ANNOTATION

Dissertation work of the doctoral student of the Kazakh National Agrarian Research University in the specialty of Agronomy Ashirali Zhusupovich Smanov on the topic: "Improvement of resource-saving technologies for efficient use of irrigated land in the conditions of the south-east of Kazakhstan," written for obtaining the academic degree of Doctor of Philosophy (Ph.D.) in the specialty 6D080100-Agronomy

1. Relevance of the research topic. The primary way of developing agriculture in Kazakhstan is the rational use of aquifers and water sources. Due to the lack of water in the country, there are very few opportunities to increase the area of water intake lands. Therefore, one of the urgent problems is implementing innovative technologies for economical water consumption, water protection, and resource conservation.

Hydrothermal conditions of the southern and south-eastern regions of Kazakhstan, where water agriculture is developed, allow efficient use of aquifers all year round. However, farmers and farms do not take advantage of these opportunities in practice. So, after harvesting winter wheat and spring crops of an early harvest, there is much time (90-120 days) to cultivate intermediate crops.

The widespread use of intermediate crops on the regions' flooded lands is a necessary agrotechnical measure when there is a shortage of feed. In this regard, the sowing of intermediate crops is the only way to use the land and increase water agriculture yields effectively. This activity will increase the volume of products produced from the field without increasing the area of land.

Soil fertility, secondary salinization processes, deterioration of physical and chemical properties of soils, and irrigation erosion cause significant harm in irrigated agriculture conditions in Kazakhstan. Therefore, one of the problems is the study and implementation of new methods and technologies that significantly reduce the cost of restoring newly saline water intakes.

In connection with the programs mentioned above of the development of agriculture, the study and introduction into production of new resources and water-saving innovative technologies that contribute to the effective use of water-saving lands is a very topical issue of water-saving agriculture.

The relevance of the dissertation work of Ashirali Smanov is that he explores innovative ways of effective use of aquifers in agriculture, proves the effectiveness of these technologies, and makes the right conclusions.

2. The objective and scientific results of the dissertation research

With its rich land resources, favorable climatic conditions, and economically developed structure, Kazakhstan needs to introduce new innovative technologies to increase agricultural production. The dissertation's primary goal is to increase the efficiency of irrigated land use by introducing drip irrigation in the cultivation of intermediate and main crops, preserving soil
fertility, and ensuring environmental protection with two harvests per year based on zero technology.

Development of ways to effectively use degraded water intake lands of the Akdalinsky water intake valley, reduce water intake losses and prevent re-salinization of soils.

There was carried out monitoring of the hydrothermal state of the south and south-east regions of Kazakhstan, which revealed the possibilities of effective year-round use of aquifers in these regions. It is proved that as ways of sufficient water-bearing lands, after sowing the main crops, it is possible to cultivate intermediate crops and get two harvests per year. The novelty of the proposed technology based on the use of stable shafts in the cultivation of main crops and the possibility of increasing water intake productivity without tillage, sowing directly intermediate crops before the end of the year with the second harvest is investigated and revealed.

As a result of the conducted research, the possibility of obtaining a guaranteed yield of intermediate crops after winter wheat grown in rent was revealed. At the same time, intermediate crops are sown immediately after harvesting winter wheat, after which they are watered in small portions (200-300m3/ha) through stored cuttings. Thus, a significant reduction in harvesting the main crop and intermediate sowing (about 30 days) is achieved.

Intermediate crops mustard, rapeseed, corn, and Sudan grass are sown in three terms. There are in the first stage after collecting winter triticale in the blue mass, oats, cows, the second phase in the blue mass, and early spring-after collecting oats and barley in the third phase.

The results of studies on the cultivation of intermediate crops after the main crops indicate that after joint sowing of oats and cows, intermediate crops were ripe for mustard and rapeseed, the average seed yield was from 13.8 to 19.4 centner/ha, and maize and sudangrass and for blue mass, the yield of which was 540.0 and 430.0 centner/ha, respectively.

After the autumn triticale, collected in a blue mass, intermediate crops (corn, rapeseed, mustard, Sudan grass) were sown on May 29-31. Data from field experiments showed that grain maize matured, grain yield averaged 72.7 centner/ha, rapeseed and mustard yields averaged 19.8 and 18.1 centners/ha, and Sudan grass was mown twice, and the average yield of blue mass was 510.7 centners/ha.

After the mainspring crops (barley and oats), intermediate crops were sown on July 24 could not fully ripen, reached only milk ripeness, i.e., there was no further ripeness were collected in a blue mass. The blue mass yield was 295 centners/ha; mustard was 390.3 centners/ha, corn for silage.

The ways of rational use of saline water-bearing lands of the Akdalinsky irrigated massif are studied, agrobiological and agromeliorative technologies that reduce irrigation water consumption and prevent secondary salinization
soils are proposed.

For the first time, it is recommended for drip irrigation, salt-water lands, the effect on phytomeliorants is studied, the preparation PA-2,1 (adaptogen) is tested on phytomeliorants.

The study results found that the grown phytomeliorants contributed to the reduction of salts in the soil. The content of dense salt deposits in the soil before sowing phytomeliorants and the content of other salts before harvesting were compared, there was a decrease in salts in the field sown with Sudan grass by 0.06%, in the field sown with guest corn to 0.10 and 0.27%, and in the lower layer of soil (20-40 cm), the decrease in salts occurred slightly in the range of 0.04-0.05%, and in the field sown with oilseed, a decrease in salts by 0.27%. It is proved that the tested drug PA-2,1 (adaptogen) has a good effect on the germination of phytomeliorants.

3. Object of research

Research work on the development of new technologies for the rational use of aquifers was carried out at the experimental field of the Kazakh Research Institute of Agriculture and Crop Production, located on open dark brown soil in the foothills of the Trans-Ili Alatau and the arable land of the farm "Baknur" of the Balkhash district of the Almaty region.

Our research objects are light-dark chestnut soils, drip irrigation, direct sowing of main and intermediate crops. The main crops are winter wheat, winter triticale, oats+cow alfalfa, barley, and pure oats. Intermediate crops are rapeseed, mustard corn, and Sudan grass. Phytomeliorants are guest corn, Sudan grass, peas, and corn.

4. Scientific novelty. The novelty of the studied technology is based on the use of stable shafts to cultivate crops. The essence of the technology is that when growing the main crops, there are two crops a year by direct sowing (without processing) of intermediate crops on prepared shafts, during the growing season the most effectively used irrigated land.

Salt-resistant phytomeliorative crops were selected in the seed crop; technologies were introduced to ensure the development of reclaimed wetlands that have gone out of circulation in agriculture. For the first time, the effect of drip irrigation on phytomeliorants grown in salt-water areas was studied, and the drug PA-2,1 (adaptogen) was tested on phytomeliorants.

5. Research methodology

The research work was carried out in the generally accepted classical ways: experiment and observation, following the methodology of setting up one-factor and multi-factor field experiments. The experiments were conducted in two zones of irrigated agriculture in the south-east of Kazakhstan:

- Foothill irrigated zone of the Trans-Ili Alatau, on a stationary site of the Kazakh Research Institute of Agriculture and Crop Production, on light chestnut soils of the Almaty region, by the method of field experience;
- Research work on the study of agrobiological and agro-ameliorative ways to improve degraded aquifers of the Akdalinsky watershed valley was carried out by conducting field experiments and laboratory studies. Field experiments were built on the fields of the farm "Bakor" Balkhash district of Almaty region.

Field and production experiments were conducted following the sketch of a complete factorial practice. The experimental results were processed by statistical processing in quantitative variability of data and by methods of variance, correlation, and regression analysis.

6. **The following provisions of the dissertation are submitted for defense:**

   1. Scientific justification for the introduction of resource-saving technologies for the effective use of aquifers;
   2. Monitoring of the hydrothermal situation in the south and south-east of Kazakhstan;
   3. Characteristics of growth, development, and yield of the main crops studied;
   4. Intensive use of irrigated land with intermediate crops;
   5. Growth, development, and productivity of phytomeliorants;
   6. Effect of phytomeliorants on the salt content in the soil;
   7. Agro-economic assessment of the cultivation of intermediate crops and phytomeliorants under drip irrigation.

7. **Practical significance of the work**

The development of the new technology will allow getting an additional crop of intermediate crops. In four regions of the south and south-east of Kazakhstan, two crops can be obtained annually on at least 200 thousand hectares. The introduction of the proposed technology will allow farms in the southern and south-eastern regions of Kazakhstan to annually produce an additional 20-25 thousand tons of bean seeds, 100-150 thousand tons of oilseed rapeseed, 1000-1200 thousand tons of silage, and 120-150 thousand tons of hay by sowing intermediate crops.

The proposed agrobiological and agro-ameliorative ways to restore degraded reclaimed floodplain lands significantly reduce costs and allow the widespread introduction of drip irrigation technology in many farms in this region. There is no need for expensive hydraulic engineering; capital reclamation works, the use of this system will significantly improve the reduction of production costs and, most importantly, save waste water by 8-10 times, protect the environment and ensure the phytomelioration of saline lands and the availability of drip irrigation to small and medium-sized farms that make up more than 90% of farms in the south and south-east of Kazakhstan.

8. **Personal presence of the author.** The direction, purpose, and objectives of the research and methods of research of the dissertation work are determined under the guidance of the author and scientific consultants. The doctoral student showed a large responsibility, taking a personal part in developing programs and methods of research, designing, and conducting experiments in two regions of wetland agriculture in South-East Kazakhstan in the dissertation. With great interest, he realized the tasks
of research work. He has achieved significant results in solving the tasks set by choosing specific control, accounting, and analysis methods. The author personally participated in experimental studies, mastered the methodology of setting field and production experiments, and methodological requirements for scientific research on the problems of agricultural science. The doctoral student's contribution consists of the task set's theoretical and practical solution, performing experimental studies, conducting observations, calculations, analysis, generalization, and interpretation of the results.

9. Approbation of the work the Materials of the thesis were presented annually at meetings of the Department "Agronomy" of faculty of "Agrobiology" of Kazakh National Agrarian Research University and was discussed at the expanded (combined) meeting of the Department of Agronomy with the participation of prominent scientists (4 Protocols, 25 November 2020).


Recommendations: "Resource-saving technologies for growing peas in the south-east of Kazakhstan" Almaty, 2019. In Scopus, publications in journals from the citation


The dissertation consists of 125 pages. It consists of an introduction, a review of the literature, materials, research methods, the principal results and discussion, a conclusion, and a list of references. The list of references consists of 107 titles. The text of the dissertation is illustrated with 30 tables and 21 figures.