

## Some Nut Characteristics and Variatin of These Characteristics Within Hazelnut Cultivar Palaz

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**Abstract:** This study was carried out to determine important nut and kernel quality characteristics and variation in nut and kernel weight and kernel percentage in orchards of Palaz hazelnut cultivar in Ordu and nearby villages. Samples were selected at random from 36 orchards. It was determined that the nut weight, shell thickness, kernel weight and kernel percentage of this cultivar were 1.810-2.721 g, 0.610-0.970 mm, 0.988-1.431 g and 41.94-60.53%, respectively. Furthermore, certain nut characteristics were examined: nut length, nut width, nut height, kernel length, kernel width, kernel height, small nuts, blanks, poor fill, shirvelled kernels, doubles and good kernels. The coefficients of variation for nut weight, kernel weight and kernel percentage were 10.79%, 8.35% and 5.68%, respectively.

### Palaz Fındık Çeşidinde Bazı Meyve Özellikleri ve Bu Özelliklerin Çeşit İçindeki Varyasyonu

**Özet:** Bu çalışma, Ordu'da en fazla yetiştirilen Palaz fındık çeşidinde önemli meyve özelliklerinin ve meyve ağırlığı, iç ağırlığı ve iç yüzdesi bakımından bahçeler arasındaki varyasyonun belirlenmesi amacıyla yürütülmüştür. Bu amaçla, Ordu Merkez ilçe ve köylerinde 36 bahçede tesadüfi olarak örnekleme yapılmıştır. Çalışma sonucunda, meyve ağırlığı, kabuk kalınlığı, iç ağırlığı ve iç yüzdesi, sırasıyla, 1.910-2.721 g, 0.610-0.970 mm, 0.988-1.431 g ve %41.94-60.53 olarak belirlenmiştir. Ayrıca, meyve uzunluğu, meyve genişliği, meyve yüksekliği, iç genişliği, iç uzunluğu, iç yüksekliği, küçük meyve oranı, boş meyve oranı, eksik içli meyve oranı, buruşuk iç oranı, çift iç oranı ve dolgun iç oranı da belirlenmiştir. Meyve ağırlığı, iç ağırlığı ve iç yüzdesi bakımından bulunan varyasyon katsayıları, sırasıyla, %10.79, %8.35 ve %5.68 olarak belirlenmiştir.

### Introduction

Turkey is the origin of many important wild and cultivated hazelnut species (1), and a major producer of hazelnuts in the world (2). Hazelnuts constitute about 12% of Turkey's foreign trade earnings. The growing of hazelnut bushes is also an effective agricultural method of preventing erosion on the steep rainy Black Sea coast (2). In Turkey, traditional production practices, arising from a variety of factors, have long been used and the adoption of improved production technologies is quite limited. In modern hazelnut production, the development of high-yield cultivars of the desired quality which are suitable for processing and fit the needs of the domestic and international markets is of considerable importance (2).

Most economically important Turkish hazelnut cultivars are selected forms of *C. avellana* and *C. maxima* hybrids. Hazelnut production in this region is based on several different cultivars and types, with the result that it is very difficult to establish a good level of standardization in nut morphology, yield and quality (3).

In hazelnut propagation in the region, suckers are used. In hazelnut plantations containing a variety of

cultivars and forms, the harvested product is usually a mixture of nuts which are heterogeneous in shape, size and quality (4).

In the province of Giresun a study was carried out in the years 1970-1973, 7 selections and 3 pollinators were found that were superior in standard to Tombul cultivars (5).

In the province of Ordu, Palaz cultivar is well adapted and is the main variety grown. The fruit of this variety have a somewhat compressed shape (2).

There is great potential for breeding by means of selection in Ordu and the surrounding area. These orchards are also a very rich genetic source. The purpose of this study was to determine the nut characteristics and variation of Palaz hazelnut cultivar grown in Ordu.

### Materials and Methods

This study was carried out on the hazelnut cultivar Palaz grown in Ordu and nearby villages in 36 hazelnut orchards in the years 1995 and 1996.

Table 1. Average values of important nut and kernel characteristics in 36 hazelnut plantations (NL: nut length, NW: nut width, NH: nut height, NWE: nut weight, ST: shell thickness, KL: kernel length, KW: kernel width, KH: kernel height, KWE: kernel weight, PK: kernel percentage).

Nr.	NL (cm)	NW (cm)	NH (cm)	NWE (g)	ST (mm)	KL (cm)	KW (cm)	KH (cm)	KWE (g)	PK (%)
1	1.671	1.891	1.779	2.229	0.79	1.258	1.440	1.383	1.200	53.84
2	1.647	2.078	1.806	2.293	0.86	1.225	1.678	1.479	1.233	53.77
3	1.691	2.189	1.948	2.667	0.97	1.284	1.737	1.554	1.431	53.66
4	1.705	2.077	1.871	2.538	0.75	1.257	1.671	1.487	1.309	51.58
5	1.624	2.007	1.813	2.119	0.90	1.209	1.904	1.412	1.174	55.40
6	1.773	2.163	1.930	2.721	0.86	1.345	1.584	1.532	1.416	52.23
7	1.645	2.122	1.906	2.529	0.90	1.252	1.703	1.573	1.391	55.00
8	1.642	2.047	1.771	2.412	0.83	1.246	1.600	1.445	1.344	55.72
9	1.606	2.038	1.766	2.178	0.71	1.142	1.570	1.405	1.212	55.65
10	1.592	2.005	1.713	2.156	0.65	1.200	1.602	1.408	1.237	57.37
11	1.716	2.178	1.881	2.413	0.93	1.273	1.539	1.520	1.281	53.09
12	1.547	1.946	1.726	2.030	0.86	1.181	1.388	1.369	1.103	54.33
13	1.563	1.996	1.726	2.164	0.79	1.141	1.512	1.375	1.175	54.30
14	1.672	1.878	1.667	1.880	0.64	1.246	1.502	1.332	1.087	57.82
15	1.625	1.943	1.663	2.161	0.90	1.215	1.574	1.330	1.112	51.46
16	1.547	2.105	1.727	2.198	0.92	1.171	1.571	1.390	1.192	54.23
17	1.526	1.888	1.673	2.113	0.82	1.161	2.560	1.385	1.178	55.75
18	1.623	1.971	1.759	2.107	0.75	1.156	1.583	1.393	1.203	57.10
19	1.598	2.125	1.806	2.556	0.97	1.183	1.744	1.482	1.373	53.72
20	1.561	1.923	1.725	2.038	0.75	1.185	1.511	1.408	1.132	55.54
21	1.664	2.057	1.762	2.271	0.74	1.219	1.516	1.401	1.214	53.46
22	1.627	2.049	1.811	2.411	0.87	1.238	1.660	1.467	1.308	54.25
23	1.660	2.062	1.771	2.242	0.95	1.231	1.567	1.394	1.201	53.57
24	1.604	2.115	1.821	2.384	0.83	1.158	1.666	1.479	1.280	53.69
25	1.622	1.996	1.755	2.162	0.75	1.171	1.571	1.393	1.158	53.56
26	1.758	1.968	1.726	2.360	0.88	1.323	1.536	1.366	1.197	50.72
27	1.642	1.946	1.630	2.213	0.73	1.240	1.579	1.212	1.244	56.21
28	1.604	1.918	1.671	2.112	0.97	1.211	1.489	1.331	1.107	52.41
29	1.593	1.886	1.652	1.925	0.72	1.153	1.412	1.267	0.988	51.32
30	1.658	1.860	1.629	1.941	0.81	1.280	1.460	1.319	1.098	56.57
31	1.649	1.874	1.651	1.974	0.75	1.199	1.512	1.343	1.100	55.72
32	1.615	1.858	1.583	1.810	0.81	1.281	1.407	1.257	1.088	60.11
33	1.664	1.962	1.738	2.840	0.93	1.234	1.591	1.413	1.191	41.94
34	1.665	2.055	1.829	2.409	0.84	1.252	1.579	1.472	1.306	54.21
35	1.873	1.756	1.601	1.966	0.61	1.420	1.368	1.299	1.190	60.53
36	1.945	1.815	1.639	2.406	0.65	1.520	1.412	1.358	1.242	51.62

During the harvest period, representative nut samples from each orchard were collected, and the orchards with the lowest variation in important nut quality characteristics were selected. These samples were dried in

laboratory conditions. From each plantation 100-150 nut samples were collected at random and certain nut characteristics-nut and kernel weight, nut and kernel size, shell thickness, kernel percentage, small nuts, blanks,

Table 2. Nut and Kernel Defects, Double and Good Kernel percentages in Palaz Hazelnut (%) (SN: small nuts, B: blanks, PF: poor fill, SK: shrivelled kernels, D: doubles, GK: good kernels)

Nr.	SN	B	PF	SK	D	GK
1	6.49	11.69	7.79	9.09	0.00	71.43
2	10.47	20.93	3.48	3.48	0.00	70.93
3	1.75	12.28	1.75	8.77	0.00	70.17
4	2.30	17.24	11.50	2.30	2.30	59.77
5	13.45	18.49	3.36	2.52	1.68	74.79
6	4.41	22.05	0.00	7.35	0.00	69.11
7	2.00	11.76	7.06	1.18	1.18	89.00
8	4.67	22.43	5.61	5.61	0.00	63.55
9	11.49	14.99	3.45	0.00	1.15	78.16
10	6.25	16.96	2.68	2.68	0.90	78.57
11	3.00	7.00	7.00	5.00	3.00	81.00
12	1.28	14.10	6.41	3.85	1.28	74.36
13	1.57	4.72	3.94	3.15	1.60	89.76
14	2.00	11.00	6.00	3.00	2.00	79.00
15	3.42	17.95	0.85	0.85	0.00	76.92
16	8.00	17.00	1.00	4.00	3.00	76.00
17	10.71	8.00	4.50	2.70	0.00	72.32
18	5.00	8.00	4.00	2.00	1.00	83.00
19	3.00	8.00	0.00	1.00	1.00	89.00
20	2.10	8.42	4.21	2.11	0.00	83.15
21	3.00	7.00	4.00	7.00	2.00	79.00
22	4.08	16.33	6.12	1.02	1.02	75.51
23	3.00	12.00	1.00	4.00	0.00	85.00
24	4.00	7.00	10.00	4.00	0.00	78.00
25	6.00	9.00	3.00	3.00	0.00	85.00
26	5.26	15.80	5.30	8.80	1.80	70.18
27	4.59	18.80	1.40	1.40	4.30	80.00
28	1.41	11.30	1.40	2.80	0.00	83.10
29	0.98	7.80	3.90	1.00	1.00	83.33
30	7.84	7.80	3.90	0.00	0.00	88.00
31	8.33	10.00	11.70	3.30	0.00	75.00
32	12.7	20.63	3.17	7.94	4.86	68.25
33	13.85	15.38	4.62	4.62	6.25	87.69
34	3.77	15.10	1.90	5.70	0.00	75.47
35	4.75	17.46	7.94	4.76	1.59	68.25
36	3.40	15.91	0.00	1.14	2.38	81.82

poor fill, shrivelled kernels, doubles and good kernels were determined. In addition, the coefficients of variation (CV %) for nut and kernel weight and kernel ratio were calculated, using the general formula:

$$C.V.= (S/ \bar{x}).100 \text{ (6)}$$

Thus, the levels of variation in the orchards regarding important quality characteristics were determined.

The nut and kernel sizes were obtained using the maximum values: between tip and base for nut and kernel length; between the sutures for nut width; between the cheeks for nut thickness; between the sutures of cotyledons for kernel width; and between the cheeks of cotyledons for kernel thickness (2). In the measurements, a weighing machine (0.01 g) and compass (0.05 mm) were used. The nuts were weighed at a moisture level of 8%.

## Results and Discussion

The nuts from Palaz cultivar matured in the period August 10-20 in the study area. The nut characteristics examined are presented in Table 1.

As shown in Table 1, the nut weights ranged from 1.810 (nr.32) g to 2.721 (nr.6) g, a variation of 0.911 g. The differences between these values and the general mean (2.248 g) are 0.438 g and 0.473 g, respectively. The coefficient of variation for nut weight was 10.79%.

Kernel weights ranged from 0.988 (nr.29) g to 1.431 (nr.3) g, a variation of 0.443 g. The differences between these values and the general mean (1.214 g) are 0.226 g and 0.217 g, respectively. The coefficient of variation for kernel weight was 8.35%.

The kernel percentages ranged from 41.94% (nr.33) to 60.35% (nr.35) with an average of 54.21%. The differences between these values and the general mean (54.21%) are 12.27% and 6.14%, respectively. The coefficient of variation for percent kernel was 5.68%.

In the other studies of Palaz cultivar conducted in Turkey, nut weight and kernel percentages were found to be 1.620 g and 49.80% (2); 1.776 g and 49.30% (7); 1.710 g and 50.00% (8); and 1.603 g and 50.00% (9), respectively. The kernel weight was 0.99 g (2), and the shell thickness was 1.07 mm (8) and 1.16 mm (9).

The nut and kernel weights and kernel percentages in this study were higher than in the other studies (2, 7, 8, 9), and the shell thickness in this study was less than in the others (8, 9).

The nut weight and kernel percentage of the hazelnut

cultivar Barcelona were found to be 3.60 g and 44%, respectively. In Casina, Negret and Ennis cultivars, these values were 2.09 g and 56%; 4.00 g and 46%; 2.49 g and 51%, respectively (10, 11, 12).

Small nuts, blanks, poor fill and shrivelled kernels, the most common defects in Palaz cultivar, were 0.98% (nr.29)-13.85% (nr.33); 4.72% (nr.13)-22.43% (nr.8); 0.00% (nr.6,19 and 36)-11.70% (nr.31); 0.00% (nr.9 and 30)-9.09% (nr.1), respectively (Table 2).

In Palaz cultivar, the frequency of doubles and good kernels ranged from 0.00% to 6.25% and 59.77% to 89.76%, respectively.

In a study, the frequency of blanks, poor fill, shrivelled kernels, doubles and good kernels ranged from 2.81% (Ennis) to 17.13% (Gasaway), 0.25% (Gasaway) to 26.94% (OSU 42.103), 0.19% (TGDL) to 11.25% (OSU 49.073), 0.00% (Butler, OSU 49.073, Badem, Gasaway and Negret) to 2.63%, (O SU 17.028) and 53.77% (Tombul) to 81.94% (Ennis) (13), respectively. In the other study, the frequency of blanks, poor fill, shrivelled

kernels and good kernels were 9.2%, 9.2%, 1.2% and 75.7% in Willamette cultivar; and 14.4%, 14.0%, 2.5% and 63.3% in Barcelona cultivar, respectively (14).

The number of blanks and doubles in this study was higher than in the other studies (13, 14), and the proportion of poor fill and shrivelled kernels was smaller (13). It appears that there are similarities in the results of this study and those of other studies (13, 14) in terms of the number of good kernels.

In this study, variation in Palaz cultivar with regard to important nut quality characteristics is relatively small, and it was found that varietal contamination was small. However, the variations in nut weight, 0.911 g, kernel weight, 0.433 g, and kernel percentage, 18.41%, are important in breeding. In addition, factors such as climate and soil and cultural and technical practices in the orchards affect the nut and kernel weight and other characteristics.

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