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Research Article

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Tobacco, worm fertilizer, yield, nicotine

Investigation of the Effects of Worm Fertilizer on the Yield and Quality of Tobacco

Abstract

Tobacco which still has a great economic importance in the world and Turkey provides extensive employment opportunities from growing to evaluation stage to a certain part of our people and is produced as a family enterprise for centuries in our various regions. The aim of the study was to determine in the effects of worm fertilizer on Aegean type tobacco yield and some quality parameters. The search was carried out in a farmer field in Saruhanli district of Manisa province in 2019. Saribaglar-407 type tobacco was used as a research material. Experimental design was randomized complete parcel design with three replications. In this research, plant height (cm), number of the leaves (per plant^{-1}), cured leaf yield (kg ha^{-1}), tobacco visual quality, leaf priming position (%), total alkaloid (nicotine) (%), total reducing sugar (%) and chlorine (%) were determined. Plant height, number of the leaves, yield, nicotine, total reducing sugar and chlorine contents were found 126.7 cm, 48 per plant^{-1}, 141 kg ha^{-1}, 1.02%, 9.08% and 0.48%, respectively. An increase in the middle stalk position of the plant was recorded with the application of fertilizer and the results were obtained among the appropriate values for tobacco of the Aegean region in terms of chemical composition.

INTRODUCTION

Tobacco has been widely produced in various regions as family agriculture for centuries, and has a very important place in our country's economy. Aegean Region, which produces more than 50% of its production, has an agricultural land that can meet the world's total oriental tobacco need alone (Anonymous, 2019). However, there has been a decrease in the amount of production and yield values in parallel with this decrease in the Aegean Region, as in our country in recent years. The native tobacco plant specific to the Aegean Region is less selective than other cultivated plants in terms of soil requirements. Monoculture cultivation has been practiced in most of the tobacco-producing areas in the region for years. For this reason, the soils in these fields fall below the optimum values in terms of plant nutrients, and as a result, it is necessary to apply fertilizers in a controlled and balanced manner (Köseoğlu et al., 2014).

Fertilization of Aegean tobacco and soil properties of the fields where it is grown are more important than other cultivated plants due to the quality of tobacco. The production technique, drying conditions and fertilization applied in tobacco cultivation are very important and cause changes in the physical and chemical properties of tobacco. Mineral fertilizers containing nitrogen, phosphorus and potassium constitute the basic fertilizers in the fertilization of tobacco and other cultivated plants. Especially, mineral fertilizers containing potassium and phosphorus are fertilizers that increase the quality. However, in the use of nitrogenous fertilizers that will increase the yield, it is necessary to determine the amount of nitrogen, nitrogen form and nitrogen giving time so as not to impair the quality. In addition, when we do not return the plant nutrients removed from the soil back to the soil, after a while, firstly the yield decreases and then the quality decreases. Providing optimal conditions where yield and quality intersect at the same or near points is of great importance for Aegean tobacco, which is in the oriental tobacco group (Ekren and Mordogan, 2012; Ekren et al., 2021). It is a well-known fact that oriental tobacco is sensitive to fertilization. However, it is possible to increase yield without sacrificing quality by means of fertilization programs to be applied to the areas the soil structure of which is known. In this sturdy, ammonium sulfate (10 kg ha^{-1}) and 10:20.20 (15 kg ha^{-1}) were applied to the field 1 month before plantation (Cabadan et al., 2014).

Since tobacco plant is a plant that is highly affected by environmental conditions, it gains character according to the soil structure in which it is grown. Physical and chemical properties of soils have an important effect on the quality of tobacco leaf. In addition, mineral substances that direct the growth and development of the tobacco plant directly or indirectly affect the quality of the tobacco leaves.

Although the places where tobacco cultivation is allowed are generally divided into rural, rural bases and bases, the morphological, physical and chemical properties and important differences of the soils are not taken into account in this distinction, and the concepts in question can vary significantly according to the personal opinions of the people who make the distinction. However, it is extremely important in terms of yield and quality to take into account characteristics such as the slope of the land, soil depth, fertility, and the comprehensive physical and chemical analysis of the soils where tobacco is grown. Organic matter and pH was changed between 0.27-2.37 and 7.27-7.78, respectively. This issue was investigated in a study conducted in our region, and the II. and III. It has been determined that it grows on the 1st class agricultural lands, the quality of the 1st class lands has decreased, and the quality and the yield are low on the 4th class lands (Tuncay et al., 1985). The amount of nicotine in tobacco is mostly affected by the physical properties of the soil. It is also

known that the amount of nicotine decreases in sandy soils and with irrigation (Akehurst, 1981).

It is aimed to increase tobacco in the Aegean Region, where the yield decreases year by year, without impairing its quality characteristics. Some agronomic studies such as planting density, fertilizer dosage and variety are carried out in tobacco production areas. In this study, the effects of worm fertilizer (vermicompost) on tobacco yield, yield and some chemical properties were investigated.

MATERIAL and METHODS

The study was conducted in a farmer field in Saruhanli district of Manisa province in 2019. The soil of the trial area was determined to be loamy, slightly alkaline, low in terms of lime and organic matter content (Table 1). The average temperature was recorded 21.2 ºC in 2019 and 19.0 ºC in long term, total rainfall was 512.6 mm in 2019 and 493.7 mm in long term, respectively (Anonymous, 2019).

Table 1. Soil analysis results of the field where the experiment was conducted

Texture	pH	Total Soluable Salt %	$CaCO_3$ %	Organic matter %	P (ppm)	K (ppm)	Ca (ppm)	Mg (ppm)
Loamy	7.53	0.0048	1.21	0.12	13.40	69.11	2606.00	414.50
	Light alkalin	Saltless	Less limy	Very few	Mid	Mid	Mid	Very high

The research material consists of Saribaglar-407 variety, which is one of the registered tobacco varieties in the Aegean Region, resistant to blue mold. Tobacco seeds were sow in the seedbed in February at a rate of 0.6 g seeds per m^2. Germination has been seen since March 10, 2019. Worm fertilizer was applied to the seedbed in two separate forms, solid and liquid.

Worm fertilizer applied in solid form 0.5-0.6 kg $m^{2\,-1}$ as cover fertilizer in March; In liquid form, 20 ml $10m^{2\,-1}$ was sprayed 2 times in April and 1 week before planting. Among the cultural processes applied in the seedbed, weed control, irrigation and ventilation were carried out regularly. Experimental plot was ploughed deeply in autumn. Before the planting in the spring, the field was ploughed and harrowed shallowly. The experiment was carried out in randomized blocks trial design with three replications. Seedlings were transplanted to the experimental plot with machine in the field on May 1, 2019 and plant spacing was 40x6 cm. Total experimental area is 1 decare. Hoeing was applied 2 times after planting during the growing season. The leaves were harvested by hand when the tobacco leaves reached maturing stage from July to September. No disease or pest was encountered in the vegetation period.

In the study, worm fertilizer was applied in the field period as well as in the seedling stage.

1. Application: 1000 ml da^{-1} with lifeline-water
2. Application: After the 1st hoeing 500 ml da^{-1}
3. Application. After the middle stalk position 500 ml da^{-1}

Plant height (cm), number of leaves (per $plant^{-1}$), ratio of stalk position in the plant (%), number of plants per decare (per/decare), yield (kg ha^{-1}), expertise quality (Anonymous, 2006), total alcaloid (nicotine) (%) (Anonymous, 1969), total reducing sugar (%) (Lindsay, 1973), chlorine (%) (Nelson, 1960) were investigated in the study.

Statistical analysis

Data from the experiment were subjected to analysis of variance (ANOVA) using TOTEM STAT statistical software (Acikgoz et al., 2004). The mean differences were compared by the least

significant difference (LSD) test (Stell et al., 1997).

RESULTS and DISCUSSION

The results of the plant height, number of leaves, yield and expertise quality in the study are shown in Table 2. The plant height and yield values of the worm fertilizer were found to be statistically significant at the level of f 1%. Plant height (110-126.7 cm), leaf number (46-48 units leaf^{-1}) and yield (130-141 kg ha^{-1}) increased by 15%, 4% and 8% compared to control, respectively. The native tobacco plant specific to the Aegean Region is less selective than other cultivated plants in terms of soil requirements. Soils where tobacco cultivation is done sometimes falls below the optimum values in terms of the amount of plant nutrients and as a result, they need to be fertilized in a balanced and controlled manner (Çolakoğlu et al., 2005). In studies conducted by some researchers to improve the yield and quality of plant nutrients in Aegean Region tobacco, it has been determined that the fertilizer has increased positively on the examined parameters (Senbayram et al., 2005; Cabadan et al., 2014; Ekren and Yalman, 2019; Ekren and Tuncer, 2021). The yield, expressed as the quality of the expertise, also showed an increase from 50 yield to 58 yield (Table 2).

Table 2. Some agronomic properties with yield and expertise quality

Application	Characteristics			
	Plant height (cm)	Number of leaves (per plant^{-1})	Yield (kg ha^{-1})	Expertise Quality
Control	110.0b	46	130	50
Worm Fertilizer	126.7a	48	141	58
Mean	118.4	47	135.5	54
LSD	37.949**	ns	2.484**	

*p<0.05, ** p<0.01, ns: not significant

When the effects of fertilizer on stalk position conditions are examined in Table 3; It was determined that 1% level was statistically significant on all priming groups except the 4th primings. There is an increase in the second priming (39.6%) and the 4th leaves (32.8%) known as the middle primings. When the total leaf amount of a tobacco plant in the Aegean Region is assumed to be 100, the shares of the 2nd, 3rd and 4th primings in the total amount are respectively; It was determined as 65%, 20% and 15% (Anonymous, 2012). The effect of the fertilizer has increased by about 30% in the 2nd priming. It also created a 3% shot in the 4rd leaves that were thick in terms of texture. Therefore, it was noted that worm manure made a difference both numerically and statistically in these two priming groups, which are among the important priming groups in terms of proportional share and texture in the increase of dry leaf tobacco yield.—Only Anonymous, (2012) expresses the rates of leaves on the stalk position, and in our current study, the 2nd primings are proportionally higher than the other primings groups.

Table 3. Stalk position (priming) of tobacco plant (%)

Application	Stalk Position (Priming)			
	1st Priming	2nd Priming	3rd Priming	4th Priming
Control	11.1	30.9	26.0	32.0
Worm Fertilizer	6.0	39.6	22.1	32.8
Mean	8.6	35.3	24.1	32.4
LSD	2.879**	19.515**	14.409**	ns

*p<0.05, ** p<0.01, ns: not significant

The effect of worm castings on the nicotine, total reducing sugar and chlorine properties of the leaf is presented in Table 4. For the other two compounds except

nicotine, the 1% level was found to be significant. The amount of nicotine with the fertilizer applied was 1.02%, sugar and chlorine ratios were determined as 9.08% and 0.48%. It was determined that the worm fertilizer applied did not increase the nicotine content of tobacco much, but only made a difference in numbers. For Aegean tobaccos, the nicotine amount is not required to be over 1%. Likewise, it is desirable that the chlorine content is below 1-1.5% (Akehurst, 1981). The figures determined by the effect of manure are within acceptable limits for Aegean Region tobaccos (Celen et. al., 2015; Delibacak et. al., 2014; Ekren et. al., 2015; Ekren and Sekin, 2008; Tepecik and Ongun, 2020).

Table 4. Some chemical composition of tobacco leaf

Application	Total Alcaloid (Nicotine) (%)	Total Reducing Sugar (%)	Chlorine (%)
Control	1.00	5.68	1.11
Worm Fertilizer	1.02	9.08	0.48
Mean	1.01	7.38	0.79
LSD	ns	3.975**	0.323**

*p<0.05, ** p<0.01, ns: not significant

CONCLUSION

It can be said that there is a significant decrease in the Aegean Region in parallel with the total tobacco production of Turkey in the recent years. It is important to determine the increase of the some parameters on yield for oriental tobaccos when the tobacco production threat decreases. It should be emphasized that proper fertilizer dosage and form application carried out on Aegean tobaccos that it is a positive effect on yield and yield parameters and therefore fertilizer should be a recommended practice. The results of Aegean tobaccos were in accordance with the data given in the previous studies and they are within the limits rate. We believe that it would be appropriate to test the existing fertilizer for at least two years in other production centers where tobacco is grown, and to reinterpret it with yield and some chemical content, especially the expertise quality of the product.

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