Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

Asian Journal of Plant Science and Research, 2022, 12(12)

ISSN : 2249-7412
CODEN (USA): AJPSKY

Growth Stimulation through Agricultural Biotechnology for Crop Improvement and Plant Protection

Kevin Brent*

Department of Plant Biology, University of Nottingham, Loughborough, UK

***Corresponding author:** Kevin Brent, Department of Plant Biology, University of Nottingham, Loughborough, UK, E-mail: Brent_K@Ne.Uk

Received date: November 21, 2022, Manuscript No. AJPSKY-22-15678; **Editor assigned date:** November 23, 2022, PreQC No. AJPSKY-22-15678 (PQ); **Reviewed date:** December 05, 2022, QC No. AJPSKY-22-15678; **Revised date:** December 14, 2022, Manuscript No. AJPSKY-22-15678 (R); **Published date:** December 21, 2022, DOI: 10.36648/2249-7412.12.12.035

Citation: Brent K (2022) Growth Stimulation through Agricultural Biotechnology for Crop Improvement and Plant Protection. Asian J Plant Sci Res Vol.12 No.12:035

Description

Plant-based research will be one of the main forces driving the growth of the bio-based economy and ensuring food security in the coming years. The availability of agricultural and physical resources, crop management, resource efficiency, quality, and the chosen crop's intrinsic yield potential all play a role in crop productivity. The intrinsic yield potential is the focus of this review because maximizing the plant's potential to produce food and energy will require an understanding of its determinants and their biological basis. A variety of intricate traits that combine strictly regulated processes and their underlying gene regulatory networks determine yield potential. Numerous potential targets that could be used to boost crop yield have been identified as a result of this inherent complexity. These include a variety of cellular, organ and canopy-level metabolic and physical processes. We go over a few of the biological processes that are thought to be important for determining yield and could be used to increase crop productivity in the future.

Crop Yield Potential

In addition to the increased demand for food and animal feed, there will also be an increase in pressure from competing uses for agricultural products, such as making it possible to switch from an economy based on fossil fuels to one based on biofuels and limiting global climate change through sustainable energy supplies. In addition, in order to increase biodiversity by restoring agricultural land to its natural state, crop production will need to be increased while maintaining the same land area-or even decreasing it. Climate change, including changes in temperature and precipitation, as well as an increase in the frequency of extreme weather events, all of which lower yield stability, will, however, pose challenges to crop production. Climate change has been estimated to have reduced agricultural productivity by 21% since 1961.

In this review, we provide an overview of the key biological processes that underpin crop yield potential. These processes have the potential to contribute to the future proofing of our current crops and could be further exploited to increase crop productivity and ensure food security in the future. More specifically, we discuss a subset of plant characteristics and their genetic basis that influence yield potential. These characteristics include leaf longevity, nutrient partitioning and remobilization, seed filling, and the growth and development of plant organs. To go even further, crop yield potential is the yield that can be achieved in the absence of input, disease, or poor growing conditions. In these circumstances, yield potential can be closely linked to the partitioning of acquired resources and the conversion of radiation into dry matter. This is the foundation for our selection of sub-traits. For each of these areas, perspectives for the future are presented.

Development of Plant Organs

Net photosynthesis cumulatively over the growing season is the primary determinant of crop biomass production, in which the process by which plants use light energy to transform carbon dioxide (CO_2) and water (H_2O) into oxygen (O_2) and carbohydrates is referred to as photosynthesis. The plant uses the produced carbohydrates for growth and development. In addition, carbohydrates support all aspects of plant metabolism because they provide precursors for a variety of diverse molecules, such as hormones, lipids, and amino acids. Despite its significance, photosynthesis' "real world" efficiency is significantly lower than its theoretical maximum in agriculture, with current C3 and C4 crops converting only 2% and 3% of the sunlight's energy into biomass when grown in favorable conditions, respectively. Experiments using Free-Air CO_2 Enrichment (FACE) have shown that increasing photosynthetic performance may result in increased crop yields. A further photoprotective mechanism is activated to quench this excited energy in conditions where chlorophyll is excited state lifetimes rise because PSII photochemistry is constrained by relatively slow electron transport. This protective mechanism prevents ROS from forming in the first place by lowering the pressure on blocked PSII reaction centers and limiting the lifetime increase in chlorophyll. Protonation of the protein PsbS and deep oxidation of the xanthophyll pigment violaxanthin to zeaxanthin are involved in this process's activation, driving rearrangements within PSII's antenna systems that result in the loss of excitation energy as heat. A process known as non-photochemical quenching. While most research on photosynthesis has focused on CO_2 uptake rates under steady-state light conditions, it is becoming increasingly clear that improving photosynthesis requires knowing how productivity is affected by dynamic environmental changes. The response of plants in field settings and the light environment must be fully characterized for future research efforts. It is still unclear how dynamic photosynthesis processes in the field are quantitatively influenced by variation in light conditions, including the speed and magnitude of changes in intensity and spectral quality, and how this might apply to various crop architectures. At the cellular and canopy scales, there are new opportunities to improve electron transport rates and processes for harvesting light. The distribution of photosynthetic activity can be influenced by enhanced light penetration as a result of leaf angle or movement, despite the fact that canopy light interception is generally not considered to be a major limitation to crop yield. To further improve the distribution of light transmission, future strategies for optimizing light use efficiency through electron transport processes ought to be combined with modifications to canopy architecture. We must also emphasize that increasing crops' photosynthesis rate without simultaneously improving nutrient uptake and utilization efficiency is unlikely to increase yield. Providing sufficient solvent water and nutrients like nitrogen (N) and phosphorus (P), which are essential components of key cell compounds and, particularly for nitrogen, one of the primary drivers of leaf growth and the absorption of solar energy, could lead to significant increases in crop biomass.

By directly altering genes that direct the processes of carbohydrate accumulation in source and sink organs, crop productivity can be increased by directing C allocation toward harvestable plant organs like stems, tubers, roots, reproductive organs, and seeds. Post-flowering nitrogen uptake from the soil during seed formation and the remobilization of organic nitrogen from senescing vegetative tissues can both contribute to the filling of seeds with nitrogen. Because N remobilization is largely responsible for the protein content of seed storage. Because maintaining the photosynthetic apparatus is detrimental to N remobilization toward developing seeds, frequently selected-for-stay-green phenotypes are not always associated with higher yields.