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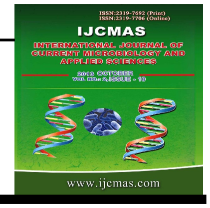

Original Research Article

Contribution of Fungal Inoculation in Degradation of Organic Residues and Nitrogen-mineralization Using ^{15}N Technique

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Keywords

Plant residues;
No_3-N;
NH_4- N;
^{15}N technique;
organic-N

A B S T R A C T

A laboratory incubation experiment was carried out to evaluate organic residue decomposition and NO_3-N and NH_4-N release in the media. Nitrate content tended to increase by increasing incubation intervals up to 45 days then gradually decreased with 60 day up to 90 days when soil amended with maize stalks. The highest decrease in NO_3-N was at 90 days of incubation. NH_4 -N in soil was affected by organic sources and microbial inoculants. And tended to decreased by increasing incubation intervals up to 15 days then gradually decreased often 30 day up to 90 days. The highest reduction in NH_4-N was detected at 90 days of incubation. Organic-N content tended to gradually decrease by increasing incubation intervals up to 90 day. The highest decrease in organic-N was detected often 90 days of incubation. Significant variation in C/N ratio occurred with time, fungi inoculation and organic amendment, on day 1, a higher C/N ratio was detected with wheat straw as compared to other treatments whereas the lowest one was recorded with chickpea straw.

Introduction

Carbon-to-nitrogen ratio (C: N) reliable predictor or the speed of organic residue decomposition and N mineralization in soil. While this relationship appears to work well for complex organic materials (e.g. plant residues), its applicability to smaller organic substrates containing N remains unknown. In the present study the intrinsic properties of amino acids and peptides could be used to predict their rate of microbial uptake and subsequent N mineralization (Roberts, 2009). Moursy (2008) showed that the C/N ratio was decreased during composting process. The initial ratio of C/N, which ranged between 22 and 72, decreased substantially in all organic materials depending on their composition. Increasing available N supply, such as NH_4, can favour bacterial growth (Yevdokimov *et al*., 2008). Fungi may be more active in soil with smaller nutrient concentrations because a complex genetic regulatory circuit in fungi confers the ability to use many different secondary

N sources when appropriate (Wallenstein *et al*, 2006).Aviva *et al*. (2004), reported different effects of plant residues on inorganic N dynamics in soil over a period of several months. Several researchers have demonstrated that low N content i.e wide C: N ratio in the substrate was caused a slow mineralization (Saidur Rahman, 2004). Immobilization could occur during the initial period of decomposition the soil applied, particularly with wheat residues which are of wide C: N ratio (Khalil *et al*, (2001).

The main objective of this work was to investigate the effect Fungal Inoculation in Degradation of Organic Residues and Nitrogen-mineralization Using 15N Technique and evaluate organic residue decomposition and NO_3-N and NH_4-N release in the media.

Materials and Methods

The soil used in the current study was a sand collected from Inshas, Sharkia Governorate.physical and chemical properties are : 88.5% sand , Silt 2.7%, and 8.8% clay , pH(1: 2.5) 7.97, EC(dSm-)0.27,O.C170 mg kg^{-1}, O.M0.3 g kg^{-1}, total N70mg kg^{-1}, C/N ratio of the soil organic matter 2.4, Ca CO3 10.0 mg kg^{-1}**.**

The organic materials: organic materials used in the study are follow maize stalks (MS), wheat straw (WS), chickpea straw, (CS) as plant residues beside cow manure (CM). Table 1 shows properties of those materials.

The inoculants

The fungus inoculants used in the study were *Aspegillus flavus* and *Trichoderma sp.* provided by the Microbiology Units, of the Soil and Water Research Department, Nuclear Research Center, Atomic Energy Authority, Inshas, Egypt. Mineral fertilizer: ^{15}N-labeled ammonium sulphate with 5% ^{15}N atom excess was used.

The experimental design and treatments

A factorial randomized complete block design, executed in three replicates was followed. Three factors were involved. Factor A: "organic materials involving 4 substances" i.e. maize stalk (MS), wheat straw(WS), chickpea straw (CS) and cow manure(CM0. Factor B: "Inoculation": which includes 4 treatments, i.e. no inoculation, inoculation with *Aspegillus flavus*, *Trichoderma* .Sp and a mixture of both , at(ratio of 1:1), Factor C: "period of incubation". These are of periods as follows 1, 15, 30,45,60,75, and 90 days. Thus these 112 treatment total combinations of 4 (organic materials) × 4 (inculcation treatment) × 7 (periods). Considering replication the total number of treatment = 112 × 3 (replicates) = 336. The experiment was performed in the laboratory at room temperature (29 ± °C) and using PVC container cups with diameter of 10 cm and 15 cm depth each filled with 100g soil. Soils were mixed with the organic materials on the basis of their N content so as to apply at a rate of 100 mg N kg^{-1} soil. During incubation soil were watered so as to reach about the water holding capacity. Measurements were done for soil organic NO_3 -N, NH_4-N, organic- N, Carbon content, following each incubation period.

Methods of analysis

Soil analysis: Soil samples collected from the surface15 cm layer air-dried, ground and sieved to pass through a 2 mm sieve then thoroughly mixed to be homogenous and analyzed for chemical and physical properties. Chemical and physical analyses of soil were determined according to methods cited by Black *et a/.,* (1965).

Results and Discussion

Nitrate content mg kg soil^{-1}

Nitrate content in soil at different incubation intervals as affected by organic sources and microbial inoculants was presented in Table 2. Data revealed that nitrate content tended to increase by increasing incubation intervals up to 45 days then gradually decreased with 60 day up to 90 days intervals when soil amended with maize stalks. The highest reduction in NO_{3-}^{15}N was detected at 90 days of incubation.

This holds true with all different inoculants. Concerning the inoculation treatments, results indicate that nitrate content was enhanced by Aspergillus, *Trichoderma* either as individual or in combination with *Trichoderma* fungi. Application of chickpea straw in combination with compared to soil treated with sole chickpea straw. This holds true under all incubation periods. In this respect, the highest value of nitrate-N (77.7 mg kg-1) content was recognized at 30 day of incubation. This value tended to decrease with incubation time up to 90 day.

Combined treatment of chickpea straw plus trichoderma inoculants showed gradual decrease in nitrate-N content with incubation time progress. In case of dual inoculants plus chickpea straw, nitrate tended to increase with increasing time of incubation time where the highest nitrate-N value (70.2 mg kg^{-1}) was recorded at 30 day, then tended to decrease up to 90 day of incubation. The overall mean of inoculation treatments indicated that the individual inoculation with *Aspirgilles* gave the best value of nitrate than those recorded with tichoderma or dual inoculants. In this regard, the inoculation treatments could be ranked as follow: Aspergillus > trichoderma > dual inoculants**.** Soil treated with wheat straw and *Aspirgilles* reflected an increase of nitrate content comparing to the uninoculated control. This holds true under different incubation periods with exception of 15 and 45 day. Approximately, the highest value seems to be stable (76.7 mg kg^{-1}) at 1, 15 and 30 days of incubation then tended to decrease up to 90 day of incubation time. Another view was noticed .

The conversion of organic N into amino N (ammonization) and subsequent reduction to NH_4 (amonification). Occur before trans formation into nitrate (nitrification)They noted that accumulation of NO_{3-}N was the highest at day 60 in conventional tillage with crop residues of the soil depth of 0-7.5, 7.5-15 and 15-30 cm where NO_3 accumulation was 18.1, 15.8 and 7.8 7g g^{-1} soil respectively.They also noted that the next highest release or accumulation of NO_{3-}N occurred in minimum tillage with crop residues at 60 days after sowing at the soil depth of 0-7.5, 7.5-15 and 15-30 and NO_3-N release or accumulation was 16.73, 19.2 and 7.5 7g g-1soil respectively. Wisal *et al.*, (2010) found that nitrate-N was the major portion of total mineral N in all incubation stages. The significantly lower NO_3-N in sugarcane, maize, and sorghum and cotton residues amended soil, showed immobilization of soil N. A significant reduction in NO_3-N in sugarcane, maize

Table.1 Chemical characteristics of the investigated plant residues and cow manure

Parameter	Maize stalk	Wheat straw	Chickpea straw	Cow manure
C:N ratio	74.1	72. 58	29.66	26.0
O.M gkg^{-1}	69:0	77.6	74.1	39.9
Total N gkg^{-1}	5.4	9.6	14.5	8.9
Total P gkg^{-1}	2.2	2.3	3.2	5.3
Total K gkg^{-1}	3.9	7.5	9.8	5.1
Total Fe ($\mu g\ g^{-1}$)	837	613	836	2730
Cu ($\mu g\ g^{-1}$)	112	106	114	148
Mn ($\mu\ g\ g^{-1}$)	121	117	103	131
Zn ($\mu\ g\ g^{-1}$)	161	136	225	223

Table.2 Effect of different organic source and inoculation intervals on changes of NO_3 -^{15}N concentration ($mgkg^{-1}$) in sandy soil

organic source(S)	Inoculants (I)	Incubation intervals (day)(T)							
		1	15	30	45	60	75	90	Mean
Maize stalk	none	51.9	55.0	73.0	75.3	55.9	56.0	51.4	59.8
	ASP	57.2	50.0	71.8	73.8	57.8	57.5	55.5	60.5
	Tr	55.3	55.9	78.5	789	57.9	56.3	59.1	**63.1**
	ASp+Tr	52.1	54.7	73.9	75.0	55.5	53.0	52.0	**595**
	mean	**5**4.1	**53.9**	**74.3**	**75**.8	56.8	55.7	54.5	**60.7**
Chickpea straw	none	58.0	60.5	79.2	82.9	52.5	51.5	50.5	**62.2**
	ASP	65.9	66.8	77.7	83.8	53.2	53.2	53.0	**64.8**
	Tr	59.4	60.8	71.2	72.1	52.7	52.4	51.8	**60.1**
	ASp+Tr	55.4	59.0	70.2	74.0	56.0	55.0	52.3	**60.3**
	mean	59.7	61.8	74.6	78.2	53.6	53.0	51.9	**61.9**
Wheat straw	none	50.0	52.0	63.4	73.2	53.2	53.0	53.7	**57.0**
	ASP	51.1	51.8	64.5	76.5	55.2	55.7	57.7	**58.9**
	Tr	43.4	49.3	61.9	71.8	540	514	517	**54.8**
	ASp+Tr	47.5	49.4	61.8	71.1	583	554	489	**56.1**
	mean	48.0	50.8	62.9	73.2	55.2	53.9	53.0	**56.7**
Caw manure	none	52.5	62.7	74.8	81.5	53.7	56.2	56.1	**62.5**
	ASP	50.3	61.5	80.1	86.4	61.2	57.1	51.0	**63.9**
	Tr	59.7	63.4	80.1	81.5	66.0	55.3	54.0	65.8
	ASp+Tr	58.2	67.2	78.3	85.7	65.0	54.5	50.5	65.6
	mean	55.2	63.7	78.3	83.8	**61.5**	55.8	52.9	64.5
Grand mean		54.3	57.5	72.5	77.8	**5**6.8	54.6	53.1	

	Organic source (S)	Time of incubation (T)	Inoculants (I)	Interaction (S x T x I)
L.S.D. (0.05)	**1.226**	**1.247**	**1.226**	**4.088**

Table.3 Effect of different organic source and inoculation intervals on changes of NH_4-^{15}Nconcentration ($mgkg^{-1}$) in sandy soil

organic source (S)	Inoculants (I)	Incubation intervals (day)(T)							
		1	**15**	**30**	**45**	**60**	**75**	**90**	**Mean**
Maize stalk	**none**	21.0	20.5	19.2	17.7	13.6	13.4	12.6	**16.9**
	ASP	21.0	19.8	19.6	19.1	15.2	14.0	13.2	**17.4**
	Tr	19.9	19.7	19.6	19.1	14.6	13.5	12.7	**17.0**
	ASp+Tr	20.0	18.0	17.2	17.0	14.0	13.5	12.6	**16.0**
	mean	**20.5**	**19.5**	**18.9**	**18.2**	**14.4**	**13.6**	**12.8**	**16.8**
Chickpea straw	**none**	19.9	17.7	16.5	16.7	16.1	13.9	12.0	**16.1**
	ASP	185	18.0	17.3	15.5	13.3	12.7	12.6	**15.4**
	Tr	16.3	15.1	14.8	14.0	11.9	11.0	9.9	**13.3**
	ASp+Tr	20.1	19.0	18.0	16.0	14.4	13.1	11.2	**16.0**
	mean	**18.7**	**17.5**	**16.7**	**15.6**	**13.9**	**12.7**	**11.4**	**15.2**
Wheat straw	**none**	16.0	14.0	13.9	12.7	12.0	11.5	10.2	**12.9**
	ASP	17.0	16.8	15.5	14.9	14.1	13.2	12.0	**14.8**
	Tr	16.6	16.1	15.0	14.3	12.5	12.0	11.2	**14.0**
	ASp+Tr	11.7	11.6	11.5	11.3	11.0	10.2	9.9	**11.0**
	mean	**15.3**	**14.6**	**14.0**	**13.3**	**12.4**	**11.7**	**10.8**	**13.2**
Caw manure	**none**	12.5	11.9	11.7	11.5	10.6	10.3	10.1	**11.2**
	ASP	13.2	12.6	12.1	11.9	11.6	11.3	11.1	**12.0**
	Tr	13.7	12.8	12.1	11.0	10.5	10.5	10.4	**11.6**
	ASp+Tr	12.0	11.9	11.7	10.3	10.1	10.1	10.0	**10.9**
	mean	**12.9**	**12.3**	**11.9**	**11.2**	**10.7**	**10.6**	**10.4**	**11.3**
Grand mean		**16.9**	**16.0**	**15.4**	**14.6**	**12.9**	**12.2**	**11.4**	

	Organic source (S)	Time of incubation (T)	Inoculants (I)	Interaction (S x T x I)
L.S.D. (0.05)	**0. 3289**	**0. 3345**	**0. 3289**	**1.09669**

and sorghum residues amended soil was 16.5, 12.4 and 16. 8 mg kg-1 soil in 7 day, 89.7, 81.3 and 85.7 mg kg-1 soil in 14 day, 41.1, 30.2 and 35.8 mg kg-1 soil in 28 day and 40.2, 32.8 and 35.3 mg kg^{-1} soil in 42 days, 22.1, 15.8 and 10.8 mg kg-1 soil in 84 day incubation period over control (no-N fertilizer). Residues of sorghum, maize, sugarcane and cotton immobilized soil total mineral N and maximum reduction in total mineral N was found at 14 days of incubation. The sugarcane residues reduced soil N mineralization more substantially greater than maize, sorghum and cotton. Overall, mineralization with fertilizer N treatment was also lower in maize, sorghum, sugarcane and cotton residues amended soil than soil + N (only N-fertilizer) and Lucerne + N treatments, which on average during 84 days of incubation showed total mineral in residues + N treatment decreases by 45 mg kg-1 in sugarcane, 34 mg kg-1 in maize, 29 mg kg-1 in sorghum and 16 mg kg-1 in cotton amended soil as compared to soil +N fertilizer. In contrast there were of increase 7 mg kg^{-1} in Lucerne amended soil. Were N mineralization increased progressively up to 14 days of incubation and then decreased. However, the mineral N often 42 days of incubation slightly increased than often 28 days and was lower than often 14 day .Because of microbial decomposition, NH_4-N and NO_3- N were released from soil organic matter, manure, crop residues. The sugarcane, maize and sorghum residues amended soil had significantly lower mineral N and NO_3-N than the control, and soil + N treatment, even after 84 day of incubation period. *Roy et al*., (2011), found that N-immobilization in terms of NH_4- N + NO_3- N estimated over control following straw incorporation was prominent up to 20th day, after which no net mineralization occurred up to 40th day. After 40th day, N mineralization exceeded immobilization ranging from 14 - 17% at 60th day and 19 - 20% at 85th day over control. Wagger *et al*. (1985) demonstrated mineralization of N from ^{15}N labeled wheat and sorghum residue to be 12.5 - 14.7% and 14.9 - 32.9% respectively during one crop season. Similar results were also reported by Sarmah and Bordoloi (1994) who observed net immobilization of N up to 4 weeks due to treatment with wheat straw after which mineralization exceeded immobilization. Patra *et al*. (2010) showed that farm yard manure increased ammonium and nitrate nitrogen in the rhizosphere, and that ammonium-N was highest during rice tillering stage whereas the nitrate-N was the highest during flowering (Mukherjee and Gaur, 1985). Stated that farmyard manure N-mineralization in soil Mishra *et al*, (2001) reported that highest level of ammonium-N at the tillering stage was due to greater rate of ammonification of organic manure. They noted that ammonium-N and nitrate -N were significantly positively correlated with microbial biomass carbon, organic carbon, total nitrogen content and nitrate nitrogen content in the rice rhizosphere.

Ammonium-N content mg kg soil^{-1}

Amonium-N content in soil at different incubation intervals as affected by organic sources and microbial inoculants is presented in Table 3. Data revealed that ammonium content tended to decrease by increasing incubation intervals up to 15 days then gradually decreased with 30 day up to 90 day intervals in soil amended with maize stalks. The highest reduction in NH_4–^{15}N was detected at 90 days of incubation. This holds true with all different inoculants. Concerning the inoculation treatments, results indicate that ammonium content was identical with *Aspergillus* and *Trichoderma* while reduction occurred with dual inoculate. Application of chickpea straw with *Aspergillus* gave the highest value of ammonium. Concerning the effect of inoculation on ammonium content as affected by chickpea straw, NH_4–^{15}N content was identical in soil inoculated or with both with either or with both, it was higher in case of uninoculated treatment. Ammonium-N content was affected by inoculation intervals where it increased with time up to 30 day then sharply decreased till the end of incubation. In case of dual inoculants plus chickpea straw, ammonium tended to increase with increasing time of incubation where the highest ammonium value (20.1 mg kg^{-1}) was recorded an day 1, then tended to decrease up to 90 day of incubation. The average of inoculation treatments indicate that the individual inoculation with *Aspergillus*, Tichoderma or dual both did not give significant variation NH_4–^{15}N content, but all of them were less then those recorded at the uninoculated control. In this regard, the inoculation treatments could be ranked as follow: uninoculated >Aspergillus ≥dual inoculants ≥Trichoderma.Soil treated with wheat straw and Tichoderma showed an increase in ammonium content. This holds true under different incubation periods with exception of 30 day. Approximately, the highest values seems to be stable (15.9 mg kg^{-1}) at 1, 15 and 30 days of incubation then tended to decrease up to 90 days of incubation. *Aspergillus* inoculation showed that ammonium content gradually increased with incubation up to 30 day (15.5 mg kg^{-1}) then tended to decrease with time progress. Similar trend was noticed with uninoculated but the highest ammonium content was recorded often 30 day then tended to decrease with time.

The overall means of inoculation treatments indicate enhancement of ammonium content as compared to dual inoculants one. In this regard, the treatments could be ranked as follows: Aspergillus >trichoderma > uninoculated > dual inoculants **.**Incorporation of caw manure in combination with Trichoderma increase of ammonium content in soil over those recorded with the *Aspergillus* or uninoculated control. These increments were higher at 15 and30 days of incubation and then tended to decrease with time up to 90 days. Similar trend was noticed with Trichoderma and dual inoculations. The overall averages show that dual inoculums and Trichoderma inoculants were nearly close to each other were NH_4–^{15}N content was concerned. Concerning the organic additives, the average indicates superiority of wheat straw over the all other additives. In this regard, it could be ranked as follow: maize stalk > chickpea straw > wheat straw > cow manure data recorded was 16.8, 15.2, and 13.2 and11.3 mg kg^{-1} respectively. Differences between organic additives are attributed to their origin, and chemical composition, which govern the decay rate. Organic matter degradation is also affected by the conditions surrounding the media. Vimlesh and Giri (2011) found that ammonical nitrogen (NH_4-N) and nitrate nitrogen (NO_3-N) to be 3. mg kg^{-1}, 725.0 mg kg^{-1} and 12.1 mg kg^{-1} 285.8 mg kg^{-1}. Saidur and Rahman (2004**)**, showed that release or accumulation of NH_4-N continued up to 60 days after sowing and then gradually decreased until harvest with fluctuation in NH_4-N concentration, and was influenced by soil moisture conditions that varied with soil decrease NH_4-N than soil+ N in 7 days of incubation. Generally,

NH_4-N decreased gradually with time. Application of sugarcane, maize, sorghum and cotton residues with fertilizer inputs decreased the mineral N pool, due to an immobilization of soil and fertilizer-derived N. Caiyan *et al* (2010), found that high N application enhanced the amount of soil NH_4-^{15}N, $N0_3$ ^{15}N and inorganic-^{15}N, compared to low N application rate. In contrast, maize straw with a wide C/N ratio was important in regulating the accumulation of NH_4-^{15}N and $N0_3$-^{15}N in soil inorganic N pool. Maize straw addition lowered the amounts of soil NH_4-^{15}N, inorganic ^{15}N, and their percent to applied ^{15}N-labeled fertilizer, and then decreased the percent loss of ^{15}N-labeled fertilizer. Thus, a combined application of chemical fertilizer and maize straw with a wide C/N ratio is an important means for reducing the superfluous accumulation of N fertilizer as soil inorganic N to subsequently lower its loss. Cayuelaon, (2009), concluded that animal residues increases available N for plants. However, high rates of application released large amounts of NH_4 that in some cases led to a temporary decrease of the microbial biomass and inhibition of nitrification processes. Application of residues caused increases microbial biomass, and soil fertility. The activities of soil enzymes involved in C and N cycles responded differently to application of plant and animal residues, but increased the capacity of soil to perform useful ecosystem functions.

Organic-N μgkg^{-1}

Organic-N content in soil at different incubation intervals as affected by organic sources and microbial inoculants was presented in Table 4. Data reveal that organic-N gradually decreased by increasing incubation time up to 90 day intervals when soil amended with maize stalks. The highest decrese in organic-N occurred at 90 day of incubation. This holds true with the mean of different inoculants. Concerning inoculation treatments, results show that organic-N content increased by *Trichoderma* either as individual or in combination with *Aspergillus* fungi. Application of chickpea straw in combination with different inoculants increased organic-N.This holds true, with some exception, under all incubation periods. In case of dual inoculants plus chickpea straw, organic-N tended to decrease with time and the highest value (24.5mg kg^{-1} soil) was recorded after 1 day, then tended to decrease up to 90 days of incubation. The overall means of inoculation_treatments indicate that the inoculation with tichoderma gave the highest value of than those recorded with *Aspergillus* or dual inoculants. In this regard, the inoculation treatments could be ranked as follow: uninoculated > trichoderma > dual Inoculants> Aspergillus**.** Soil treated with wheat straw and tichoderma increased of organic-N. This was true under 1, 15 and 30 day of incubation periods. Approximately, organic-N at the first 3 incubation periods was nearly the some. Another view was noticed with *Aspergillus* inoculation where organic-N gradually decreased with time up to 30 day (20.0 mg kg^{-1}) then decreased with time. Similar trend was noticed with dual inoculation.

The overall means of inoculation plus trichoderma or *Aspergillus* treatments indicate that all inoculants resulted in enhancement of organic-N as compared to uninoculated and dual inoculants one. In this regard, the treatments could be ranked as follows: dual inoculants >trichoderma > uninoculated >Aspergillus. Incorporation of caw manure in combination with *Aspirgilles* induced an increase of organic-N in soil over those recorded with the uninoculated control. These increments were higher after 15 and30 days of incubation and then tended to decrease with time up to 90 days. Similar trend was noticed with Trichoderma. The overall averages showed the superiority of *Aspirgilles* over the other treatments. Concerning the organic additives, the averages indicate superiority of wheat straw over the other additives. In this regard, it could be ranked as follows wheat straw > maize straw> chickpea straw > cow manure, with 2.09%, 1.98%.1.73%and1.59% increase respectively. Difference between organic additives reflect their differences in origin and chemical composition the organic matter degradation is be affected by the conditions surrounding the incubated Moursy, (2008). Found that organic matter was more able to degrade with time progress up to 60 days of incubation., and that addition of compost encouraged degradation.

C/N ratio

The C/N ratio of organic materials is shown Table 5. The effect of plant residues and fungi amended soil on changes of carbon to nitrogen ratio at different incubation intervals for 90 day show variation in C/N ratio with time. Fungi inoculation and organic amendments on day1 was widest (highest) on average the C/N ratio was widest (highest) with maize stalk and marrows(lowest) with chickpea straw with wheat straw as compared to other treatments whereas the lowest one was recorded with chickpea straw.

The overall means showed that the C/N ratio of organic materials became very narrow after 90 days of incubation (averages of 48.2:1 at day 1, became 12:4 at day 90) this means that organic matter reached maturity and became rich in N content. In this regard chickpea straw and caw manure showed lowest C/N values amongst all materially. Although the C/N ratio of wheat straw and maize stalk slightly decreased with time, they were close to chickpea straw and caw manure especially at the end of incubation time. The inoculation treatments showed positive and effects on degradation of the different organic materials the organic material treatments could be ranked as following: chickpea straw ≥ caw manure ≥ wheat straw > maize stalk .The fungi treatments could be ranked as following: trichoderma (17.5)> uninoculated (17.9) > dual inoculants (18.4) > Aspergillus (18.9). Roy *et al*. (2011), showed that the nature and content of lignin is a reliable index for prediction of net N release. In a study with several parameters Muller *et al*. (1988), concluded that lignin content was amore effective parameters than N concentration or C:N ratio in predicting the amount of mineralized N. Cayuela *et al*. (2009), found that residues of wheat and cotton caused rapid immobilization of N and affected microbial size and activity and mineralization. Hadas *et al*. (2004) reported that maize stalks caused immobilization of approximately 48μg N g^{-1} soil over the 56-day incubation period. (Das *et al*. 1993) reported that, sorghum Stover with C/N ratio of 72.1 resulted in immobilization of N up to 90 days of incubation whereas residues of lucerne caused no immobilization. Low N content (high C:N ratio) in maize, sorghum, and sugarcane residues seemed to be a major factor limiting microbial decomposition. Which would limit enzyme activities of

Table.4 Effect of different organic source and inoculation intervals on changes of (Organic –N µgkg^{-1}) in sandy soil

organic source (S)	Inoculants (I)	Incubation intervals (day)(T)							
		1	**15**	**30**	**45**	**60**	**75**	**90**	**Mean**
Maize stalk	**none**	27.1	24.5	7.8	7.0	30.5	30.6	36.0	**23.4**
	ASP	21.8	20.2	8.6	7.1	21.8	28.5	31.3	**19.9**
	Tr	24.8	24.4	1.9	2.0	27.5	30.2	28.2	**19.9**
	ASp+Tr	27.9	27.3	8.9	8.0	30.5	35.5	35.4	**24.8**
	mean	**25.4**	**24.1**	**6.8**	**6.0**	**27.6**	**31.2**	**32.7**	**22.0**
Chickpea straw	**none**	22.1	23.7	4.3	4.0	31.4	34.6	37.5	**22.0**
	ASP	15.6	15.2	5.0	7 .0	34.1	36.2	36.2	**20.4**
	Tr	24.3	24.1	14.0	13.9	35.4	36.6	38.3	**26.7**
	ASp+Tr	24.5	22.0	11.8	10.0	29.6	31.9	37.8	**23.9**
	mean	**21.6**	**21.3**	**8.8**	**6.3**	**32.6**	**34.8**	**37.5**	**23.3**
Wheat straw	**none**	34.0	33.4	22.7	14.1	34.8	35.5	36.1	**30.1**
	ASP	31.9	31.4	20.0	8.6	30.7	31.1	30.3	**26.3**
	Tr	40.0	34.6	23.1	13.9	35.5	36.6	36.3	**31.4**
	ASp+Tr	40.8	39.9	26.7	17.6	35.2	34.4	41.2	**33.7**
	mean	**36.7**	**34.8**	**23.1**	**13.6**	**34.1**	**34.4**	**36.0**	**30.4**
Caw manure	**none**	35.0	25.4	13.5	7.0	35.7	33.5	33.8	**26.3**
	ASP	36.5	19.9	7.8	1.7	27.2	31.6	37.9	**23.2**
	Tr	26.6	23.8	23.8	7.5	23.5	34.2	35.6	**25.0**
	ASp+Tr	29.8	20.9	9.8	4.0	24.3	34.9	39.5	**23.3**
	mean	**32.0**	**22.5**	**13.7**	**5.1**	**27.7**	**33.6**	**36.7**	**24.5**
Grand mean		**28.9**	**25.7**	**13.1**	**7.8**	**31.5**	**33.5**	**35.7**	

	Organic source (S)	**Time of incubation (T)**	**Inoculants (I)**	**Interaction (S x T x I)**
L.S.D. (0.05)	**0.1141**	**0.1161**	**0.1141**	**0.3804**

Table.5 Effect of different organic source and inoculation intervals on changes of (C / N ratio) in sandy soil

organic source (S)	Inoculants (I)	Incubation intervals (day)(T)							
		1	15	30	45	60	75	90	Mean
Maize stalk	none	61.0	41.0	25.7	17.7	14.9	13.7	13.0	**26.7**
	ASP	63.7	43.7	30.3	15.7	15.3	15.0	14.7	**283**
	Tr	60.3	40.3	24.3	14.0	14.3	14.0	13.6	**25.8**
	ASp+Tr	63.3	43.3	27.3	14.2	13.3	12.8	12.0	**26.6**
	mean	**62.1**	**42.1**	**26.9**	**15.4**	**14.5**	**13.9**	**13.3**	**26.9**
Chickpea straw	none	47.7	37.7	24.7	13.4	13.1	12.7	12.0	**23.0**
	ASP	47.9	37.9	25.1	16.2	15.4	14.3	13.5	**23.3**
	Tr	49.9	39.9	24.0	12.4	12.3	12.1	12.0	**23.2**
	ASp+Tr	41.5	41.5	23.6	14.3	13.9	13.0	12.4	**22.9**
	mean	**46.8**	**39.2**	**24.4**	**14.1**	**13.7**	**13.0**	**12.3**	**23.1**
Wheat straw	none	52.0	42.0	27.3	23.0	19.2	18.0	15.0	**28.1**
	ASP	49.8	39.8	25.1	16.9	16.1	13.7	13.3	**25.0**
	Tr	52.5	42.5	30.7	15.9	14.1	13.4	12.3	**25.9**
	ASp+Tr	54.7	44.7	31.0	20.2	15.2	14.7	14.6	**27.9**
	mean	**52.3**	**42.3**	**28.5**	**19.0**	**16.2**	**15.0**	**13.5**	**26.7**
Caw manure	none	46.3	36.3	22.3	15.6	15.7	15.6	12.7	**23.5**
	ASP	50.3	40.3	22.4	16.3	14.0	13.7	13.3	**24.3**
	Tr	48.6	38.6	21.0	15.0	13.0	12.2	11.7	**22.9**
	ASp+Tr	47.7	37.7	24.0	16.6	12.8	12.3	12.0	**23.3**
	mean	**48.2**	**38.2**	**22.4**	**15.9**	**13.9**	**13.5**	**12.4**	**23.5**
Grand mean		**52.0**	**40.5**	**25.6**	**16.1**	**14.6**	**13.9**	**12.9**	

	Organic source (S)	Time of incubation (T)	Inoculants (I)	Interaction (S x T x I)
L.S.D. (0.05)	**0.8131**	**0.8271**	**0.8131**	**2.7097**

Table.6 Effect of different organic source and inoculation intervals on changes of (O.M %) in sandy soil

organic source (S)	Inoculants (I)	Incubation intervals (day)(T)							
		1	15	30	45	60	75	90	Mean
Maize stalk	none	82.8	70.6	44.3	30.5	25.6	22.6	22.4	**42.7**
	ASP	89.1	57.3	52.2	27.0	26.3	25.9	25.3	**43.3**
	Tr	83.3	69.5	41.9	24.1	24.7	24.1	23.4	**41.6**
	ASp+Tr	88.4	74.6	47.1	24.5	22.9	22.1	20.7	**42.9**
	mean	**85.9**	**68.0**	**46.4**	**26,5**	**24.9**	**23.7**	**23.0**	**42.6**
Chickpea straw	none	82.2	65.0	42.6	23.1	22.6	21.9	20.7	**39.7**
	ASP	82.6	65.3	43.3	27.9	26.5	24.7	23.3	**41.9**
	Tr	86.0	68.8	41.4	21.4	21.2	20.9	20.7	**40.1**
	ASp+Tr	71.5	71.5	40.7	24.7	24.0	22.4	21.4	**39.5**
	mean	**80.6**	**67.7**	**42.0**	**24.3**	**23.6**	**22.5**	**21.5**	**40.3**
Wheat straw	none	89.6	72.4	47.1	39.7	33.1	31.0	25.9	**48.4**
	ASP	85.9	68.6	43.3	29.1	27.8	23.6	22.9	**43.0**
	Tr	90.5	73.3	52.9	27.4	24.3	23.1	21.2	**44.7**
	ASp+Tr	94.3	77.1	53.4	34.8	26.2	25.3	25.2	**48.0**
	mean	**90.1**	**72.9**	**49.2**	**32.8**	**27.9**	**25.8**	**23.8**	**46.0**
Caw manure	none	79.8	62.6	38.4	26.9	27.1	26.9	21.9	**40.5**
	ASP	86.7	69.5	38.6	28.1	24.1	23.6	22.9	**41.9**
	Tr	83.8	66.5	36.2	25.9	22.4	21.0	20.2	**39.4**
	ASp+Tr	82.2	65.0	41.4	28.6	22.1	21.2	20.7	**40.2**
	mean	**83.1**	**65.9**	**38.7**	**27.4**	**23.9**	**23.2**	**21.4**	**40.5**
Grand mean		**84.9**	**68.6**	**44.1**	**27.8**	**25.1**	**23.8**	**22.4**	

	Organic source (S)	Time of incubation (T)	Inoculants (I)	Interaction (S x T x I)
L.S.D. (0.05)	**2.196**	**2.234**	**2.196**	**7.3214**

microbial decomposers. The benefit of combining low quality residue with N fertilizer in reducing N losses indicates that such soil fertility management strategy should be adopted in environments of higher soil N losses (Gentile *et al*. 2009). Organic matter that is high in N content has greater N mineralization than organic matter that is low in N content Burke (1989. Application of fertilizer N with sugarcane, maize, sorghum and cotton residues to soil decreased the mineral N pool than soil +N, due to an immobilization of fertilizer-derived N. This might lead to lower N_2O losses (Gentile *et al*. 2008). The patterns of mineralization and N immobilization were reported to be modified by residue quality when combined with N fertilizer (Sall *et al*. 2003). .Microbial biomass ((MB)-C) and N increased in residue amended soils. The highest MBC and MBN in sugarcane, maize sorghum and cotton residue amended soil are reported to be due to immobilization of N (Cayuela *et al*. 2009).

Application of N fertilizer improving residues quality and alter its chemistry that may changes microbial community as residues are decomposed Stemmer *et al*. (2007). Residue quality affects microbial activity and of N mineralization and immobilization (Gentile *et al*. 2009). Jensen (1997) found that microbial biomass N in barley residues was apparently stabilized to a higher degree than the biomass N in the pea residue. Naeem *et al*, (2009), found that effect of organic and inorganic fertilizer treatments affect microbial activity, microbial biomass C and N and mineralizable C and N was significant.

Organic matter percentage

Results presented in Table 6, show the effect of organic materials incorporated in to the soil and inoculated with fungi on changes of organic carbon percent at different incubation intervals.

In general, data indicate that the organic carbon significantly declined with incubation time, in soil treated with chickpea straw the carbon percent tended to decrease after 30 day, where the plant residues content tended to decrease slightly with time progress. On the other hand maize stalk treatment indicated that organic carbon was decreased after 30 days, then increased up to 45 days, then decreased again up to 90 days of incubation periods. The overall means indicate that organic residues were more able to degrade with time progress up to 90 days of incubation. The priorities of fungi inoculation treatments could be ranked as follows: Aspergillus > uninoculated > trichoderma > dual inoculants. At any given time, the amount of carbon percent as affected by decomposed residues could follow the ascending order: Chickpea straw> Caw manure > Maize stalk > Wheat straw. Patra *et al*. (2010), showed that addition of farmyard manure increased in the organic carbon of rhizosphere soil from tillering to maturity stage of rice Debnath *et al*. ((1994) reported that organic carbon in soil decreased from tillering to maturity stage of rice due to utilization of organic carbonaceous materials by the increased number of micro-organisms resulting in higher breakdown of organic matter Burke (1989) noted that organic matter that is high in N content has greater N mineralization than organic matter that is low in N content. Moursy(2008). Found that organic matter degrade with time progress up to 60 days of incubation.

Soil organic matter quality, biofertilizer, and period may be important determining factors for N mineralization in sandy soils. Ammonium-N and nitrate -N were significantly positively correlated with microbial biomass carbon, organic carbon, total nitrogen content and nitrate nitrogen content and accumulation of NO_3-N was the highest at day 60**.**

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