



**Appendix A Schematic diagram of the maize/alfalfa intercropping pot experiment.** NS, NNS and PSS represent no root separation, root separation with nylon net and root separation with plastic, respectively.

1 Appendix B Results of repeated measures ANOVA on maize yield, alfalfa yield, maize nitrogen content, alfalfa nitrogen content, total yield and total nitrogen

2 content, with nitrogen level (N) and root separation patterns (RS) as the independent variables.

Source	Df	Maize yield			Alfalfa yield			Maize nitrogen content			Alfalfa nitrogen content			Total yield			Total nitrogen content		
		MS	F	P	MS	F	P	MS	F	P	MS	F	P	MS	F	P	MS	F	P
N	1	20662.99	165.00	**	71.45	40.40	**	58.31	1819.20	**	0.65	145.90	**	23162.69	177.21	**	71.28	2462.07	**
RS	2	15371.82	122.75	**	1776.71	1004.62	**	15.02	468.68	**	2.19	493.02	**	6837.95	52.32	**	5.85	202.12	**
N×RS	2	1698.63	13.56	**	2.23	1.26	ns	0.70	21.78	**	0.03	7.07	**	1597.64	12.22	**	0.54	18.82	**
Model	5	10960.78	87.53	**	725.87	410.43	**	17.95	560.20	**	1.02	229.22	**	8006.77	61.26	**	16.81	580.79	**
Error	18	125.23			1.77			0.03			0.00			130.70			0.03		
Corrected Total	23																		

3 Df, degrees of freedom. MS, Mean Square. \*, P<0.05. \*\*, P<0.01. ns, no significant difference.

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6 Appendix C Results of repeated measures ANOVA on nitrogen fixation of alfalfa and nitrogen transfer, with nitrogen level (N) and root separation patterns (RS) as  
 7 the independent variables.

Source	Df	Rate of N fixation			Amount of N fixation			Rate of N transfer			Amount of N transfer		
		MS	F	P	MS	F	P	MS	F	P	MS	F	P
N	1	1169.01	446.30	**	151098.27	84.76	**	13.99	2.43	ns	1084.88	5.46	*
RS	2	1657.23	632.69	**	123042.17	69.02	**	24.06	4.19	ns	9622.14	48.39	**
N×RS	2	119.95	45.79	**	14624.07	8.20	**	14.75	2.57	ns	369.89	1.86	ns
Model	5	944.67	360.65	**	85286.15	47.84	**	17.60	3.06	ns	3692.30	18.57	**
Error	18	2.62			1782.69			5.74			198.83		
Corrected Total	23												

8 Df, degrees of freedom. MS, Mean Square. \*, P<0.05. \*\*, P<0.01. ns, no significant difference.

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13 Appendix D Results of repeated measures ANOVA on the crown root dry weight (CRDW), crown  
 14 root length (CRL), crown root surface area (CRS), crown root volume (CRV), crown root average  
 15 diameter (CRAD), lateral root branch density (LRBD), crown root angle (CRA) and crown root  
 16 number (CRN) of maize crown roots, with nitrogen level (N), and root separation patterns (RS) as  
 17 the independent variables.

Source	Df	CRDW	CRL	CRS	CRV	CRAD	LRBD	CRA	CRN
N	1	160.19**	167.00**	49.03**	46.10**	59.45**	51.60**	73.17**	145.66**
RS	2	197.02**	197.48**	47.48**	121.15**	52.84**	18.22**	62.21**	62.55**
N×RS	2	2.51ns	10.85**	0.85ns	2.83ns	3.92*	0.34ns	0.46ns	5.09*

18 Df, degrees of freedom. \*, P<0.05. \*\*, P<0.01. ns, no significant difference.

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 64 Appendix E Results of repeated measures ANOVA on the root dry weight (RDW), root length (RL),  
 65 root surface area (RS), root volume (RV), root average diameter (RAD), root collar diameter (RCD),  
 66 taproot length (TL) and lateral root number (LRN) of alfalfa, with nitrogen level (N) and root  
 67 separation patterns (RS) as the independent variables.

Source	Df	RDW	RL	RS	RV	RAD	RCD	TL	LRN
N	1	46.34**	1.58 <sup>ns</sup>	4.04 <sup>ns</sup>	0.03 <sup>ns</sup>	16.89**	1.64 <sup>ns</sup>	41.63**	130.18**
RS	2	336.56**	221.88**	72.18**	111.69**	167.37**	183.96**	311.58**	516.17**
N×RS	2	0.21 <sup>ns</sup>	3.29 <sup>ns</sup>	1.76 <sup>ns</sup>	1.97 <sup>ns</sup>	1.64 <sup>ns</sup>	1.21 <sup>ns</sup>	0.51 <sup>ns</sup>	15.43**

68 Df, degrees of freedom. \*, P<0.05. \*\*, P<0.01. ns, no significant difference.

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Appendix F Correlations between the root morphology indices of maize and alfalfa and the rates of N fixation and transfer at two N levels

Crop variety	Nitrogen level	Root morphology index <sup>1)</sup>	Rate of N fixation (%)	Rate of N transfer (%)
Maize	N0	CRDW	0.9204**	0.5287*
		CRL	0.8166**	0.5547ns
		CRS	0.5916**	0.4949*
		CRV	0.8130**	0.6136**
		CRAD	0.8123**	0.7277ns
		LRBD	0.5894**	0.2412**
		CRA	-0.8551**	-0.6680**
		CRN	0.7957**	0.5477*
	N1	CRDW	0.8655**	0.8892**
		CRL	0.8566**	0.7149ns
		CRS	0.7963**	0.4298**
		CRV	0.8374**	0.7278**
		CRAD	0.5802**	0.6645**
		LRBD	0.7324**	0.6684**
		CRA	-0.8298**	-0.7044**
		CRN	0.8788**	0.6620**
Alfalfa	N0	RDW	-0.8057**	-0.6081**
		RL	-0.6932**	-0.4725ns
		RS	-0.8438**	-0.8435**
		RV	-0.8245**	-0.8152**
		RAD	-0.7109**	-0.5499**
		RCD	-0.6044**	-0.4773ns
		TL	-0.8606**	-0.7310**
		LRN	-0.9431**	-0.7878**
	N1	RDW	-0.6754**	-0.3776ns
		RL	-0.6343**	-0.6738**
		RS	-0.7127**	-0.8756**
		RV	-0.6191**	-0.6363**
		RAD	-0.6732**	-0.6107**
		RCD	-0.5424**	-0.0359ns
		TL	-0.8671**	-0.6297**
		LRN	-0.8697**	-0.4809ns

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<sup>1)</sup>CRDW, CRL, CRS, CRV, CRAD, CLRBD, CRA and CRN represent the crown root dry weight, crown root length, crown root surface area, crown root volume, crown root average diameter, lateral root branch density, crown root angle and crown root number of maize crown roots, respectively. RDW, RL, RS, RV, RAD, RCD, TL and LRN represent the root dry weight, root length, root surface area, root volume, root average diameter, root collar diameter, taproot length and lateral root number of alfalfa roots, respectively. \*, P<0.05, \*\*, P<0.01, ns, no significant difference.

