Brief information about the project

Name of the project: IRN AP09260382 «Production of sweetpotato plants tolerant to abiotic stresses and determination methods for its effective cultivation».

Sweetpotato (*Ipomoea batatas*) grown in over 100 countries around the world. Sweetpotato is considered as a food security crop and staple food in the rural economies of many countries.

Sweetpotato is a heat-loving plant, it takes about 90 warm days to form a tuber. The optimal temperature for growth and development is 24°C. For large-scale cultivation and cost-effective production, even in the southern regions of Kazakhstan, cold tolerant cultivars are required. Nowadays, this agricultural crop among the population in Kazakhstan is practically unknown and is not cultivated on an industrial scale, therefore it is very important to optimize agricultural technology for effective cultivation.

In Kazakhstan, sweetpotato have been studied for the last 5 years at the National Center for Biotechnology of the Republic of Kazakhstan and by the authors of the project (IPBB). Studies have shown that in the southeast of Kazakhstan, this crop gives a good harvest results, but in years with spring frosts, the harvest results is decreasing.

One of the most effective ways to increase plant tolerance simultaneously to several abiotic stress factors is the use of genetic engineering methods to increase the rate of proline biosynthesis and reduce the rate of its biodegradation in plant. Proline is the second osmolytic after carbohydrates in terms of prevalence and content in plant, and there is a positive correlation between the level of its content in plant tissues and their tolerance to abiotic stress factors.

To achieve the goal of the project, namely, obtaining cold-resistant sweetpotato lines, we intend to increase the collection of sweetpotato, select the best varieties in terms of yield and biochemical composition, on their basis, create cisgenic plants resistant to abiotic stresses by suppressing the proline dehydrogenase gene.

Project goal: To select the best sweetpotato cultivars in terms of yield and biochemical composition of tubers and, on their basis, create cisgenic plants resistant to abiotic stress by suppressing the proline dehydrogenase gene and develop scientifically based agrotechnics for the effective cultivation of sweetpotato in the Almaty region of Kazakhstan.

Expected results:

The collection of sweetpotato will be expanded (no less than 35 samples) for field trials and selection of the best varieties for genetic transformation

Genetic construction for suppressing the proline dehydrogenase gene

Scientifically grounded agrotechnology for growing sweetpotato in the Almaty region of Kazakhstan. (Optimization of the timing and density of planting seedlings, covering the ridges with various films and mulch).

The selection of the best collection samples of sweet potatoes in terms of yield and biochemical composition (vitamins, sugar, starch) will be carried out based on the results of growing the first year of field trials

Sweetpotato plants will be obtained carrying a DNA region in the genome encoding dsRNA to the conserved region of the ProDH gene.

Sweet potato plants carrying a DNA region encoding dsRNA to the conserved region of the proline dehydrogenase (ProDH) gene for resistance to cold and drought will be studied

The main hypotheses of the project will be confirmed or refuted.

Project manager:

Temirbaeva Kamshat Askarovna - higher education (specialty Ecology), PhD degree received at Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, scientific work experience of 7 years, h-index-2.

(https://www.scopus.com/authid/detail.uri?authorId=55331576800; https://app.webofknowledge.com/author/record/3844956)

Member in the research group:

Zhapar Kuanysh Kabyluly: bachelor (specialty Biology), master (specialty Biology), doctoral student of KazNAU (specialty Plant Protection and Quarantine), scientific work experience of 7 years corresponds to the profile of the scientific project, h-index 1.
(https://www.scopus.com/authid/detail.uri?authorId=57201671071;
https://app.webofknowledge.com/author/record/13315794).

Zhigalov Andrey Viktorovich: higher education (specialty biology), candidate of biological sciences (specialty molecular biology), 15 years of scientific work experience corresponds to the profile of the scientific project, h-index 2.
(https://www.scopus.com/authid/detail.uri?origin=resultslist&authorId=6508121286&zone=&featureToggles=FEATURE_AUTHOR_DETAILS_BOTOX:1&at_feature_toggle=1),
(https://app.webofknowledge.com/author/record/4848976?lang=ru_RU&SID=E6Z3oWNmLijDjWIAkQB).

Daurov Dias Lamzarovich: bachelor (specialty Biotechnology), master (specialty Biotechnology), scientific work experience of 7 years corresponds to the profile of the scientific project, h-index 1.
(https://www.scopus.com/authid/detail.uri?origin=resultslist&authorId=57201666405&zone=;
https://app.webofknowledge.com/author/record/35819805?lang=ru_RU&SID=F5UIG1R9xCKg1bvOMMo).

Abdrasulova Zhanna Tubekbaevna: higher education (specialty Biology), master's degree (specialty Biology), PhD in biology, scientific work experience of 7 years corresponds to the profile of the scientific project, h-index3.
(https://www.scopus.com/authid/detail.uri?authorId=56128035400;
https://app.webofknowledge.com/author/record/22902874).

Abay Zhandos Sailaubekuly: higher education (specialty Biotechnology), 2 years of scientific work experience corresponds to the profile of the scientific project.

List of publications and patents of the project performers for the period from 2015 to 2020.

1. **Temirbayeva K.,** Zhang M.L., Molecular phylogenetic and biogeographical analysis of *Nitraria* based on nuclear and chloroplast DNA sequences. Plant Systematics and Evolution. 2015. 301 (7): 1897-1906. DOI: 10.1007/s00606-015-1202-5. IF(WoS)-1.3 (2019), Q3, P (Scopus) – 73.

2. Zhang M.L., **Temirbayeva K.,** Sacnderson S.C., Chen X. Young dispersal of xerophil *Nitraria* lineages in intercontinental disjunctions of the Old World. Scientific Reports. 2015. DOI: 10.1038/srep13840. IF(WoS)- 3.99, Q1, P (Scopus) – 93.

1. **Zhigailov,**A.V., Alexandrova,A.M., Nizkorodova,A.S., Stanbekova.G.E., KryldakovR.V., Karpova O.V., PolimbetovaN.S., Halford,N.G., Iskakov,B.K. Evidence That Phosphorylation of the α-Subunit of eIF2 Does Not Essentially Inhibit mRNA Translation in Wheat Germ Cell-Free System. Frontiers in Plant Science, 2020, 11, 936 DOI:1010.3389/fpls.2020.00936 IF – 4,4, Q1, P (Scopus) – 95.

2. Nizkorodova, A., Suvorova, M., **Zhigailov, A**., Iskakov, B. The Effect of Translation Promoting Site (TPS) on Protein Expression in E. coli Cells. Molecular Biotechnology. Volume 62, Issue 6-7, 1 July 2020, Pages 326-334 IF – 2, Q3, P (Scopus) – 54.

3. **Temirbayeva K.,** Zhang M.L., Molecular phylogenetic and biogeographical analysis of *Nitraria* based on nuclear and chloroplast DNA sequences. Plant Systematics and Evolution. 2015. 301 (7): 1897-1906. DOI: 10.1007/s00606-015-1202-5. IF(WoS)-1.3 (2019), Q3, P (Scopus) – 73.

4. Zhang M.L., **Temirbayeva K.,** Sacnderson S.C., Chen X. Young dispersal of xerophil *Nitraria* lineages in intercontinental disjunctions of the Old World. Scientific Reports. 2015. DOI: 10.1038/srep13840. IF(WoS)- 3.99, Q1, P (Scopus) – 93.

5. Zhambakin, K., **Zhapar, K**. Current status and prospects of plant biotechnology in Kazakhstan. Plant Biotechnology Report 14, 177–184 (2020). DOI:10.1007/s11816-020-00601-0 IF-1.259, Q-3, P (Scopus) – 64.

6. **Daurov D., Zhapar K**., Daurova A., Volkov D., Bakbergenova M., Tolegenova D., Shamekova M., Zhambakin K. Production of virus-free sweet potato planting material for the southeast of Kazakhstan. International journal of agriculture and biology 20 (4) : 851-856, 2018. DOI: 10.17957/IJAB/15.0576. IF (WoS) – 0,82, Q-3, P (Scopus) – 56.

7. Daurova Ainash**, Daurov Dias,** Volkov Dmitriy, Aibek Karimov, Zhandos Abai, Daniyar Raimbek, **Kuanish Zhapar,** Kabyl Zhambakin, Malika Shamekova. Mutagenic treatment of microspore-derived embryos of turnip rape (*Brassica rapa*) to increase oleic acid content. Plant Breeding. 2020; 00:1–7. DOI:10.1111/pbr.12830 IF (WoS) – 1.251, Q -3, P (Scopus) – 62.

8. **Daurov, D.,** Daurova, A., Karimov, A. Tolegenova, D., Volkov, D., Raimbek D., Zhambakin K.,Shamekova M. Determining Effective Methods of Obtaining Virus-Free Potato for Cultivation in Kazakhstan. Am.J.PotatoRes. 97, 367–375 (2020). DOI:10.1007/s12230-020-09787-z, IF (WoS) -1.085, Q-3, P (Scopus) – 57.

9. Daurova A, **Daurov D,** Volkov D, **Zhapar K**, Raimbek D, Shamekova M, Zhambakin K. 2020. Doubled haploids of interspecific hybrids between Brassica napus and Brassica rapa for canola production with valuable breeding traits. OCL 27: 45. DOI:10.1051/ocl/2020041; SiteCoreScopus-2.8, P (Scopus) – 70

10. **Daurov D, Zhapar K**, Daurova A, Volkov D**,** Borhan I, Zhambakin K, Shamekova M**.** Isolated meristem culture of sweet potatoes. Research, results 2: 34-42, 2017.

11. **Zhapar K, Daurov D**, Zhambakin K, Shamekova M. Sweet potato's resistance to various stress factors. Science News of Kazakhstan 2(132) : 90 -112, 2017.

12. Daurova A, **Daurov D, Zhapar K,** Volkov D, Zhambakin K, Shamekova M. Production of transgenic sweet potato plants with the dreb1a gene. News of the National Academy of Sciences of the Republic of Kazakhstan, Biological and medical series. 2 (309) : 71-77, 2017.