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AGRO-ECONOMIC EFFICIENCY OF INTERMEDIATE LAYER CROPS IN CROP ROTATION

Saribek B. Galstyan
Shushi University of Technology
35/12, Naberejnaya 3rd alley, Stepanakert, RA
galstyan.saribek@mail.ru
ORCID iD: 0000-0001-6728-7817
Republic of Artsakh

Valeri A. Alexanyan
Shushi University of Technology
35/12, Naberejnaya 3rd alley, Stepanakert, RA
artsakhgk@rambler.ru
ORCID iD: 0000-0001-8136-5236
Republic of Artsakh

Susanna S. Mesropyan
Shushi University of Technology
35/12, Naberejnaya 3rd alley, Stepanakert, RA
susanna-mesropyan87@mail.ru
ORCID iD: 0000-0002-3630-6349
Republic of Artsakh

Hovsep A. Ohanyan
Shushi University of Technology
35/12, Naberejnaya 3rd alley, Stepanakert, RA
hovsep.ohanyan1995@mail.ru
ORCID iD: 0000-0002-4122-6423
Republic of Artsakh

Abstract

The perspectives of any agricultural system depend on its economic efficiency, i.e. the material and labor resources spent on the product of the agricultural unit which is the cost price. From this point of view, the reduction of costs on land cultivation and the efficient use of bioclimatic conditions are of primary importance.

Based on the above mentioned, in the post-forest brown, gravelly, carbonated, medium-strength soils of the lowland zone of the Artsakh Republic where the average annual air temperature is 12^{o}C, the average of annual atmospheric precipitation is 400-450mm and the humus content in the soil is 2.5-3.0 %, the agronomic and economic efficiency of cucumber in crop rotation was studied in the conditions of irrigated agriculture depending on the main soil cultivation method.

Experimental research has shown that in case of minimal cultivation of the land, compared to the traditional plough and in the conditions of proper implementation of other agro-technical measures irrigation water is saved, and high yield of afterharvest cucumbers and then low-cost winter wheat is provided.

Key words: intermediate layer crop, winter wheat, afterharvest cucumber, minimal cultivation of soil, humidity, nutrients, yield, harvest.

Introduction

In order to increase the productivity of arable lands and to use them effectively, the field is cultivated by crops throughout the vegetation in the areas with sufficient moisture where the amount of precipitation is not less than 100 mm after the harvest of the main crops and the amount of active temperatures is more than 800ºC. The same thing is done in the southern regions in the conditions of irrigated agriculture.

Plants that occupy the field until the next major crop is sown are called intermediate layer plants. Depending on the period of use, intermediate layer plants can be afterharvest, harvested, crops can be harvested, harvested, additional sown and winter sown.

Afterharvest and harvested plants are sown after the harvest of main crops in the same year [1].

In the agro-technique of afterharvest crops the main tillage is especially problematic after the previous one. In the traditional deep tillage, especially in soils with heavy mechanical composition, in the process of implementation of this important agro-technical measure, such negative phenomena as the formation of rootballs, decomposition of soil aggregates during their crushing, dusting of the cultivated layer, moisture loss, increase in labor and material costs etc may appear.

In contrast to the traditional tillage, the minimum cultivation the main factor of which is the cultivation of the soil without deep tillage based on the principle of reducing the depth of the cultivated layer and reducing the number of operations, is free from the above-mentioned negative phenomena. Many researchers believe that the exclusion of deep tillage and the creation of a layer of moss on the surface of the soil promotes the accumulation and retention of moisture in the soil, prevents the emergence and development of soil erosion and crusting, significantly reduces soil erosion. Its potential and effective fertility, agrophysical properties, food, water, air, and heat regimes are changed [2, 3].

Under the same irrigation regime the amount of capillary moisture accumulating in the soil significantly depends on the effective cultivation of the soil which has a positive effect on both the afterharvest crop and the water supply of the sown winter wheat and the availability of nutrients in the soil.

It has been cleared out the amount of soil moisture in various depths of tillage depends both on the method of soil cultivation and the previous by researches of many authors [4, 5].

The fact is obvious that the root system has positive hydrotropism which occurs due to uneven distribution of water in the soil [6].

Conflict setting

In the arid climate of the south, such as the lowlands of the Askeran region, there are all the bioclimatic conditions for getting an extra crop of thermophilic plants under irrigated agriculture.

At present grain-row crop short-rotation is mainly used in this climatic zone with the following scheme: winter grain-winter grain-row (for corn grain). In order to increase the efficiency of land and utilization of irrigation water and to get additional income in such conditions we advise to first put the soil which is intended for winter sowing under the afterharvest cucumber before sowing the second year winter grain. This valuable and most popular vegetable provides not only a high-quality crop and high yiled under the best agricultural techniques, but is also considered a good crop for previous fall crops. Regular weeding and loosening, feeding and watering the cucumber for 100-120 days in addition to providing favorable conditions for normal growth and development of the crop as an intercalare plant creates the best conditions for the winter sowing.

Based on the above mentioned, we set ourselves the task of identifying the agro-economic efficiency of theafterharvest crop in the case of different main tillage methods through experimental research.

Material and method of research

Field experiments were carried out in brown residual-carbonated, medium-strength soils (40-50 cm) in the plain zone of the Askeran region under irrigated agriculture. Two main land cultivation methods were tested:

1. Traditional deep tillage
2. Surface cultivation with flatter

The testings were done 6 times over the 1000 m^2 surface of breaks.

Mila hybrid of the production of Seminis company and Alex sort of winter wheat were used for study.

In all the years of research, winter wheat was the previous one. Immediately after the previous harvest, stubble tillage (7-8 cm) was done with a BDT-10 flatter in the test site. Two weeks after fertilizing the field (manure was applied - 30 t/ ha, $P_{60}K_{60}$) and localization a deep plowing was done with a turn furrow of 25-27 cm in all repetitions of the first version with PN-4-35 plow. During the same period in all repetitions of the second version, flat cutting was performed together with (10-15 cm) loosening. Immediately after the tillage a zero tillage was carried out with an aggregate consisting of a disk rake and a needle roller in order to crush the formed crusts in the first version. According to the planting scheme, before sowing in early July planting furrows were made, they were watered and after drying the sprouted seeds were planted by hand. Plant care and plant protection works in all versions and replications were carried out using the same agricultural machines. Harvesting was done every 2-3 days. Crop yield was calculated by weighing and harvesting the yield of each variety and replication [7].

After the last cucumber harvest samples were taken from all varieties and replications from different depths of the arable soil of testing site to determine the volumetric mass of the soil and the field moisture [8]. The same research was repeated the following summer during the piping and full maturation stages of the plants. The field was then fertilized with P90K60 (active substance). To fertilize the plant residues after fertilization, the test site was developed with a BDT-10 disc flatter. Nitrogen was fed to wheat plants as nutrition in early spring in the amount of N_{90} (active substance). The sowing was done with SZU-3.6 narrow rowing and the harvest was done with SK-5 combine. Grain yield was determined by weighing method. Crop data of cucumber and wheat grain were mathematically processed by dispersion analysis [7].

Research results

The yield of cucumber is shown in Tab. 1.

As the data of cucumber yield show it was higher in case of zero tillage of the soil and exceeded the traditional tillage by 23,3%. In this case the percent ratio of produced crop was also high.

Table 1

The yield of afterharvested cucumber depending on soil cultivation method (average for three years)

Variant	Average yield c/h	Difference between the first and the second variant		Produced crop %
		c/h	%	
Deep tillage with furrow turn, 27-30cm	165.6	-	-	83.4
Surface cultivation 8-10cm	204.3	38.7	23.3	86.7

Before sowing the wheat, the data on the effective moisture content of the soil during the piping and maturation stages, depending on the main cultivation method, are given in Tab.2.

The data show that in both variants the difference between the volumes of soil in that layer after the top layer of soil for winter wheat (0-10 cm) is not large and comprises 1.03 - 0.98 g/cm^3. However, in the case of surface cultivation, the soil density is significantly higher in the lower layers of the tillage than the density observed in the deep tillage.

Table 2

Soil volume and the amount of effective moisture depending on the cultivation method (average for three years)

Variant	Depth of soil layer , cm	Soil volume, g/cm^3, according o developing stage				Amount of effective moisture, %, according to developing stage			
		Berofe sowing	Stage of piping	Before harvest	Average during vegetation	Berofe sowing	Stage of piping	Before harvest	Average during vegetation
Deep tillage with furrow turn 27-30 cm	0-10	0,98	1,14	1,16	1,09	19,56	17,48	4,15	13,73
	10-20	1,04	1,18	2,11	1,44	22,33	20,40	4,45	15,72
	20-40	1,13	1,16	1,19	1,16	23,51	21,37	6,31	17,06
Surface cultivation, 8-10 cm	0-10	1,03	1,12	1,13	1,09	19,46	18,15	4,62	14,07
	10-20	1,12	1,16	1,19	1,15	23,71	21,39	5,16	16,75
	20-40	1,15	1,15	1,17	1,15	24,80	23,10	7,65	18,51

Such a density of arable land is quite favorable for cereals with minimal cultivation. When sowing, the seeds are placed on a solid layer of soil where there is drip irrigation and covered with a layer of loose soil and plant remnants which creates favorable conditions for rapid and balanced germination of seeds.

In the piping stage the arable soil is compacted before harvest in both versions. As the data in the same table show, the density process is more intense in the traditional deep tillage. However, during all vegetation period, the soil density in both versions did not exceed the density of 1.09-1.44 g/cm which is considered the best for winter wheat.

Many scientists believe that the whole complex of physical and biophysical processes in the soil depends on its density.

According to the same scientists, a significant improvement in the agrophysical properties of the soil can be achieved only by cultivating the soil without turning furrows and preserving the stubble on the surface. In this case no soil crust is formed which improves water permeability, accumulates more moisture and increases the amount of moving nutrients in the topsoil. This is also proved by the data we received given in the same Tab. 2.

According to the data in the table, during all the vegetation, the moisture content in all the depths of the arable layer was high in the minimum cultivation. This proves the current prevailing opinion in the scientific literature that in case of minimal cultivation, in the lower (10-40 cm) layers of the arable land the natural holes in the soil and ditches opened by the decaying roots of previous plants, ravens and other animals living in the soil are better preserved which contribute to the improvement of the water-air properties of the soil and the upper layer rich in plant residues becomes a blockage for excessive water loss [2, 4].

So, the best air-water conditions created in the soil under the conditions of minimal cultivation not only contributed to the high yield of best quality cucumbers, but also accumulated and used the irrigation water obtained during the cucumber vegetation in the arable land ensuring a 23.1% higher yield than during the traditional tillage which is shown in Tab. 3.

Table 3

The crop yield of winter wheat after afterharvest tillage depending on the main method of soil cultivation

Variant	Average yield of grain c/h	Difference between the first and the second variant	
		c/h	%
Deep tillage with furrow turn, 27-30 cm	37.2	-	-
Surface cultivation, 8-10 cm	45.8		23.1

The analytic data on sharp increase of productivity of arable lands and economic efficiency of crops are brought in Tab. 4.

Table 4

Economic efficiency of afterharvest tillages depending on the method of soil cultivation

Variant	Yield		Crop price, thousand Drams		Crop price, thousand Drams		Expences, thousand Drams wheat/cucumber				Obtained income
	Wheat grain	Cucumber	Wheat grain	Cucumber	Grain	Cucumber	Material costs	Salary	Other expences 10%	Total expences	
1	37.2	138.1	12.0	20.0	446.4	2762	150.8	88.2	23.9	262.9	183.5
							291.6	1747.0	203.8	2242.4	519.6
2	45.8	177.1	12.0	20.0	549.6	3542	150,8	93.2	24.4	268,4	281,2
							294.0	1986.0	478,8	2758,8	783.2

As the data show, a sufficient crop of harvested cucumbers and winter wheat was obtained in both versions which ensured a rather high profit. However, in the second version, where in case of similarity of all other agricultural measures, surface cultivation was used instead of the traditional tillage, the profit of cucumber cultivation exceeded the first version by 50.7% and wheat by 53.7% respectively.

Conclusion

Our experimental research on increasing the productivity of irrigated arable lands, crop yields and economic efficiency on the use of intermediate layer crops and minimal cultivation in the plains of the Artsakh Republic has shown that the introduction of minimal cultivation and its continuous use contribute to the improvement of agrophysical properties of soil, regulation of water regime and reduction of land cultivation costs.

The agronomic techniques of cultivating the afterharvest cucumber crop, which is a very irrigation demanding crop, especially in case of minimal cultivation, creates favorable conditions for weeding the field for winter wheat accumulating moving nutrients and significant amount of moisture in the surface layer of the soil.

The accumulation of moisture in the lower layers of the soil contributed to the formation of a root system based on positive hydrotropism which penetrates deep into the soil enabling a guaranteed high yield of winter wheat in arid conditions.

In terms of economic efficiency, the total profit from cucumber and winter wheat amounted to 1064.4 thousand AMD/h in the version of minimal cultivation which exceeded the traditional tillage by 51.3%.

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ՄԻՋԱՆԿՅԱԼ ՄՇԱԿԱԲՈՒՅՍԵՐԻ ԱԳՐՈՆՈՄԻԱ-ՏՆՏԵՍԱԿԱՆ ԱՐԴՅՈՒՆԱՎԵՏՈՒԹՅՈՒՆԸ ՑԱՆՔԱՇՐՋԱՆԱՌՈՒԹՅՈՒՆՈՒՄ

Գալստյան Ս.Բ., Ալեքսանյան Վ.Ա., Մեսրոպյան Ս.Ս., Օհանյան Հ.Ա.
Շուշիի տեխնոլոգիական համալսարան

Երկրագործության ցանկացած համակարգի հեռանկարայնությունը կախված է նրա տնտեսական արդյունավետությունից, այսինքն՝ գյուղատնտեսական միավոր արտադրանքի վրա ծախսված նյութական և աշխատանքային միջոցներից՝ ինքնարժեքից: Այս տեսակետից առաջնահերթ նշանակություն ունի հողի մշակման վրա կատարվող ծախսերի կրճատումը և կենսակլիմայական պայմանների արդյունավետ օգտագործումը:

Ելնելով վերը նշվածից՝ Արցախի Հանրապետության հարթավայրային գոտու հետանտառային շագանակագույն, խճաքարային, կարբոնատացված, միջին հզորության հողերում, որտեղ օդի տարեկան միջին ջերմաստիճանը 12°C է, մթնոլորտային տեղումների բազմամյա տարիների միջինը՝ 400-450մմ, հողում հումուսի պարունակությունը՝ 2,5-3,0%, ջրովի երկրագործության պայմաններում ուսումնասիրվել է խոզանացան վարունգի ագրոնոմիական և տնտեսական արդյունավետությունը ցանքաշրջանառությունում՝ կախված հողի հիմնական մշակման եղանակից:

Փորձարարահետազոտական ճանապարհով պարզվել է, որ հողի նվազագույն մշակման դեպքում, ավանդական վարի համեմատությամբ, ագրոտեխնիկական մյուս միջոցառումների պատշաճ իրականացման պայմաններում ապահովվում է ոռոգման ջրի խնայում, խոզանացան վարունգի և դրանից հետո ցանվող աշնանացան ցորենի ցածր ինքնարժեքով բարձր բերք:

Բանալի բառեր. միջանկյալ մշակաբույս, աշնանացան ցորեն, խոզանացան վարունգ, հողի նվազագույն մշակում, խոնավություն, սննդատարրեր, բերքատվություն, եկամտաբերություն:

АГРОНОМО-ЭКОНОМИЧЕСКАЯ ЭФФЕКТИВНОСТЬ ПРОМЕЖУТОЧНЫХ КУЛЬТУР В СЕВООБОРОТЕ

Галстян С.Б., Алексанян В.А., Месропян С.С., Оганян О.А.
Шушинский технологический университет

Перспективность любой системы земледелия зависит от ее экономической эффективности, то есть от себестоимости материальных и трудовых средств, затраченных на сельскохозяйственную единицу продукции. С этой точки зрения первостепенное значение имеют снижение затрат на обработку почвы и эффективное использование биоклиматических условий. Исходя из вышеизложенного, на залесных коричневых, гравийных, карбонатных почвах средней мощности равнинной зоны Республики Арцах, где среднегодовая температура воздуха составляет 12^{o}C, среднее многолетнее количество атмосферных осадков - 400-450 мм, содержание гумуса в почве - 2,5-3,0%, в условиях орошаемого земледелия была изучена агрономо-экономическая эффективность прямого посева огурца в севообороте в зависимости от способа основной обработки почвы.

Опытно-исследовательским путем было выяснено, что при минимальной обработке почвы, по сравнению с традиционной вспашкой, в условиях должного осуществления других агротехнических мероприятий обеспечивается экономия оросительной воды, высокий урожай посевных огурцов и засеянной после них озимой пшеницы по низкой себестоимости.

Ключевые слова: промежуточная культура, озимая пшеница, посевной огурец, минимальная обработка почвы, влажность, питательные вещества, урожайность, прибыльность.

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