



Research Article

Effect of Irrigation Regimes by Mini Sprinkler on Chemical Composition of Tombul Hazelnut Kernels

A. K lah ilar¹, T. Tonkaz² and S.Z. Bostan^{3*}

¹Department of Horticulture, Institute of Science, Ordu University, Ordu, Turkey,

²Department of Biosystem Engineering, Faculty of Agriculture, Ordu University, Ordu, Turkey,

³Department of Horticulture, Faculty of Agriculture, Ordu University, Ordu, Turkey

*Corresponding Author: e-mail: szbostan@hotmail.com

Abstract

This research was carried out on 'Tombul' hazelnut cultivar grown in Giresun province of Turkey in 2015. The treatments were full irrigation (100% of soil water depletion at a depth of 60 cm), 50% of soil water depletion applied on the same day as the 100% treatment, and rain-fed control. The orchards plots were irrigated by mini-sprinklers. Mean values were calculated for protein, fat and ash compositions. As a result of the analysis of variance, it was determined that the ash content was significant for the irrigation regimes, and the protein and fat contents were not significant. The ash content varied between 2.183% (0%) and 2.337% (100%), and water supply was increased this value. The effect of irrigation treatments on the fat and protein contents were found to be insignificant.

Received
08 Oct 2018

Accepted
10 Nov 2018

Keywords
Hazelnut
Irrigation Levels
Chemical
Tombul
Turkey

³ Corresponding Author
Email: szbostan@hotmail.com

INTRODUCTION

Turkey is the origin of both the motherland and place of cultural history of hazelnut, and it has been growing since about 2500 years [1]. Turkey is a leading country in the world by means of hazelnut production and export. However, hazelnut yield of Turkey is low compared to other countries. Hazelnut grows in wet, moist, temperate zones. It is important that the total annual precipitation is more than 700 mm, the precipitation is balanced distribution [2].

Considering the climate needs of hazelnut, it appears that the Black Sea Region (especially Middle and East parts) in Turkey characterizes the climate characteristics [3]. Hazelnut farming in the Middle and East Black Sea regions have been doing on high and sloping land without irrigation. Although the Black Sea Region is the region with the highest rainfall in Turkey, rainfall is inadequate in some months, when the hazelnut most need water. For this reason, the yield and quality of hazelnut in the orchards where irrigation is not possible have been reducing.

The global climate change and the regional changes in the climatic parameters have caused significant fluctuations in hazelnut production. In the Black Sea Region, which is a hazelnut region due to climate change in recent years, it is observed that the air temperature increases frequently above 30 °C especially in the summer months. In addition, inadequate rainfall in July and August, with high temperatures, affects hazelnut production negatively [4]. Hazelnut is very sensitive to drought especially in sloping lands.

Application irrigation water is very limited by topographical condition of the region. The nut grows rapidly after fertilization in early May, shell grows until early July, and kernel grows from early July to early August [5,6]. Therefore, the nuts need water very intensively from June to the first half of August so that the kernel can develop well and fill the interior. If the water needed by precipitation cannot be met these months, the irrigation of hazelnut orchards will be the most correct and valid treatment. This study was carried out in order to determine the effects of irrigation by the mini-sprinkler method to important chemical characteristics of Tombul hazelnut cultivar.

MATERIAL AND METHODS

This research was carried out in Tombul hazelnut orchard about 100 years old in Barça village of Giresun province of Turkey in 2015. The research orchard is located 4 km away from the coastal line and 115 m above sea level. The orchard was set up as ocak system (multiple stem). The orchard is north-facing slope, with a gradient of 45%. In 2015, three different levels of irrigation were carried out in the study, control (0%), 50% and 100% to ocaks. In the orchard, the excesses were cut and uniformed, as the number of stems in ocaks was 5 during the rest period of the year 2014.

The orchards plots were irrigated by mini-sprinkler irrigation system and irrigation water was taken by a pump (2.2 KWh) from water-tank nearly located to the experiment site. Soil water status were measured using gravimetric methods in every 10-day starting from May, 15 until 10-day before nut harvesting time. Irrigation treatment is initiated when soil water is depleted to 50% level of usable soil water amount (Table 1). Hazelnuts were harvested on August 19, 2015, separated from its husks by husker on August 21, and then sun dried until August 29. Protein, fat and ash analysis were made in dried kernels. The experiment was designed on randomized block design with 3 replications and 3 ocaks were used in each replication. Statistical analyses were

performed using the JMP11 program. The LSD test was used to compare treatment means.

Table 1. Irrigation Program

Irrigation level	Irrigation amount (mm)	Irrigation date
0 % (Control)	---	---
50 %	157.08	May 22
		May 26
		July 29
		August 2
		August 6
100 %	314.16	August 9
		May 22
		May 26
		July 29
		August 2
		August 6
		August 9

RESULTS AND DISCUSSION

As a result of the analysis of variance, it was determined that the ash content was significant for the irrigation regimes, and the protein and fat contents were not significant (Table 2). The effect of irrigation treatments on the fat content was found to be insignificant as in the previous research [7]. The fat content changed between 57.797% and 59.490%. The value we found in our study was different from other studies as 65.92%-67.98% [1], 63.82% [8], 62.56% [9] and 64.60% [10]. This is thought to be due to ecological factors, thus the content of fat varies considerably according to varieties, locality and years [11]. On the other hand, Bostan et al. reported that the fat content increased in fruit development and reached maximum during harvest time [5].

Table 2. Variation of chemical traits according to irrigation levels

Traits	Irrigation levels		
	0% (Control)	50%	100%
Fat (%)	58.67	59.49	57.80
Crude Protein (%)	17.05	17.42	17.67
Ash (%)	2.18 b	2.22 b	2.34 a

LSD (0.05)_{Ash}: 0.081

Şahin et al. stated that the content of protein varies considerably according to varieties, locality and years [11]. In our study the effect of irrigation treatments on the protein content was found to be insignificant, and this value changed from 17.673% to 17.653%. In the other studies, it was stated that protein content of Tombul hazelnut was 16.79%-18.03% [1], 19.92% [8], 14.95% [9] and 17.51% [10]. Protein value is in

parallel with the literature results. The effect of irrigation treatments on the ash content was found to be significant. Ash content of hazelnuts varies significantly according to varieties, years and regions [11]. In addition it was reported that ash content has been decrease with the increase in altitude [12]. In our research, the ash content in the study varied significantly between 2.183% (0%) and 2.337% (100%), and water supply was increased this value. and this value is in parallel with the literature results, thus this value was reported to be 2.07% [9], 2.43% [10] and 2.40% [13].

ACKNOWLEDGEMENT

This study is a part of the MSc Thesis of Arif KÜLAHÇILAR. The authors would like to thank to the Ordu University Scientific Research Projects Coordination Unit (ODUBAP) for its financial support to the project (Project Number: TF-1516).

REFERENCES

- [1] Ayfer, M., Uzun, A., Baş, F. 1986. Türk Fındık Çeşitleri. Karadeniz Bölgesi Fındık İhracatçıları Birliği Yayınları, 95s, Ankara.
- [2] Okay, A.N., Kaya, A., Küçük, Y.V., Küçük, A., 1986. Fındık Tarımı. Tarım ve Orman Köy İşleri Bakanlığı, Teşkilatlandırma ve Destekleme Genel Müdürlüğü, Yayın No: 142, 85s. Ankara.
- [3] Özbek, S. 1978. Özel Meyvecilik. Çukurova Üniversitesi Ziraat Fakültesi Yayınları No: 128, Adana.
- [4] Tonkaz, T., Bostan, S.Z. 2010. Giresun ili standardize yağış indeksi değerlerinin fındık verimi ile ilişkilerinin incelenmesi. I. Sulama ve Tarımsal Yapılar Kongresi, s: 362-369, Kahramanmaraş.
- [5] Bostan, S. Z., İslam, A., Şen, S. M. 1997. Investigation on nut development in hazelnut and determination of nut characteristics and variation within cultivars in some hazelnut cultivars. Acta Horticulturae, 445: 101-108.
- [6] Bostan, S.Z., 1998. Bazı önemli fındık çeşitlerinde tohum taslağı gelişimi üzerine bir araştırma. Türk Tarım ve Ormanlık Dergisi, 22: 295-298.
- [7] Bignami, C., Cristofori, V., Ghini, P., Rugini, E., 2009. Effects of irrigation on growth and yield components of hazelnut (*Corylus avellana*) in central Italy. Acta Horticulturae, 845: 309-314.
- [8] Çalışkan, T. 1995. Fındık Çeşit Kataloğu. Tarım ve Köy İşleri Bakanlığı, Tarımsal Üretim ve Geliştirme Genel Müdürlüğü, Bitkisel Ürün Geliştirme Başkanlığı Mesleki Yayınlar Serisi, Ankara, s:72
- [9] İslam, A. 2000. Ordu ili merkez ilçede yetiştirilen fındık çeşitlerinde klon seleksiyonu. Doktora Tezi, Çukurova Üniversitesi Fen Bilimleri, Enstitüsü, Adana.
- [10] Köksal, İ. 2002. Türk Fındık Çeşitleri. Fındık Tanıtım Grubu yayınları. 131s, Ankara.
- [11] Şahin, İ., Erkut, A., Öztekin, L., Üstün, Ş., Oysun, G. 1990. Orta ve Doğu Karadeniz bölgesinde yetiştirilen fındık çeşitlerinin teknolojik özellikleri üzerinde araştırmalar. Ondokuz Mayıs Üniversitesi Yayınları No: 63, 54s.
- [12] Bostan, S. Z., Karadeniz, T. 2004. Tombul fındık çeşitinde meyve ve toprak özelliklerinin rakıma göre değişimi ve bunlar arasındaki ilişkilerin belirlenmesi. 3. Milli Fındık Şurası, s.471.
- [13] Bostan, S.Z., 2003. Important chemical and physical traits and variation in these traits in 'Tombul' hazelnut cultivar at different elevations. Grasas Aceites 54(3): 234-239.