

SUMMARY

of the dissertation work of Bereketova Ainur Malikkyzy on the topic "Formation of safflower crops in the WKO diversified crop production system" submitted for the degree of Doctor of Philosophy (PhD) in the specialty 8D08100 - "Agronomy"

Relevance of the research topic.

Rising temperatures and changing climatic conditions around the world are having a major impact on agriculture, contributing to ecosystems and the benefits they bring to society. Crop and livestock problems are worsening, agricultural land and water resources are being depleted, food security is being damaged. The impacts of climate change are expected to intensify and lead to severe weather fluctuations, more frequent events such as drought, flooding, extreme heat, unpredictable rainfall, situations that threaten food security and make agriculture difficult or even impossible. All this together can lead to global warming and create even more problems due to the release of greenhouse gases from soil into the atmosphere. Already vulnerable ecosystems could be affected, resulting in significant land damage and further compounding food security issues.

At first glance, global warming should positively contribute to the development of agriculture in the northern countries. However, this is also not easy. In addition to warming in regions that were previously too cold to grow wheat, the effects of warming are beginning to be felt even in areas that previously had excellent climatic conditions for agriculture. It is likely that it will become noticeably hotter and the drought will intensify in many areas. On the one hand, in one place agriculture will prosper, while in other places it will lose its productivity. It is very difficult to predict what the end result of such a "global reconstruction of agriculture" will be for different states.

To save humanity and win the fight for survival, urgent action must be taken to deal with both pandemics and climate emergencies. To deal with climate emergencies, post-pandemic recovery plans should take into account long-term systemic changes that change the trajectory of atmospheric CO₂ levels. A "global reconstruction of agriculture" measure must be taken.

The primary and priority task is to make adjustments to the technology for the formation of agrocenoses in connection with climate change in West Kazakhstan.

At the same time, in connection with the diversification of crop production in West Kazakhstan region, along with grain and fodder crops, crops of plastic oilseeds appeared - sunflower, safflower, mustard, which in an ecological context can take full advantage of harsh continental weather and soil and climatic conditions of the region.

Especially in recent years, farmers and producers have begun to increase the yield of safflower, a very drought-resistant and economically profitable crop. In particular, over the past 5 years, the area under safflower crops in the region has grown from 5 thousand to 123.2 thousand hectares. At the same time, due to the incomplete use of bioclimatic resources of the region, the yield of this crop is 5-6 c/ha, and fat content is 25-28%.

In order to further diversify crop production in West Kazakhstan region, it is

important to form high-yielding crops by improving the technology of growing safflower, and the need for scientific research in this direction has also been identified.

The purpose of dissertation research.

Formation of highly productive safflower crops for use in the diversification of crop production in West Kazakhstan region.

Research objectives.

1. To clarify seeding rate of safflower in the conditions of West Kazakhstan region;
2. To study the effect of biological products and bioorganic fertilizers on the yield and oil content of safflower;
3. To study phytomeliorative role of safflower to improve the fertility of dark chestnut soil in the system of organic farming;
4. To give economic assessment of the studied methods.

Research methods.

Scientific research on the dissertation topic was carried out in 2020, 2021, 2022 on the basis of field experiments at Zhangir Khan West Kazakhstan Agrarian Technical University, and field experiments were established on the experimental plot of Daukara farm in Baiterek district, in the dry steppe zone 1 of West Kazakhstan.

Object of study - safflower crops (*Carthamus tinctorius*).

The studies were carried out in field experiments during 2020, 2021, 2022 agricultural years in 3 replications, in the plots placed according to systematic method, with a total area of 60 m², with an accounting area of 50 m².

In the course of the study, the onset of phenological phases of safflower was controlled; organization of accounting for growth and development (height and density of crops) was carried out according to the existing methodology.

Photosynthetic activity of safflower was considered according to the general method.

Infestation of safflower crops was determined by the quantitative-weight method.

Determination of chemical composition of oilseeds of safflower was carried out according to the existing methods in the agrochemical laboratory of Zhangir Khan WKATU.

Determination of economic efficiency of the elements of safflower cultivation technology was carried out by the calculation-normative method based on technological maps.

Statistical processing of the study results was carried out by Dospekhov analysis of variance using computer programs. Statistical plots were performed in the Statistica 6.0 program by regression analysis and ANOVA test.

Agrotechnics: In the experiments, the zoned safflower variety "Akhrum" was used. The soil for sowing safflower is cultivated in the generally accepted system in West Kazakhstan.

In the second field experiment, ammonium nitrate (NH₄NO₃), double superphosphate (Ca(H₂PO₄)₂) at a dose of N₄₀P₄₀ in autumn and N₄₀P₄₀ in spring were used as a mineral fertilizer in the traditional technology. Sowing of safflower was carried out in the 3rd decade of April to a depth of 4-5 cm with a seeder SKP 2.1. In the

2nd and 3rd field experiments, safflower seeds were sown at the rate of 500 thousand viable seeds per 1 ha. During the growing season, no other additional operations for the care of safflower were organized.

In the 1st and 2nd field experiments, safflower harvesting was carried out in the period of full ripening by continuous harvesting by bringing the crop to standard moisture content (10%) and purity (100%).

In the 3rd field experiment, yellow mustard variety “Flagman Sarepty” was used as green manure with a seeding rate of 1.5 million viable seeds per 1 hectare. The depth of sowing seeds is 2-3 cm, the sowing time for safflower is the 3rd decade of April. To study phytomeliorative effect, vegetative green mass of crops of yellow mustard and safflower was planted in the soil with a heavy disc harrow BDT-3.8 during the flowering period.

The indicators of soil fertility were studied: density, structure, nitrate nitrogen content, mobile phosphorus, biological activity. Soil samples were analyzed according to the current methodology in the agrochemical laboratory of Zhangir Khan WKATU.

In the studies, microbiological activity of soil was assessed by the method of D.G. Zvyagintsev.

In the system of biologized farming, microbiological preparations and bioorganic fertilizers offered and available on the market were used for research for the treatment of seed material before sowing and spraying safflower during the growing season.

The main provisions submitted for defense (proven scientific hypotheses and other conclusions that are new knowledge).

- yield and quality of products depending on the seeding rate of safflower in the conditions of West Kazakhstan region;
- productivity and quality of safflower products depending on biological products and bioorganic fertilizers in the conditions of West Kazakhstan region;
- phytomeliorative influence of safflower on the indicators of dark chestnut soil of West Kazakhstan region;
- economic efficiency of safflower cultivation technology elements.

Description of the main results of the study.

In the studies, crops of effective height were formed when sowing safflower at the rate of 500 thousand viable seeds per 1 hectare. The thinning or thickening of crops had a negative impact on biometric indicators of the yield, especially at plant height. In the course of the study, on average, the largest leaf area of 48.68 thousand m²/ha and indicators of photosynthetic capacity of 4.94 million m²/ha were determined when safflower was sown at the rate of 500 thousand pieces of seed germination. In crops with a seeding rate of 500 thousand seeds for harvesting, the number of weeds decreased by 13 compared to the variant with a norm of 400 thousand seeds, the wet weight of weeds decreased by 189.0 g/m² or 27.64%. Also in 2022, during the flowering period of safflower with a seeding rate of 500 thousand seeds per 1 hectare, an absolute moisture reserve in the soil was found at the level of 9.65%. In 2020, the lowest absolute moisture content of 7.86% at a soil depth of 0-100 cm was revealed. According to the results of the studies, the highest yield of safflower oil seeds in West Kazakhstan region was obtained when seeds were sown at the rate of 500 thousand seeds per 1 ha,

i.e. 7.28 c/ha. Moreover, this variant recorded the highest average crude fat content of 29.74%. From an economic point of view, in West Kazakhstan region it is profitable to sow safflower at a rate of 500 thousand seeds per 1 hectare. In general, in this variant, compared with the control, the cost of production was higher by 10,300 tenge per 1 hectare. Despite the cost of 46,658 tenge, this option generated a higher conditional net profit of 8,994 tenge per hectare compared to the control, and the level of profitability increased by 18.22%. Thus, in the conditions of West Kazakhstan region, the sowing of safflower at the rate of 500 thousand seeds per 1 hectare is an economically beneficial agricultural technique.

During the years of research, the combined use of Biodux biological product, Organica S biofungicide and Organit N, Organit P bioorganic fertilizers, when treating safflower seeds and foliar feeding (biologized technology) of plants during the growing season, i.e. in the period of formation of 3-4 pairs of leaves gave high biometric, productive and economic indicators compared to the traditional technology of safflower cultivation (control). In the conditions of 2000-2022, the highest yield (9.47 c/ha) was obtained with the simultaneous use of Biodux biopreparation, Organica S biofungicide and Organit N, Organit P bioorganic fertilizers (biologized technology) by seed dressing and crop treatment during the growing season. On average, over 3 years, the use of traditional technology reduced biological yield of safflower by 2.22 c/ha or 30.62%. As a result of a comparative study over the years of the study (2020-2022), an increase in fat content in safflower seeds with a biologized variant was determined. According to the studies in 2020-2022, the maximum yield of safflower in the variant of biologized technology with the combined use of Biodux biopreparation, Organica S biofungicide and Organit N, Organit P bioorganic fertilizers was 83.05%. This was achieved by combining bioorganic fertilizers with the above preparations during seed treatment and spraying in 3-4 leaf phase during safflower growing season. In this regard, in West Kazakhstan region, the cultivation of safflower using biologized technology is a cost-effective agricultural technique.

Agrochemical analysis data showed that safflower helps to increase the content of nutrient mineral elements in soil. Under the influence of phytomeliorative effect of safflower at a depth of 0-20 cm of dark chestnut soil, the content of nitrate nitrogen increased from 5.06 to 5.35 mg/100 g of soil, or by 5.73%. On average, over 3 years (2020-2022), during the spring-autumn period, the content of mobile phosphorus in the 0-20 cm layer of dark chestnut soil increased from 1.16 to 1.22 mg/100 g, or by 5.17%. Research data showed that safflower crops in 2020-2022 had a positive effect on agrophysical indicators of dark chestnut soils. During the period of phytomelioration, loosening of soil in the soil layer of 0-20 cm by 0.020 g/cm³ was observed. Safflower also increased biological activity of dark chestnut soil. Therefore, to increase the fertility of dark chestnut soils in the organic farming system of West Kazakhstan region, along with black fallow and yellow mustard, an effective measure is the use of safflower plants as a green fertilizer for phytomeliorative purposes.

Substantiation of the novelty and importance of the results obtained.

For the first time, on the basis of research, the rate of effective and optimal sowing of safflower in the conditions of West Kazakhstan region was clarified;

For the first time it was determined that biological preparations and bioorganic fertilizers can be used in the cultivation of safflower in the conditions of West Kazakhstan region;

For the first time, it was found that with the improvement of the indicators of dark brown soil of West Kazakhstan region, it is possible to use safflower as a green fertilizer or phytomeliorant.

The study results were put into production in the conditions of Daukara farm in West Kazakhstan region.

Compliance with the directions of scientific development or state programs.

The dissertation work was carried out within the framework of the grant funding project AP 08855595 “Formation of agrolandscapes of fodder crops and safflower in the system of diversified and biologized crop production in West Kazakhstan”, in accordance with the agreement No. 308 dated November 16, 2020, concluded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan with registration number 0120RK00343. Priority direction of science: "Sustainable development of agro-industrial complex and safety of agricultural products".

Description of post-graduate's contribution to the preparation of each publication.

During the dissertation work, the post-graduate was distinguished by great responsibility and personal contribution to the development of the research program and methodology, establishing and conducting of experiments. She has completed the tasks of research work with great interest. With the correct use of specific methods of observation, accounting, analysis in solving the tasks, the intended results were achieved. The author personally participated in experimental studies, mastered the method of laying field and production experiments, as well as methodological requirements for research on agricultural science. All the results and conclusions presented in the dissertation were obtained and formulated with the direct participation of the applicant in accordance with the research results.

The author actively participated in the discussion and publication of the work results in scientific publications, in the preparation and presentation of abstracts for international scientific and practical conferences. Based on the results of scientific research, 16 scientific papers were published, including 6 articles in scientific publications recommended by the Committee for Control in the Sphere of Education and Science of the Ministry of Science and Higher Education RK, 3 articles in a scientific journal included in the information and abstract fund of the Scopus base, 1 article in the journal of the RSCI base, 5 articles in the collections of international scientific and practical conferences. 1 recommendation for production was prepared.

Scope and structure of the thesis.

The dissertation work consists of 6 chapters containing an introduction, literature review, objects and methods of research, research results, conclusions, recommendations for production, a list of references and applications written in the state language on 151 pages. There are 27 tables, 21 figures in the work. The list of references is 184 items.