



## Effect of the Different Organic Fertilizer Sources and Doses on Yield in Organic Tobacco (*Nicotiana tabacum* L.) Production

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**Abstract:** This research was carried out to determine the effect of different sources and doses of organic manure on some chemical properties and fertility at Xanthi/2A tobaccos in Samsun-Bafra conditions in 2 years. The study at farmers' land in 2010 and 2011, three different organic fertilizer (Compost OMU Faculty of Agriculture, Yeşil Küre Chicken Manure and Biofarm), 4 doses (0-5-10-15 t/h), based on randomized complete block design with 3 replicates. The result of the statistical analysis has displayed that the differences between the years is very important in terms of plant height, number of leaves, leaf yield and nicotine ratio. Types of fertilizer had a significant impact on the stem diameter and reducing sugar content. Besides, doses had a significant impact in all specifications except for number of leaf. It was found out that yearxdose interactions deeply affected reducing sugar content and the size of body. Because of the fact that all other properties were within reasonable limits, it was detected that the nicotine rate changed between 1.8-2.1% ranges. Further, it has been determined as one result of regression analysis that the fertilizer application, which can be by any type of the fertilizers between 9.5-10 t/h ranges, will meet the market demand.

**Key Words:** Fertilizer, *Nicotiana tabacum* L., organic, oriental, tobacco

### Organik Tütün (*Nicotiana tabacum* L.) Üretiminde Farklı Gübre Kaynakları ve Dozlarının Verim Üzerine Etkileri

**Özet:** Bu araştırma, farklı organik gübre kaynakları ve dozlarının Xanthi-2A tütün çeşidinde verim ve bazı kimyasal özelliklere etkisini belirlemek için Samsun-Bafra şartlarında 2 yıl olarak yürütülmüştür. 2010 ve 2011 yıllarında çiftçi arazisinde yapılan çalışma, 3 farklı organik gübre (OMÜ Ziraat Fakültesi Kompostu, Yeşil Küre Tavuk Gübresi ve Biofarm), 4 dozda (0-5-10-15 t/h), tesadüf blokları deneme desenine göre yürütülmüştür. Araştırma sonucunda bitki boyu, yaprak sayısı, yaprak verimi ve nikotin oranında yıllar arasındaki fark önemli olmuştur. Gübre çeşitleri, gövde çapı ve indirgen şeker oranı üzerine, dozlar ise incelenen tüm özelliklere önemli etkide bulunmuştur. Yılxdoz interaksyonunun ise gövde çapı ve indirgen şeker oranı üzerine önemli etkide bulunduğu saptanmıştır. Diğer tüm özelliklerin kabul edilebilir sınırlar içinde olması nedeniyle, nikotin oranının %1.8-2.1 arasında değiştiği, yapılan regresyon analiz sonucunda 9.5-10 t/ha aralığındaki, araştırmada kullanılan herhangi bir gübre çeşidiyle yapılacak gübre uygulamasının piyasa talebini karşılar nitelikte olduğu saptanmıştır.

**Anahtar Kelimeler:** Gübreleme, *Nicotiana tabacum* L., Organik, Oryantal, Tütün

#### 1. Introduction

Tobacco, despite the losses set forth in terms of health care, remains one of the economically effective agricultural products in the countries

which are grown and consumed. In case of using pesticides for unnecessary situations in tobacco production, like in all kinds of agricultural applications, their residues on crops have threatened

human and environmental health. In addition for oriental type tobacco cultivation; increasing efficiency methods such as fertilizing, watering are known to have a negative influence on the quality. The main point, which is based on the quality of the work, is done without increasing the amount of yield in the cultivation of tobacco (Camas et al., 2009). Furthermore, damages of the chemical fertilizers to the ecosystem are known by all parties and this situation makes us question the use of chemical inputs in production. Proposed solution to this issue is the use of fertilizers from natural sources. Organic agriculture aims to return to reestablishment of ecological balance, disturbed as a result of improper practices of organic sustainable agro-ecosystem by using conscious farming techniques and natural entries (Tasbasli et al., 2003). Today, organic manure mentioned, large and small animals, excretion of poultry and composts vegetable or animal origin are understood (Atalay, 2007). Aim of the research investigate suitable organic manure and concentration for tobacco growing.

## 2. Materials and Methods

### Material

Organic fertilizers used in the research are Ondokuz Mayıs University Faculty of Agriculture compost as fertilizer (compost), Yeşil Küre Organic Chicken Manure (Yeşilküre) and Biofarm Solid Organic Livestock Manure (Biofarm) (Table 1). As a plant material, Xanthi-2A used in the research is grown commercially by the grower of regions.

### Methods

This research was carried out to determine the effect of different sources and doses of organic manure on some chemical properties and fertility at Xanthi/2A tobaccos in Samsun-Bafra conditions in 2 years (Table 2, 3). After smoothened, fermented farm manure was layered slightly on seed bed. Seeds were sowed by mixing with water as 1-2 g/m<sup>2</sup> pest was observed during seedling period but herb control was performed regularly. In the day of planting, seedlings were watered and then ripped. The experiment based on randomized complete block design with three replicates was established as a factorial design. A field experiment prepared as an area 5m x 2m = 10 m<sup>2</sup> of each plots. All fertilizers and doses with 0, 5, 10 and 15 t/h were applied before planting at once. Planting density plots were arranged by hand planting with 40x12 cm intervals. In this study, some features were determined such as plant height (cm), stem diameter (mm), leaf number (number/plant), leaf width (cm), leaf length (cm), leaf yield (kg/da), nicotine ratio (%) and reducing sugar content (%) (Aytac ve Esenal, 1996; Camas ve ark., 2007). Nicotine rate was determined by using "Tobacco and tobacco products-Determination of the amount of alkaloid-spectrophotometric method" (Egilmez, 1988) and reducing sugar content "Lane-Eynon method" (Cemeroglu, 1992). The experiment with 3 different organic fertilizer, 4 doses and 3 replicates was carried out during 2 years. As a result of analysis of variance and regression results obtained from the fertilizer, the most suitable dose levels of the fertilizer have been determined.

**Table 1.** Some of the features of the organic fertilizers

	Compost*	Yeşil Küre*	Biofarm**
Organic N (%)	2.20	2.90	1.91
Total N (%)	4.03	5.30	3.50
Total P (%)	1.06	6.40	3.00
Total K (%)	2.36	3.70	3.00
Total Organic matter (%)	32.0	65.0	65.0
pH	8.35	7.50	7.00

\*: Ondokuz Mayıs University, Agriculture Faculty, Soil Department

\*\*.: Company data

**Table 2.** Soil properties of field experiment (\*)

Sand (%)	34.70	Clay (%)	39.07	Silt (%)	26.20
Texstüre	Clay-loam	OM (%)	2.44	pH	8.25
EC (dS/m)	0.31	P (ppm)	1.18	K (meq/100gr)	0.35

(\*):Ondokuz Mayıs University, Agriculture Faculty, Soil Department

**Table 3.** Some climatic data for months during experimental period(\*)

Months	Years	Average Temperature ( $^{\circ}$ C)	Average Moisture (%)	Total Rainfall (mm)
May	1975-2009	15.1	78.5	53.5
	2010	17.3	77.1	16.4
	2011	14.5	89.9	72.1
June	1975-2009	19.8	74.7	42.4
	2010	21.6	82.0	110.3
	2011	20.1	82.6	52.3
July	1975-2009	22.6	72.6	78.2
	2010	24.2	82.5	106.1
	2011	24.4	81.6	13.8
August	1975-2009	22.6	74.2	87.9
	2010	25.7	75.0	18.2
	2011	23.0	75.8	66.9
September	1975-2009	19.0	76.3	77.6
	2010	21.0	81.6	47.5
	2011	19.8	75.9	16.2

(\*): Meteorology 10. Regional Office, Samsun

### 3. Results and Discussion

Research was carried out with Xanthi/2A tobacco from three different sources with different kinds of organic fertilizers and with the implementation of 4 different doses of these fertilizers in the years of 2010 and 2011. In connection with this study, yield and observations related to chemical criteria and measurements were taken. As a result of the statistical analysis, the relationship between the years is significant statistically ( $p < 0.01$ ) for plant height, number of leaves, leaf yield and nicotine ratio. Types of fertilizer had a significant impact on the size of the body and more important one on reducing sugar content. Doses had a significant influence in all specifications except for number of leaf. Yearxdose interactions were significant for the stem diameter ( $p < 0.05$ ) and reducing sugar content ( $p < 0.01$ ). Different varieties of organic fertilizers had insignificant effects on plant height, but fertilizer dosages had significant effects at a level of  $p < 0.01$ . Plant height ranged from 136.04-159.57 cm in the trial (Table 4). Organic fertilizer

doses, according to the control (0 t/h) application, have been effective in increasing the size of the plant. In parallel with increasing nitrogen doses in previous studies (Incekara, 1971; Lolas, 1976; Azman, 1985) and increasing doses of organic fertilizer (Camas et al., 2009); plant height has always increased. As a result of Camas et al. (2009) 's work, in parallel with increasing amounts of organic fertilizer it was concluded that plant height increased, but an increase in the amount of fertilizer was effective up to a certain level for the plant height. We observed that increasing doses of fertilizer increased yield but this increase was found to be cubic, not linear. There were negligible effects on leaf length of different varieties of organic fertilizers, while fertilizer doses were significant ( $p < 0.01$ ). In the experiment, leaf length ranged from 15.73 to 18.63 cm (Table 4). As expected; due to the increasing doses, an increase was observed in leaf length, but there was no significant difference between the different organic fertilizers. In this study, leaf width varied between 8.06 and 9.20 cm

(Table 4). Doses of fertilizers, manure applied to the  $p < 0.01$  level was found to be an important. According to Raab and Terry (1994), the rate of nitrogen increases leaf area. However Camas et al. (2009), Jung et al. (1982), and Otan (1983) reported that the leaf length and width of the kind property indicates different features. In the study, there is a significant effect of longitudinal and transverse leaf variety of different doses of organic fertilizer, positive effect of increasing doses on leaf area suggest that it is aroused from this increasing doses. Depending on the experiment of increasing doses of different organic fertilizers, the number of leafs ranged from 31.83-34.65 unit/plant (Table 4). In the statistical evaluation of the variety of different doses of organic fertilizer; its effects on the number of leaf were minor, but the years were found to be very important. It was concluded that the leaves of a kind of feature reached different values between the years due to especially differences in rainfall regime, the effects of climatic and environmental conditions.

It was identified in the studies of Samsun, (Esendal et al., 1989; Camas et al., 2009), of Hungary (Gondola, 2002) and of Malaysia (Azman, 1985) that an important criterion of efficiency was not a significant increase in number of leaves similarly.

According to the results, yield was realized between 94.81 kg/da and 137.25 kg/da (Table 4). Increasing the dose of fertilizer occurred in parallel with increases in efficiency yield values obtained from the  $p < 0.01$  levels was found to be an important point. The effects of fertilizers applied to leaf yield were not significant. Corresponds to increasing doses of fertilizers, plant height variation is of  $\hat{Y} = -0,0000313x^2 + 0.07x + 93.8872$  ( $R^2 = 0.98^{**}$ ) (Figure 1). This relationship has been found statistically very significant. After the calculation, the maximum dose limit is 11.15 t/h respectively. After this dose, it was concluded that increasing doses didn't affect leaf yield and recommended doses would be 11.15 t/h based on the leaf yield.

In the experiment, depending on the increasing doses of different organic fertilizers, the rate of nicotine ranged from 1.49% to 2.32% (Table 4). In response to increasing doses of fertilizer response, the rate of nicotine replacement is  $\hat{Y} = -0.00000045x^2 + 0.0012x + 1.4437$  ( $R^2 = 0.88^*$ ) (Figure 1). This relationship has been found important.

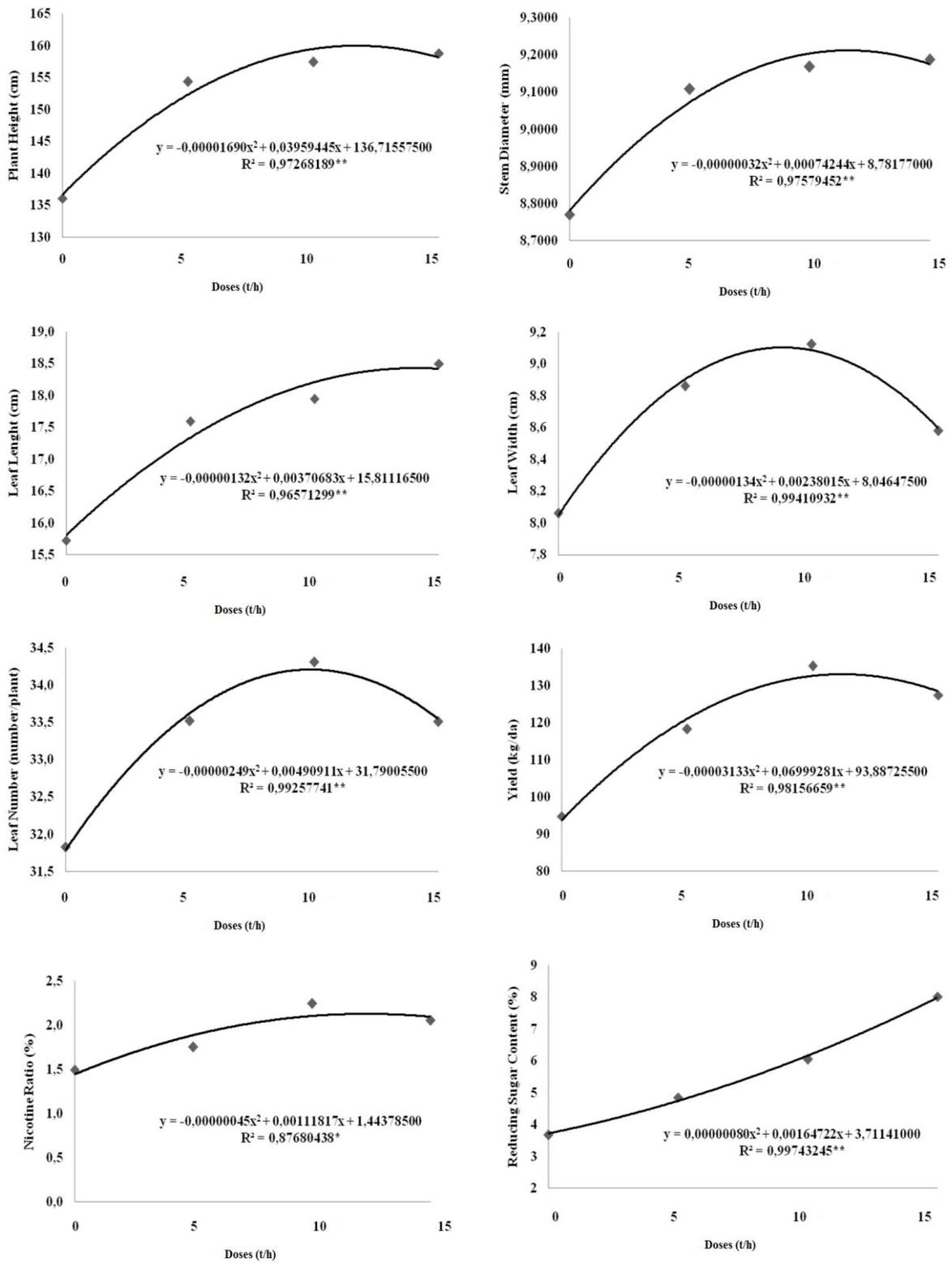
At the studies on the effects of different doses of fertilizer on yield and quality of tobacco, usually increasing the amount of fertilizer redouble the amount of nicotine, a compound that is nitrogen and nitrogen from the soil.

Further increase in the rate of nicotine is not required for quality tobaccos. In Peksuslu (1998)'s giving rise to his work and one to one meetings with representatives of the sector, the rate of nicotine of variety Xanthi/2A is indicated and required in the range 1.8-2.1%. In the calculation which was done with the help of regression equation, it was found out that 9.5-10 t/h fertilizer application was able to meet the demand which was mentioned before.

When analysed the reduced amount of sugar, it is understood that it is in the range of 8.02% to 3.68% (Table 4). At the statistical evaluation, different organic fertilizers, doses and dose interaction of year were significant at a level of  $P < 0.01$  on variety of reducing sugar content. After the calculation, the maximum dose limit has been identified as 10.30 t/h.

It was concluded that the Yeşil Küre chicken manure application which involved NPK (especially P) content higher than the others was understood to be more effective. Year and the dose exchange and reduced sugar increase depending on the increased doses when it comes to 15 t/h both years is reached, there is decrease in both years.

There is an inverse relationship between the proportion of nicotine and reducing sugar for oriental tobacco plant and increasing the amount of reducing sugars is known to have a positive impact on the quality (Egilmez, 1988 and Sekin, 1979).



**Figure 1.** Regression curves for the effects of organic fertilizer and its doses on yield, and chemical characters of Xanthi/2A cultivar

**Table 4.** The effects of organic fertilizer origins and doses on yield, yield components and some chemical characters of tobacco cultivar Xanthi-2A

	Doses (t/h)	Plant height (cm)	Stem Diameter (mm)	Leaf Length (cm)	Leaf Width (cm)	Leaf Number (number/plant)	Leaf Yield (kg/da)	Nicotine Ratio (%)	Reducing Sugar Content (%)
Compost	0	136.04	8.77	15.73	8.06	31.83	94.81	1.49	3.68
	5	156.06	9.00	17.82	9.20	33.13	115.44	1.85	4.25
	10	159.09	9.04	18.12	9.20	33.93	133.73	2.23	5.61
	15	159.57	9.07	18.59	8.47	34.10	126.03	1.98	6.68
Yeşilküre	0	136.04	8.77	15.73	8.06	31.83	94.81	1.49	3.68
	5	155.01	9.01	17.52	8.41	34.65	117.52	1.72	5.24
	10	155.28	9.09	17.70	9.04	35.54	134.98	2.18	5.68
	15	157.56	9.14	18.26	8.55	33.37	127.23	1.99	7.93
Biofarm	0	136.04	8.77	15.73	8.06	31.83	94.81	1.49	3.68
	5	151.87	9.31	17.45	8.97	32.77	121.89	1.70	5.04
	10	157.78	9.38	18.02	9.14	33.47	137.25	2.32	6.87
	15	159.14	9.36	18.63	8.72	33.07	129.16	2.19	8.02

Given the many years of research in the mean climate; during the years of the experiment, especially the high temperatures in the months corresponding to the period of vegetation and scattered rainfall regime are thought to cause the ratio of reducing sugar to occur less than expected.

#### 4. Conclusions

Decline in quality, as well as excessive use of chemical fertilizers that causes damage to the environment and chemical pesticides that leaves residue, scare all companies and public institutions that operate in areas of leaf tobacco and tobacco products concerned. A large part of R&D resources of international tobacco cigarette manufacturers is used for removal of tobacco residuals, and is an important input of production concentrates on alternatives to chemical fertilizers. The executed researches show that producing qualified tobacco leaf by a method which is harmless to environment, without chemical pesticides, is only possible with using organic originated fertilizer and pesticides. The way meeting all these conditions is tobacco production.

In tobacco production, yield and quality are the most important features of it. The quality of

leaf is directly related with its composition. In this research, nicotine and reducing sugar rates that make up the main elements of the yield and quality, are stable ones on the other hand the rest of all those other differences occurred, these are in acceptable limits in view of variety and region. In the calculation, originated the yield related regression equality, the maximum dose brink is set as 11.15 t/h. Especially because of adverse weather and environment conditions, the dose brink is calculated as 10.30 t/h, is less than expected level of reducing sugar. When the changing market and developing world's desires are on spot, the dose of fertilizer, which can meet nicotine, which is in interval of %1.8-2.1, is reached a conclusion as determiner dose of it and after the calculation, 9.5-10 t/h dose of the all studied fertilizers, is enough to meet mentioned demand, is determined.

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