



Effect of combined application of fertilizer and MSG residue on ammonia volatilization and nitrogen leaching in paddy fields

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Abstract: Rice is one of the main crops in China. In order to ensure the stable and high yield, chemical fertilizer is often overapplied during rice cultivation, leading to resources waste and environment pollution. The use of organic materials to replace some chemical fertilizers can not only ensure a reasonable supply of nitrogen, but also increase the utilization rate of nitrogen fertilizers and maintain good environmental quality. Therefore, it is very important to study the effects of fertilizer reduction and alternative application on crop yield, quality and environment to reduce agricultural non-point source pollution.

Materials and Methods

◆Rice: (*Oryza sativa* L.) was used as the test crop.

◆Fertilizers: Urea (N:46%); Ammonium Sulfate (N:21.2%); Potassium Chloride (K₂O: 60%); Superphosphate (P₂O₅: 12%); Compound Fertilizer (N:P:K =17:17:17); monosodium glutamate residue (N: 8.42%, P: 1.54%, K: 1.25%, organic matter: 54.36g/kg).

◆Treatments: no fertilizer (CK); conventional fertilizer (CF); minus 20% nitrogen (N80%); 50% MSG residue replaces chemical fertilizer (GM50%), 100% MSG residue replaces chemical fertilizer (GM100%).

◆Measured indexes: rice yield; amount of ammonia volatilization; ammonium nitrogen and nitrate nitrogen concentration in soil solution.

Results and Discussion

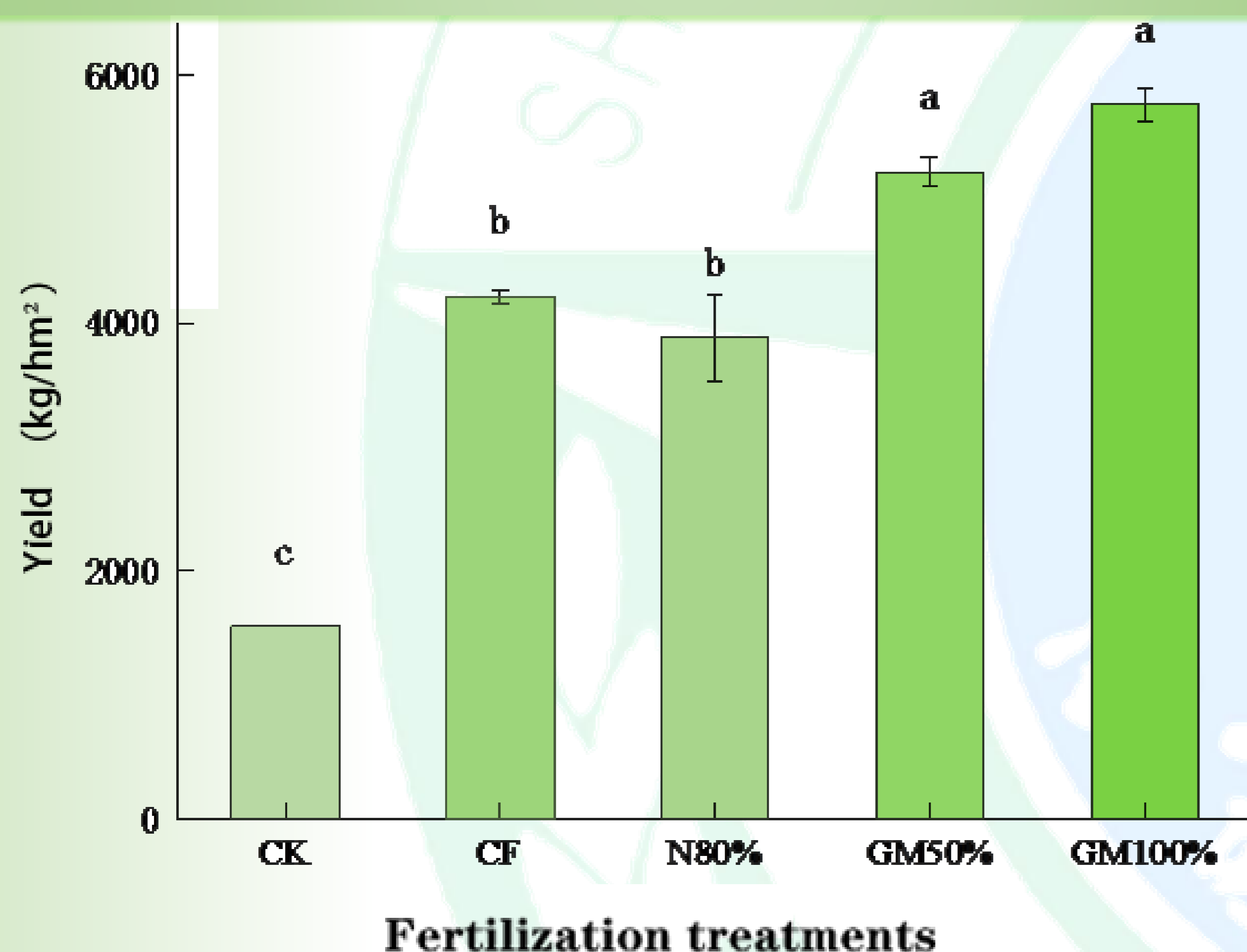


Fig.1. Rice yield of different fertilization treatments

The application of MSG residue (GM 50%, GM 100%) significantly improved rice yield relative to other treatments, indicating that MSG application can improve soil fertility and increase crop yield.

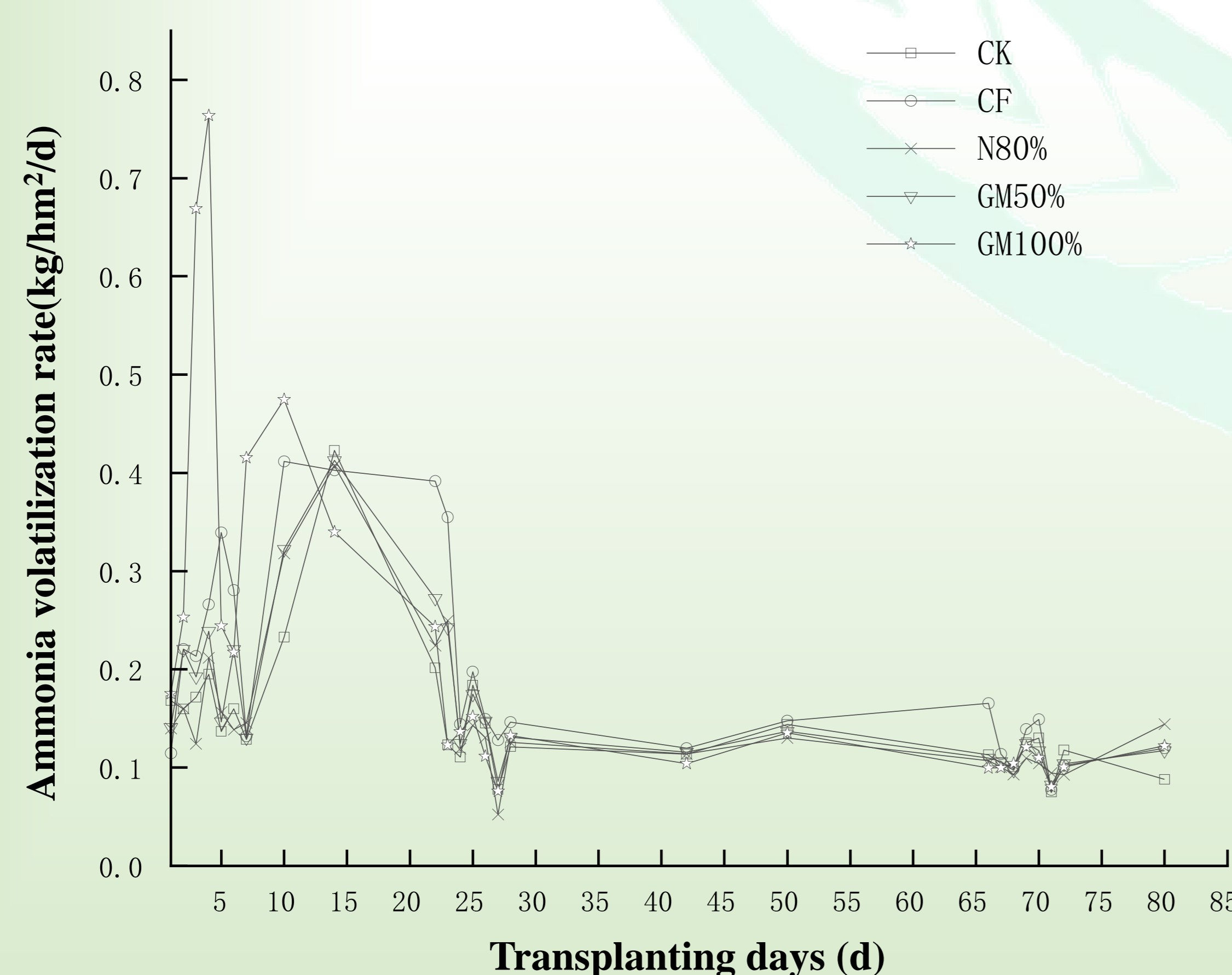


Fig.2. Variations of ammonia volatilization in paddy soil under different fertilization treatments

The ammonia volatilization in the paddy field soil increased in the early stage, reached its peak, and then gradually decreased to stable in all treatments. This trend indicated that the volatilization of ammonia mainly happened in the early stage during rice growth process.

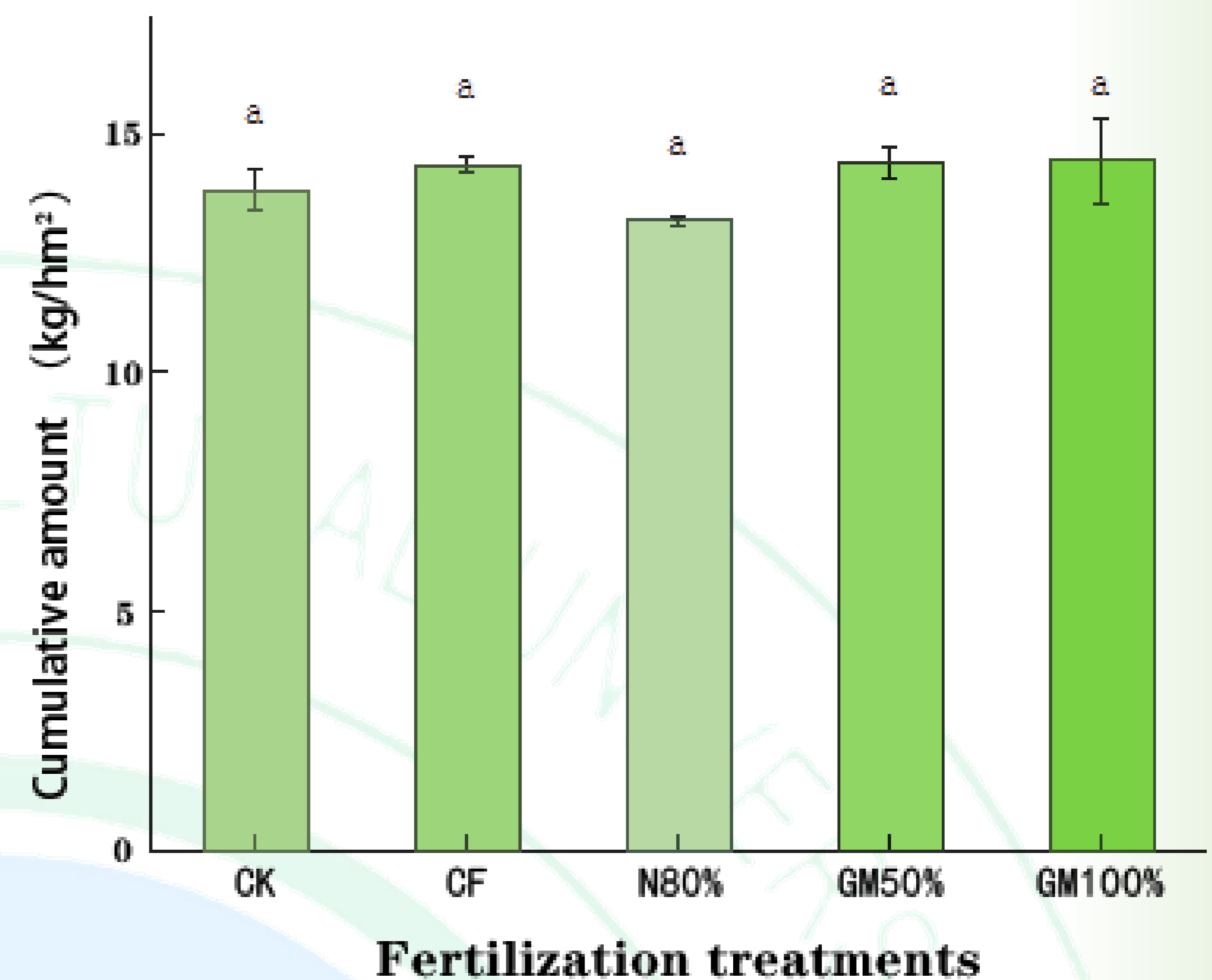


Fig.3. The cumulative amount of ammonia volatilization in paddy soil under different fertilization treatments

The cumulative amount of ammonia volatilization in N80% treatment is lower than other treatments, indicating that reducing nitrogen supply can decrease the loss of soil ammonia volatilization.

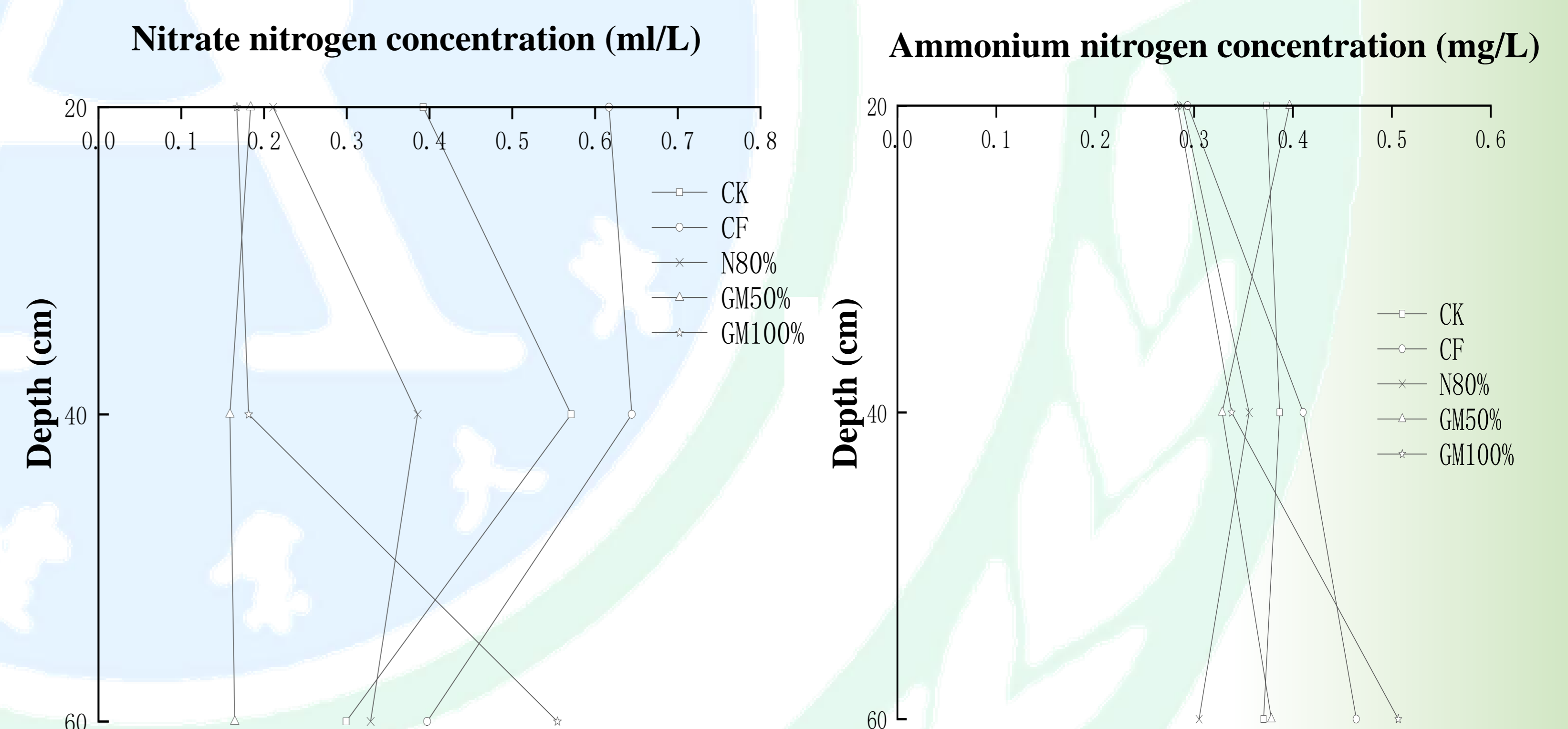


Fig.4. Changes of ammonium nitrogen and nitrate nitrogen concentration in soil solution at different depths under different fertilization treatments

The concentration of ammonium nitrogen and nitrate nitrogen in the soil solution of N80% treatment and GM50% treatment was lower, indicating that appropriate reduction of nitrogen can help decrease the amount of ammonium nitrogen and nitrate nitrogen in the soil solution.

Conclusions

Results from this study showed that the application of MSG residue can help increase rice yield and reduce ammonia volatilization in paddy soil. Therefore, it is feasible to appropriately decrease the application amount of nitrogen fertilizer, coupled with the application of MSG residue, to increase rice yield and promote cleaner rice production.

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