Introduction

Rice blast induced by *Magnaporthe grisea* causes severe damage to rice production in all over the world. In China, the area of rice blast incidence is above 3.80 mio. ha since 1990s, causes 10-15% rice yield loss every year (Stephen, 2002). Intercropping can increase grain yields and agricultural productivity greatly (Li et al, 2007) and decrease the crops disease occurrence markedly (Zhu et al, 2000; Tang et al, 2005) Large scale field experiments demonstrated that disease-susceptible rice varieties planted in mixture with resistant varieties achieved 89% yields increment and rice blast severity decreased by 94% in comparison with mono cultured rice (Zhu et al, 2000). The effect of crop disease control by intercropping showed much dependent on nutrition status, especially on nitrogen (Tang et al, 2005; Xiao et al, 2006, Chen et al, 2007; Li et al, 2007) and the rice blast resistance is influenced by N fertilizers(Tang, et al, 2006). But the relationship between nitrogen uptake and utilization and diseases occurrence in rice intercropping system and its mechanisms are known little. The objective of this paper was to investigate the Effect of N level on rice yield, nitrogen accumulation and rice blast occurrence in rice monocropping and intercropping system.

1. Materials and methods

The field experiments were conducted in Luliang（104.64° E，25.04° N, Yunnan province, to investigate the rice growth, nitrogen uptake and utilization and the occurrence of rice blast (*Magnaporthe grisea*) at different growth stage and its relation to N fertilizer application levels in rice Hexi 41 (Resistant, Japonica rice)/ Huangkenuo intercropping and rice Huangkenuo monoculture system. The study had two nitrogen level treatments 180 $kghm^{-2}$ N (N_{180}) and 300 $kghm^{-2}$ N (N_{300}), 1/2 N applied as base fertilizer and 1/2 as top dressing. The plot area was 54 m^2, each treatment was three replicates. The soil properties were organic matter 19.24 g kg^{-1}, total N 1.30 g kg^{-1}, available P 25.97 mg kg^{-1}, available K 72.2 mg kg^{-1}.

2. Results

2.1 Effect of high N rate on rice yield and LER

High N rate (N_{300}) decreased the monocropped rice Huangkenuo biomass and yield significantly, the yield at higher N rate (N_{300}) decreased 23.8% than that at N_{180}. But higher N rate supply increased the intercropped rice biomass markedly and was no significant influence on intercropped rice grain yield (Table.1).

Compared with the Monocropped rice, the biomass and yield of intercropping rice was increased significantly at high N level (N_{300}). The rice biomass and grain yield increased 48.7% and 41.8%, respectively.

Table 1 Effects of N rate on yield of Huangkenuo and Land equivalent ratios

Treatment	**Biomass (g/plant)**		**Yield (g/plant)**		**LER**	
	intercropping	Monocropping	intercropping	Monocropping	Biomass	Yield
N_{300}	68.36a	45.98c	24.56a	17.32b	2.35	2.33
N_{180}	59.09b	51.94b	25.24a	22.72a	1.92	1.91

Hexi 41 intercropped with Huangkenuo increased the Land equivalent ratios (LER) significantly (Table 1). The remarkable intercropping advantage was produced. The LER at the conventional nitrogenous fertilizer (N_{180}) LER was 1.91 and it was 2.33 under high nitrogen supply (N_{300}), indicating the intercropping advantage of improving rice productivity was much greater at higher N supply.

2.2 Effect of high N rate on nitrogen accumulation

High N rate supply increased the nitrogen accumulation of rice shoot, but the increase varied much under different cropping system (Table 2). At rice heading stage, the N accumulation amount in leaf and stem increased 156.4% and 55.3% under Hexi 41 and Huangkenuo intercropping, but the increase under Huangkenuo monocropping was 41.5% and 27.8%.

Table2. Effects of N rate on N accumulation of rice Huangkenuo

Treatment	Stem (g/plant)	Leaf (g/plant)
N_{300}-I	0.146a	0.259a
N_{300}-M	0.143ab	0.226a
N_{180}-I	0.094c	0.101c
N_{180}-M	0.104bc	0.159bc

Notes：Different letter is significant at 5% in the same column.

2.3 Effect of high N rate on rice blast

High N rate supply increased the occurrence and severity of leaf blast and panicle blast significantly (Fig. 1).

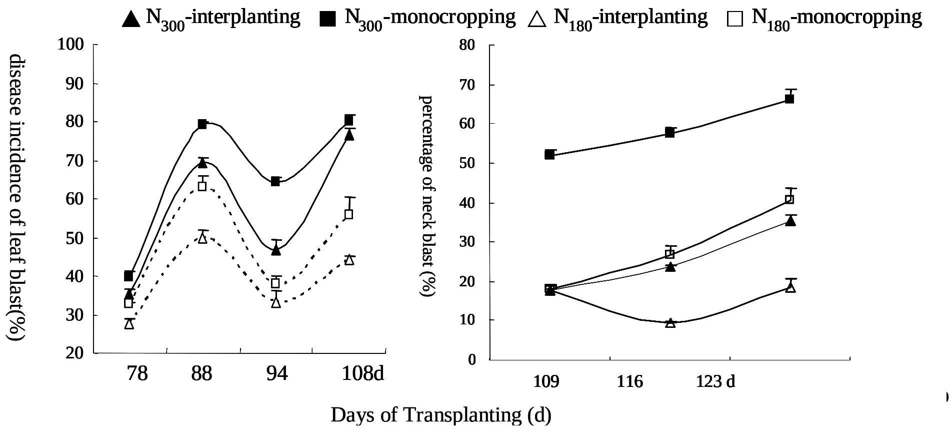

Fig. 1 Effects of nitrogen levels on incidence of leaf blast and panicle blast of Huangkenuo

Compared with N_{180}, the averaged incidence of leaf blast and panicle blast of monocropped rice Huangkenuo increased 43.3% and 122%, and the severity index increased 29.2% and 167%, respectively. But under intercropping, the averaged incidence and severity index of leaf blast only increased 19.7% and 19.3%, respectively. The results indicated that the influence of high N supply on rice blast of monocropped rice was more significant than that on intercropped rice.

Intercropping decreased the rice blast occurrence significantly. At N_{300}, the incidence and severity index of leaf blast decreased 13.5% and 7.8% by intercropping, and the incidence and severity index of panicle blast decreased 57% and 63% under intercropping, compared with monocropping. At N_{180}, the incidence and severity index of leaf blast decreased 17.4% and 11%, and that of panicle blast decreased 40.9% and 36%.

3. Conclusion

Higher N level was one of the major reasons caused the occurrence and severity of rice blast. High nitrogen rate application reduced the biomass, yield and increased the incidence and severity of rice blast, significantly in monocropping. Hexi-41 and Huangkenuo intercropping increased the rice yield and decreased the occurrence and severity of rice blast. The intercropping advantage, which increasing yield, enhancing LER and reducing rice blast, was much greater at high N supply level. The interaction between crop disease control and nitrogen nutrition and its mechanisms under intercropping are need further more research.

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