Appendix

Appendix Table 1 Layout of experiment treatments
(RCB design)

Symbol : R = Rice
S = Soybean

R0 = 0 kg N/ha applied to rice
R1 = 100 kg N/ha applied to rice
R3 = 300 kg N/ha applied to rice

S0 = 0 kg N/ha applied to soybean
S2 = 25 kg N/ha applied to soybean
S5 = 50 kg N/ha applied to soybean

→ N

1 R1S5	2 R0S5	3 R3S2	4 R0S0	5 R1S2	6 R0S2	7 R3S5	8 R1S0	9 R3S0
Replication----- 1								
10 R3S2	11 R3S0	12 R1S2	13 R0S5	14 R0S2	15 R3S5	16 R0S0	17 R1S0	18 R1S5
Replication----- 2								
19 R1S0	20 R3S0	21 R0S5	22 R1S5	23 R0S2	24 R0S0	25 R1S2	26 R3S2	27 R3S5
Replication----- 3								
28 R1S0	29 R1S2	30 R3S0	31 R3S2	32 R0S5	33 R1S5	34 R0S0	35 R3S5	36 R0S2
Replication----- 4								
37 R1S2	38 R0S0	39 R0S5	40 R3S0	41 R1S5	42 R3S2	43 R1S0	44 R0S2	45 R3S5
Replication----- 5								
46 R1S0	47 R0S2	48 R1S2	49 R3S2	50 R0S0	51 R1S5	52 R3S0	53 R3S5	54 R0S5
Replication----- 6								

Appendix Table 2 Soil available nitrogen (µg/g)

2.1 Original data for analysis of variance

Treatment	Replication						
	I	II	III	IV	V	VI	Mean
	sowing time						
R0							
S0	2.02	2.13	2.31	2.44	2.52	2.05	2
S25	6.22	6.56	6.72	6.69	6.71	6.14	7
S50	8.92	9.1	9.27	8.45	9.11	8.24	9
R100							
S0	3.08	3.12	2.62	2.52	2.74	2.46	3
S25	6.74	6.97	6.62	7.12	9.67	6.2	7
S50	9.35	9.58	9.76	9.61	9.86	9.57	10
R300							
S0	3.35	3.17	3.62	4.29	3.05	3.7	4
S25	7.29	7.64	9.08	9.79	7.1	6.32	8
S50	14.02	10.9	13.59	13.69	12.08	15.12	13
LSD(0.05):	RN=0.56		SYN=0.56			RN*SYN=0.97	
LSD(0.01):	RN=0.75		SYN=0.75			RN*SYN=1.30	
	at seed development stage (R5)						
R0							
S0	2.12	1.75	1.34	1.99	1.46	1.73	2
S25	4.04	4.01	4.06	3.7	3.63	4.28	4
S50	5.26	3.15	4.3	5.82	5.82	6.75	5
R100							
S0	1.73	2.61	2.33	1.76	1.62	2.12	2
S25	4.6	3.83	4.34	3.89	3.71	5.55	4
S50	5.95	5.31	4.34	8.23	5.85	6.18	6
R300							
S0	2.76	2.33	2.84	2.7	2.52	2.77	3
S25	5.03	3.95	4.16	6.21	4.39	6.99	5
S50	6.6	8.48	6.9	7.6	8.55	7.91	8
LSD(0.05):	RN=0.52		SYN=0.52			RN*SYN=0.89	
LSD(0.01):	RN=0.69		SYN=0.69			RN*SYN=1.20	

2.2 Analysis of variance

At sowing stage

Source	DF	SS	MS	F
Replication	5	2.63	0.53	0.76
Treatment	8	620.24	77.53	111.31 **
N to rice (RN)	2	52.54	26.27	37.72 **
N to soybean (SYN	2	539.84	269.92	387.52 **
RN x SYN	4	23.80	5.95	8.54
Error	40	27.86	0.70	

At seed develpment (R5)

Source	DF	SS	MS	F
Replication	5	7.84	1.57	2.68
Treatment	8	200.39	25.05	42.75 **
N to rice (RN)	2	21.90	10.95	18.69 **
N to soybean(SYN)	2	155.05	77.53	132.32 ns
RN x SYN	4	4.45	1.11	1.90
Error	40	23.44	0.59	

* = significance at 5% level
** = significance at 1% level
ns = not significant

Appendix Table 3 Soybean shoot dry matter and total N uptake (kg/ha)

3.1 Original data for analysis of variance

Treatment	Replication						
	I	II	III	IV	V	VI	Mean
			Shoot dry matter at R1				
R0							
S0	1030	1110	1070	1000	1050	910	1028
S25	1190	1280	1120	1230	1160	1080	1177
S50	1350	1300	1360	1250	1290	1260	1302
R100							
S0	1090	1190	1170	1250	1120	1230	1175
S25	1330	1200	1250	1260	1110	1160	1218
S50	1250	1170	1470	1400	1460	1230	1330
R300							
S0	1280	1330	1340	1260	1230	1290	1288
S25	1290	1410	1330	1300	1380	1350	1343
S50	1390	1460	1490	1490	1370	1300	1417
LSD(0.05):		RN=43		SYN=43		RN*SYN=74	
LSD(0.01):		RN=57		SYN=57		RN*SYN=99	
			Shoot dry matter at R7				
R0							
S0	4680	4240	4100	4420	4180	4340	4327
S25	4510	4910	4830	4830	5120	4730	4822
S50	4820	5030	5060	5020	5070	5030	5005
R100							
S0	4890	4810	4600	4770	4620	4800	4748
S25	5250	5150	4750	4970	5090	4540	4958
S50	4940	4770	5070	4870	4670	4770	4848
R300							
S0	5110	5130	5100	4930	5340	4860	5078
S25	5250	5290	5330	5070	4850	5110	5150
S50	5210	5310	5080	5160	5210	5270	5207
LSD(0.05):		RN=118		SYN=118		RN*SYN=204	
LSD(0.01):		RN=158		SYN=158		RN*SYN=273	

Total N uptake

R0							
S0	152	142	120	143	135	138	138
S25	150	155	164	151	161	148	155
S50	152	159	156	163	160	159	158
R100							
S0	156	166	142	163	149	159	156
S25	168	165	150	155	161	138	156
S50	145	149	182	153	142	147	153
R300							
S0	160	159	158	148	167	148	157
S25	172	163	161	152	147	153	158
S50	164	173	152	158	158	168	162

LSD(0.05): RN=6.32 SYN=6.32 RN*SYN=11
LSD(0.01): RN=8.46 SYN=8.46 RN*SYN=15

3.2 Analysis of variance

Shoot dry matter at R1

Source	DF	SS	MS	F
Replication	5	440	88	1.78
Treatment	8	6485	811	16.36 **
N to rice (RN)	2	2973	1487	29.99 **
N to soybean(SYN)	2	3112	1556	31.40 **
RN x SYN	4	832	208	4.20
Error	40	1983	50	

Shoot dry matter at R7

Source	DF	SS	MS	F
Replication	5	108300	21660	0.71
Treatment	8	3415280	426910	13.97 **
N to rice (RN)	2	1747900	873950	28.60 **
N to soybean(SYN)	2	975390	487695	15.96 **
RN x SYN	4	691990	172998	5.66 **
Error	40	1222300	30558	

Total N uptake

Source	DF	SS	MS	F
Replication	5	401.26	80.25	0.91
Treatment	8	2143.81	267.98	3.04 *
N to rice (RN)	2	659.70	329.85	3.75 ns
N to soybean(SYN)	2	561.04	280.52	3.19 *
RN x SYN	4	923.07	230.77	2.62
Error	40	3521.10	88.03	

* = significance at 5% level
** = significance at 1% level
ns = not significant

Appendix Table 4 Nodule dry weight (mg/plant)

4.1 Original data for analysis of variance

Treatment	Replication						
	I	II	III	IV	V	VI	Mean
	42 days after sowing						
R0							
S0	88	88	86	82	73	82	83
S25	73	84	76	73	80	77	77
S50	54	62	72	74	56	76	66
R100							
S0	68	69	74	94	61	66	72
S25	63	68	74	68	74	64	69
S50	36	74	80	44	93	58	64
R300							
S0	53	70	82	74	67	72	70
S25	61	64	58	77	59	62	64
S50	45	49	58	54	55	55	53
LSD(0.05):		RN=6.6		SYN=6.6		RN*SYN=11.4	
LSD(0.01):		RN=8.8		SYN=8.8		RN*SYN=15.2	
	77 days after sowing						
R0							
S0	352	339	340	328	333	363	343
S25	341	329	348	327	396	373	352
S50	351	396	330	337	329	278	337
R100							
S0	342	313	306	322	396	388	345
S25	343	334	387	350	235	362	335
S50	309	363	318	261	374	252	313
R300							
S0	308	297	321	341	336	318	320
S25	314	306	345	318	330	306	320
S50	264	256	295	277	270	282	274
LSD(0.05):		RN=23		SYN=23		RN*SYN=40	
LSD(0.01):		RN=32		SYN=32		RN*SYN=54	

4.3 Analysis of variance

42 days after sowing (V6)

Source	DF	SS	MS	F
Replication	5	922.17	184.43	1.94 ns
Treatment	8	3637.91	454.74	4.78 **
N to rice (RN)	2	1615.40	807.70	8.49 **
N to soybean(SYN)	2	1832.40	916.20	9.64 **
RN x SYN	4	190.11	47.53	0.50 ns
Error	40	3803.30	95.08	

77 days after sowing (R5)

Source	DF	SS	MS	F
Replication	5	1425.60	285.12	0.24 *
Treatment	8	26740.80	3342.60	2.80 *
N to rice (RN)	2	14361.00	7180.50	6.01 *
N to rice (SYN)	2	9314.90	4657.45	3.90 ns
RN x SYN	4	3064.90	766.23	0.64
Error	40	47769.00	1194.23	

* = significance at 5% level
** = significance at 1% level
ns = not significant

Appendix Table 5 The relative abundance of ureide (%)

5.1 Comparison of average value at each sampling time

Treatment	42*	47	54	77	83	96
	V6**	R1	R3	R5	R6	R7
R0						
S0	62	72	88	84	81	70
S25	57	71	84	85	79	69
S50	60	77	85	86	82	77
R100						
S0	65	76	86	84	81	77
S25	56	70	83	87	78	72
S50	55	71	84	85	76	76
R300						
S0	67	77	83	86	79	76
S25	62	70	84	84	80	71
S50	41	60	80	83	81	74
LSD						
(0.05)RN	3.7	3.6	2	2	2.6	3
(0.01)RN	4.9	4.7	2.6	2.6	3.4	4
(0.05)SYN	3.7	3.6	2	2	2.6	3
(0.01)SYN	4.9	4.7	2.6	2.6	3.4	4
(0.05)RN*SYN	6.4	6.2	3.4	3.4	6.9	5.1
(0.01)RN*SYN	8.6	8.2	4.5	4.6	9.2	6.8

* Days after sowing
** Growth stage, according to Fehr et al, 1971

5.2 Original data for analysis of variance

Treatment	Replication						
	I	II	III	IV	V	VI	Mean
	42 days after sowing (V6)						
R0							
S0	68	62	62	61	62	59	62
S25	59	55	56	56	56	61	57
S50	58	75	64	51	55	59	60
R100							
S0	72	59	61	65	63	71	65
S25	54	65	46	47	58	67	56
S50	52	58	43	57	58	61	55
R300							
S0	66	71	66	68	67	66	67
S25	67	62	61	58	64	61	62
S50	48	51	35	42	37	31	41
	47 days after sowing (R1)						
R0							
S0	72	74	63	73	73	77	72
S25	72	66	74	71	73	70	71
S50	78	72	77	76	78	82	77
R100							
S0	79	74	73	77	75	75	76
S25	72	68	74	47	81	80	70
S50	63	69	74	67	76	76	71
R300							
S0	80	76	81	79	74	72	77
S25	74	67	67	71	69	70	70
S50	62	64	58	54	61	63	60
	64 days after sowing (R3)						
R0							
S0	88	87	86	90	88	86	88
S25	80	82	81	89	85	89	84
S50	80	79	85	89	89	86	85
R100							
S0	85	86	88	87	79	88	86
S25	80	85	80	78	87	89	83
S50	80	85	85	83	86	85	84
R300							
S0	80	83	81	87	83	85	83
S25	81	83	79	88	85	86	84
S50	79	76	83	83	80	81	80

77 days after sowing (R5)							
R0							
S0	78	77	80	91	89	86	84
S25	86	80	80	89	86	86	85
S50	81	83	85	89	90	88	86
R100							
S0	86	82	80	84	88	85	84
S25	86	87	86	82	92	88	87
S50	83	83	88	81	89	87	85
R300							
S0	86	86	83	87	84	88	86
S25	81	86	83	85	85	84	84
S50	82	82	85	83	83	82	83
83 days after sowing (R6)							
R0							
S0	75	71	80	88	87	82	81
S25	78	75	75	84	80	81	79
S50	80	77	82	85	88	79	82
R100							
S0	82	80	83	72	86	81	81
S25	81	80	80	74	80	74	78
S50	80	77	75	72	75	79	76
R300							
S0	77	77	84	80	81	77	79
S25	81	76	81	84	83	76	80
S50	76	77	81	87	83	79	81
96 days after sowing (R7)							
R0							
S0	66	69	76	63	73	71	70
S25	66	66	67	76	73	67	69
S50	77	73	77	77	77	83	77
R100							
S0	78	82	77	75	77	72	77
S25	72	79	72	68	69	69	72
S50	78	75	71	82	74	77	76
R300							
S0	74	75	74	77	75	81	76
S25	56	78	75	74	75	69	71
S50	71	73	72	73	78	76	74

5.3 Analysis of variance

42 days after sowing (V6)

Source	DF	SS	MS	F	
Replication	5	327.65	65.53	2.17	**
Treatment	8	2955.86	369.48	12.26	ns
N to rice (RN)	2	95.26	47.63	1.58	**
N to soybean(SYN)	2	1521.00	760.50	25.23	**
RN x SYN	4	1339.60	334.90	11.11	
Error	40	1205.90	30.15		

47 days after sowing (R1)

Source	DF	SS	MS	F	
Replication	5	200.76	40.15	1.44	**
Treatment	8	1252.26	156.53	5.63	*
N to rice (RN)	2	186.04	93.02	3.34	**
N to soybean(SYN)	2	300.48	150.24	5.40	**
RN x SYN	4	765.74	191.44	6.88	
Error	40	1112.40	27.81		

* = significance at 5% level
** = significance at 1% level
ns = not significant

64 days after sowing (R3)

Source	DF	SS	MS	F
Replication	5	122.10	24.42	2.95 *
Treatment	8	180	22.49	2.72 *
N to rice (RN)	2	88.04	44.02	5.32 *
N to soybean(SYN)	2	54.04	27.02	3.27 ns
RN x SYN	4	37.85	9.46	1.14
Error	40	330.96	8.27	

77 days after sowing (R5)

Source	DF	SS	MS	F
Replication	5	91.93	18.39	2.14 ns
Treatment	8	79	9.84	1.14 ns
N to rice (RN)	2	13.59	6.80	0.79 ns
N to soybean(SYN)	2	4.15	2.07	0.24 ns
RN x SYN	4	60.96	15.24	1.77
Error	40	343.74	8.59	

* = significance at 5% level
** = significance at 1% level
ns = not significant

83 days after sowing (R6)

Source	DF	SS	MS	F
Replication	5	181.01	36.20	2.51 ns
Treatment	8	129	16.09	1.11 ns
N to rice (RN)	2	40.48	20.24	1.40 ns
N to soybean(SYN)	2	11.15	5.57	0.39 ns
RN x SYN	4	77.07	19.27	1.34
Error	40	577.30	14.43	

96 days after sowing (R7)

Source	DF	SS	MS	F
Replication	5	82.15	16.43	0.86 *
Treatment	8	493	61.64	3.21 ns
N to rice (RN)	2	70.04	35.02	1.82 **
N to soybean(SYN)	2	251.59	125.80	6.55 ns
RN x SYN	4	171.52	42.88	2.23
Error	40	768.19	19.20	

* = significance at 5% level
** = significance at 5% level
ns = not significant

Appendix Table 6 The proportion of plant N derived from N fixation (%)

6.1 Comparison of average value at each sampling time

Treatment	42*	47	54	77	83	96
	V6**	R1	R3	R5	R6	R7
R0						
S0	32	71	89	97	82	82
S25	29	67	86	95	81	81
S50	31	73	90	97	88	88
R100						
S0	34	75	89	95	87	87
S25	27	65	84	96	81	81
S50	27	65	86	96	83	83
R300						
S0	36	78	89	95	86	86
S25	32	69	84	94	83	83
S50	17	47	75	91	85	85
LSD						
(0.05)RN	2.7	4.1	3.4	2	2.7	2.9
(0.01)RN	3.6	5.4	4.5	2.7	3.7	3.9
(0.05)SYN	2.7	4.1	3.4	2	2.7	2.9
(0.01)SYN	3.6	5.4	4.5	2.7	3.7	3.9
(0.05)RN*SYN	4.6	7.1	5.8	4.7	4.7	5
(0.01)RN*SYN	6.1	9.4	7.8	6.3	6.3	6.7

* Days after sowing
** Growth stage, according to Fehr et al, 1971

6.2 Original data for analysis of variance

Treatment	Replication						
	I	II	III	IV	V	VI	Mean
	42 days after sowing (V6)						
R0							
S0	38	34	30	30	31	28	32
S25	33	30	26	26	26	30	29
S50	32	42	32	22	26	29	31
R100							
S0	40	33	30	33	31	37	34
S25	30	36	18	19	27	34	27
S50	28	32	16	27	27	30	27
R300							
S0	37	40	34	35	34	34	36
S25	37	35	30	28	32	30	32
S50	26	28	10	16	12	8	17
	47 days after sowing (R1)						
R0							
S0	79	76	61	68	70	70	71
S25	73	67	65	63	65	66	67
S50	76	83	73	63	68	74	73
R100							
S0	85	74	69	74	71	77	75
S25	70	74	58	39	72	78	65
S50	64	71	56	61	68	71	65
R300							
S0	82	82	79	78	73	72	78
S25	79	72	64	65	68	67	69
S50	61	63	38	40	42	39	47
	64 days after sowing (R3)						
R0							
S0	91	91	79	91	89	90	89
S25	86	83	84	88	86	87	86
S50	89	85	90	92	93	94	90
R100							
S0	92	90	89	90	84	90	89
S25	86	86	83	62	94	94	84
S50	81	87	87	81	89	89	86
R300							
S0	91	90	89	92	86	86	89
S25	87	85	78	87	83	86	84
S50	79	78	74	70	73	76	75

	77 days after sowing (R5)						
R0							
S0	94	92	92	100	100	100	97
S25	94	92	89	100	96	99	95
S50	91	91	96	100	100	98	97
R100							
S0	97	95	94	96	94	98	95
S25	94	97	92	89	100	100	96
S50	92	95	98	91	100	97	96
R300							
S0	94	95	91	98	94	98	95
S25	91	96	90	98	96	95	94
S50	91	89	94	92	90	91	91
	83 days after sowing (R6)						
R0							
S0	86	83	88	100	100	98	93
S25	92	87	84	98	93	94	91
S50	91	90	94	98	100	93	94
R100							
S0	95	91	90	85	99	92	92
S25	94	94	92	85	97	90	92
S50	92	90	91	83	91	92	90
R300							
S0	92	92	93	93	92	92	92
S25	91	91	91	95	94	88	92
S50	89	90	92	96	92	89	91
	96 days after sowing (R7)						
R0							
S0	79	78	85	81	88	83	82
S25	81	79	75	88	83	79	81
S50	88	84	87	89	92	89	88
R100							
S0	90	91	88	78	90	82	87
S25	86	90	82	74	80	75	81
S50	89	85	77	84	79	85	83
R300							
S0	84	86	86	86	85	86	86
S25	76	87	85	87	86	77	83
S50	83	84	83	88	89	84	85

6. 3 Analysis of variance

42 days after sowing (V6)

Source	DF	SS	MS	F
Replication	5	172.09	34.42	2.21 ns
Treatment	8	1493	186.59	11.98 **
N to rice (RN)	2	42.48	21.24	1.36 ns
N to soybean(SYN)	2	765.48	382.74	24.57 **
RN x SYN	4	684.74	171.19	10.99 **
Error	40	623.07	15.58	

47 days after sowing (R1)

Source	DF	SS	MS	F
Replication	5	339.70	67.94	1.86 ns
Treatment	8	3755	469.38	12.87 **
N to rice (RN)	2	1472.30	736.15	20.19 **
N to soybean(SYN)	2	270.81	135.41	3.71 *
RN x SYN	4	2011.90	502.98	13.79 **
Error	40	1458.60	36.46	

* = significance at 5% level
** = significance at 1% level
ns = not significant

64 days after sowing (R3)

Source	DF	SS	MS	F
Replication	5	139.56	27.91	1.13 **
Treatment	8	1035	129.33	5.23 **
N to rice (RN)	2	275.11	137.56	5.56 **
N to soybean(SYN)	2	270.33	135.17	5.47 **
RN x SYN	4	489.22	122.31	4.95
Error	40	989.11	24.73	

77 days after sowing (R5)

Source	DF	SS	MS	F
Replication	5	173.70	34.74	3.88 ns
Treatment	8	112	14.00	1.56 *
N to rice (RN)	2	55.59	27.80	3.11 ns
N to soybean(SYN)	2	18.82	9.41	1.05 ns
RN x SYN	4	37.63	9.41	1.05
Error	40	357.96	8.95	

* = significance at 5% level
** = significance at 1% level
ns = not significant

83 days after sowing (R6)

Source	DF	SS	MS	F
Replication	5	169.70	33.94	2.07 ns
Treatment	8	69	8.59	0.52 ns
N to rice (RN)	2	19.37	9.69	0.59 ns
N to soybean(SYN)	2	3.59	1.80	0.11 ns
RN x SYN	4	45.74	11.44	0.70
Error	40	655.30	16.38	

96 days after sowing (R7)

Source	DF	SS	MS	F
Replication	5	71.20	14.24	0.78 ns
Treatment	8	298	37.31	2.05 ns
N to rice (RN)	2	9.15	4.57	0.25 *
N to soybean(SYN)	2	149.37	74.69	4.10 ns
RN x SYN	4	139.96	34.99	1.92
Error	40	729.30	18.23	

* = significance at 5% level
** = significance at 1% level
ns = not significant

Appendix Table 7 Total N increment (kg/ha)

7.1 Comparison of average value at each sampling time

Treatment	42*	47	54	77	83	96
	V6**	R1	R3	R5	R6	R7
R0						
S0	22	26	37	99	132	146
S25	25	29	47	102	147	165
S50	30	33	44	116	146	171
R100						
S0	23	28	38	100	137	165
S25	28	30	39	106	142	169
S50	28	32	42	108	149	168
R300						
S0	24	32	44	110	152	159
S25	28	35	57	109	146	170
S50	33	39	53	112	148	179
LSD						
(0.05)RN	1.3	2.1	5.2	5.7	6.8	7.1
(0.01)RN	1.7	2.8	6.9	7.6	9.1	9.5
(0.05)SYN	3.7	3.6	2	2	2.6	3
(0.01)SYN	4.9	4.7	2.6	2.6	3.4	4
(0.05)RN*SYN	2.2	3.6	9	9.8	11.8	12.3
(0.01)RN*SYN	3	4.8	12	13.1	15.8	16.5

* Days after sowing
** Growth stage, according to Fehr et al, 1971

7.2 Original data for analysis of variance

Treatment	Replication						
	I	II	III	IV	V	VI	Mean
	42 days after sowing (V6)						
R0							
S0	22.65	21.5	22.58	21.45	22.31	20.52	22
S25	24.65	27.14	25.83	22.98	26.08	25.66	25
S50	29.82	28.66	31.75	29.94	29.23	28.88	30
R100							
S0	24.72	23.52	22.51	25.9	24.12	18.35	23
S25	25.08	28.38	27.14	29.53	26.68	28.54	28
S50	30.02	29.13	28.48	26.98	30.1	25.89	28
R300							
S0	21.94	25.68	26.78	28.14	19.28	23.64	24
S25	27.7	29.57	25.91	28.73	27.2	29.24	28
S50	32.71	32.11	30.69	35.05	35.77	32.36	33
	47 days after sowing (R1)						
R0							
S0	31.26	28.85	24.49	23.52	23.78	26.94	26
S25	28.93	28.04	30.97	28.29	30.23	28.34	29
S50	31.08	35.76	32.2	32.66	35.22	32.75	33
R100							
S0	26.63	27.6	24.1	34.77	24.93	28.27	28
S25	27.62	32.13	30.98	31.06	27.21	30.6	30
S50	30.77	30.77	34.28	32.23	34.34	26.97	32
R300							
S0	34.22	31.72	30.37	35.73	36.39	25.63	32
S25	35.64	30.39	38.63	31.6	41.09	30.29	35
S50	42.05	38.43	38.68	38.79	41.4	32.6	39
	64 days after sowing (R3)						
R0							
S0	36.94	34.15	37.42	39.03	37.99	33.76	37
S25	53.28	39.56	48.75	44.85	50.54	45.88	47
S50	36.39	58.13	45.07	34.68	39.1	49.77	44
R100							
S0	36.99	35.57	35.35	39.55	43.65	35.03	38
S25	42.46	34.16	39.37	42.91	34.66	40.17	39
S50	36.83	32.45	49.4	35.99	53.88	44.23	42
R300							
S0	42.88	45.41	36.33	37.11	54.13	49.13	44
S25	53.96	51.99	52.48	81.76	58.96	42.03	57
S50	61.54	49.87	57.51	44.16	56.71	49.28	53

	77 days after sowing (R5)						
R0							
S0	109.2	98.2	90.09	102.8	99.86	95.66	99
S25	93.9	88.72	111.4	110.4	103.7	106.6	102
S50	107.9	127.3	112.8	123.4	112.4	112.1	116
R100							
S0	94.02	93.92	106.7	103.4	92.98	108.4	100
S25	100.8	99.78	118.4	106.4	96.36	115.3	106
S50	102.4	105.5	120.6	113.6	98.55	106.2	108
R300							
S0	108.3	112.0	115.3	107.1	102.8	114.7	110
S25	104.9	99.47	115.8	112.3	99.27	123.8	109
S50	105.2	98.1	114.5	117.0	117.9	118.6	112
	83 days after sowing (R6)						
R0							
S0	127.9	136.6	126.7	122.3	137.8	140.7	137
S25	133.8	130.9	159.0	159.9	150.6	147.3	153
S50	136.2	141.8	145.4	151.0	147.9	152.4	154
R100							
S0	144.2	137.8	129.3	142.0	126.9	141.8	143
S25	120.9	124.1	162.3	142.2	149.9	152.1	148
S50	148.2	148.3	166.9	151.6	133.0	144.9	156
R300							
S0	147.6	152.8	160.5	137.9	167.8	144.6	158
S25	145.6	151.7	167.0	145.0	127.9	138.1	153
S50	152.9	139.6	152.1	146.6	146.3	149.4	154
	96 days after sowing (R7)						
R0							
S0	141.6	152.4	142.1	147.2	144.6	148.0	146
S25	162.1	167.1	176.2	162.7	160.7	159.5	165
S50	167.1	172.9	170.3	167.1	173.7	172.9	171
R100							
S0	168.4	177.9	154.1	164.6	160.7	161.3	165
S25	179	175.8	161.1	165.5	171.8	161.0	169
S50	157.7	162.3	205.0	166.4	154.9	159.9	168
R300							
S0	151.7	170.5	151.1	159.9	159.1	159.7	159
S25	170.6	177.9	175.9	167.1	162.4	168.3	170
S50	174.1	183.1	161.8	167.9	168.3	177.9	179

7.3 Analysis of variance

42 days after sowing (V6)

Source	DF	SS	MS	F
Replication	5	16.19	3.24	0.88 ns
Treatment	8	596	74.56	20.26 **
N to rice (RN)	2	77.21	38.61	10.49 **
N to soybean(SYN)	2	484.59	242.30	65.85 **
RN x SYN	4	34.68	8.67	2.36 ns
Error	40	147.19	3.68	

47 days after sowing (R1)

Source	DF	SS	MS	F
Replication	5	66.72	13.34	1.42 ns
Treatment	8	674	84.30	8.98 **
N to rice (RN)	2	365.79	182.90	19.49 **
N to soybean(SYN)	2	290.15	145.08	15.46 **
RN x SYN	4	18.47	4.62	0.49 ns
Error	40	375.35	9.38	

* = significance at 5% level
** = significance at 1% level
ns = not significant

64 days after sowing (R3)

Source	DF	SS	MS	F
Replication	5	178.72	35.74	0.61
Treatment	8	2162	270.21	4.60 **
N to rice (RN)	2	1452.70	726.35	12.35 *
N to soybean(SYN)	2	400.44	200.22	3.41 ns
RN x SYN	4	308.53	77.13	1.31
Error	40	2351.80	58.80	

77 days after sowing (R5)

Source	DF	SS	MS	F
Replication	5	476.83	95.37	1.35
Treatment	8	2191	273.84	3.88 *
N to rice (RN)	2	751.37	375.69	5.32 **
N to soybean(SYN)	2	601.19	300.60	4.26 *
RN x SYN	4	838.19	209.55	2.97 *
Error	40	2822.20	70.55	

* = significance at 5% level
** = significance at 1% level
ns = not significant

83 days after sowing (R6)

Source	DF	SS	MS	F
Replication	5	911.62	182.32	1.79 *
Treatment	8	1871	233.88	2.29 ns
N to rice (RN)	2	507.36	253.68	2.49 ns
N to soybean(SYN)	2	478.65	239.33	2.34 ns
RN x SYN	4	884.99	221.25	2.17
Error	40	4082.80	102.07	

96 days after sowing (R7)

Source	DF	SS	MS	F
Replication	5	573.43	114.69	1.03 *
Treatment	8	2058	257.24	2.32 ns
N to rice (RN)	2	543.59	271.80	2.45 ns
N to rice (SYN)	2	589.84	294.92	2.65 ns
RN x SYN	4	924.52	231.13	2.08
Error	40	4443.40	111.09	

* = significance at 5% level
** = significance at 1% level
ns = not significant

Appendix Table 8 The amount of N fixed (kg/ha)

8.1 Comparison of average value at each sampling time

Treatment	42*	47	54	77	83	96
	V6**	R1	R3	R5	R6	R7
R0						
S0	5	8	22	80	113	122
S25	5	8	24	76	117	132
S50	7	9	19	88	124	141
R100						
S0	5	9	17	73	117	138
S25	6	8	14	80	118	135
S50	6	8	17	79	122	131
R300						
S0	6	12	23	90	130	139
S25	7	11	30	79	120	136
S50	4	7	18	72	110	128
LSD						
(0.05)RN	0.8	1.9	4.7	5.2	6.9	6
(0.01)RN	1.1	2.5	6.3	6.9	9.2	8
(0.05)SYN	0.8	1.9	4.7	5.2	6.9	6
(0.01)SYN	1.1	2.5	6.3	6.9	9.2	8
(0.05)RN*SYN	1.4	3.2	8.2	9	12	10
(0.01)RN*SYN	1.8	4.3	11	12	16	14

* Days after sowing
** Growth stage, according to Fehr et al, 1971

8.2 Original data for analysis of variance

Treatment	Replication						
	I	II	III	IV	V	VI	Mean
	42 days after sowing (V6)						
R0							
S0	5.87	4.86	4.61	4.28	4.68	3.73	4.7
S25	5.76	5.98	4.84	4.10	4.91	5.54	5.2
S50	7.24	9.01	7.86	5.00	5.73	6.29	6.9
R100							
S0	7.01	5.39	4.59	6.17	5.25	4.13	5.4
S25	5.36	7.62	3.59	4.24	5.26	7.25	5.6
S50	6.39	7.02	3.40	5.34	6.18	5.61	5.7
R300							
S0	5.45	7.39	6.66	7.33	4.11	5.59	6.1
S25	7.59	7.83	5.61	6.03	6.40	6.61	6.7
S50	6.63	6.97	2.35	4.46	3.43	2.01	4.3
	47 days after sowing (R1)						
R0							
S0	12.68	10.44	5.78	5.68	5.71	8.22	8.1
S25	8.88	6.58	8.18	7.45	7.60	7.30	7.7
S50	8.20	14.91	8.18	6.71	9.80	9.15	9.5
R100							
S0	8.63	8.00	5.69	12.73	5.82	11.76	8.8
S25	7.14	10.85	6.89	5.51	5.59	9.19	7.5
S50	6.87	8.18	6.65	8.54	9.07	6.38	7.6
R300							
S0	15.52	12.35	9.49	13.25	16.59	7.02	12.4
S25	13.86	8.42	13.75	7.89	15.84	7.32	11.2
S50	12.33	10.95	5.38	5.95	5.79	2.11	7.1
	64 days after sowing (R3)						
R0							
S0	27.0	24.4	23.9	19.8	18.4	19.8	22.2
S25	29.8	16.2	23.0	22.0	28.5	22.6	23.7
S50	12.9	33.9	19.8	8.6	13.4	25.2	19.0
R100							
S0	18.2	10.3	15.7	17.0	21.5	17.9	16.8
S25	19.9	12.6	13.9	6.7	12.6	18.2	14.0
S50	11.8	9.7	19.8	11.6	26.5	21.7	16.8
R300							
S0	23.4	24.7	15.1	14.5	31.9	27.2	22.8
S25	29.8	26.8	24.6	51.5	30.7	17.4	30.1
S50	27.7	19.9	19.3	9.7	17.0	14.8	18.1

	77 days after sowing (R5)						
R0							
S0	85.5	90.9	63.2	83.6	80.2	75.7	80
S25	68.0	61.4	78.9	87.6	75.7	82.7	76
S50	78.1	96.9	84.9	97.3	86.7	86.3	88
R100							
S0	73.5	71.4	64.0	78.4	67.9	80.0	73
S25	74.8	76.2	86.6	72.2	74.3	93.4	80
S50	72.5	79.1	89.7	82.2	71.1	81.9	79
R300							
S0	85.0	88.0	86.7	83.2	105.8	91.5	90
S25	76.2	72.4	81.6	81.5	69.4	95.2	79
S50	67.5	62.8	73.0	76.8	72.0	77.9	72
	83 days after sowing (R6)						
R0							
S0	106.57	112.65	100.39	108.07	123.23	124.83	113
S25	109.71	98.13	118.90	136.14	119.34	120.99	117
S50	110.83	116.99	122.46	131.43	129.21	130.74	124
R100							
S0	127.16	117.34	108.37	117.16	107.56	125.95	117
S25	98.64	104.19	132.01	107.50	131.26	131.44	118
S50	120.25	123.57	137.80	119.82	108.55	123.46	122
R300							
S0	127.06	131.47	134.69	117.76	144.06	125.08	130
S25	120.22	126.89	135.19	119.59	103.31	114.70	120
S50	115.93	106.24	113.54	111.17	104.19	111.28	110
	96 days after sowing (R7)						
R0							
S0	119.30	121.18	108.78	129.00	124.36	126.57	122
S25	127.98	127.24	132.79	137.99	137.77	131.17	132
S50	130.93	137.33	137.97	148.17	146.07	142.54	141
R100							
S0	143.21	147.94	124.61	138.26	130.00	145.28	138
S25	143.14	144.74	125.95	126.00	143.99	124.88	135
S50	127.16	129.42	154.37	126.27	120.57	130.17	131
R300							
S0	142.43	141.38	138.50	131.36	148.45	132.71	139
S25	146.01	142.66	136.01	131.71	126.09	132.39	136
S50	130.22	139.31	118.32	126.08	119.92	131.81	128

8.3 Analysis of variance

42 days after sowing (V6)

Source	DF	SS	MS	F
Replication	5	10.15	2.03	1.48 *
Treatment	8	36.04	4.50	3.28 ns
N to rice (RN)	2	0.59	0.30	0.22 ns
N to soybean(SYN)	2	2.48	1.24	0.90 **
RN x SYN	4	32.96	8.24	6.01
Error	40	54.85	1.37	

47 days after sowing (R1)

Source	DF	SS	MS	F
Replication	5	65.04	13.01	1.72 *
Treatment	8	159.47	19.93	2.64 *
N to rice (RN)	2	50.85	25.43	3.37 ns
N to soybean(SYN)	2	25.15	12.57	1.67 *
RN x SYN	4	83.47	20.87	2.76
Error	40	301.94	7.55	

* = significance at 5% level
** = significance at 1% level
ns = not significant

64 days after sowing (R3)

Source	DF	SS	MS	F
Replication	5	129.29	25.86	0.53
Treatment	8	1134.32	141.79	2.88 *
N to rice (RN)	2	588.88	294.44	5.98 **
N to soybean(SYN)	2	194.86	97.43	1.98 ns
RN x SYN	4	350.58	87.65	1.78 ns
Error	40	1969.80	49.25	

77 days after sowing (R5)

Source	DF	SS	MS	F
Replication	5	533.69	106.74	1.80
Treatment	8	1882.80	235.35	3.97 *
N to rice (RN)	2	168.72	84.36	1.42 ns
N to soybean(SYN)	2	60.88	30.44	0.51 ns
RN x SYN	4	1653.20	413.30	6.97 **
Error	40	2370.20	59.25	

* = significance at 5% level
** = significance at 1% level
ns = not significant

83 days after sowing (R6)

Source	DF	SS	MS	F
Replication	5	562.98	112.60	1.07 ns
Treatment	8	1560.31	195.04	1.86 ns
N to rice (RN)	2	1.81	0.91	0.01 ns
N to soybean(SYN)	2	36.59	18.30	0.17 *
RN x SYN	4	1521.90	380.48	3.62
Error	40	4204.20	105.10	

96 days after sowing (R7)

Source	DF	SS	MS	F
Replication	5	286.80	57.36	0.71 *
Treatment	8	1752.74	219.09	2.72 ns
N to rice (RN)	2	96.48	48.24	0.60 ns
N to soybean(SYN)	2	12.57	6.28	0.08 **
RN x SYN	4	1643.70	410.93	5.11
Error	40	3219.60	80.49	

* = significance at 5% level
** = significance at 1% level
ns = not significant

Appendix Table 9 Soybean yield, total N content and N removed

9.1 Original data for analysis of variance

Treatment	Replication						
	I	II	III	IV	V	VI	Mean
	Soybean seed yield (kg/ha)						
R0							
S0	1760	1883	1593	1769	1496	1646	1691
S25	1989	1892	1866	1795	1769	1663	1829
S50	1804	1901	1883	1874	1866	1690	1836
R100							
S0	1848	1927	1751	1637	1892	1769	1804
S25	1910	1866	1874	1874	1769	1751	1841
S50	1654	1795	1857	1874	1989	1989	1860
R300							
S0	1927	1804	1839	1698	1795	1901	1827
S25	1954	1725	1778	1707	1954	1927	1841
S50	1989	1918	1813	1610	2191	1954	1913
LSD(0.05):	RN=79		SYN=79			RN*SYN=137	
LSD(0.01):	RN=106		SYN=106			RN*SYN=184	
	total N content (%)						
R0							
S0	7.25	7.24	7.46	7.21	7.20	7.01	7.23
S25	7.27	7.23	7.21	7.34	7.18	7.25	7.25
S50	7.21	7.18	7.13	7.15	7.15	7.07	7.15
R100							
S0	7.22	7.37	7.53	7.35	7.39	7.23	7.35
S25	7.29	7.39	7.26	7.25	7.11	7.33	7.27
S50	7.19	7.27	7.18	7.23	7.20	7.18	7.21
R300							
S0	7.15	7.14	7.10	7.41	6.89	7.15	7.14
S25	7.10	7.25	7.31	7.21	7.25	7.11	7.21
S50	7.16	7.33	7.36	7.15	7.38	7.01	7.23
LSD(0.05):	RN=0.07		SYN=0.07			RN*SYN=0.12	
LSD(0.01):	RN=0.09		SYN=0.08			RN*SYN=0.16	

N removal with seeds (kg/ha)

R0							
S0	128	136	119	128	108	115	122
S25	145	137	135	132	127	121	133
S50	130	136	134	134	133	119	131
R100							
S0	133	142	132	120	140	128	133
S25	139	138	136	136	126	128	134
S50	119	131	133	136	143	143	134
R300							
S0	138	129	131	126	124	136	130
S25	139	125	130	123	142	137	133
S50	142	141	133	115	162	137	138

LSD(0.05): RN=6.0 SYN=6.0 RN*SYN=10.3
LSD(0.01): RN=8.0 SYN=8.0 RN*SYN=13.8

9.3 Analysis of variance

Seed yield

Source	DF	SS	MS	F
Replication	5	80879	16176	1.16 ns
Treatment	8	166957	20870	1.50 ns
N to rice (RN)	2	51955	25978	1.86 *
N to soybean (SYN	2	84496	42248	3.03 ns
RN x SYN	4	30506	7627	0.55
Error	40	557280	13932	

Seed total N content

Source	DF	SS	MS	F
Replication	5	0.12	0.02	2.30 *
Treatment	8	0.19	0.02	2.32 *
N to rice (RN)	2	0.07	0.04	3.50 ns
N to soybean(SYN)	2	0.02	0.01	1.13 ns
RN x SYN	4	0.10	0.02	2.33
Error	40	0.41	0.01	

Seed N removal

Source	DF	SS	MS	F
Replication	5	409.70	81.94	1.05 ns
Treatment	8	874.60	109.33	1.40 ns
N to rice (RN)	2	298.04	149.02	1.90 ns
N to soybean(SYN)	2	355.15	177.58	2.27 ns
RN x SYN	4	221.41	55.35	0.71
Error	40	3133.60	78.34	

* = significance at 5% level
** = significance at 1% level
ns = not significant

Appendix Table 10 Amount of N returned to field with fallen leaves

10.1 Original data for analysis of variance

Treatment	Replication						
	I	II	III	IV	V	VI	Mean
	Dry matter (kg/ha)						
R0							
S0	882	1003	1219	922	912	1062	1000
S25	1061	1097	1054	1044	1067	1069	1065
S50	1159	1082	1157	1169	1082	1181	1138
R100							
S0	1243	1182	987	1172	905	879	1061
S25	983	1252	1053	1131	932	1087	1073
S50	1182	902	1283	909	1247	1004	1088
R300							
S0	1279	949	1057	1045	1007	1051	1065
S25	1057	1062	1217	1177	922	1245	1113
S50	1047	1367	1110	1111	1109	1007	1125
LSD(0.05):		RN=81		SYN=81		RN*SYN=141	
LSD(0.05):		RN=108		SYN=108		RN*SYN=188	
	N content (%)						
R0							
S0	1.00	0.94	1.05	1.07	1.01	0.98	1.01
S25	1.18	1.19	1.12	1.21	1.14	1.19	1.17
S50	1.25	1.35	1.15	1.25	1.23	1.28	1.25
R100							
S0	1.09	1.03	1.15	1.13	1.19	1.12	1.12
S25	0.93	1.05	1.01	1.06	1.15	0.96	1.03
S50	1.21	1.19	1.23	1.14	1.19	1.15	1.19
R300							
S0	1.03	1.06	1.20	1.14	1.01	1.09	1.09
S25	1.27	1.39	1.28	1.33	1.25	1.36	1.31
S50	1.50	1.38	1.34	1.57	1.40	1.49	1.45
LSD(0.05):		RN=0.04		SYN=0.04		RN*SYN=0.17	
LSD(0.05):		RN=0.06		SYN=0.06		RN*SYN=0.21	

	Amount of N returned to field (kg/ha)						
R0							
S0	9	9	13	10	9	10	10
S25	13	13	12	13	12	13	12
S50	14	15	13	15	13	15	14
R100							
S0	14	12	11	13	11	10	12
S25	9	13	11	12	11	10	11
S50	14	11	16	10	15	12	13
R300							
S0	13	10	13	12	10	11	12
S25	13	15	16	16	12	17	15
S50	16	19	15	17	16	15	16

LSD(0.05): RN=1.1 SYN=1.1 RN*SYN=1.8
LSD(0.05): RN=1.4 SYN=1.4 RN*SYN=2.4

10.2 Analysis of variance

Leaf dry weight

Source	DF	SS	MS	F
Replication	5	60278	12056	0.83 ns
Treatment	8	83123	10390	0.72 ns
N to rice (RN)	2	11202	5601	0.39 ns
N to soybean(SYN)	2	51000	25500	1.76 ns
RN x SYN	4	20921	5230	0.36
Error	40	580710	14518	

Total N content

Source	DF	SS	MS	F
Replication	5	0.01	0.00	0.66 **
Treatment	8	0.96	0.12	30.65 **
N to rice (RN)	2	0.30	0.15	38.70 **
N to soybean(SYN)	2	0.45	0.22	57.53 **
RN x SYN	4	0.21	0.05	13.18
Error	40	0.16	0.00	

Nitrogen removal

Source	DF	SS	MS	F
Replication	5	8.59	1.72	0.70
Treatment	8	193.48	24.19	9.86 **
N to rice (RN)	2	54.48	27.24	11.11 **
N to soybean(SYN)	2	103.37	51.69	21.08 **
RN x SYN	4	35.63	8.91	3.63 *
Error	40	98.07	2.45	

* = significance at 5% level
** = significance at 1% level
ns = not significant

Biographical Sketch

Name: Ying Ji-feng

Birth date: 23 April, 1964

Education Background:

1971-1976: Primary School
Haiyan county, Zhejiang Province, China

1976-1981: Middle School
Haiyan county, Zhejiang province, China

1981-1985: B. Sc. Agriculture (Agronomy)
Nanjing Agricultural University, Nanjing, China

1988-1990: M. Sc. Agriculture (Agricultural Systems), Chiang Mai University, Chiang Mai, Thailand

Work Experience:

1985-1988: Research Asistant
Department of Agronomy
China National Rice Research Institute (CNRRI)
Hangzhou, China

Address: Department of Agronomy
China National Rice Research Institute
Hangzhou, Zhejiang,
China