A RESEARCH ON THE UREA HYDROLYSIS RATE IN THE SOILS OF THRACE REGION

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Manuscript received: February 10, 2005; Reviewed: April 15, 2005; Accepted for publication: April 27, 2005

ABSTRACT

It seems that urea fertilizers have advantages over ammonium nitrate fertilizers in terms of leaching losses when they are applied in February. On the other hand, the losses from the urea fertilizers in the form of NH_3 gas when they are applied in February which is damp and cool, may be considered to be non significant, which becomes a profound idea. Conducting field trials on the investigation of suitable time and rate of urea fertilizers application may be suggested a way to be followed. According to the diagnosis from the research, hydrolyse of urea is bound to features of the soil. In the beginning of the incubation for the fact hydrolysis of urea is fast that features of soil. Dry wheat agriculture which takes major part in our agriculture, urea's progress of hydrolysis ensure suitable and balanced fertilizing and also ensure the amount and quality of crop increase in a field. It has to be emphasized with processing of an adequate and balanced program of fertilizing is useful both our economy and environment.

KEYWORDS: Nitrogen, urea, hydrolysis of urea, incubation

INTRODUCTION

Cereals are very important in Turkey's agricultural production. Cereal production is made in about 80 % of agriculture lands which are used in Turkey and wheat production is made in about 65 % of these lands [1]. One of the plants that takes the first place in Turkey's nutrition is the wheat. In Thrace region, wheat is sowed in about 680 000 ha, it is produced about 2.5 million ton and its average of yield which is taken from one hectare is 2130 kg. As it is seen, the wheat yield that is taken in one hectare in Thrace region is higher 80 % proportion than Turkey's average [2].

According to FAO data world fertilizer consumption increased from 31.2 million ton in 1961 to 137.7 million ton in 2001. Nitrogenous fertilizer comprised 60 % of total fertilizer consumption with 82 million ton. The amount utilized by America, Asia and Europe accounts for 94 % of world fertilizer consumption. Fertilizer consumption of Turkey increased from 0.07 million ton in 1961 to 1.7 million ton in 2001 (1.2 % of world total consumption). In Turkey, nitrogenous fertilizer comprises 65 % of total fertilizer consumption [3].

Urea consumption began to increase relatively in Turkey in 2000 years. In Thrace agriculture region, annual average nitrogenous fertilizer is consumed mostly in Tekirdag province (38 910 ton) [4]. Urea consumption began to increase relatively in Turkey in 2000 years. In Thrace agriculture region, annual average nitrogenous fertilizer is consumed mostly in Tekirdag during 1972-2000 (38 910 ton). In Turkey urea fertilizer is consumed 95 958 ton in 2000, 207 013 ton in 2001, and 537 086 ton in 2002 [5].

It is not possible to keep the nitrogenous fertilizer in the soil or store it in order to use in next years, because of chemical features of nitrogenous fertilizer. Nitrogen is a nutrient element which should be applied to soil every year. If nitrogenous fertilizer isn't applied to soil, existing natural organic substance in soil is exhausted in 40-50 years [6].

According to Aydemir [7], nitrogen which is applied to soil with fertilizer is taken by the plants about 50 % in first year, its 30 % is fixed by micro organism, its 15 % is lost by denitrification and its 5 % is lost by leaching.

Alpaslan [8] made incubation trials in 30 soil samples that belong to Konya and Nigde locations, and he applied 500 ppm nitrogen to each soil as urea form and it was applied as solution. In soil samples which were taken from incubation in 0, 7th, 14th and 28th days, ammonium-N, nitrate-N and urea were determined, their relationship with the soil samples were investigated. At the en of the experiment, it was observed that ammonium nitrogen of soils increased depending on the process of incubation up to 14th day it decreased in 28th day and nitrate nitrogen soils generally increased.

According to the results that were taken from the research related to the subject; after the urea added in 5 days, 80 % of urea nitrogen was hydrolysed and urea nitrogen decreased to 1-2 mg kg^{-1} in 11 days, but NH_4 and NO_3 nitrogen increased. Soil analyses after 11 days showed that, mineral-N and total nitrogen were significantly higher in urea treatments than in those with ammonium sulphate. It was explained that urea hydrolysis was on important factor to decrease the loss of ammonium [9].

Bremner and Douglas [10] who made a lab experiment about this subject explained that the nitrogen of urea lost as NH_3 in the proportion of 4.6-61.1 % (average 21.2 %) at the end of 14 days incubation. The researchers informed that using urea instead of urea-phosphate has more advantages and it delays the hydrolysis of urea, what's more it lessens possible NH_3-N losses.

Martens and Bremner [11] applied urea in 20 soil samples; soils were left to incubation in 30 ^oC through 10 days. At the en of the research, they found that there was 0-65 % loss with the urea application and there was 14 % NH_3 loss.

According to Allison [12], some parts of nitrogen in nitrogenous fertilizer which is applied to the soil, are lost in the manner of ammonia flying and this amount goes up to 50 % in some situations. These nitrogen losses are related to the amount of $CaCO_3$ in the soil, pH of soil, the king of applied fertilizer, the nitrogen concentration of applied fertilizer, the application form of fertilizer and some other features of soil.

Karaca et al. [13]; have experimented the soils in 28 days incubation in order to research urea-enzyme activity effect in CO_2 exit and nitrogen mineralization. At the en of the research, depending on the incubation process in the soil in which urea is added have more 5 times NH_4-N and 4 times NO_3-N than in the soils that urea isn't added.

The hydrolysis time has been investigated with this study for the soils which have different features. Some physical and chemical features of soils were taken into consideration in order to determine urea's application time and the factors that effect urea's hydrolysis were taken into evaluation. When hydrolysis process of urea fertilizer which was applied to the soils was investigated, through 14 days incubation, it was aimed to determine nitrogen amount which was hydrolyzed in applied urea.

MATERIAL AND METHODS

The soil samples which were used in investigation were collected from different parts of the Thrace Region,

Turkey. With this aim, the soil samples were taken 0-20 cm depth and 20 soil samples were used in research in order to represent all soils of Thrace Region.

Climatic data of Tekirdag were taken from Tekirdag Meteorology Head Office [14]. These data are long years averages registered up to 2003. According to this; annual average temperature is 13.8 °C, average rainfall total is 580.6 kg/m^2, average atmospheric pressure is 1015.9 hPa and average relative humidity is 77.6 %.

Establishing of Incubation Experiment: The experiment was made in 3x3x2 factor organization as 2 repetitions [15]. The procedures that were followed in experiment establishment and in other processes were carried out according to principals who were assigned by Saglam [16]. In lab experiment 46.62 % urea was applied in 200 kg N/ha as solution in these soils. The soil samples were air-dried in air and 10 gram of this soil (passed through a 2-mm sieve) was mixed with 30 gram of quartz sand which was washed and sieved from 30-60 mesh-sieves. They were mixed in special containers with cover. The urea fertilizer was applied to experiment containers with 6 ml water and 10 gram soil. After this process, the surfaces of these containers which had urea soil samples were closed with stretch film. The same processes were made for the control group samples that didn't contain urea. Both of these samples that contained urea and no-urea were subjected to 14 days incubation in 30 °C. Later nitrogen {(NH_4+NO_3+NO_2)-N, mg kg^{-1}} analyses were made in both two groups soil samples through 2 weeks. The hydrolysis proportion of urea and its change in the soil were investigated.

Chemical analyses: Soil texture was determined following Bouyoucos hydrometer method [17]; pH in a soil:water (1:2.5) mixture with a pH meter [18]. The electrical conductivity has been determined in the same mixture prepared for the determination of pH value [19]. Organic matter by Smith-Weldon method; exchangeable cations; cation exchange capacity, plant available P by sodium bicarbonate blue-colour method; the variable nitrogen of ammonium has been determined through modified Kjeldahl Method with an addition of 0.2 g MgO; the modified Kjeldahl Method with an addition of 0.2 g Devarda's alloy has determined the nitrogen of nitrate and the total nitrogen has been determined with the modified Kjeldahl Method after wet burning with sulphuric acid [20]; lime with a volumetric calcimeter [21].

Calculations and statistical analysis: Data were statistically analysed (correlation and LSD) using TARIST programme. Least significant differences LSD were used to compare significant differences at the 99 % confidence level among treatments. [22].

Rate of the nitrogen hydrolysed from urea: 14. day of incubation nitrogen hydrolysed from urea sum of mineral nitrogen {(NH_4+NO_3+NO_2)-N, mg kg^{-1}}is counted by ratio with the formula below.

$$\text{UHR (\%)} = \frac{b}{a} \times 100$$ Here;

UHR: Rate of the nitrogen hydrolysed from urea, %

a: Amount of nitrogen in the state of urea given to the soil, mg kg^{-1}

b: Amount of nitrogen hydrolysed from urea {(NH_4+NO_3+NO_2)-N}, mg kg^{-1}

RESULTS AND DISCUSSION

Some physical and chemical characteristics of soil samples are given in Table 1. Soil samples' pH values between 5.10 and 8.00. When research % of salt all soils are in the class of salt less. Content of the soil samples $CaCO_3$ (%) differs from % 0.00 to % 24.12. A solution of this research shows that 90 % of the soils are poor in the mean of organic materials. Soil samples' capacity of exchange in cation (CEC) differs from 10.66 me/100 g to 47.14 me/100 g. Content of phosphorus of the soils are between 5.03 mg kg^{-1} and 75.72 mg kg^{-1}. According to the results, 45 % of the soils are rich in phosphorus. Amount of total nitrogen is between 500.84 mg kg^{-1} and 1040.04 mg kg^{-1}. Changeable content of potassium is between 0.16 me /100 g and 1.13 me/100. Changeable content of sodium is between 0.07 me/100 g and 0.72 me/100 g. Changeable content of Ca+Mg between 12.72 me/100 g and 45.64 me/100 g. Average changeable cation distribution is in queue of Ca+Mg > K > Na. These are all verified by Usta [23].

Hydrolysed nitrogen ratios from urea practiced on soils: In this research, values related to hydrolysed nitrogen ratios from urea practiced on soils is shown in Figure 1. Total transformation of nitrogen in the first day of incubation is between 23.97-60.57 %, 7th day between 44.99-78.25 % and the last day (14th) between 22.66-60.59 %. When we check these, from the first day until the 7th day hydrolysed nitrogen from urea increases after the 7th day till the end once again decreases. Same results are also obtained by Alpaslan [8].

Throughout the incubation increase of ammonium nitrogen is mineralized according to the urea due to the time is declared [24].

$$CO(NH_2)_2 + 2H_2O \rightarrow (NH_4)_2CO_3$$

$$(NH_4)_2CO_3 + H_2O \rightarrow 2NH_3 + 2H_2O + CO_2$$

When check the total transformation ratio of nitrogen, in

Table 1. Some physical and chemical properties of the soils samples

Soil No	pH (1/2,5 H_2O)	% Salt	% $CaCO_3$	% Org. Matter	CEC me/100 g	P mg kg^{-1}	Total N mg kg^{-1}	Exchangeable Cations me/100 g			Structure			
								Na	K	Ca+Mg	%Clay	%Silt	%Sand	Class
1	7,48	0,03	1,45	1,52	34,63	31,58	777,51	0,17	0,38	34,08	35,86	22,80	41,34	CL
2	6,26	0,02	0,32	1,16	30,93	27,97	714,90	0,16	0,41	30,36	37,80	17,62	44,58	CL
3	6,70	0,03	0,77	1,40	32,63	23,76	799,72	0,23	0,48	31,92	42,20	17,76	40,04	C
4	6,05	0,03	0,00	1,63	25,39	48,05	805,78	0,14	0,36	24,89	20,96	13,47	65,57	SCL
5	7,40	0,02	1,40	1,89	36,58	6,32	926,95	0,21	0,64	35,73	37,90	15,79	46,31	SC
6	5,26	0,03	0,00	0,88	10,66	75,72	504,87	0,22	0,72	12,72	11,09	9,34	79,57	SL
7	7,77	0,03	4,14	2,28	35,13	11,13	1021,87	0,09	0,50	34,54	41,80	26,59	31,61	C
8	7,61	0,03	7,62	1,17	32,17	8,72	686,63	0,26	0,64	31,27	43,96	24,55	31,49	C
9	5,83	0,01	0,00	0,91	17,15	15,09	547,28	0,13	0,32	16,70	18,47	23,83	57,70	SL
10	5,10	0,01	0,00	1,30	24,00	5,03	561,42	0,07	0,16	23,77	23,60	11,74	64,66	SCL
11	6,05	0,01	0,00	0,85	26,14	27,42	500,84	0,10	0,21	25,83	24,76	11,86	63,38	SCL
12	6,58	0,01	0,21	1,22	25,76	26,47	597,77	0,26	0,33	25,17	29,11	24,30	46,59	SCL
13	7,70	0,03	1,73	2,30	40,40	9,93	1040,04	0,72	0,34	39,34	35,35	26,41	38,24	CL
14	7,15	0,03	1,34	1,07	28,35	19,55	593,71	0,10	0,18	28,07	31,14	20,16	48,70	SCL
15	5,50	0,01	0,00	1,11	17,11	46,03	569,50	0,07	0,25	16,79	16,40	7,69	75,91	SL
16	6,35	0,01	0,48	1,55	36,43	30,08	773,47	0,24	0,41	35,78	39,51	18,55	41,94	CL
17	6,16	0,01	0,10	1,32	23,66	5,79	751,25	0,10	0,29	23,27	20,76	29,62	49,62	L
18	8,00	0,04	24,12	1,58	47,14	17,74	861,66	0,37	1,13	45,64	53,34	20,66	26,00	C
19	7,45	0,03	8,00	1,60	25,12	16,85	783,57	0,19	0,73	24,20	41,85	26,38	31,77	C
20	7,40	0,03	2,80	1,15	25,55	19,85	686,63	0,11	0,26	25,18	27,21	22,06	50,73	SCL
Min.	5,10	0,01	0,00	0,85	10,66	5,03	500,84	0,07	0,16	12,72	11,09	7,69	26,00	
Max.	8,00	0,04	24,12	2,30	47,14	75,72	1040,04	0,72	1,13	45,64	53,34	29,62	79,57	

Table 2. Relation between amounts of nitrogen hydrolysed from urea in three period of incubation and some physical and chemical features of soil

Soil Properties	$(NH_4+NO_3+NO_2)$-N, mg kg^{-1}		
Days	1st	7th	14th
Sand (%)	-0.629**	-0.244 ns	-0.223 ns
Clay (%)	0.700**	0.282 ns	0.215 ns
Silt (%)	0.286 ns	0.093 ns	-0.044 ns
Organic Matter (%)	0.272 ns	0.365 ns	0.271 ns
pH	0.464*	0.321 ns	0.402 ns
Lime (%)	0.669**	0.356 ns	0.588**
CEC (me/100 g)	0.655**	0.316 ns	0.269 ns

*: 0.05 significant **: 0.01 significant ns: non significant

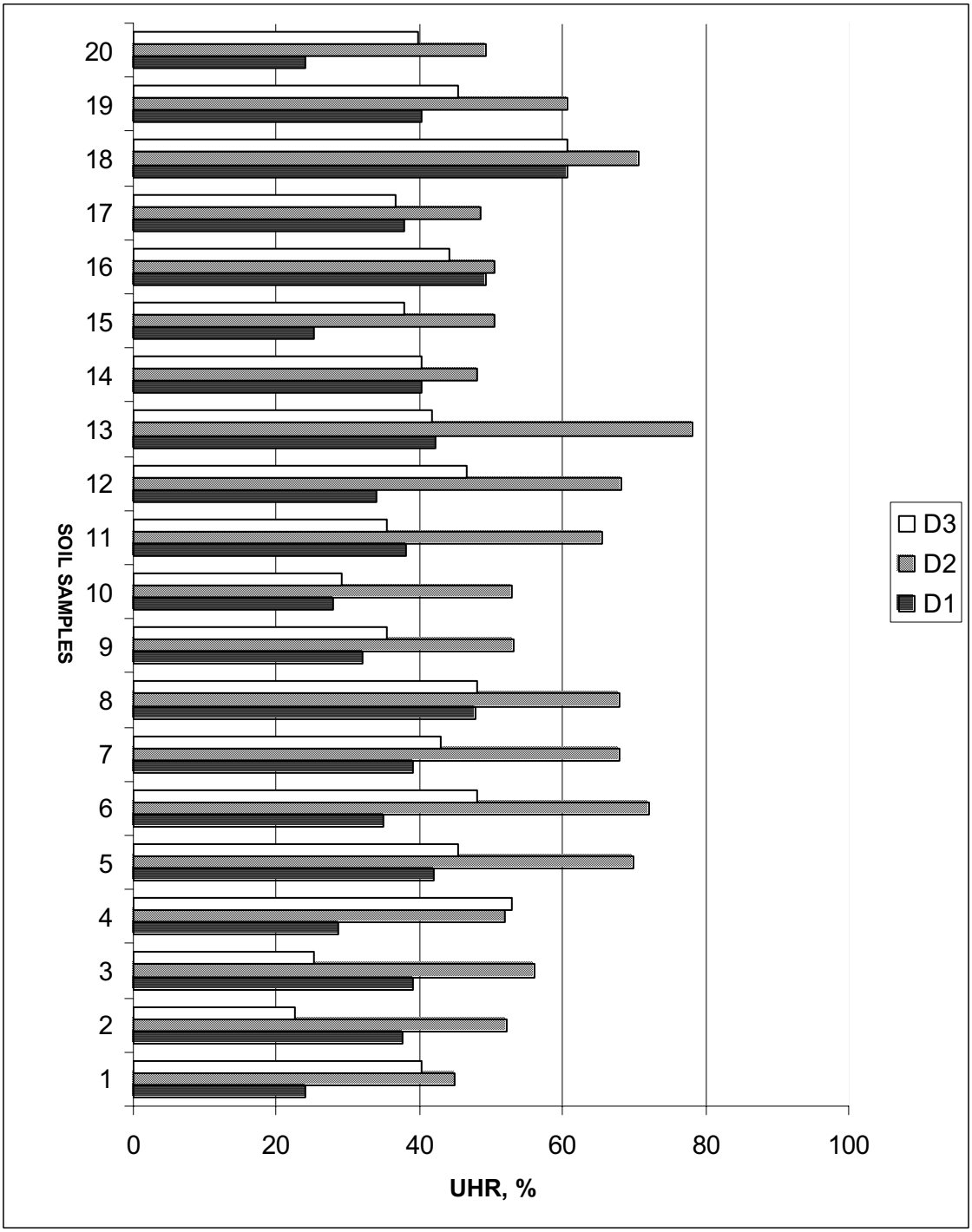

Figure 1. Three different period (D1= 1st day, D2= 7th day and D3= 14th day) hydrolysis urea nitrogen ratios (UHR, %)

the beginning it is seen hydrolysed urea was very fast. In most of the soils averagely until the 7th day hydrolyse increase then slow down. In first days affect of soil features on hydrolyse is densely is considering to be the reason of this condition. Most of researchers on this matter is claimed that hydrolyse of urea is bound to the features of the soil [8, 11, 13]. Soil cation exchange capacity affects transformation of nitrogen and loss of ammonia. As a general rule when the capacity of exchange of cation is increase, ammonia nitrogen loss is decrease.

Relation between nitrogen hydrolysed from urea and soil features: Relation between amount of nitrogen hydrolysed from urea in three period of incubation {(NH_4+NO_3+NO_2)-N, mg kg^{-1}} and some physical and chemical features of soil (sand, clay, silt, organic matter, pH, lime and CEC) are shown in Table 2. These statically relations are true for 20 soil samples.

When we check relation between amount of nitrogen hydrolysed from urea in three period of incubation {(NH_4+NO_3+NO_2)-N, mg kg^{-1}} and some physical and chemical features of soil generally the first day with clay, pH, lime and CEC significant and positive, with sand significant and negative relations occured.14th day of incubation only significant relations occurred with lime.

Nitrogen amount for 1st, 7th and 14th in incubation {(NH_4+NO_3+NO_2)-N, mg kg^{-1}} and (%) sand there is a negative relation. (%) clay, organic matter (%), pH, lime (%) and CEC (me/100 g) there is a positive relation. But amount of silt (%) and nitrogen {(NH_4+NO_3+NO_2)-N, mg kg^{-1}} in between 1st and 7th day there is a positive relation and 14th day of incubation there is negative relations.

Nitrogen amount in the incubation's first day {(NH_4+NO_3+NO_2)-N, mg kg^{-1}} and sand there is a negative relation (r = -0.629**) and this solution is significant (P<0.01). Nitrogen amount in the incubation's 7th and 14th day nitrogen amount in the incubation's {(NH_4+NO_3+NO_2)-N, mg kg^{-1}} and soil's sand amount negative and non significant relation statically. Nitrogen amount in the incubation's first day {(NH_4+NO_3+NO_2)-N, mg kg^{-1}} and amount of clay there is a positive relation in the state of r =0.700 this is statically important (P<0.01). Nitrogen determined in 1st, 7th and 14th day of incubation {(NH_4+NO_3+NO_2)-N, mg kg^{-1}} and relation between silt (r = 0.286, r = 0.093 and r = -0.044, respectively) statically non significant.

Nitrogen determined in 1st, 7th and 14th day of incubation {(NH_4+NO_3+NO_2)-N,mg kg^{-1}} and relation between organic matters (r = 0.272, r = 0.365 and r = 0.271, respectively) statically non significant. Nitrogen determined in first day of incubation {(NH_4+NO_3+NO_2)-N, mg kg^{-1}} and pH values there is a positive relation and this is statically significant (P<0.05). When soil's pH increase also the amount nitrogen formed by the hydrolysed of urea {(NH_4+NO_3+NO_2)-N} is increase.

Nitrogen determined in 1st and 14th day of incubation {(NH_4+NO_3+NO_2)-N, mg kg^{-1}} and amount of lime (%) there is a positive relations r = 0.669 and r = 0.588 this is statically significant (P<0.01). Co efficiency of correlation in incubation's 7th day is r = 0.365 this is statically non significant.

Nitrogen determined in first day {(NH_4+NO_3+NO_2)-N, mg kg^{-1}} and CEC (me/100 g) relation is positive r = 0.655 it is statically significant (P<0.01), when one of them increase the other also increase. Co efficiency of correlation in incubation's 7th and 14th day is r = 0.316 and r = 0.269 it is statically non significant.

According to relation between nitrogen values hydrolysed from urea some physical and chemical features of soil, in the beginning hydrolyse is very fast for this reason effect on hydrolyse features of soil is very important. This circumstance can easily be seen in the statically relations in first day of incubation. But 7th and 14th day of incubation effect on hydrolyse features of soil decreases and except lime with all the other features of soil statically any significant relations couldn't be obtained. The fact 14th day of incubation relation between nitrogen hydrolysed from urea and lime in the soil is statically significant r = 0.588** that the soil's lime ratio is differ from % 0.00 to % 24.12.

It can be clearly seen both statically relations and measurable value of nitrogen. In sandy soils the hydrolysis of urea is very slow. It is estimated that urea enzyme activation is slow. Amount of pH, clay, lime and CEC affect hydrolysis of urea positively.

As a conclusion in all regions of Turkey climate and soil features are different. Holding .this kind of researches in all the region of Turkey will be useful to ensure preventing environmental pollution and loss of nitrogen. In spite of the erroneous fertilizing that doesn't basis scientific data, to use the optimum agricultural potential and input, minimize the losses, both protecting environment and health, habit of using more than needed and wrong fertilizing must be given up. This researches result can be source for this kind of project both in field and in greenhouse conditions.

ACKNOWLEDGEMENTS

This research was supported by Trakya University (Project Number: TUBAP-577). This research is a part of Ph. D. Thesis.

REFERENCES

[1] Güneş, A., Alpaslan, M., Karaman, M.R, Yalvaç, K. and Yazar, S., Evaluation of nitrogen, phosphorus, potassium, boron, zinc nutritional status of wheat grown in Ankara district with soil and plant samples. Journal of the Agricultural Faculty of Gaziosmanpaşa University, Tokat, (2003) 20 (1): 149-155.

[2] Süzer, S., The effect of fertilizer application and plant nutrition deficiency in wheat grain. Journal of Marmara Agricultural, (1994) 59: 42-44.

[3] Güler, S., Fertilizer consumption status in World and Turkey. Third National Congress of Fertilizer. Agriculture-Industry-Environment, Tokat, 11-13 October 2004, 47-54.

[4] Eyüpoglu, F., Fertilizer required, consumption and future for Turkey. General Directorate of Rural Services. Soil and Fertilizer Research Institute. Technical Publication Number: T-2, General Publication Number: 2, Ankara, 2002.

[5] Anonymous, Statistical Yearbook of Turkey, 2779, Ankara, 2002.

[6] Bayraklı, F. and Balkaya, N., Application of phosphorus and nitrogenous fertilisers, fertilizer-environment interactions. Agricultural Environment and Water Pollution Symposium. Ministry of Agriculture and Village Work, General Directorate of Conservation and Control Services Publications, Ankara, 2000.

7] Aydemir, O., Fertilizers and enviromental pollution. Atatürk Univ. Journal of the Faculty of Agriculture, Erzurum. (1979)10 (3-4): 189-197.

[8] Alpaslan, M., The effect of urea application on the urease activity, nitrate and ammonium transformation in soils. Ankara Univ. Agric Fac. Journal of Agricultural Sciences, Ankara, (2000) 4:49-56.

[9] Matar, Y. and Doering, H.W., Transformation of urea and ammonium sulphate in sand loam soils of Tripoli, Libya. Water and fertilizer use for food production in arid and semi-arid zones. 3rd CIEC Symposium, Vienna, 1979, 285-288.

[10] Bremner, J.M. and Douglas, L.A., Decomposition of urea phosphate in soils. Soil Sci. Soc. Amer. Proc. (1971) 35: 575-578.

[11] Martens, D.A. and Bremner, J.M., Soil properties affecting volatilization of ammonia from soils treated with urea. Communications in Soil Science and Plant Analyses, (1989) 20 (15-16): 1645-1657.

[12] Allison, F.E., The enigma of soil nitrogen balance sheets. Advances in Agronomy (1955) VII: 231-250.

[13] Karaca, A., Baran, A. and Haktanır, K., The effect of compaction on urease enzyme activitiy, carbon dioxide evaluation and nitrogen mineralization. Turk J Agric. (2000) 24: 437-441.

[14] Anonymous, Climatic data of Tekirdağ province. Turkish State Meteorological Service, Directorship of Tekirdag, 2004.

[15] Düzgüneş, O., Kesici, T., Kavuncu, O. and Gürbüz, F., Methods of research and experiment (Statistics Methods-II) Ankara Univ. Agric. Fac. Number: 1021, Study Book Number: 295, Ankara, 1987.

[16] Saglam, M.T., Analyses of some nitrogen forms and nitrogen suitability index. (Editor: J.M. Bremner, "methods of soil analyses"). Atatürk Univ. Publ., 523, Translation Series: 18, Erzurum, 1979.

[17] Tüzüner, A., Handbook of soil and water analyses. Ministry of Agriculture and Village Work, General Directorate of Rural Services, Ankara, 1990.

[18] Bayraklı, F., Analyses of plant and soil. Nineteen May Univ. Agric Fac. Samsun, Turkey. 1986.

[19] Tuncay, H., Quality of water (First Edition). Ege Univ. Agric. Fac. Publ.: 512, Bornova-Izmir, 1994.

[20] Saglam, M.T., Methods of soil and water analyses. Trakya Univ. Agric. Fac. Publ., 189, Tekirdag, 2001.

[21] Gedikoglu, İ., Methods of laboratory analyses for used soil fertility. General Directorate of Rural Services. Rural Services Sanlıurfa Research Institute. Technical Publication Number: 11, General Publication Number: 55, Sanlıurfa, 1990.

[22] Açıkgöz, N., Akkaş, M.E., Moghaddam, A., and Ozcan, K., TARIST: Special package PC program is used to count statically analyses. Selcuk Univ., Computer Research Services. International Symposium on Computer Application, 19 October, Konya, 1993.

[23] Usta, S., Soil Chemistry. Ankara Univ. Agricultural Faculty, Publication, 401, Ankara, 1995.

[24] Aktaş, M., Plant feeding and soil fertility. 3rd Edition, Ankara Univ. Agrig Fac. Publ., Ankara, 1429, 1995.