ANNOTATION

to the dissertation work of Absatova Botagoz,
submitted for the degree of Doctor of Philosophy (PhD)
in the specialty 6D080100 - "Agronomy",
on the topic:
" Increasing the productivity of old growth alfalfa crops using "green technology" in the conditions of the arid zones of Southern Kazakhstan

Relevance of the research topic

In recent years, the republic has experienced a shortage of alfalfa seed due to disruptions in perennial grass seed production. Therefore, it is important to study methods for increasing the yield of old alfalfa crops, as well as **enhancing grass productivity using "green technologies**." Furthermore, to increase the productivity of old alfalfa crops with reduced plant density, **the vegetation density can be increased by sowing grains, annual forage grasses, legumes, and oilseeds** , which is a pressing issue for ensuring feed for livestock farming.

Green Evolution is a resource dedicated to green technologies in energy efficiency, industry, construction, agriculture, waste management, and other areas. The portal provides up-to-date information on how innovations help preserve nature for future generations: news, articles, blogs, photo reports, and other useful materials.

This concept encompasses environmentally friendly technical solutions aimed at reducing resource consumption and increasing resource efficiency.
Green technologies are closely linked to the global trend of transitioning to a new type of economy—one that is resource-efficient and environmentally friendly. The development and implementation of this field of knowledge makes it possible to create additional jobs, improve quality of life, and reduce risks to human health.
Applications of green technologies range from the construction of passive eco-homes to the production of clean-fuel vehicles. Globally, solutions to combat global climate change and environmental pollution are actively sought. Many UNEP environmental programs are aimed at implementing green technologies, phasing out hazardous industries, and replacing anthropogenic sources of harmful emissions.

Green technologies are principles that make development more sustainable and use resources more efficiently.
The key feature of green technologies is reducing their negative impact on the environment.

Green technologies have two main features:

- firstly, this is in-depth environmental management, including the fight against air and water pollution;

- secondly, the rational use of resources - water, wind and solar energy, reducing the impact on the climate and reducing harmful emissions into the atmosphere.

Such technologies, particularly green technologies, encompass all areas of human life. When integrating objects into space, it's essential to keep the environment in mind. Before creating public art, a number of questions must be answered: What material will be used? How does this material affect the atmosphere and space? How is the environmental impact reduced?

Currently, the development of the agro-industrial complex is based on diversifying the structure of cropped areas with an increased share of forage crops, advancing breeding and seed production, and developing and disseminating new technological methods for their cultivation. These methods are considered the primary means for increasing forage production, improving its quality, and restoring soil fertility. The new state program for the development of the agro-industrial complex for 2017–2021 envisages an increase in the area sown to perennial forage crops to 3.9 million hectares, more than doubling the current level. Achieving this goal requires actively engaging local communities and small and medium-sized farms in grass seeding, as well as providing them with recommendations for growing forage crops, developed taking into account economic and biological characteristics.

1.2. The purpose of the dissertation research

The aim of the study was to increase the productivity of old, sparse alfalfa crops on rainfed sierozem soils in southern Kazakhstan by managing them with light tillage and fertilizers, as well as developing a seed production system for old alfalfa crops. Furthermore, to increase the yield of green forage and dry hay from sparse old alfalfa crops, positive results were obtained using "green" technologies—early spring overseeding of spring barley, Sudan grass, and safflower.

3. The main objectives of the study:

- to study the influence of the agro-technological system of light soil cultivation and the applied mineral fertilizers on the growth, development and structure of crop yields on old alfalfa crops;
- to determine the effect of early spring surface loosening of the soil followed by sowing of spring barley, safflower and Sudan grass into sparse old alfalfa crops on the yield structure of green mass and hay in mixed cultivation;
- to study the effect of surface treatment of the top layer of soil of old alfalfa crops using growth stimulants and micro fertilizers on hay yield;
- to establish the impact of the use of “green” technologies on the yield of green mass and hay in old alfalfa crops;
- to evaluate the economic efficiency of using “green” technologies in the cultivation of old-growth alfalfa on rainfed lands.

4. Research methods

Experimental studies to study agronomic techniques for increasing the yield of green forage, dry hay, and seed from mature (4-5-year-old) alfalfa crops using "green" technologies were conducted on rainfed lands in the Turkestan region, Kazygurt district, and on the fields of Karabau LLC, where the average annual precipitation is 450-500 mm. The experiment was conducted on ordinary gray soils over a total area of 14 hectares, as well as on a 2-hectare plot at the Southwest

Research Institute of Animal Husbandry and Plant Growing, with four replicates. The plot size was 200 m².

The study subjects were the regionalized alfalfa varieties " Krasnovodopad early ripening " and "Krasnovodopad irrigated." The accompanying crops included the spring barley varieties "Baisheshek," safflower "Nurlan," and Sudan grass "Broadleaf."

The experiments involved the use of the growth stimulator "Vympel", which includes polyethylene oxide (PEO) — 770 g/l and salts of extracted humic acids — 30 g/l (foliar feeding).

The micro fertilizer "Oracle Multicomplex" contains: nitrogen — 100 g/l, phosphorus — 6.6 g/l, potassium — 44 g/l, sulfur — 36 g/l, iron — 6 g/l, copper — 8 g/l, zinc — 8 g/l, boron — 6 g/l, manganese — 6 g/l, cobalt — 0.05 g/l, molybdenum — 0.12 g/l. For increased efficiency, foliar feeding is recommended to be carried out in the evening. Combined use with insecticides, fungicides and biological products is permitted; however, their compatibility must be checked before use.

The experiments were accompanied by the following observations and records:

- phenological observations according to the method of M.A. Fedin: timing of regrowth, leaf formation, stem formation, branching, flowering, pollination, fertilization, bud formation and the beginning of ripening;
- taking into account the density of grass after regrowth and before harvesting according to the method of M.A. Fedin;
- study of the linear growth of alfalfa stem height on constantly selected typical plants in each experimental variant;
- determination of the species composition and number of alfalfa pests in the dry lands of Southern Kazakhstan;
- study of crop infestation depending on the agricultural measures carried out using the quantitative-weight method;
- conducting a biological and structural analysis of alfalfa yield and its seed productivity;
- statistical and mathematical processing of data, as well as dispersion analysis of experimental results using the method of B.A. Dospekhov;
- determination of the economic efficiency of the options being studied by calculating the actual labor and monetary costs for all types of work based on the current market prices in the Turkestan region.

5. Main provisions to be defended:

development of a model of an agro-technological system for easy processing of sparse old-growth alfalfa crops with the aim of increasing their seed productivity;

proposal of a scientifically based model for improving the quality of competitive green mass and dry hay of old alfalfa crops using “green” technologies;

determination of the economic efficiency of effective processing of sparse alfalfa crops using fertilizers, growth stimulants and micronutrients.

6. Characteristics of the main results of the study:

1. Research conducted in March revealed the onset of germination of ephemeral, annual, and perennial dicotyledonous, as well as cereal weeds. After applying agronomic management techniques, weed infestation in mature alfalfa crops decreased by 77–94%.

2. At the end of March, isolated cases of the Phytonomus pest were recorded in old alfalfa crops. As a result, in early April (April 3, 2018), the alfalfa crops were treated with the Sharpei insecticide at a dose of 0.25–0.30 l/ha, and in the middle of the second ten-day period of April (April 15, 2020), with the Karate preparation 0.50 EC at a rate of 0.2 l/ha. Taking into account the pest population compared to the initial level, the Phytonomus population decreased by 89–94%, indicating the high biological effectiveness of the insecticides used.

3. In the well-maintained 'Krasnovodopad early ripening ' variety, the number of stems forming from a single root was 15-19, with 3-4 lateral shoots on each stem. In the 'Krasnovodopad irrigated' variety, these indicators varied between 17-21 stems and 4-6 shoots, respectively. In the control variant without treatment, the number of stems per plant was only 2-3, and the degree of branching was 1-3. It should be noted that in the untreated variant, 34 weed species were identified, primarily cereal weeds (wild barley, barnyard grass, couch grass, etc.), as well as annual and perennial dicotyledonous weeds (field sow thistle, pink thistle, field bindweed, wild pea, dyer's fly agaric).

4. When implementing agronomic measures to care for old, sparse alfalfa crops and co-growing them with early-spring sowing of the spring barley variety "Baisheshek," the average green forage yield over three years was 278.8 c/ha, which is 112.9 c/ha higher than the control variant, or 168% more. When co-growing old alfalfa with safflower variety "Nurlan" using "green" technologies, the green forage yield was 248.6 c/ha, which is 82.7 c/ha higher than the control, i.e., the yield increase reached 150% compared to the untreated variant.

7. Justification of the scientific novelty and practical significance of the obtained results

In the rainfed conditions of southern Kazakhstan, research was conducted for the first time to increase seed productivity in sparse, old-growth alfalfa crops using "green" technologies. Additionally, the impact of early spring surface tillage of old alfalfa crops, with under seeding of spring barley, safflower, and Sudan grass, on the yield structure of green fodder and hay was studied. The influence of growth stimulants, micronutrient fertilizers, and light tillage technology on the quantitative and qualitative characteristics of the yield was determined.

8. Connection of the dissertation topic with state programs

This dissertation was completed as part of a research project implemented in 2018–2020 in the agro-industrial complex, code: 8.0880.

The work was carried out under the scientific and technical program **"Creation of highly productive pasture lands in northern and western Kazakhstan and their rational use . "**

9. Characteristics of the doctoral student's contribution to the preparation of each publication

A total of 8 scientific papers have been published, including those based on dissertation materials: in scientific publications recommended by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Higher Education of the Republic of Kazakhstan - 4 articles; in the materials of international scientific and practical conferences - 2, of which 1 - in foreign conferences; in journals included in the Scopus database - 2 articles; 1 recommendation has been prepared for implementation into production.

The following works have been published in publications recommended by the Committee for Quality Assurance in Education and Science of the Ministry of Higher Education of the Republic of Kazakhstan:

"Green technology of forage crop cultivation", international scientific journal "Society, science and creativity", No. 7, Shymkent, 2018, pp. 25–29;

"The Impact of the Application of Green Technologies on the Productivity of Alfalfa on Rainfed Lands of Southern Kazakhstan", scientific journal "Searches, results", Almaty, 2019, pp. 143–149;

"Economic efficiency of agrotechnological methods for caring for alfalfa seed crops on rainfed lands of southern Kazakhstan", multidisciplinary scientific journal "3i: intellect, idea, innovation", No. 4, December 2020, pp. 14–22;

"Productivity of old-growth alfalfa seeds depending on the agricultural technology of care in dryland conditions of southern Kazakhstan", journal "Science and Education", volume III, no. 60, 2020, pp. 3–8;

"Features of growth and development of old-growth alfalfa depending on agrotechnological care methods in the zone of rich dryland agriculture of southern Kazakhstan", journal "Science and Education", volume III, no. 60, 2020, pp. 58–66.

Testing the work

The results of the dissertation research were discussed at a meeting of the Agronomy Department. Furthermore, the main points of the dissertation were presented at international and national scientific conferences, including:

in the collection of scientific articles dedicated to the 30th anniversary of independence of the Republic of Kazakhstan - 1 publication; recommendation for implementation into production - 1; The main provisions of the dissertation were presented at international scientific and practical conferences:

"Alfalfa as a main crop in crop rotation in Kazakhstan", IV international scientific conference *"Global science and innovations 2019: Central Asia"* , volume III, Astana, 2019, pp. 19–23;

"Efficiency of agricultural technology for caring for old-growth alfalfa seed plants in dryland conditions in southern Kazakhstan", CLXXXII International Scientific and Practical Conference *"Young Researcher: Challenges and Prospects"* , No. 35 (182), Moscow, Internauka Publishing House, 2020, pp. 36–39.

10. Structure and scope of the dissertation

The dissertation is 147 pages long and consists of an introduction, four sections, a conclusion, recommendations for further study, a bibliography, and appendices. The work is illustrated with 18 tables and 8 figures. The bibliography includes 138 references.