Выработка стратегии по управлению засухой и смягчению ее последствий должна основываться на координации информации и сборе данных от различных организаций. При этом нет необходимости создавать новые структуры, что потребует значительного времени и усилий. Десятиэтапный процесс [5, 6], принятый официальными ведомствами для разработки рациональных или агроклиматических планов готовности к засухе, можно при надлежащих изменениях использовать и в Азербайджане. Эти этапы следующие:

1. Формирование национальной рабочей группы по проблемам засухи.
2. Объявление основной цели и подходов рабочей группы.
3. Разработка организационной структуры рабочей группы и подготовка плана на случай засухи.
4. Интеграция науки, технологий и политики и ликвидация институциональных пробелов.
5. Разработка организационной структуры и подготовка плана по преодолению засухи.
6. Инвентаризация природных ресурсов на научной основе.
7. Реализация плана.
8. Разработка программ по распространению знаний.
9. Распределение ресурсов, координация фондов внешней (международной) помощи.
10. Оценка последствий засухи.

Вывод. Таким образом, стратегия готовности к засухе направлена на использование подхода, основанного на принципе превентивности и управления рисками засухи, что сокращает уязвимость, переориентирует будущие национальные программы развития и укрепления координации срочной помощи различных организаций. Процесс разработки плана позволит определить уязвимые районы, четко обозначить зоны, группы населения, экономические и экологические сектора.

В конечном итоге, стратегии готовности будут способствовать совершенствованию межведомственной координации государственных и негосударственных организаций, повышению эффективности мониторинга, оценки, реагирования на дефицит основных нужд, а именно воды, продуктов питания и кормов, будут способствовать доведению информации до основных пользователей и эффективности распределение ресурсов. Задачи этих планов состоят в том, чтобы сократить последствия, связанные с дефицитом воды, продовольствия и кормов, человеческие страдания и конфликты между потребителями воды и других природных ресурсов.

Эти планы должны способствовать укреплению опоры на собственные силы в результате систематического решения основных проблем на районном, областном, региональном или национальном уровне. Для обеспечения успешности планов готовности к засухе необходимо обеспечить их интеграцию в работу всех уровней органов управления и национальные планы или стратегии, направленные на обеспечение продовольственной безопасности, управление природными ресурсами и сохранение почвенных ресурсов для борьбы с опустыниванием.

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ENVIRONMENTAL, ECONOMIC AND ENERGY EFFICIENCY OF SOIL TILLAGE SYSTEMS IN CROP ROTATION UNDER IRRIGATION

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Introduction. The main criteria for energy assessment of the crop cultivation technologies is the coefficient of energy efficiency, which is defined as a ratio of the gross energy contained in the grown produce to the total energy spent on its obtaining.

It is important to determine the structure of expenses which can help to reveal the reserves of decreasing the energy and money expenses related to logistical supplies in particular fertilizers, protection means, fuel and oil materials, irrigation water, electric power.

The coefficient of energy efficiency enables to display all components of the single constant (MJ, GJ, kcal and so on) in contrast to the cost factors that are subject to significant fluctuations due to the lack of stable prices on agricultural products [1].

Therefore, the need for scientific substantiation of ecologically safe and energy efficient soil tillage systems is urgent and significant in order to define their impact on the main indices of soil fertility and yielding capacity of crops grown in rotation under irrigation [2,3,4].

The object of research is different methods of soil tillage in crop rotation under irrigation and systems of machines and tools.

The aim of research is to determine the total energy consumption and gross energy output using the cultivation technologies based on different methods and depths of soil tillage for the crops in rotation.

Materials and methods. The research was conducted in the four field crop rotation under irrigation in the experimental field of the Institute of Irrigated Agriculture of NAAS in the area of the Ingulets irrigation system with the water duty of 0.35 – 0.4 l/s/ha during 2011-2013. The five systems of primary soil tillage which differ in methods, depth of loosening and consumption of non-renewable energy for their implementation were studied (Table 1).

Table 1. – Scheme of the stationary experiment for studying methods of primary soil tillage in four field crop rotation under irrigation

№	System of primary soil tillage	Tillage for the crops in rotation			
		maize for silage making	winter wheat	winter rape	winter barley
1	Moldboard tillage with different depths	28-30 (p)	20-22 (p)	25-27 (p)	23-25 (p)
2	Boardless tillage with different depths	28-30 (ch)	20-22 (ch)	25-27 (ch)	23-25 (ch)
3	Boardless tillage with the same depth	12-14 (d)	12-14 (d)	12-14 (d)	12-14 (ch)
4	Differentiated – 1	20-22 (p)	12-14 (ch+s.c)	14-16 (ch)	12-14 (ch)
5	Differentiated – 2	28-30 (p)	6-8 (d)	14-16 (ch)	14-16 (ch)

Note: p – ploughing; ch – chisel loosening; s.l – surface loosening; s.c – soil compaction; d – disc harrow tillage.

The crop rotation is located in time and space. The technologies of cultivating agricultural crops are generally admitted for irrigation conditions in southern Ukraine. The experiment was repeated four times, the area of the plot sown was 450 m^2, the area of the plot recorded was 50 m^2. The varieties and hybrids of agricultural crops listed in the Register of plant varieties suitable for spreading in Ukraine were sown in the experiment [5].

The energy efficiency of the methods of primary soil tillage and cultivation technologies of agricultural crops based on them was determined using generally accepted methods [1,6,7].

The results and discussion. The sets of machines and units that were used for the researched methods of primary soil tillage significantly differed among themselves in labor productivity, consumption of non-renewable energy, both materialized and anthropogenic, that is why, taking into account all the material and experience gained in Ukraine, we have tested various combinations of methods and depths of primary soil tillage for agricultural crops of four field crop rotation under irrigation. To determine the energy consumption of certain technological operations and technologies in general, we evaluated the energy consumption of different methods of primary soil tillage for every agricultural crop of the crop rotation. On the basis of the calculations obtained the energy consumption per hectare of the crop rotation area was determined.. As you can see from the table 2, the highest energy consumption was observed when applying the system of primary soil tillage with different depths and layer rotation and amounted to 1567.2 MJ/ha of the crop rotation area. The systems of shallow boardless primary soil tillage with different and equal depths promoted reducing energy consumption by 37.2 and 68.1%, respectively. The anthropogenic energy consumption when applying the differentiated system of primary soil tillage (version 4) with soil compaction and ploughing in the rotation made it possible to decrease the expenses by 27.5% in comparison with the system of the ploughing with different depths (Table 2).

Table 2. – Energy consumption when applying different systems of primary soil tillage in crop rotation, MJ/ha

System of primary soil tillage	Tillage for the crop in rotation				Mean in the crop rotation
	maize for silage making	winter wheat	winter rape	winter barley	
Moldboard tillage with different depths	1781.2	1335.6	1686.6	1465.3	1567.2
Boardless with different depths	1136.7	746.3	1082.5	969.6	983.8
Boardless with equal depths	499.4	499.4	499.4	499.4	499.4
Differentiated – 1	1335.6	2120.0	592.6	499.4	1136,9
Differentiated – 2	1781.2	363.0	592.6	592.6	832.3

The system of differentiated primary soil tillage provided decrease of the total energy consumption by 46.9% , when one ploughing to the depth of 28-30 cm for maize for silage making in the crop rotation took turns with boardlees loosening (twice) to the depth of 14-16 cm for winter rape and barley and surface (8-10 cm) tillage for winter wheat.

Determining the energy intensity of cultivation technologies agricultural crops based on different methods and depths of loosening made it possible to find out that decrease in the expenses for primary soil tillage several times, had a little impact on the energy intensity of cultivation technologies in general. Thus, when applying ploughing in the system of moldboard soil tillage with different depths, the energy consumption was 37.8 GJ/ha, in the case of chisel tillage in the system of shallow boardless soil tillage with equal depths it was by 6.9% less, and in the case of differentiated-2 it was by 5.3% less. It is connected with the fact that unit costs for primary soil tillage ranged from 1% to 3% of the energy intensity of cultivation technologies per 1 ha of the crop rotation area.

As a result of the calculations it was found out that the highest coefficient of energy efficiency was provided by the cultivation technology in the system of differentiated primary soil tillage (version 5), when one ploughing to the depth of 28-10 cm for maize for silage making in the crop rotation alternated with boardless loosening (twice) to the depth of 14-16 cm for winter rape and barley and surface tillage (6-8cm) for winter wheat. The coefficient of energy efficiency in the options of moldboard tillage with different depths (version 1) and differentiated system with one lossening and ploughing for maizr for silage making (version 4) had similar values and amounted to 2.17 and 2.23, respectively. The applicaton of shallow boardless soil tillage for all the crops in the crop rotation (version 3) reduced the recoupment of expenses compared with the systematic moldboard soil tillage with different depths by 6.9%.

The basis of environmental, economic and energy efficiency of primary soil tillage in the four field crop rotation on dark chestnut loamy soils is not only formed by the production effect as the difference between the cost of production and the expenses for cultivation, but also by the environmental impact which includes saving non-renewable energy consumption that should be used to preserve and restore soil fertility. Owing to environmental and economic evaluation of the operation of the agrocenosis studied we found a positive impact of the differentiated systems of primary soil tillage and the systems with different depths for the formation of humus reserves. An average annual increase of humus during the years of research in these versions ranged from 17.4 to 21.9 GJ/ha or 0.81-1.02 t/ha and only in the case of long term application of shallow boardless soil tillage with equal depths (12-14 cm) the intensity of accumulation of organic matter in the soil layer of 0-40 cm was 2.5-3 times less (0.34 t/ha) and was formed by means of enrichment of the top soil layer (0-15 cm). Total energy consumption for works concerning the soil preparation, sowing, treatment of crops, irrigation and harvest calculated per hectare of the crop rotation area in the version of the ploughing with different depths amounted to 37.8 GJ, in the version of boardless loosening with different depths it was 36.4 GJ, in the version of shallow tillage with equal depths it amounted to 35.2 GJ, in the case of differerntiated systems of soil tillage it was 36.7 та 35.8 GJ, respectively (Table 3).

Table 3. – Energy recoupment of cultivation technologies of agricultural crops of four-field crop rotation under irrigation

System of primary soil tillage	Energy consumption of technologies, GJ/ha	Energy consumption of the yield, GJ/ha	Increase of energy consumption of the yield, GJ/ha	+,- to the control, GJ/ha	CEE
Moldboard tillage with different depths	37.8	82.2	44.4	-	2.17
Boardless with different depths	36.4	75.8	39.4	-5,0	2.08
Boardless with equal depths	35.2	71.0	35.8	-8.6	2.02
Differentiated – 1	36.7	82.0	45.3	+0.9	2.23
Differentiated – 2	35.8	82.0	46.2	+1.8	2.29

Note: CEE – coefficient of energy efficiency

In general, the highest average annual ecological and economic efficiency (21.8 thousand UAH) calculated per hectare of the crop rotation area was obtained in the version of the primary soil tillage with different depths with the layer rotation. The versions with differentiated systems of soil tillage were close in the efficiency. In this case an average annual ecological and economic effect amounted to 42.9 and 41.7 thousand UAH. The calculation of environmental and economic efficiency of the four field crop rotation according to the researched systems of primary soil tillage taking into account soil protective action of agricultural crops, the level of mineralization of organic matter and the yield obtained showed a lower total environmental and economic impact of the studied four versions of differentiated and boardless systems of primary soil tillage compared to the tillage with different depths based on the application of tools of the moldboard type (Table 4).

Table 4. – Environmental and economic efficiency of operation of four-field crop rotation under irrigation depending on different methods and systems of primary dark chestnut soil tillage

System of primary soil tillage	Energy increa-seGJ/ha	Also at the expense of:		Total average annual environmental and economic effect, … thousand UAH/ha	+, – to control, …thousand UAH/ ha
		yield, GJ/ha	humus, GJ/ha		
Moldboard tillage with different depths	104.1	82.2	21.9	43.6	-
Boardless with different depths	94.4	75.8	18.6	39.6	-4,0
Boardless with equal depths	78.2	71.0	7.2	32.8	-10.8
Differentiated – 1	102.3	82.0	20.3	42.9	-0.7
Differentiated – 2	99.4	82.0	17.4	41.7	-1.9

Scientific production research and approbation of the worked out methods of primary soil tillage were conducted in the SOE «Experimental farm of Askaniyske» of the Institute of Irrigated Agriculture of the NAAS in the area irrigated by the Kakhovka irrigation system using the water duty of 0.4- 0.45 l/s/ha. The data experimentally obtained were confirmed in the stationary experiments by means of long term application of the systems of primary soil tillage and use of the soil tillage machinery and agricultural implements with different designs of working elements and irrigation equipment such as «Fregat» and «Zimmatic». During the three years of research 1.8-2.2 vegetation watering with the rate of 800-1200 $м^3$ per 1 ha of the crop rotation area took place depending on the hydrothermal conditions of vegetation period.

Conclusion. Applying the systems of moldboard (with different depths) and differentiated primary soil tillage under irrigation conditions and using agricultural implements with different designs of working elements facilitate implementation of the potential yielding capabilities of the varieties and hybrids of agricultural crops and provide the productivity of crop rotation at the level of 82.0-82.2 GJ/ha (the output of gross energy).

The highest environmental and economic effect, taking into account monetary and energy assessment of increase of humus reserves (0.81-1.02 t/ha per year, or 20.3-21.9 GJ/ha) was observed in the options with different tillage depths and differentiated systems of primary soil tillage and amounted to 42.9-43.6 thousand UAH.

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ВПЛИВ РЕГУЛЯТОРА РОСТУ РЕГОПЛАНТ НА УРОЖАЙНІСТЬ ТА ТЕХНОЛОІЧНІ ПОКАЗИКИ ЯКОСТІ НАСІННЯ САФЛОРУ КРАСИЛЬНОГО В УМОВАХ ЛІСОСТЕПУ ЗАХІДНОГО

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Постановка проблеми. Сафлор красильний – це олійна, лікарська і кормова культура. Серед країн близького зарубіжжя сафлор вирощують як кормову культуру на богарних землях в Казахстані, Узбекистані, Таджикистані та в Росії, що спонукає до проведення досліджень на цій культурі у різних напрямках її використання. В Україні в основному сафлор вирощують як олійну культуру. Його насіння містить 25–37 % (у ядрі 46–60 %) напіввисихаючої олії (йодне число – 115–155) і до 12 % білка. Олія, добута з ядер насіння сафлору, не поступається за смаковими якостями соняшниковій, її використовують у харчових цілях, зокрема для виготовлення маргарину високої якості. Олія, одержана з цілого насіння, має гіркуватий присмак, її використовують як технічну [1]. Сафлорова олія – прекрасне джерело магнію, вітамінів (В1, В2, РР, Е, В-токоферол), в ній також містяться каротиноїди, лінолева кислота (до 90 %) (клас Омега-6), а вона є незамінною для людського організму. Тому, сафлор володіє цінними лікувальними властивостями. Про багатий жирнокислотний склад олії сафлору та цінні лікувальні властивості вказують М.М. Гаврилюк, В.Н. Салатенко, А.В. Чехов та М.І. Федорчук [2].

Проте, культура в умовах Лісостепу досі мало поширена і дуже мало публікацій щодо використання її в різних галузях народного господарства.

Стан вивчення проблеми. Сафлор красильний – посухостійка, жаровитривала і в цілому невибаглива до умов вирощування культура, тому вона представляє інтерес насамперед для степових районів України. В незрошуваних умовах Півдня України вивчались питання технології вирощування цієї культури, зокрема встановлена залежність урожайності від внесення ряду гербіцидів. Так, за результатами досліджень Адаменя Ф.Ф., Прошиної І.О. найвища урожайність сафлору красильного сформувалась на варіантах із внесенням гербіцидів Гоал 2Е – 1,5 т/га, Стомп 330 – 1,48 т/га, та Гезагард 500 – 1,46 т/га [3]. Цими ж науковцями встановлено вплив на