NEW PROMISING MANAGEMENT PRACTICE TO COPE WITH ADVERSE CONDITIONS OF ACID SULFATE SOILS ON RICE PRODUCTION

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INTRODUCTION

Dong Thap Muoi, The Plain of Reeds in Long An province has a natural land of about 696,000 ha. It is a great swamp where some areas are lower than sea level. Severe acid sulphate soils occupied more than 40% of the plain. The plain was idle during the Vietnam wars and has been reclaimed since 1980. Heavy fertilization has been implemented for rice production during the last 30 years. Nowadays, many areas achieve a grain yield of seven tonnes/ha and above in the winter-spring cropping season while a grain yield of three tonnes/ha is rarely obtained in the summer-autumn season. More fertilizers are needed during the latter but no positive return due to Al, Fe and organic acid toxicity resulting in high surface water's EC. Water management to leach high concentration of toxic elements out of the profile is no longer the first recommendation as water deficit occuring in he region due to the effect of climate change. Many farmers skip this season to ensure not capital loss but then the effort to alleviate the acidity of their land will be double in the next season. Therefore different technologies have been tested to improve farmer's income in this season. One of the efforts sounds very promising is to reduce the nitrogen application rate with the presence of microorganisms. BioGro, a biofertilizer containing four strains of microbes proven to produce IAA and to supply more N from the decomposition of soil organic matter, has been used for this purpose.

MATERIALS AND METHODS

Two long-term experiments had been carried out on a Typic Sulfaquept of Tan Lap village, Tan Thanh district, Long An province, in the Plain of Reeds. Selected soil properties are listed in Table 1. Either N or P rate was the main factor and the presence of BioGro (without and with 100 kg/ha, 10^{-6} CFU/g) was the sub factor. The N or P rate was set up at the optimum rate for rice crop on that soil type at the village. The next N or P rate was 25% lower than. By this way, treatment could be cross compared to evaluate the effect of BioGro application on crop yield. The treatments are indicated in Table 2.

Table 1. Selected properties of soil in the Summer-Autumn season 2010 prior to experimentation

No	Parameter	Value
1	pH H_2O (1:5)	3.97
2	pH $_{KCl}$(1:5) 1M	3.91
3	Exchangeable acidity ($cmol_c\ kg^{-1}$)	4.74
4	Exchangeable Al^{3+}($cmol_c\ kg^{-1}$)	4.14
5	Olsen P (mg/kg)	17.3
6	NH_4^+ (mg/kg)	14.3
7	Labile Carbon (mg/kg)	1.97
8	Surface water EC (dS/m)	1.01
9	Surface water pH H_2O (1:5)	3.72

Table 2. Treatments from experiments N and P; where A: without BioGro; B: with 100 kg BioGro/ha (10^{-6} CFU/g)

Treatment	Fertilizer formula	Treatment	Fertilizer formula
N 1 A	0 N- 0 P_20_5- 0 K_20	P 1 A	80 N- 0 P_20_5- 60 K_20
N 1 B	0 N- 0 P_20_5- 0 K_20	P 1 B	80 N- 0 P_20_5- 60 K_20
N 2 A	0 N- 60 P_20_5- 60 K_20	P 2 A	80 N- 30 P_20_5- 60 K_20
N 2 B	0 N- 60 P_20_5- 60 K_20	P 2 B	80 N- 30 P_20_5- 60 K_20
N 3 A	45 N- 60 P_20_5- 60 K_20	P 3 A	80 N- 45 P_20_5- 60 K_20
N 3 B	45 N- 60 P_20_5- 60 K_20	P 3 B	80 N- 45 P_20_5- 60 K_20
N 4 A	60 N- 60 P_20_5- 60 K_20	P 4 A	80 N- 60 P_20_5- 60 K_20
N 4 B	60 N- 60 P_20_5- 60 K_20	P 4 B	80 N- 60 P_20_5- 60 K_20
N 5 A	80 N- 60 P_20_5- 60 K_20	P 5 A	80 N- 60* P_20_5- 60 K_20
N 5 B	80 N- 60 P_20_5- 60 K_20	P 5 B	80 N- 60* P_20_5- 60 K_20
N 6 A	107 N- 60 P_20_5- 60 K_20	P 6 A	80 N- 90 P_20_5- 60 K_20
N 6 B	107 N- 60 P_20_5- 60 K_20	P 6 B	80 N- 90 P_20_5- 60 K_20

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RESULTS

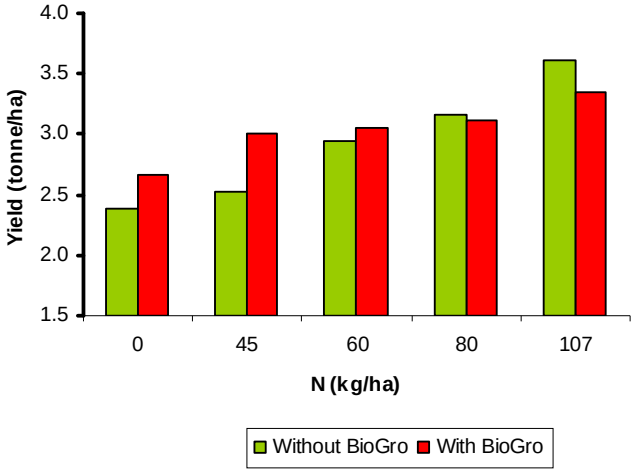

Figure 1. Effect of N rates and BioGro on grain yield of rice on a Typic Sulfaquept at The Plain of Reeds, Long An province

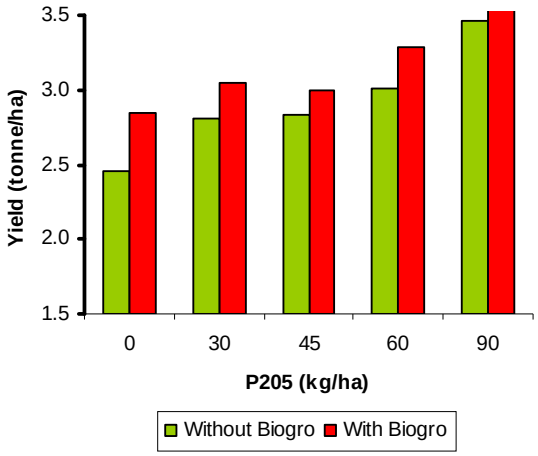

Figure 2. Effect of P rates and BioGro on grain yield of rice on a Typic Sulfaquept at The Plain of Reeds, Long An province

Table 3. Contrast analysis on the effect of N rates and BioGro rates on grain yield

			Without BioGro				
N rate			0	45	60	80	107
		Grain Yield	2.39	2.531	2.95	3.161	3.607
With Bio Gro	0	2.657	ns	ns	ns	*	*
	45	3.007	*	*	ns	ns	*
	60	3.056	*	*	ns	ns	*
	80	3.112	*	*	ns	ns	*
	107	3.341	*	*	*	ns	ns

Table 4. Contrast analysis on the effect of P rates and BioGro rates on grain yield

			Without BioGro				
P rate			0	30	45	60	90
		Grain Yield	2.451	2.813	2.832	3.014	3.466
With BioGro	0	2.84	*	ns	ns	ns	*
	30	3.052	*	ns	ns	ns	*
	45	2.999	*	ns	ns	ns	*
	60	3.288	*	*	*	ns	ns
	90	3.566	*	*	*	*	ns

CONCLUSION

1. Maximum grain yields in the Summer-Autumn season of 2010 were around 3.5 tonnes at 107 kg N/ha or 90 kg P_2O_5/ha;
2. When no N nor P added, the application of BioGro brought back a grain yield as high as treatment received 60 kg N/ha or 60 P_2O_5 kg/ha, respectively.
3. Grain yield was not significantly different when N or P application rate reduced 25% with the presence of BioGro.
4. At low N or P application rate, BioGro application brought back an equivalent grain yield even N or P was 50% reduced.