Adaptive Strategies of Maize in Leaf Traits to N Deficiency

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Abstract : Nitrogen (N) utilization for crop production under N deficiency conditions is subject to a trade-off between maintaining specific leaf N content (SLN), important for radiation-use efficiency (RUE), versus maintaining leaf area (LA) development, important for light capture. This paper aims to explore how maize deals with this trade-off through responses in SLN, LA and their underlying traits during the vegetative and reproductive growth stages. In a ten-year N fertilization trial in Jilin province, Northeast China, three N fertilizer levels have been maintained: N-deficiency (N0), low N supply (N1), and high N supply (N2). We analyzed data from years 8 and 10 of this experiment for two common hybrids. Under N deficiency, maize plants maintained LA and decreased SLN during vegetative stages, while both LA and SLN decreased comparably during reproductive stages. Canopy-average specific leaf area (SLA) decreased sharply during vegetative stages and slightly during reproductive stages, mainly because senesced leaves in the lower canopy had a higher SLA. In the vegetative stage, maize maintained leaf area at low N by maintaining leaf biomass (albeit hence having N content/mass) and slightly increasing SLA. These responses to N deficiency were stronger in maize hybrid XY335 than in ZD958. We conclude the main strategy of maize to cope with low N is to maintain plant growth, mainly by increasing SLA throughout the plant during early growth. N was too limiting for either strategy to be followed during later growth stages.