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EDITORIAL

Plant biotechnological tools: Solutions for raising climate-resilient crop plants

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Abstract

Global food security is strongly governed by crop production. Climate change-stimulated environmental stresses significantly impact crop productivity globally. Thus, to cope with the climate changes, modern biotechnological tools-mediated studies are still required to identify novel players that can improve the morphological, physiological, biochemical, cellular, and molecular processes, which can ultimately help in developing stress-resilient (single or combined) future plants to achieve a "zero hunger" goal.

Keywords: Abiotic stress, biotechnology, CRISPR/Cas system, crop improvement, food security, genomics interventions, multi-omics, speed breeding

Introduction

Climate change is the main limiting factor for agricultural production, which constantly affects crop production worldwide (Del Buono 2021). Climate change mainly gives rise to numerous environmental stresses, including both abiotic (high salinity, drought, waterlogging, heat, cold, heavy metals, etc.) and biotic (virus, fungi, bacteria, nematodes, etc.) (Del Buono 2021). These stresses significantly reduce crop productivity by hampering physio-biochemical and molecular mechanisms, and develop challenges for food security worldwide (Molotoks et al. 2021). Consequently, there is an urgent prerequisite to combine the expertise of all disciplines of crop sciences with revolutionary attempts in crop production to sustain crop growth and thus enhance crop production. It is vital for summarizing adapting mechanisms of plants as that could be augmented employing genetic improvement of cultivars that can somewhat adapt to the altering environmental cues. In this scenario, modern plant biotechnological tools [(genome editing, transgenic breeding, multi-omics (genomics, transcriptomics, proteomics, metabolomics, miRNAomics, ionomics, phenomics), epigenetic modifications, etc.)] are expected to play a vital role, with a clear mandate for innovative developments that can accelerate the rate of genetic progress required to meet the challenge for more food sustainability. During the last few years, several scientists have reviewed the attempts made in developing stress-resilient plants, e.g., temperature (Raza et al. 2021a; Bhardwaj et al. 2021); heavy metals (Jamla et al. 2021; Raza et al. 2021c); drought (Bhardwaj et al. 2021); salinity (Singhal et al. 2021); etc., using state-of-the-art biotechnological tools. Additionally, various advances count on continual breeding (conventional, speed breeding, fast-forward breeding, etc.), chemical treatments (including different plant growth regulators such as phytohormones and gaseous molecules), and/or amendment of stress-associated genetic makeup have been introduced to feed the growing population. Likewise, different breeding techniques such as speed breeding (Watson et al. 2018); and fast-forward breeding (Varshney et al. 2021) has been introduced for a food-secure world. The potential of different plant growth regulators has also been reviewed by various scientists globally (Raza et al. 2021b; Mubarik et al. 2021; Kosakivska et al. 2021; Sabagh et al. 2021). In conclusion, to cope with the climate changes, modern biotechnological tools-mediated researches are still required to identify novel players that can improve the morphological, physiological, biochemical, cellular, and molecular processes, which can ultimately help in developing stress-resilient (single or combined) future plants to achieve a "zero hunger" goal. Therefore, we (Modern Phytomorphology Editors) are anticipated to receive valuable works dealing with crop production in the era of climate change.

References

Bhardwaj A., Devi P., Chaudhary S., Rani A., Jha U.C., Kumar S., Bindumadhava H., Prasad P.V., Sharma K.D., Siddique K.H., Nayyar H. (2021). 'Omics' approaches in developing combined drought and heat tolerance in food crops. *Plant Cell Rep* pp: 1-41. https://doi.org/10.1007/s00299-021-02742-0

Del Buono D. (2021). Can biostimulants be used to mitigate the effect of anthropogenic climate change on agriculture? It is time to respond. *Sci Total Environ* **751:** 141763. https://doi.org/10.1016/j.scitotenv.2020.141763

Sabagh A.E., Mbarki S., Hossain A., Iqbal M.A., Islam M.S., Raza A., Llanes A., Reginato M., Rahman M.A., Mahboob W., Singhal R.K., Kumari A., Rajendran K., Wasaya A., Javed T., Shabbir R., Rahim J., Barutçular C., Habib Ur Rahman M., Raza M.A., Ratnasekera D., Konuskan Ö.l., Hossain M.A., Meena V.S., Ahmed S., Ahmad Z., Mubeen M., Singh K., Skalicky M., Brestic M., Sytar O., Karademir E., Karademir C., Erman M., Farooq M. (2021). Potential role of plant growth regulators in administering crucial processes against abiotic stresses. *Front Agron* **3:** 648694. https://doi.org/10.3389/fagro.2021.648694

Jamla M., Khare T., Joshi S., Patil S., Penna S., Kumar V. (2021). Omics approaches for understanding heavy metal responses and tolerance in plants. *Curr Plant Biol* **27:** 100213. https://doi.org/10.1016/j.cpb.2021.100213

Kosakivska I.V., Vedenicheva N.P., Babenko L.M., Voytenko L.V., Romanenko K.O., Vasyuk V.A. (2021). Exogenous phytohormones in the regulation of growth and development of cereals under abiotic stresses. *Mol Biol Rep* pp:1-12. https://doi.org/10.1007/s11033-021-06802-2

Molotoks A., Smith P., Dawson T.P. (2021). Impacts of land use, population, and climate change on global food security. *Food Energy Security* **10:** e261. https://doi.org/10.1002/fes3.261

Mubarik, M.S., Khan S.H., Sajjad M., Raza A., Hafeez M.B., Yasmeen T., Rizwan M., Ali S., Arif M.S. (2021). A manipulative interplay between positive and negative regulators of phytohormones: A way forward for improving drought tolerance in plants. *Physiologia Plantarum* **172:** 1269-1290. https://doi.org/10.1111/ppl.13325

Raza A., Tabassum J., Kudapa H., Varshney R.K. (2021a). Can omics deliver temperature resilient ready-to-grow crops?. *Crit Rev Biotechnol* **41:** 1209-1232. https://doi.org/10.1080/07388551.2021.1898332

Raza A., Tabassum J., Mubarik M.S., Anwar S., Zahra N., Sharif Y., Hafeez M.B., Zhang C., Corpas F.J., Chen H. (2021b). Hydrogen sulfide: an emerging component against abiotic stress in plants. *Plant Biol*. https://doi.org/10.1111/plb.13368

Raza A., Tabassum J., Zahid Z., Charagh S., Bashir S., Barmukh R., Ahmad Khan R.S., Barbosa Jr F., Zhang C., Chen H. (2021c). Advances in 'omics' approaches for improving toxic metals/metalloids tolerance in plants. *Front Plant Sci* pp:2949.

Singhal R.K., Saha D., Skalicky M., Mishra U.N., Chauhan J., Behera L.P., Lenka D., Chand S., Kumar V., Dey P., El Sabagh A. (2021). Crucial cell signaling compounds crosstalk and integrative multi-omics techniques for salinity stress tolerance in plants. *Front Plant Sci* **12:** 670369. https://doi.org/10.3389/fpls.2021.670369

Varshney R.K., Bohra A., Roorkiwal M., Barmukh R., Cowling W.A., Chitikineni A., Lam H.M., Hickey L.T., Croser J.S., Bayer P.E., Siddique K.H. (2021). Fast-forward breeding for a food-secure world. *Trends in Genetics* **37:** 1124-1136. https://doi.org/10.1016/j.tig.2021.08.002

Watson A., Ghosh S., Williams M.J., Cuddy W.S., Simmonds J., Rey M.D., Hatta MA, Hinchliffe A., Steed A., Reynolds D., Hickey L.T. (2018). Speed breeding is a powerful tool to accelerate crop research and breeding. *Nature Plants* **4:** 23-29. https://doi.org/10.1038/s41477-017-0083-8