Zagazig J.Agric. Res., Vol .31 No.(3) 2004 973-991

SOIL NITROGEN MINERALIZATION AND MICROBIAL BIOMASS FORMATION IN SANDY SOIL AMENDED WITH LABELLED LEGUMINOUS AND NON-LEGUMINOUS PLANT RESIDUES

El-Sherbieny*, A.E.A.; E.A.M. Awad*; S.M. Soliman and M.M. Ismail****

***Department of Soil Science, Fac. of Agric. Zagazig University.**
**** Soil and Water Department, Nuclear Research Center, Atomic Energy Authority.**

Accepted 23 / 2 / 2004

ABSTRACT: A lab experiment was conducted to evaluate the effect of different plant residues having varying (C/N) ratios and nitrogen content. Both types of ^{15}N-labelled plant residues were mixed with a sandy soil and incubated under different rates (0, 50 and 100 mg N Kg^{-1} soil) at about 22°C for about 10 weeks in a laboratory under aerobic conditions. Results showed that the organic C and C/N ratios decreased with time up to 10 weeks period of incubation at the rate of 50 and 100 mg N Kg^{-1} soil added as plant residues, but N content increased at any given time until the end of incubation, being followed the order: Soybean > (Wh + Soy) > wheat residues. In general, data showed that the amount of biomass-N gradually increased up to 4 weeks and thereafter, slightly decreased for wheat residues at 50, 100 mg N Kg^{-1} soil until the end of incubation period. However, the values of biomass-N was as low as 9.44 and 21.85 to as high as 21.22 and 32.27 mg N Kg^{-1} soil for wheat and soybean residues-treated soil at 50 and 100 mg N Kg^{-1} soil, respectively. Using ^{15}N- technique results indicated that the of ^{15}N-mineralization percent for soybean increased overtime-N (narrow C/N ratio) being more effective and superior compared to wheat residue-N (wide C/N ratio) on the net of ^{15}N-mineralization through out the time of incubation.

Key Words: Sandy soil, Plant residues, C/N ratio, Net ^{15}N-mineralization and Microbial biomass-N

INTRODUCTION

It is well recognized that the organic matter content of soil is a key attribute of its fertility. The additions of organic materials such as, crop residues play and important role in the recycling of nutrients (IAEA 2003). Plant residues are essential for maintaining soil productivity acting as a source of nutrients (Kumar and Goh 2000). The SOM maintains favourable soil physical, chemical and biological properties and release nutrients to the soil mostly through plant residues decomposition (Kumar *et al.*, 2001; Goh *et al.*, 2001).

The decomposition of crop residues in soil and their carbon and nitrogen mineralization are largely influenced by the quality of plant materials, i.e. by their origin and composition (Heal *et al.*, 1997). Several studies have shown that the N content of crop residues, or their C/N ratio, has a primary effect on the net N mineralization from residues (Abdelmagide and Frankenberger, 1985; Constantinides and Fownes, 1994;). As well as, Janssen (1996), reported that N-mineralization of organic products strongly depends on the decomposability and the C/N ratio of organic matter in the product.

Trisoutrot *et al.*, (2000), indicated that the dynamics of N mineralization / immobilization after incorporation of crop residues in soil are mainly controlled by the organic-N content or C/N ratio of these residues.

Organic materials with C/N ratio of about 25 or less (Keeney, 1985), or N content > 1.5% (Hausenbuiller 1972) are required for net N mineralization to occur quickly. Moreover, Gentry *et al.*, (2001), reported that the net mineralization of soil N appeared to be influenced by both quality (C/N ratio) and quantity of residue.

The soil mincrobial biomass is the. living organisms component of the soil that comprises mainly fungi and bacteria including soil microfauna and algae. Although, it accounts for only 1-3% of organic C (Brookes *et al.*, 1990) and 1-6% of organic N in soil (Jenkinson, 1987), it plays a key role in soil organic matter and nutrient dynamics by acting as both a sink (during immobilization)and as a source (mineralization) of plant nutrient.

Because soil microbial biomass and microbial activity are closely related to soil organic matter content, they are influenced positively by organic amendments such as crop residues and animal manures (Ocio *et al.*, 1991b;

Collins *et al.*, 1992; Nannipieri, 1994).

The relationship between soil microbial biomass and gross N mineralization was studied under field conditions by Puri and Ashman (1998), reveled that changes in the gross mineralization rate were not reflected in the size of the soil microbial N Pool, which remained essentially stable over 12 months. However, Bending *et al.*, (1998) reported that quality controls decomposition and mineralization by direct effects on microbes responsible for these processes, and measurement of the size and N content of microbial biomass could serve as a useful predictor of N mineralization.

The aim of this work was to assess the changes in N-mineralization and microbial biomass-N as influenced by different quality of labelled plant residues application under lab condition at various incubation periods.

MATERIALS AND METHODS

An incubation experiment was conducted in the plant Nutrition and Fertilization Unit of the Soils and Water Dep., Nuclear Research Center, Atomic Energy Authority, Inshas, Egypt.

Soil:

The soil used was sandy in texture having coarse sand 64.10%, fine sand 26.4%, silt 2.70% and clay 6.80%; pH 8 (1 : 2.5 soil : Water ratio); 0.03% organic matter and 0.0053% in total nitrogen content (according to Jakson, 1973); available N(NH^+_4 + NO^-_3) was 11.2 mg N Kg^{-1} soil.

Plant residues labelled with ^{15}N:

Wheat, soybean residues and their mixture at a 1:1 ratio were selected in this study, C/N ratios being 41.30, 20.40 and 28.60, respectively; ^{15}N-labelled in the initial had 0.693, 0.060 and 0.339 atom % ^{15}N excess for wheat, soybean and mixture residues, respectively.

Addition of plant residues to soil and incubation:

A lab experiment under aerobic conditions and about 22°C temperature in to measure soil organic C, N content, C/N as well as ^{15}N-mineralization and microbial biomass-N at various incubation periods for 10 weeks at intervals: 0, 1, 2, 3, 4, 6, 8, and 10 weeks. The plant residues were mixed with a sandy soil on the basis of their N content at (0, 50 and 100 µg N g^{-1} soil) Plastic pots under non-leaching conditions, received portions of 25 g in weight of a sandy soil and received the following treatments:

I. 50 and 100 μg Ng^{-1} soil as ^{15}N-wheat residue.

II. 50 and 100 μg Ng^{-1} soil as ^{15}N-soybean residue.

III. 50 and 100 μg Ng^{-1} soil as (^{15}N-wheat + ^{15}N-soybean residues).

IV. No treatment (control).

The moisture content of the soil-plant residues mixture was adjusted to 60% of their water holding capacity (W.H.C).

Analytical procedures:

1- Determination of N mineralizations:

The soil was extracted with 100 ml of 1.0M K_2SO_4 (shaking time 1h) and the amount of mineral $N(NH^+_4 + NO^-_3)$ was determined by steam distillation (Bremner 1965).

2- Determination of biomass-N:

The chloroform fumigation method (Jenkinson and Powlson, 1976) was adopted to estimate the amount of biomass-N in the soil treated with plant residues. Fresh soil samples in quadruplicate equivalent to 25 g oven dry weight from each treated-incubated soil were weighed in glass vials (4 cm diam. X 8 cm in length). Half of the samples were fumigated with chloroform ($CHCl_3$) and other were left un-fumigated. For fumigation, the moist soils were exposed to alcohol-free chloroform vapour in a desiccator lined with moist filter paper for 24 h at 25°C, and the chloroform was then removed by repeated evacuation using a vacuum pump and water pump. An identical set of soil samples was kept as non-fumigated control and was treated similarly without chloroform. The fumigated-and non-fumigated soil were extracted with 100ml of 1.0M K_2SO_4 (Shaking time 1h) and the amount of mineral $N(NH^+_4 + NO^-_3)$ was determined by steam distillation (Bremner 1965).

Methods of calculation:

The amount of biomass-N was claculated according to (Jenkinson 1988): Biomass-N = F_N / 0.57.
where F_N is the flush of N-mineralized by the fumigated soil minus that by an unfumigated soil.

^{15}N analysed by an automated emission spectrometer NO I-6 (Yamamoro, 1981). The amount of mineral N derived from the labelled plant residues (TNdfr) was calculated as total mineral N x (atom % ^{15}N excess mineral N/ atom % ^{15}N excess mineral N/atom % ^{15}N excess plant residues). The percentage of plant residue-N mineralization was calculated as

100 x TNdfr / total N applied as plant residue.

Statistical analysis of the results was carried out according to Snedecor and Cochran (1982).

RESULTS AND DISCUSSION

Soil organic-C content:

Results illustrated in Fig.(1) show the effect of plant residues incorporated with sandy soil on changes of soil organic carbon content (g kg^{-1} soil) at different incubation periods up to 10 weeks. In general, data indicated that different plant residues applied to sandy soil as a N-source in two rates, i.e., 50 and 100 $\mu g\ g^{-1}$ soil had a significant decrease effect for all treatments on soil organic C content. The gradually reduction in organic C contents were shown listed until the end of incubation time. In addition, at any given time, the amount of C-residues decomposed was followed the ascending order:
Wheat > (Wheat + Soybean) residues > Soybean residues.

Dou and Jiang (1988) reported that the presence of soil may enhance decomposition through the effect of organic acids on bacterial activity and reduce organic carbon decomposition through the formation of organo-mineral complexes that are difficult to degrade.

These results are in agreement with that obtained by Chen *et al.*, (2003). They added that rice, corn and alfalfa residues lost a larger proportion of their original C than cattle and pig feces.

After one week from incubation, high decomposition of carbon content was detected under both nitrogen rates. On the other hand, plant residues applied to the tested sandy soil resulted the highest value of organic C content comparing with control. Data showed that the maximum organic carbon decomposition in soil was recorded after one day from incubation. The amounts of rest C were 3.440, 1.980 and 2.610 g kg^{-1} at 50 mg N kg^{-1} soil and 5.220, 3.370 and 4.210 g kg^{-1} at 100 mg N kg^{-1} for wheat, soybean and (wheat + soybean) residues comparing with control, respectively.

The values of carbon content (Fig.1) in the (wheat + soybean) residues treated soil ranged from 1.570 to 2.610 g kg^{-1}. In the soil amended with wheat residues it was ranged between 1.840 to 3.440 g kg^{-1}. The lower value was recorded when soil was amended with soybean residues which ranged from 1.340 to 1.980 g kg^{-1} at 50 mg N kg^{-1} soil, while at 100 mg N kg^{-1} soil, the amounts of

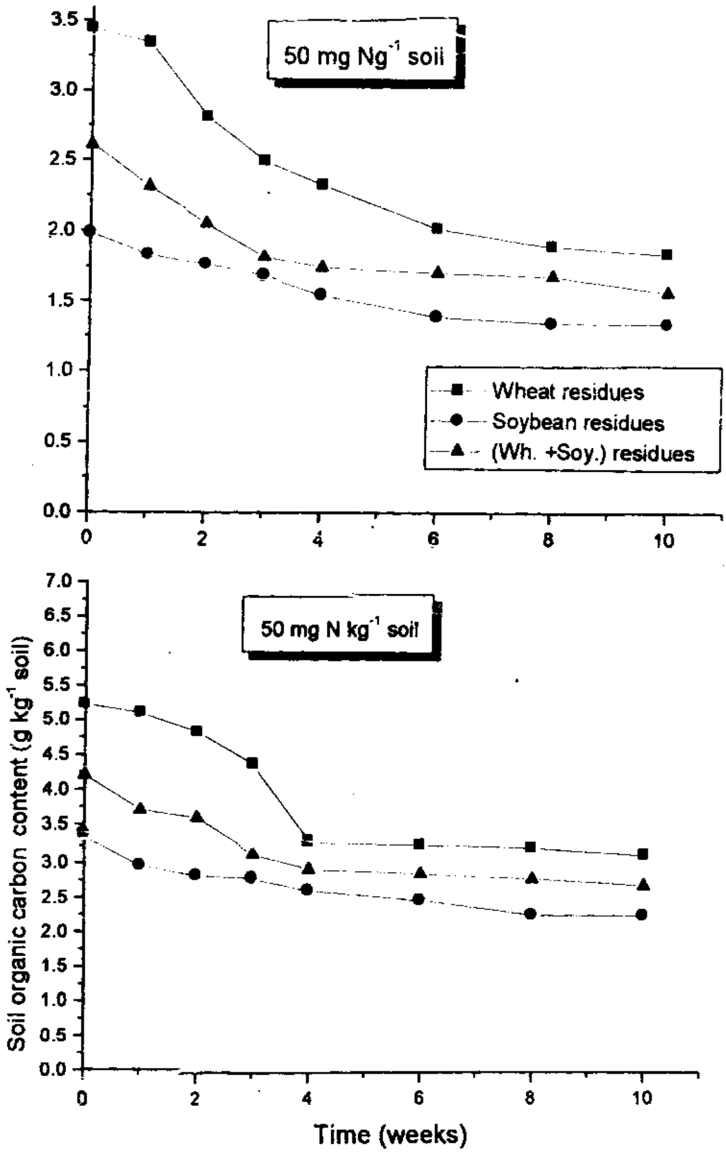

Fig.(1): Total soil organic carbon content (g kg^{-1} soil) in sandy soil mixed with wheat (Wh.) and/or soybean (Soy.) added at the rate of 50 and 100 mg N kg^{-1} soil at different incubation periods.

organic carbon decomposed ranged from 2.660 to 4.210, from 3.100 to 5.220 and from 3.100 to 5.220 g kg^{-1} when the soil mixed with wheat straw +soybean, wheat straw and soybean residue respectively.

Similar results were obtained by (Rasmussen and collins, 1991) who found that soil C decreased with time for all residues additions except manure, and the rate of decrease was related to the level but not the type of residue returned to the soil. Several studies showed that organic C in soil responded linearly to an increased rate of residue addition (Larson *et al.*, 1972; Black, 1973; Rasmussen, *et al.*, 1980, Karlen, *et al.*, 1994).

N-Content:

Data illustrated in Fig.(2) show the effect of plant residues amended sandy soil on changes of nitrogen content g N kg^{-1} soil at different incubation periods for 10 weeks.

Results showed that N decomposition in the soil significantly increased with consequent smaller loss of N due to the application of plant residues and so, the N increments were remained nearly constant at any given time until the end of the incubation period application under 50 and 100mg N kg^{-1} soil on the basis of N content in the plant residues.

The value of N content was as low as 0.047 g kg^{-1} to as high 0.107 g kg^{-1} in the control soil and soybean amended soil, respectively after 10 weeks of incubation under 50 mg N kg^{-1} soil. While, at 100 mg N kg^{-1} soil, it was 0.047 g kg^{-1} and 0.164 g kg^{-1} in the control and soybean residue amended soil, respectively.

Data showed that N content remained in soil had significantly increased with increasing plant residues rate applied as N at the rats of 50 and 100 mg N kg^{-1} soil. The amounts of N content remained in the soil after one day of incubation were 159.38, 181.25 and 171.88% at 50 mg N kg^{-1} soil, while at 100 mg N kg^{-1} addition rate treatment to the soil they were 284.38, 328.12 and 321.88% for wheat, soybean and mixture residues over the control, respectively.

The highest N content in soil by the end of the incubation followed the order: Soybean > (wheat + soybean) > wheat residues.

Overall, these results came to agree with those obtained by Broersma, *et al.*, (2000) who found that the decomposition of ^{15}N-labelled residues followed the trend: Fababeen > barely > fescue. Which pointed out that fababeen residues with a high N content and low C/N ratio decomposed more

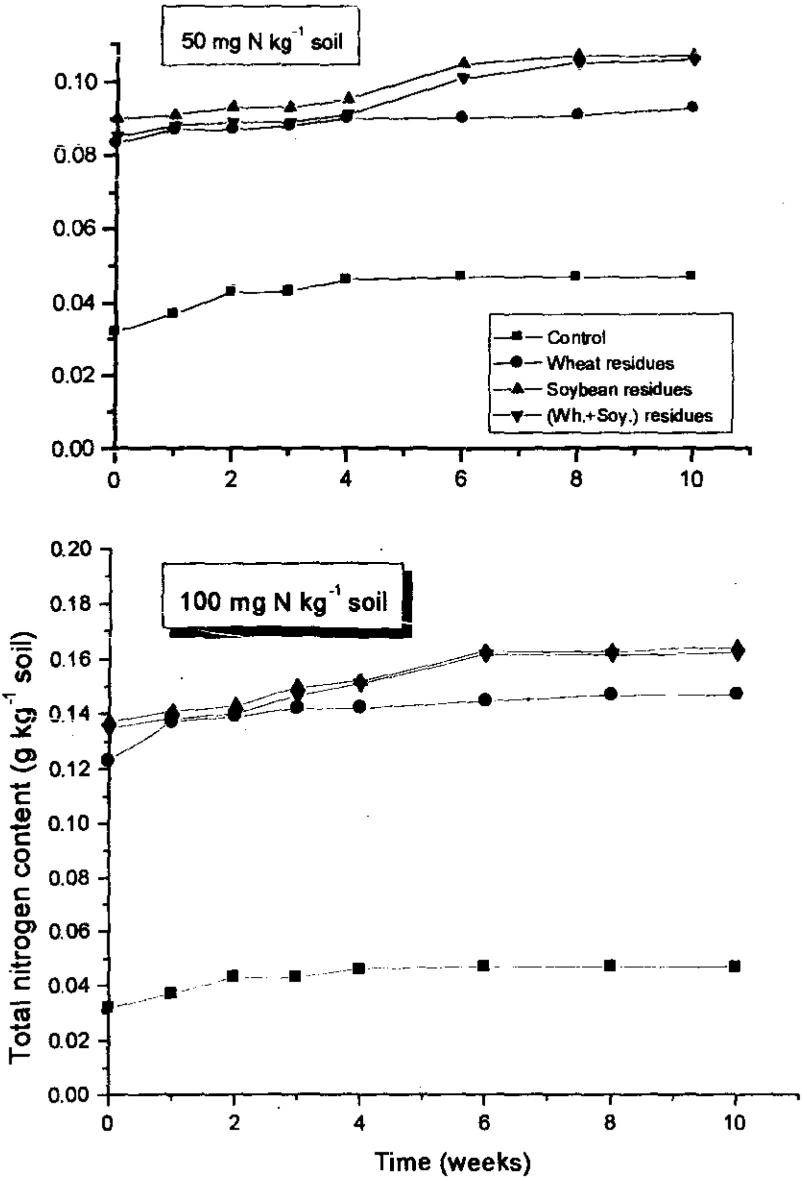

Fig.(2): Total nitrogen content (g kg^{-1} soil) in sandy soil mixed with wheat (Wh.) and/or soybean (Soy.) added at the rate of 50 and 100 mg N kg^{-1} soil at different incubation periods.

rapidly and released more ^{15}N than barley or fescue residues.

C/N ratio:

Data illustrated in Fig.(3) show the effect of plant residues amended sandy soil on changes of C/N ratio at different incubation periods for 10 weeks.

Results showed that the application of plant residues, in general, as expected significantly reduced the C/N ratio of N-residues and hence in the soil O.M it self. Under the rate of 50 mg N kg^{-1} soil, the C/N ratio of the added plant residues that were initially 41.45, 30.71 and 22.0 by the end of the incubation period were narrowed to 19.78, 14.81 and 12.52 comprising diminution percents of about 52.27%, 51.77% and 43.10% for wheat, wheat + soybean and soybean residues, respectively. Under the rate of 100 mg N kg^{-1} soil addition the corresponding reduction in N-residues mounted to 48.87%, 47.35% and 455.49%.

Consequently, soybean residues are having a significantly lower C/N ratio than all of the other plant residues at all the time of incubation.

These results came to agree with those obtained by (Parr and Papendick, 1978) who found that plant residues with higher C/N ratio are usually considered to decompose more slowly (wheat residues) than those with low C/N ratio (soybean residue).

Heal *et al.*, 1997; Swift *et al.*, 1979 reported that the quality of plant materials has been considered one of the most important factors that affect decomposition and nutrient release. As well as, Broersma *et al.*, (2000) reported that total plant C, N and C/N ratios of plant residues were significantly different between plant species. In most cases, O.M with lower C/N ratios showed a higher rate of N mineralization. For agricultural crops, plant materials with N concentrations greater than 1.7% or C/N ratios less than 20 are considered desirable (Frankenberger and Abdelmagid 1985).

Chen *et al.*, (2003) reported that the C/N ratios of all materials (rice, corn and alfalfa) decreased during the decomposition.

Net ^{15}N-mineralization:

Data illustrated in Fig.(4) demonstrated that the percent ^{15}N-mineralized from the plant residues added at the rates of 50 and 100 mg N kg^{-1} soil increased with the time for all treatments.

At the end of incubation periods (10 weeks), the rested treatments added at the rate of 50 mg N kg^{-1} soil, 25.43, 19.04 and 15.33% ^{15}N were mineralized from soybean,

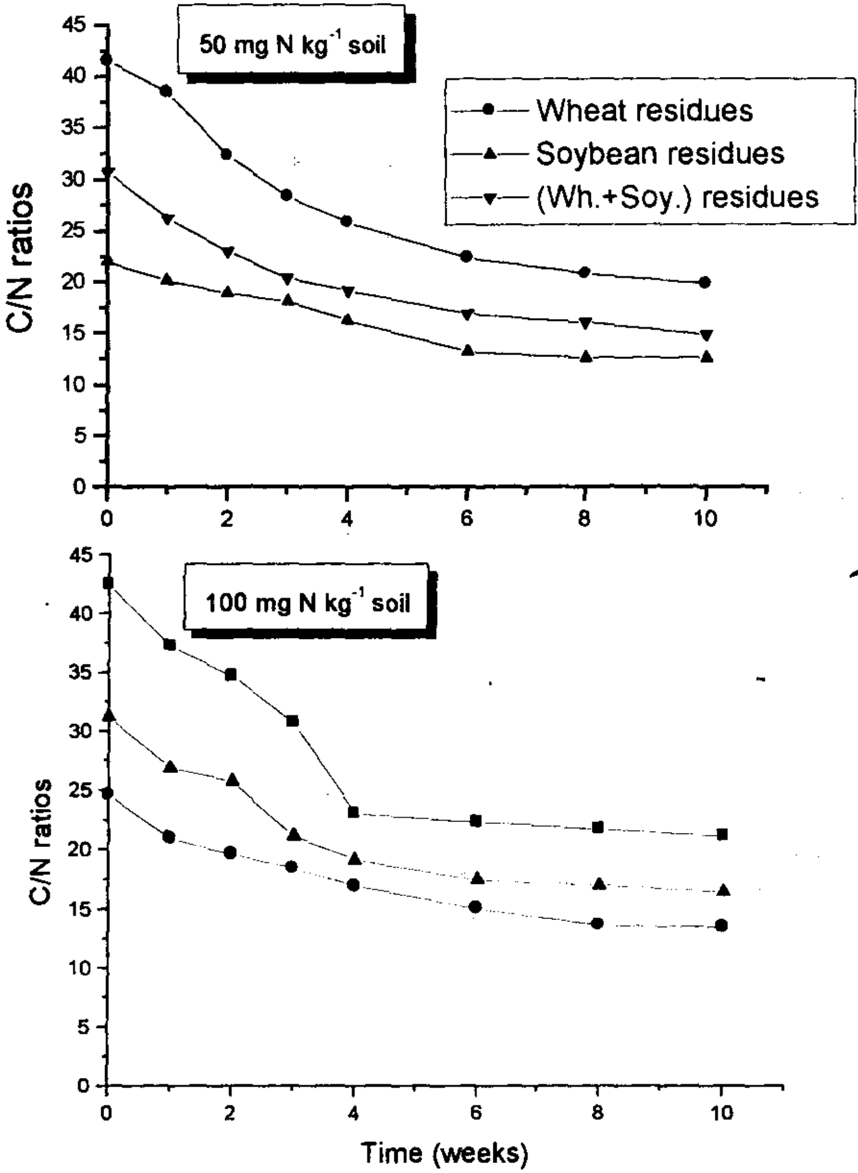

Fig.(3): Changes in C/N ratios in sandy soil mixed with wheat (Wh.) and/or soybean (Soy.) added at the rate of 50 and 100 mg N kg^{-1} soil at different incubation periods.

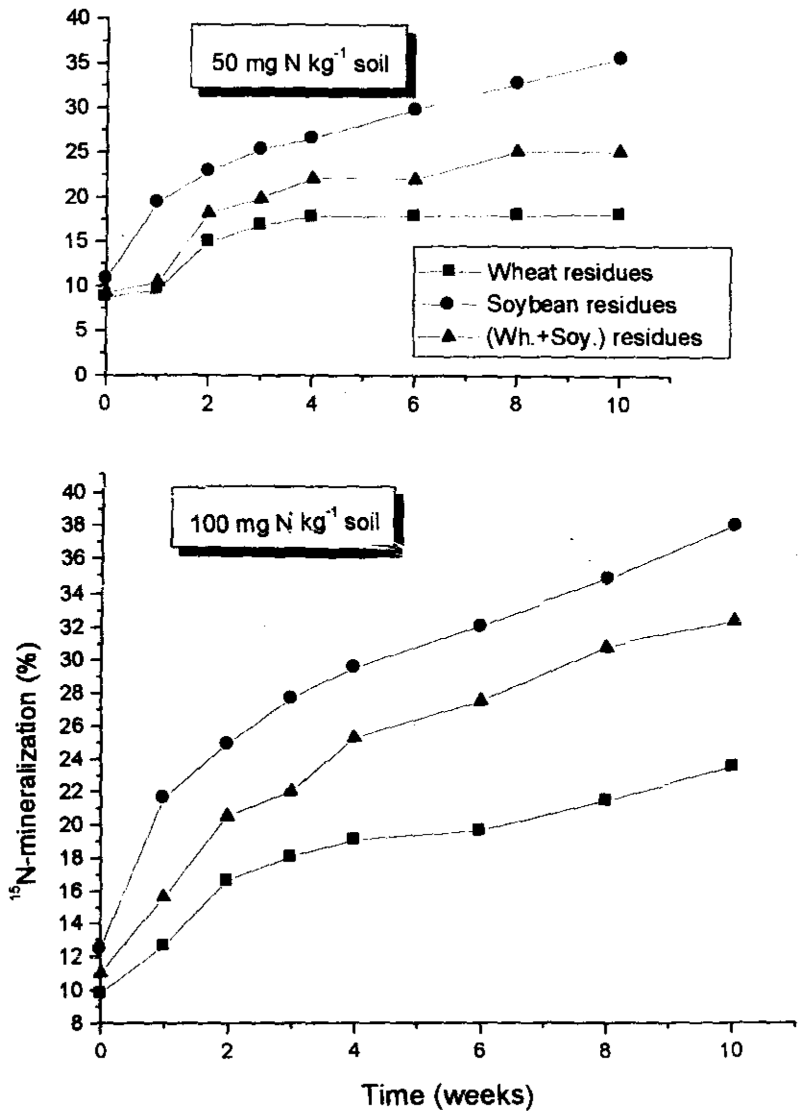

Fig.(4): Nitrogen-15 mineralization (%) in sandy soil mixed with wheat (Wh.) and/or soybean (Soy.) added at the rate of 50 and 100 mg N kg^{-1} soil at different incubation periods.

wheat+ soybean mixture and wheat residues respectively. While at the rate of 100 mg N kg^{-1} soil 27.64, 23.13 and 17.62% ^{15}N were mineralized from soybean, wheat + soybean mixture and wheat residues respectively.

The proportions of ^{15}N mineralized under the two doses of N were significantly different. The decomposition of ^{15}N-labelled residues followed the trend:
Soybean > (Wheat + Soybean) > wheat residues.

Soybean residues with the highest N content and lowest C/N ratio decomposed more rapidly and released more ^{15}N than (wheat + soybean) or wheat residues.

Regarding, the relationship between the different types of plant residues, data showed that the net ^{15}N-mineralization from plant residues increased significantly with time of incubation, under the different N rates of plant residues.

The amounts of net ^{15}N-mineralized after 10 weeks were 18.71, 35.73 and 25.20%, and 32.43, 37.97 and 32.20% at 50 and 100 mg N kg^{-1} soil by addition of wheat, soybean and (wheat + soybean) residues, respectively.

These results are in agreement with those obtained by Broermsa, *et al.*, (2000) who found that after 20 weeks 14.0, 10.5 and 7.1% of ^{15}N was mineralized from fababean, barely and fescue residues, respectively, when averaged across cropping systems. Also, Jensen, (1997) reported that the net mineralization of residue-derived N was 2% for barely and 22% for the pea residues treatment after 24 days of incubation.

However, under laboratory incubations, Handayanto *et al.*, 1997, reported that up to 70% of the N from legume prunings was released within 3-4 months. In addition, plant residue C/N ratio, polyphenol and lignin content were negatively correlated with residue decomposition and N-release rates (Palm and Sanchez 1991, Tian *et al.*, 1992; Jama and Nair 1996; Kumar and Goh 2000). The initial plant residue C/N ratio was reported as the best indicator of residue decomposition and N-mineralization for a wide range of plant residues compared with other biochemical variables (Seneviratne, 2000).

In addition, Soon and Arshad (2002), reported that wheat straw decomposed more slowly than Canola or pea straw (Losing N averages of 12%, 24% and 25%), respectively.

Soil microbial biomass-N:

Data illustrated in Fig.(5) showed that at any time of incubation periods, the addition of plant residues increased

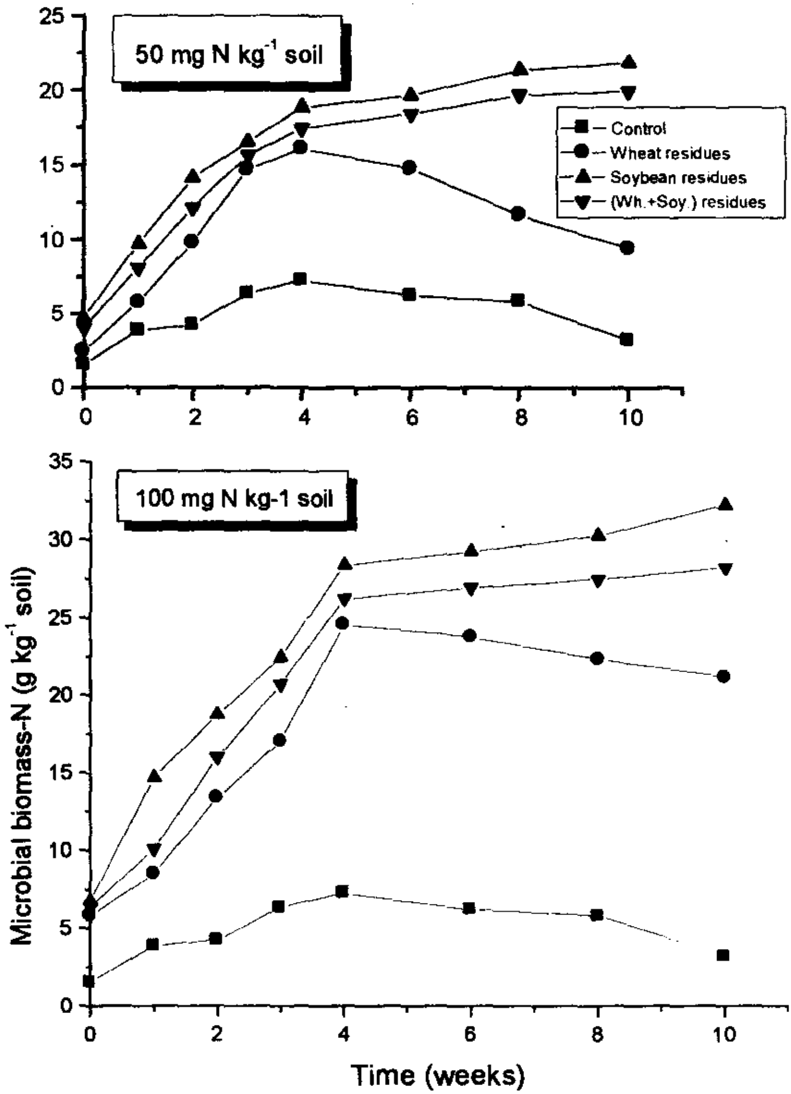

Fig.(5): Changes of Microbial biomass-N (mg kg^{-1} soil) in sandy soil mixed with wheat (Wh.) and/or soybean (Soy.) added at the rate of 50 and 100 mg N kg^{-1} soil at different incubation periods.

significantly in the amount of microbial biomass-N. However the pattern of change in microbial biomass N varied with time of incubation and type of plant residues amendment. In all treatments, the amount of biomass N in wheat straw-treated soil and control markedly increased rapidly within 14-28 d (2 - 4 weeks) and then decreased with time whereas that in the soybean and mixture-treated soil significantly increased with time of incubation (10 weeks).

Soil amended with plant residues enhanced biomass formation (Fig.5). The increase in the amount of biomass N by the addition of plant residues at the time of maximum formation was in the range of 16.1-21.85 mg N kg^{-1} soil at 50 mg N kg^{-1} soil, 24.56-32.27 at 100 mg N kg^{-1} soil added as plant residues at 22°C.

The maximum amount of biomass N was recorded when soil amended with soybean plant residues followed by (soybean + wheat straw) residues and then wheat straw.

The decomposition of the plant residues proceeded rapidly probably due to the higher microbial activity and the high activity of the microorganisms enhanced assimilation of available nutrients. It may be considered that at 22°C (at lab temp.) easily decomposable organic substances were decomposed rabidly and the released nutrients were probably immediately immobilized into the microbial body. Furthermore, it is assumed that due to the rapid assimilation of nutrients a part of the organic substances was directly absorbed by the microbial biomass.

These results are in agreement with those obtained by Patra *et al.*, (1992) who found that the amount of biomass N was significantly larger with the cowpea straw amended soil as compared to wheat incorporation. Also, these results are in agreement with those obtained by Armstrong, *et al.*, (1998); Azmal, *et al.*, (1996 a,b) and Ocio, *et al.*, (1991) who reported that soil microbial biomass N was increased following the application of plant residues to the soil.

CONCLUSION

This study my provide a greater understanding of microbial activity and N dynamics in soil after application of plant residues, and is higher in soil receiving legumenous crops than on non-legumenous crops or non-treated soil.

The application of plant residues enhanced microbial biomass formation as well as the assimilation of available nutrients.

REFERENCES

Armstrong, R.D.; M.E. Probert, K. McCosker and G. Millar, (1998): Fluxes of nitrogen derived from plant residues and fertilizer on a cracking clay in a semi-arid environment. Austra. J. of Agric. Res., 49(3): 437-449.

Azmal, A.K.M.; T. Marumoto, H. Shindo and M. Nishiyama (1996a): Mineralization and microbial biomass formation in upland soil amended with some tropical plant residues at different temperatures. Soil Sci. Plant Nutr., 42(3): 463-473.

Azmal, A.K.M.; T. Marumoto, H. Shindo and M. Nishiyama (1996b): Mineralization and changes in microbial biomass in water-saturated soil amended with some tropical plant residues. Soil Sci. Plant Nutr., 42(3): 483-492.

Bending, G.D.; M.K. Turner and J.G. Burns (1998): Fate of nitrogen from crop residues as affected by biochemical quality and the microbial biomass. Soil Biol. Biochem., 30(14): 2055-2065.

Black, A.L. (1973): Soil property changes in association with crop residues management in a wheat follow rotation. Soil Sci. Soc. Am. Proc., 37: 943-946.

Bremner, J.M. (1965): Inorganic forms of nitrogen. In methods of soil analysis, part 2, Ed. C.A. Black, D.D. Evans, J.L. White, L.E. Ensminger and F.E. Clark, p. 1179-1237, American Society of Agronomy, Madison, WI.

Broersma, K.; N.G. Juma and J.A. Robertson (2000): Plant residues and cropping system effects on N dynamics in a Gray Luvisolic soil Can. J. Soil Sci., 80:277-282.

Brookes, P.C.; J.A. Ocio and J. Wu. (1990): The soil microbial biomass: Its measurement, properties and role in soil nitrogen and carbon dynamics following substrate incorporation. Soil Biol. Biochem., 35: 39-51.

Chen, X.; M.L. Cabrera, L. Zhang, Y. Shi and S.M. Shen (2003): Long-term decomposition of organic materials with different carbon/ nitrogen ratios. Comm. Soil Sci. Plant Analysis, 34: 41-54.

Collins, H.P.; P.E. Rasmussen and C.L. Jr. Douglas (1992): Crop rotation and residue management effect on soil carbon and microbial dynamics. Soil Sci. Soc. Am. J., 56: 783-788.

Constantinides, M. and J.H. Fowns (1994): Nitrogen mineralization from leaves and litter of tropical plants: Relationships to nitrogen, lignin and soluble polyphenols concentration. Soil Biol. Biochem., 26: 49-55.

Dou, S. and Y. Jiang (1988): Effect of application of organic materials on the properties of humic substances in organo-mineral complexes of soils. ACTA Pedol, Sin., 25: 252-261, in Chinese.

Frankenberger, Jr. W.T. and H.M. Abdelmagid (1985): Kinetics parameters of nitrogen mineralization rates of leguminous incorporated into soil. Plant and soil. 87: 257-271.

Gentry, L.E.; F.E. Below, M.B. David and J.A. Bergerou (2001): Source of soybean N credit in maize production. Plant and Soil, 236: 175-184.

Goh, K.M.; D.R. Pearson and M.J. Daly (2001): Soil physical, chemical and biological indicators of soil quality in conventional, biological and integrated apple orchard manage-ment systems. Biol Agric. Hortic., 18: 269-292.

Handayanto, E.; K.E. Giller and G. Cadisch (1997): Regulating N release from legume tree prunings by mixing residues of different quality. Soil Biol. Biochem., 29: 1417-1426.

Hausenbuiller, R.L. (1972): Soil science: principles and practices. 2nd ed. W.C. Brown Co., Dubuque, IA.

Heal, O.W.; J.M. Anderson and M.J. Swift (1997): Plant litter quality and decomposition. In Driven by Nature, Plant Litter Quality and Decomposition. Eds, G. Cadish andK.E. Giller. pp.47-66. CAB International, Wallingford, Oxon, UK.

IAEA (2003): Management of crop residues for sustainable crop production. IAEA-TECDOC-1354.

Jakson, M.L. (1973): Soil chemical analysis. Prentice-Hall of India, New Delhi.

Jama, B.A. and P.K.R. Nair (1996): Decomposition- and nitrogen-mineralization patterns of Leucaena Leucocephala and Cassia Siamea mulch tropical semiarid conditions in Kenya. Plant and Soil, 179: 275-285.

Janssen, B.H. (1996): Nitrogen mineralization in relation to C:N ratio and decomposability of organic materials. Plant and Soil. 181: 39-45.

Jenkinson, D.S. and D.S. Powlson (1976): The effects of biological treatments on metabolism in soil. V.A. method for measuring soil biomass. Soil Biol. Biochem. 8: 209-213.

Jenkinson, D.S. (1987): Determination of microbial biomass carbon and nitrogen in soil. In "Advances in nitrogen cycling in agricultural systems" (J.R. Wilson, ed.), pp. 368-386. CAB International, Wallingford, UK.

Jenkinson, D.S. (1988): Determination of microbial biomass carbon and nitrogen in soil. In advances in Nitrogen Cycling in Agricultural Ecosystems. Ed. J.R. Wilson, p. 368-386. CAB International. Wallingford, UK.

Jensen, E.S. (1997): Nitrogen immobilization and mineralization during initial decomposition of ^{15}N labelled pea and parley residues. Biol. Fertil. Soils, 24: 39-44.

Keeney, D.R. (1985): Mineralization of nitrogen from legume residues, Pages 177-182 in R.F. Barnes, P.R. Ball, R.W. Brougham, G.C. Marten and D.J. Minson, eds. Forage legumes for energy efficient animal production. Proc. Trilateral Workshop Nat. Tech. Info. Serv., Spring-field, VA.

Kumar, K.; and K.M. Goh (2000): Crop residues and management practices effect on soil quality, Soil nitrogen dynamics, crop yield, and nitrogen recovery. Adv. Agron., 68: 197-319.

Kumar, K. and K.M. Goh, W.R. Scott and C.M. Frampton (2001): Effects of ^{15}N-labelled crop residues and management practices on subsequent winter wheat yield, nitrogen benefits and recovery under field conditions. J. Agric. Sci., 136: 35-53.

Larson, W.E.; C.E. Clapp, W.H. Pierre and Y.B. Morachan (1972): Effects of increasing amounts of organic residues on continuous corn. II. Organic carbon, nitrogen, phosphorus and sulfur. Agron. J. 64: 204-208.

Nannipieri, P. (1994): The potential use of soil enzymes as indicators of productivity, sustainability and pollution. In "Soil biota, management in sustainable farming system" (C.E. Pankhurst, B.M. Doube, V.V.S.R. Gupta and P.R. Grace), pp. 238-244. CSIRO. Adelaide, Austalia.

Ocio, J.A.; J. Martinez and P.C. Brookes (1991 b): Contribution of straw-derived N to biomass N following incorporation of cereal straw to soil. Soil Biol. Biochem., 23: 655-659.

Parr, J.F. and R.I. Papendick (1978): Factors affecting the decomposition of crop residues by microorganisms. In "Crop residue management systems" (W.R. Oschwald, ed.), pp. 101-129. Am. Soc. Agron., Madison, WI.

Patra, D.D.; S.C. Bhandari and A. Misra (1992): Effect of plant residues on size of micro-bal biomass and nitrogen mineralization of Cawpea and Wheat straw. Soil Sci. Plant Nutr., 38(1): 1–6.

Plam, C.A. and P.A. Sanchez (1991): Nitrogen release prom the leaves of some tropical legumes as affected by their lignin and polyphenolic contents. Soil Biol. Biochem., 23: 83-88.

Puri, G. and M.R. Ashman (1998): Relationship between soil microbial biomass and gross N mineralization. Soil Biol. Biochem. 30: 251-256.

Rasmussen, P.E.; R.R. Allmaras, C.R. Rodhe and N.C. Jr. Roager (1980): Crop residue influences on soil carbon and nitrogen in a wheat-fallow system. Soil Sci. Soc. Am. J. 44: 596-600.

Rasmussen, P.E. and H.P. Collins (1991): Long-term impacts of tillage, fertilizer and crop residue on soil organic matter in temperature semi-arid regions. Adv. Agron. 45: 93-134.

Seneviratne, G. (2000): Litter quality and nitrogen release in tropical agriculture: a synthesis. Biol Fertil. Soils. 31: 60-64.

Snedecor, G.W. and W.G. Cochran (1982): Statistical Methods, 7th ed. The Iowa State Univ. Press, Iowa, U.S.A.

Soon, Y.K. and M.A. Arshad (2002): Comparison of the decomposition and N and D mineralization of conola, pea and wheat residues. Biol. Fertil. Soils, 36: 10-17.

Swift, M.S.; O.W. Heal and J.M. Anderson(1979):"Decompositio n in Terrestrial Ecosystems" Stud. Ecol., Vol. 1. California Univ. Press, Berkeley.

Tian, G.; B.T. Kang and L. Brussaard (1992): Biological effects of plant residues with contrasting chemical compositions under humid tropical conditions-decomposition and nutrient release. Soil Biol. Biochem., 24: 1051-1060.

Trinsoutrot, I.; S. Recous, B. Bentz, M. Lineres, D. Cheneby and B. Nicolardot (2000):

Biochemical quality of crop residues and C and N mineralization under non-limiting N conditions. Soil Sci. Soc. Am. J. 64: 918-926.

Yamamoro, S. (1981): The accurate determination of nitrogen-15 with an emission spectrometer. Soil Sci. Plant Nutr., 27(3): 405-419.

معدنة نيتروجين التربه وتكون الكتله الميكروبيه الحيه فى الاراضى الرمليه المعامله ببقايه النباتات البقولية والغير بقولية والمرقمة بالنيتروجين-١٥

أحمد عفت الشربينى* - السيد عوض محمد* - سليمان محمد سليمان**
مازن مصطفى إسماعيل**
*قسم علوم الأراضى - كلية الزراعة-جامعة الزقازيق
**قسم بحوث الأراضى والمياه - مركز البحوث النووية-هيئة الطاقة الذرية.

أجريت تجربة معملية لتقييم تأثير أنواع مختلفة من بقايا نباتية تختلف فى محتواها من النيتروجين ونسبة الكربون إلى النيتروجين عند إضافتها للتربة على الكربون العضوى ومحتوى النيتروجين ونسبة ك:ن ، وكذلك معدنة النيتروجين الناتج وتغيرات النيتروجين الميكروبى فى الأرض الرملية.

لدراسة معدنة نيتروجين التربة (ن-١٥) ، تم متابعته مباشرة بعد إضافة البقايا النباتية المرقمة إلى التربة وتحضينها تحت الظروف الهوائية عند درجة حرارة المعمل (٢٢م) لمدة ١٠ أسابيع. أوضحت النتائج أن قيم الكربون العضوى ونسبة ك:ن إنخفضت مع مرور الوقت حتى ١٠ اسابيع (فترة التحضين) مع معدل ٥٠، ١٠٠ ملليجرام ن/كيلوجرام تربة من البقايا النباتية المضافة، ولكن المحتوى النيتروجينى إزداد مع زيادة وقت فترة التحضين وكانت كما يلى: بقايا فول الصويا > بقايا الصويا + بقايا القمح > بقايا القمح

كما أوضحت النتائج أن كمية النيتروجين الميكروبى ازدادت تدريجيا حتى الاسبوع الرابع بوعد ذلك قلت ببطء عند إضافة بقايا القمح بمعدل ٥٠، ١٠٠ ملليجرام ن/كيلوجرام وكذلك الكنترول، وكانت نتائج قيم النيتروجين الميكروبى أقل قيمة سجلت ٩,٤٤، ٢١,٨٥ وأعلى قيمه سجلت ٢١,٢٢، ٣٢,٢٧ ملليجرام ن/كيلوجرام تربة لكل من بقايا القمح وبقايا فول الصويا عند معدلى إضافة ١٠٠،٥٠ ملليجرام ن/كيلوجرام تربه على التوالى. وكذلك تبين النتائج أن نسبة معدنة نيتروجين بقايا نباتات فول الصويا تزداد كلما كانت نسبة ك:ن ضيقة وتكون أكثر تأثيرا بالمقارنة ببقايا القمح التى تكون نسبة ك:ن واسعة وذلك على حجم معدنة النيتروجين المرقم-١٥ خلال فترة التحضين.