USE OF BIOFERTILIZATION AND ORGANIC MANURE TO DECREASE THE ADVERSE ENVIRONMENTAL IMPACTS OF INORGANIC NITROGEN IN AGRO-ECOSYSTEM.

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ABSTRACT

It is well known that large percentages of nitrogen in the form of nitrate anions leach through soil especially when excessive amounts are applied to soil.

Plant intake of nitrate is not fast enough to recover all the excessive amounts of nitrates from plants root zone. The relative slow utilization of nitrate by plants allow losses of nitrates by leaching out the root zone. On the other hand, ammonium cation is adsorbed by soil colloids, so it does not leach out of soil . Nitrification of NH^{+}_{4} to NO^{-}_{3} in soil is also a source for nitrate .

The aim of the present investigation was to look for how to reduce this risk and at the same time increase the economic reflect of the nitrogen unit in the soil by using organic manure treatment (town refuses [TR] , farmyard manure [FYM]), and biofertilizer (Nitrobin).

Two pot experiments were conducted during the successive growing seasons of 1996/97 and 1997/98 at El-Serw Agriculture Station - Damietta. Each pot was filled with 15 kg of a sandy soil obtained from El-Rakabia.

The experiment were designed as split-split plot , two treatments of microbial inoculation (I_0 and I_1) assigned the main plots. Five forms and levels of organic manure treatments (Control, 5g FYM, 10g FYM, 5g TR and 10g TR / kg soil) occupied the sub-plots, while, the nitrogen fertilizer levels (N_0, N_{20}, N_{40}, and N_{80} mg N / kg soil) occupied the sub-sub plots . The total number of this trial were 40 treatments. Each treatment was replicated five times, hence 200 containers were conducted.

The obtained results could be summarized as follows:-

Biofertilization of wheat grains by Nitroben and organic manure additions caused significant increases in the mean values of wheat dry weight (g/plant) during both seasons.

Significant decreases in leached NO^{-}_{3} and NH^{+}_{4}-N in drainage water were recorded due to biofertilization and manure application.

Nitrogen uptake high significantly increased due to both Nitrobin inoculation and manure treatments.

The highest means of utilization rate (UR) of applied nitrogen were produced due to organic manure additions.

Increasing the applied-N fertilizer tended to reduce the N-utilized percent.

The obtained results illustrate the beneficial effects of bio and organic fertilization on reducing the adverse environmental impacts of inorganic nitrogen in agro-ecosystem.

INTRODUCTION

There is a need to develop and adopt economical and efficient N management strategies that conserve natural resources while minimizing adverse environmental impacts (Hargrove *et al*., 1988). Pollution concern, public criticism, and the desire to cut input costs have prompted some producers to reduce N fertilizer applications and make more efficient use of organic N sources produced on-farm (legumes, green manure, animal manure, and crop residues).

In the absence of inorganic fertilizers, N availability depends on the soil's N cycling capacity. Because most of the reactions involved in the N cycle are biologically mediated, the size and activity of soil microbial populations play an important role in N supply. Long-term applications of manufactured N fertilizers result in soils that have lower biological activity relative to soils that have received repeated additions of organic materials (Collins *et al*., 1992; Dick *et al*., 1988; McGill *et al*., 1986 and Bolton *et al*., 1985).

Nitrogen from both manure and mineral fertilizer is exposed to leaching through soil profile as NO^-_3 and may potentially contaminate the ground water. Several studies reported the occurrence of higher soil profile nitrate or greater leaching of nitrate from mineral fertilizer N than from manure (Kimball *et al*., 1972 and Comfort *et al*., 1987).

Kaloosh and Koreish (1995) reported that the addition of organic manure fertilizer decreased the level of nitrate in leached water under the root zone, and has a good effect on plant growth (wheat). This indicate the slow release of almost all the essential nutrient from organic fertilizer.

The collected city refuse represents one of the cheapest wastes that could be utilized for manuring. At the same time, the injuries of the city refuse can be overcome (Meshref *et al*., 1994)

On the other hand, recent studies by many authors showed that the microbial inoculation of wheat grains with the free living N_2-fixing bacteria enhanced the N-fixation and consequently encourage the growth and yield of wheat (Pozzo *et al*., 1993; Elgala *et al*., 1995; Fares, 1997 and El-Naggar, 1999). Kaloosh and Koreish (1995) also stated that the total leached nitrate was greater with NH_4NO_3 addition treatment than with either microbial inoculation or manure application.

Therefore, the following investigation aims to study the differential responses of wheat (*Triticum sativum*) to the combined effects of biofertilization (Nitrobin inoculation), organic manure amendments, N-levels and their interactions. Plant growth, dry matter accumulation, nitrogen uptake, and leaching NO^-_3-N and NH^+_4-N at different stages of growth (30, 60 and 90 days after sowing) were also studied during two growth seasons (1996/97 and 1997/98).

MATERIALS AND METHODS

Two pot experiments were conducted at the greenhouse of El-serw Agric. Res. St. during the successive growing seasons of 1996/97 and 1997/98. A split-split plot design with five replicates was adopted. The main plots were occupied by two Nitrobin inoculation treatments (I_0: without inoculation and I_1: with Nitrobin inoculation)., while, five organic manure treatments were assigned to the sub-plots (O_0: without addition, , O_1: 5g farmyard manure (FYM) per 1 kg soil, O_2: 10 g FYM/ kg soil, O_3: 5g / kg soil town refuses manure (TR), and O_4: 10g / kg soil TR). The sub-sub plots were assigned to four N-fertilizer rates (N_0, N_{20}, N_{40} and N_{80} mg/kg soil)..

The total number of this trial are (I x O x N) = 2 x 5 x 4 = 40 treatments. Each treatment was replicated five times to give a total of 200 pots.

The experimental was carried out in plastic pots of 15 cm diameter and 50 cm height. The bottom of each pot was prepared with an orifices to facilities drainage. The orifices were covered by glass wool followed by 3 cm layer of washed fine gravels. Each pot contained 15 kg air dry sandy loam soil collected from El-Rakabia village.

The experimental used soil were collected from El-Rakabia village, Domitta Governorate. The soil is sandy loam in texture that contains 59% sand, 21% silt and 20% clay. The EC value of the saturated extract was 0.53 dS/m, while the pH was about 8.11 in the 1:2.5 soil water suspension. The organic matter content and $CaCO_3$ were 0.29 and 1.2%, respectively. The physical and chemical properties of the investigated soil were estimated according to Page *et al*. (1982).

The pots were regularly irrigated with tap water up to the field capacity for two weeks then during the next two weeks irrigation was added to reach to the saturation point (70%) in order to get the leachates.

During the growth stages, three plant samples were taken periodically after 30, 60 and 90 days from sowing. The plant materials were oven dried at 70°C then crushed and kept to analysis.

Drainage water was collected from each pot 3 times during the season (monthly) to determine the concentration of leached NH^+_4-N and NO^-_3-N ions in the drainage water.

Ammonium and nitrate concentration in soil was determined by Magnesium oxide - Devarda Alloy method (Black, 1982).

The dry materials of plant organs (oven dry basis) were wet digested with an H_2SO_4-$HClO_4$ mixture as described by Peterburgski (1968). Nitrogen, was determined in the digestion according to the micro-kjeldahl method (Jackson, 1967).

Important properties of both farmyard manure and Dammita's city refuse were determined according to the methods reported by **Page *et al*. (1982)**. Table 1 shows the main characteristics of the two manures.

Table 1. Some chemical properties of the used organic manures.

Organic matter	Total C (%)	Total N (%)	C : N ratio	Total P	Total K	pH	EC dSm^{-1}
Dammitta's city refuse	15.30	1.08	14.2	1.23	0.75	7.82	0.82
Farm yard manure	14.45	0.83	20:1	0.36	2.10	8.53	0.63

100 ml of drainage water were taken from each pot at every sample date to determine the concentration of leached nitrate and ammonium according to the methods reported by **Black (1982)**.

Utilization rate of applied nitrogen (UR):

Finck (1982) suggested the value of UR% to evaluate the fertilizer use efficiency by different plants. He used the following equation to calculate this value:-

$$UR\% = \frac{\text{Total removed}^{1} - \text{removed from soil reserves}^{2}}{\text{Nutrient amount of fertilizer}^{3}} \times 100$$

Where:-

Total removal from fertilizer and soil reserves (plant uptake).

Removal from soil reserves (The uptake of the control treatment).

Quantity of the applied nitrogen.

All data were statistically analyzed according to the technique of analysis of variance (ANOVA) and the least significant differences (L.S.D.) method was used to test the difference between the treatment means as published by **Gomez and Gomez (1984)**. All statistical analysis were performed using analysis of variance technique by means of MSTAT Computer Software Package.

RESULTS AND DISCUSSION

I. Dry weight of wheat plants:

The results of Table 2 show the effect of Nitrobin inoculation, organic manure treatments, nitrogen fertilization and their interaction on the dry weight of wheat plants (g/pot) at different stages of growth during both 1996/97 and 1997/98 seasons.

1. Effect of Nitrobin inoculation:

Data presented in Table 2 show that the whole dry weight of wheat plants (g/pot) tended to increase significantly due to Nitrobin inoculation at the 1st and 2nd growth stages during both seasons. At flowering stage (90 days after sowing) insignificant increases were recorded due to Nitrobin inoculation in the two seasons of experimentation. These results are similar to those obtained by Elgala *et al*. (1995); Amara and Dahdoh (1997); Fares (1997) and Galal *et al*. (1999).

The increase in whole dry weight of wheat plants due to Nitrobin inoculation could be attributed to the role of the microorganisms by supplying wheat roots with their fixed nitrogen and consequently improving the vegetative growth. Meanwhile, the efficiency of Nitrobin as a biofertilizer was previously recorded by Saber (1993), who ascribed such beneficial effect to its composition of N_2-fixing bacteria that acts through N_2-fixation, mobilization of certain macro- and micro-nutrients to a form available for plant absorption and secretion a set of growth promoting substances and biocontrolling certain soil born diseases.

Table 2. Means of dry weight (g/pot)* of wheat plants as affected by Nitrobin inoculation, organic manure treatments, nitrogen fertilizer levels and their interactions at different stages of growth during 1996/97 and 1997/98 seasons.

Treatments	30 days		60 days		90 days	
	1996/97	1997/98	1996/97	1997/98	1996/97	1997/98
A. Nitrobin inoculation:						
Without	0.40	0.40	5.72	5.33	13.18	13.18
With	0.50	0.50	6.10	5.90	13.28	13.02
F. test	*	*	*	*	NS	NS
L.S.D. at 5%	0.001	0.005	0.07	0.07	--	--
B. Organic Manure tr.:						
Control	0.30	0.30	5.27	4.97	11.44	11.42
FYM 5g /kg soil	0.40	0.40	5.77	5.47	13.24	12.20
FYM 10g/ kg soil	0.50	0.50	6.13	5.83	13.52	13.56
TR 5g/ kg soil	0.40	0.50	5.83	5.66	13.54	13.32
TR 10g/ kg soil	0.60	0.60	6.50	6.17	14.38	14.98
F. test	**	**	**	**	**	**
L.S.D. at 5%	0.004	0.003	0.04	0.05	0.32	0.43
C. N-levels (mg/kg soil):						
N_0	0.30	0.30	4.50	4.02	6.72	6.62
N_{20}	0.40	0.40	5.67	5.13	11.60	12.00
N_{40}	0.50	0.50	6.63	6.43	16.64	16.13
N_{80}	0.50	0.50	6.80	6.87	17.92	17.48
F. test	**	**	**	**	**	**
L.S.D. at 5%	0.003	0.004	0.05	0.05	0.23	0.28
Interaction Sign.:						
A x B	NS	NS	NS	NS	NS	NS
A x C	*	NS	NS	*	NS	NS
B x C	NS	NS	NS	NS	**	**
A x B x C	NS	NS	NS	NS	NS	NS

* Each pot contains 10 plants.

2. Effect of organic manure treatments:

The statistical analysis indicated that organic manure treatments produced high significantly effects on the average means of dry weight of wheat at 30, 60 and 90 days after sowing in both seasons. This trend agrees with the findings of Abdel-Magid *et al*. (1995), who indicated that the application of organic manure increased the dry weight of wheat by increasing rate of organic manure additions.

As shown in Table 2, the highest values of dry matter yield were obtained due to the addition of town refuses at the rate of 10 g/kg soil at all growth stages during both seasons. The data also show the superiority of this manure compared to the farmyard manure. These findings may be explained by lower C/N ratio of town residues (14.2), which increases mineral nitrogen in soil media by reducing immobilization of native soil nitrogen or added nitrogen by soil organisms and reducing their competition with plants on soil available nitrogen (El-Naggar, 1996). This explain are confirmed by increasing nitrogen uptake by wheat plant with decreasing of C/N ratio as reported in Table 6.

3. Effect of N fertilizer levels:

Highly significant differences were noticed between the means of dry weight (g/pot) at 30, 60 and 90 days after sowing in response to nitrogen fertilizer levels.

The data in Table 2 also showed that the highest dry weight / pot was achieved by the application of 80 mg N/kg soil at the age 60 and 90 days from sowing in both seasons. The increase in dry matter of plant due to N fertilization could be attributed to stimulation effect of nitrogen on metabolic process in the plant. Whereas, nitrogen is an essential element for building up dry matter in plant. **Laurent and Lazzari (1991) and Zebarth and Sheard (1992)** came to the same conclusions.

4. Interaction effects:

The statistical data of Table 2 show that the interaction between A and B as well as A x C and A x B x C were insignificant at all growth stages during both seasons. On the other hand, the interaction of B x C was significant at 30 days and high significant at 90 days in both seasons.

The superiority of I_1 x N_{80} in increasing the dry matter yield of wheat could be attributed mainly to the effect of Nitrobin inoculation on increasing the efficiency use of added fertilizer and consequently increased the amount of adsorbed nitrogen by wheat plants (Table 5). The use of Nitrobin biofertilizer may also help in decreasing the amount of nitrogen leached by the irrigation water and so it could be recommended as a mean to reducing the pollution effect of N-fertilizers

With regard to the combined addition of organic matter and inorganic N levels, data show that the most effective treatment was TR_{10} x N_{80}..

II. Leached NO^-_3-N concentration in drainage water at different stages of wheat growth:

Data of Table 3 show the effect of Nitrobin inoculation, organic manure treatments, N-fertilizer levels and their interaction on leached NO^-_3-N in drainage water.

1. Effect of Nitrobin inoculation:

Data in Table 3 show that the means of nitrate in drainage water tended to decrease high significantly due to Nitrobin inoculation at different stages of wheat growth during both seasons. At 30 days, the means of leached nitrate were 5.86, 5.56, 5.97 and 5.56 ppm for without and with inoculation in both seasons, respectively. The highest value of nitrate (14.73 mg/pots) was obtained at the 60 days. This result agrees with the findings of Kaloosh and Koreish (1995), who observed the decrease of NO^-_3-N in drainage water due to Nitrobin inoculation.

2. Effect of organic manure treatments:

The data recorded in Table 3 showed that the means of nitrate in drainage water tended to decrease high significantly due to increasing the level of applied manure at 60 and 90 days age of plant growth in both seasons. The data revealed also that the FYM always give higher values of NO^-_3 ions in the leachate than the city refuses manure. This result agrees with the findings of Mercer and Elson (1992), who found that the application of FYM reduced the rate of leaching NO^-_3.

3. Effect of N levels:

Results of Table 3 showed that there were positive and highly significant effects on leached nitrate due to N fertilizer application at all different stages in both seasons. The highest value of leached nitrate (21.39 mg/pot) was obtained at 60 days when the plant received 80 mg N/ kg soil kg soil. This result agrees with the findings of Lars and Brink (1986).

Table 3. Means of leached nitrate (NO^-_3-N) (ppm) in drainage water as affected by Nitrobin inoculation, organic manure treatments, nitrogen fertilizer levels and their interactions at different stages of growth during 1996/97 and 1997/98 seasons.

Treatments	30 days		60 days		90 days	
	1996/97	1997/98	1996/97	1997/98	1996/97	1997/98
A. Nitrobin inoculation:						
Without	5.86	5.97	14.73	14.72	9.50	9.53
With	5.56	5.56	14.11	14.22	9.27	8.99
F. test	**	**	**	**	**	**
L.S.D. at 5%	0.21	0.20	0.29	0.26	0.05	0.52
B. Organic Manure tr.:						
Control	5.51	5.75	16.55	17.20	8.41	8.74
FYM 5g /kg soil	5.70	5.81	13.84	14.35	9.60	9.34
FYM 10g/ kg soil	5.92	5.75	13.78	13.65	9.77	9.33
TR 5g/ kg soil	5.74	5.85	13.97	13.86	9.75	9.60
TR 10g/ kg soil	5.69	5.67	13.60	13.26	9.40	9.28
F. test	**	NS	**	**	**	**
L.S.D. at 5%	0.12	--	0.32	0.40	0.15	0.24
C. N-levels (mg/kg soil):						
N_0	2.38	2.25	2.45	2.49	6.87	7.02
N_{20}	6.24	6.18	16.71	16.86	8.73	8.51
N_{40}	6.25	6.58	17.14	17.83	9.77	9.55
N_{80}	7.98	8.05	21.39	20.69	12.19	11.96
F. test	**	**	**	**	**	**
L.S.D. at 5%	0.16	0.18	0.32	0.36	0.14	0.24
Interaction Sign.:						
A x B	NS	NS	NS	NS	NS	NS
A x C	NS	NS	NS	NS	NS	NS
B x C	**	NS	**	**	**	**
A x B x C	NS	NS	NS	NS	NS	NS

4. Interaction effects:

At all stages in both seasons, leached nitrate were affected significantly or non-significantly due to the different ways of interactions (Table 3).

III. Leached NH^+_4-N concentration in drainage water at different stages of wheat growth:

Data of Table 4 show the effect of Nitrobin inoculation, organic manure treatments, N-fertilizer levels and their interaction on leached NH^+_4-N on drainage water.

1. Effect of Nitrobin inoculation:

The data in Table 4 show that the means of NH^{+}_{4}-N in drainage water tended to decrease high significantly due to Nitrobin inoculation at different stages of wheat growth during both seasons. This trend is agree with the findings of Kaloosh and Koreish (1995), who found that Nitrobin inoculation decreased the amount of leached NH^{+}_{4}-N in drainage water.

Table 4. Means of leached NH^{+}_{4}-N (ppm) in drainage water as affected by Nitrobin inoculation, organic manure treatments, nitrogen fertilizer levels and their interactions at different stages of growth during 1996/97 and 1997/98 seasons.

Treatments	30 days		60 days		90 days	
	1996/97	1997/98	1996/97	1997/98	1996/97	1997/98
A. Nitrobin inoculation:						
Without	2.19	2.60	19.62	18.01	19.79	18.88
With	2.12	2.40	19.37	17.56	19.41	18.46
F. test	**	**	**	**	**	**
L.S.D. at 5%	0.06	0.06	0.06	0.27	0.13	0.32
B. Organic Manure tr.:						
Control	2.02	2.39	19.66	18.89	19.80	19.78
FYM 5g /kg soil	2.22	2.73	19.63	18.11	19.80	18.94
FYM 10g/ kg soil	2.15	2.42	19.54	17.20	19.51	18.59
TR 5g/ kg soil	2.26	2.53	19.55	17.90	19.65	18.65
TR 10g/ kg soil	2.13	2.45	19.10	16.83	19.23	18.38
F. test	**	**	**	**	**	**
L.S.D. at 5%	0.05	0.11	0.43	0.35	0.12	0.46
C. N-levels (mg/kg soil):						
N_0	2.00	2.02	2.39	2.03	2.35	2.07
N_{20}	2.18	2.21	23.33	19.17	22.45	20.10
N_{40}	2.18	2.48	24.65	21.57	24.00	23.71
N_{80}	2.26	3.30	27.60	28.37	29.60	28.79
F. test	**	**	**	**	**	**
L.S.D. at 5%	0.06	0.08	0.65	0.47	0.18	0.34
Interaction Sign.:						
A x B	NS	NS	NS	NS	NS	NS
A x C	NS	NS	NS	NS	NS	NS
B x C	NS	**	NS	**	*	**
A x B x C	NS	NS	NS	NS	NS	NS

2. Effect of organic manure treatments:

Data in Table 4 showed that the means of NH^{+}_{4}-N in drainage water tended to decrease high significantly due to increasing the level of organic manure at different stages of wheat growth in both seasons. This result agrees with the findings of Hancarova (1993) and Mandersloot *et al*. (1993).

3. Effect of N-fertilizer levels:

Results in Table 4 showed that the means of NH^{+}_{4}-N in drainage water tended to increase high significantly due to increasing N-fertilizer levels at different stages of wheat growth in both seasons. This result is in harmony with the finding of Robert *et al*. (1994).

4. Interaction effects:

The statistical data of Table 4 show that in both seasons, the interaction between B x C at 30 days was insignificant and high significantly in 1996/97 and 1997/98, respectively. At 60 days, B x C had insignificant and high significantly effects in 1996/97 and 1997/98, respectively. At 90 days, B x C had significant and high significantly effect in 1996/97 and 1997/98, respectively.

IV.1. Nitrogen uptake:

1. Effect of Nitrobin inoculation:

Data recorded in Table 6 indicated that the means of nitrogen absorbed by wheat tended to increase significantly due to Nitrobin inoculation in 1996/1997 season, but the effect was insignificant in the 2nd season. The lowest values of N-uptake were produced from uninoculated plants in the two seasons. This result is disagree with those of Gouzou *et al*. (1995). They found that the inoculation did not affect N-uptake. Meanwhile the data agree with Mikhaeel *et al*. (1997), who found that the inoculation increased the uptake of nitrogen by wheat plants. El-Mancy (1998) also found that the inoculation of wheat grains, under chemical N, P and K fertilization gave higher values of N concentration and uptake.

2. Effect of organic manure treatments:

Results of Table 6 showed that the addition of organic manure high significantly increased N-uptake at all growth stages during both seasons. These results agree with those obtained by Mikhaeel *et al*. (1997).

It is worthy to note that the highest values of N uptake by wheat plants were produced due to the application of town refuses manure at the rate of 10 g/kg soil at all growth stages in both seasons. This manure has lower C/N ratio than the FYM. This may help to reduce the competition between soil organisms and plant root on soil nitrogen, thus mineral nitrogen would be more liberate (available) and exist in soil media to meet plant demands.

3. Effect of N fertilization:

Results of Table 6 showed that the addition of nitrogen high significantly affected N-uptake during both seasons. Additional doses of N fertilizer gradually increased the amount of N obtained by wheat during both seasons. At flowering stage (90 days after sowing), the mean values of N-uptake were 70.48, 99.20, 112.38 and 161.56 mg/pot and 64.14, 88.19, 112.08 and 161.19 mg/pot due to the addition of 0, 20, 40 and 80 mg N/kg soil in the 1st and 2nd seasons, respectively. These results are in agreement with Shams El-Din (1989), who showed that increasing N levels increased N concentration in wheat plant at different stages. Also, Mercedes *et al*. (1993) found that N uptake efficiency was greatest with the addition of 75 kg N/ha.

Table 6. Means of nitrogen uptake (mg/pot) of wheat plants as affected by Nitrobin inoculation, organic manure treatments, nitrogen fertilizer levels and their interactions at different stages of growth during 1996/97 and 1997/98 seasons.

Treatments	30 days		60 days		90 days	
	1996/97	1997/98	1996/97	1997/98	1996/97	1997/98
A. Nitrobin inoculation:						
Without	13.92	14.93	59.65	65.97	108.98	99.32
With	16.35	16.26	62.23	67.84	34.14	113.48
F. test	*	NS	*	NS	*	*
L.S.D. at 5%	0.07	--	1.04	--	1.12	1.30
B. Organic Manure tr.:						
Control	11.21	10.69	50.61	55.85	93.78	91.09
FYM 5g /kg soil	13.41	12.88	60.03	61.35	105.51	101.51
FYM 10g/ kg soil	17.16	17.31	63.34	71.74	114.70	110.96
TR 5g/ kg soil	14.20	16.61	61.84	67.74	108.84	106.83
TR 10g/ kg soil	19.69	20.47	68.87	79.01	130.40	121.62
F. test	**	**	**	**	**	**
L.S.D. at 5%	0.13	0.11	1.44	2.68	1.36	1.22
C. N-levels (mg/kg soil):						
N_0	7.68	7.23	22.91	23.67	70.48	64.14
N_{20}	10.92	12.14	46.69	48.22	99.20	88.19
N_{40}	19.67	19.35	79.73	76.54	112.38	112.08
N_{80}	22.87	23.65	94.42	119.18	161.56	161.19
F. test	**	**	**	**	**	**
L.S.D. at 5%	0.14	0.13	1.34	2.44	1.62	1.11
Interaction Sign.:						
A x B	NS	NS	NS	NS	NS	NS
A x C	*	NS	NS	NS	NS	**
B x C	**	**	**	*	*	*
A x B x C	NS	NS	NS	NS	NS	NS

4. Interaction effect:

Data in Table 6 cleared that the interactions of A x B and A x B X C had insignificant effects during both seasons. Data also show that B X C had highly and significant effects on N-uptake values at all stages during both seasons.

V. UR% of applied nitrogen as affected by Nitrobin inoculation:

Data in Table 7 reveal the effect of N levels and Nitrobin inoculation treatment at harvest stage during the 1st and 2nd season of experimentation. It is clear that the UR values tended to decrease gradually due to the incremental doses of N fertilizer to the sandy soil of the experimental pots. The highest means of UR% were obtained as a result to the application of 20 mg N/kg soil. These values were 22.52 and 24.11% in the 1st and 2nd season, respectively. While, the suggested addition of Nitrobin improved these means slightly to be 24.18 and 24.12% in the two seasons, respectively. At the level of 40mg N/kg soil, the inoculation trial increased UR% by 7.17 and 4.6% in the two seasons, respectively. As N applied increased, up to 80 mg N/kg soil level, the UR% were improved only by 0.9 and 3.12% due to Nitrobin inoculation in the 1st and 2nd season, respectively.

Table 7. Utilization rate of applied nitrogen (%) as affected by N levels and Nitrobin inoculation at harvest stage during both seasons.

N	Uninoculation	Inoculation	Mean

level	1996/97	1997/98	1996/97	1997/98	1996/97	1997/98
N_0	--	--	--	--	--	--
N_{20}	22.52	24.11	24.18	24.12	23.35	24.15
N_{40}	19.24	18.71	20.62	19.57	19.93	19.14
N_{80}	11.75	14.67	11.85	15.13	11.80	14.90
Mean	17.84	19.16	18.88	19.61		

It could be concluded that the UR values tended to decrease due to the incremental doses of applied nitrogen under the conditions of this experiment. It is also worthy to note that Nitrobin inoculation has the efficiency to improve this percentage at all levels of nitrogen during both seasons. Recently, Ghanim (1998) came to the same conclusion and reported that microbial inoculation has a beneficial role in increasing the efficiency of the applied nitrogen fertilizer to rice fields.

VI. UR% of applied nitrogen as affected by organic manure treatments:

Data illustrated in Table 8 revealed that the organic matter applications to wheat crop under sandy soil conditions were more effective in increasing the UR% than microbial inoculation. In the 1st season, the highest value of UR (19.37%) was produced due to the use of FYM at the rate of 10g /kg soil. In the second season, TR_{10} manure produced the highest mean value of UR (23.02%), while the control treatment (without addition) gave the mean of 15.11%. In this case, the percent of increase in UR value due to TR_{10} treatment reached to 47.47% compared to the control.

It could be concluded that the use of microbial inoculation and OM management helped to reduce the potential for adverse environmental impacts of inorganic nitrogen in agro-ecosystem through its pronounced effect on improving UR% of applied nitrogen and consequently reducing the amount of leached nitrate in drainage water.

Table 8. UR% of applied nitrogen as affected by organic manure treatments at harvest stage during both seasons

N-levels O.M. treat.	N_0		N_{20}		N_{40}		N_{80}		Mean	
	1996/97	1997/98	1996/97	1997/98	1996/97	1997/98	1996/97	1997/98	1996/97	1997/98
Control	-	--	17.27	16.91	18.65	17.54	9.45	12.39	15.12	15.61
FYM 5g/kg soil	--	--	24.14	20.99	18.89	18.41	11.84	13.61	18.29	17.67
FYM 10g/kg soil	--	--	25.74	26.46	20.67	19.66	11.71	15.84	19.37	20.65
TR 5g/kg soil	--	--	23.18	25.63	19.34	19.21	12.31	15.06	18.28	19.97
TR10g/kg soil	--	--	26.18	30.58	10.81	20.88	13.71	17.59	16.90	23.02

Mean	--	--	23.35	24.15	19.93	19.14	11.80	14.90		

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إستخدام التسميد الحيوى والأسمدة العضوية لتقليل الآثار البيئية السلبية للنتروجين المعدنى فى البيئات الزراعية

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من المعروف أن نسبة كبيرة من النتروجين المعدنى المضاف للتربة يفقد فى صورة نترات خاصة عند إضافة معدلات زائدة للتربة٠ إمتصاص النبات للنترات لايتم بالسرعة الكافية للإستفادة من كل الكمية المضافة فى منطقة الجذور٠ تسمح السرعة النسبية المنخفضة للإستفادة من النترات بواسطة النبات لكمية كبيرة منها للغسيل من خلال الجذور للتلوث المائى الأرضى٠ عملية التأزت لأيونات الأمونيوم المدمصه على معقدات التربة الغروية تعتبر أيضا مصدر للنترات٠ تهدف هذه الدراسة للبحث عن طريقة لخفض هذا التأثير الضار مع العمل على زيادة القيمة الإقتصادية لوحدة النتروجين المضاف وذلك عن طريق إضافة المادة العضوية (مخلفات المدن - سماد المزرعة) وكذلك إستخدام السماد الحيوى (النتروبين)٠

أقيمت تجربتى أصص خلال الموسمين المتتالين ١٩٩٧/٩٦ و ١٩٩٨/٩٧ بمحطة البحوث الزراعية بالسرو - محافظة دمياط٠ إحتوى كل أصيص على ١٥ كجم تربة رملية تم الحصول عليها من منطقة الركبية٠ صممت التجربة بنظام القطع المنشقة مرتين حيث خصصت القطع الرئيسية المعاملات التسميد الحيوى (I_0, I_1) بينما خصصت القطع تحت الرئيسية لمعاملات التسميد العضوى (كنترول ، ٥ جم سماد مزرعة ، ١٠ جم سماد مزرعة - ٥ جم سماد مخلفات مدن ، ١٠ جم من سماد مخلفات المدن / كجم تربة)٠ كانت القطع تحت تحت الرئيسية مخصصة لمعاملات التسميد النتروجينى صفر ، ٢٠ ، ٤٠ ، ٨٠ مللجم نتروجين / كجم تربة٠ العدد الكلى للمعاملات ٤٠ معاملة وعدد المكررات ٥ بحيث كان العدد الكلى للأصص فى التجربة ٢٠٠ أصيص٠

ويمكن تلخيص أهم النتائج فيما يلى:-

التسميد الحيوى لحبوب القمح بالنتروبين قبل الزراعة وإضافة الأسمدة العضوية كان له تأثير معنوى فى زيادة متوسط محصول المادة الجافة (جم/نبات) خلال موسمى النمو٠

حدث إنخفاض معنوى فى تركيز النترات والأمونيوم المغسولة إلى الماء الأرضى نتيجة للمعاملات السابق ذكرها٠

لوحظ زيادة معنوية فى كمية النتروجين الكلية الممتصة بواسطة نباتات القمح نتيجة لكل من التسميد الحيوى وإضافة الأسمدة العضوية٠

كان أعلى معدل للإستفادة من النتروجين المعدنى تحت ظروف التسميد العضوى.

عموماً النتائج المتحصل عليها توضح أهمية التسميد الحيوى والتسميد العضوى لتقليل الآثار البيئية السيئة للسماد النتروجينى فى البيئات الزراعية٠