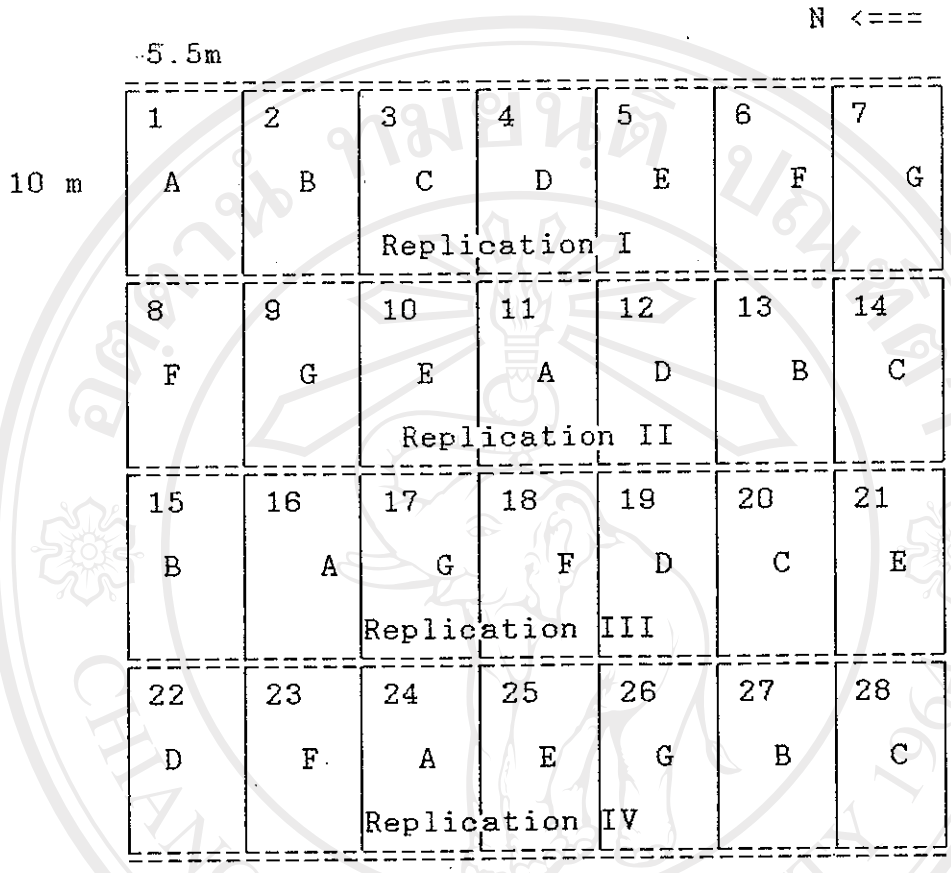
APPENDICES

Appendix Figure 1. Layout of field experiment

(Randomized Complete Block Design)



Experimental plot size : 5.5m x 10m
Size/rep : 10m x 40m
Total study area : 40m x 40m
No. of treatments : 7
No. of replications : 4
Total treatment plots : 28

Legend :
- A Monocropped rice
- B Mono-rice bean sown four weeks after rice
- C Intercropped rice with bean sown four weeks after rice sowing
- D Mono-rice bean sown at the same time with rice
- E Intercropped rice with bean sown at the same time
- F Intercropped rice with bean sown two weeks after rice
- G Mono-rice bean sown two weeks after rice sowing

Appendix Table 1. Accumulation of total dry matter (kg/ha) in rice as influenced by intercropping.

Cropping system	Growth stage		
	Tillering	Flowering	Harvesting
Sole rice	332	2759	4972
Intercrop			
Simultaneous	193	265	0
Intermediate	600	1734	(94)
Late	544	4028	3634

( ) Figure in parenthesis is taken from 1 replication only, other replications, no yield

Appendix Table 2. ANOVA of total dry matter in rice at three growth stages.

Source of variation	DF	Tillering		Flowering		DF	Harvesting*	
		MS	P	MS	P		MS	P
REP (A)	3	6934	.60	10917	.72	3	11206	.67
TRT (B)	3	482010	.00	1015100	.00	1	357930	.02
A * B	9	10585		23692		3	19885	

* Only sole rice and late bean sowing in rice intercrop are included in the ANOVA

ANOVA Analysis of variance; DF Degree of freedom; MS Mean square; P probability

Appendix Table 3. ANOVA* of grain yield and yield components of rice.

Source of variation	DF	Grain yld		Yield components									
				Pan/hill		Seeds/pan		Seed wt./pan(g)		1000 seed wt(g)		% Unf seeds	
		MS	P	MS	P	MS	P	MS	P	MS	P	MS	P
REP (A)	3	896	.98	.23	.80	50	.94	.21	.23	.36	.43	18	91
TRT (B)	3	233980	.04	1.93	.19	4680	.04	1.44	.02	.68	.22	350	18
A * B	9	19549		.69		426		.08		.29		114	

* Only sole rice and rice intercropped with late bean sowing are included in the ANOVA

Appendix Table 4. Total nitrogen (kgN/ha) in rice straw and seeds.

Cropping system	Growth stage			Seed N
	Tillering	Flowering	Harvesting	
Sole rice	11.8	35.9	13.0	30.6
Intecrop				
Simultaneous	5.9	5.7	-	-
Intermediate	12.8	30.1	ND	ND
Late	40.0	39.3	11.8	20.5

- No harvest
ND Not determined

Appendix Table 5. ANOVA of total nitrogen in rice straw and seeds.

Source of variation	DF	Growth stage							Seed N *		
		Tillering		Flowering		Harvesting*					
		MS	P	MS	P	DF	MS	P	DF	MS	P
REP (A)	3	25.6	.58	21.8	.68	3	1.5	.81	3	4.2	.82
TRT (B)	3	927.6	.00	924.5	.00	1	2.9	.49	1	204.3	.03
A * B	9	37.0		41.9		3	4.8		3	13.9	

* Only sole rice and rice intercropped with late sowing was included in the ANOVA

Appendix Table 6. ANOVA of shoot dry matter in rice bean.

Source of variation	DF	Growth stage									
		V6		V12		V20		R1		R3	
		MS	P	MS	P	MS	P	MS	P	MS	P
REP (A)	3	25727	.17	38354	.54	43113	.93	285870	.06	70019	.60
TRT (B)	5	38493	.05	641940	.00	341960	.37	175960	.17	179860	.21
A * B	15	13276		118790		293090		96185		110020	

Appendix Table 7. ANOVA of grain yield and yield components of rice bean.

Source of variation	DF	Grain yld		Yield components					
				Seeds/pod		Seed wt/pod (g)		100 seed wt (g)	
		MS	P	MS	P	MS	P	MS	P
REP (A)	3	282.5	.62	.49	.00	.0001	.59	1.09	.23
TRT (B)	5	732.6	.23	.11	.24	.002	.00	.41	.69
A * B	15	469.8		.07		.0002		.67	

Appendix Table 8. ANOVA of nodule number and nodule dry weight in rice bean during late vegetative stage (V20).

Source of variation	DF	Late vegetative stage (V20)			
		Nodule no/plant		Nodule dry wt/plant	
		MS	P	MS	P
REP (A)	3	1998.8	.07	1123.4	.52
TRT (B)	5	6464.8	.00	5068.6	.03
A * B	15	703.5		1441.6	

Appendix Table 9. The relative ureide index (RU %) of rice bean as influenced by intercropping.

Cropping system	Growth stage				
	V6	V12	V20	R1	R3
Sole					
Simultaneous	59.4	67.5	72.3	58.7	51.5
Intermediate	50.4	53.8	72.4	41.4	39.5
Late	42.6	65.2	71.3	46.6	45.0
Intercrop					
Simultaneous	63.5	70.5	81.4	64.3	51.8
Intermediate	54.3	75.8	83.5	50.0	47.6
Late	67.2	86.2	90.6	61.9	55.1

Appendix Table 10. ANOVA of the relative ureide index of rice bean.

Source of variation	DF	Growth stage									
		V6		V12		V20		R1		R3	
		MS	P	MS	P	MS	P	MS	P	MS	P
REP (A)	2	13.3	.84	4.3	.87	29.7	.47	43.7	.29	17.2	.78
TRT (B)	5	244.3	.05	353.2	.00	185.1	.01	256.4	.00	94.9	.31
A * B	10	74.9		31.3		36.4		29.0		69.5	

Appendix Table 11. The proportion of nitrogen fixed (Pfix %) by rice bean as influenced by intercropping.

Cropping system	Growth stage				
	V6	V12	V20	R1	R3
Sole					
Simultaneous	64.2	74.7	80.9	63.3	54.0
Intermediate	52.5	56.9	81.1	40.4	38.3
Late	42.3	71.7	79.7	47.6	45.5
Intercrop					
Simultaneous	69.6	78.6	92.8	70.6	54.4
Intermediate	57.6	85.6	95.5	51.9	48.9
Late	74.3	99.0	100.0	7.5	58.6

Appendix Table 12. ANOVA of the proportion of nitrogen fixed by rice bean.

Source of variation	DF	Growth stage									
		V6		V12		V20		R1		R3	
		MS	P	MS	P	MS	P	MS	P	MS	P
REP (A)	2	22.4	.84	7.3	.87	50.2	.47	73.9	.27	29.1	.78
TRT (B)	5	412.9	.05	597.0	.00	312.8	.01	433.3	.00	160.3	.31
A * B	10	126.5		53.0		61.6		49.1		117.4	

Appendix Table 13. Total nitrogen (kgN/ha) in shoot dry matter of rice bean as influenced by intercropping.

Cropping system	Growth stage				
	V6	V12	V20	R1	R3
Sole					
Simultaneous	46.9	81.5	113.1	111.3	100.7
Itermediate	45.1	103.1	137.8	122.4	101.3
Late	67.5	100.6	144.7	119.7	98.0
Intercrop					
Simultaneous	38.6	72.2	115.5	106.3	89.9
Intermediate	33.7	70.6	131.7	117.7	103.3
Late	17.8	29.1	91.6	93.5	72.2

Appendix Table 14. ANOVA of total nitrogen in shoot dry matter of rice bean.

Source of variation	DF	Growth stage									
		V6		V12		V20		R1		R3	
		MS	P	MS	P	MS	P	MS	P	MS	P
REP (A)	3	108.8	.43	591.6	.44	66.5	.99	461.4	.02	371.0	.46
TRT (B)	5	1077.5	.00	2891.9	.01	1525.7	.56	1058.8	.13	551.9	.30
A * B	15	111.8		623.9		1903.2		225.0		410.1	

Appendix Table 15. Amount of N2 fixed (kgN/ha) by rice bean over time.

Cropping system	Growth stage				
	V6	V12	V20	R1	R3
Sole					
Simultaneous	14.1	38.1	62.8	61.5	55.3
Intermediate	11.1	42.8	66.8	57.4	49.1
Late	13.7	32.6	65.9	50.0	39.9
Intercrop					
Simultaneous	12.4	37.3	74.4	66.9	56.7
Intermediate	8.9	35.3	90.6	80.3	73.1
Late	5.6	15.3	79.0	80.6	67.2

Appendix Table 16. ANOVA of the amount of N2 fixed by rice bean over time.

Source of variation	DF	Growth stage									
		V6		V12		V20		R1		R3	
		MS	P	MS	P	MS	P	MS	P	MS	P
REP (A)	2	.79	.90	4.0	.83	2.9	.92	1.5	.96	1.9	.94
TRT (B)	5	31.86	.02	274.6	.00	324.5	.00	461.0	.00	433.1	.00
A * B	10	7.46		21.4		34.9		32.9		31.2	

Appendix Table 17. ANOVA of the nitrogen balance of rice bean at stage V20.

Source of variation	DF	Seed N (kgN/ha)		DF	N-fixed (kgN/ha)		N-fixed (%)		N-balance (kgN/ha)	
		MS	P		MS	P	MS	P	MS	P
REP (A)	3	2.9	.63	2	4.7	.87	2.9	.88	4.6	.87
TRT (B)	5	6.0	.34	5	314.5	.00	630.0	.00	366.6	.00
A * B	15	4.9		10	33.4		22.0		33.5	

Appendix Table 18. ANOVA of two nitrogen balances (NB) of four cropping systems.

Source of variation	DF	NB^1		NB^2	
		MS	P	MS	P
REP (A)	2	4.3	.87	4.0	.88
TRT (B)	6	3190.1	.00	1196.1	.00
A * B	10	30.9	30.0		

1. Nitrogen balance after rice/rice bean cropping system
2. Nitrogen balance after rice/rice bean and corn cropping sequence

Appendix Table 19. ANOVA of shoot dry matter (t/ha) in corn as influenced by preceding treatments.

Source of variation	DF	Days after sowing					
		30		50		88	
		MS	P	MS	P	MS	P
REP (A)	3	2.1	.26	69.4	.23	274.0	.34
TRT (B)	6	4.3	.03	303.4	.00	1904.2	.00
A * B	18	1.4		44.1		227.9	

Appendix Table 20. ANOVA of grain yield and yield components of corn.

Source of variation	Grain yld			Yield components					
				DF	Ears/plant		Seeds/ear		100 seed wt. (g)	
	DF	MS	P		MS	P	MS	P	MS	P
REP (A)	3	130.9	.29	3	.007	.17	912.9	.65	1.8	.66
TRT (B)	5	413.1	.01	6	.008	.08	6296.5	.01	8.5	.06
A * B	15	96.4		18	.004		1627.9		3.4	

Appendix Table 21. Total N yield (kgN/ha) in seed and dry matter of corn as influenced by preceding treatments.

Source of variation	DF	Seed N		Days after sowing					
				30		55		88	
		MS	P	MS	P	MS	P	MS	P
REP (A)	3	419.7	.37	11.4	.38	244.8	.12	186.6	.76
TRT (B)	6	1695.7	.0	30.2	.04	679.7	.00	2701.2	.00
A * B	18	381.7		10.6		109.8		473.6	

Appendix Table 22. ANOVA of component crop yields of four cropping systems.

Source of variation	Rice			Rice bean			Corn		
	DF	MS	P	DF	MS	P	DF	MS	P
REP (A)	3	9.0	.98	3	3.8	.54	3	2604.7	.01
TRT (B)	1	2339.8	.04	2	14.2	.12	3	6821.8	.00
A * B	3	86.5		6	4.7		9	313.2	

Appendix Table 23. ANOVA of gross return (Bht/kg) of four cropping systems.

Source of variation	Rice			Rice bean			Corn			Total		
	DF	MS	P	DF	MS	P	DF	MS	P	DF	MS	P
REP (A)	3	109770	.98	3	242360	.54	3	21906000	.01	3	23755000	.03
TRT (B)	1	28663000	.04	2	910210	.12	3	57371000	.00	3	30226000	.01
A * B	3	2394700		6	302410		9	2633700		9	4989400	

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