UDC 631.362.3
AGRIS F07
https://doi.org/10.33619/2414-2948/99/08

DEVELOPMENT OF RESOURCE CONSERVATION TECHNOLOGIES AND COMPLEXES OF MACHINES FOR CULTIVATION OF VEGETABLE CROPS

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РАЗРАБОТКА РЕСУРСОСБЕРЕГАЮЩИХ ТЕХНОЛОГИЙ И КОМПЛЕКСОВ МАШИН ДЛЯ ВОЗДЕЛЫВАНИЯ ОВОЩНЫХ КУЛЬТУР

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Abstract. The main activities of leading foreign companies are currently the development and production of agricultural machinery, taking into account new legislative requirements both for agricultural production in general and directly for the machinery itself. There is a clear trend towards the widest use of modern computer and information technologies in the design of agricultural machines, which allows to increase productivity and quality of technological operations while reducing operating costs, as well as improve working conditions of employees, management and control of work performed. Intensive resource conservation technologies are technologies related to the introduction of the latest high-performance combines, tractors and a plume of wide-range or combined agricultural units. The next type of resource conservation technologies is based on knowledge and respect for the laws of nature. These are resource conservation technologies through the biologization of agriculture. Resource conservation activities in crop production are based on the complete restoration of land fertility after the removal of nutrients from the soil by agricultural crops. This is ensured by the integrated application of organic and inorganic fertilizers, green manure, bacterial fertilizers, as well as peat and sapropel. All crop production technologies should be resource conservation, environmentally balanced, and have a pronounced zonal character. Moisture conservation technologies in crop production have great prospects due to the development of new crop rotations with an expanded set of crops.

Аннотация. Основными направлениями деятельности ведущих зарубежных фирм в настоящее время являются разработка и производство сельскохозяйственной техники с учетом новых законодательных требований как к сельскохозяйственному производству в целом, так и непосредственно к самой технике. Явно прослеживается тенденция на самое

Т. 10. №2. 2024
https://doi.org/10.33619/2414-2948/99

широкое использование в конструкции сельскохозяйственных машин современных компьютерных и информационных технологий, что позволяет повысить производительность и качество технологических операций при снижении эксплуатационных затрат, а также улучшить условия труда работников, управление и контроль за выполняемыми работами. Интенсивные ресурсосберегающие технологии, связанные с внедрением новейших высокопроизводительных комбайнов, тракторов и шлейфа широкозахватных или комбинированных сельскохозяйственных агрегатов. Следующий тип ресурсосберегающих технологий основан на знании и уважении законов природы. Это технологии ресурсосбережения путем биологизации земледелия. Ресурсосберегающая деятельность в растениеводстве опирается на полное восстановление плодородия земель после изъятия из почвы сельскохозяйственными культурами питательных веществ. Это обеспечивается путем интегрированного внесения органических и минеральных удобрений, сидератов, бактериальных удобрений, а также торфа и сапропеля. Все технологии производства растениеводческой продукции должны быть ресурсосберегающими, экологически сбалансированными, носить выраженный зональный характер. Большие перспективы имеют влагосберегающие технологии в растениеводстве за счет разработки новых севооборотов с расширенным набором культур.

Keywords: agriculture, agricultural mechanization, resource conservation, vegetable growing.

Ключевые слова: сельское хозяйство, механизация сельского хозяйства, сохранение ресурсов, овощеводство.

Agriculture for Azerbaijan is a strategic multifunctional branch of the economy that performs important functions for the state and society. The importance of agriculture lies in the possibility of obtaining a synergistic effect from the development of this industry due to the diverse inter-sectoral relations. Agriculture has multiplicative properties and, in times of crisis, could become the economic locomotive of the country, allowing it to use almost unlimited reserves of GDP growth in Azerbaijan. A fundamentally important priority of the economic program for 2016 and the near future is the further deepening of reform and structural transformations in agriculture, efficient use of land and water resources. As a result of the implementation of comprehensive measures to accelerate the transition to an innovative path of agricultural development aimed at structural transformation and diversification of the industry, as well as rational use of resources, it was possible to maintain the trend of growth in agricultural production at an average of 6.2% over the period 2005-2014. In terms of the pace of development of agricultural production, Azerbaijan consistently occupies a leading position among the CIS countries [1, 2].

In conditions of limited land and water resources and taking into account the constant growth of the population of Azerbaijan, thanks to a consistent agricultural policy and rational use of the potential available to the agricultural sector, we have achieved sustainable provision of the population's food needs. In modern conditions, the key to maximizing the realization of this potential is the introduction of modern cultivation technologies at all stages of production, further increasing efficiency and optimizing the use of all types of resources (land, irrigation water, fertilizers, financial and labor resources, etc.), the use of high-yielding and precocious varieties, the mobilization of the latest scientific achievements in the field of seed and crop production to expand the types and varieties of food crops adapted to the soil and climatic conditions of Azerbaijan and organizational and economic factors [3-5].

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Currently, the transition to resource conservation technologies for the cultivation of vegetable crops in many agricultural enterprises of Azerbaijan acts as one of the main directions in the restructuring of vegetable farming methods. The effectiveness of resource conservation technologies depends on a set of interrelated issues: crop rotation with a certain set and alternation of field crops, a system of agricultural machines, a combination of basic and pre-sowing tillage, taking into account local soil and climatic conditions, the phytosanitary condition of fields, the balance of elements of mineral nutrition of plants in the soil [6-9].

The following scientific methods were the methodological bases of the research: historical-dialectical, analysis and synthesis, theoretical search and abstract logical, mathematical and statistical analysis based on the research results. The aim of the article is investigating modern technologies of agricultural production from the positions of resource and energy conservation as a modern direction of raising energy efficiency of the rural territories. The efficient using of local natural and power resources in the rural territories is the most important, ecologically and socially expedient direction, but at the same time, the least used and the least understood means of raising both the level of profitability, life of everybody, and the life under environmental preservation. Thus, first of all, the necessity arises concerning the development of adaptive measures as to the negative impact of climatic changes; such measures have to be introduced organically in the technologies of agricultural production. Secondly, these are technological measures in accumulating, preserving, and rational using of local natural-power resources [10].

The following measures, which can be used to withstand climatic problems, belong to the first group: developing a new territory zoning; using drought resistant varieties and hybrids of crops, adapted to a considerably shorter vegetation period; introducing new (niche) drought-resistant crops; using anti-stress chemical, biological, and microbiological preparations, complex micro-fertilizers; applying fermented manure and composted fertilizers; using humates, minerals (bentonite, etc.); controlling phytosanitary conditions of sown areas under crops, and others. Resource conservation technologies are based on the following principles: minimal tillage, ensuring the preservation of plant residues on the soil surface, the use of science-based crop rotations, the selection of highly effective crop varieties, the implementation of measures to improve soil fertility, integrated approaches to pest control and diseases [11].

The analysis of scientific papers makes it possible to single out the main directions for the use of resource conservation technologies in crop production: technical — the use of modern highly efficient machines and equipment; technological — the introduction of innovative resource conservation technologies for the production of crop products; organizational — optimization of production processes aimed at the conservation and efficient use of available resources, organization of accounting and control over them. Resource conservation is a complex process consisting of many components. The results of studies of agricultural organizations in the Krasnodar Territory confirm that each farm has reserves that can reduce the level of resource costs for the production of agricultural products and obtain an additional effect per unit area. The organization of an effective accounting and control system makes it possible to find growth potential. The use of resource conservation technologies in crop production is not always associated with the purchase of new agricultural machinery and units. First of all, it is necessary to focus on highly efficient seed material, crop rotations, compliance with agrotechnical measures, and economical use of available resources [4].

The aim of the article is investigating modern technologies of agricultural production from the positions of resource and energy conservation as a modern direction of raising energy efficiency of the rural territories. The efficient using of local natural and power resources in the rural territories is

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Achieving the projected growth rates of socio-economic development of the village is possible, provided that the accelerated transition to the use of new high-performance and resource conservation technologies, taking into account their zonal characteristics, improving the financial situation of agricultural producers and the material and technical base of agriculture. The use of resource conservation technologies should be accompanied by a constant increase in soil fertility, taking into account the biological characteristics of zoned highly productive intensive varieties, the use of integrated plant protection against weeds, pests and diseases, the formation of an optimal composition of the machine and tractor fleet with its high-performance use, highly qualified personnel, impeccable observance of technological discipline (Figure 1).

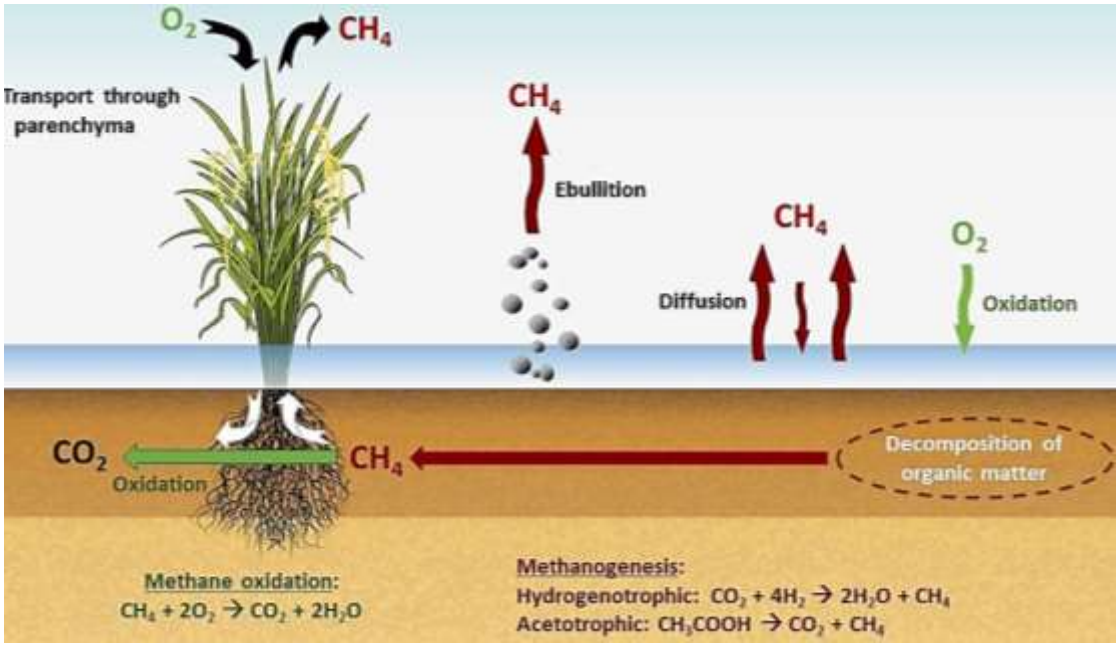

Figure 1. Adapted from Le Mer et al. (2001). CH_4 emission from rice paddies ~ 36 Tg year^{-1} 18% of the total anthropogenic CH_4 emission to the atmosphere

Resource conservation is a process of efficient use of material, technical, labor, financial and other resources. Its goals are the production of agricultural products with the best quality indicators with a minimum of total costs of production resources and an increase in economic returns from a natural unit of resources. Resource conservation measures include technical, technological, organizational and economic blocks [7].

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https://doi.org/10.33619/2414-2948/99

The organizational and economic mechanism of resource conservation is understood as a system of interrelated organizational and economic measures aimed at improving the efficiency of use and stimulating savings of material and technical resources, and the production of agricultural products with minimal expenditure of all resources in monetary and in-kind terms (Figure 2.).

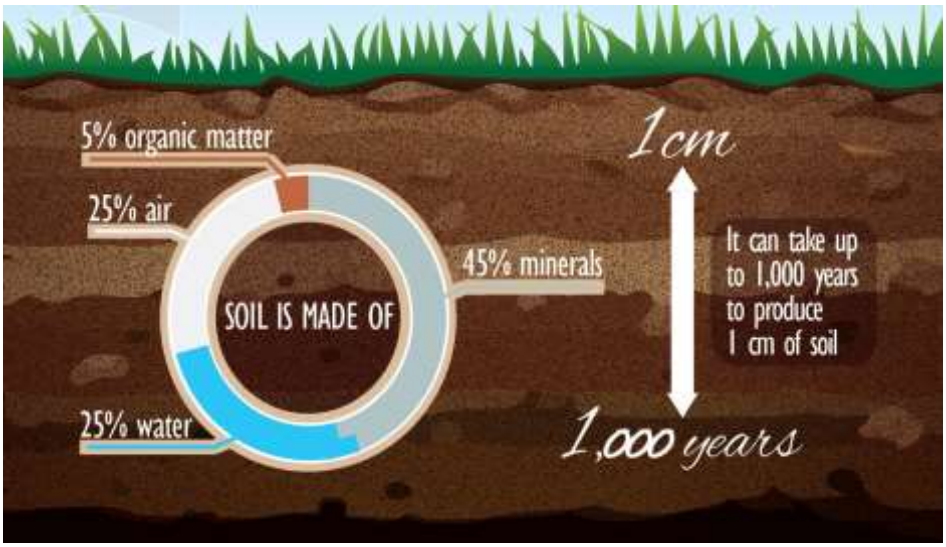

Figure 2. Soil: a complex integrated living system

Soil Organic Matter: organic constituents in various stages of decomposition (tissues from dead plants and animals, soil organism) 58% of C into Soil Organic Matter (CHONPS) 5.0% SOM = 2.9% SOC. Large amounts of nutrients under an organic form, they don't leach (nutrients storage & recycling). Soil organic carbon (SOC) can be responsible for more than 80% of the cation exchange capacity (CEC: Ca, Mg,) of highly weathered soils, such as Oxisols and Ultisols. In Azerbaijan, the main activities of the organizational and economic mechanism of resource conservation are: preparation of energy and resource conservation programs; allocation of subsidies for the development, production and implementation of resource conservation technologies and equipment that reduce the consumption of technical means, energy resources and labor; subsidizing the interest rate for the purchase of resource conservation equipment; reimbursement of part of the costs of production of alternative fuels to industrial enterprises, as well as its use in agricultural production; allocation of subsidies for the purchase of equipment for the production of alternative types of energy (for example, solar panels); allocation of subsidies for the purchase of diesel fuel, payment for electricity and fuel. Soil fertility: ability of soil to support and sustain plant growth through making nutrients available for plant uptake. Soil fertility facilitated by: nutrient storage in soil organic matter, nutrient recycling from organic to plant-available mineral forms and physical and chemical processes (that control availability, losses) [12]. SOC accumulation: increased soil biota (abundance, diversity), water and nutrient holding capacity and improved soil structure enhances soil productivity (Figure 3).

The evaluation of technological-energy factors has shown, that the intensive farming system has been remaining the most expensive and unproductive system. At the same time, other systems are almost equal, except using alternative energy sources (it depends more on the producer, but not the system) and the quality of final products (because chemical means are used even by following the standards). Concerning social factors organic farming is leading, as by its essence it presupposes social effect and it is possible to be used on farmsteads [12].

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https://doi.org/10.33619/2414-2948/99

While bio-enzyme and biogenic systems do not sufficiently influence the population living standards, nevertheless the revival on unproductive lands enables to increase the population employment and decreases the level of disease incidences, because chemical means and fertilizers are almost not used. At no-till, strip-till, and precision farming systems the minimizing of operational processes takes place, so the number of employees decreases.

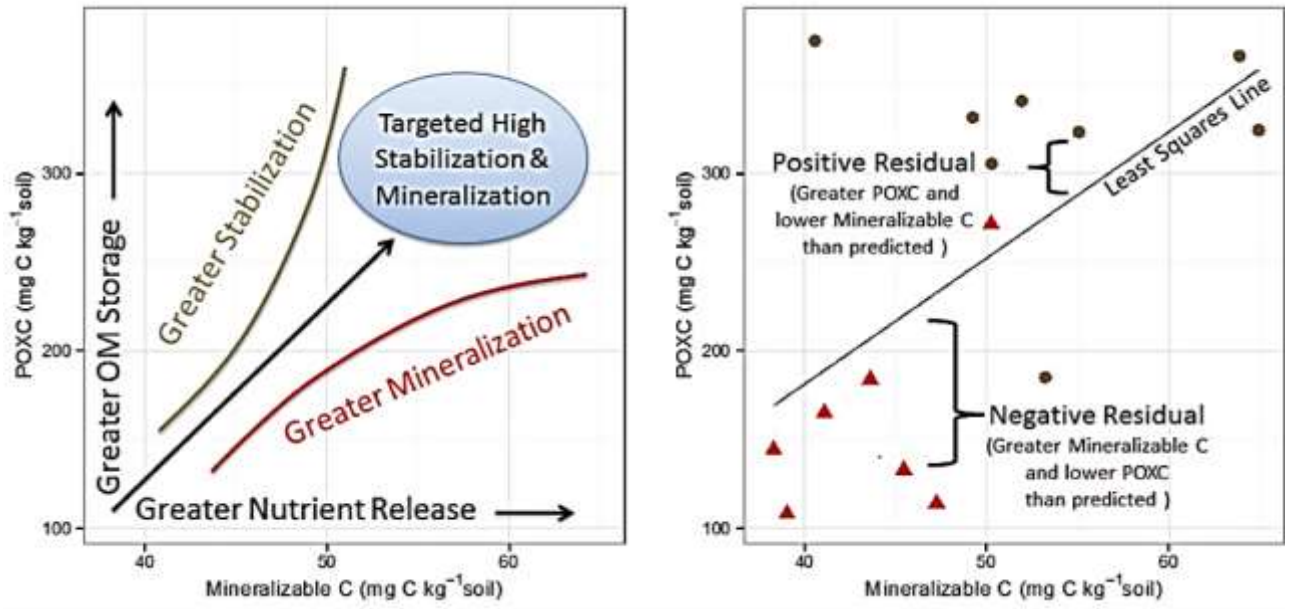

Figure 3. Impacts of CA/SIA on C stabilization

Thus, judging by the conducted estimation, the conclusion can be made that having fertile soils in this country the organic farming system is the most resource and energy conservation, because the system takes into account natural processes and does not harm the environment, but on the contrary, it favors its restoration. Besides, organic products cost 30-50% more, than traditional products, under constantly increasing demand on the world food markets.

References:

1. Tarariko, Yu. O., Saidak R. V., Soroka Yu. V., Vitvitskii S. V. (2015). Raionirovanie territorii Ukrainy po urovnyu obespechennosti gidrotermal'nymi resursami i ob"emam ispol'zovaniya khozyaistvennykh melioratsii. Kiev. (in Russian).

2. Yasnolob, I. O., Chayka, T. O., Gorb, O. O., Galych, O. A., Kalashnyk, O. V., Konchakovskiy, Y. O., ... & Shvedenko, P. Y. (2019). Using resource and energy-saving technologies in agricultural production as a direction of raising energy efficiency of rural territories. *Ukrainian journal of ecology*, *9*(1), 244-250.

3. Grift, D. R., Monkirif, J. F., & Exert, D. J. (2017). Specified Moments of Modern Understanding the Notion of No-Till Farming System in the USA. *Grain*, *10*(139), 106-110.

4. Randy, L. A. (2016). Is it Possible to Do without Soil Tillage and Herbicides. *Grain*, *2*(129), 72-82.

5. Yasnolob I. O., Chayka T. O., Gorb O. O., Galych O. A., Kalashnyk O. V., Konchakovskiy Ye. O., Moroz S. E., & Shvedenko P. Yu. (2019). Using resource and energy-saving technologies in agricultural production as a direction of raising energy efficiency of rural territories. *Ukrainian Journal of Ecology*, *9* (1), 244-250.

6. Samoilenko, I. (2017). Biocenosis Launching. *Grain, 12* (141), 30-35.

7. Timofeev, M. M. (2010). Biogenic Farming in the Aspect of Power Resources. *Bulletin of Grain Economy, 38*, 154-158.

8. Yasnolob, I. O., Pysarenko, V. M., Chayka, T. O., Gorb, O. O., Pestsova-Svitalka, O. S., Kononenko, Z. A., & Pomaz, O. M. (2018). Ecologization of tillage methods with the aim of soil fertility improvement. *Ukrainian Journal of Ecology*, *8*(2), 280-286. https://doi.org/10.15421/2018_339

9. Tabatabaeefar, A., Emamzadeh, H., Varnamkhasti, M. G., Rahimizadeh, R., & Karimi, M. (2009). Comparison of energy of tillage systems in wheat production. *Energy*, *34*(1), 41-45. https://doi.org/10.1016/j.energy.2008.09.023

10. Villamil, M. B., Miguez, F. E., & Bollero, G. A. (2008). Multivariate analysis and visualization of soil quality data for no-till systems. *Journal of Environmental Quality*, *37*(6), 2063-2069. https://doi.org/10.2134/jeq2007.0349

11. Shirokov, Y., & Tikhnenko, V. (2021). Analysis of environmental problems of crop production and ways to solve them. In *E3S Web of Conferences* (Vol. 273, p. 01025). EDP Sciences. https://doi.org/10.1051/e3sconf/202127301025

12. Pashkov, S. V., & Martsinevskaya, L. V. (2021, July). Biological Resources to reproduce Arable Soils Fertility in the Old-cultivated Regions of Kazakhstan. In *IOP Conference Series: Earth and Environmental Science* (Vol. 817, No. 1, p. 012081). IOP Publishing. https://doi.org/10.1088/1755-1315/817/1/012081

Список литературы:

1. Тарарико Ю. О., Сайдак Р. В., Сорока Ю. В., Витвицкий С. В. Районирование территории Украины по уровню обеспеченности гидротермальными ресурсами и объемам использования хозяйственных мелиораций. Киев: Компринт, 2015. 62 с.

2. Yasnolob I. O., Chayka T. O., Gorb O. O., Galych O. A., Kalashnyk O. V., Konchakovskiy Y. O., Shvedenko P. Y. Using resource and energy-saving technologies in agricultural production as a direction of raising energy efficiency of rural territories // Ukrainian journal of ecology. 2019. V. 9. №1. P. 244-250.

3. Grift D. R., Monkirif J. F., Exert D. J. Specified Moments of Modern Understanding the Notion of No-Till Farming System in the USA // Grain. 2017. V. 10. №139. P. 106-110.

4. Randy L. A. Is it Possible to Do without Soil Tillage and Herbicides // Grain. 2016. V. 2. №129. P. 72-82.

5. Yasnolob I. O., Chayka T. O., Gorb O. O., Galych O. A., Kalashnyk O. V., Konchakovskiy Ye. O., Moroz S. E., Shvedenko P. Yu. Using resource and energy-saving technologies in agricultural production as a direction of raising energy efficiency of rural territories // Ukrainian Journal of Ecology. 2019. №1. P. 244-250.

6. Samoilenko I. Biocenosis Launching // Grain. 2017. V. 12. №141. P. 30-35.

7. Timofeev M. M. Biogenic Farming in the Aspect of Power Resources // Bulletin of Grain Economy. 2010. №38. P. 154-158.

8. Yasnolob I., Pysarenko V. M., Chayka T. O., Gorb O. O., Pestsova-Svitalka O. S., Kononenko Z. A., Pomaz O. M. Ecologization of tillage methods with the aim of soil fertility improvement // Ukrainian Journal of Ecology. 2018. V. 8. №2. P. 280-286. https://doi.org/10.15421/2018_339

9. Tabatabaeefar A., Emamzadeh H., Varnamkhasti M. G., Rahimizadeh R., Karimi M. Comparison of energy of tillage systems in wheat production // Energy. 2009. V. 34. №1. P. 41-45.

https://doi.org/10.1016/j.energy.2008.09.023

10. Villamil M. B., Miguez F. E., Bollero G. A. Multivariate analysis and visualization of soil quality data for no-till systems // Journal of Environmental Quality. 2008. V. 37. №6. P. 2063-2069. https://doi.org/10.2134/jeq2007.0349

11. Shirokov Y., Tikhnenko V. Analysis of environmental problems of crop production and ways to solve them // E3S Web of Conferences. EDP Sciences, 2021. V. 273. P. 01025. https://doi.org/10.1051/e3sconf/202127301025

12. Pashkov S. V., Martsinevskaya L. V. Biological Resources to reproduce Arable Soils Fertility in the Old-cultivated Regions of Kazakhstan // IOP Conference Series: Earth and Environmental Science. IOP Publishing, 2021. V. 817. №1. P. 012081. https://doi.org/10.1088/1755-1315/817/1/012081

Работа поступила
в редакцию 05.01.2024 г.

Принята к публикации
17.01.2024 г.

Ссылка для цитирования:

Yusubova U., Bayramov M., Babayev V., Allazov E. Development of Resource Conservation Technologies and Complexes of Machines for Cultivation of Vegetable Crops // Бюллетень науки и практики. 2024. Т. 10. №2. С. 65-72. https://doi.org/10.33619/2414-2948/99/08

Cite as (APA):

Yusubova, U., Bayramov, M., Babayev, V., & Allazov, E. (2024). Development of Resource Conservation Technologies and Complexes of Machines for Cultivation of Vegetable Crops. *Bulletin of Science and Practice, 10*(2), 65-72. https://doi.org/10.33619/2414-2948/99/08