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Contrasting patterns of accumulation, partitioning, and reallocation patterns of DM and N within the maize canopy under decreased N availabilities

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Abstract

The reallocation of dry matter (DM) and nitrogen (N) from vegetative tissues to the grain sinks are critical for grain yield. The objective of this study was to quantify the DM and N accumulation, partition, and reallocation at the single-leaf, different-organ, and individual-plant scales and clarify the responses to different levels of N availabilities. A two-year field experiment was conducted in Jinlin province, Northeast China, with three N fertilizer rates to create the different N availability levels: N0 (N deficiency), N1(low supply), and N2 (high supply). The results showed that grain N depends more on reallocations of vegetative organs compared with grain DM. Besides, vegetative organs reallocated more DM and N to grain under lower N availability, whereas, more grain DM and grain N were derived from post-silking leaf photosynthesis and post-silking N uptake from the soil under high N availability. Furthermore, the reallocation amount and reallocation efficiency of leaf DM and leaf N content differed among leaf ranks and were regulated by N availability, specifically, the DM reallocation occurs mainly on senesced leaves, whereas the leaf N reallocation was in live leaves. These results provide a theoretical basis for deriving parameters in crop models for the simulation of the demand, uptake, partition, and reallocation processes of DM and N.

Keywords: Dry matter, Leaf N content, Leaf rank, N availability, Reallocation, Reallocation efficiency