International Journal of Psychosocial Rehabilitation, Vol. 23, Issue 1, 2019
ISSN: 1475-7192

Environmental Factors Affecting the Crops' Growth and Development: An Analytical Study

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Abstract

Environmental elements have a vital role to play in the cultivation and maturation of crops. It is essential to comprehend these factors to augment crop output and eminence. A detailed analysis has been conducted to investigate the effects of distinct environmental components on crop growth and development. These factors encompass temperature, illumination, water, soil, and atmospheric gases. Temperature influences the rate of photosynthesis and respiration, which, in turn, impact crop growth and development. Illumination is a prerequisite for photosynthesis and influences the physical structure, growth, and yield of plants. Water supply is a crucial factor in the growth of plants, and soil conditions can impact the nutrition of plants and the development of roots. Atmospheric gases, such as carbon dioxide, nitrogen, and oxygen, impact the physiology and growth of plants. Environmental factors can also give rise to abiotic pressures like drought, inundation, and salinity, which may restrict crop output and quality. Familiarity with the implications of environmental elements on crop growth and development can facilitate farmers in optimizing crop production and augmenting yield and quality while curbing environmental degradation.

Keyword: Environmental Factors, Crops, Atmospherics, Soil Conditions, Crop's Growth and Development.

Introduction

The proliferation of the global populace is occurring at an unprecedented pace, which subsequently increases the necessity for sustenance. Agriculture represents one of the principals means of food production, and the request for crops is incessantly escalating. However, the cultivation of crops is a complex undertaking.

There are multiple ecological factors affect crop growth and development, which ultimately impacts the yield and quality of crops. Thus, apprehending the consequences of these ecological factors is pivotal in optimizing crop production, augmenting yield and quality, and reducing environmental repercussions. Environmental factors encompass a variety of components, such as ambient temperature, luminescence, aqua, ground, and gaseous elements found in the atmosphere. These elements play a pivotal part in the advancement and maturation of agricultural produce. The rate of photosynthesis and respiration, which ultimately affects crop progress and development, is influenced by the temperature. Photosynthesis necessitates light, and the plant's morphology, maturation, and yield hinge on this element. H20 is an indispensable prerequisite for flora maturation, and its accessibility influences crop quality and yield. Figure 1 shows the important factors that affect the crop productivity (Kami, Lorrain, Hornitschek, & Fankhauser, 2010).

Figure 1 "Factors Affecting Soil Ecosystem and Agricultural Productivity"

Source: www.researchgate.net

Soil characteristics influence the flora's nourishment and root development, which, in turn, have an impact on crop growth and yield. The plant's physiology and growth are affected by atmospheric gases such as carbon dioxide, nitrogen, and oxygen. Environmental factors can elicit abiotic stresses such as drought, flooding, and salinity, impeding crop yield and quality.

The repercussions of these stresses can be substantial economic losses and food insecurity. For instance, drought alone can result in a fifty percent reduction in crop yield. Thus, comprehending the effects of environmental factors and their management is a critical concern for both farmers and researchers. Researchers have been investigating the impacts of temperature, light, water, soil, and atmospheric gases on crop growth and development for several decades. Numerous studies have explored the effects of these environmental factors on plant physiology, biochemistry, and genetics. Nonetheless, there remains a plethora of information yet to be discovered and understood about these factors, which researchers continue to scrutinize (Hatfield & Prueger, 2015).

This analytical examination endeavours to scrutinize the ramifications of environmental components on the progression and advancement of crops. The inquiry will envelop an assortment of components that sway crop development and advancement, for instance, temperature, illumination, aqueous Ness, earth, and atmospheric fumes. The scrutiny will provide an overview of the consequences of these components on the physiology and expansion of vegetation, as well as their impact on the quality and amount of crop yield. The study will also investigate how these environmental components can contribute to the prevalence of abiotic strains, such as drought, inundation, and salinity, which can limit crop yield and quality. The discoveries of this analytical study will have a notable implication for agriculturists and researchers alike. Acquaintance with the aftermaths of environmental components on crop growth and development can aid farmers in optimizing crop production and enhancing yield and quality while reducing environmental impact. The study will also furnish insights into the mechanisms underlying the consequences of these environmental components on the physiology and growth of vegetation, which can aid researchers in developing innovative strategies to regulate crop growth and advancement. Ultimately, the examination aspires to contribute to the sustainable production of crops and the security of food.

Literature review

The production of agricultural goods is a crucial contributor to the sustenance of the human population, and its efficacy and output are contingent upon numerous environmental factors that influence the cultivation and maturation of crops. Yang et al., (2018) in particular, the climatic factors hold the greatest sway as they determine the prolonged patterns of the

environmental circumstances in a specific area. The growth and development of crops are subject to an array of environmental factors, comprising temperature, precipitation, humidity, sunlight, wind, and soil dampness. These factors are intricately interrelated with the climate, which describes the long-standing course of weather conditions in a given location.Light is a fundamental ecological constituent that impacts the proliferation and maturation of vegetation. It is a crucial source of vitality for flora, and its caliber and quantum possess a pivotal function in plant evolvement. Illumination governs several vegetal processes, including photosynthesis, photomorphogenesis, and photoperiodism. Hence, comprehending the involvement of illumination in vegetation proliferation and maturation is indispensable in refining vegetation production. Photosynthesis, the phenomenon through which plants synthesize sustenance in the presence of luminosity, is a crucial process vital for their proliferation and maturation.

Kendrick & Kronenberg, (2012) found that the magnitude and duration of photosynthesis are influenced by the luminosity's spectrum, strength, and persistence, thereby necessitating the optimal supply of light in terms of both quality and quantity for optimal plant development. Photomorphogenesis pertains to the alterations in the growth and maturation of flora in reaction to light exposure. This encompasses modifications in the external appearance, inner workings, and chemical processes of the plant. The characteristics and quantity of the light source determine the degree and direction of these changes. For instance, blue light advances the elongation of the stem, while red light triggers the blossoming of the plant. Photoperiodism, on the other hand, concerns the response of plants to the changes in the duration of the day and night cycle. It plays an essential role in regulating the growth stages of the plant, particularly the emergence of flowers and fruits. The ideal quantity and quality of light are essential in initiating and sustaining the flowering process of the plant. Moisture provision serves as a pivotal environmental determinant that substantially influences the proliferation and maturation of crops.

Bengtsson-Palme, Kristiansson, & Larsson, (2018) revealed that the presence of water holds utmost significance in the context of plant growth as it constitutes a prerequisite for the photosynthetic process, which is essentially indispensable for the generation of carbohydrates, the cardinal fuel source for the flora. Plants necessitate varying quantities of water depending on an array of factors, including crop species, climate conditions, and soil type. Inadequate hydration provision may lead to impeded growth, drooping, and even mortality of the flora. In

contrast, an overabundance of water can engender waterlogging, which impedes root expansion and inhibits the plant's capacity to absorb nutrients.

Harmer, (2009) found that watering plants is a nuanced process that demands careful consideration of timing and frequency. To ensure that the plant effectively absorbs water, it is recommended to water during the early morning or late evening. Superficial and recurrent watering can yield shallow roots, rendering the plant vulnerable to drought. In contrast, sporadic and profound watering prompts root growth to extend deeply, which bolsters the plant's ability to withstand arid conditions. Radiant energy, also acknowledged as solar radiation, is a paramount environmental component that bears upon the growth and maturation of crops.

Fageria, Baligar, & Jones, (2010) found that Vegetation harnesses this form of energy to engage in photosynthesis, a sophisticated mechanism by which the energy of the sun is transmuted into chemical energy, which the plant then utilizes to germinate, multiply, and execute other vital life-sustaining operations. Radiant energy can have both affirmative and negative impacts on the growth and development of crops. On one hand, it is indispensable for plants to obtain an adequate amount of sunlight to conduct photosynthesis and yield wholesome, robust crops. However, excessive sunlight can be detrimental and lead to harm to the crops, such as sunburn or heat-induced strain.

Gouda, Kerry, Das, Paramithiotis, Shin, & Patra, (2018) found that the potency and persistence of sunlight have a pivotal function in the cultivation and maturation of crops. For instance, crops that are nurtured in areas with feeble light intensity may not obtain an adequate amount of vigor to efficiently perform photosynthesis, which can result in underdeveloped crops and inferior harvests. Conversely, crops that are raised in areas with towering light intensity may undergo prompt development, although this could also necessitate additional water and nutrients to sustain their growth and progression. The arrangement of the atmosphere is a crucial environmental element that has a notable influence on the cultivation and maturation of crops. A medley of gases, such as nitrogen, oxygen, carbon dioxide, and water vapor, are the components that form the atmospheric composition. These gases execute a significant function in the growth and development of crops. Carbon dioxide plays a fundamental part in photosynthesis, the mechanism by which plants manufacture food.

Alloway, (2009) found that plants assimilate carbon dioxide from the atmosphere and metamorphose it into carbohydrates, which they consume for energy and expansion. The concentration of carbon dioxide in the atmosphere plays a pivotal role in plant growth and yield. Higher carbon dioxide concentrations can trigger accelerated growth and yield, while lower concentrations can result in attenuated growth and yield. Oxygen plays a crucial role in the growth and development of plants. The respiration process in plants, where carbohydrates are converted into energy, is heavily reliant on oxygen. The deficiency of oxygen can lead to root damage and stifle the growth of plants. Furthermore, water vapor, an important gas present in the atmosphere, has a significant impact on the growth and development of crops. Sánchez, Rasmussen, & Porter, (2014) revealed that the level of humidity in the atmosphere, which is affected by water vapor, can influence the rate at which plants transpire. Transpiration, which is the loss of water through the leaves of plants, can occur at an accelerated pace in extremely arid conditions, thereby subjecting plants to water stress. Nitrogen constitutes a pivotal nutrient in the growth and maturation of flora. Its indispensable presence in amino acids, the elemental components of proteins, underlies its significance. Furthermore, nitrogen is an integral component of chlorophyll production, a vital process for photosynthesis. The proliferation of crops and its yield are subject to the availability of nitrogen in the atmosphere.

Hatfield & Prueger, (2015) found that crops are susceptible to a range of environmental factors that can either bolster or hinder their growth and development. While some environmental factors such as adequate sunlight, water, and essential nutrients like nitrogen and phosphorus can help facilitate growth, the absence of inhibiting substances like pests, diseases, and pollutants is equally vital. One key factor that significantly impacts the growth and development of crops is the quality of the soil. Soil quality, determined by its texture, nutrient content, and acidity level, plays a significant role in providing the necessary nutrients for plant growth. Figure 2 presents the various factors pertaining to soil quality that affect the plant’s growth and development.

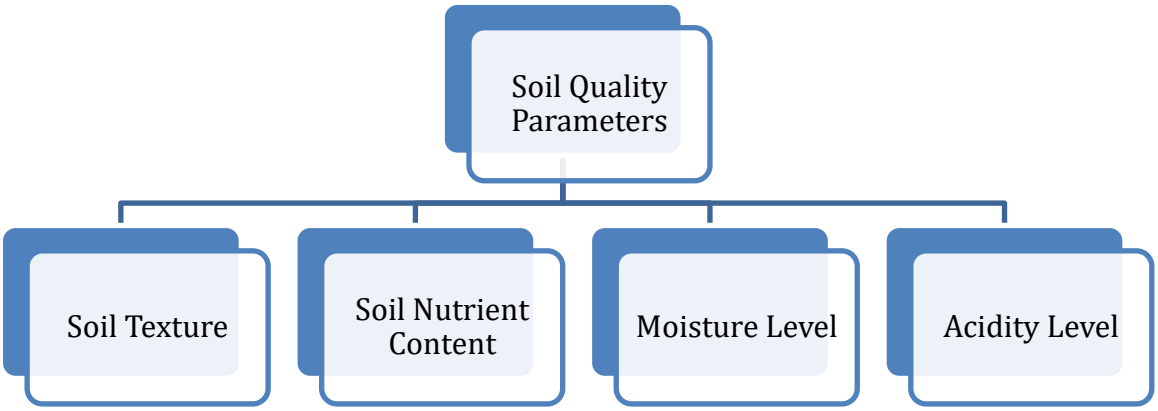

Figure 2 Soil Quality Parameters

Soil that is overly acidic or alkaline can impede nutrient uptake, while nutrient-poor soil can cause stunted growth or even death. In addition, soil that is contaminated with pollutants or heavy metals can cause irreversible damage to crops and render them unfit for consumption. Other environmental factors, such as air quality, sunlight exposure, and humidity, can also affect crop growth and development. Air pollution can stunt plant growth and decrease crop yields, while lack of sunlight can cause yellowing and slowed growth. Humidity can also impact crop growth, as overly humid conditions can encourage the growth of fungi and other pathogens that can harm plants.

Conclusion

This analysis accentuates the momentous function that environmental factors perform in molding the proliferation and maturation of crops. The scrutiny has manifested that the interplays among determinants such as temperature, water availability, soil caliber, and luminosity intensity can exert a profound influence on the crop's yield, eminence, and nutritive worth. Comprehending these interrelationships is indispensable for ecologically sound agriculture and safeguarding food security for an expanding worldwide populace. By adopting adaptable and resilient agricultural methodologies, farmers can aid in alleviating the consequences of climate change and contributing to a more sustainable future.

References

1. Kami, C., Lorrain, S., Hornitschek, P., & Fankhauser, C. (2010). Light-regulated plant growth and development. *Current topics in developmental biology*, *91*, 29-66.

2. Hatfield, J. L., & Prueger, J. H. (2015). Temperature extremes: Effect on plant growth and development. *Weather and climate extremes*, *10*, 4-10.
3. Yang, L., Wen, K. S., Ruan, X., Zhao, Y. X., Wei, F., & Wang, Q. (2018). Response of plant secondary metabolites to environmental factors. *Molecules*, *23*(4), 762.
4. Kendrick, R. E., & Kronenberg, G. H. (Eds.). (2012). *Photomorphogenesis in plants*. Springer Science & Business Media.
5. Bengtsson-Palme, J., Kristiansson, E., & Larsson, D. J. (2018). Environmental factors influencing the development and spread of antibiotic resistance. *FEMS microbiology reviews*, *42*(1), fux053.
6. Harmer, S. L. (2009). The circadian system in higher plants. *Annual review of plant biology*, *60*, 357-377.
7. Fageria, N. K., Baligar, V. C., & Jones, C. A. (2010). *Growth and mineral nutrition of field crops*. CRC press.
8. Gouda, S., Kerry, R. G., Das, G., Paramithiotis, S., Shin, H. S., & Patra, J. K. (2018). Revitalization of plant growth promoting rhizobacteria for sustainable development in agriculture. *Microbiological research*, *206*, 131-140.
9. Alloway, B. J. (2009). Soil factors associated with zinc deficiency in crops and humans. *Environmental geochemistry and health*, *31*(5), 537-548.
10. Sánchez, B., Rasmussen, A., & Porter, J. R. (2014). Temperatures and the growth and development of maize and rice: a review. *Global change biology*, *20*(2), 408-417.
11. Hatfield, J. L., & Prueger, J. H. (2015). Temperature extremes: Effect on plant growth and development. *Weather and climate extremes*, *10*, 4-10.
12. Machado, R. M. A., & Serralheiro, R. P. (2017). Soil salinity: effect on vegetable crop growth. Management practices to prevent and mitigate soil salinization. *Horticulturae*, *3*(2), 30.