

Subject name: ИРН АР19674514 «Development of a chisel subsoiler fertilizer for intrasoil variable rate tiered application of mineral fertilizers»

Relevance: The main reason for the low productivity of grain crops in Kazakhstan is the depletion and compaction of soils, the low efficiency of the spreading method of applying fertilizers. The implementation of the technology of intrasoil application of the main dose of fertilizers is hampered by the lack of production of fertilizers.

The proposed project is aimed at solving the problem of decreasing soil fertility, optimal plant nutrition and increasing crop yields.

Goal: of the project is to increase the productivity of agricultural crops by developing a technical tool for deep loosening of the soil with simultaneous variable rate tiered application of mineral fertilizers in the precision farming system, which allows increasing yields by 1.3-1.7 times, saving mineral fertilizers by 25-30% and reduce the agrochemical load on the environment.

Expected results: The main result of the research is an experimental sample of a fertilizer for deep loosening of the soil with simultaneous variable rate tiered application of mineral fertilizers in the precision farming system, which provides intrasoil application of mineral fertilizers at different depths, increases productivity by 1.3-1.7 times, and saves mineral fertilizers by 25 -30% and reduction of the agrochemical load on the environment and the draft terms of reference for the production of its prototype.

According to the results of scientific research carried out within the framework of the project, it is planned:

- publication of at least 2 articles in peer-reviewed scientific journals indexed in the Science Citation Index Expanded Web of Science database and (or) having a CiteScore percentile in the Scopus database of at least 35, as well as at least 1 article in a peer-reviewed foreign or domestic publication recommended by the CCHES;

- obtaining a patent in the Kazakhstan patent bureau;

- development of a draft specification for the production of a prototype.

Scientific Results for 2023:

- the technology of layered differentiated application of the main dose of mineral fertilizers and constructive-technological scheme of chisel subsoiler fertilizer for its realization are substantiated;

- regularities of interaction of working bodies with fertilizers and soil have been established;

- regularities of processes of agitator, dosing and transportation of granulated mineral fertilizers by the crank agitator, studded rollers and fertilizer tubes of the chisel subsoiler fertilizer, allowing to substantiate the limits of their basic design parameters, have been determined.

The expected scientific effect is the mechanical and technological foundations of the technology of deep loosening of the soil and variable rate, intrasoil tiered application of the main dose of mineral fertilizers to different depths.

The implementation of the project will allow generating new knowledge, competitive scientific and technical potential and a scientific team in the field of

differentiated impact of mineral fertilizers and working bodies on the "soil-plant" system.

The expected socio-economic and environmental effect is the technology of variable rate application of the main dose of one type or different types of fertilizers at different depths and a fertilizer for its implementation, providing:

- increase in the yield of grain crops by 1.3-1.7 times;
- saving of mineral fertilizers by 25-30%;
- differentiation of doses of mineral fertilizers - 0-400 kg/ha.

The application of the results of the project will allow:

- exclude the accumulation of fertilizers in the soil and input to wastewater;
- strengthen the economic situation of farmers;
- get a new impetus to agricultural engineering;
- use the result of scientific and technical activity by designers and engineers

for the further development of machines.

Members of the research group:

Project manager – Nukeshev Sayakhat, Doctor of Technical Sciences, Professor. Hirsch Index - Scopus – 4, RSCI – 4

<https://www.scopus.com/authid/detail.uri?authorId=56011320800>,

<https://orcid.org/0000-0003-3525-6228>,

<https://publons.com/researcher/1508767/sayakhat-nukeshev/>

research group:

1. Yeskhozhin Jadyger, d.t.s., professor, principal researcher - Web of Science Hirsch Index - 1, Hirsch index in Scopus - 2, Scopus Author ID: 56009476200, Researcher ID: ABE-6999-2021

2. Akhmetov Erzhan, c.t.s., associate professor, senior researcher - Hirsch index in Scopus – 1, Scopus Author ID: 57194243870

3. Yeskhozhin Kairat, c.t.s., professor, senior researcher - ORCID ID: [0000-0002-7921-9114](https://orcid.org/0000-0002-7921-9114), [Scopus Author ID: 56011003900](https://www.scopus.com/authid/detail.uri?authorId=56011003900), [Scopus Author ID: 57194244175](https://www.scopus.com/authid/detail.uri?authorId=57194244175)

4. Tokushev Masgut, PhD, senior researcher - Scopus Author ID – 57191404007, ORCID ID <https://orcid.org/0000-0002-2555-8081>

5. Mamyrbayeva Indira, Candidate of Physical and Mathematical Sciences, research associate - *h*- index – 1, Scopus Author ID: 57200824327

6. Zhaksylykova Ziyada, PhD, research associate - *h*-index – 1, ORCIDID: [0000-0002-3448-6657](https://orcid.org/0000-0002-3448-6657), Scopus Author ID: 57194185547, Web of Science Researcher ID: ABF-4471-2021

7. Sugirbay Adilet PhD, research associate - *h*- index – 7, Scopus Author ID: 57209004043, Researcher ID: ABD-6659-2021, ORCID ID: [0000-0003-3637-2749](https://orcid.org/0000-0003-3637-2749)

8. Kossatbekova Dinara, master's degree, research associate - Scopus Author ID: 57201701285, ORCID ID: [0000-0002-8909-2225](https://orcid.org/0000-0002-8909-2225), Researcher ID Web of Science – ABT-3140-2022

9. Tanbayev Khozhakeldi, master's degree, research associate - Scopus Author ID: 57967174300, ORCID ID: [0000-0002-6378-3247](https://orcid.org/0000-0002-6378-3247)

10. Tleumbetov Kaldybek, master's degree, research associate - Scopus
Author ID: 58248143300