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PJBS

ISSN 1028-8880

**Pakistan
Journal of Biological Sciences**

ANSI*net*

Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Preliminary Results on Chestnut Selection in Black Sea Region

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Abstract: The behavior of 10 chestnut genotypes selected from different provinces of Black Sea Region was determined under the same ecological conditions between 1999 and 2004. Two locations were used in the study, the first one is Fatsa County in Ordu provinces and second one is Terme County in Samsun provinces. Trial orchards were established in 1998-1999. Plant growth, yield, pomological and phenological traits of the genotypes were examined. The data were evaluated by the weighted-rankit method. The scores of the chestnut genotypes were determined with respect to their qualitative characteristics. And then, relative scores of them for general quality, nut size, earliness and suitability to chestnut paste were determined. The following genotypes were selected for their special quality scores. For nut size: 556-7 (12.6 g), for earliness: 552-8 and SE 21-2 which maturing in the first half of September, for chestnut paste: 556-8 and SE 3-12, for general quality: SE 21-9.

Key words: Chestnut, *Castanea sativa* Mill., selection, Black Sea Region

INTRODUCTION

Anatolia is one of the original centers of chestnut (*C. sativa* Mill.). Chestnut growing areas in Turkey spread from East of the Black Sea Region, thorough Marmara and Aegean Regions and reach to Antalya in the Mediterranean Region in Anatolia^[1]. Turkey has a big share in the world chestnut production with its 48,000 tons of annual production^[2].

A lot of selection studies for different aims were made on chestnut in many countries^[3-7]. The selection studies of chestnut were started by Ayfer *et al.*^[8-10] in Marmara Region in 1975 in Turkey. Researchers studied on 120 chestnut genotypes and selected 24 cultivars or genotypes for the second step of the selection. As a result, 13 cultivars or genotypes were recommended to the growers. Aegean Region was also searched by Ozkarakas *et al.*^[11] and 23 genotypes were selected for further studies.

Black Sea Region has 34% of chestnut trees in number and 29% of production in Turkey^[12]. The first selection studies started in Black Sea Region by Ayfer *et al.*^[13]. On the other hand, Serdar^[14] studied on chestnut selection in Sinop. In this study, 78 genotypes were investigated and five genotypes were selected. In addition, Serdar and Soylu^[15] studied also on chestnut selection in Samsun. In this study, 49 genotypes were investigated and seven genotypes were selected.

This study aimed to compare the selected chestnut genotypes from Sinop and Samsun under the same ecological conditions in connection with the second step of the selection study.

MATERIALS AND METHODS

This research has been conducted in two locations, Fatsa County in Ordu province and Terme County in Samsun province (Table 1). Chestnut genotypes, selected from Sinop and Samsun^[14,15], were used as plant material. In Fatsa, grafted trees of SA 5-1, SE 3-12, SE 18-2, SE 21-2, SE 21-9 and 556-8 genotypes were planted in February, 1998. However, grafted trees of 552-8, 552-10, 554-14 and 556-7 genotypes were planted in February, 1999. In Terme, grafted trees of SE 21-2 and SE 21-9 were planted in February, 1998 and other genotypes were planted in 1999. In 1999 seedlings of 554-14 were used as rootstock, although seedlings of mixture genotypes were used in 1998. Five-ten grafted trees for each genotype were planted in space of 7x7 m in Fatsa. However, less number grafted tree were planted in Terme.

In order to determine the behaviours of chestnut genotypes under the same ecological conditions, plant growth, yield, pomological and phenological traits were studied according to Ayfer *et al.*^[9]. Cumulative yield and plant growth was determined for five years after planting, because of the differences in the planting time of the

Table 1: Some characteristics of trial locations

Location	General characteristics			Soil characteristics					
	Altitude (m)	Slope (%)	Direction	Texture	pH	Total salt (%)	P ₂ O ₅ (kg da ⁻¹)	K ₂ O (kg da ⁻¹)	Organic material (%)
Fatsa	240	45	East	Cly-loam	5.75	0.01	6.9	89.1	1.14
Terme	190	10	North-west	Loam	4.25	0.08	16.3	82.1	3.47

Table 2: The scores of the characteristics and their relative values

Characteristics	Relative scores				Class of the characteristics and their scores
	For general quality	For nut size	For earliness	For chestnut paste	
Fruit bearing	15	15	15	15	High: 10, Good: 7, Medium : 4, Low: 1
Number of Nuts per bur	10	10	10	10	3.0-2.5: 10, 2.4-1.5: 6, 1.4-1.0: 3
Shell					
Color	10	10	5	0	Typical chestnut brown: 10, Slightly dark: 7, Light brown: 4, Dark: 1
Brightness	5	5	5	0	Bright: 10, Mat (dull): 4, Hairy: 1
Thickness and hardness	5	5	5	5	Very thin (≤ 0.42 mm): 7, Thin (0.43-0.48): 5, Slightly thick (0.49-0.60 mm): 3, Thick (≥ 0.61 mm): 1, Soft: 3, Slightly hard: 2, Hard: 1
Nut size (No. of Nuts/kg)	15	30	15	10	Very large (≤ 55): 10, Large (56-65): 8, Medium (66-85): 6, Small (86-100): 3, Very small (≥ 100): 1
Kernel color	10	8	5	15	Light cream: 10, Cream: 7, Dark cream: 1
Testa					
Peeling	10	5	5	20	Peel easily: 10, Peel fairly : 5, Peel with difficult: 1
Entry to the seed (mm)	0	0	0	10	Not entered or slightly entered (≤ 1.0 mm): 10, Fairly entered (2.0-3.0 mm): 7, Deeply entered (≥ 4.0 mm): 1
Earliness in	10	5	30	0	Very early (harvested in the first seven days of harvest season): 10, Early maturity (Harvested in the second seven days): 7, Mid season (Harvested in the third Seven days): 5, Late (Harvested in the fourth seven days): 3, Very late (Harvested after the fourth seven days): 1
Taste	10	7	5	15	Tasteful: 10, Good: 7, Medium: 4, Poor: 1
Total	100	100	100	100	

genotypes. Length and diameter (at 50 cm high from the ground) of the genotypes were determined at the end of the 5th years. Index of growth habit was calculated according to the ratio of crown width/tree length.

The data were evaluated by the weighted-rankit method^[10] according to the results of Fatsa location (Table 2). The scores of the chestnut genotypes were determined to their qualitative and quantitative characteristics. Relative scores of them for general quality, nut size, earliness and suitability to chestnut paste were evaluated.

RESULTS AND DISCUSSION

Young trees of the chestnut genotypes reached the bearing stage in 2-5 years. This period was shortest in 556-8 with two years (Table 3). Cumulative yield for five years after planting varied from 70 to 3168 g/tree, 556-8 and SE 21-9 were the most productive genotypes in Fatsa. Yield varied by the locations. Chestnut genotypes had generally higher yield in Terme than Fatsa. The highest cumulative yield was obtained from SE 3-12 in Terme. SE 18-2 and 552-10 had lowest cumulative yield in both of the locations. However, cumulative yield of SE 21-2 was 1220 g in Terme, although it was 70 g in Fatsa

(Table 3). This case may have resulted from climatic factors, slopes, directions and soil characteristics. Chestnut orchard in Terme have light slope and better soil characteristics than Fatsa.

At the end of the 5th year, tree lengths varied from 433-590 cm in Fatsa, 370-645 cm in Terme. The highest tree length was obtained from 554-14 in both of the locations. In Terme, chestnut genotypes had generally higher tree growth especially with respect to the diameter growth except SE 18-2. Index of growth habit varied from 0.50 to 0.75 in Fatsa and 0.56-0.84 in Terme. It was generally higher in Terme for the genotypes which had higher yield except SE 3-12. SE 21-2 had higher spreading habit than the others (Table 3).

Mean number of nut per bur varied from 1.80 to 2.44 in Fatsa and 1.76 to 2.29 in Terme (Table 4). SA 5-1, SE 18-2, SE 21-2, 552-10 and 556-8 genotypes had similar nut number per bur with the original trees^[14,15]. However, other genotypes had lower nut number per bur than the original trees. Nut sizes of genotypes were generally smaller than original trees except 552-8 and 552-10. Moreover, nut size of 556-8 was dramatically smaller than the nuts of the original tree. Ayfer and Soyulu^[10] reported that this case might be caused by the higher production of flower and the youth of the trees. In Term genotypes

Table 3: Yields and growths of chestnut genotypes

Genotypes	Unproductive years		Cumulative yield (g/tree)		Yield in the 6th year (g/tree)		Length of tree (cm)		Diameter of tree (mm)		Index of growth habit	
	Fatsa	Terme	Fatsa	Terme	Fatsa	Terme	Fatsa	Terme	Fatsa	Terme	Fatsa	Terme
SE 3-12	4	4	1573	4052	357	*	490	472	91.6	140.1	0.70	0.65
SA 5-1	5	*	439	*	150	*	490	*	78.6	*	0.69	*
SE 18-2	5	5	71	161	124	*	444	432	78.8	071.7	0.65	0.56
SE 21-2	5	5	70	1220	304	2485	434	370	85.5	113.2	0.75	0.84
SE 21-9	3	3	2439	3428	582	1287	509	530	102.1	130.3	0.70	0.71
552-8	3	3	1640	3399	*	*	443	556	99.3	136.1	0.66	0.74
552-10	5	5	123	68	*	*	433	479	92.4	137.0	0.67	0.64
554-14	3	3	1107	2901	*	*	590	645	95.5	129.0	0.59	0.68
556-7	4	*	1926	*	*	*	580	*	94.0	*	0.57	*
556-8	2	*	3168	*	773	*	472	*	63.8	*	0.50	*

*Data not available

Table 4: Some quantitative fruit traits of chestnut genotypes

Genotypes	No. of nut/bur		Nut weight (g)		No. of nut/bur		Dimensions of the nut (mm)						Shell thickness (mm)	
							Width		Length		Height			
	Fatsa	Terme	Fatsa	Terme	Fatsa	Terme	Fatsa	Terme	Fatsa	Terme	Fatsa	Terme	Fatsa	Terme
SE 3-12	2.27	2.18	6.6	7.8	151	128	16.2	17.0	25.7	27.7	27.8	29.7	0.69	0.61
SA 5-1	2.09		10.1		99		20.1		32.0		25.6		0.64	-
SE 18-2	2.44	2.17	7.2	6.4	138	156	17.3	15.0	30.5	26.9	25.9	22.3	0.55	0.43
SE 21-2	2.17	2.29	5.2	6.3	192	158	15.7	17.3	25.2	28.5	25.5	28.1	0.68	0.45
SE 21-9	2.18	2.15	8.9	10.3	112	97	17.7	18.8	29.8	31.7	27.6	28.7	0.73	0.67
552-8	2.00	2.06	5.0	5.4	200	185	16.0	16.2	25.1	26.7	24.0	25.4	0.82	0.76
552-10	2.44	2.20	5.1	5.4	196	185	13.4	13.7	23.5	23.9	23.3	23.6	0.75	0.62
554-14	1.80	1.76	8.5	9.1	117	109	17.1	17.5	31.7	32.8	27.8	28.4	0.89	0.82
556-7	2.11	-	12.6	-	79	-	21.6	-	35.9	-	29.9	-	0.63	-
556-8	1.82	-	5.0	-	200	-	13.6	-	24.3	-	22.4	-	0.42	-

had higher shell thickness than the original trees except 556-8 and 556-7. In Fatsa, chestnut genotypes had generally higher shell thickness than in Terme.

Chestnut genotypes had generally similar qualitative nut traits with original trees. Peeling of the testa varied from fairly difficult to easy and generally, it was easy (Table 5). Testa did not enter to the seed in most of the genotypes. But, only in one type (556-7) it fairly entered.

Bud swelling of genotypes varied from 28 March to 22 April according to the genotypes and years (Table 6). It was very early in SE 18-2, SE 21-2, 552-8 and 552-10. Due to this reason, these genotypes was damaged slightly from the spring frost in 3-4 April 2004. Blooming period of male catkins took place in June. 556-8 showed flowering twice in a year, e.g. first flowering was in the second half of June and second flowering was in the first half of September. SE 18-2, 552-8, 552-10 and SE 21-2 were earliest genotypes for male flowering. Maturity time of the genotypes varied from the second week of September to the end of October. In the genotypes of SE 3-12, SE 21-9, 552-8, 552-10 and 556-8, maturity time was later 10-15 days than the original trees^[14,15]. 556-8 had twice fruit maturity time in a year. The first one was in the last week of October and the second one was from the second half of

November to the first half of December. Yield in the second harvest was ¼ of the yield of the first harvest in this genotype. Beginning of leaf yellowing was determined in November. Leaf fall of the genotypes varied from the last week of November to the first half of December. Leaf fall were latest in SE 3-12, 552-10, 556-7 and 556-8. Phenological traits of the genotypes were generally similar in both of the locations for each genotype.

The chestnut blight (*Crphoectria parasitica*) was very important problem in both of the locations. Various control methods were used against chestnut blight. SA 5-1 and 554-14 genotypes had the highest mortality rate with 87.5 and 57.1%, respectively in the same orchard in Fatsa^[16]. However, SE 3-12, 556-8, SE 21-2 and 552-8 were determined as hopeful genotypes against chestnut blight^[16,17].

According to the first five years of evaluations of genotypes by the weighted-rankit method, the following genotypes can be recommended to the growers at this stage. For nut size: 556-7 (12.6 g), for earliness: 552-8 and SE 21-2 maturing in the first half of September, for chestnut paste: 556-8 and SE 3-12, for general quality: SE 21-9. However, this study is going on in 2005-2009 in order to have further results.

Table 5: Some qualitative fruit traits of chestnut genotypes

Genotypes	Shell color	Shell brightness	Testa peeling	Testa entering to the seed (mm)	Kernel color	Taste
SE 3-12	Slightly dark	Bright	Easy	0.0	Light cream	Tasteful
SA 5-1	Brown	Bright	Rather easy	0.0	Cream	Good
SE 18-2	Brown	Bright	Rather easy	0.0	Cream	Good
SE 21-2	Slightly dark	Rather bright	Easy	0.0	Cream	Good
SE 21-9	Slightly dark	Bright	Easy	0.0	Light cream	Good
552-8	Brown	Hairy	Easy	0.0	Light cream	Tasteful
552-10	Brown	Bright	Easy	0.0	Cream	Good
554-14	Slightly dark	Rather bright	Fairly difficult	0.0	Cream	Good
556-7	Brown	Bright	Fairly difficult	2.4-3.5	Light cream	Good
556-8	Brown	Bright	Easy	0.0	Cream	Tasteful

Table 6: Some phenological traits of chestnut genotypes

Genotypes	Location	Bud swelling	Bud burst	Blooming period of male catkins	Date of full blooming in male catkins	Fruit ripening	Beginning of leaf yellowing	Leaf fall
SE 3-12	Fatsa	10-19 Apr.	16-23 Apr.	18 June-1 July	25 June	19-25 Oct.	20-26 Nov.	10-17 Dec.
	Terme	10-20 Apr.	16-22 Apr.	17 June-5 July	25 June	15-21 Oct.	20-25 Nov.	7-20 Dec.
SA 5-1	Fatsa	7-18 Apr.	14-23 Apr.	16 June-2 July	23 June	11-17 Oct.	12-17 Nov.	30 Nov.-9 Dec.
SE 18-2	Fatsa	28 Mar.-7 Apr.	5-20 Apr.	7-25 June	15 June	28 Sept.-3 Oct.	11-15 Nov.	25 Nov.-8 Dec.
	Terme	29 Mar.-10 Apr.	9-23 Apr.	9-25 June	16 June	25 Sept.	14-20 Nov.	29 Nov.-5 Dec.
SE 21-2	Fatsa	28 Mar.-10 Apr.	6-18 Apr.	12-25 June	18 June	11-18 Sept.	14-21 Nov.	26 Nov-7 Dec.
	Terme	29 Mar.11 Apr.	10-20 Apr.	10-23 June	16 June	9-16 Sept.	15-20 Nov.	30 Nov.-5 Dec.
SE 21-9	Fatsa	1-13 Apr.	8-21 Apr.	14-26 June	19 June	4-6 Oct.	15-21 Nov.	3-8 Dec.
	Terme	4-15 Apr.	11-21 Apr.	13-30 June	20 June	2-4 Oct.	18-20 Nov.	2-6 Dec.
552-8	Fatsa	29 Mar.-10 Apr.	7-18 Apr.	8-20 June	13 June	14-21 Sept.	12-16 Nov.	29 Nov.-8 Dec.
	Terme	29 Mar.-10 Apr.	10-18 Apr.	9-21 June	16 June	13-20 Sept.	13-18 Nov.	28 Nov.-4 Dec.
552-10	Fatsa	28 Mar.-8 Apr.	7-16 Apr.	9-24 June	15 June	26 Sept.-1 Oct.	16-24 Nov.	10-15 Dec.
	Terme	29 Mar.-10 Apr.	11-20 Apr.	10-25 June	16 June	25 Sept.	23-28 Nov.	8-15 Dec.
554-14	Fatsa	5-14 Apr.	11-20 Apr.	12-27 June	19 June	25-28 Oct.	15-22 Nov.	1-8 Dec.
	Terme	6-14 Apr.	12-20 Apr.	14-29 June	20 June	25-28 Oct.	15-18 Nov.	1-5 Dec.
556-7	Fatsa	10-22 Apr.	19-29 Apr.	-	-	25-30 Oct.	16-26 Nov.	8-13 Dec.
556-8	Fatsa	8-14 Apr.	16-23 Apr.	16-29 June and 1-15 Sept.	22 June and 5 Sept.	25-28 Oct. and 20 Nov.-13 Dec.	23-29 Nov.	9-13 Dec.

ACKNOWLEDGMENTS

This research was supported by The Units of Research Projects of Ondokuz Mayıs University (Project No. Z-290). The authors wish to thank Emine DUMAN and M.Ali Arslan for helping measurement.

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