RECYCLING OF CROP RESIDUES FOR SUSTAINABLE CROP PRODUCTION IN WHEAT-PEANUT ROTATION SYSTEM

A - Experiment

M.S.A. Safwat*, M.A. Sherif*, E.A.Abdel-Bary**,
O.A.O. Saad* and M.A. El -Mohandes*

** Minia University, and*
*** Zagazig University in Egypt*

Abstract

Field experiments were conducted in sandy soil of West-Samalout, Minia, Egypt, under the auspices of (FAO/IAEA), Vienna, Austria, from December 1996 to October 1999. The experiment considered of four treatments: (i) T1-^{15}N labeled $(NH_4)_2$ SO_4, 60 kg N/ha at 9.82% 15N with unlabeled residues; (ii) T2-^{15}N labeled wheat residues 26 kg N/ha at 1.94% 15N a.e, applied at end of the first season; (iii) T3 to generate unlabeled residues and yield and (iv) T4-^{15}N labeled $(NH_4)_2$ SO_4, 60 kg N/ha at 9.82% ^{15}N a.e., applied at beginning of the first season, without residues. The Ndff recoveries during the first season in T1 and T4 treatments were 26.8% and 25.6% respectively. While ^{15}N remaining in soil was 24.6% and 24.5% for T1 and T4, respectively. Thus, the total ^{15}N accounted (in plant and soil) were 51.4% for T1 and 50.2% for T4. After the second crop the total ^{15}N recovery was 24.9% and 13% for T1 and T4 treatments, respectively. The application of the crop residues seems to decrease the N losses from the soil.

Recoveries of %Ndfr by wheat from the labeled residue (T2) were 1.0% and 0.4% during the seasons 3 and 5, respectively. While recoveries of %Ndfr by peanut from T2 treatments were 3.7, 4.1 and 0.3 during the seasons 2, 4 and 6 respectively. In the following five seasons (peanut-wheat- peanut-wheat- peanut) total ^{15}N recovery by plant and soil were 66.7, 52.5, 34.3, 24.9 and 16.4%, respectively.

1.INTRODUCTION

Egypt has been as much as 24 millions tones per year, which is equivalent 120 millions kg N 130 millions kg P, and 1300 millions kg K. the used of crop residues in the field not only enhanced the content of organic matter in soil and increase the crop production, but also decreased the total amounts of chemical fertilizer consumption, as well as the environmental concerns. Understanding how crop residues decompose and how the resulting released nutrients are recycled or lost is important for more efficient residue and fertilizer management practices.

Soil microorganisms play a major role in crop residue decomposition (Tester, 1988) and the subsequent fate of the nutrients derived from this process (Paul and Voroney, 1980).

Isotopic studies using 15N labeled plant materials have been useful it estimating crop N uptake from organic N inputs (Azam et al., 1993, Jensen, 1994; Vanlauwe et al., 1996; Hood et al., 1999).

The main objectives of these experiments is (i) obtain long term effects of applications of crop residues on crop nutrition, yields and soil fertility; (ii) improve process level understanding of nutrient flows through the use of isotopic techniques and (iii) enhance the efficiency of use nutrients by wheat-peanut rotation system.

2. MATERIALS AND METHODS

The experiments were conducted in sandy soil (newly reclaimed land of Minia Governorate, Egypt) at the Experimental Farm of the Minia University ducring 1996-1997, 1997-1998 and 1998-1999 winter season (November-May) and the summer season (May-October) in the system of wheat-peanut rotation every year. Mean day and night temperatures were 22C° and 10C° in the winter, while 35 C° and 20 C° in the summer, respectively. The relative humidity varied between 60 and 50 % during the winter and summer, respectively. Soil samples were collected from three depths (0-15, 15-30 and 30-50 cm). The collected samples were air dried and crushed to pass 2-mm sieve. Physical and chemical analyses of soil samples are presented in Table1.

Table 1. Initial physical and chemical soil characteristics

	Depth [cm]		
Mechanical analysis	0-15	15-30	30-50
Coarse sand %	41.12	41.00	40.92
Fine sand %	46.32	45.06	45.11
Silt %	9.32	9.12	9.11
Clay %	4.14	4.82	4.86
Texture	sandy	sandy	sandy
Soil moisture %	6.50	6.85	7.10
Bulk density (g/cm^3)	1.86	1.62	1.65
pH	8.13	8.65	8.68
CEC	4.00	4.00	8.68
EC (ms/cm)	0.65	0.85	0.90
Organic matter %	0.11	0.10	0.10
Total nitrogen %	0.014	0.013	0.013
Organic carbon %	0.064	0.058	0.058
C/N ratio	4.54	4.46	4.46
Available P (ppm)	4.00	3.00	1.00
Available K (ppm)	0.37	0.37	0.38
Available NH_4 (ppm)	98.00	63.00	27.00
Available NO_3 (ppm)	0.20	0.10	0.10
Biomass N ($\mu g/g$ soil)	24.00	16.00	-
Biomass C ($\mu g/g$ soil)	98.00	63.00	27.00

Experimental design was a randomized complete block with 4 treatments, replicated 4 times. The experiment consisted of four treatments: (i)T1-^{15}N labeled $(NH_4)_2$ SO_4, 60 kg N/ha at 9.82% 15N with unlabeled residues; (ii) $_{T2}$-^{15}N labeled wheat residues 26 kg N/ha at 1.94% 15N a.e, applied at end of the first season; (iii) T3 to generate unlabeled residues and yield and (iv) T4-^{15}N labeled $(NH_4)_2$ SO_4, 60 kg N/ha at 9.82% ^{15}N a.e., applied at beginning of the first season, without residues. Wheat seeds (*Triticum aestivum* L) var. Seds-1 and/or Beni Suef-6 and Peanut (*Arachis hypogeae* L) var. Giza-5 were used.

First year, at seeding of the growing season 1 of wheat, micro plots of T1 and T4 were amended with 15N at rate of 60 kg N/ha (9.82% atom excess equivalent 5.89 kg 15N ha). 15N fertilizer (as ammonium sulphate) was split into four applications on T1 and T4 as follows: 25% at time of seeding, 25% 2 weeks after seeding, 25% 4 weeks after seeding and last dose 6 weeks after seeding. Plots of T1-T4 received 60 kg N/ha as unlabeled ammonium sulphate. At the harvest of the growing season 1, 5 kg of labelled wheat straw (1.94% atom excess with 1.14% N) from micro plot of T1 was applied (5kg/plot equivalent to 3125 kg/ha or 0.69 15N kg/ha) to micro plot of $_{T2}$ after land preparation. Unlabeled wheat straw from plot T3 was applied at the same rate to micro plot of T1. Micro plot of T4 without addition labelled or unlabelled wheat straw was also included.

Growing season 2, peanut seeds were inoculated before sowing with Bradyrhizobium that were grown on yeast extract mannitol (YEM) broth "Medium 79" described by Allen (1959) for 6 days incubation at 39 ^{o}C then cultivated with normal cultural practices were conducted as recommended and practiced by farmer in the area. At the harvest, 15N-labelled peanut residues from 15N microplots of T1 and $_{T2}$ were removed and replaced with unlabelled peanut residues from T3. 15N-labelled peanut residues from 15N microplots of T4 was removed without unlabelled peanut replacement. The same consequent was conducted in the following seasons 3,4,5,and 6 in the second and third years.

From the wheat-peanut rotation for three years, soil and plant samples were collected every season for peanut or wheat. Percentage of N-derived from fertilizer %Ndff, wheat residue %Ndfr, soil %Ndfs, were calculated according to the equations of Hauck and Bremmer (1976) and IAEA (1990).

3. RESULTS AND DISCUSSION

3.1. Year 1, Growing season 1, Wheat crop

Table 2. Wheat yield, N and ^{15}N concentration and yield, Ndff and N-recovery (year 1, season 1)

Treatment	Plant Part	Yield Kg/ha	N %	^{15}N %	N yield Kg/ha	^{15}N- recovery g/ha	Ndff %	N-recovery %	Total-N % recovery
T1	Grain	1970.31	1.93	2.24	38.03	851.87	22.81	14.46	
	Straw	3125.00	1.14	1.94	35.63	691.13	19.76	26969	
	Total	5095.31	1.48	2.09	75.41	1576.07	21.28	26.75	26.75
T4	Grain	2015.63	2.74	2.74	37.09	1016.27	27.90	17.25	
	Straw	3046.88	1.57	1.57	37134	488.00	15.99	8-28	
	Total	5062.51	2.16	2.16	69.86	1509.00	22.00	25.61	25.61

3.1. Year 1, Growing season 1, Wheat crop

Table 3. Soil N and 15N concentration and yield, Ndff and N-recovery after harvest of wheat (year 1, season 1)

Treatment	Depth, cm	Soil w. t/ha	N %	^{15}N %	N-soil Kg/ha	^{15}N-recovery g/ha	Ndff %	N-recovery %	Total N recovery [%]	Total-N recovery [%] plant and soil
T1	0 - 15	2025	0.03	1.84	607.5	1117.8	1.87	18.97		
	15 - 30	2100	0.02	0.09	420.0	390.6	0.95	6.63	24.60	51.35
T4	0 - 15	2025	0.03	1.68	607.5	1020.6	1.71	17.32		
	15 - 30	2100	0.01	0.20	210.0	426.3	0.21	7.24	24.56	50.17

3.1. Year 1, Growing season 1, Wheat crop

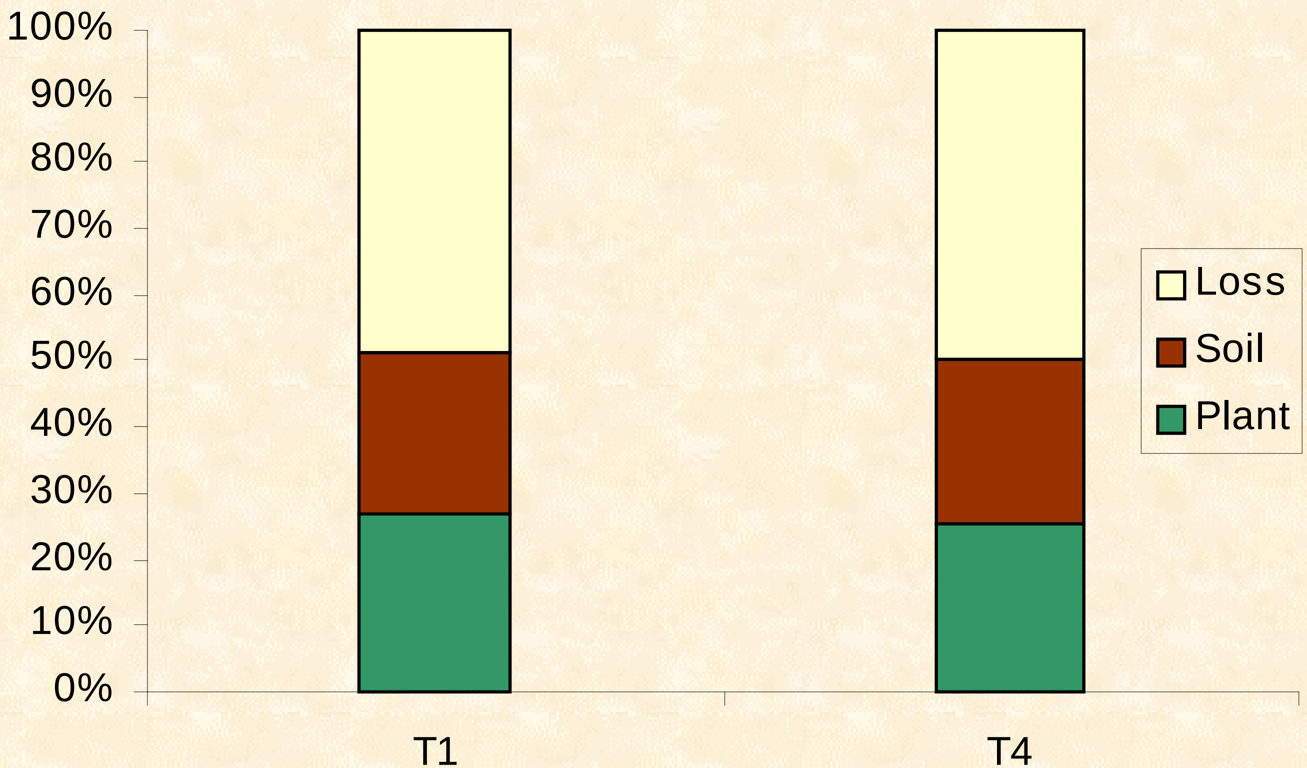

Fig.1 Total ^{15}N-recovery [%] in Plant, Soil and Losses (year 1, season 1)

3.2. Year 1, Growing season 2, Peanut crop

Table 4. Peanut yield, N and 15N concentration and yield, Ndff and N-recovery (year 1, season 2)

Treatment	Plant Part	Yield Kg/ha	N %	^{15}N %	N yield Kg/ha	^{15}N-recovery g/ha	Ndff %	N-recovery %	Total-N % recovery
T1	Leaves	2828.13	1.10	0.242	31.11	75.29	2.46	1.28	
	Seeds	2240.63	3.84	0.205	86.04	176.38	2.09	2.99	
	Hulls	1100.00	0.71	0.200	7.81	15.62	2.04	0.03	4.30
T_2	Leaves	2859.38	1.68	0.024	48.04	11.53	1.24	1.67	
	Seeds	2281.25	2.64	0.019	60.23	11.44	0.98	1.66	
	Hulls	1127.25	0.87	0.024	2.35	2.35	1.24	0.34	3.67
T4	Leaves	2937.50	1.20	0.251	35.25	88.48	2.56	1.50	
	Seeds	2296.88	3.54	0.192	81.31	156.12	1.96	2.65	
	Hulls	1162.00	0.60	0.195	6.97	13.59	1.99	0.23	4.38

3.2. Year 1, Growing season 2, Peanut crop

Table 5. Soil N and 15N concentration and yield, Ndff and N-recovery after harvest of peanut (year 1, season 2)

Treatment	Depth, cm	Soil w. t/ha	N %	^{15}N %	N-soil Kg/ha	^{15}N-recovery g/ha	Ndff %	N-recovery %	Total N recovery	Total-N
T_1	0 - 15	2025	0.02	0.154	405.00	623.7	1.57	10.59		
	15 - 30	2100	0.02	0.140	420.00	588.0	1.43	9.98	20.57	24.87
T_2	0 - 15	2025	0.03	0.045	607.5	273.4	2.32	39.57		
	15 - 30	2100	0.02	0.040	405.0	162.0	2.06	23.48	63.05	66.72
T_4	0 - 15	2025	0.02	0.104	405.0	421.2	1.06	7.15		
	15 - 30	2100	0.01	0.080	105.0	84.0	0.82	1.43	8.58	12.96

3.2. Year 1, Growing season 2, Peanut crop

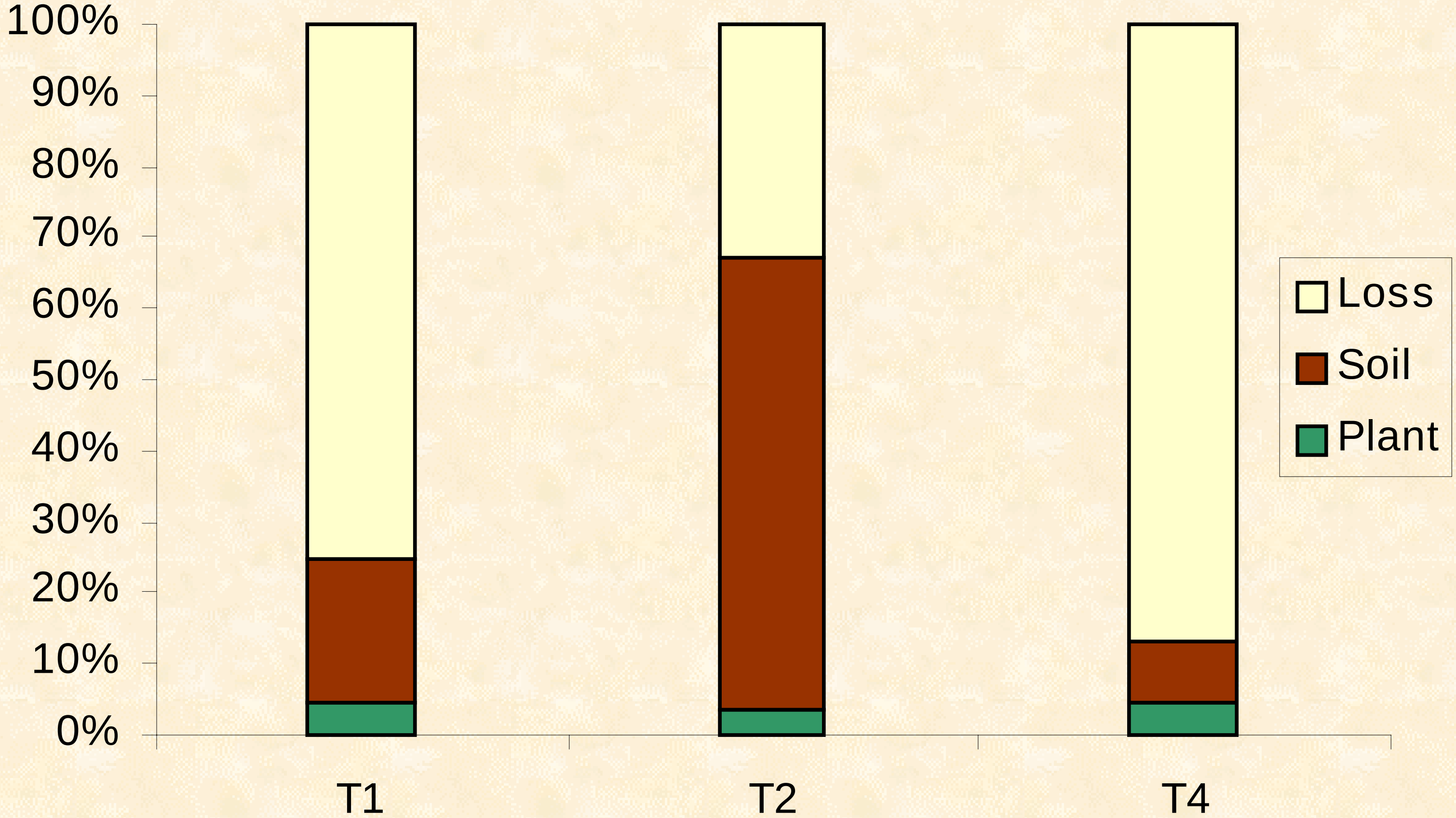

Fig.2 Total ^{15}N-recovery [%] in Plant, Soil and Losses (year 1, season 2)

3.3. Year 2, Growing season 3, Wheat crop

Table 6.Wheat yield, N and ^{15}N concentration and yield, Ndff and N-recovery (year 2, season 3)

Treatment	Plant Part	Yield Kg/ha	N %	^{15}N %	N yield Kg/ha	^{15}N recovery g/ha	Ndff %	N-recovery %	Total-N Recovery %
T_1	Grain	1329.69	3.62	0.037	34.84	12.89	0.38	0.22	
	Straw	5332.81	0.82	0.030	43.73	13.12	0.31	0.22	0.44
T_2	Grain	1071.88	2.82	0.009	30.23	2.72	0.46	0.39	
	Straw	5179.69	0.67	0.012	34.70	4.16	0.62	0.60	0.99
T_4	Grain	1059.38	2.91	0.043	30.83	13.26	0.44	0.23	
	Straw	4967.19	0.98	0.030	48.68	14.60	0.31	0.25	0.48

3.3. Year 2, Growing season 3, Wheat crop

Table 6.Wheat yield, N and ^{15}N concentration and yield, Ndff and N-recovery (year 2, season 3)

Treatment	Plant Part	Yield Kg/ha	N %	^{15}N %	N yield Kg/ha	^{15}N recovery g/ha	Ndff %	N-recovery %	Total-N Recovery %
T_1	Grain	1329.69	3.62	0.037	34.84	12.89	0.38	0.22	
	Straw	5332.81	0.82	0.030	43.73	13.12	0.31	0.22	0.44
T_2	Grain	1071.88	2.82	0.009	30.23	2.72	0.46	0.39	
	Straw	5179.69	0.67	0.012	34.70	4.16	0.62	0.60	0.99
T_4	Grain	1059.38	2.91	0.043	30.83	13.26	0.44	0.23	
	Straw	4967.19	0.98	0.030	48.68	14.60	0.31	0.25	0.48

3.3. Year 2, Growing season 3, Wheat crop

Table 7. Soil N and ^{15}N concentration and yield, Ndff and N-recovery after harvest of wheat (year 2, season 3)

Treatment	Depth, cm	Soil w. t/ha	N %	^{15}N %	N-soil Kg/ha	^{15}N-recovery g/ha	Ndff %	N-recovery %	Total N % residue	Total-N % plant and soil recovery
T_1	0 - 15	2025	0.03	0.110	607.5	668.3	1.12	11.34		
	15 - 30	2100	0.02	0.092	420.0	386.4	0.94	6.25	17.59	18.03
T_2	0 - 15	2025	0.03	0.040	607.5	243.0	2.06	25.31		
	15 - 30	2100	0.02	0.043	420.0	180.6	2.22	26.17	51.48	52.47
T_4	0 - 15	2025	0.02	0.098	405.0	396.9	1.00	6.74		
	15 - 30	2100	0.01	0.084	210.0	167.4	0.86	2.99	9.73	10.21

3.3. Year 2, Growing season 3, Wheat crop

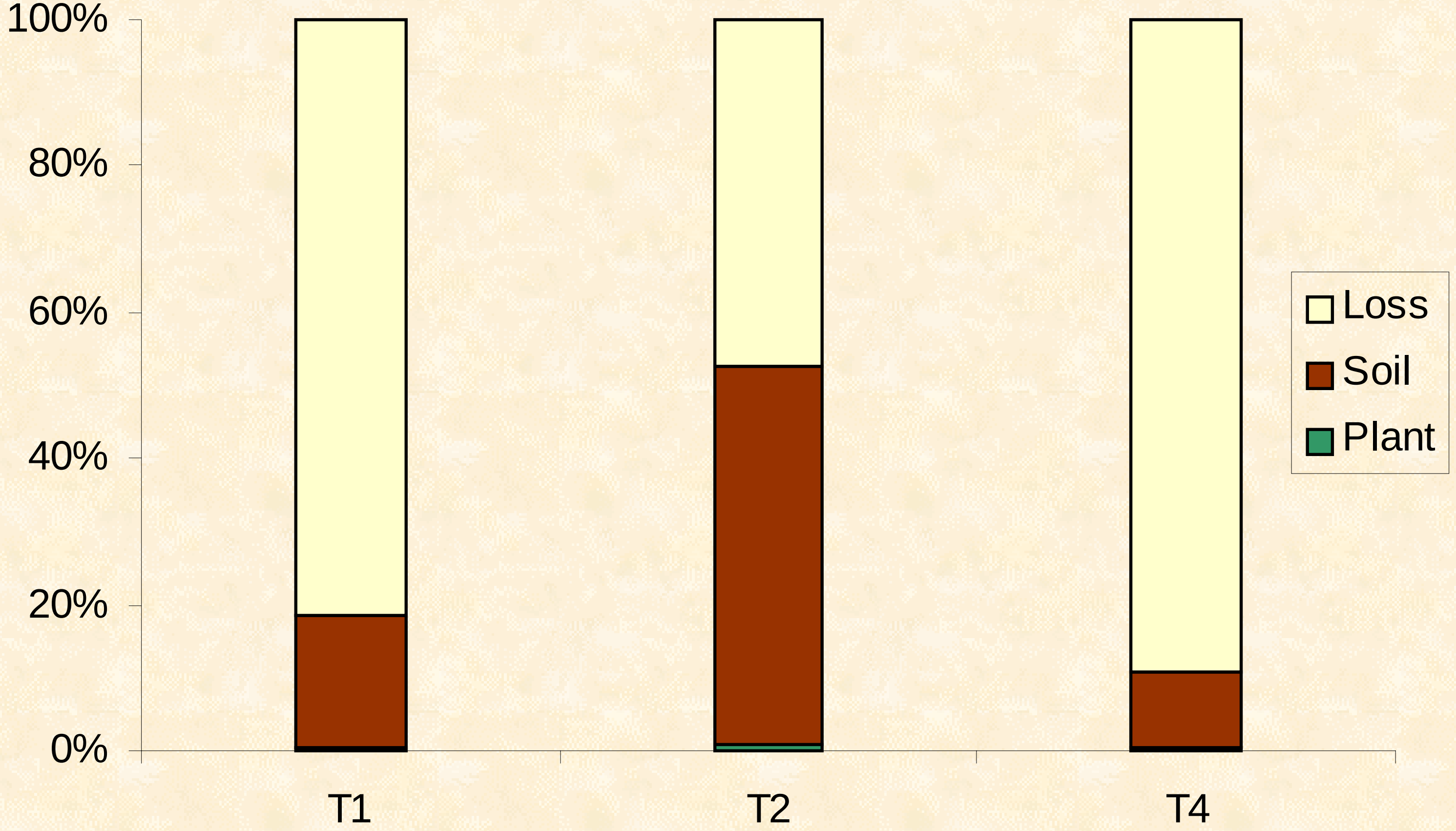

Fig.3 Total ^{15}N-recovery [%] in Plant, Soil and Losses (year 2, season 3)

3.4. Year 2, Growing season 4, Peanut crop

Table 8. Peanut yield, N and ^{15}N concentration and yield, Ndff and N-recovery (year 2, season 4)

Treatment	Plant Part	Yield Kg/ha	N %	^{15}N %	N yield Kg/ha	^{15}N recovery g/ha	Ndff %	N-recovery %	Total-N Recovery %
T_1	Leaves	2218.75	1.19	0.234	26.40	61.78	2.38	1.05	
	Seeds	1004.06	4.04	0.216	40.56	87.62	2.20	1.49	
	Hulls	969.69	0.71	0.113	6.89	7.79	1.15	0.13	2.67
T_2	Leaves	2687.5	1.54	0.024	41.39	9.93	1.24	1.44	
	Seeds	1045.5	3.79	0.019	39.62	7.53	0.98	1.09	
	Hulls	1004.50	0.62	0.170	6.23	10.59	8.76	1.54	4.07
T_4	Leaves	2487.5	1.19	0.236	29.60	69.86	2.40	1.19	
	Seeds	981.75	3.79	0.230	37.21	85.58	1.45	1.45	
	Hulls	943.3	0.70	0.122	6.60	8.05	1.24	0.14	2.78

3.4. Year 2, Growing season 4, Peanut crop

Table 9. Soil N and 15N concentration and yield, Ndff and N recovery after harvest of peanut (year 2, season 4)

Treatment	Depth, cm	Soil w. t/ha	N %	^{15}N %	N-soil Kg/ha	^{15}N-recovery g/ha	Ndff %	N-recovery %	Total N Recovery %	Total-N recovery % plant and soil
T_1	0 - 15	2025	0.03	0.092	607.5	558.9	0.94	9.49		
	15 - 30	2100	0.02	0.041	420.0	172.2	0.42	2.92	12.41	15.28
T_2	0 - 15	2025	0.03	0.025	607.5	151.88	1.29	22.01		
	15 - 30	2100	0.03	0.009	630.0	56.7	0.46	8.22	30.23	34.30
T_4	0 - 15	2025	0.02	0.072	405.0	291.6	0.73	4.95		
	15 - 30	2100	0.02	0.030	420	126.0	0.31	2.14	7.09	9.87

3.4. Year 2, Growing season 4, Peanut crop

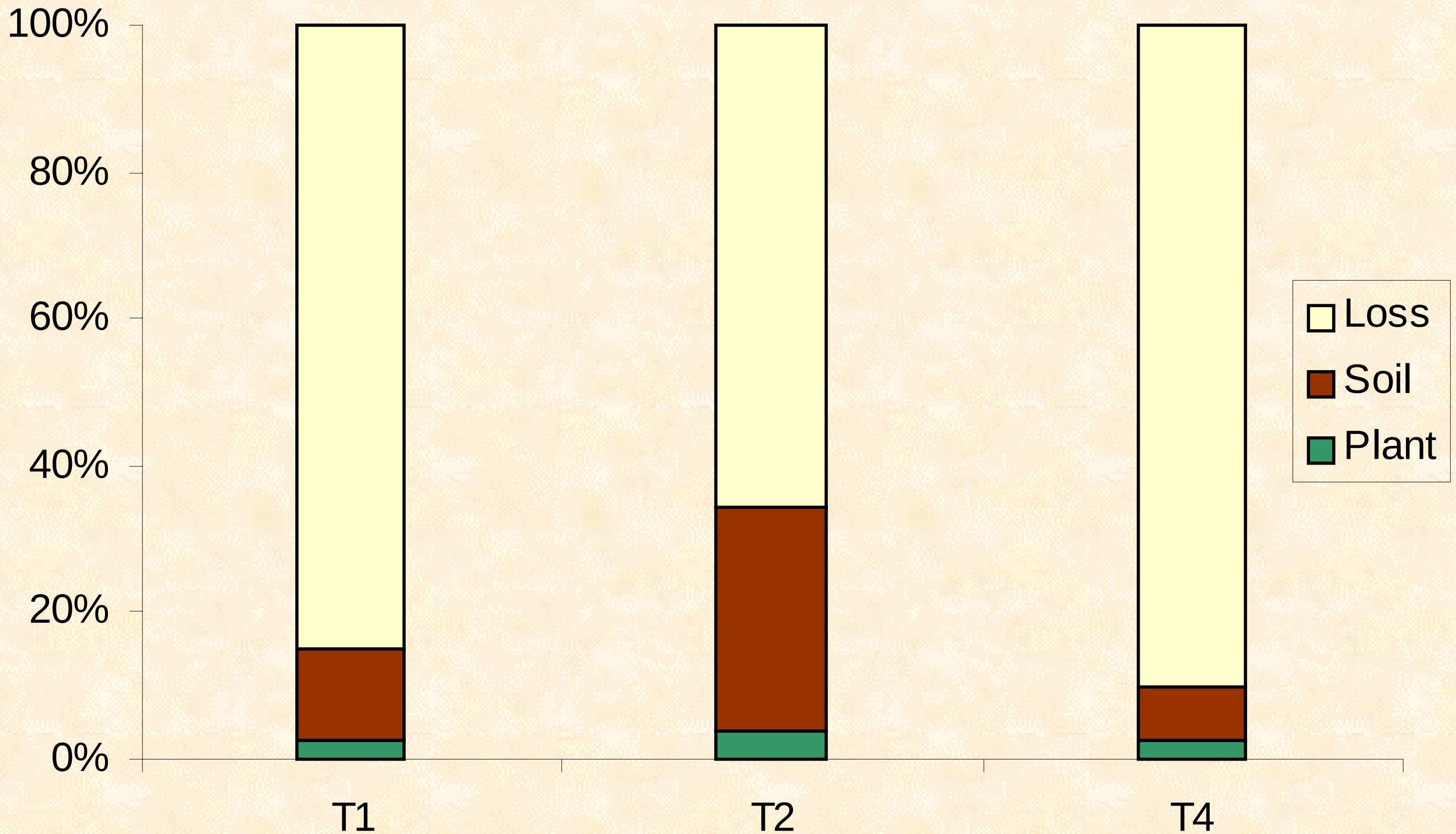

Fig.4 Total ^{15}N-recovery [%] in Plant, Soil and Losses (year 2, season 4)

3.5. Year 3, Growing season 5, Wheat crop

Table 10. Wheat yield, N and 15N concentration and yield, Ndff and N-recovery (year 3, season 5)

Treatment	Plant Part	Yield Kg/ha	N %	^{15}N %	N yield Kg/ha	^{15}N recovery g/ha	Ndff %	N-recovery %	Total-N Recovery %
T_1	**Grain**	**1906.3**	**2.82**	**0.008**	**53.76**	**4.30**	**0.08**	**0.07**	
	Straw	**2953.1**	**0.55**	**0.008**	**16.24**	**1.30**	**0.08**	**0.02**	**0.09**
T_2	**Grain**	**1578.1**	**3.19**	**0.003**	**50.34**	**1.51**	**0.16**	**0.22**	
	Straw	**4015.6**	**0.86**	**0.003**	**34.53**	**1.04**	**0.16**	**0.15**	**0.37**
T_4	**Grain**	**1890.6**	**2.43**	**0.019**	**45.94**	**8.73**	**0.19**	**0.15**	
	Straw	**3000**	**0.49**	**0.014**	**14.70**	**2.06**	**0.14**	**0.04**	**0.19**

3.5. Year 3, Growing season 5, Wheat crop

Table 11. Soil N and 15N concentration and yield, Ndff and N recovery after harvest of wheat (year 3, season 5)

Treatment	Depth, cm	Soil w. t/ha	N %	^{15}N %	N-soil Kg/ha	^{15}N-recovery g/ha	Ndff %	N-recovery %	Total N % residue	Total-N% plant and soil recovery
T_1	0 – 15	2010	0.03	0.09	603	542.7	0.92	9.21		
	15 – 30	2055	0.03	0.02	616.5	123.3	0.20	2.09	11.30	11.39
T_2	0 – 15	2010	0.03	0.021	603	126.6	1.08	18.35		
	15 – 30	2055	0.03	0.007	616.5	43.16	0.36	6.25	24.50	24.87
T_4	0 – 15	2010	0.03	0.04	603	241.2	0.41	37138		
	15 – 30	2055	0.02	0.028	411	115.1	0.29	1.95	6.04	6.23

3.5. Year 3, Growing season 5, Wheat crop

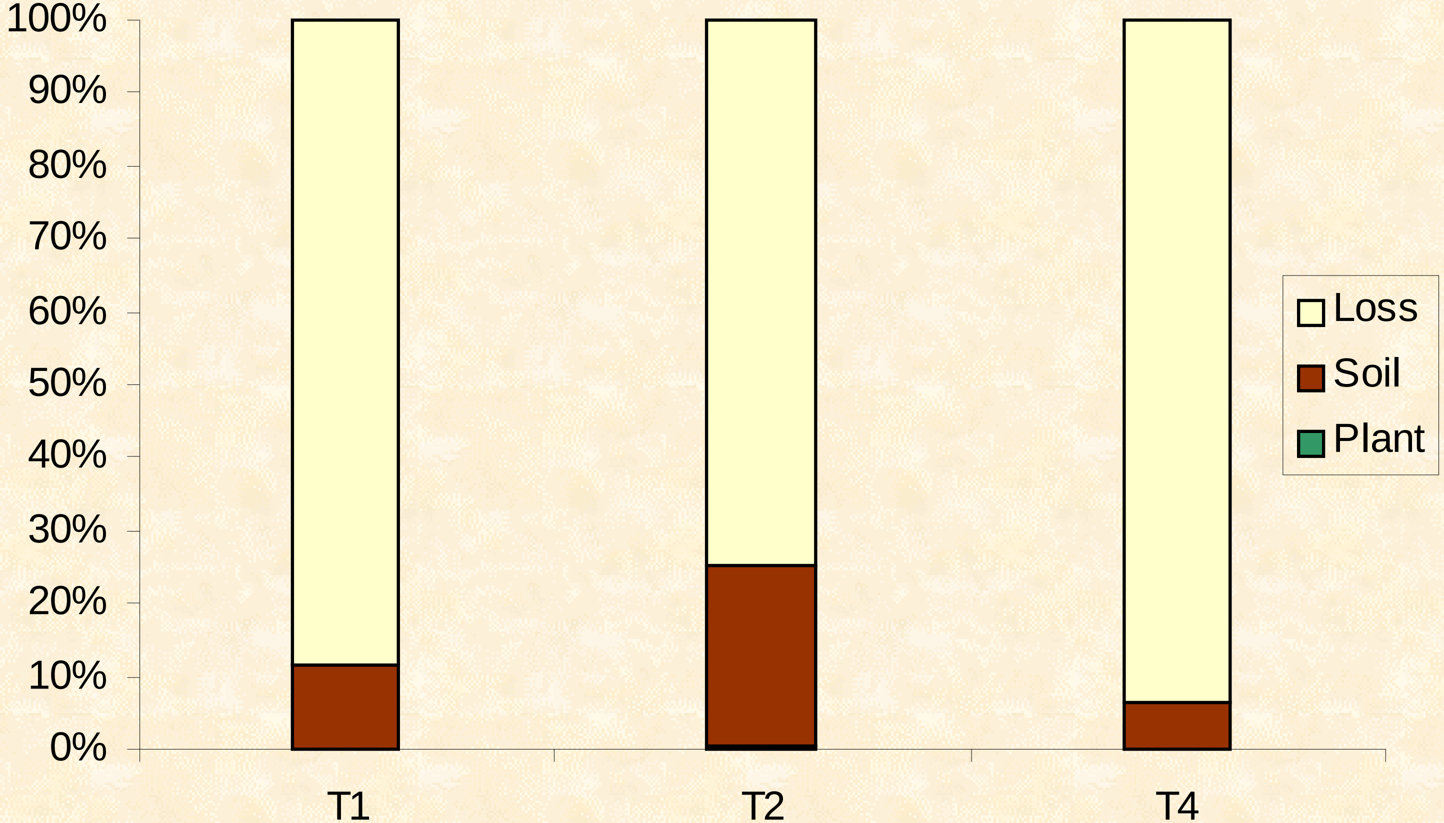

Fig.5 Total ^{15}N-recovery [%] in Plant, Soil and Losses
(year 3, season 5)

3.6. Year 3, Growing season 6, Peanut crop

Table 12. Peanut yield, N and ^{15}N concentration and yield, Ndff and N-recovery (year 3, season 6)

Treatment	Plant	DM	N	^{15}N	N yield	^{15}N recovered	Ndff	N-recovery	Total-N
T_1	**Leaves**	**1019.75**	**4.28**	**0.024**	**43.65**	**10.48**	**0.24**	**0.18**	
	Seeds	**2050.45**	**2.07**	**0.065**	**42.44**	**24.59**	**0.66**	**0.47**	
	Hulls	**707.85**	**1.88**	**0.071**	**13.31**	**9.45**	**0.72**	**0.16**	**0.81**
T_2	**Leaves**	**1000**	**4.54**	**0.0013**	**45.40**	**0.59**	**0.07**	**0.09**	
	Seeds	**2197.25**	**13912**	**0.0013**	**52.30**	**0.78**	**0.08**	**0.11**	
	Hulls	**849.5**	**22647**	**0.0055**	**13.76**	**0.76**	**0.28**	**0.11**	**0.31**
T_4	**Leaves**	**967.25**	**5.32**	**0.037**	**51.46**	**19.04**	**0.38**	**0.32**	
	Seeds	**2003.5**	**1.90**	**0.019**	**38.07**	**7.23**	**0.19**	**0.12**	
	Hulls	**749.5**	**1.10**	**0.021**	**8.25**	**1.73**	**0.21**	**0.03**	**0.47**

3.6. Year 3, Growing season 6, Peanut crop

Table 13. Soil N and 15N concentration and yield, Ndff and N recovery after harvest of peanut (year 3, season 6)

Treatment	Depth, cm	Soil w. t/ha	N %	^{15}N %	N-soil Kg/ha	^{15}N-recovery g/ha	Ndff %	N-recovery %	Total N % residue	Total-N% plant and soil recovery
T_1	**0 – 15**	**2010**	**0.03**	**0.087**	**603.0**	**524.61**	**0.89**	**0.90**		
	15 – 30	**2055**	**0.02**	**0.048**	**411.0**	**197.28**	**0.49**	**3.35**	**12.25**	**13.06**
T_2	**0 – 15**	**2010**	**0.035**	**0.014**	**703.5**	**98.49**	**0.72**	**14.27**		
	15 – 30	**2055**	**0.02**	**0.003**	**411.0**	**12.33**	**0.16**	**14.27**	**16.06**	**16.37**
T_4	**0 – 15**	**2010**	**0.025**	**0.065**	**502.5**	**326.63**	**0.66**	**5.54**		
	15 – 30	**2055**	**0.013**	**0.023**	**267.2**	**61.46**	**0.23**	**1.04**	**6.58**	**7.05**

3.6. Year 3, Growing season 6, Peanut crop

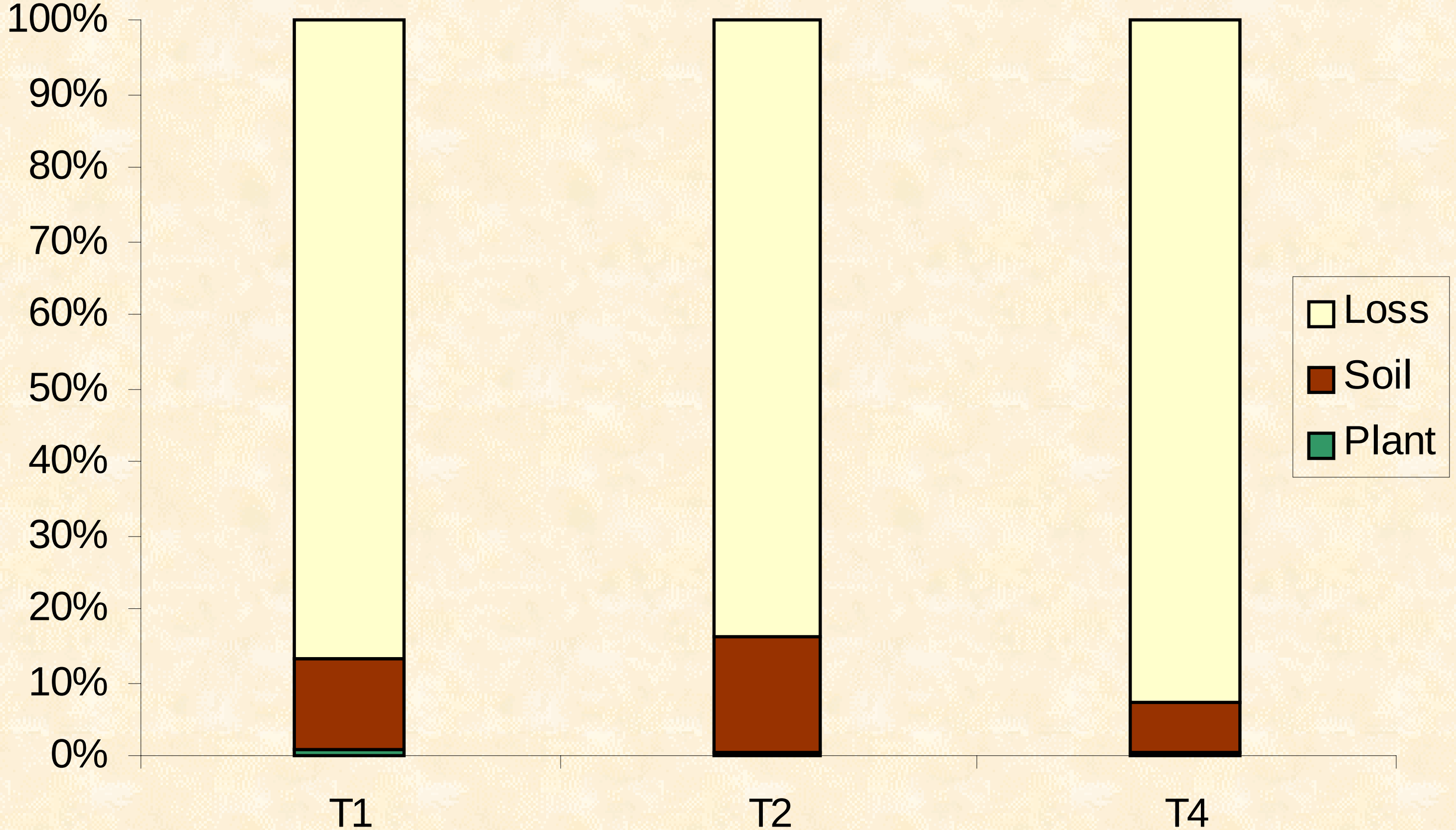

Fig.6 Total ^{15}N-recovery [%] in Plant, Soil and Losses (year 3, season 6)

3.7. Nitrogen Recovery during 3 Years of Wheat-Peanut Rotation System

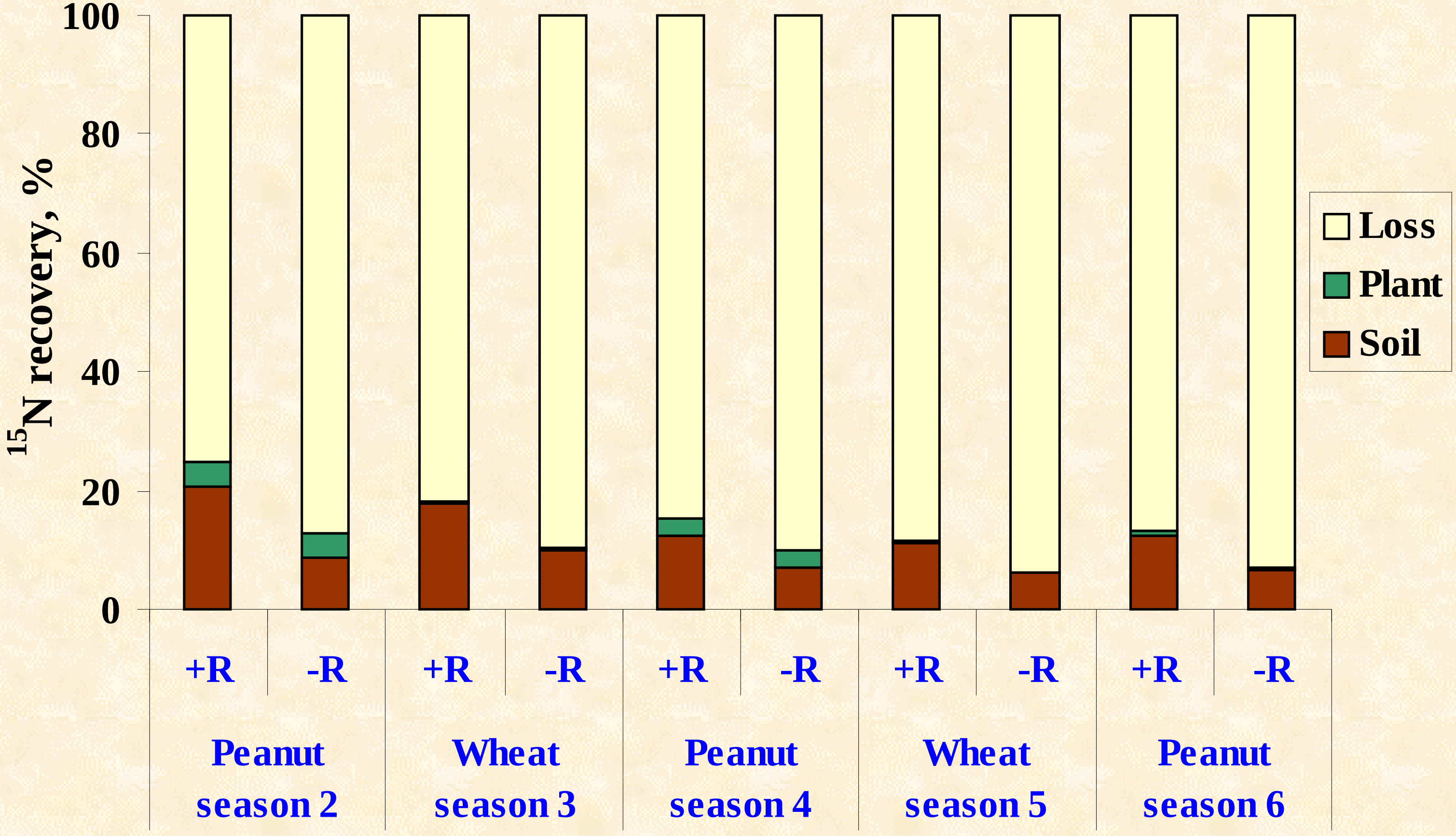

Fig. 7. Effect of incoporation of crop residues (+R = with residues; -R = without residues) on the recovery of mineral 15N.

3.7. Nitrogen Recovery during 3 Years of Wheat-Peanut Rotation System

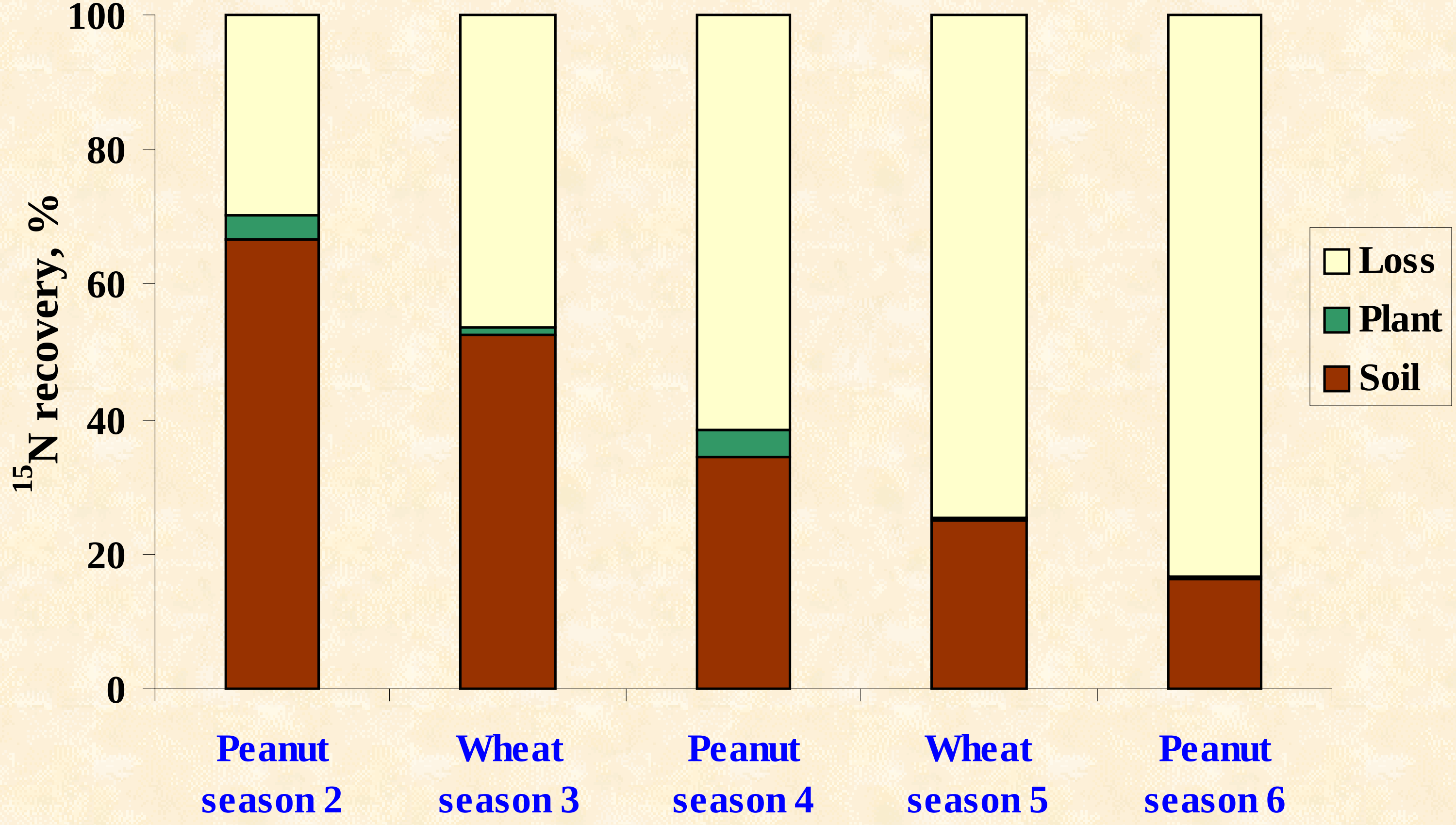

Fig. 8. Effect of incoporation of lablled crop residues on the recovery of 15N.

4. CONCLUSION

In the newly reclaimed sandy soil, which is poor in organic matter (0.11%O.M.) and low in nitrogen content (0.014%), wheat straw and peanut leaves (as residues) maintain continuos N supply in the soil during most of the growing period of wheat-peanut rotation system and can be utilized as a source of N for wheat-peanut production in such sandy soil. It appears that wheat straw and peanut leaves as N source has very little utility, especially during the seasons of application. The present investigation also shows that incorporation of organic materials improved soil fertility and hence increased the yields of wheat and peanut during the years of cultivation.

ACKNOWLEDDGMENT

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RECYCLING OF CROP RESIDUES FOR SUSTAINABLE CROP PRODUCTION IN WHEAT-PEANUT ROTATION SYSTEM

B - synchrony of nitrogen release

M.S.A. Safwat*, M.A. Sherif*, E.A.Abdel-Bary, O.A.O. Saad* and M.A. El -Mohandes***

*** Minia University, and**

***** Zagazig University in Egypt**

Abstract

Synchronizing N supply from incorporated plant residues with N demand of peanut may increase the plants N use efficiency and reduce soil N losses. The synchrony of N release from plant residues showed that N contents of soils at depth 0-15 cm decreased with time incorporated after one month. NO_3 accumulated in soil as a function of time. The highest rate of nitrate production was in the incorporated after harvested wheat. ^{15}N enrichment in the 0-15 cm layer of soil was enhanced at three months after incorporation, when the residue was added 2 weeks before peanut is seeded. The optimum time of incorporating crop residues to obtain the highest of total nitrogen was two weeks before planting.

1. Introduction

It has been shown that crop N recovery from organic inputs such as, plant residues or manure is often less than 20%(Hagger et al., 1993; Vanlauwe et al., 1996). The decomposition rate and nutrient release from crop residues are influenced by a number of soils environmental and crop residue factors. The final N status of crop is determined by the N availability through out the growing season and the crop N demand.

The progress of this study was reviewed in line with the following objectives:

- To increase the quantity of nutrients available to crops from organic sources and from more effective recycling,
- To enhance the efficiency of use of nutrients by crops and minimize losses through improved synchrony between nutrient supply and crop demand,
- To improve process level understanding of nutrient flows through the use of isotopic techniques so that the management recommendations can extrapolated to a wide range of environments using models.

2. Materials and Methods

The experiment was conducted in sandy soil (newly reclaimed land of Minia Governorate, Egypt) at the experiment farm of the Minia University during 1999 summer season. The initial physiochemical characteristics of the used soil were as follows: 880 g kg^{-1} sand, 40 g kg^{-1} clay, 8.5 pH (1:2.5 soil suspension); 1.1 g kg^{-1} organic mater; and CEC of 4 $mole_c$ kg^{-1}. The ^{15}N-labeled wheat straw (1.94% atom excess with 1.14% N) was applied at rate of 3125 kg/ha. 80 cylinders were prepared according to the IAEA guideline.

The application period of residues was designed at four stages:

- Applied residues after harvested wheat.
- Applied residues two weeks before peanut sowing.
- Applied residues at peanut sowing.
- Applied residues two weeks after sowing.

Soil samples were collected from three depths (0-15, 15-30 and 30-50 cm) at one, two, three and four months after sowing.

2. Materials and Methods

Table 1. Effect of incorporation of labeled crop residues (applied residues after harvested wheat) on the residue ^{15}N in soil.

Time of sample, month	Depth, cm	Soil weight t/ha	% N	% ^{15}N	N-soil residue g/ha	^{15}N residue g/ha	NdfR%	N-residue %	Total N-residue %
	0-15	2100	0,03	0,0063	630	39,69	0,33	5,75	
1	15-30	2250	0,02	0,0043	450	19,35	0,22	2,8	
	30-50	3080	0,02	0,0037	616	22,79	0,19	3,3	11,85
	0-15	2100	0,01	0,0104	210	21,84	0,54	3,17	
2	15-30	2250	0,01	0,0124	225	27,9	0,64	4,04	
	30-50	3080	0,01	0,0128	308	39,42	0,66	5,71	12,92
	0-15	2100	0,02	0,0223	420	93,66	1,15	13,57	
3	15-30	2250	0,02	0,0244	450	109,8	1,26	15,91	
	30-50	3080	0,023	0,0243	708,4	172,14	1,25	24,95	54,43
	0-15	2100	0,01	0,0119	210	24,99	0,61	3,62	
4	15-30	2250	0,027	0,014	607,5	85,05	0,72	12,33	
	30-50	3080	0,027	0,0122	831,6	101,46	0,63	14,7	57,65

3. Results and Discussion

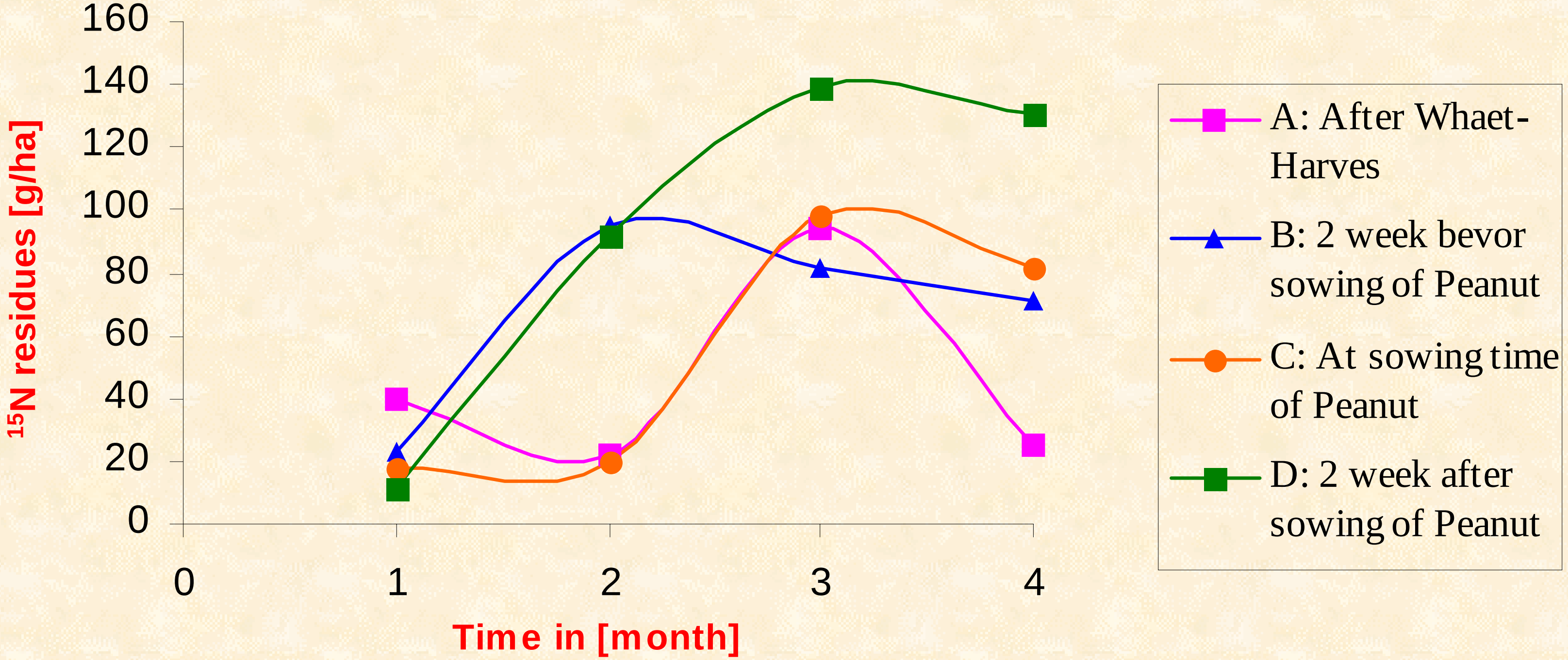

Fig. 1.1: The synchronizing of ^{15}N Wheat residues release in a depth (0-15 cm) of sandy soil

3. Results and Discussion

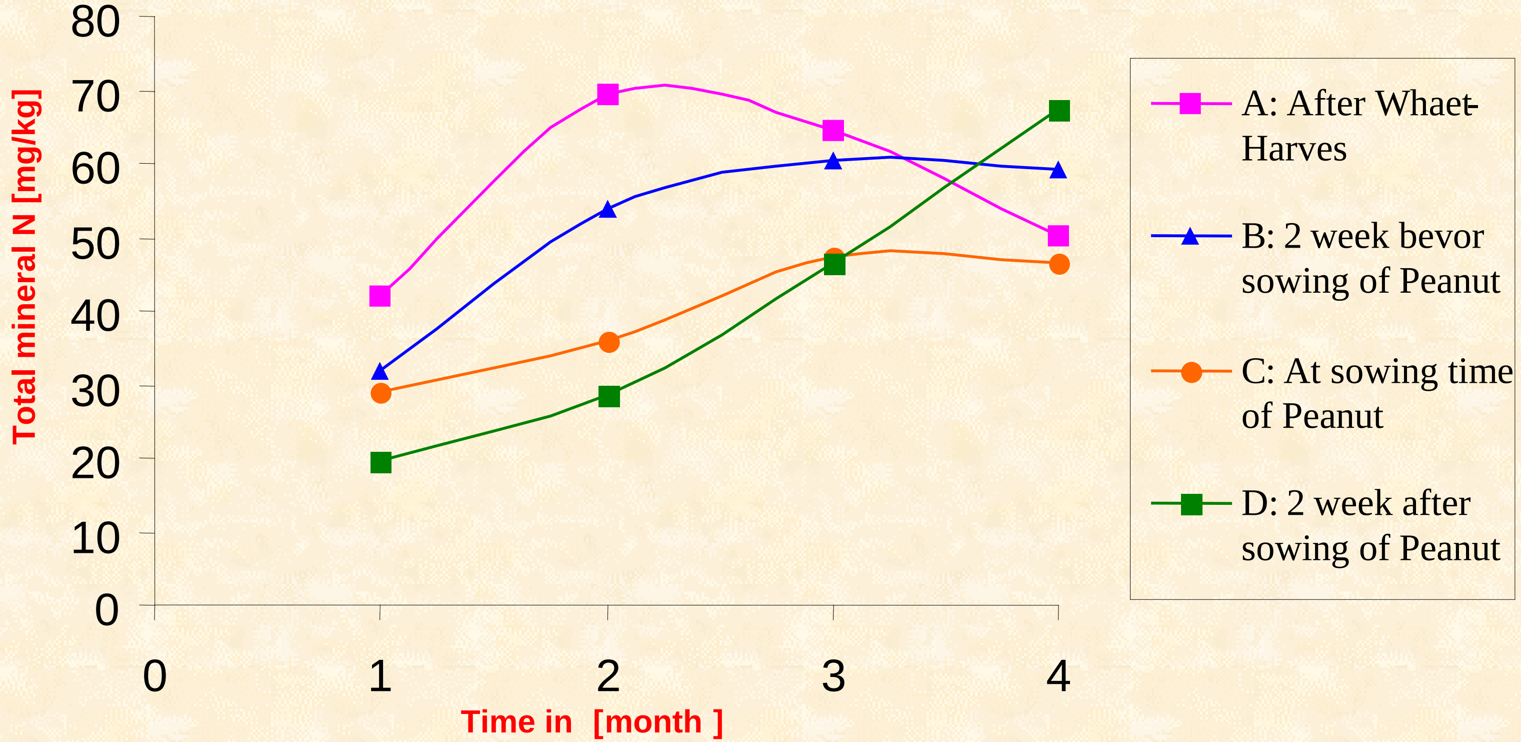

Fig. 1.2: The synchronizing of ^{15}N Wheat residues release in a depth (0-15 cm) of sandy soil

3. Results and Discussion

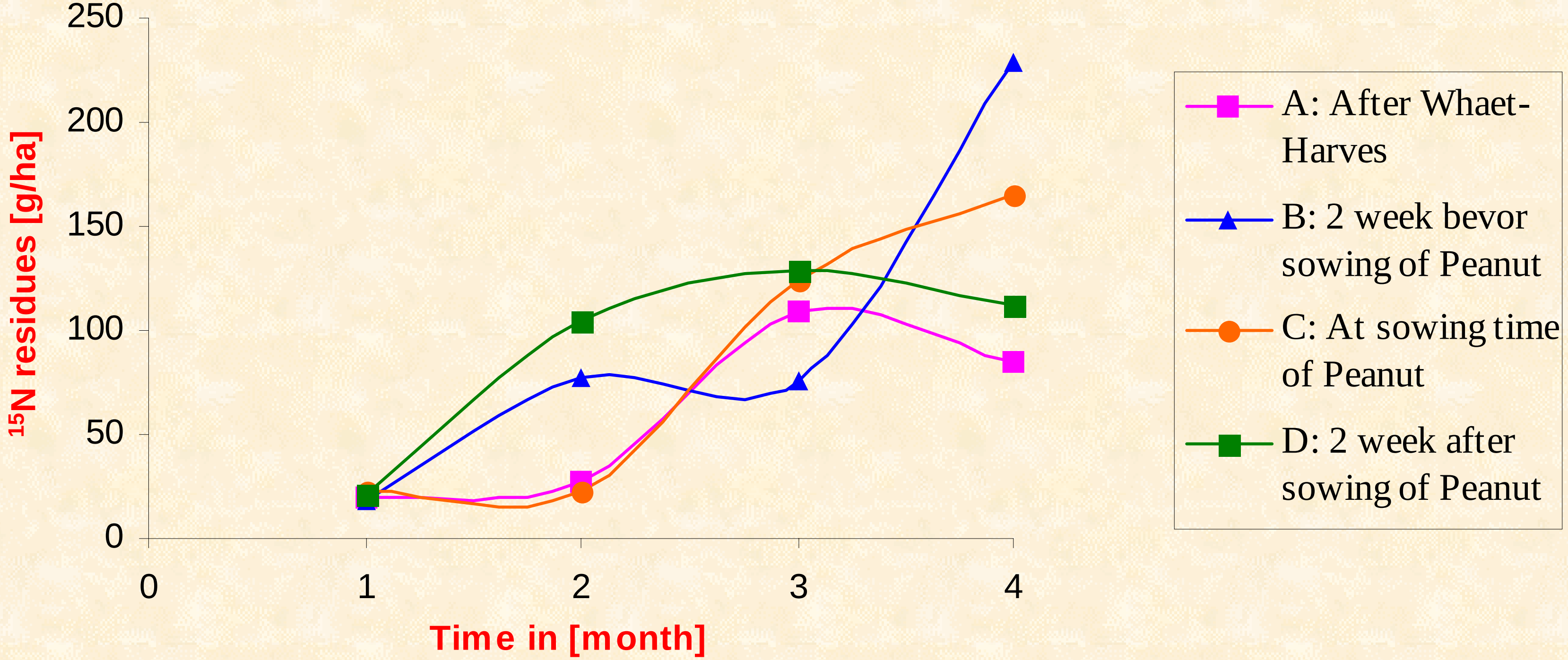

Fig. 2.1: The synchronizing of ^{15}N Wheat residues release in a depth (15-30 cm) of sandy soil

3. Results and Discussion

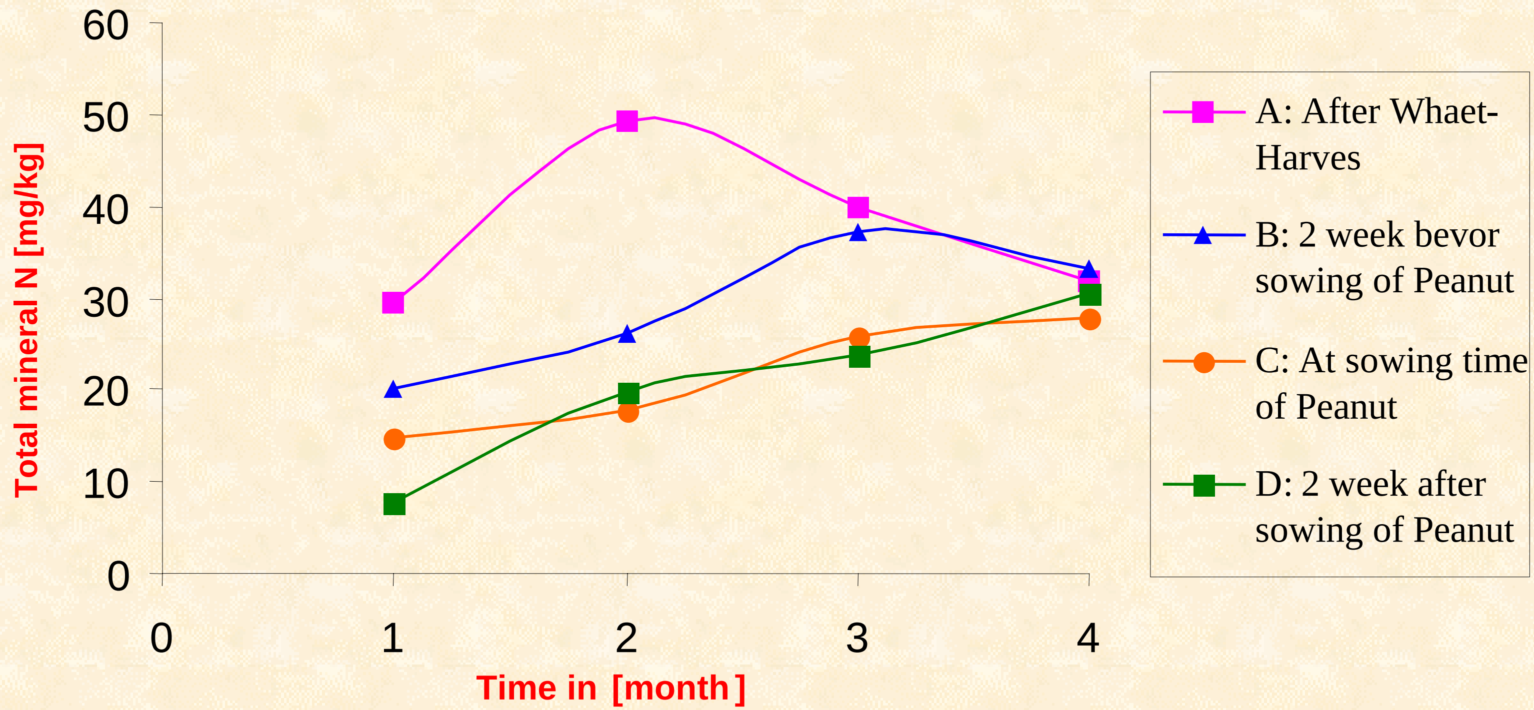

Fig. 2.2: The synchronizing of ^{15}N Wheat residues release in a depth (15-30 cm) of sandy soil

3. Results and Discussion

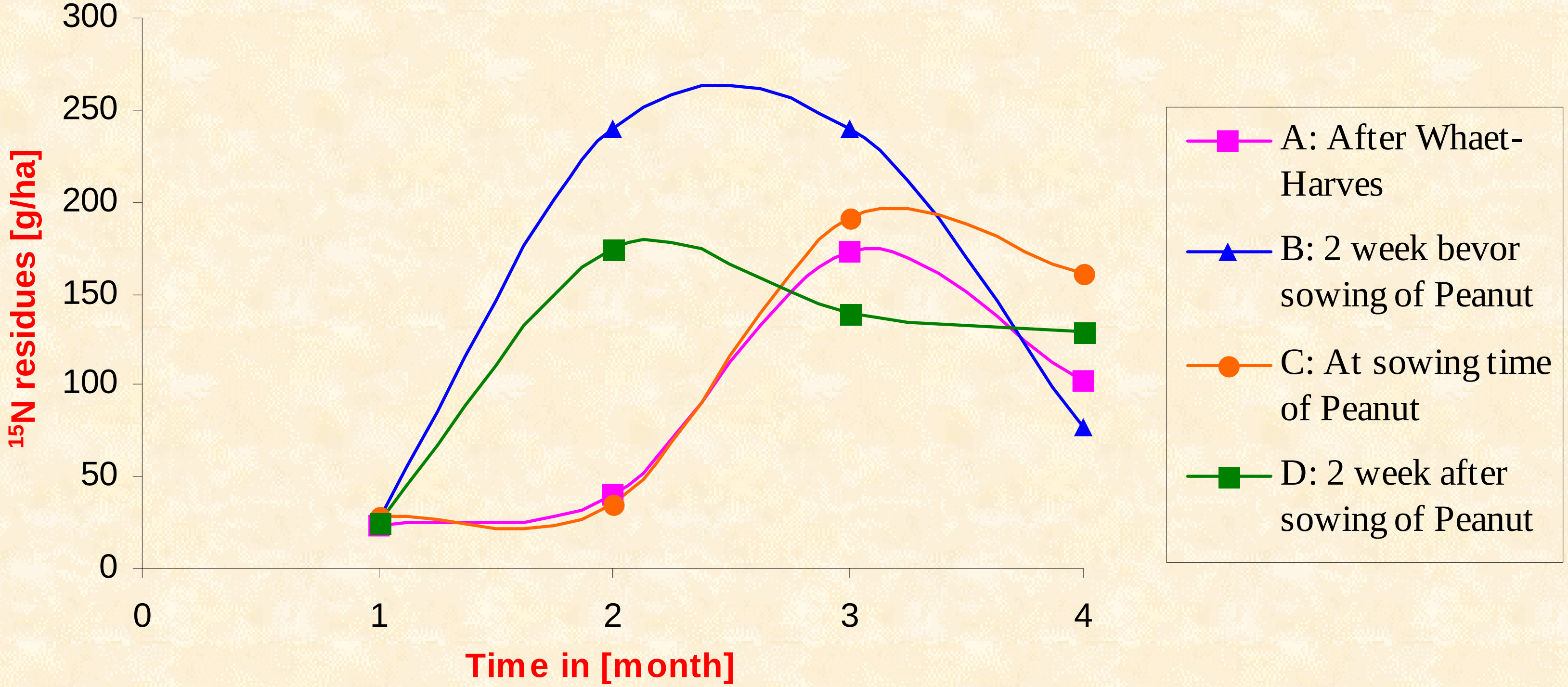

Fig. 3.1: The synchronizing of ^{15}N Wheat residues release in a depth (30-50 cm) of sandy soil

3. Results and Discussion

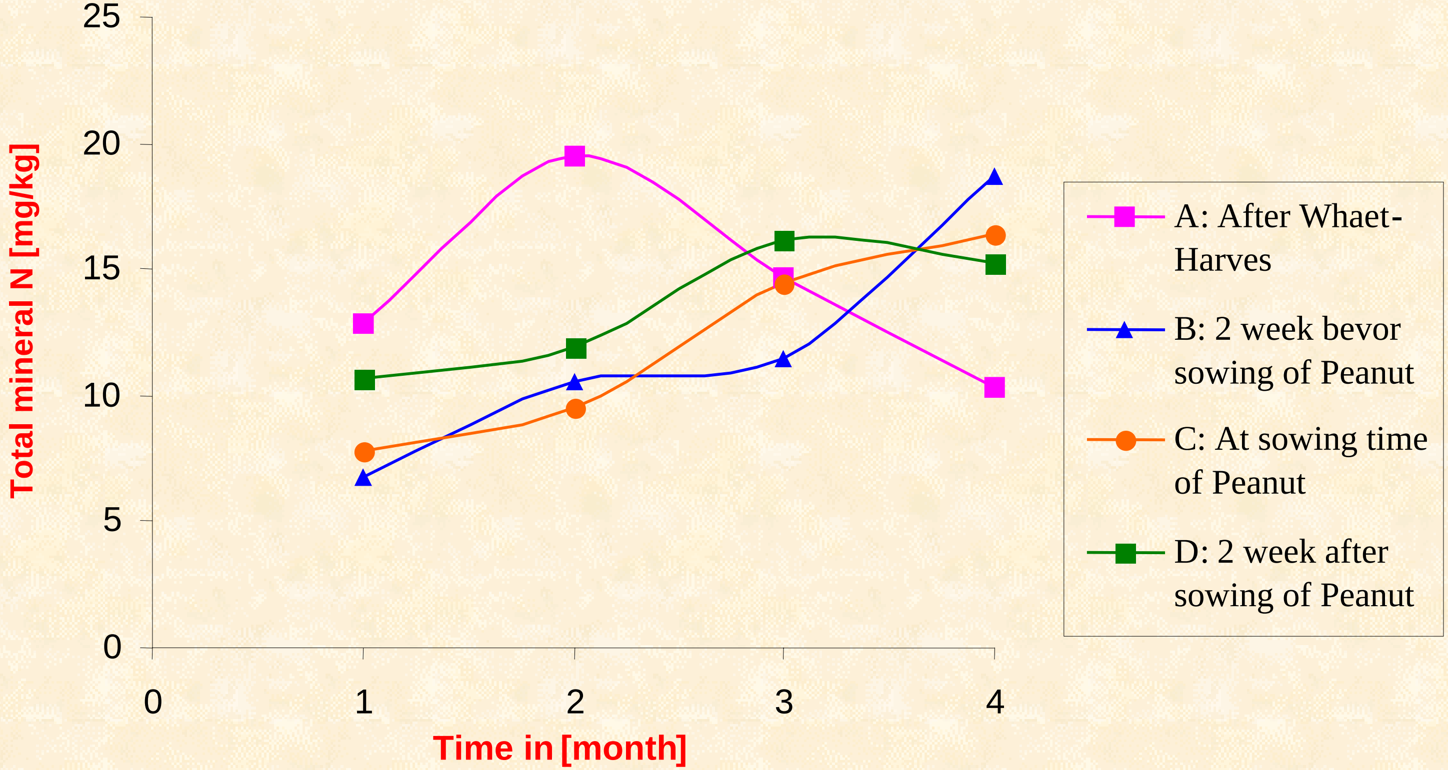

Fig. 3.2: The synchronizing of ^{15}N Wheat residues release in a depth (30-50 cm) of sandy soil

3. Results and Discussion

The effect of incorporation of labeled crop residues at different times on percentage of nitrogen drived from residue % NdfR % is presented in Tables (1, 2, 3 and 4). The results revealed that application of the residue increased the nitrogen from residue with time. The highest % NdfR was at a third month for applied residues after harvested wheat 1.20%, while it recorded the highest value were applied residue two weeks before peanut it seeded compared with different times. Data in Table (3) show that the highest % NdfR was at 0 – 15 cm when application of residues at time of sowing the peanut.

Extractable NH_4^+-N and NO_3-N in soil under field conditions in the absence of peanut plants are given in Tables 5, 6, 7 and 8 NH_4^+-N release in wheat straw increased gradually and reached a maximum at the 2 from 4 months after seedling, then it decreases gradually till the end of the experiment in all treatments.

Nitrogen released from decomposing wheat residues in soil appears as NH_4^+ in soil.

This NH_4^+-N can remain as the stable end product of N mineralization in the soil (Nagarajah et al., 1989).

3. Results and Discussion

The ammonium ions might be lost from the soils if subjected to excessive leaching or held on the exchangeable sites of the exchange complex. Moreover ammonium ions are usually involved in a biochemical reaction known as nitrification. The nitrification process is affected by several variables rate of application, soil texture, soil reaction soil temperature, organic matter content, moisture and aeration. The concentration of NO_3^- as shown in Tables 5, 6, 7 and 8. It is apparent that NO_3-N accumulation as a function of time. The NO_3—N concentration at the 0-15 cm depth was 11.2 to 40 mg kg^{-1} in all treatments. At the end of the experiment the maximum total concentration NO_3—N were 75.5 mg kg^{-1} after four months when applied wheat straw after harvested wheat. The rate of decomposition of plant residues is in fact related to their C : N ratio (Parr & Papendick, 1978; Jenkinson, 1981) and also to the plant biochemical composition, i.e. lignin, cellulose or soluble carbon contents (Iritani & Arnold, 1960; Herman et al., 1977, Frankenberger & Abdelmagid, 1985). Based on the data of this work, it can be concluded that organic residues may be feasible for the newly reclaimed sandy soils of Egypt, from an agronomic and an environmental point.

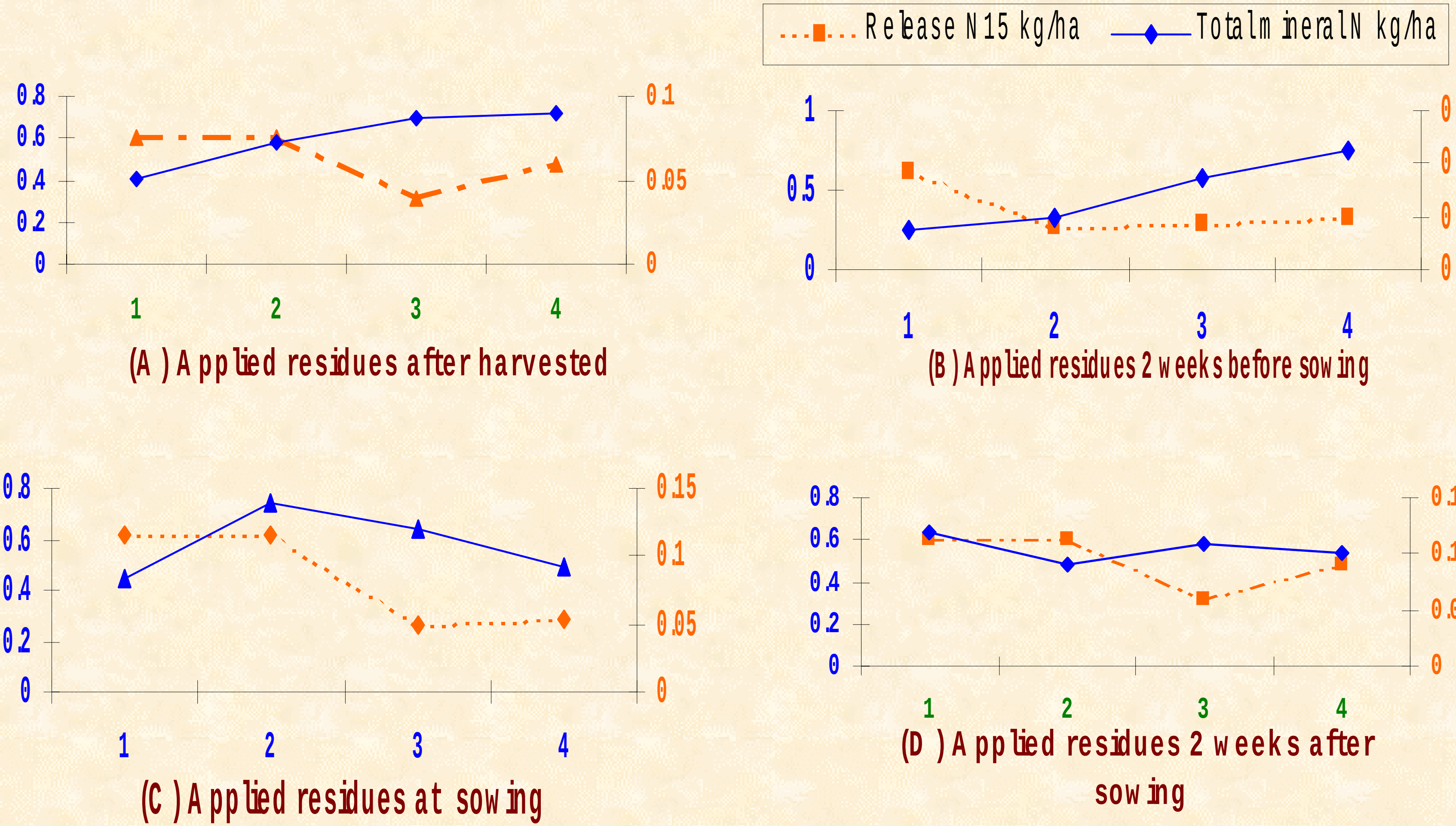

Fig (4): Relationship Bestween Total N15 Release and Total Mineral N in (0-50) cm Soil During Experimental Period.