

GLOSSARY OF TERMS

Once drought or other abiotic stress is visible in the field, it is easy to explain and discuss. However, abiotic stress begins to affect plant tissue long before it is visible. Understanding how is much easier with a clear understanding of the terms that are used. Here is a glossary of terms common to the discussion.



Abiotic stress - Any environmental factor that negatively affects a plant, such as temperature, light, water and soil conditions (acidity, alkalinity, minerals, toxins, etc.) Abiotic stress is suspected of reducing potential crop yields by as much as 60%.

Biotic stress - Living factors such as pathogens, insects, animals and weeds. Biotic stress generally causes a fraction of the loss of productivity caused by abiotic stress.

Elicitor pathways - Receptor proteins in a cell membrane activated by a stress respond by activating other proteins, creating a cascade effect that eventually reaches the nucleus of the cell, where gene transcription takes place. Different stresses activate different receptors.

Signaling Pathways - Transmission and often amplification of a biochemical change, whether due to elicitor binding or other cellular inputs or perturbations. May result in an influence on gene transcription or a direct biochemical impact on stress coping or other defense systems in the plant. May also influence the utilization of nutrients or hormonal interactions within the plant, as well as other physiological systems (i.e. photoperiod, etc.)

Gene transcription - The process where a segment of the cell's DNA is copied into RNA by an enzyme called RNA polymerase. These are the operating instructions for cell functions and can be affected by stress caused signals.

Free radicals - Light energy absorbed by chloroplasts in the plant or in cell mitochondria creates oxygen molecules with two unpaired electrons, known collectively as Reactive Oxygen Species. Can also result from mitochondrial electron transport.

Reactive Oxygen Species (ROS) - Molecules containing oxygen with two unpaired electrons and forming superoxide anions, peroxides (hydrogen peroxide) or hydroxyl radicals. When produced as part of normal plant functioning, they are broken down to use in plant growth and development, to protect the cell or in intercellular and intracellular signaling. When produced in excess, ROS can damage cell membranes and macromolecules such as lipids, proteins and nucleic acids essential for plant life, damaging plant cells and leading to plant death.

Genetic response - Protein signals caused by stress can alter gene transcription and affect normal cell functioning, such as producing chlorophyll, enzymes or hormones needed for plant growth and development. These changes can be short term or permanent.

Dicarboxylic acids - Organic compounds that inhibit one or more redox enzymes, which in turn activate or deactivate various plant enzymes and systems, more than 450 enzymes in all.

Redox enzymes - Enzymes that sense the chemical status of plant cells and regulate other proteins and enzymes within the plant.

ROX - Oxidative response triggered in plants by stress.

Cell membranes - Rigid membrane of cellulose fiber that surrounds a plant cell, gives it support and bonds with other cell walls to form a structure.

Mitochondria - Structures that convert nutrients into energy rich molecules called adenosine triphosphate (ATP) through a biochemical process known as cellular respiration.

Chloroplasts - Subunits in plant cells that use chlorophyll to capture energy from sunlight, store it as ATP and in the process free oxygen from water and convert CO₂ to carbohydrates. They also synthesize amino acids, fatty acids and lipid components in their membranes and reduce nitrite to ammonia, essential to incorporating nitrogen into organic compounds.

Endoplasmic reticulum - Network of membranes where proteins and membrane lipids are synthesized and exported.

Cytosol - Intracellular fluid within the cell membrane that plays a role in osmosis regulation (osmoregulation) and cell signaling.

Osmosis - Movement of fluids through a semi-permeable membrane to equalize pressure on both sides of the membrane.