Effect of reducing nitrogen fertilizer on soil N_2O and NH_3 in a paddy field

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Abstact： In current agricultural production activities, in order to pursue high and stable yield, a large number of chemical fertilizers are used.However, the excessive and unreasonable application of nitrogen fertilizer will lead to a series of problems such as low fertilizer utilization rate, increasing economic cost and aggravating resource pressure.Substituting nitrogenous organic material for fertilizer can not only absorb waste and reduce fertilizer input, but also improve fertilizer utilization rate and soil fertility.Experiments were conducted to investigate the effects of chemical nitrogen fertilizer on nitrogen loss in rice fields replaced by fertilizer reduction and monosodium glutamate slag.

Methods and Materials

- Selected crops：:rice（*Oryza sativa* L.）.
- Experimental location :Xinmin,Liaoning.
- Experimental fertilizer: Urea(N：46%)，Ammonium sulfate(N：21%)，Potassium Chlorid(K_2O：60%)， Superphosphate（P_2O_5：12%)，Compound fertilizer (N:P:K=17:17:17)，Monosodium glutamate waste liquid residue(N：8.42%，P：1.54%，K：1.25%，Organic matter：54.36 g/kg)。
- Five treatments:

(1)Unfertilized treatment (CK);

(2)Conventional fertilization treatment(CF);

(3)20% reduction in nitrogen fertilizer treatment (N80%);

(4)monosodium glutamate residue 100% instead of chemical nitrogen fertilizer (GM50%);

(5)monosodium glutamate residue 100% instead of chemical nitrogen fertilizer(GM100%)。

Results and Discussion

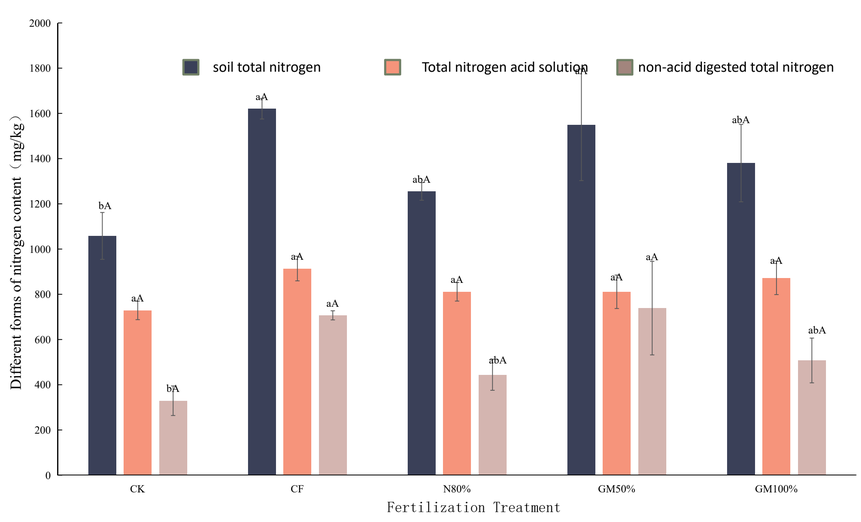

Fig. 1 Different forms of nitrogen content in different treatments

The total nitrogen content of all treatments was consistent with the trend of non-acid nitrogen content.It was significant that MSG reduce (GM50%) can improve the content of soil total nitrogen and the content of non-acid digested total nitrogen.

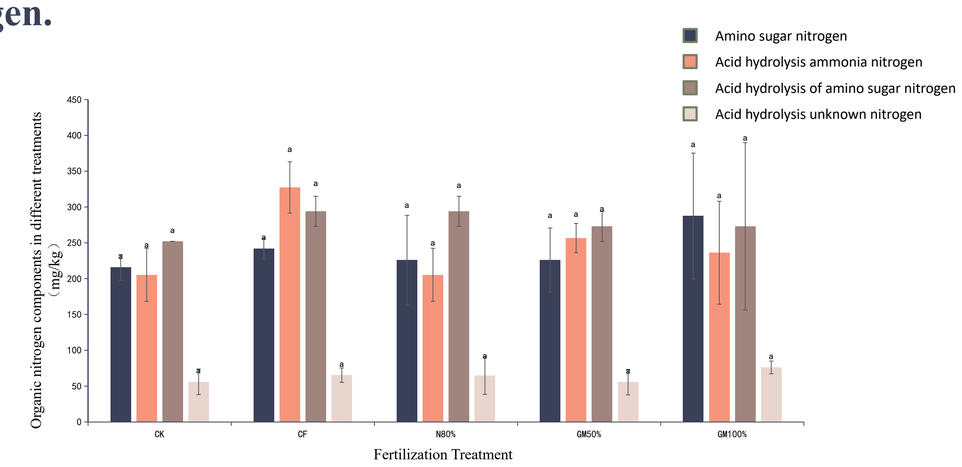

Fig. 2 Organic nitrogen components in different treatments

It was advantageous that soil organic nitrogen components can be increased by the applications of fertilization.In the conditon of reduced nitrogen 20% ,MSG residue 100% instead of chemical nitrogen fertilizer (GM100%) can improve the contents of Amino sugar nitrogen、Acid hydrolysis ammonia nitrogen and Acid hydrolysis unknown nitrogen.MSG residue 100% instead of chemical nitrogen fertilizer (GM50%) can improve the contents of Acid hydrolysis of amino sugar nitrogen.

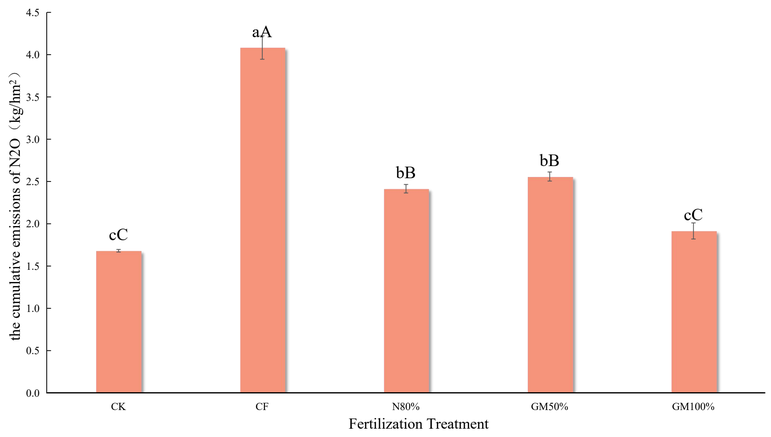

Fig.3 Cumulative emissions of N_2O from different processes

Application of nitrogen fertilizer will increase N_2O emission in the paddy field system.The cumulative emission of N_2O decreases with the reduction of nitrogen application.Compared with conventional fertilization, different proportion of MSG residue could reduce N_2O emission in rice field.

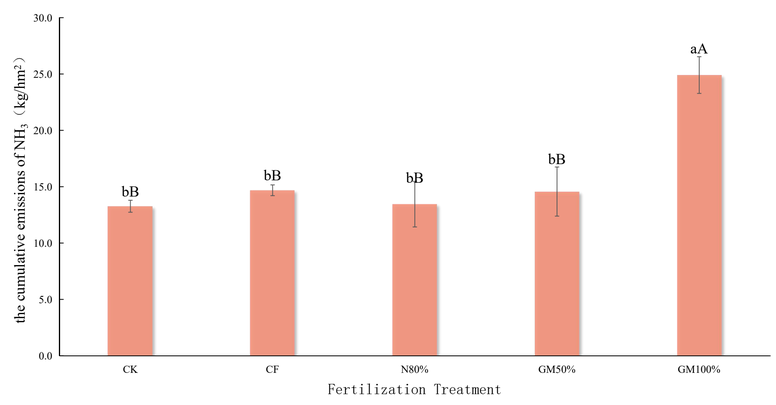

Fig.4 Cumulative emissions of NH_3 under different treatments

Nitrogen reduction fertilization can reduce the ammonia volatilizationin the paddy field soil.Compared with CF treatment,GM50% treatment reduced NH_3 volatilization .

Conclusions

Reduced chemical nitrogen fertilizer could reduce the loss of gaseous active nitrogen in rice field.

The application of monosodium glutamate (MSG) dreg can increase the contents of total nitrogen (TN), acid-hydrolyzed tN and non-acid-hydrolyzed TN in the soil of rice field, and help to increase the content of organic nitrogen components.

Under the condition of constant nitrogen, GM50% treatment can increase the content of acid ammoniated nitrogen.

Compared with CF treatment, N80% treatment and GM50% treatment can significantly reduce N_2O cumulative emission and NH_3 volatile accumulation.

GM100% treatment can increase the content of amino sugar nitrogen, acid ammonia nitrogen and unknown acid nitrogen.

Thanks

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