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THE IMPACT OF CULTIVATION METHODS ON SOIL FERTILITY ELEMENTS AND WINTER CROP

S.B. Galstyan, V.S. Adamyan, V.A. Alexanyan, A.V. Avagimyan
Shushi University of Technology

In the conditions of dry agriculture of lowland zone of the Republic of Artsakh the effects of traditional deep tillage with furrow turn and minimum cultivation on soil humus content, humidity, nutrients, agrophysical properties and the yield of winter crop were compared.

It has been found out that in dark cinnamonic gravel soils of Askeran region humus and mineral nutrients are distributed at different depths of the plowland depending on the main method of soil tillage, soil moisture content during vegetation is higher after different precursors in minimum cultivation which helps to decrease the interval of change of soil density during vegetation, to preserve optimal density and to increase the yield of winter crop.

Key words: winter crop, soil density, water supply, nutrient distribution, crop**.**

Introduction

The intensification of traditional agriculture which has been accompanied by a significant increase in the capacity and productivity of soil-cultivating machines and tools in the tillage system by increasing the depth of soil cultivation, the intensive mellowing of soil, the increase in the number of cultivation activities has produced such negative effects as decomposition of soil aggregates, acceleration of the tempos of solution of organic materials, powdering of cultivated layer, loss of moisture, increased labor and material costs etc. [5].

Unlike the traditional soil cultivation, the minimal land cultivation system whose main and decisive link is soil cultivation by turning furrow based on the reduction of cultivated layer, reduction of the number of operations and the principle of creation of vegetation residues on its surface for its protection excludes such negative events [5].

Based on the above mentioned, our task is to identify the agronomic, environmental and economic advantages of the traditional land cultivation system through field experiments and laboratory studies.

Conflict setting

Field experiments have been made in dark cinnamonic, gravel, in some places carbonated, medium strong, weak humus soils of Ivanyan, Askeran region for 4 times with 4 repetition.

Based on the circumstance that winter tillage is mainly done in clean fallow or after winter crops, the following versions have been developed as

1. Precursor clean fallow with traditional soil cultivation,
2. Precursor winter corn with traditional soil cultivation,
3. Precursor clean fallow with minimum soil cultivation,
4. Precursor winter corn with minimum soil cultivation.

The precursor was done in clean fallows versions with early fallow which was done PLN-35 plough in one case (the first version) in 23-25 cm depth and in the other case (the third version) with heavy disc plough in 7-8 cm depth.

In precursor winter corn versions the main soil cultivation was done after harvest with the same tools.

Initial cultivation in all variants was done in the first ten days of November and sowing was done after 2–3 days with the norm of 5 million germinated grains of “Krasnodarski 99” sort per hectare.

During the research period (2015–2017) the dynamics of humus and plant nutrients, soil mass density, change in moisture content depending on type of soil cultivation and the precursor was determined in soil samples taken from different depths of the tillage layer by the appropriate method.

Phenological observations and biometric measurements were performed during vegetation. The crop yield was determined by combining and weighing the crop field. Prior to harvesting, samples were taken to determine the structure of elements of wheat harvest [2].

Research results

The results of the analysis of the soil samples selected from the experiment field (Table 1) showed that the humic substances and mineral nutrients in the plowland are distributed at different depths of the soil depending on the cultivation method. In the case of furrow turn of fallow they are mainly concentrated in the layer of 15-30 cm and in the case of minimal cultivation in 0-15 cm layer. There are some viewpoints that such differentiation of fertility of the layer is generally dangerous while applying shallow cultivation and particularly during drought as drying of the top layer (0-15 cm) of the plowland does not allow plants to use the fertility factors distributed there [6].

Table 1

The dynamics of change of humus and nutrients available for plants in plowland depending on the method of soil cultivation and the previous (2015-2017)

The main method of soil cultivation and the previous	Depth of plowland, cm	Humus content in plowland, %			Nutrient content in plowland mg in 100 g soil								
					2015			2016			2017		
		2015	2016	2017	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Tillage clean fallow	0-15	3,75	3,75	3,41	4,33	2,44	32,2	4,03	2,40	30,5	3,96	2,38	30,18
	15-30	3,18	3,18	3,47	3,01	2,14	20,8	3,12	2,11	21,1	3,11	2,12	20,70
	0-30	3,46	3,46	3,44	3,67	22,9	26,5	3,57	2,25	25,8	3,53	2,25	25,44
Tillage corn	0-15	3,61	3,61	3,65	2,82	2,05	28	2,67	2,1	27,1	2,71	2,15	27,11
	15-30	3,58	3,58	3,48	2,56	2,00	24,2	2,70	2,07	24,10	2,64	2,00	23,98
	0-30	3,59	3,59	3,56	2,69	2,02	26,1	2,68	2,08	25,6	2,67	2,07	25,54
Shallow cultivation clean fallow	0-15	3,78	3,78	3,82	3,15	2,48	32,9	3,01	3,15	32,9	3,11	3,18	32,95
	15-30	3,18	3,18	3,14	2,12	1,65	25,2	2,00	2,11	25,6	2,08	2,11	25,58
	0-30	3,48	3,48	3,48	2,63	2,06	29	2,50	2,63	29,3	2,59	2,64	29,26
Shallow cultivation corn	0-15	3,82	3,82	3,75	2,96	2,35	30,7	2,98	3,14	31,1	3,12	3,16	31,13
	15-30	3,14	3,12	3,28	1,92	1,93	23,1	1,87	2,07	24,1	1,68	2,12	24,07
	0-30	3,48	3,47	3,51	2,44	2,14	26,9	2,42	2,60	27,6	2,40	2,64	27,60

But attempts have proved the contrary: in both wet and especially dry seasons the crop yields are higher by shallow cultivation than by traditional crop cultivation. Differentiation of plowland according to the degree of fertility is considered to be one of the conditions for increasing the yield during minimum cultivation [3; 1].

In case of a furrow turn of fallow, deep covering of the surface layer of soil results in its rapid loss of already created activity and slow activation of the newly formed upper layer. However, the next tillage averts the desired differentiation mentioned above.

It can also be seen from the data in Table 1, in case of shallow cultivation there is a decrease in movable nitrogen in the first years depending on the decrease in humus decomposition rates. On the contrary, soil phosphorus and potassium regimes are improving and this should be taken into account when developing a fertilizing system.

Describing the process of land-accumulation and the factors conditioning it P.A. Kostichev (1949) set the physical properties of the soil and especially its mass volume into the first place [5].

Many scientists believe that frequent cultivation in the system of furrow turn in fallow leads to deterioration of soil composition and structure and against the conditions created are to fight with more frequent tillage.

Table 2

Dynamics of change of mass amount in plowland depending on the method of soil cultivation and the precursor (g/cm³) average in 2015-2017

Main method of soil cultivation and the precursor	Plowland depth, cm	Observation stages					Average according to the depth	Average in 0- 40 cm layer
		Before tillage	Stooling, pipeline	Earing	Ripening	Before harvest		
Tillage clean fallow	0-10	1,09	1,11	1,12	1,13	1,44	1,17	1,21
	10-20	1,16	1,00	1,15	1,17	1,64	1,22	
	20-30	1,17	1,01	1,15	1,15	1,56	1,20	
	30-40	1,15	1,28	1,18	1,19	1,63	1,28	
Tillage corn	0-10	0,61	1,11	1,11	1,18	1,38	1,07	1,18
	10-20	0,65	1,03	1,07	1,15	1,66	1,11	
	20-30	0,95	1,17	1,15	1,24	1,52	1,20	
	30-40	1,28	1,27	1,28	1,29	1,58	1,34	
Shallow cultivation clean fallow	0-10	1,01	1,16	1,16	1,09	1,3	1,14	1,19
	10-20	1,19	1,00	1,12	1,14	1,4	1,17	
	20-30	1,23	1,07	1,13	1,15	1,45	1,20	
	30-40	1,24	1,27	1,25	1,25	1,4	1,28	
Shallow cultivation corn	0-10	1,05	1,12	1,13	1,15	1,46	1,18	1,22
	10-20	1,16	1,01	1,15	1,17	1,47	1,19	
	20-30	1,15	1,15	1,14	1,16	1,52	1,22	
	30-40	1,19	1,25	1,26	1,28	1,55	1,30	

Our laboratory studies on the dynamics of soil size amount at different stages of vegetation and at different depths of the arable land (Table 2) show that in the case of a tillage of furrow turn the density of the soil is small compared to the minimum cultivation only immediately after planting. During other period of the year the 5-10 cm soil layer is 10-20% denser when fallowed than when cultivating the soil with the minimum cultivation. It should also be noted that the range of density change in the lower case is greater and ranges from 0,61 to 1,63 g/cm^3 while during the minimum cultivation the same rate was 1,01 - 1,55 g/cm^3. According to the average data of three years the highest density was observed in the 40 cm layer of soil, the precursor was autumn corn in the version of minimal cultivation with 1,22 g/cm^3 and the lowest was the previous winter corn in the traditional soil cultivation version with 1,18 g/cm^3.

Based on the above mentioned, we can conclude in comparison with the minimum cultivation the fallow leads to excessive soil fragility, which, however, at the time of tillage crops is equal with its density to the minimum density. In addition, when preparing the soil for winter wheat crop with a breast plow excessive porosity of the sowing layer may occur due to which the conditions for seed germination deteriorate depending on the rapid loss of moisture and weak contact of seed and soil [4].

The soil cultivator can accumulate, preserve and provide nutrients and precipitation and subsoil waters to the plants by proper cultivation of the soil. Minimal tillage of the soil, combined with the stubble and the remnants of the stubble along with its mulching, improves the water regime of the soil. This is due to the role of the snow accumulating role of stubble as well as the reduction of water evaporation from the soil surface due to the plant mulch.

Table 3

Dynamics of moisture change in plowland (%)
2015-2017 average data

Main method of soil cultivation and the precursor	Depth of precursor, cm	Observation stages					Average density due to the depths	Average in 0-40 cm
		Before tillage	Stooling, pipeline	Earing	Ripening	Before harvest		
Tillage clean fallow	0-10	18,35	21,17	16,22	4,53	14,75	15,00	20,23
	10-20	25,96	22,74	23,98	21,01	16,22	21,98	
	20-30	26,82	20,90	24,6	25,86	15,77	22,79	
	30-40	24,38	20,11	23,28	24,23	13,77	21,15	
Tillage corn	0-10	11,19	21,7	21,17	9,58	14,78	15,68	18,02
	10-20	22,95	22,90	22,74	14,85	13,43	19,37	
	20-30	21,38	20,80	20,90	15,92	15,2	18,84	
	30-40	20,16	20,15	20,17	15,41	15,15	18,2	
Shallow cultivation, clean fallow	0-10	18,03	21,18	21,26	13,62	12,98	17,41	20,41
	10-20	25,61	23,11	23,28	27,08	15,38	20,89	
	20-30	27,25	20,90	24,27	27,56	15,85	23,16	
	30-40	25,21	20,12	21,35	18,00	16,31	20,19	
Shallow cultivation, corn	0-10	17,45	20,48	20,62	8,34	15,12	16,4	19,15
	10-20	24,45	22,98	22,59	15,84	14,21	20,01	
	20-30	27,91	19,76	23,49	17,53	15,75	20,89	
	30-40	26,18	18,40	20,78	17,05	14,12	19,30	

Hence, minimal cultivation ensures the differentiation of plowland according to its fertility, the concentration of fertility elements in the soil of 0-15 cm layer, creation of favorable soil density, moisture accumulation, preservation and efficient use which has a significant impact on plant growth and development. The seeds sown in the biologically active layer germinate harmoniously, their field germination is high, the expiration dates of the initial stage of plant development are accelerated, the energy of the stooling is high, winter tillage is well matured in the initial winter period and withstands unfavorable winter conditions.

The highest yields in our surveys, on average for three years (Table 4), were obtained in the minimal cultivation-clean fallow version (42,5 c/ha) and the lowest in the non-fallow precursor traditional tillage version with 25,8 c/ha.

Table 4

Yield of autumn wheat and gluten content in a grain depending the main method of soil cultivation and precursor (2015-2017)

Main soil cultivation	Precursor	Yield, c/ha	Additives, c/ha		Gluten content, %	Additives, %	
			Precursor	Cultivation method		Precursor	Cultivation method
Tillage	Clean fallow	41,6	15,8/ 7,9	-	23,3	1,2	0,8
	Corn	25,8	-	-	22,1	-	1,1
Shallow cultivation	Clean fallow	42,5	14,3/7,1	0,9	22,5	1,5	-
	Corn	28,2	-	2,4	21,0	-	-
AET $_{os}$			1,7			0,5	

The increase in yield was calculated depending on the precursor and the method of tillage. As data in the table show, the increase in yield in the traditional cultivation-clean fallow version was 15,8 c/ha or 7,9 c/ha per year depending on the precursor, in clean fallow-minimal cultivation version 14,3 c/ha or 7,1 c/ha annually and depending on the method of soil cultivation, the yield increase was observed in clean fallow-minimal cultivation version. 0,9 c/ ha to clean fallow-traditional cultivation version and 2,4 c/ha in the non fallow-precursor-minimal cultivation version to non fallow-precursor-traditional cultivation version were obtained.

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ՄՇԱԿՄԱՆ ԵՂԱՆԱԿՆԵՐԻ ԱԶԴԵՑՈՒԹՅՈՒՆԸ ՀՈՂԻ ԲԵՐՐԻՈՒԹՅԱՆ ՏԱՐՐԵՐԻ ԵՎ ԱՇՆԱՆԱՑԱՆ ՑՈՐԵՆԻ ԲԵՐՔԱՏՎՈՒԹՅԱՆ ՎՐԱ

Ս.Բ. Գալստյան, Վ.Ս. Ադամյան, Վ.Ա. Ալեքսանյան, Ա.Վ. Ավագիմյան
Շուշիի տեխնոլոգիական համալսարան

Արցախի հանրապետության ցածրադիր գոտու անջրդի երկրագործության պայմաններում համեմատվել են ավանդական առի շրջմամբ խորը վարի և նվազագույն մշակման ազդեցությունը հողի հումոսայնության, սննդային տարրերի, խոնավապահովածություն, ագրոֆիզիկական հատկունների և աշնանացան ցորենի բերքատվության վրա:

Պարզվել է, որ Ասկերանի շրջանի մուգ շագանակագույն խճաքարային հողերում՝ կախված հողի հիմնական մշակման եղանակից, հումոսային նյութերն ու հանքային սննդատարրերը տեղաբաշխվում են վարելաշերտի տարբեր խորություններում, հողի խոնավությունը վեգետացիայի ընթացքում տարբեր նախորդներից հետո բարձր է լինում նվազագույն մշակման դեպքում, որը նպաստում է վեգետացիայի ընթացքում հողի խտության փոփոխման միջակայքի նվազեցմանը, օպտիմալ խտության պահպանմանը և աշնանացան ցորենի բերքատվության ավելացմանը:

Բանալի բառեր. աշնանացան ցորեն, հողի խտություն, ջրապահովածություն, սննդատարրերի տեղաբաշխում, բերք:

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ВЛИЯНИЕ СПОСОБОВ ОБРАБОТКИ НА ЭЛЕМЕНТЫ ПЛОДОРОДИЯ ПОЧВЫ И НА ПРОДУКТИВНОСТЬ ОЗИМОЙ ПШЕНИЦЫ

С.Б. Галстян, В.С. Адамян, В.А. Алексанян, А.В. Авагимян
Шушинский технологический университет

В условиях богарного земледелия в низменной зоне Республики Арцах было сравнено влияние традиционной - глубокой отвальной вспашки и минимальной обработки на гумусность, питательные элементы, влагообеспеченность, агрофизические свойство и урожайность озимой пшеницы.

Выяснилось, что в темно-коричневых, щебенно - каменных почвах Аскеранского района, в зависимости от типа основной обработки почвы, гумусовые вещества и минерально питательные элементы располагаются на разных глубинах пахотного слоя почвы. Во время вегетации при минимальной обработке влажность почвы оставалась высокой, что также способствовало снижению диапазона изменению плотности почвы во время вегетации и сохранению оптимальной плотности и увеличению урожайности озимой пшеницы.

Ключевые слова: озимая пшеница, плотность почвы, водообеспеченность, распределение питательных элементов, урожай.

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