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Editorial

Delayed Sowing in Winter Wheat Can Reduce Nitrogen Input

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INTRODUCTION

In the natural ecosystem, N is one of the most important limiting factors for yield and quality of wheat. However, in current agricultural systems, the utilization rate of N is still low and because of differences in species and soil conditions, only less than half of applied N fertilizer is absorbed by plants. Large amounts of nitrogen fertilizer are wasted through runoff and volatilization, which not only led to negative effects of N utilization, but also pollute water and air. Therefore, how to reduce nitrogen fertilizer input and maintain high yield makes us face a more serious problem at present.

Generally, improving nitrogen use efficiency (NUE) is an effective method to reduce nitrogen fertilizer input. However, the current NUE of cereal crops is often low, with 33 kg of dry matter produced per kilogram of N. To meet the rising global demand for food, the NUE must be improved and the application of N fertilizer must be reduced. The main strategy to achieve this is to increase crop yields and reduce N fertilizer application by increasing the UPE and UTE in plants, to ultimately improve NUE and reduce environmental pollution. Ultimately, this involves achieving an ideal state whereby the maximum N absorption and photosynthetic production can be achieved by optimizing the light, water, and photosynthetic canopy under conditions of the lowest possible N fertilizer application, however, it is difficult to achieve. Therefore, the challenge is to ascertain whether certain cultivation strategies can reduce N input and improve NUE without reducing yield.

Nitrate-N leaching can be reduced by optimizing soil and crop management practices, such as the use of different sowing dates. Meanwhile, sowing date is one of the most important factors that affect grain yield and quality. Showed that delayed sowing in wheat reduces N uptake and grain yield. As a result of global warming, the accumulated temperature before winter in North China Plain reportedly reaches 600-700^{oC}, which is 20-40% higher than that in the 70-80 years of the last century. As a result of such climate changes, there is a possibility that the sowing of winter wheat can be delayed. Furthermore, previous studies have indicated that delayed sowing of wheat can maintain grain yield and improve UTE, while accompanied by a higher final apparent N mineralization in soil and apparent N loss at harvest. Lower N uptake and higher UTE suggested the possibility of reducing N inputs and improving NUE.

NUE also implies how plant N can be used for photosynthetic production. Previous studies have shown leaf N content to be positively correlated with photosynthesis, and that an optimal N distribution in the plant canopy can improve photosynthesis without additional N input. In a leaf canopy of wheat, leaf N content per unit leaf area is highest at the top of the canopy and decreases with depth. Such a gradient of the specific green leaf area N (SLN) contributes to an efficient use of N at the whole-plant level and is classically considered to be a key plant adaptation in response to local light environments to maximize canopy photosynthesis .In our recent study, we evaluated three treatments: normal sowing (8 October), late sowing (22 October), and optimized late sowing (22 October, with 75% N application) over two wheat (Triticum aestivum Linnaeus) growing seasons (2017-2019), and assessed their effects on crop N status, N allocation and use, net photosynthetic rate (Pmax), grain yield, and soil N budget. We found that optimized late sowing resulted in a near-optimum N status, improved NUE, UTE and UPE. Optimized NNI and N distribution contributed a higher Pmax, which resulted in a higher dry matter accumulation rate during post-anthesis, and ultimately a consistent grain yield among the three treatments.

Moreover, a reduction of the N input under optimized late sowing decreased the final mineral N in the 0-100 cm soil layer at harvest and apparent N loss, which reduced the environmental pollution and resources waste. The prospects for improving grain protein content under optimized late sowing date should be verified by future research.

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