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5. Crop Physiology and Crop Production

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Abstract:

The physiological processes and the environmental conditions affect growth and productivity of crops. Yield is a complex trait. Analysis of yield in terms of the underlying processes provides a mechanism to explain the variability in crop growth and yield. Crop production is the sustainable methods, to meet the growing requirement for food and nutrition among the population of the world, while also fighting against the risk of climate change due to global warming. Crop Physiology and Crop Production are very closely related to each other. This chapter describes the crop production methods, physiology and functioning of the plants. In crop physiology the current challenges are Climate Change, efficient water and nutrient use, Lack of new crop land and Soil biology. Due to these challenges demands for food, Fiber, and energy production continue to rise in all over the world. We must find those plants or crops that can help meet these demands.

Keywords: *Crop growth, crop physiology, crop production, climate change, growth hormones*

5.1 Introduction:

A plant community that grows together in a specific area and for a specific purpose is called a product. Plant physiologists are trying to understand why some plants are more productive and produce more crops per acre. By growing the crops that are most efficient in terms of water, nutrients and solar energy, we can get more good food from those crops.

Plants make life on earth possible because they convert solar energy into chemical energy that we can use. This process is called photosynthesis. We all rely on plants for food, fiber, medicine and many natural remedies. Plant physiologists collect different information about the processes that control growth, development of seeds, and production of useful plants. Crop Production Physiology provides a comprehensive overview of cutting-edge research and information on crop physiology, all in one place, at your fingertips. This useful book provides soil and crop professionals with comprehensive and in-depth information to maximize crop yields worldwide.

Crop physiology is needed to understand the growth and development of crop yields. Provide a scientific basis for improving crop yields by understanding physiological parameters such as seed germination, seedling growth, crop production, vegetative growth and development, flowering, seed and fruit production, growth, plant hormones, nutritional physiology, and stress physiology. The crops are bearing fruit. Crop physiology studies these conditions to provide better solutions.

A The Importance of Plant Physiology in Crop Production:

Knowledge of physiological processes such as seed germination, growth and development, photosynthesis, water uptake and minerals, sap rise, solute translocation, transpiration, light respiration, respiration, photoperiod, vernalization, flowering, fruit ripening, plant senescence and death provide a rich experience and help increase crop yields.

This knowledge will help develop some advances in agriculture, horticulture, forestry, plant pathology and other botanical disciplines. The study of plant physiology has been and will be useful for crop improvement and crop planning. The physiological environment of the material or genotype must be taken into account in the creation of new crops and plant varieties.

Managing soil fertility through physiological plants that are known to remove more salt from the soil and help increase crop yields. Understanding the metabolic processes of plants can help improve the photosynthetic conversion of solar energy to produce food for human consumption. A simple knowledge of nitrogen fixation will help improve the use of atmospheric nitrogen by different plant species. Many cultural techniques have been developed in the last few years to shorten the life cycle of many plant species, make it easier to grow plants from seeds with reduced endosperm, and understand the formation of cell walls and mineral absorption from plants.

Complete knowledge of plant hormones, their synthesis and types of performance greatly helps in their application in the management of poor water quality and control of crops and growth. Reduce the incidence of weeds in field crops by using hormonal herbicides. The use of growth hormones such as auxins, cyclosporin, gibberellins, phenols and fatty alcohols increased the yield. The rules of flowering, fruiting and seed formation are controlled by the application of different growth hormones at the appropriate time in the plants' cycle. In recent years, most breeding programs also seek help from plant physiologists. Physiological processes play an important role in the interaction between plants and animals. People change the physiological characteristics of plants by changing the environment, knowingly or unknowingly. Rapid urbanization, industrial development and excessive land use have led to environmental changes. These changes had a significant impact on flora and fauna.

B. Importance of Crop Physiology in Agriculture:

Crop Physiology in Agriculture is important because it examines the whole plant and its communities, soil science, plant physiology, botany, etc. Examines information in various fields such as. Crop physiology is the process and function of crops in response to environmental changes and the development of cellular, subcellular and whole plants.

One of the most important results of plant physiology is the elucidation of the subtle mechanisms that regulate energy metabolism in green plants. Photosynthesis and respiration are seen as two effects of nutrient and energy metabolism performing the same function and finally "increasing plant economy".

5.2 Current Challenges in Crop Physiology:

A. Climate Change:

Our staple crops are still affected by climate change. We understand many aspects of this process and have been breeding more drought-tolerant plants for decades.

But the weather has changed. Weather patterns are more variable. At the same time, the demand for food, fiber and energy production continues to increase. Crop scientists need to find plants that can help meet these needs.

B. Water and nutrient efficiency:

Our primary crop uses 250 to 530 gallons of water for every two pounds of grain produced. (This is the equivalent of about 20 washing machine loads of water!) By understanding how plants use water, we can create better plants. Plants also obtain most of their nutrients from the soil. How their roots interact with the soil environment may be key to creating plants that use nutrients more efficiently.

C. No New Farmers:

As population increases, the amount of land available for growing or growing crops decreases. We need to use the agricultural lands we have. By growing crops that make the most of water, nutrients, and solar energy, we can harvest a profitable crop.

D. Soil biology:

Soil microbes can help plants get nutrients, help defend against diseases, and even create growth-promoting compounds. The knowledge of plant interactions with favorable soil microorganisms is very limited. Studying how this happens may lead to discovering crop plants that work more closely with the microbes in the soil. This can reduce the level of fertilizers and pesticides farmers need to apply while still increasing yields.

E. Management strategies for physiological crop production:

- Ideal plant architecture
- Maximizing root systems
- Ideal yield components
- Maximizing photosynthesis
- Maximizing source-sink relationship
- Sequestration of carbon dioxide

- Reducing the effects of drought
- Improving N, P, K, Ca, Mg, and S nutrition
- Improving micronutrient uptake

E. Ideal Plant Architecture:

Canopy structure is important for understanding plant processes because its structure has a significant impact on the plant's interaction with the environment. Plant models not only influence the exchange of mass and energy between plants and their environment, but can also reveal strategies to prevent long-term processes such as chemical or biological changes occurring in the body by factors that affect the body's survival. activity or growth and development. Plant morphological research is generally positive, a long-established fact. Unfortunately, the geometric properties of a tree, plant, or trunk are difficult to describe quantitatively because canopies vary over space and time.

The growth and development of a branch leads to the growth of the tree and the tree structure. The upper part of the tree, depending on size, consists of the apical meristem, leaves, bud units, or nodes (structures containing a ball of lateral appendages, usually a leaf, and the axils and proximal internodes of the lateral appendages). Extend the growing season and canopy area. The main difference between the tree is in the tropics, where the climate is stable and diverse, the forest area is large, and the environment has changed little over thousands of years.

F. Maximizing the Root System:

Crop growth is important for plant survival. Both primary roots and secondary roots can be produced. The root cap is located at the tip of the root to protect the growing cells. There are three areas under the root cap that play a role in root development, including areas of cell division, growth, and development. Weaver, 1926 reported that the importance of roots to productivity has been recognized for almost a century. As we all know, roots are the fulcrum of the plant, meaning it absorbs the water and nutrients it needs to survive and grow. In recent years, the application of modern technology has revealed the genetics of cotton roots and the role of root markers in influencing the overall growth and development of plants.

G. Ideal Yield Components:

Yield components depend on the number of plants, such as tillers per acre, beans per head, and are generally more important to crop decisions. Each component becomes most environmentally friendly over time. These times correspond to stages of development where a piece's ability is determined and then realized. For example, the number of plants in an area is affected by seeding rate, germination rate, and seedling survival rate. Seedbed conditions, temperature, moisture content, contact between soil and seeds, etc. affects germination and seedling survival rate. The evidence was determined at the time of decision and the growth and development of the plant was predicted. The most important growth events occur at branch tips, and it may take time to use the outer growth stages. All animals follow this growth pattern, but the rate and timing of growth events may differ.

H. Maximizing Photosynthesis:

Long et al., (2006) show that photosynthesis is the main factor in crop yield and the efficiency with which crops capture light and convert it into biomass throughout the growing season is important for crops. The final yield, whether biomass or grain. The maximum yield obtained from the crop is called yield potential and can be defined as the maximum yield obtained if the most suitable crop is grown under optimal conditions, without biotic or abiotic stress (Evans and Fischer, 1999). Potential product concepts include light availability, light capture, energy conversion and facility architecture. Long et al., 2006 and Zhu et al., 2010 found that only one of the four factors by which major crops such as wheat, rice, and corn fall below the maximum value is energy conversion, which is determined by: Photosynthetic efficiency. However, the efficiency of converting energy into biomass products has not been fully investigated because in some cases up to 50% of carbon monoxide goes to photorespiration.

I. Maximizing the Resource-Homeland Relationship:

Plant resources are responsible for synthesizing the carbohydrates or sugars necessary for plant growth. Stores in plants use sugar for immediate use and store the rest for future metabolic needs. Leaves serve as surfaces when photosynthesis occurs.

For seeds, yield is the result of surface and sink utilization of photoassimilates and nutrients during seed formation. Photoassimilate density is determined by the net photosynthetic rate and the rate of remobilization of photoassimilate from tissues. This review focuses on the current understanding of crop-sink relationships that influence crop growth rate, crop robustness, and food quality. We present the limitations of current methods for accurate sink measurements and highlight differences in the relationship between photosynthesis and yield in different environments. We demonstrate the possibility of using sink material to increase yield and highlight the importance of flexibility in yield and nutritional quality for cropping strategies.

J. CO2 Sequestration:

When plants photosynthesize to produce their food, they remove carbon dioxide from the air and produce the oxygen we need to breathe. Thanks to this chemical process, carbon is retained in the soil. Carbon monoxide is essential to life on Earth, supporting biological activity, biodiversity, and ecosystem productivity. While humans and animals excrete carbon dioxide (CO2), plants absorb carbon dioxide and release oxygen, returning carbon to the soil when they die. It is generally accepted that until the late 1880s the carbon cycle remained more or less in balance.

K. Managing for carbon sequestration:

When it comes to managing soil organic matter and carbon sequestration, there is no single practice that will improve soil performance, nor is there a set of practices that always work. The aim is to improve soil organic matter and soil activity in agricultural lands, pastures and forests.

Best practices include some known ideas and some unknown ideas. Greater use of residual cover crops and rotations, such as oats and hay, increases plant biomass and stores more carbon in the soil. Less soil degradation means less erosion. Some best practices include planting high biomass and cover crops, residue management (cover tillage, no-till, strip tillage), crop protection and rotational grazing.

L. Reducing the Impact of Drought:

More crops are needed to meet future population growth, but drought has caused crop losses in water rains and crop fields. Severe droughts can reduce crop yields because less water and moisture is available for crops to grow. Therefore, by reducing the impact of drought, we obtain more products in the field of agriculture. Improve the nutrition of nitrogen, phosphorus, potassium, calcium, magnesium and sulfur, which are necessary or beneficial for plant growth and development. Carbon (C), hydrogen (H) and oxygen (O) are obtained from air and water. Plants require different amounts of macronutrients: nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg) and sulfur (S). Like all living things, plants need nutrients to grow and develop. In order for plants to properly utilize nutrients, there must be sufficient light, heat and water. Planting and pest and disease management also play an important role in crop production. Each plant is unique and has optimum levels of nutrients and nutrients. Below this minimum, plants begin to show signs of nutrient deficiency. Excessive absorption of nutrients can also cause poor growth due to toxicity. Therefore, correct application and release of food is important. (J.A. Siva 2000)

M. Increases the Absorption of Micronutrients:

These are boron (B), chloride (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), Nickel (Ni) and zinc (Zn). Micronutrients are important for plant growth because plants need a balance of all essential nutrients for growth and well-being. Micronutrients or micronutrients are important for plant growth and development, but their requirements in plant systems are very low. Such as Fe, Cu, Cl, Mn, B, Ni, Zn, Mo. The accumulation of these elements in plants generally follows the order Mn > Fe > Zn > B > Cu > Mo. The growth and development of plants depends on the composition and content of minerals in the soil. Because of their relative weakness, plants often face significant problems in obtaining sufficient nutrients to meet the needs of important cellular processes.

Nutrient intake is the amount of all nutrients a crop needs to complete its life cycle at a given level of yield. Nutrient removal is calculated by multiplying the concentration of each nutrient in the harvest. Micronutrients are important for plant nutrition because they affect the growth, development and quality of all crops. The function of micronutrients in plants is studied, including absorption, transport and accumulation, as well as interactions and guidance with other nutrients.

N. Measuring the Growth of Crops:

For the growth of crops, all dry work needs to be done from one area to another. High dry matter yield is associated with ideal page index and net absorption rate. (CGR = NAR × LAI) This concept of good tree management forms the basis of pruning garden plants such

as mango. Other crops, including soybeans, corn, cotton, wheat and tobacco, can all benefit from improved production and management. Extension programmers in this field focus on topics such as economics, pest management, permaculture practices, threats to the environment and public health, species, laws, and values to which growers and organizations relate. Production of food and fiber crops is the aim of this agriculture. Many farmers around the world use this information to better manage their crops. This method requires a good understanding of all nutritional areas that need to be monitored and cultivated. This unique field of research allows us to farm more efficiently and effectively to increase food production through better crop production and management.

List of the key variables affecting crop production:

- **Preparing the soil.**
- **Sowing seeds.**
- **Irrigation.**
- **Usage of manure, fertilizer, and pesticides.**
- **Harvesting crops.**
- **Storage of crops.**

Since the goal of plant physiology is to explain and predict the relationship between traits or traits and the environment, plant physiology can establish relationships between phenotypic traits and plant production.

This research is important in terms of understanding and making inferences about the mechanisms and working processes of different organizations. Breeders question initial ideas of the ideal type because of its competitiveness and apparent simplicity.

5.3 Summary:

The scientific basis for the effective care and effective use of these conditions is provided by an understanding of the physiological processes involved. Seed germination, seedling growth, sowing, vegetative growth, flowering, fruit set and seed set, crop maturation, plant hormones, nutritional physiology, stress (biotic/abiotic) physiology and others. Plant physiology forms the basis of crop improvement as we are interested in plant health and the economic output from these conditions. Crop physiology studies these conditions to develop better crop management methods.

Cutting, picking, or taking crops are examples of harvesting. The process begins when the crops grow and turn golden or brown. The time of year, the type of crop, the crop to be grown, and the season are often the variables that determine the harvest. In India, Baisakhi, Bihu, Holi, Pongal etc. The festivals are celebrated during the harvest season.

There are two types of harvesting used specifically in agriculture: hand harvesting and machine harvesting. The process of writing a book takes more time and is labor intensive. Farmers often use sickles and machetes to harvest ripe crops. Mechanical harvesting involves harvesting ripe crops using tools such as lawnmowers and is a good example of modern agricultural equipment.

5.4 Conclusion:

The study of crop physiology is crucial for disease control and growth of other crops. Physiological state. It helps increase crop yield and food quality. Physiological mechanisms of growth and development are increasingly used to improve the quality and quantity of crops. This view also leads to the survival and/or further growth of the desired plant.

This view also leads to the survival and/or further growth of the desired plant. Fertilizer management and water quality management have made the best use of limited resources. As the population increases, the need for the production of various food products also increases. As agriculture and agricultural products become commercialized, the role of plant health professionals continues to grow. With the commercialization of agriculture and agricultural products, the role of plant physiologists has increased.

The environment in which the products grow and the yield of the products are controlled by genetic diversity and the interaction of genetic diversity. Crop physiological processes can control growth, including climate and culture. So, the physiological process of the plant is the process in which genes and environment work together to create the quantity and quality of growth or phenotype.

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