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**Images on the front cover:** Scientific activity on sugar beet breeding at the Kazakh Research Institute has been conducted for more than 30 years. More than 15 sugar beet hybrids have been developed and approved for use. The production of high-quality seeds of the most popular cultivars is an urgent task. Within the framework of the State Program (AR09057999) "Creation of sugar beet hybrids with genetically identified properties based on molecular breeding and biotechnology for their sustainable introduction into production", the working collection of the sugar beet laboratory on the allocation of valuable raw materials for their involvement in the breeding process and their combinational ability was studied. Various combinations have been proposed for crossing in order to obtain the high heterosis effects. Detailed information about the said research work can be found in the below manuscripts:

Tabynbayeva LK, Bastaubayeva ShO, Yerzhebayeva RS, Konusbekov K, Roik NV (2023). Heterotic effects of sugar beet (*Beta vulgaris* L.) hybrids for root yield and sugar content. *SABRAO J. Breed. Genet.* 55(5): 1476-1485.  
<http://doi.org/10.54910/sabrao2023.55.5.3>.

Amangeldiyeva A, Daniyarova A, Tabynbayeva LK, Bastaubayeva S, Kovalchuk N, Yerzhebayeva R (2023). Assessment of the genetic diversity in sugar beet (*Beta vulgaris* L.) using SSR markers. *SABRAO J. Breed. Genet.* 55(5): 1616-1628. <http://doi.org/10.54910/sabrao2023.55.5.15>.

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<http://doi.org/10.54910/sabralo2023.55.5.1>.

Turaev OS, Baboev SK, Ziyaev ZM, Norbekov JK, Erjigitov DSh, Bakhadirov USh, Tursunmurodova BT, Dolimov AA, Turakulov KhS, Ernazarova DK, Kushanov FN (2023). Present status and future perspectives of wheat (*Triticum aestivum* L.) research in Uzbekistan. *SABRAO J. Breed. Genet.* 55(5): 1463-1475.  
<http://doi.org/10.54910/sabralo2023.55.5.2>.

Tabynbayeva LK, Bastaubayeva ShO, Yerzhebayeva RS, Konusbekov K, Roik NV (2023). Heterotic effects of sugar beet (*Beta vulgaris* L.) hybrids for root yield and sugar content. *SABRAO J. Breed. Genet.* 55(5): 1476-1485.  
<http://doi.org/10.54910/sabralo2023.55.5.3>.

Aipeisova S, Utarbayeva N, Kazkeev E, Agadiyeva M, Berkaliyeva A, Baubekova A, Alzhanova B, Kaisagaliyeva G (2023). Species diversity and structure of the saxicolous floral complex in the Aktobe floristic district. *SABRAO J. Breed. Genet.* 55(5): 1486-1495. <http://doi.org/10.54910/sabralo2023.55.5.4>.

Areche FO, Gondal AH, Sumarriva-Bustinza LA, Zela-Payi NO, Sumarriva-Hustinza IM, Oscanoa-León RH, Calcina-Sotelo AF, Anguilar MCTTD, Lopez ERA, Julcahuanga-Dominguez IA, Flores DDC, Huayapa MAC, Donayre EMF, Rodriguez AR, Cruz ZLDL, Huaman CWT, Gamarra FBL (2023). Role of biotechnology in food security: A review. *SABRAO J. Breed. Genet.* 55(5): 1496-1509. <http://doi.org/10.54910/sabralo2023.55.5.5>.

- Djabbarov I, Sobirov F, Bozorov T, Turakulov K, Baboev S (2023). *Aegilops* L. genetic diversity in Southwestern Region of Uzbekistan. *SABRAO J. Breed. Genet.* 55(5): 1510-1525. <http://doi.org/10.54910/sabrawo2023.55.5.6>.
- Hasan SA, Abdullah RM, Hanoon MB, Sahi MK (2023). Genetic and path coefficient analyses of quality-related traits of oat (*Avena sativa* L.) with potassium application. *SABRAO J. Breed. Genet.* 55(5): 1526-1535. <http://doi.org/10.54910/sabrawo2023.55.5.7>.
- Mulyaningsih ES, Devi AF, Anggraheni YGD, Paradisa YB, Priadi D, Indrayani S, Sulistyowati Y, Perdani AY, Nuro F, Adi EBM, Deswina P (2023). Physicochemical properties and eating quality of promising crossbred upland rice lines developed from superior parental genotypes. *SABRAO J. Breed. Genet.* 55(5): 1536-1546. <http://doi.org/10.54910/sabrawo2023.55.5.8>.
- Al-Khayri JM, El-Malky MM (2023). Genetic parameters and principal component analysis for quantitative traits in rice (*Oryza sativa* L.). *SABRAO J. Breed. Genet.* 55(5): 1547-1560. <http://doi.org/10.54910/sabrawo2023.55.5.9>.
- Narimonov A, Azimov A, Yakubjanova N, Shavkiev J (2023). Scientific basis of cotton seed germination in the Central Region of Uzbekistan. *SABRAO J. Breed. Genet.* 55(5): 1561-1572. <http://doi.org/10.54910/sabrawo2023.55.5.10>.
- Elec VH, Cadorna CAE, Rey JD (2023). *In silico* mining and validation of simple sequence repeat (SSR) markers derived from the *Fragaria x ananassa* genome assembly. *SABRAO J. Breed. Genet.* 55(5): 1573-1586. <http://doi.org/10.54910/sabrawo2023.55.5.11>.
- Alanbari AK, Al-Hadeethi MA, Al-Shami SS, Salman T (2023). Palynological diversity of pollen morphology in endemic Northern Iraqi *Hypericum* species (Hypericaceae). *SABRAO J. Breed. Genet.* 55(5): 1587-1592. <http://doi.org/10.54910/sabrawo2023.55.5.12>.
- Turganbayev NO, Sydik DA, Kenenbayev SB, Sydykov MA, Kazybayeva AT (2023). Optimization of winter wheat nutrition with zero tillage technology in the rainfed zones of Southern Kazakhstan. *SABRAO J. Breed. Genet.* 55(5): 1593-1603. <http://doi.org/10.54910/sabrawo2023.55.5.13>.
- Khan F, Iqbal M, Mohibullah M, Aamir SS, Jatoi SA (2023). Flowering annuals production behavior against diverse nutritional management. *SABRAO J. Breed. Genet.* 55(5): 1604-1615. <http://doi.org/10.54910/sabrawo2023.55.5.14>.
- Amangeldiyeva A, Daniyarova A, Tabynbayeva LK, Bastaubayeva S, Kovalchuk N, Yerzhebayeva R (2023). Assessment of the genetic diversity in sugar beet (*Beta vulgaris* L.) using SSR markers. *SABRAO J. Breed. Genet.* 55(5): 1616-1628. <http://doi.org/10.54910/sabrawo2023.55.5.15>.
- Rohaeni WR, Trikoesoemaningtyas, Susanto U, Ghulamahdi M, Suwarno WB, Aswidinnoor H (2023). Phytic acid content in biofortified rice lines and its association with micronutrient content and grain yield of rice. *SABRAO J. Breed. Genet.* 55(5): 1629-1640. <http://doi.org/10.54910/sabrawo2023.55.5.16>.

Nieto DDC, Areche FO, Chirre ETC, Menacho JUR, Tantaleán HEC, Bartolomé HJC, Sumarriva-Bustinza LA, Zela-Payi NO, De-Aguilar MCTT, Camposano-Cordova AI, Mallma NES, Solano MAQ, FLORES DDC, Mamani RAA, Cajavilca HLV (2023). Use of cytokinins and composting to improve the agronomic and physiological traits of Caigua (*Cyclanthera pedata* L.). *SABRAO J. Breed. Genet.* 55(5): 1641-1653. <http://doi.org/10.54910/sabrawo2023.55.5.17>.

El-Nwehy SS, Afify RRM (2023). Utilization of gibberellic acid (GA3) and mepiquat chloride (M.C) as growth regulators on maize to alleviate salinity stress. *SABRAO J. Breed. Genet.* 55(5): 1654-1665. <http://doi.org/10.54910/sabrawo2023.55.5.18>.

Sharadhi GP, Avinashe H, Dubey N, Danalakoti K, Ghosh S, Sachan S, Choudhary S (2023). Correlation and path analyses in f<sub>4</sub> segregating populations of bread wheat for grain yield and its attributes. *SABRAO J. Breed. Genet.* 55(5): 1666-1677. <http://doi.org/10.54910/sabrawo2023.55.5.19>.

Zhapayev RK, Kunypiyaeva GT, Mustafaev FM, Bekzhanov SZh, Nurgaliev AK (2023). Comparative assessment of pearl millet genotypes under arid conditions of Southeast Kazakhstan. *SABRAO J. Breed. Genet.* 55(5): 1678-1689. <http://doi.org/10.54910/sabrawo2023.55.5.20>.

Osman A, Sitohy M, Mohsen FS, Abbas E (2023). Effectiveness of 7s globulin against *Botrytis cinerea* causing gray mold in strawberry. *SABRAO J. Breed. Genet.* 55(5): 1690-1702. <http://doi.org/10.54910/sabrawo2023.55.5.21>.

Jasmi, Afrillah M, Nasution A (2023). Effect of refugia plants on whitefly population and red chili (*Capsicum annuum* L.) production. *SABRAO J. Breed. Genet.* 55(5): 1703-1712. <http://doi.org/10.54910/sabrawo2023.55.5.22>.

Ghazaryan MH (2023). Chemical control of *Helicoverpa armigera* and *Spodoptera exigua* and its effects on the qualitative indicators of peppers. *SABRAO J. Breed. Genet.* 55(5): 1713-1718. <http://doi.org/10.54910/sabrawo2023.55.5.23>.

Aisakulova KR, Slyamova ND, Ustemirova AM, Seisenova AA, Kazybayeva SZh, Skak S, Matai Zh (2023). Organic fertilizer's role in the improvement of soil microflora and biometric values in fruit crops. *SABRAO J. Breed. Genet.* 55(5): 1719-1728. <http://doi.org/10.54910/sabrawo2023.55.5.24>.

Osman A, Sitohy M, Mohsen FS, Abbas E (2023). Green biochemical protection of postharvest table grapes against gray mold (*Botrytis cinerea*) using 7s proteins. *SABRAO J. Breed. Genet.* 55(5): 1729-1742. <http://doi.org/10.54910/sabrawo2023.55.5.25>.

Altynbek TO, Esenbekova PA, Zhaxybayev MB, Batyrova KI, Kulzhanova DK (2023). The fauna of aquatic hemiptera (*Heteroptera*) in charyn nature park. *SABRAO J. Breed. Genet.* 55(5): 1743-1753. <http://doi.org/10.54910/sabrawo2023.55.5.26>.

Sukwiwat K, Kumchai J, Bundithya W, Potapohn N (2023). Apetaloid and petaloid female performance on horticultural characteristics of F<sub>1</sub> American marigold (*Tagetes erecta* L.) hybrids. *SABRAO J. Breed. Genet.* 55(5): 1754-1767. <http://doi.org/10.54910/sabrawo2023.55.5.27>.

- Dukenov Z, Rakhimzhanov A, Akhmetov R, Dosmanbetov D, Abayeva K, Borissova Y, Rakymbekov Z, Bekturbanov A, Malenko A, Shashkin A, Trushin M (2023). Reforestation potential of tugai forests in the floodplains of Syr Darya and Ili Rivers in the territory of Kazakhstan. *SABRAO J. Breed. Genet.* 55(5): 1768-1777. <http://doi.org/10.54910/sabralo2023.55.5.28>.
- Novita A, Siregar LAM, Rosmayati, Rahmawati N (2023). Vetiver (*Vetiveria zizanioides* L.) ecotypes assessment for salinity tolerance. *SABRAO J. Breed. Genet.* 55(5): 1778-1788. <http://doi.org/10.54910/sabralo2023.55.5.29>.
- Al-Naggar AMM, Abd El-Salam RM, Hassan AIA, El-Moghazi MMA, Ahmed AA (2023). Salinity tolerance of quinoa (*Chenopodium quinoa* willd.) genotypes to elevated NaCl concentrations at germination and seedling stages. *SABRAO J. Breed. Genet.* 55(5): 1789-1802. <http://doi.org/10.54910/sabralo2023.55.5.30>.
- Gusev VN, Bastaubayeva ShO, Tabynbayeva LK, Zhusupbekov EK, Musagodzhaev NT (2023). Mineral fertilizers impact on sugar beet productivity in Southeast Kazakhstan. *SABRAO J. Breed. Genet.* 55(5): 1803-1811. <http://doi.org/10.54910/sabralo2023.55.5.31>.
- Ramazanova SB, Kenenbaev SB, Gusev VN, Baymakanova GSh (2023). Nitrogen fertilizers role in grain crops productivity in South-East Kazakhstan. *SABRAO J. Breed. Genet.* 55(5): 1812-1820. <http://doi.org/10.54910/sabralo2023.55.5.32>.
- Zhapayev RK, Kunypiyaeva GT, Ospanbayev Zh, Sembayeva AS, Ibash ND, Mustafaev MG, Khidirov AE (2023). Structural-aggregate composition and soil water resistance based on tillage regimes in Southeast Kazakhstan. *SABRAO J. Breed. Genet.* 55(5): 1821-1830. <http://doi.org/10.54910/sabralo2023.55.5.33>.
- Zhapayev RK, Kunypiyaeva GT, Mustafaev MG, Doszhanova AS, Isabay BT, Maybasova AS, Kydyrov AK, Omarova ASh (2023). Different tillage regimes' effect on soil-water physical and agrochemical properties under the environmental conditions of Southeast Kazakhstan. *SABRAO J. Breed. Genet.* 55(5): 1831-1842. <http://doi.org/10.54910/sabralo2023.55.5.34>.
- Al-Naggar AMM, Shabana MRA, Hassanein MS, Metwally AMA (2023). Effects of elevated plant density and reduced nitrogen on agronomic and yield attributes of maize inbred lines and their diallel crosses. *SABRAO J. Breed. Genet.* 55(5): 1843-1854. <http://doi.org/10.54910/sabralo2023.55.5.35>.
- Kudaibergenova I, Kalashnikov A, Balgabaev N, Zharkov V, Angold E (2023). Effect of drip irrigation with foliar dressing of mineral fertilizer Kristalon and their impact on maize grain yield in Southern Kazakhstan. *SABRAO J. Breed. Genet.* 55(5): 1855-1864. <http://doi.org/10.54910/sabralo2023.55.5.36>.

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