ISSN: 2348-1927

Opinion

Annals of Biological Sciences
2021, 9 (12):62-63

# Gas Exchanges in Silage Maize Leaves Depending on fore crop and Maize Development Stage

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***Received Date:** December 04, 2021; **Accepted Date:** December 18, 2021, **Published Date:** December 24, 2021*

## ABSTRACT

*In a sustainable farming system, crop rotation is an important factor limiting maize productivity. A field trial was carried out to investigate:(i) Whether cultivating silage maize in a short (2-year) crop rotation in succession after a grassland (grassland-maize), winter triticale (winter triticale-maize), or maize (maize-maize) will affect the course of the photosynthetic process; (ii) whether these processes will be determined by the stage of maize development; and (iii) whether there is a relationship between gas exchange parameters, foliage The research was carried out between 2017 and 2018 at the following stages (BBCH): stem elongation and flowering. Gas exchange parameters, foliage development characteristics, and maize yield were all evaluated. It was demonstrated that photosynthesis of maize grown after grassland was more efficient than photosynthesis of triticale and maize grown after grassland (higher stomatal conductance, transpiration rate, intercellular CO2 concentration, and lower temperature). Growing maize after grassland resulted in more favourable foliage characteristics (leaf area, leaf area index, chlorophyll content) and translated into a higher yield volume than growing triticale and maize. The results confirmed grassland's beneficial role as a forecrop for maize when compared to growing maize after winter triticale and after maize.*

**Keywords:** Adult hippocampal neurogenesis; Allan-Herndon-Dudley Syndrome; Mct8; Oatp1c1; thyroid hormone; Slc16a2; Slco1c1.

## INTRODUCTION

Maize ranks first in the world in terms of sown area and yield. The development of new (hybrid) cultivars tolerant of lower temperatures allowed the maize cultivation range to be expanded to include countries with colder climate zones. The area under maize cultivation in Poland has increased significantly over the last decade (from 628,000 ha in 2011 to 1,257,000 ha in 2019). Approximately half of this area is dedicated to grain production, while the other half is dedicated to the production of whole-crop silage. Maize is an extremely important and energy-dense food source for humans (grain) and animal feed (both grains and biomass). Maize is increasingly being used to produce biofuels and biogas due to its high yield of carbohydrate-rich biomass.

Photosynthesis is a critical process that influences plant growth, biomass, and productivity. Plant photosynthetic capacity is determined by environmental factors, crop production techniques used, plant species and characteristics, and growth stage. Solar radiation intensity, atmospheric air quality, temperature, water availability, atmospheric CO2 concentration, soil fertility, and relative humidity are the main abiotic environmental factors that influence this process. Endogenous factors, such as those related to plant anatomy and morphology (particularly the leaves), structure, and physiological and biochemical properties, also aid in the efficient course of photosynthesis. More stomatal conductance, combined with improved leaf parameters (more chlorophyll, N, mesophyll weight, and thickness), allows more light to be captured and converted into chemical energy. Stomatal conductance (gs) and net assimilation (A), as well as these parameters and leaf characteristics, were found to have a strong positive relationship (chlorophyll and nitrogen contents, palisade parenchyma content, thickness, etc.). The higher A is attributed to the leaves' greater volume weight, higher chlorophyll content, palisade parenchyma content, and thicker leaves. Under adverse conditions, stomata close, protecting the plant from water loss while reducing absorption of light and carbon from the atmosphere, lowering the net assimilation rate. In such cases, the plant reduces transpiration (by closing the stomata) and manages water more efficiently to maintain turgor pressure. The net assimilation rate varies throughout the growing season of the plant. An increases in the plants as they grow, reaching a peak at flowering. However, total plant dry matter productivity is determined not only by light capture and utilization in the photosynthetic process, but also by plant respiration.

The course of the photosynthetic process is also determined by crop production techniques used, as it affects soil environment fertility, which affects plant growth and foliage. Crop rotation is one of the crop production technique factors that influence the volume of produced plant biomass.

Yield falls in monoculture and short rotation cycles owing to loss of soil quality. This inhibits root growth as well as water and nutrient intake. Crop rotation (even if it is just for a short time) enhances root function and increases root area and activity. All plants other than maize (e.g., monocotyledon or dicotyledon plants) utilized as a forecrop can outperform maize grown after maize in terms of yield. The literature also reports on this plant's relatively strong tolerance to the seeding of the same crop after itself, particularly under conditions of more plentiful N fertilisation.

The current research posits the concept that changing the environmental parameters of a forecrop would impact leaf growth and architecture, as well as plant physiology (gas exchange), resulting in a change in yield volume. The current study is one of the first to look at the effect of a forecrop on plant physiological leaf properties. It was believed that growing maize after multi-species grassland would benefit both photosynthesis and yield, but growing it in succession after winter triticale and after maize would have a limiting influence on this process.