

ภาคผนวก

ตารางภาคผนวกที่ 1 Analysis of variance of dry matter of red kidney bean in pot experiments with KNO_3 and $(\text{NH}_4)_2\text{SO}_4$ fertilization at various stages of growth.

SOV	df	MS	
		KNO ₃	(NH ₄) ₂ SO ₄
V ₄ stage			
Treatment	5	4.4437**	3.7210**
Error	18	0.6571	0.2346
Total	23		
R ₂ stage			
Treatment	5	18.874**	38.089**
Error	18	1.5607	1.6012
Total	23		
R ₄ stage			
Treatment	5	78.285**	57.53**
Error	18	4.9783	1.9937
Total	23		
R ₆ stage			
Treatment	5	137.57**	151.00**
Error	18	27.030	8.6832
Total	23		

ตารางภาคผนวกที่ 2 Analysis of variance of N uptake of red kidney bean in pot experiments with KNO_3 and $(\text{NH}_4)_2\text{SO}_4$ fertilization at various stages of growth.

SOV	df	MS	
		KNO ₃	(NH ₄) ₂ SO ₄
V ₄ stage			
Treatment	5	0.0087**	0.0181**
Error	18	0.0011	0.0005
Total	23		
R ₂ stage			
Treatment	5	0.0278**	0.1034**
Error	18	0.0027	0.0026
Total	23		
R ₄ stage			
Treatment	5	0.0978**	0.2090**
Error	18	0.0052	0.0051
Total	23		
R ₆ stage			
Treatment	5	0.1349**	0.4811**
Error	18	0.0284	0.0131
Total	23		

ตารางภาคผนวกที่ 3 Analysis of variance of nodule dry weight of red kidney bean from pot experiments with KNO_3 and $(\text{NH}_4)_2\text{SO}_4$ fertilization at various stages of growth.

SOV	df	MS		
		KNO_3	$(\text{NH}_4)_2\text{SO}_4$	
		V ₄ stage	V ₄ stage	R ₁ stage
Treatment	5	137,810**	129,060**	106,540
Error	18	1339.3	1559.9	756.01
Total	23			

ตารางภาคผนวกที่ 4 Analysis of variance of ureide index of red kidney bean from pot experiment with KNO_3 and $(\text{NH}_4)_2\text{SO}_4$ fertilization at various stages of growth.

SOV	df	MS			
		KNO_3		$(\text{NH}_4)_2\text{SO}_4$	
		sap	tissue	sap	tissue
		V ₄ stage			
Treatment	5	4548.3**	3478.1**	2758.8**	2374.2**
Error	18	3.3552	5.1442	9.4412	4.1042
Total	23				
		R ₂ stage			
Treatment	5	3176.5**	3500.0**	3068.4**	2857.2**
Error	18	3.8401	7.8315	8.6491	2.2200
Total	23				
		R ₄ stage			
Treatment	5	2427.3**	2740.4**	2703.0**	2306.9**
Error	18	5.2729	6.5378	10.949	5.3398
Total	23				
		R ₆ stage			
Treatment	5	2677.7**	2679.1**	2406.6**	2679.9**
Error	18	6.7674	7.5663	5.6825	62.121
Total	23				

ตารางภาคผนวกที่ 5 Analysis of variance of $\text{NO}_3\text{-N}$ index of red kidney bean from pot experiment with KNO_3 and $(\text{NH}_4)_2\text{SO}_4$ fertilization at various stages of growth.

SOV	df	MS			
		KNO_3		$(\text{NH}_4)_2\text{SO}_4$	
		sap	tissue	sap	tissue
Treatment	5	4293.7**	3478.1**	183.5**	2377.1**
Error	18	12.777	5.1446	16.951	4.0095
Total	23				
Treatment	5	2310.1**	3500.0**	768.87**	2857.2**
Error	18	4.9578	7.8314	19.557	2.2202
Total	23				
Treatment	5	2256.4**	2740.5**	485.53**	2306.9**
Error	18	9.0725	6.5371	5.2427	5.3395
Total	23				
Treatment	5	1875.5**	2679.2**	986.47**	2465.9**
Error	18	5.0783	7.5662	8.4816	5.4085
Total	23				

ตารางภาคผนวกที่ 6 Analysis of variance of amino-N index of red kidney bean from pot experiments with KNO_3 and $(\text{NH}_4)_2\text{SO}_4$ fertilization at various stages of growth.

SOV	df	MS	
		KNO_3	$(\text{NH}_4)_2\text{SO}_4$
Treatment	5	45.910*	1612.3**
Error	18	11.094	65.727
Total	23		
Treatment	5	114.84**	1134.5**
Error	18	4.0736	35.837
Total	23		
Treatment	5	39.181*	921.11**
Error	18	9.6062	22.037
Total	23		
Treatment	5	189.51**	450.20**
Error	18	12.571	16.584
Total	23		

ตารางภาคผนวกที่ 7 Analysis of variance of %N₂-fixed of red kidney bean from pot experiments with KNO₃ and (NH₄)₂SO₄ fertilization at various stages of growth.

SOV	df	MS	
		sap	tissue
Treatment	5	3034.5**	2990.2**
	18	7.5378	8.7834
	23		
Error	5	1967.8**	1887.9**
	18	2.5622	2.4406
	23		
Total	5		
	18		
	23		

ตารางภาคผนวกที่ 8 Analysis of variance of amount of N₂ fixed of red kidney bean from pot experiments with KNO₃ and (NH₄)₂SO₄ fertilization at various stages of growth.

SOV	df	MS	
		sap	tissue
Treatment	5	0.0766**	0.0653**
	18	0.0056	0.0059
	23		
Error	5	0.0075**	0.0096**
	18	0.0016	0.0014
	23		
Total	5		
	18		
	23		

ตารางภาคผนวกที่ 9 Dry matter (g/pot) of red kidney bean in pot experiment with KNO_3 fertilization at various stages of growth.

Treatment rate ($\text{mMNO}_3\text{-N}$)	Stage	Replication			
		1	2	3	4
0	V_4	2.7300	3.1833	3.6670	3.9413
2		4.8000	4.4533	3.9233	5.8967
4		7.8729	5.2033	2.2300	6.5137
6		5.8867	4.5833	4.8933	5.8333
8		5.9767	5.8500	5.3067	7.0133
10		6.3075	6.2667	4.9533	5.6400
0	R_2	7.4300	7.8467	7.0833	7.6967
2		10.346	10.753	10.617	7.6267
4		9.8100	10.407	9.9133	10.060
6		12.553	10.317	11.497	10.820
8		9.5813	12.469	14.317	13.640
10		14.147	15.261	12.510	12.707
0	R_4	9.5850	9.7067	11.990	10.513
2		14.760	15.783	16.884	13.137
4		16.884	20.734	17.032	15.814
6		15.848	16.845	22.470	16.779
8		21.146	21.063	27.150	21.862
10		21.263	24.027	19.634	38.733
0	R_6	18.997	27.293	27.367	26.963
2		24.573	22.987	34.826	23.704
4		40.586	27.960	28.270	32.977
6		34.387	35.460	39.177	35.734
8		33.626	40.507	35.933	34.880
10		37.880	32.030	51.289	38.733

ตารางภาคผนวกที่ 10 Dry matter (g/pot) of red kidney bean from pot experiment with $(\text{NH}_4)_2\text{SO}_4$ fertilization at various stages of growth.

Treatment rate (mM $\text{NH}_4\text{-N}$)	Stage	Replication			
		1	2	3	4
0	V_4	5.5710	6.0510	4.6770	6.0060
2		6.2460	7.0320	7.1700	7.3560
4		8.2650	8.1191	8.4330	6.8910
6		8.2800	7.5360	8.4450	8.3640
8		8.1660	7.8030	7.7730	8.0820
10		6.9840	7.1910	7.3260	7.5420
0	R_2	9.4479	10.059	10.024	9.9421
2		17.496	14.622	15.624	16.113
4		17.967	17.661	18.660	18.817
6		18.890	19.973	15.407	18.447
8		18.047	15.135	15.323	17.650
10		16.581	14.889	15.108	17.607
0	R_4	15.321	16.234	15.386	16.258
2		21.354	20.698	21.054	22.014
4		22.456	24.087	26.312	24.985
6		23.010	26.541	24.358	28.354
8		26.354	23.140	25.984	25.314
10		23.685	26.254	24.685	25.035
0	R_6	19.723	21.369	21.063	25.774
2		27.417	29.693	29.014	29.458
4		28.697	33.458	31.025	32.451
6		32.268	35.168	37.150	37.246
8		33.245	34.245	44.648	36.145
10		38.356	37.200	35.400	42.240

ตารางภาคผนวกที่ 11 Nodule dry weight (mg/pot) of red kidney bean in pot experiments with KNO_3 and $(\text{NH}_4)_2\text{SO}_4$ fertilization at various stages of growth.

Treatment rate (mMN)	Replication	KNO ₃ exp. V ₄ stage	(NH ₄) ₂ SO ₄ exp.	
			V ₄ stage	R ₂ stage
		nodule DW (mg/pot)		
0	1	399.77	402.96	420.21
0	2	556.27	437.67	519.21
0	3	476.17	478.11	364.53
0	4	548.90	563.76	409.80
2	1	359.47	330.51	248.04
2	2	404.83	326.40	241.05
2	3	401.13	281.07	217.95
2	4	377.66	292.14	227.22
4	1	396.08	282.45	91.860
4	2	381.50	161.61	80.250
4	3	345.67	182.40	83.160
4	4	347.90	148.98	82.890
6	1	185.93	59.100	35.490
6	2	119.40	56.310	53.220
6	3	148.50	62.490	35.910
6	4	201.0	63.120	47.250
8	1	65.933	65.220	28.080
8	2	99.600	37.767	24.810
8	3	80.833	48.690	24.360
8	4	85.467	27.000	23.130
10	1	37.100	13.033	15.360
10	2	37.200	13.500	15.870
10	3	48.300	13.733	14.940
10	4	32.325	13.167	15.030

ตารางภาคผนวกที่ 12 N-uptake (gN/pot) of red kidney bean in pot experiment with KNO_3 fertilization at various stages of growth.

Treatment rate (mMNO ₃ -N)	Stage	Replication			
		1	2	3	4
0	V ₄	0.0959	0.1011	0.1173	0.1363
2		0.1602	0.1562	0.1367	0.1965
4		0.2899	0.1837	0.1873	0.2546
6		0.2305	0.1784	0.1783	0.2039
8		0.2241	0.2287	0.1775	0.2669
10		0.2527	0.2526	0.1964	0.2069
0	R ₂	0.2448	0.2429	0.2557	0.2599
2		0.3210	0.3704	0.3316	0.2324
4		0.1356	0.3245	0.2926	0.3350
6		0.3464	0.3514	0.3843	0.3271
8		0.3365	0.4388	0.4704	0.4816
10		0.4988	0.5856	0.3869	0.4401
0	R ₄	0.2600	0.2364	0.3103	0.3057
2		0.4570	0.4833	0.4997	0.3612
4		0.5065	0.5880	0.4430	0.4793
6		0.4649	0.5549	0.7425	0.4696
8		0.7005	0.6788	0.8185	0.7141
10		0.6053	0.6816	0.6008	0.6676
0	R ₆	0.4475	0.6245	0.6547	0.6473
2		0.6298	0.5895	0.9786	0.6126
4		1.0324	0.7856	0.7222	0.8907
6		0.8736	0.9211	1.2422	0.9307
8		0.8944	1.2564	0.9564	0.9190
10		0.9897	0.8022	1.3478	1.0396

ตารางภาคผนวกที่ 13 N-uptake (gN/pot) of red kidney bean in pot experiment with $(\text{NH}_4)_2\text{SO}_4$ fertilization at various stages of growth.

Treatment rate (mMNH ₄ -N)	Stage	Replication			
		1	2	3	4
0	V ₄	0.1752	0.2075	0.1594	0.1906
2		0.2296	0.2286	0.2785	0.2653
4		0.3130	0.3084	0.3300	0.2656
6		0.3394	0.3291	0.3385	0.3433
8		0.3249	0.3547	0.3868	0.3712
10		0.3264	0.3294	0.3589	0.3504
0	R ₂	0.3202	0.3191	0.2997	0.3150
2		0.5469	0.4640	0.5628	0.5532
4		0.6644	0.6578	0.7201	0.7248
6		0.7048	0.7882	0.5958	0.7183
8		0.7037	0.6686	0.6992	0.7472
10		0.7593	0.6444	0.6740	0.7851
0	R ₄	0.4408	0.4760	0.4222	0.4703
2		0.6310	0.6223	0.6392	0.6471
4		0.7958	0.8026	0.9041	0.8554
6		0.8357	1.0190	0.9312	1.0714
8		0.8876	1.0158	1.0921	1.0624
10		0.9539	0.8960	1.0935	1.0610
0	R ₆	0.5097	0.4880	0.4923	0.6053
2		0.7127	0.7763	0.8396	0.7921
4		0.8705	1.0083	0.9161	1.0051
6		1.0280	1.1608	1.1520	1.1536
8		1.0952	1.2825	1.6482	1.3103
10		1.5096	1.3785	1.3442	1.5623

ตารางภาคผนวกที่ 14 RUI (%) of red kidney bean from pot experiments with KNO_3 fertilization at various stages of growth.

Method at estimation	Treatment rate ($\text{mMNO}_3\text{-N}$)	Stage	Replication			
			1	2	3	4
sap	0	V_4	88.521	84.450	85.057	86.074
	2		54.352	52.128	53.478	47.222
	4		37.013	34.371	40.195	38.680
	6		6.7493	7.2610	7.9487	8.0028
	8		2.6594	2.4530	2.8315	2.8979
	10		2.6356	1.7053	2.0626	2.3914
	0	R_2	84.527	83.581	78.685	74.382
	2		45.475	49.613	51.351	52.187
	4		36.573	36.699	39.284	40.454
	6		25.660	25.302	25.709	26.615
	8		12.759	11.266	14.715	13.154
	10		5.2560	4.2796	4.9757	5.8192
	0	R_4	73.964	74.521	79.080	75.860
	2		49.480	52.941	45.584	47.285
	4		31.562	33.817	35.539	38.680
	6		20.883	23.402	26.615	23.192
	8		19.005	17.950	16.045	17.727
	10		8.1568	8.2023	7.2847	7.3590
	0	R_6	82.746	72.911	74.809	73.813
	2		45.122	50.726	53.112	47.123
	4		36.037	36.139	37.094	32.548
	6		22.006	21.208	22.950	22.182
	8		9.8466	10.324	13.569	10.992
	10		7.5125	7.8532	8.2549	7.4620
tissue	0	V_4	75.161	79.776	75.985	85.253
	2		41.305	43.818	41.889	37.630
	4		21.021	18.424	18.285	18.004
	6		9.8064	9.5866	9.411	11.473
	8		4.7495	5.3860	4.9480	5.3226
	10		2.0821	2.1027	2.4376	2.4083
	0	R_2	74.238	84.477	79.097	81.988
	2		41.083	42.232	50.823	43.081
	4		23.799	18.880	23.331	21.041
	6		12.335	9.2208	8.6808	10.121
	8		6.0935	7.5091	6.8766	6.6676
	10		3.3835	3.4716	3.6899	3.3896
	0	R_4	67.189	73.337	75.934	37.048
	2		40.644	39.569	34.486	39.636
	4		24.868	18.686	23.050	18.356
	6		14.474	12.483	12.760	13.168
	8		7.0134	9.1776	8.2365	7.0795
	10		3.5793	3.6643	3.7038	2.7882
	0	R_6	71.567	64.651	74.549	73.973
	2		41.839	46.903	38.270	37.353
	4		21.738	23.962	20.250	24.302
	6		14.326	12.368	14.562	11.892
	8		6.6821	6.3750	6.7177	5.8234
	10		2.7204	3.8770	3.3140	2.6683

ตารางภาคผนวกที่ 15 RUI (%) of red kidney bean from pot experiments with $(\text{NH}_4)_2\text{SO}_4$ fertilization at various stages of growth.

Method at estimation	Treatment rate (mMNH ₄ -N)	Stage	Replication			
			1	2	3	4
sap	0	V ₄	86.900	80.655	80.878	79.717
	2		47.710	53.385	58.074	47.909
	4		40.474	38.281	37.073	40.665
	6		32.434	25.847	25.361	22.805
	8		18.883	16.630	17.002	18.186
	10		9.9420	9.4711	10.820	10.364
	0	R ₂	89.736	92.582	87.918	89.986
	2		49.531	45.214	43.772	50.891
	4		25.068	28.574	28.175	31.382
	6		22.314	21.840	28.601	21.801
	8		26.142	26.287	19.176	23.419
	10		12.111	14.544	18.783	14.023
	0	R ₄	87.176	90.622	86.144	85.523
	2		48.677	50.469	37.740	50.459
	4		34.325	31.571	29.770	37.275
	6		34.015	32.157	27.706	32.092
	8		21.182	22.682	24.048	22.286
	10		14.014	14.463	14.001	13.931
	0	R ₆	75.362	79.651	75.763	86.535
	2		44.353	43.997	45.941	45.121
	4		31.742	34.610	32.530	31.211
	6		26.949	29.094	29.254	26.097
	8		16.006	16.425	17.947	15.206
	10		11.763	12.642	11.163	11.134
tissue	0	V ₄	76.319	79.854	70.100	74.438
	2		44.438	47.159	47.181	46.272
	4		30.472	27.598	27.510	25.868
	6		21.401	21.445	18.401	21.469
	8		15.823	15.407	14.955	15.594
	10		9.6150	9.7094	9.8809	10.920
	0	R ₂	73.662	75.924	73.200	74.758
	2		62.528	58.593	55.796	58.888
	4		30.856	28.578	30.372	29.231
	6		18.092	17.617	18.149	15.939
	8		11.191	14.006	14.132	13.091
	10		9.8332	10.333	9.3946	9.3268
	0	R ₄	78.538	76.461	73.947	75.314
	2		46.935	39.899	47.655	41.456
	4		25.190	28.059	29.254	32.090
	6		22.323	24.291	20.602	22.185
	8		18.050	15.959	14.784	17.631
	10		10.192	11.457	10.191	10.072
	0	R ₆	76.972	74.636	79.765	78.184
	2		48.165	41.074	35.739	47.259
	4		31.101	29.509	28.475	26.908
	6		21.973	22.048	22.866	21.611
	8		16.005	16.854	13.890	14.561
	10		8.9357	8.9475	8.0235	8.5806

ตารางภาคผนวกที่ 16 $\text{NO}_3\text{-N}$ (%) of red kidney bean from pot experiments with KNO_3 fertilization at various stages of growth.

Method at estimation	Treatment rate ($\text{mMNO}_3\text{-N}$)	Stage	Replication			
			1	2	3	4
sap	0	V_4	0.4465	2.9435	3.1183	4.4153
	2		30.495	29.424	28.200	23.257
	4		41.880	45.926	45.449	47.022
	6		76.349	74.084	72.526	75.357
	8		84.555	84.260	78.885	85.486
	10		70.434	84.482	82.738	84.866
	0	R_2	11.025	14.524	18.263	13.841
	2		17.071	16.327	17.143	16.548
	4		14.053	15.993	13.389	13.065
	6		18.903	23.365	21.546	22.656
	8		23.353	28.525	28.457	28.783
	10		24.830	23.384	21.178	24.829
	0	R_4	1.0989	1.0411	0.8325	0.7072
	2		28.384	25.918	27.004	33.077
	4		44.368	44.895	45.120	38.853
	6		45.796	41.912	47.418	50.904
	8		50.201	57.087	59.297	56.855
	10		66.907	72.659	68.150	69.710
	0	R_6	1.6321	2.7847	0.9863	0.8604
	2		14.925	14.089	15.805	14.885
	4		32.140	34.950	35.551	33.510
	6		45.522	37.130	38.683	35.913
	8		58.977	57.326	58.024	57.920
	10		55.384	51.724	48.503	52.416
tissue	0	V_4	24.839	20.224	24.015	14.747
	2		58.695	56.182	58.111	62.370
	4		78.979	81.576	81.715	81.996
	6		90.194	90.413	90.589	88.527
	8		95.251	94.614	95.052	94.677
	10		97.918	97.897	97.362	97.592
	0	R_2	25.762	15.523	20.903	18.012
	2		58.917	57.768	49.177	56.919
	4		76.202	81.120	76.669	78.959
	6		87.665	90.779	91.319	89.879
	8		93.907	92.491	93.123	93.332
	10		96.617	96.528	96.310	96.610
	0	R_4	32.811	26.663	24.066	22.952
	2		59.359	60.431	65.514	60.364
	4		75.131	81.314	76.950	81.444
	6		85.526	87.517	87.240	86.832
	8		92.987	90.822	91.763	92.920
	10		96.421	96.336	96.296	97.212
	0	R_6	28.433	35.349	25.451	26.027
	2		58.161	53.097	61.730	62.647
	4		78.262	76.038	79.750	75.698
	6		85.674	87.632	85.438	88.109
	8		93.318	93.625	93.282	94.177
	10		97.280	96.123	96.686	97.332

ตารางภาคผนวกที่ 17 $\text{NO}_3\text{-N}$ (%) of red kidney bean from pot experiments with $(\text{NH}_4)_2\text{SO}_4$ fertilization at various stages of growth.

Method at estimation	Treatment rate (mM $\text{NH}_4\text{-N}$)	Stage	Replication			
			1	2	3	4
sap	0	V_4	4.0678	5.3720	3.9366	4.0538
	2		6.9654	7.0498	7.1927	6.5765
	4		9.1579	21.452	8.8988	9.6068
	6		15.238	15.675	9.9803	7.6614
	8		30.734	18.237	17.836	17.867
	10		21.521	18.796	17.181	23.053
	0	R_2	1.5088	1.1621	2.6337	2.2946
	2		9.8943	12.597	8.7496	18.112
	4		17.195	23.748	19.336	25.505
	6		22.617	22.881	20.862	25.503
	8		25.540	25.361	25.578	25.796
	10		34.375	37.492	47.187	54.004
	0	R_4	1.2863	0.7882	1.2922	1.0248
	2		19.059	18.453	16.785	18.369
	4		21.377	20.587	22.378	26.791
	6		27.415	23.992	24.094	28.964
	8		27.793	33.716	31.132	30.186
	10		34.052	26.993	29.78	28.882
	0	R_6	0.9364	2.6044	1.9370	1.3356
	2		9.5180	13.845	13.778	14.903
	4		19.535	23.104	22.245	20.178
	6		34.101	34.212	28.195	33.411
	8		37.547	38.552	49.403	38.306
	10		40.743	41.157	39.354	38.390
tissue	0	V_4	23.681	20.146	29.900	25.562
	2		55.041	52.841	52.817	53.728
	4		69.528	72.402	72.490	74.132
	6		78.599	78.555	81.599	78.531
	8		84.177	84.593	85.045	84.406
	10		89.080	90.385	90.291	90.119
	0	R_2	26.338	24.076	26.800	25.242
	2		37.472	41.407	44.204	41.112
	4		69.144	71.422	69.628	70.769
	6		81.908	82.383	81.851	84.061
	8		88.809	85.994	85.868	86.909
	10		90.167	89.667	90.605	90.673
	0	R_4	21.462	23.539	26.053	24.686
	2		53.065	60.101	52.345	58.544
	4		74.810	71.941	70.746	67.910
	6		77.677	75.709	79.398	77.815
	8		81.950	84.041	85.216	82.369
	10		89.808	88.543	89.809	89.928
	0	R_6	23.029	25.364	20.235	21.816
	2		57.669	58.926	64.261	52.741
	4		68.896	70.491	71.525	73.092
	6		78.027	77.952	77.134	78.339
	8		83.995	83.146	86.110	85.439
	10		91.064	91.052	91.977	91.419

ตารางภาคผนวกที่ 18 amino-N (%) of red kidney bean from pot experiments with KNO_3 fertilization at various stages of growth.

Treatment rate (mMNO ₃ -N)	Stage	Replication			
		1	2	3	4
0	V ₄	11.032	12.606	11.825	9.5107
2		15.154	18.448	18.322	29.521
4		21.107	19.704	14.355	14.298
6		16.901	18.655	19.531	16.640
8		12.786	13.287	18.283	11.616
10		11.981	13.813	15.200	12.743
0	R ₂	11.025	14.524	18.263	13.841
2		17.071	16.327	17.143	16.548
4		14.053	15.993	13.389	13.065
6		18.903	23.365	21.546	22.656
8		23.353	28.525	28.457	28.783
10		24.830	23.384	21.178	24.829
0	R ₄	24.937	24.438	20.087	23.433
2		22.136	21.141	27.412	19.639
4		24.070	21.287	19.341	22.468
6		33.321	37.685	25.967	25.904
8		30.794	24.964	24.658	25.418
10		29.937	19.139	24.565	22.931
0	R ₆	13.467	21.200	22.617	25.327
2		36.809	31.657	29.447	35.789
4		31.823	28.911	25.673	33.943
6		32.472	41.662	38.367	41.905
8		31.309	32.811	30.874	33.007
10		37.104	40.187	42.066	39.603

ตารางภาคผนวกที่ 19 amino-N (%) of red kidney bean from pot experiments with $(\text{NH}_4)_2\text{SO}_4$ fertilization at various stages of growth.

Treatment rate (mMNH ₄ -N)	Stage	Replication			
		1	2	3	4
0	V ₄	9.0326	13.973	15.185	16.229
2		45.325	39.565	34.733	45.514
4		50.386	40.267	54.028	49.728
6		52.328	58.478	04.659	76.982
8		36.158	65.133	65.161	64.127
10		68.537	71.733	71.999	66.583
0	R ₂	8.7548	6.2556	9.4486	7.8256
2		40.575	42.188	47.478	30.997
4		57.738	47.678	52.488	43.113
6		55.069	55.280	50.537	52.696
8		48.319	48.353	55.247	50.786
10		53.514	47.965	34.030	31.973
0	R ₄	11.538	8.5902	12.564	13.452
2		32.264	31.078	45.475	31.172
4		44.298	47.842	47.851	35.934
6		38.570	43.851	48.200	38.944
8		51.024	43.602	44.821	47.528
10		51.934	58.543	56.956	57.187
0	R ₆	23.701	17.744	22.300	12.130
2		46.129	42.158	40.281	39.976
4		48.723	42.286	45.225	48.611
6		38.950	36.694	42.551	40.492
8		46.447	45.023	32.651	46.448
10		47.494	46.202	49.484	50.476

ตารางภาคผนวกที่ 20 %N₂-fixed of red kidney bean in pot experiments with KNO₃ and (NH₄)₂SO₄ fertilization at various stages of growth.

Treatment rate (mMN)	Replication	KNO ₃ (NH ₄) ₂ SO ₄			
		method of estimation			
		sap	tissue	sap	tissue
0	1	86.357	83.195	83.724	79.788
0	2	95.456	98.567	79.412	76.342
0	3	86.075	90.040	82.040	77.665
0	4	84.296	90.848	84.841	81.440
2	1	53.611	53.303	53.523	63.161
2	2	56.202	54.943	53.790	57.797
2	3	59.053	56.072	53.074	57.569
2	4	50.331	48.862	53.748	58.623
4	1	39.506	36.010	39.877	40.900
4	2	40.785	33.223	40.499	40.091
4	3	42.772	34.645	39.005	40.176
4	4	42.224	33.778	44.173	41.411
6	1	25.832	27.277	36.314	32.902
6	2	27.567	26.119	34.173	33.616
6	3	30.371	27.098	34.008	30.739
6	4	27.734	26.549	32.066	31.564
8	1	18.785	20.326	29.433	27.581
8	2	19.180	22.687	28.611	27.109
8	3	19.927	22.352	27.503	26.231
8	4	18.846	21.134	28.294	27.452
10	1	14.135	18.476	20.605	22.367
10	2	14.231	19.225	20.769	22.217
10	3	13.307	18.707	20.595	21.353
10	4	13.422	18.259	20.897	22.359

ตารางภาคผนวกที่ 21 Amount of (gN/pot) N₂-fixed of red kidney bean in pot experiments with KNO₃ and (NH₄)₂SO₄ fertilization at various stages of growth.

Treatment rate (mMN)	Replication	KNO ₃ (NH ₄) ₂ SO ₄			
		method of estimation			
		sap	tissue	sap	tissue
0	1	0.3864	0.3723	0.4268	0.4067
0	2	0.5961	0.6155	0.3876	0.3726
0	3	0.5635	0.5895	0.4039	0.3824
0	4	0.5456	0.5880	0.5135	0.4929
2	1	0.3376	0.3357	0.3814	0.4501
2	2	0.3313	0.3239	0.4176	0.4487
2	3	0.5779	0.5487	0.4456	0.4833
2	4	0.3083	0.2993	0.4258	0.4644
4	1	0.4079	0.3718	0.3471	0.3560
4	2	0.3204	0.2610	0.4084	0.4042
4	3	0.3089	0.2502	0.3573	0.3680
4	4	0.3761	0.3009	0.4440	0.4162
6	1	0.2257	0.2383	0.3733	0.3382
6	2	0.2539	0.2406	0.3967	0.3902
6	3	0.3773	0.3366	0.3918	0.3541
6	4	0.2581	0.2471	0.3699	0.3641
8	1	0.1680	0.1818	0.3223	0.3021
8	2	0.2410	0.2850	0.3669	0.3477
8	3	0.1906	0.2138	0.4533	0.4323
8	4	0.1732	0.1942	0.3707	0.3597
10	1	0.1399	0.1828	0.3111	0.3377
10	2	0.1142	0.1542	0.2863	0.3063
10	3	0.1793	0.2521	0.2971	0.2870
10	4	0.1395	0.1898	0.3265	0.3493

ตารางภาคผนวกที่ 22 Analysis of variance of dry matter of red kidney bean from field experiment at Pangda station at various stages of growth.

SOV	df	MS
		V ₄ Stage
Treatment	4	77.709
Replication	3	151.10
Erroer	12	137.86
Total	19	
		R ₁ Stage
Treatment	4	453.51
Replication	3	445.01
Erroer	12	945.73
Total	19	
		R ₄ Stage
Treatment	4	1275.5
Replication	3	2891.6
Erroer	12	2724.0
Total	19	
		R ₆ Stage
Treatment	4	7238.1
Replication	3	1736.2
Erroer	12	1347.3
Total	19	

ตารางภาคผนวกที่ 23 Analysis of variance of Nuptake of red kidney bean from field experiment at Pangda station at various stages of growth.

SOV	df	MS
		V ₄ Stage
Treatment	4	0.0993
Replication	3	0.2785
Erroer	12	0.3273
Total	19	
		R ₂ Stage
Treatment	4	0.6714
Replication	3	0.3695
Erroer	12	1.4348
Total	19	
		R ₄ Stage
Treatment	4	1.3309
Replication	3	2.0800
Erroer	12	2.3732
Total	19	
		R ₆ Stage
Treatment	4	5.0959
Replication	3	13.291
Erroer	12	7.2157
Total	19	

ตารางภาคผนวกที่ 24 Analysis of variance of nodule dry weight of red kidney bean from field experiment at Pangda station at various stages of growth.

SOV	df	MS
		V ₄ Stage
Treatment	4	21.562
Replication	3	34.438
Erroer	12	86.847
Total	19	
		R ₁ Stage
Treatment	4	287.40
Replication	3	208.99
Erroer	12	420.39
Total	19	

ตารางภาคผนวกที่ 25 Analysis of variance of ureide index of red kidney bean from field experiment at Pangda station at various stages of growth.

SOV	df	MS	
		sap	tissue
		V ₄ stage	
Treatment	4	199.37	41.53
Replication	3	147.86	48.997
Error	12	226.21	35.463
Total	19		
		R ₁ stage	
Treatment	4	225.69	481.55
Relication	3	45.804	192.01
Error	12	171.69	186.52
Total	19		
		R ₄ stage	
Treatment	4	287.6	541.45
Relication	3	301.34	262.77
Error	12	205.40	437.46
Total	19		
		R ₆ stage	
Treatment	4	138.65	329.24*
Relication	3	215.68	85.234
Error	12	62.38	86.08
Total	19		

ตารางภาคผนวกที่ 26 Analysis of variance of $\text{NO}_3\text{-N}$ index of red kidney bean from field experiment at Pangda station at various stages of growth.

SOV	df	MS	
		sap	tissue
		V_4 stage	
Treatment	4	314.60	41.530
Replication	3	187.10	48.997
Error	12	286.79	35.463
Total	19		
		R_1 stage	
Treatment	4	311.93	481.45
Replication	3	6.7516	192.01
Error	12	111.05	186.52
Total	19		
		R_4 stage	
Treatment	4	244.96	541.45
Replication	3	369.83	262.77
Error	12	161.32	437.46
Total	19		
		R_6 stage	
Treatment	4	97.185	329.24*
Replication	3	47.477	85.234
Error	12	68.673	86.086
Total	19		

ตารางภาคผนวกที่ 27 Analysis of variance of amino-N index of red kidney bean from field experiment at Pangda station at various stages of growth.

SOV	df	MS
		V ₄ stage
Treatment	4	43.185
Replication	3	107.88
Error	12	29.471
Total	19	
		R ₁ stage
Treatment	4	11.995
Relication	3	21.221
Error	12	26.659
Total	19	
		R ₄ stage
Treatment	4	208.79
Relication	3	131.81
Error	12	118.97
Total	19	
		R ₆ stage
Treatment	4	23.952
Relication	3	76.532
Error	12	42.968
Total	19	

ตารางภาคผนวกที่ 28 Analysis of variance of amount of N₂-fixed and %N₂-fixed of red kidney bean from field experiment at Pangda station at various stages of growth.

SOV	df	MS	
		Sap	tissue
		amount of N ₂ -fixed	
Treatment	4	6.4051	6.4308
REP	3	12.152	6.5903
Error	12	5.1637	3.2449
Total	19		
		%N ₂ -fixed	
Treatment	4	123.66	209.18
Replication	3	95.202	13.032
Error	12	93.090	103.36
Total	19		

ตารางภาคผนวกที่ 29 Dry matter (kg/rai) of red kidney bean from field experiment at Pangda station at various stages of growth.

Treatment	stage	Replication			
		1	2	3	4
-N-R	V ₄	60.038	69.120	67.123	52.194
+N		67.027	78.674	56.720	63.936
CIAT 899		39.875	75.798	64.973	63.987
UMR 1899		83.913	76.240	57.600	48.064
isolate-KN6		58.789	47.482	62.576	52.107
-N-R	R ₁	144.37	122.02	139.46	94.224
+N		168.22	132.94	131.76	168.08
CIAT 899		96.384	111.49	150.13	143.27
UMR 1899		130.46	194.54	106.42	95.127
isolate-KN6		153.77	157.95	102.62	152.22
-N-R	R ₄	185.39	312.48	160.94	274.94
+N		216.93	223.99	231.38	144.91
CIAT 899		294.69	194.67	281.90	229.87
UMR 1899		217.91	232.77	182.61	141.88
isolate-KN6		228.67	261.94	205.88	152.22
-N-R	R ₆	620.84	760.40	663.82	541.62
+N		831.67	647.55	757.92	603.09
CIAT 899		616.57	760.30	483.95	496.05
UMR 1899		720.99	836.39	703.43	553.65
isolate-KN6		681.56	647.55	495.94	687.73

ตารางภาคผนวกที่ 30 Nodule dry weight (mg/plant) of red kidney bean from field experiment at Pangda station at various stages of growth.

Treatment	Replication	Stage	
		V ₄	R ₁
-N-R	1	6.5481	28.081
	2	3.6913	39.619
	3	1.1042	6.9762
	4	9.2048	17.515
+N	1	1.5043	13.287
	2	10.932	11.971
	3	4.2917	2.7087
	4	2.212	0.6167
CIAT 899	1	8.7565	9.1
	2	2.8710	20.05
	3	10.06	54.212
	4	3.950	1.05
UMR 1899	1	2.375	13.823
	2	3.3625	34.022
	3	0.7	2.52
	4	34.63	64.655
isolate KN6	1	5.1304	18.2
	2	4.7278	47.915
	3	21.148	35.715
	4	2.5652	4.684

ตารางภาคผนวกที่ 31 N uptake (KgN/rai) of red kidney bean from field experiment at Pangda station at various stages of growth.

Treatment	Stage	Replication			
		1	2	3	4
-N-R	V ₄	1.7262	3.3122	2.5364	2.7301
+N		3.2667	2.1258	2.9443	2.4091
CIAT 899		2.5222	3.1240	2.5219	2.2748
UMR 1899		3.6461	3.1454	3.1178	1.8193
isolate-KN6		2.7347	3.3515	2.4219	2.9598
-N-R	R ₁	3.0511	3.8085	3.8303	5.7575
+N		5.8445	5.1335	4.9837	3.2331
CIAT 899		5.0276	3.796	2.749	3.8445
UMR 1899		4.0736	6.0289	4.2561	2.6831
isolate-KN6		4.9553	3.9967	4.0243	5.591
-N-R	R ₄	6.9194	6.6085	8.5007	6.5879
+N		10.275	6.6085	9.0977	5.7489
CIAT 899		6.636	7.9231	7.9659	8.2527
UMR 1899		7.1473	10.586	5.2914	5.0437
isolate-KN6		7.8244	7.9659	8.5715	7.3257
-N-R	R ₆	15.276	16.501	15.342	13.498
+N		20.691	13.031	19.257	16.089
CIAT 899		16.501	19.871	12.902	12.541
UMR 1899		17.347	20.793	16.953	16.144
isolate-KN6		15.578	17.064	12.567	15.571

ตารางภาคผนวกที่ 32 RUI (%) of red kidney bean from field experiments Pangda station at various stages of growth.

Method at estimation	Treatment	Stage	Replication			
			1	2	3	4
sap	-N-R	V ₄	28.491	23.190	32.273	27.180
	+N		20.392	21.731	26.069	22.044
	CIAT 899		27.497	23.085	37.377	32.666
	UMR 1899		33.765	26.641	37.233	37.176
	isolate KN6		32.415	27.821	42.607	44.295
	-N-R	R ₁	49.494	46.745	41.951	56.475
	+N		25.320	20.033	23.530	22.065
	CIAT 899		30.685	17.738	51.288	39.774
	UMR 1899		36.153	50.103	83.421	59.244
	isolate KN6		49.325	31.939	66.318	43.554
	-N-R	R ₄	36.947	55.860	32.101	38.770
	+N		37.511	46.426	36.552	28.893
	CIAT 899		41.195	77.045	79.923	31.116
	UMR 1899		52.906	60.400	53.818	71.560
	isolate KN6		35.831	38.426	54.657	25.805
	-N-R	R ₆	62.637	50.786	56.979	47.269
	+N		38.747	44.334	28.764	40.391
	CIAT 899		68.170	45.609	45.002	33.290
	UMR 1899		67.130	58.766	55.972	57.012
	isolate KN6		58.929	51.837	76.890	59.372
tissue	-N-R	V ₄	20.438	12.59	14.915	4.5498
	+N		3.3824	6.7735	25.827	14.754
	CIAT 899		19.738	5.9162	3.8117	17.456
	UMR 1899		15.293	25.193	15.580	20.706
	isolate KN6		20.25	3.1437	18.810	16.126
	-N-R	R ₁	4.1628	23.206	6.0324	16.367
	+N		8.8848	26.712	43.508	15.304
	CIAT 899		8.3209	12.683	7.1832	7.6472
	UMR 1899		20.036	13.760	16.336	74.538
	isolate KN6		68.943	4.131	35.746	6.4377
	-N-R	R ₄	3.3644	10.388	3.2902	19.413
	+N		3.0664	5.8844	1.6255	2.6374
	CIAT 899		4.4675	6.0073	41.131	3.3661
	UMR 1899		15.740	11.675	9.1667	21.783
	isolate KN6		4.3785	20.657	26.577	4.0857
	-N-R	R ₆	40.372	28.917	20.700	20.815
	+N		22.831	21.682	12.611	28.827
	CIAT 899		32.165	34.586	24.793	29.474
	UMR 1899		32.062	38.059	41.773	31.889
	isolate KN6		63.196	58.378	54.228	34.731

ตารางภาคผนวกที่ 33 NO₃-N (%) of red kidney bean from field experiments at
Pangda station at various stages of growth.

Method at estimation	Treatment	Stage	Replication			
			1	2	3	4
sap	-N-R	V ₄	54.432	67.290	57.056	58.417
	+N		69.326	67.93 1	64.634	69.063
	CIAT 899		52.278	63.826	52.840	53.947
	UMR 1899		43.720	63.329	45.659	54.993
	isolate KN6		40.243	60.219	48.560	45.846
	-N-R	R ₁	31.648	36.207	35.628	21.933
	+N		51.106	60.412	60.131	59.362
	CIAT 899		48.326	47.739	32.439	37.264
	UMR 1899		47.286	35.570	41.543	31.138
	isolate KN6		30.548	45.507	17.872	34.796
	-N-R	R ₄	46.193	30.574	49.794	46.471
	+N		46.860	37.071	41.226	55.563
	CIAT 899		32.865	10.473	10.204	15.131
	UMR 1899		33.390	24.553	31.425	13.936
	isolate KN6		45.738	38.090	30.084	50.219
	-N-R	R ₆	15.912	20.490	27.932	35.613
	+N		27.478	31.385	42.252	33.312
	CIAT 899		22.692	19.828	37.880	31.194
	UMR 1899		21.827	31.608	16.917	25.189
	isolate KN6		30.251	32.996	21.930	28.748
tissue	-N-R	V ₄	80.262	94.084	84.420	85.246
	+N		96.816	96.857	96.188	95.450
	CIAT 899		79.562	87.410	81.190	83.874
	UMR 1899		84.707	74.807	85.085	79.294
	isolate KN6		79.750	93.227	74.173	82.544
	-N-R	R ₁	91.679	87.317	83.664	84.696
	+N		91.115	95.869	92.817	83.633
	CIAT 899		95.837	76.794	64.254	93.562
	UMR 1899		79.964	86.240	93.968	25.462
	isolate KN6		31.057	73.288	56.492	92.353
	-N-R	R ₄	96.636	89.612	96.710	80.587
	+N		96.934	94.116	98.374	97.363
	CIAT 899		95.532	93.993	58.869	96.639
	UMR 1899		84.260	88.325	90.833	78.217
	isolate KN6		95.622	79.343	73.423	95.914
	-N-R	R ₆	59.628	71.083	79.306	79.185
	+N		77.169	78.318	87.389	71.173
	CIAT 899		67.835	65.415	75.207	70.526
	UMR 1899		67.938	61.941	58.227	68.111
	isolate KN6		36.804	41.622	45.772	65.269

ตารางภาคผนวกที่ 34 amino-N (%) of red kidney bean from field experiment at Pangda station at various stages of growth.

Treatment	Stage	Replication			
		1	2	3	4
-N-R	V ₄	17.076	9.5206	10.671	14.403
+N		10.282	10.337	9.2966	8.8936
CIAT 899		20.225	13.087	9.7827	13.387
UMR 1899		22.514	10.029	17.108	7.8311
isolate-KN6		27.343	11.960	8.8331	9.8587
-N-R	R ₁	18.861	17.048	22.421	21.592
+N		23.574	19.555	16.340	18.572
CIAT 899		20.988	13.296	16.273	22.961
UMR 1899		16.561	14.326	25.037	9.6172
isolate-KN6		20.127	22.554	15.810	21.650
-N-R	R ₄	16.859	13.566	18.105	14.759
+N		15.629	16.503	22.222	15.544
CIAT 899		25.940	12.482	9.8728	23.753
UMR 1899		13.704	15.046	14.757	14.504
isolate-KN6		18.431	22.484	15.258	23.976
-N-R	R ₆	21.451	28.724	15.089	17.118
+N		33.775	24.281	28.984	26.298
CIAT 899		9.1376	34.562	17.118	35.516
UMR 1899		11.043	9.6251	27.111	17.798
isolate-KN6		10.824	15.168	7.1801	11.880

ตารางภาคผนวกที่ 35 %N₂-fixed of red kidney bean from field experiment at Pangda station at various stages of growth.

Treatment	Replication	method of estimation	
		sap	tissue
-N-R	1	55.455	48.412
	2	62.58	65.34
	3	46.426	74.252
	4	48.819	58.995
+N	1	54.558	42.454
	2	47.475	46.408
	3	57.355	34.998
	4	39.574	45.991
CIAT 899	1	53.245	58.599
	2	49.514	54.023
	3	62.361	76.648
	4	37.388	39.701
UMR 1899	1	58.646	62.574
	2	62.279	56.775
	3	57.304	55.773
	4	74.807	73.827
isolate KN6	1	54.381	65.022
	2	76.47	71.307
	3	54.096	65.570
	4	44.785	48.168

ตารางภาคผนวกที่ 36 Amount of N₂-fixed (kgN/rai) of red kidney bean from field experiment at Pangda station at various stages of growth.

Treatment	Replication	method of estimation	
		sap	tissue
-N-R	1	8.4712	7.2168
	2	13.183	13.038
	3	7.1226	6.7650
	4	6.5896	7.9631
+N	1	11.289	8.8029
	2	6.1865	6.0084
	3	11.045	6.7395
	4	6.3671	7.3862
CIAT 899	1	8.7859	9.0332
	2	9.8389	10.735
	3	8.458	9.3116
	4	4.6889	4.8240
UMR 1899	1	10.173	10.643
	2	12.950	11.259
	3	9.7148	9.4552
	4	12.077	11.700
isolate KN6	1	8.4715	9.0265
	2	13.049	10.991
	3	6.7982	8.2402
	4	6.9735	7.4639

ตารางภาคผนวกที่ 37 Analysis of variance of dry matter of red kidney bean from field experiment at Kaenoi station at various stages of growth.

SOV	df	MS
		Stage V ₄
Treatment	4	20.657
Replication	3	57.302
Error	12	23.313
Total	19	
		Stage R ₁
Treatment	4	913.18
Replication	3	154.91
Error	12	410.17
Total	19	
		Stage R ₄
Treatment	4	723.28
Replication	3	2734.3
Error	12	1881.2
Total	19	

ตารางภาคผนวกที่ 38 Analysis of variance of nodule dry weight of red kidney bean from field experiment at Kaenoi station at various stages of growth.

SOV	df	MS
Treatment	4	Stage V ₄ 331.42*
Replication	3	123.36
Error	12	61.26
Total	19	
Treatment	4	Stage R ₁ 833.29**
Replication	3	112.17
Error	12	143.95
Total	19	
Treatment	4	Stage R ₄ 74.178
Replication	3	27.618
Error	12	125.93
Total	19	

ตารางภาคผนวกที่ 39 Analysis of variance of ureide index of red kidney bean from field experiment at Kaenoi station at various stages of growth.

SOV	df	MS	
		sap	tissue
		V ₄ stage	
Treatment	4	172.6	66.120
Replication	3	18.626	74.890
Error	12	120.72	53.812
Total	19		
		R ₁ stage	
Treatment	4	256.97	119.23
Replication	3	30.769	82.165
Error	12	238.48	60.876
Total	19		
		R ₄ stage	
Treatment	4	50.479	67.702
Replication	3	7.6368	47.554
Error	12	26.573	46.904
Total	19		

ตารางภาคผนวกที่ 40 Analysis of variance of $\text{NO}_3\text{-N}$ index of red kidney bean from field experiment at Kaenoi station at various stages of growth.

SOV	df	MS	
		sap	tissue
		V ₄ stage	
Treatment	4	266.98	66.12
Replication	3	7.4738	74.895
Error	12	186.3	53.712
Total	19		
		R ₁ stage	
Treatment	4	230.52	119.23
Replication	3	30.158	82.165
Error	12	247.11	60.876
Total	19		
		R ₄ stage	
Treatment	4	15.696	67.702
Replication	3	26.331	47.554
Error	12	46.256	46.904
Total	19		

ตารางภาคผนวกที่ 41 Analysis of variance of amino-N index of red kidney bean from field experiment at Kaenoi station at various stages of growth.

SOV	df	MS
		V ₄ stage
Treatment	4	36.749
Replication	3	11.984
Error	12	76.148
Total	19	
		R ₁ stage
Treatment	4	50.403*
Replication	3	8.4188
Error	12	13.800
Total	19	
		R ₄ stage
Treatment	4	30.138
Replication	3	20.549
Error	12	7.9779
Total	19	

ตารางภาคผนวกที่ 42 Analysis of variance of %N₂-fixed and amount of N₂-fixed of red kidney bean from field experiment at Kaenoi station at various stages of growth.

SOV	df	MS	
		%N ₂ -fixed	
		sap	tissue
Treatment	4	27.923	27.923
Replication	3	15.929	15.929
Error	12	31.697	31.697
Total	19		
		amount of N ₂ -fixed	
		sap	tissue
Treatment	4	0.2226	0.2291
Replication	3	0.3347	0.3041
Error	12	0.3608	0.5242
Total	19		

ตารางภาคผนวกที่ 43 Analysis of variance of Nuptake red kidney bean from field experiment at Kaenoi station at various stages of growth.

SOV	df	MS
		V ₄ stage
Treatment	4	0.0077
Replication	3	0.1296
Error	12	0.0504
Total	19	
		R ₁ stage
Treatment	4	1.3097
Replication	3	0.2173
Error	12	0.4534
Total	19	
		R ₄ stage
Treatment	4	0.8480
Replication	3	2.7705
Error	12	2.0356
Total	19	

ตารางภาคผนวกที่ 44 Dry matter (kg/rai) of red kidney bean from experiment at Kaenoi station at various stages of growth.

Treatment	Stage	Replication			
		1	2	3	4
-N-R	V ₄	47.533	49.906	52.792	57.460
+N		50.838	49.586	52.192	59.824
CIAT 899		45.713	52.144	45.863	61.486
UMR 1899		52.884	43.853	46.433	54.879
isolate-KN6		42.202	55.717	53.808	45.420
-N-R	R ₁	78.912	77.84	85.737	93.77
+N		93.155	110.21	126.21	144.61
CIAT 899		62.316	95.132	84.947	99.41
UMR 1899		64.156	95.616	65.383	80.993
isolate-KN6		144.66	86.311	89.428	97.319
-N-R	R ₄	199.52	182.29	204.51	181.57
+N		174.22	171.15	182.9	199.76
CIAT 899		154.97	163.0	193.89	228.55
UMR 1899		286.17	168.82	163.02	164.13
isolate-KN6		311.39	161.33	232.5	159.68

ตารางภาคผนวกที่ 45 N uptake (kgN/rai) of red kidney bean from field experiment at Kaenoi station at various stages of growth.

Treatment	Replication	Stage		
		V ₄	R ₁	R ₄
-N-R	1	1.8942	2.5260	5.9557
	2	1.8810	2.8397	5.5186
	3	2.0518	3.0839	6.1844
	4	2.4144	3.2932	5.7340
+N	1	1.8744	3.0779	5.2696
	2	1.9761	3.5421	4.9206
	3	1.9807	4.3038	5.8468
	4	2.3068	5.0917	5.9189
CIAT 899	1	1.8219	2.9864	4.6895
	2	2.0154	3.3729	5.1149
	3	1.7898	2.9792	5.9689
	4	2.4473	3.4446	7.1193
UMR 1899	1	2.1220	2.198	9.0593
	2	1.6993	3.1027	5.308
	3	1.9154	2.2976	4.8485
	4	2.2516	2.7832	4.9748
isolate KN6	1	1.6372	5.1213	9.7278
	2	2.2955	3.3543	4.9561
	3	2.0512	3.0296	7.3121
	4	1.7930	3.3667	4.8102

ตารางภาคผนวกที่ 46 Nodule dry weight (mg/plant) of red kidney bean from field experiment at Kaenoi station at various stages of growth.

Treatment	Replication	Stange		
		V ₄	R ₁	R ₄
-N-R	1	0.000	0.0000	34.546
	2	1.7214	0.0000	5.172
	3	0.4696	0.4545	6.1905
	4	0.55	1.4286	5.0583
+N	1	0.06	0.3846	2.575
	2	1.7652	2.7273	9.2583
	3	4.8654	0.8	2.0435
	4	26.98	2.381	12.192
CIAT 899	1	24.216	40.714	2.8524
	2	11.829	18.000	26.736
	3	10.825	22.8	11.826
	4	9.628	12.143	8.7261
UMR 1899	1	14.773	30.357	18.783
	2	26.679	51.071	30.276
	3	13.583	2.6316	2.256
	4	39.10	45.625	21.770
isolate KN6	1	0.3684	0.8696	3.752
	2	1.5182	1.7391	12.213
	3	1.685	1.1111	4.6833
	4	10.508	17.083	19.4

ตารางภาคผนวกที่ 47 RUI (%) of red kidney bean from field experiments at
Kaenoi station at various stages of growth.

Method at estimation	Treatment	Stage	Replication			
			1	2	3	4
sap	-N-R	V ₄	42.266	36.766	31.104	45.452
	+N		24.191	30.407	26.503	29.478
	CIAT 899		50.008	42.743	69.309	54.018
	UMR 1899		39.851	35.517	29.387	47.793
	isolate KN6		46.233	41.725	39.313	33.291
	-N-R	R ₁	24.009	29.201	22.557	23.704
	+N		17.164	17.712	15.219	19.479
	CIAT 899		67.955	62.199	76.526	62.648
	UMR 1899		55.417	47.564	30.003	43.436
	isolate KN6		35.555	40.630	30.468	55.363
	-N-R	R ₄	21.071	28.749	28.648	28.340
	+N		16.304	21.587	14.146	19.970
	CIAT 899		45.286	39.912	49.153	49.842
	UMR 1899		45.381	37.665	39.493	32.670
	isolate KN6		31.810	31.213	36.865	45.809
tissue	-N-R	V ₄	32.534	29.204	31.851	29.445
	+N		9.0448	23.389	25.339	27.042
	CIAT 899		45.439	34.720	37.372	38.210
	UMR 1899		29.847	28.916	30.580	42.873
	isolate KN6		39.462	33.673	34.659	30.481
	-N-R	R ₁	24.826	25.688	16.466	20.451
	+N		18.462	14.154	14.952	15.697
	CIAT 899		50.440	61.301	44.20	47.233
	UMR 1899		33.658	41.977	39.986	23.449
	isolate KN6		25.782	35.026	25.245	35.699
	-N-R	R ₄	28.461	28.832	24.977	34.395
	+N		25.147	30.895	17.333	17.853
	CIAT 899		41.375	44.824	59.021	56.968
	UMR 1899		26.081	43.760	31.402	42.102
	isolate KN6		45.201	40.647	36.296	42.928

ตารางภาคผนวกที่ 48 $\text{NO}_3\text{-N}$ (%) of red kidney bean from field experiments at
Kaenoi station at various stages of growth.

Method at estimation	Treatment	Stage	Replication			
			1	2	3	4
sap	-N-R	V_4	28.871	28.587	33.783	14.651
	+N		55.339	40.745	49.423	37.882
	CIAT 899		9.7591	15.399	8.0460	24.217
	UMR 1899		37.207	30.011	32.281	33.796
	isolate KN6		5.0757	24.339	24.047	22.717
	-N-R	R_1	52.195	41.822	67.981	46.636
	+N		53.125	50.406	52.001	60.786
	CIAT 899		7.1278	24.034	10.331	11.383
	UMR 1899		25.796	25.165	26.855	18.802
	isolate KN6		42.419	31.356	46.999	43.807
	-N-R	R_4	60.573	49.990	47.860	50.954
	+N		61.487	51.908	64.873	51.562
	CIAT 899		36.599	40.904	40.418	36.178
	UMR 1899		39.421	40.386	42.352	39.334
	isolate KN6		56.963	50.822	49.179	49.753
tissue	-N-R	V_4	67.466	70.796	68.149	70.555
	+N		90.955	76.611	74.611	72.958
	CIAT 899		54.561	65.280	62.628	61.790
	UMR 1899		67.466	71.084	69.420	69.519
	isolate KN6		63.538	66.327	65.341	57.127
	-N-R	R_1	75.174	74.312	83.534	79.549
	+N		81.538	85.846	85.048	84.303
	CIAT 899		49.560	38.699	55.800	52.767
	UMR 1899		66.342	58.023	60.014	64.301
	isolate KN6		74.218	64.974	74.755	76.551
	-N-R	R_4	71.539	71.168	75.023	65.605
	+N		74.853	69.105	82.665	82.147
	CIAT 899		58.625	55.176	59.013	43.032
	UMR 1899		73.919	56.240	68.598	57.072
	isolate KN6		54.799	59.353	63.704	57.898

ตารางภาคผนวกที่ 49 amino-N (%) of red kidney bean from field experiments at Kaenoi station at various stages of growth.

Treatment	Stage	Replication			
		1	2	3	4
-N-R	V ₄	28.863	34.647	35.113	39.897
+N		20.470	28.844	24.074	32.640
CIAT 899		40.233	41.859	22.645	21.766
UMR 1899		22.941	34.472	38.331	32.913
isolate KN6		48.692	33.936	36.640	29.490
-N-R	R ₁	23.796	28.977	9.4614	29.660
+N		29.710	31.882	32.780	19.735
CIAT 899		24.917	13.676	13.143	25.969
UMR 1899		18.788	27.270	43.142	25.836
isolate KN6		22.027	28.013	22.532	12.763
-N-R	R ₄	18.356	21.261	23.492	20.706
+N		22.209	26.504	20.710	28.469
CIAT 899		18.115	19.184	10.428	13.980
UMR 1899		15.197	21.949	18.155	14.857
isolate KN6		11.227	17.965	13.956	17.577

ตารางภาคผนวกที่ 50 Amount of N₂-fixed (kg N/rai) of red kidney bean from field experiment at Kaenoi station at various stages of growth.

Treatment	Replication	method of estimation	
		sap	tissue
-N-R	1	2.0493	2.0850
	2	1.9371	2.5779
	3	2.1161	2.8986
	4	1.6553	2.1372
+N	1	1.7960	1.7172
	2	2.0553	2.1831
	3	2.2056	2.2545
	4	2.8878	2.3063
CIAT 899	1	2.4942	2.3181
	2	1.9475	2.4302
	3	3.4210	2.6826
	4	2.5034	2.8618
UMR 1899	1	3.3379	3.3744
	2	2.2687	2.4293
	3	1.3427	1.6145
	4	2.1901	2.1318
isolate KN6	1	3.2073	4.5518
	2	1.5232	1.7221
	3	2.4523	2.6624
	4	2.2891	2.1117

ตารางภาคผนวกที่ 51 % N₂-fixed (KgN/rai) of red kidney bean from field experiment at Kaenoi station at various stages of growth.

Treatment	Replication	method of estimation	
		sap	tissue
-N-R	1	34.409	35.009
	2	35.101	46.713
	3	34.216	46.869
	4	28.868	37.273
+N	1	34.082	32.586
	2	41.769	44.367
	3	37.724	38.56
	4	48.789	38.966
CIAT 899	1	53.186	49.432
	2	38.074	47.511
	3	57.313	44.942
	4	35.163	40.197
UMR 1899	1	36.845	37.248
	2	42.741	45.767
	3	27.694	33.298
	4	44.024	42.851
isolate KN6	1	32.971	46.797
	2	30.734	34.747
	3	33.537	36.411
	4	47.589	43.901

สูตรเตรียมสารละลายที่ใช้ปลูกกล้วย

Stock Solution	Element	μ M	Form	MW.	g/l	M
1	Ca	1000	$\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$	147.03	294.1	2.0
2	P	500	KH_2PO_4	136.09	136.1	1.0
3	Fe	10	Fe-citrate	335.02	6.7	0.02
	Mg	250	$\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$	246.5	123.3	0.5
	K	250	K_2SO_4	174.06	87.0	0.5
	Mn	1	$\text{MnSO}_4 \cdot \text{H}_2\text{O}$	169.02	0.338	0.002
4	B	2	H_3BO_3	61.84	0.247	0.004
	Zn	0.5	$\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$	287.56	0.288	0.001
	Cu	0.2	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	249.69	0.100	0.0004
	Co	0.1	$\text{CoSO}_4 \cdot 7\text{H}_2\text{O}$	281.12	0.056	0.0002
	Mo	0.1	$\text{Na}_2\text{MoO}_4 \cdot \text{H}_2\text{O}$	241.98	0.048	0.0002

For each 10 liters of full strenght culture solution, take 5.0 ml. each of solution 1 to 4, then add to 5.0 liters of water, then dilute to 10 liters. Use 1 N NaOH to adjust the pH to 6.6-6.8. For plus N control treatment, KNO_3 (0.05%) is added giving an N concentration of 70 ppm.

METHODS FOR ANALYSIS OF N-SOLUTES IN XYLEM EXUDATE AND IN HOT WATER EXTRACTS FROM PLANT PARTS (Peoples et al., 1989)

UREIDES

Reagents:

1. Sodium hydroxide (0.5 N)-20 g/l NaOH
2. Hydrochloric acid (0.65 N)-65 ml/l conc. HCl
3. Phenylhydrazine hydrochloride (0.33%)-0.33g/100 ml H_2O , prepared daily
4. Potassium ferricyanide (1.67%)-1.67 g/100 ml H_2O , prepared daily
5. Concentrated hydrochloric acid (10 N) 416 ml/500
6. Ureide standare (1 mM)- 39.53 mg allantoin/250 ml H_2O . Use 0.50 mM allantoin as internal standard.

Procedure:

1. Pipette 0.5 ml hot water extracts or 0.05/0.1 ml xylem exudate samples into test and dilution to 2.5 ml with distilled water. Include water blanks (*2) and internal standaaards (*2) with each batch. Internal standard is 2.5 ml of 0.05 mM allantoin.
2. Add 0.5 ml of 0.5 N sodium hydroxide.
3. Place tubes in a boiling water bath for 8-10 minutes
4. Remove and add 0.5 ml of 0.65 N HCl plus 0.5 ml phynylhydrazine solution to each tube.
5. Shake the tubes and place in a boiling water bath for exactly 2 minutes.
6. Remove from boiling water bath and immediately plunge tubes into an ice bath (80% ethanol, chilled to 0° C) and leave for 15 minutes.

7. Remove from ice bath and add 2 ml of 10 N HCl (also chilled to 0° C) and 0.5 ml potassium ferricyanide to each tube.
8. Mix contents well.
9. Leave at room temperature for 10 minutes and measure O.D. at 520 nm on a spectrophotometer.

There is some background noise with extracts of plant parts. For shoot axes, subtract 1.7 u mol ureides/g dry wt; for root subtract 1.0 u mol.

NITRATE

Reagents:

1. Salicylic acid in (c) sulphuric acid (5% w/v)-5 g in 100 ml conc. H_2SO_4
2. Sodium hydroxide (2 N) -80 g/l.
3. Nitrate standard (25 mM) -632 mg KNO_3 /250 ml water Use 2.5 mM as internal standard.

Procedure:

1. Pipette 0.05 ml xylem exudate into test tubes. Include water blanks (*2) and internal standard (*2) with each batch. Internal standard is 0.05 ml of 2.5 mM nitrate.
2. Add 0.20 ml salicylic acid in (c) H_2SO_4 .
3. Mix well until solution clears and room temperature for 20 minutes.
4. Add 4.75 ml of 2 N NaOH (to raise pH above 12.0), cool to room temperature.
5. Read O.D. at 410 nm.

Amino acid

Reagents

1. ninhydrin reagent, store in a dark bottle at 4° C.
4.79 g (Merck) ninhydrin
167 mg ascorbic acid in 16 ml H_2O
500 ml methoxyethanol.
2. Citrate buffer
67.2 g citric acid
25.6 g NaOH
400 ml H_2O
3. ethanol (60 % v/v) 600 ml ETOH-400 ml H_2O
4. asparagine standard (1 mM) 37.5 mg/250 ml, use 0.2 mM as internal standard.

Procedure

1. pipette 0.05/0.10 ml exudate into test tubes and dilute to 1.0 ml with distilled water.
2. Add 0.5 ml citrate buffer.
3. Add 1.2 ml ninhydrin reagent.
4. Place in boiling water bath for 20 min.
5. Remove, add 3.0 ml 60% ethanol
6. Cool to room temperature
7. Read O.D. at 570 nm.

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