

Determination of the Utilization of Nitrogen From Tobacco Waste By Wheat Crop With ¹⁵N Tracer Technique*

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Received: 07.01.1997

Abstract: The field experiment was laid out with randomized block design with split plot and three replications during the 1991-92 years. Each plot was 16 m². Tobacco-waste at the rates of 0, 10, 20, 30 and 40 tons/ha were applied to the plots and Bezostiya wheat variety was sown in 23rd October, 1991. Nitrogen as (NH₄)₂SO₄ at the rates of 0, 20, 40, 60 and 80 kg N/ha was applied to the plots in 31st March, 1992. The rates of 20 and 80 kg N/ha were only labelled with ¹⁵N at 10% atom excess because of their high cost under field conditions. Wheat crop was harvested in 13th July, 1992. Straw and grain yield were recorded. The straw and grain were analysed for total N and ¹⁵N by emission spectrophotometry.

According to the results of this research, increasing tobacco-waste and nitrogenous fertilizers have important effect on the yield, N content and N uptake of wheat crop. The % Ndff (nitrogenous fertilizer) increased from 6.14 to 19.03 at 20 and 80 kg N/ha respectively for wheat straw. The % Ndf (Tobacco-waste) was 12.49, 26.45, 34.01 and 33.86 (as the mean of 20 and 80 kg N/ha rates) at 10, 20, 30 and 40 tons/ha T.W rates, respectively. The percent N utilization of nitrogen fertilizer (N.F.) decreased from 13.50 to 10.90 at 20 and 80 kg N/ha rates, respectively. The percent utilization of T.W was 1.86, 3.24, 2.55 and 2.74 (as the mean of 20 and 80 kg N/ha rates) at 10, 20, 30 and 40 tons/ha rates respectively. In wheat grain, the percent N utilization of nitrogen fertilizer (N.F.) decreased from 40.60 to 38.40 at 20 and 80 kg N/ha, respectively. The percent utilization of T.W decreased from 16.53 (control) to 8.97 (40 ton/ha).

Buğday Bitkisinin Tütün Artığındaki Azottan Yararlanmasının ¹⁵N Tekniği Kullanılarak Belirlenmesi

Özet: Tarla koşullarında yürütülen bu araştırma, 1991-92 yılları arasında tesadüf bloklarında bölünmüş parseller deneme desenesine göre ve üç tekerrürlü olarak kurulmuştur. Her parselin büyüklüğü 16 m² olarak belirlenmiştir. Tütün tozu 0, 10, 20, 30, 40 ton/ha düzeylerinde parsellere uygulanmış ve Bezostiya çeşidi buğday bitkisi ekilmiştir (23.10.1991). (NH₄)₂SO₄ formunda azotlu gübre 0, 20, 40, 60 ve 80 kg N/ha dozlarında 31.3.1992 tarihinde parsellere uygulanmıştır. Buğday bitkisi 13.7.1992 tarihinde hasat edilerek sap ve dane verimleri kaydedilmiştir. Sap ve denemelerde toplam azot ve ¹⁵N analizleri emisyon spektrofotometrede belirlenmiştir.

Araştırma sonuçlarına göre, artan tütün tozu düzeyi ve azotlu gübreleme buğday bitkisinin sap ve dane verimi ile N kapsamı ve sömürülen N miktarına önemli etkide bulunmuştur. Azot dozunun 20'den 80 kg N/ha'a yükselmesi ile birlikte buğday saplarında % Ndff (gübre gelen azot) oranı ise 10, 20, 30 ve 40 ton/ha dozlarına bağlı olarak 12.49, 26.45, 34.01 ve 33.86 (20 ve 80 kg N/ha ortalaması olarak) sırasını izlemiştir. Azotlu gübredeki N'dan yararlanma oranı sırasıyla 20 ve 80 kg N/ha dozlarında %13.50'den %10.90'a düşmüştür. Tütün tozundaki azottan yararlanma oranı ise 10, 20, 30 ve 40 tons/ha dozlarına bağlı olarak sırasıyla %1.86, 3.24, 2.55 ve 2.74 (20 ve 80 kg N/ha ortalaması olarak) olmuştur. Buğday danelerinde ise azottan yararlanma oranı azotlu gübrelemeye bağlı olarak sırasıyla % 40.60 (20 kg N/ha) ve 38.40 (80 kg N/ha), tütün tozuna bağlı olarak ise % 16.53 (kontrol) ve 8.97 (40 ton/ha) arasında değişmiştir.

Introduction

The most important development of the recent years is continuousness of the environmental pollution. The industrial development has caused the effluent or residue problems, that should be minimized in order to protect the environment residue problems, that should be

minimized in order to protect the environment. Tobacco-waste or residues obtained during the manufacturing of cigarette from cigarette industries could create problems for the environment if they are not disposed off or not used in agricultural practices as organic fertilizer (1, 2).

About 60 000 - 65 000 tons of tobacco-leaves are

* This research work was sponsored by State Planning Commission of Turkey and presented in XXVth Annual Meeting of ESNA in Italy, September 15-19, 1995.

used for cigarette factories in Turkey. As reported by the factor authorities about 10% of the waste is produced during cigarette manufacturing. This means a waste of 6000-6500 tons is produced which needs disposal for cleaning the environment (3). In addition to this, Turkish Monopoly Authorities make huge stocks of tobacco leaves for the consumption of the factories. While doing this they also purchase low quality tobacco-leaves so as to support the farmers. Then after, these low grade tobacco-leaves are being disposed of by burning (4).

The main object of the study was to evaluate the possibility of tobacco-waste as organic fertilizer especially for N source, for this purpose, N recovery by wheat plant was determined by using ¹⁵N tracer technique. Efficiency of N utilization by wheat plant mainly depends on fertilizer type and rate together with other factors. In this study, there are three nitrogen sources (soil, tobacco-waste, nitrogenous fertilizer). ¹⁵N tracer technique enabled the determination of the percent utilization of nitrogen derived from tobacco-waste by wheat plant when both tobacco-waste and N-fertilizer were applied to the experimental soil.

Materials and Method

The field experiment was laid out with randomized block design with split plot and three replications during the 1991-92 years. Each plot was 16 m². Tobacco-waste at the rates of 0, 10, 20, 30 and 40 tons/ha was applied and mixed with soil in 27th August, 1991. Bezostiya wheat variety was sown in 23rd of October 1991. Phosphorus at the rate of 80 kg/ha as triple superphosphate was applied to the all plots. Nitrogen at the rates of 0, 20, 40, 60 and 80 kg/ha as (NH₄)₂SO₄ was applied in 31st March 1992. The rates of 20 and 80 kg N/ha were labelled with ¹⁵N at 10% atom excess as (NH₄)₂SO₄. The labelled plot size was 0.80 m². For the highest rate of 80 kg N/ha, half of it was labelled and half of it was unlabelled (NH₄)₂SO₄. The wheat crop was harvested in 13th of July 1992. Straw and grain yield were recorded and analysed for total N by kjeldahl method (5) and ¹⁵N by Jasco emission spectrophotometry by Turkish Atomic Energy Centre in Ankara (6). Calculations as regarding ¹⁵N were made as below;

%At. Exc.= It was determined by ¹⁵N emission spectrophotometry

$$\% \text{Ndf} = \frac{\% \text{ } ^{15}\text{N at.exc (plant)}}{\% \text{ } ^{15}\text{N at.exc (soil)}}$$

$$\% \text{Ndf (T.W)} = \frac{\% \text{Ndf} \times \text{A value}}{\text{Applied nitrogen, kg N/ha}}$$

$$\text{A value} = A_{\text{soil+T.W.}} - A_{\text{soil}}$$

$$\% \text{N utilization from fertilizer} = \frac{\text{N-uptake} \times \% \text{Ndf}}{\text{Applied nitrogen, kg N/ha}}$$

$$\% \text{N utilization from T.W} = \frac{\text{N-uptake} \times \% \text{Ndf} \times \text{W}}{100} \times 100$$

Tobacco-waste (T.W), kg/ha

Tobacco waste contains 2.23% total N. Therefore, for example, tobacco-waste-N for 10 ton/ha T.W. rate was calculated as 10x2.23/100=223 kg/ha.

The field soil used in this experiment was silty-loam in texture with 35.07, 29.27 and 35.64 percent clay, silt and sand contents respectively. The soil is of 31.74% of field capacity and 10.30% of CaCO₃. The organic matter content is 1.48%. The pH and EC were 7.62 and 0.340 mmhos/cm. The cation exchange capacity was 19.63 me. 100 grams/soil. The available amounts of P and K measured were 165 kg P₂O₅/ha and 702 kg K₂O/ha, respectively. Total N contents of the soil and tobacco-waste are 0.074 and 2.23%, respectively.

Results and Discussion

Straw and grain yields of wheat crop

The effect of tobacco-waste together with N fertilization on the straw yield of wheat crop is given on Table 1.

As it is seen on table 1, tobacco-waste and N-fertilizer applied at different rates significantly (P<0.01 level) increased the straw weight of wheat crop. N fertilizer and tobacco-waste interaction was found non-significant statistically. The straw yield was increased from 10.32 tons/ha (control) to a maximum of 14.79 tons/ha (40 tons T.W/ha). The treatment of 30 and 40 tons T.W/ha fell under the same group according to the Duncan's test. Similar results have been obtained by other workers (1, 2).

Nitrogen rates increased the straw weight of wheat from 10.27 tons/ha (control) to a maximum of 13.99

| Tobacco Waste (tons/ha) | Nitrogen, kg/ha | | | | | Av.** |
|-------------------------|-----------------|-----------------|---------|---------|-----------------|---------|
| | 0 | 20 ⁺ | 40 | 60 | 80 ⁺ | |
| 0 | 7.38 | 9.47 | 10.48 | 12.14 | 12.13 | 10.32 b |
| 10 | 10.03 | 10.16 | 11.71 | 12.73 | 12.75 | 11.48 b |
| 20 | 10.69 | 11.55 | 12.88 | 11.90 | 12.93 | 11.99 b |
| 30 | 11.31 | 12.73 | 14.99 | 15.95 | 15.59 | 14.11 a |
| 40 | 11.92 | 13.35 | 15.47 | 17.21 | 16.02 | 14.79 a |
| Av.** | 10.27 c | 11.45 b | 13.11 a | 13.99 a | 13.88 a | |

Table 1. Straw yield of wheat crop affected by T.W. and N-fertilizer (ton/ha).

+, ¹⁵N labelled N rates, **, Significant at 1% level statistically N fertilizer x tobacco-waste; non-significant statistically

| Tobacco Waste (tons/ha) | Nitrogen, kg/ha | | | | | Av.** |
|-------------------------|-----------------|-----------------|--------|--------|-----------------|---------|
| | 0 | 20 ⁺ | 40 | 60 | 80 ⁺ | |
| 0 | 3.17 | 3.49 | 4.11 | 4.42 | 4.49 | 3.94 d |
| 10 | 3.82 | 3.97 | 4.28 | 4.61 | 4.72 | 4.28 cd |
| 20 | 4.25 | 4.45 | 5.07 | 4.69 | 5.06 | 4.70 bc |
| 30 | 4.37 | 4.70 | 5.55 | 5.78 | 5.77 | 5.23 ab |
| 40 | 4.65 | 4.98 | 5.40 | 6.13 | 5.75 | 5.38 a |
| Av.** | 4.05 b | 4.32 b | 4.88 a | 5.13 a | 5.16 a | |

Table 2. Grain yield of wheat crop affected by T.W. and N-fertilizer (ton/ha).

+, ¹⁵N labelled N rates, **, Significant at 1% level N fertilizer x tobacco-waste; non-significant statistically

tons/ha (60 kg N/ha). According to Duncan tests, the treatments of 40, 60 and 80 kg N/ha fell under the same group. The results are in agreement with the findings of other workers (7, 8). They have also found that the straw yield of wheat was increased with increasing nitrogen rates.

The effect of tobacco-waste together with N fertilization on grain yield of wheat crop is given on Table 2.

The increasing rates of tobacco-waste increased the wheat grain yield significantly as compared to control. A grain yields of 3.94, 4.28, 4.70, 5.23 and 5.38 tons/ha were obtained at 0, 10, 20, 30 and 40 tons/ha rate of tobacco-waste, respectively. Increasing rates of nitrogen together with T.W increased the grain yield from 4.05 tons (control) to a maximum of 5.16 tons/ha (80 kg N/ha). However, the treatments of 40, 60 and 80 kg N/ha

fell under the same group, whereas control and 20 kg N/ha treatment also fell under the same group. The results are confirmed with the data found by other workers (9, 10).

N-content of wheat crop

The effect of tobacco-waste together with N-fertilization on the N-content of wheat straw is given on Table 3 and N-content of wheat grain is given on Table 4.

Tobacco-waste increased N-content of the wheat straw (Table 3) from 0.42% (control) to 0.72% (40 tons/ha T.W). Duncan test's results showed that the treatments of 20, 30 and 40 tons T.W/ha have the same effect. N-fertilization increased N-content of the straw from 0.45% (control) to a maximum of 0.69% (60 kg N/ha). Other workers have also found that the straw N-content of wheat was increased with increasing nitrogen rates (9, 11).

| Tobacco Waste (tons/ha) | Nitrogen, kg/ha | | | | | Av.** |
|-------------------------|-----------------|-----------------|--------|--------|-----------------|---------|
| | 0 | 20 ⁺ | 40 | 60 | 80 ⁺ | |
| 0 | 0.30 | 0.36 | 0.55 | 0.46 | 0.42 | 0.42 c |
| 10 | 0.39 | 0.47 | 0.54 | 0.49 | 0.65 | 0.51 bc |
| 20 | 0.45 | 0.54 | 0.70 | 0.74 | 0.70 | 0.63 ab |
| 30 | 0.50 | 0.57 | 0.74 | 0.92 | 0.78 | 0.70 ab |
| 40 | 0.62 | 0.65 | 0.88 | 0.86 | 0.57 | 0.72 a |
| Av.** | 0.45 c | 0.52 bc | 0.68 a | 0.69 a | 0.62 ab | |

Table 3. Straw N-content of wheat crop affected by tobacco-waste and N fertilization (%).

+, ¹⁵N labelled N rates, **, Significant at 1% level
N fertilizer x tobacco-waste; non-significant statistically

| Tobacco Waste (tons/ha) | Nitrogen, kg/ha | | | | | Av.** |
|-------------------------|-----------------|-----------------|--------|--------|-----------------|-------|
| | 0 | 20 ⁺ | 40 | 60 | 80 ⁺ | |
| 0 | 2.64 | 2.31 | 2.66 | 2.49 | 2.70 | 2.56 |
| 10 | 2.30 | 2.67 | 2.67 | 2.68 | 2.84 | 2.63 |
| 20 | 2.64 | 2.56 | 2.83 | 2.85 | 2.77 | 2.73 |
| 30 | 2.50 | 2.54 | 2.66 | 2.83 | 2.68 | 2.64 |
| 40 | 2.12 | 2.72 | 2.82 | 3.01 | 2.64 | 2.66 |
| Av.** | 2.44 b | 2.56 ab | 2.73 a | 2.77 a | 2.73 a | |

Table 4. Grain N-content of wheat crop affected by tobacco-waste and N fertilization (%).

+, ¹⁵N labelled N rates, **, Significant at 1% level
N fertilizer x tobacco-waste; non-significant statistically

As it seen on Table 4, tobacco-waste rates have increased the wheat grain N-content from 2.56% (control) to a maximum of 2.73% (20 tons/ha), whereas N-rates have increased the wheat grain N-content from 2.44% (control) to a maximum of 2.77% (60 kg N/ha). The positive effect of N-rates on the wheat grain N content has also been found in other studies (9, 10).

¹⁵N Calculations for wheat straw

The results regarding ¹⁵N labelled rates is given on Table 5 for straw of wheat. As it is seen on Table 5, the straw yield increased from 12.1 ton/ha (20 kg N/ha) to 12.6 ton (80 kg N/ha). The findings are parallel with the other findings (8, 11, 12). At 20 kg N/ha, tobacco-waste increased the straw weight from 8.67 ton (control) to 15.07 ton (40 tons/ha T.W), whereas at 80 kg N/ha, it increased from 11.06 ton (control) to 14.21 ton (40

tons/ha T.W). The average N content of straw was 0.38 and 0.37% at 20 and 80 kg N/ha rates, respectively, whereas N-uptakes at these rates were 47.4 and 47.2 tons/ha.

The atom % ¹⁵N excess value of straw was 0.614 and 0.952 at 20 and 80 kg N/ha rates respectively. The similar results were also found with increasing rates of N-application (12, 13). Increasing rates of tobacco-waste decreased this value from 0.824 to 0.489 (at 20 kg N/ha) and from 1.149 to 0.838 (at 80 kg N/ha). Nitrogen derived from fertilizer depending on N rates increased from 6.14% (20 kg N/ha) to 19.03% (80 kg N/ha). %Ndff at 20 kg N/ha was 8.24, 7.26, 5.43, 4.86 and 4.89%, whereas at 80 kg N/ha, it was 22.98, 19.98, 18.66, 16.78 and 16.76 at 0, 10, 20, 30 and 40 tons/ha of tobacco-waste rates, respectively. The similar results were also found by other worker working with ¹⁵N (12).

Table 5. Calculations regarding with ^{15}N for wheat straw (in the plots of 0.80 m^2)

| N-rate kg/ha | Calculations regarding with ^{15}N | Tobacco-waste, tons/ha | | | | | |
|-----------------|---|------------------------|-------|-------|-------|-------|-------|
| | | 0 | 10 | 20 | 30 | 40 | Av. |
| 20 | Yield, tons/ha | 8.67 | 11.19 | 12.46 | 13.20 | 15.07 | 12.12 |
| | N-content, % | 0.24 | 0.34 | 0.41 | 0.45 | 0.45 | 0.38 |
| | N-uptake, kg/ha | 20.8 | 38.0 | 51.1 | 59.4 | 67.8 | 47.4 |
| | %At.exc. | 0.824 | 0.726 | 0.543 | 0.486 | 0.489 | 0.614 |
| | %Ndff. | 8.24 | 7.26 | 5.43 | 4.86 | 4.89 | 6.14 |
| | %Ndfd. (T.W.) | - | 11.91 | 34.10 | 41.02 | 40.66 | 31.92 |
| | A-value, kg/ha | - | 32.8 | 125.6 | 168.8 | 166.3 | 123.4 |
| | %N Utilization from fertilizer | 8.50 | 14.00 | 14.00 | 14.50 | 16.50 | 13.50 |
| | %N Utilization from T.W. | - | 2.02 | 3.90 | 3.65 | 3.09 | 3.17 |
| 80 | Yield, tons/ha | 11.06 | 12.27 | 12.76 | 12.88 | 14.21 | 12.64 |
| | N-content, % | 0.28 | 0.24 | 0.48 | 0.28 | 0.55 | 0.37 |
| | N-uptake, kg/ha | 31.0 | 29.4 | 61.2 | 36.1 | 78.2 | 47.2 |
| | %At.exc. | 1.149 | 0.999 | 0.933 | 0.839 | 0.838 | 0.952 |
| | %Ndff. | 22.98 | 19.98 | 18.66 | 16.78 | 16.76 | 19.03 |
| | %Ndfd. (T.W.) | - | 13.06 | 18.80 | 26.99 | 27.07 | 21.48 |
| | A-value, kg/ha | - | 52.30 | 80.60 | 128.7 | 129.2 | 97.76 |
| | %N Utilization from fertilizer | 8.88 | 7.38 | 14.25 | 7.63 | 16.38 | 10.90 |
| | %N Utilization from T.W. | - | 1.70 | 2.58 | 1.45 | 2.38 | 2.03 |

The N derived from tobacco-waste was 31.92% (av. of all T.W rates) at 20 kg N/ha rate and decreased to 21.48% at 80 kg N/ha rate. The percent N derived from different rates of tobacco-waste at 20 kg N/ha was 11.91, 34.10, 41.02 and 40.66, whereas at 80 kg N/ha it was 13.06, 18.80, 26.99 and 27.07% with 10, 20, 30 and 40 tons/ha rates of tobacco-waste, respectively. A-value of wheat straw decreased from 123.4 kg/ha (at 20 kg N/ha) to 97.7 kg/ha (at 80 kg N/ha). When the average of two

rates of N was taken into consideration. A-value at 20 kg N/ha was 32.8, 125.6, 168.8 and 166.3 kg/ha and at 80 kg N/ha was 52.3, 80.6, 128.7 and 129.2 kg/ha at the 10, 20, 30 and 40 tons/ha rates of tobacco waste, respectively.

The percent utilization of N from nitrogen fertilizer together with the average of all tobacco-waste rates decreased from 13.50% (20 kg N/ha) to 10.90% (80 kg

Table 6. Calculations regarding with ¹⁵N for wheat grain (in the plots of 0.80 m²).

| N-rate kg/ha | Calculations regarding with ¹⁵ N | Tobacco-waste, tons/ha | | | | | |
|-----------------------------------|---|------------------------|-------|-------|-------|-------|-------|
| | | 0 | 10 | 20 | 30 | 40 | Av. |
| 20 | Yield, tons/ha | 5.59 | 6.48 | 7.03 | 7.89 | 7.81 | 6.96 |
| | N-content, % | 1.86 | 1.85 | 2.24 | 2.02 | 2.30 | 2.05 |
| | N-uptake, kg/ha | 103.9 | 119.9 | 157.4 | 159.4 | 179.6 | 144.0 |
| | %At.exc. | 0.818 | 0.596 | 0.478 | 0.644 | 0.399 | 0.587 |
| | %Ndff. | 8.18 | 5.96 | 4.78 | 6.44 | 3.99 | 5.87 |
| | %Ndft. (T.W.) | - | 27.15 | 41.56 | 21.28 | 51.23 | 35.31 |
| | A-value, kg/ha | - | 91.1 | 173.9 | 66.1 | 256.8 | 147.0 |
| | %N Utilization from fertilizer | 42.50 | 35.50 | 37.50 | 51.50 | 36.00 | 40.60 |
| | %N Utilization from T.W. | - | 14.62 | 14.66 | 5.07 | 10.31 | 11.17 |
| | 80 | Yield, tons/ha | 6.53 | 6.73 | 7.19 | 7.50 | 8.75 |
| N-content, % | | 2.16 | 2.23 | 2.23 | 2.19 | 2.29 | 2.22 |
| N-uptake, kg/ha | | 141.0 | 150.0 | 160.3 | 164.3 | 200.4 | 163.2 |
| %At.exc. | | 1.297 | 0.942 | 0.789 | 0.885 | 0.857 | 0.954 |
| %Ndff. | | 25.94 | 18.84 | 15.78 | 17.70 | 17.14 | 19.08 |
| %Ndft. (T.W.) | | - | 27.37 | 39.17 | 31.77 | 33.92 | 33.06 |
| A-value, kg/ha | | - | 116.2 | 198.6 | 143.6 | 158.3 | 154.2 |
| %N Utilization from fertilizer | | 45.75 | 35.38 | 31.63 | 36.38 | 42.88 | 38.40 |
| %N Utilization from T.W. | | - | 18.43 | 14.08 | 7.80 | 7.62 | 11.98 |

N/ha), whereas the percent utilization of N from tobacco-waste (Av. of all rates) decreased from 3.17% to 2.03% at 20 and 80 kg/ha rates, respectively. Rates of tobacco-waste has no effect on percent utilization of N in wheat straw. The results regarding grain yield, N-content, N uptake, atom % ¹⁵N excess values, %Ndff, %Ndf T.W, A-values, %N utilization from fertilizer and tobacco-waste by wheat plant are in confirmation with the data found by other workers (12, 13, 14).

¹⁵N Calculations for wheat grain

The results regarding ¹⁵N labelled rates are given on Table 6 for grain of wheat.

As it is seen on Table 6, the grain yield was increased from 6.96 tons to 7.34 tons/ha at 20 and 80 kg N/ha respectively. Grain yield of 5.59, 6.48, 7.89 and 7.81 (at 20 kg N/ha) and 6.53, 6.73, 7.19, 7.50 and 8.75 tons (at 80 kg N/ha) were obtained at 0, 10, 20, 30 and 40

tons/ha rates of tobacco-waste, respectively. N-content of grain increased from 2.05 (20 kg N/ha) to 2.22% (80 kg N/ha). N-uptake at these N-rates increased from 144.0 kg/ha to 163.2 kg/ha. Increasing rates of tobacco-waste applied at 20 kg N/ha rate increased the grain N content from 1.86% (control) to 2.30% (40 tons/ha T.W), whereas, at 80 kg N/ha, the maximum grain N-content of 2.29% was obtained with highest T.W rate as compared to 2.16% of the control plots. The increasing rates of tobacco-waste have increased the grain N-uptake. Grain N-uptakes of 103.9, 119.9, 157.4, 159.4 and 179.6 (at 20 kg N/ha) and 141.0, 150.0, 160.3, 164.3 and 200.4 (at 80 kg N/ha) were obtained at 0, 10, 20, 30 and 40 tons/ha rates of tobacco-waste respectively.

The atom ^{15}N excess values of wheat grain increased from 0.587 (20 kg N/ha) to 0.954 (80 kg N/ha). Increasing rates of tobacco-waste applied at both N rates decreased the atom ^{15}N excess values. The decrease at 20 kg N/ha was found from 0.818 (control) to 0.399% (40 tons/ha T.W), whereas the decrease at 80 kg N/ha was found from 1.297% (control) to 0.857% (40 tons/ha T.W).

Nitrogen derived from fertilizer depending on N rates by grain increased 5.87 (20 kg N/ha) to 19.08% (80 kg N/ha), whereas N derived from tobacco-waste by grain decreased from 8.18 (control) to 3.99% (40 tons/ha) at 20 kg N/ha rate, whereas it decreased from 25.94% (control) to 17.14% (40 tons/ha) at 80 kg N/ha rate. The N derived from tobacco-waste (average of all rates) decreased from 35.31% (at 20 kg N/ha) to 33.06% (at 80 kg N/ha). The percent N derived from tobacco-waste at 20 kg N/ha rate was 27.15, 41.56, 21.28 and 51.23%, whereas at 80 kg N/ha it was 27.37, 39.17, 31.77 and 33.92% at 10, 20, 30 and 40 tons/ha rates

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of tobacco-waste respectively. A-value of wheat grain increased from 147.0 kg/ha (at 20 kg N) to 154.2 kg/ha (at 80 kg N). A-value at different rates of tobacco-waste was 91.1, 173.9, 66.1 and 256.8 (at 20 kg N/ha) and it was 116.2, 198.6, 143.6 and 158.3 (at 80 kg N/ha) at 10, 20, 30 and 40 tons/ha rates of tobacco-waste, respectively.

The percent N utilization of N fertilizer by wheat grain decreased from 40.60 (20 kg N/ha) to 38.40% (80 kg N/ha), whereas the percent utilization of N from tobacco-waste decreased from 18.43% (control) to 7.62% (40 tons/ha T.W) at 80 kg N/ha rate. The N % utilization from T.W at 20 kg N/ha was 14.62, 14.66, 5.07 and 10.31 at 10, 20, 30 and 40 tons/ha tobacco-waste rates respectively. The results regarding grain yield, N- content, N uptake, atom ^{15}N excess values, %Ndff, %Ndf T.W, A-values, % utilization from fertilizer and % utilization from tobacco-waste by wheat plant are parallel to the data found by other workers (12, 13, 14). These workers studied on different plants with same ^{15}N tracer technique and their calculations of ^{15}N are same to our calculations.

As a result, increasing tobacco-waste and nitrogenous fertilizers have important effect on the yield, N content and N uptake of wheat crop. Tobacco waste-N utilization by wheat crop is dependent upon organic and inorganic fertilizer rates. Especially, the N utilization decreased at high nitrogen rates. In addition, Ndf T.W. was found more effective than NdfN.F. for plant. According to the results obtained from this experiment, 40 tons/ha tobacco waste and 60 kg/ha nitrogenous fertilizer may be used safely for optimum yield. This treatment will also decrease environmental pollution.

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