grams, the mass of the grain coming out of the 1m2 area 427 grams is determined.

Total biomass of winter wheat from 1m2 area in continuous cropping option 1607 grams, plant height 95.4 cm, number of productive stems in 1m2 area 335 number, spike length 8.4 cm, number of grains in one spike 46 number, one the mass of the grain in the spike was 1.43 g, the mass of the grain coming out of the 1m^2 area was 475 grams.

The development of fodder peas in crop rotation and continuous crops, which ensures biological diversity, has been varied. Observations were made regularly during the developmental phases to monitor how each plant was developing. In the stage of pod formation, the green mass of plants in 1m^2 area, the height of the plant before harvesting, the number of branches and the number of pods are listed in Table 2.

Table 2

EFFECT OF CROPPING SCHEMES ON THE DEVELOPMENT OF FODDER PEA

Types of planting	*Productivity of green mass, c/ha*	*Plant height, cm*	*Number of branches in a plant, pcs.*	*Number of beans, no*
Crop rotation	559.4	72.0	3.5	15.6
Continuous cropping	537.6	64.2	2.9	13.1

As can be seen from the table, the average height of a plant from pre-harvest repetitions in the crop rotation option was 72.0 cm, number of branches 3.5 number and number of pods15.6 number. In terms of green mass productivity, an increase of 559 c/ha was observed in crop rotation compared to continuous cropping.Along with the structural indicators of plants in the crops we analyzed, the research and investigation of their economic efficiency indicators is also of great importance. The productivity and economic indicators of the plants in the experiments set according to the two planting schemes are given in Table 3.

Table 3

MAIN ECONOMIC INDICATORS

Types of planting	*Plant type and variety name*	*Productivity per hectare, c/ha*	*Gross income per hectare, $*	*Expenditure per hectare,$*	*Net revenue per hectare, $*	*The cost of 1 centner of the product, $*	*Profitability level, %*
Crop rotation Types of planting	Feed peas(green mass) ("Azerbaijan 1508")	559.4	987.2	304.5	682.6	0.54	224.2
	Winter wheat ("Gobustan")	44.6	1574.1	458.6	1115.5	10.28	243.3
	Barley ("Jalilabad-19")	37.7	1108.8	422.6	686.2	11.21	162.4
Continuous cropping Types of planting	Feed peas(green mas) ("Azerbaijan 1508")	537.6	948.7	304.5	644.2	0.56	211.5
	Winter wheat ("Gobustan")	42.5	1500	458.6	1041.4	10.78	227.1
	Barley ("Jalilabad-19")	35.4	1041.2	422.6	618.6	11.93	146.4

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As can be seen from the table, the productivity and efficiency indicators of plants in the crop rotation scheme were higher than in continuous cropping. In this variant, for the green mass productivity of fodder peas, the net income obtained from one hectare was 682.6 $, and the level of economic profitability was 224.2%.

For winter wheat, these indicators are respectively 1115.5$; 243.3% and in barley it was 686.2$ and 162.4%.

The net income per hectare for fodder pea productivity in the continuous cropping option is 644.2$, the level of profitability is 211.5%, and for winter wheat, these indicators are respectively 1041.4 $; 227.1% and in barley 618.6 $; 146.4 organized.

In the option of continuous cultivation, the cost of one centner of the crop was higher compared to the crop rotation.

Taking into account the general analysis, it can be concluded that the indicators of the crop rotation option were better than the other option in all plant samples. The reason that enables this is the proper planting and cultivation of the soil.

Correlation between yield traits

Among the yield characteristics, grain yield per plant significantly and positively correlated with the number of grains per ear (r = 0.47), seed index (r = 0.51) and yield index (r = 0.54), while the number of grains per ear (r = 0.54), ear significantly and positively correlated with seeds. index (r = 0.65) and yield index (r = 0.37) (Table 4).

Table 4

COEFFICIENT OF CORRELATION BETWEEN YIELD TRAITS EFFECT OF CROP ROTATION AND CONTINUOUS CROPPING ON STRUCTURAL ELEMENTS OF WINTER WHEAT AND BARLEY CROPS

Parameters	*Plant height*	*Total biomass from 1m^2,*	*The mass of the grain*	*Seed index*	*Productivity*
Plant height	-	0.35	0.48	0.52	0.55
Total biomass, 1m^2, g	-	-	0.32	0.12	0.62
The mass of the grain	-	-	-	0.37*	0.48**
Seed index					0.78**

Seed index and yield index were also significantly and positively correlated (r = 0.78). These correlations showed that increases in grains per ear, seed index, and yield caused a simultaneous increase in grains per plant. Some of these correlations between yield traits correspond to correlations [6], who in their studies also noted a significant and positive correlation between grain per ear, seed index, grain yield per plant, and yield index.

Conclusion

By diversifying plants under the conditions of Absheron irrigation and the same agrotechnical care, it is possible to obtain high and quality grain products from the varieties of fodder pea "Azerbaijan 1508" (green mass), wheat "Gobustan" and barley "Jalilabad-19". This method is considered to be efficient both economically and agrotechnically.

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