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# Clonal Selection in Hatun Parmagi Grape Variety (1st Stage)

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**Abstract:** This study was conducted to determine the candidate clones in Hatun Parmagi grape variety from 2012 to 2014. In the scope of the study; yield, development and quality parameters were determined on 220 vines grafted on Rupestris du Lot rootstock from 7 vineyards. According to obtained results from Weighted-Rankit test, totally 28 candidate clones were selected. When selected candidate clones compared to their vineyards' averages as to yield, number of clusters, cluster weight, berry weight, maturity index and pruned wood weight: 160 %, 110 %, 59 %, 32 %, 46 % and 100 % increase were determined, respectively. However, 23 % decrease in yield, 19 % decrease in cluster weight and 10 % decrease in berry weight was determined in some selected candidate clones.

**Keywords:** Clone selection, Hatun Parmağı, table grape, weighted-rankit, yield

# Hatun Parmağı Üzüm Çeşidinde Klon Seleksiyonu (1. Aşama)

**Öz:** Bu çalışma Hatun Parmağı üzüm çeşidinde klon adaylarını belirlemek amacıyla 2012-2014 yılları arasında yürütülmüştür. Çalışmada; 7 adet bağda Rupestrisdu Lot anacı üzerine aşılı 220 omcada verim, gelişme ve kalite parametreleri tespit edilmiştir. Tartılı derecelendirme sonucunda toplamda 28 adet klon adayı seçilmiştir. Seçilen klon adayları, alındıkları bağın ortalamasına göre karşılaştırıldığında verimde % 160, salkım sayısında % 110, salkım ağırlığında % 59, tane ağırlığında % 32, olgunluk indisinde % 46, budama odunu ağırlığında % 100 oranında artışlar saptanmıştır. Ayrıca, seçilen bazı klon adaylarının verimde % 23, salkım ağırlığında % 19, tane ağırlığında % 10 azalış tespit edilmiştir.

**Anahtar Kelimeler:** Klon seleksiyonu, Hatun Parmağı, sofralık üzüm, tartılı derecelendirme, verim

## 1. Introduction

Selection is the oldest method used in breeding of cultural crops and plants (Gökçora, 1983). This method has also been used in viticulture for breeding of plants/varieties. The vegetative-propagated plants generally bear all characteristics of parent plants (Eriş, 1995). However, some of the characteristics may change in some cases. The variations among the plants within the same variety may result from more than one closely related parent of population rather than a single parent via virus or viroid impacts and mutations (Mullins et al., 1992; Eriş, 1995; Possingham, 1998; Mannini, 2002). Mutation-induced variations play significant roles in plant breeding (Şehirali and Özden, 2007). Long lasting vegetative propagation causes increasing in possibility of being mutations in grapevines (Dokuzoğuz, 1964; Fidan, 1985; Eriş, 1995). The objective of clonal selection in viticultureis to select the individuals with maximum capacities from the population of a variety based on genetics of the variety (Gülcan and İlter, 1795). The yield increase inselected clones was reported as 35% in Germany, 64 % in Spain, 30 % in Italy, 30-40% in Hungary and 15% in China (Köse and Güleryüz 2003). In Turkey, the yield increase achieved through selected clones varied between 6-225 % (Kiracı et al., 2002; Kader et al., 2004). In previous studies, significant variations were also reported within the same variety with regard to cluster weight, berry weight, berry shape,

solible solid, ripening time, leaf shape and size, resistance against disease and pests (Boidron, 1995; Borgo et al.,1998; Kader et al., 2004; Kiracı and Karauz, 2015).

There are not much available data about the research on candidate clones constituting the 1st stage (nominees of mother clone vine) researches carried out in the world and Turkey. In Turkey, detailed researches on the 1st stage of clone selection were conducted by Köse (2002), Kaya (2008), Karataş et al (2013) and Yağcı et al (2014).

Southeast Anatolia Region with 1.2 million tons annual production has about 25.9 % of total grape production of Turkey. Within this region, the provinces of Gaziantep, Adıyaman and Kilis have about %36,3 regional production with 438962 tons annual production 9.4 % of country grape production and about 36.3% of regional grape production (TUIK, 2015). The present study was performed to select healthy, high-yield and quality candidate clones of Hatun Parmağı grape variety commonly grown as table grape in Gaziantep and Mardin Provinces and well-adapted to regional conditions.

## 2. Material and Methods

### Selection of experimental vineyards

Following the observations made on 7347 vines in 17 vineyards during the 2012 season, 7 producer vineyards (the 7th was included in 2013) were selected based on development levels of vines, existence of pests and diseases, maintenance conditions, location and position of vineyard. Of the selected vineyards, 5 are located in Gaziantep-Islahiye and 2 are located in Mardin-Midyat. Macroscopic investigations were carried out on virus, yield and quality of 2875 vines in 7 vineyards. At the end, 220 candidate clones were marked and selected for further selection works. Goble-trained and Rup.du Lot rootstocks were used in all experimental vineyards used for selections.

Hatun Parmağı, the plant material of the study, is a grape variety used as table grape. It has branchy-conical clusters weighing around 300-350 g. Berries have long-elliptical shape, yellow color, 2-4 seeds and weigh about 5-6 g. The variety is need to pruning with 2-3 buds and it is a mid-season variety (Çelik 2002).

### Yield, quality and development values

**Bearing rate (%):** Shoots and inflorescences (flower clusters) were counted when the shoots were 30-40 cm.

**Yield (kgvine$^{-1}$):** Harvested grapes were weighed on a digital scale.

**Cluster weight (g):** The yield per vine was divided by number of clusters and classified in accordance with OIV (1997).

**Berry weight (g):** Randomly selected 100 berries from 10 clusters were weighed and average of them was taken. Berry weights were classified according to OIV (1997).

**Maturity Index:** Solible solid was divided by acid ratio to get maturity index. Resultant values were used to form 5 different classes.

**Development (pruning weight – kg vine$^{-1}$):** The pruned annual shoots were weighed to get pruning weight (kg vine$^{-1}$).

Class intervals and scores for yield, quality and development are provided in Table 1.

### Data analysis

Average of counting, weighing, observation and analysis values of three years were taken and assessed through Weighted-Rankit method. The vines with the greatest scores were then selected as candidate clones.

## 3. Results and Discussion

Following 3-year observations and investigations, 211 vines were assessed, 9 vines were excluded because of problems experienced with them (shot berry, scattered cluster and etc.). The weighted-rankit scores of selected candidate clones of each vineyard are provided in Table 2; yield, quality and development values and vineyard averages are provided in Table 3; increase/decrease ratios compared to averages of the vineyard from which they were selected are provided in Table 4.

**Table 1.** Criteria for adjusted weighted-ranked, class score and intervals
***Çizelge 1.*** *Uyarlanmış tartılı derecelendirmeye esas olan kriterler, sınıf puan ve aralıkları*

| Criteria | Class Score | Class Interval | Relative Score |
|---|---|---|---|
| Bearing Rate (%) | 1 (very low) | <0.8 | X 20 |
| | 2 (low) | 0.90-1.12 | |
| | 3 (medium) | 1.13-1.36 | |
| | 4 (high) | 1.37-1.59 | |
| | 5 (very high) | >1,60 | |
| Yield (kg/omca) | 1 (very low) | <1,0 | X 40 |
| | 3 (low) | 1.1-2.5 | |
| | 5 (medium) | 2.6-3.5 | |
| | 7 (high) | 3.6-4.0 | |
| | 9 (very high) | >4.1 | |
| Cluster Weight (g) | 1 (very low) | <50 g | X 10 |
| | 3 (low) | 50-125 g | |
| | 5 (medium) | 126-250 g | |
| | 7 (high) | 251-500 g | |
| | 9 (very high) | >1000 g | |
| Berry Weight (g) | 1 (very low) | <0.35 g | X 15 |
| | 3 (low) | 0.35-1.10 g | |
| | 5 (medium) | 1.11-3.30 g | |
| | 7 (high) | 3.31-7.00 | |
| | 9 (very high) | >7.00 g | |
| Maturity Index | 1 (very low) | <-22.1 | X 5 |
| | 3 (low) | 22.2-31.1 | |
| | 5 (medium) | 31.2-40.1 | |
| | 7 (high) | 40.2-49.1 | |
| | 9 (very high) | >49.2 | |
| Development | 1 (very low) | <1300 | X 10 |
| | 3 (low) | 1301-2540 | |
| | 5 (medium) | 2550-3690 | |
| | 7 (high) | 3700-4840 | |
| | 9 (very high) | >4850 | |

**Table 2.** Weighted-Rankit scores of selected candidate clones
***Çizelge 2.*** *Seçilen adayların tartılı derecelendirme puanları*

| Vineyard | Candidate Clone | Bearing rate (20) | Yield (20) | Development (10) | Cluster weight (15) | Berry weight (15) | Maturity index (5) | Total score |
|---|---|---|---|---|---|---|---|---|
| 1st Vineyard | 4 | 40 | 360 | 90 | 70 | 105 | 15 | 680 |
| | 17 | 20 | 360 | 90 | 70 | 105 | 25 | 670 |
| | 26 | 40 | 360 | 90 | 70 | 105 | 25 | 690 |
| | 29 | 60 | 360 | 70 | 70 | 105 | 25 | 690 |
| | 33 | 60 | 360 | 90 | 90 | 105 | 25 | 730 |
| | 37 | 80 | 360 | 50 | 70 | 105 | 25 | 690 |
| **Vineyard average** | | **37**±13 | **360**±0 | **54**±18 | **69**±6 | **104**±5 | **26**±10 | **650** |
| 2nd Vineyard | 1 | 20 | 360 | 90 | 70 | 105 | 5 | 650 |
| | 2 | 20 | 360 | 90 | 70 | 105 | 5 | 650 |
| | 22 | 20 | 360 | 90 | 90 | 105 | 5 | 670 |
| | 33 | 20 | 360 | 90 | 70 | 105 | 5 | 650 |
| | 51 | 40 | 360 | 90 | 70 | 105 | 15 | 680 |
| **Vineyard average** | | **22**±6 | **360**±0 | **66**±22 | **71**±5 | **105**±0 | **6**±5 | **631** |
| 3rd Vineyard | 2 | 80 | 360 | 10 | 70 | 105 | 15 | 640 |
| | 3 | 20 | 360 | 50 | 70 | 105 | 15 | 620 |
| | 10 | 20 | 360 | 30 | 70 | 105 | 25 | 610 |
| | 45 | 60 | 360 | 50 | 70 | 105 | 15 | 660 |
| **Vineyard average** | | **31**±15 | **360**±0 | **31**±10 | **69**±0 | **105**±0 | **13**±6 | **609** |
| 4th Vineyard | 2 | 60 | 360 | 30 | 50 | 105 | 25 | 630 |
| | 13 | 20 | 360 | 50 | 50 | 105 | 25 | 610 |
| | 36 | 40 | 360 | 30 | 50 | 105 | 25 | 610 |
| | 37 | 20 | 360 | 30 | 50 | 105 | 45 | 610 |
| | 38 | 60 | 360 | 30 | 50 | 105 | 15 | 620 |
| **Vineyard average** | | **27**±12 | **358**±13 | **31**±9 | **50**±5 | **105**±0 | **16**±10 | **586** |
| 5th Vineyard | 1 | 40 | 360 | 30 | 70 | 105 | 45 | 650 |
| | 11 | 20 | 360 | 30 | 70 | 75 | 45 | 600 |
| **Vineyard average** | | **21**±5 | **297**±78 | **19**±10 | **64**±8 | **77**±8 | **36**±11 | **515** |
| 6th Vineyard | 3 | 60 | 360 | 30 | 70 | 75 | 35 | 630 |
| | 4 | 40 | 360 | 50 | 70 | 75 | 25 | 620 |
| **Vineyard average** | | **33**±14 | **360**±0 | **32**±12 | **63**±10 | **75**±0 | **22**±14 | **586** |
| 7th Vineyard | 28 | 20 | 360 | 50 | 70 | 105 | 45 | 650 |
| | 29 | 20 | 360 | 70 | 70 | 105 | 15 | 640 |
| | 30 | 20 | 360 | 50 | 70 | 105 | 35 | 640 |
| | 34 | 20 | 360 | 50 | 70 | 105 | 35 | 640 |
| | 45 | 20 | 360 | 50 | 70 | 105 | 45 | 650 |
| **Vineyard average** | | **20**±3 | **360**±0 | **37**±13 | **70**±0 | **105**±0 | **21**±10 | **614** |

**Table 3.** Yield and quality values for selected candidate clones of HatunParmağı grape variety (3-year average)

***Çizelge 3.*** *Hatun Parmağı üzüm çeşidinde seçilen klon adaylarının bazı verim ve kalite değerleri (3 yıl ortalaması)*

| Vineyard | Candidate Clone | Bearing rate | Yield (kg vine$^{-1}$) | Cluster weight (g) | 100 Berry weight (g) | Solible solid (%) | Maturity index | Pruning weight (kg vine$^{-1}$) |
|---|---|---|---|---|---|---|---|---|
| 1st Vineyard | 4 | 1.03 | 20.7 | 423.3 | 457.0 | 15.0 | 34.5 | 3.9 |
| | 17 | 0.79 | 23.8 | 471.7 | 477.0 | 16.6 | 34.7 | 5.2 |
| | 26 | 0.93 | 24.4 | 394.7 | 471.3 | 16.8 | 38.8 | 5.4 |
| | 29 | 1.30 | 24.3 | 469.7 | 565.0 | 17.9 | 38.4 | 5.4 |
| | 33 | 1.19 | 32.3 | 528.3 | 459.0 | 14.7 | 30.1 | 6.9 |
| | 37 | 1.49 | 24.8 | 406.0 | 441.0 | 17.1 | 40.9 | 2.2 |
| **Vineyard average** | | 1.0±0.2 | 16.4±5.5 | 359±69 | 429±52 | 16.4±1.0 | 36.2±4.3 | 3.4±1.2 |
| 2nd Vineyard | 1 | 0.74 | 11.3 | 315.7 | 497.0 | 15.0 | 22.9 | 5.8 |
| | 2 | 0.60 | 12.2 | 455.7 | 575.7 | 15.7 | 36.9 | 4.9 |
| | 22 | 0.67 | 19.6 | 616.0 | 439.3 | 17.0 | 28.6 | 5.8 |
| | 33 | 0.69 | 14.7 | 334.0 | 477.7 | 15.3 | 18.9 | 6.7 |
| | 51 | 0.95 | 25.1 | 462.7 | 547.0 | 16.0 | 23.9 | 5.4 |
| **Vineyard average** | | 0.74±0.2 | 14.2±3.9 | 392±73 | 489±50 | 15.8±0.7 | 25.2±3.7 | 4.2±1.5 |
| 3rd Vineyard | 2 | 1.29 | 9.2 | 310.0 | 500.0 | 15.1 | 33.5 | 0.8 |
| | 3 | 0.73 | 6.9 | 297.7 | 460.0 | 16.1 | 32.9 | 3.1 |
| | 10 | 0.62 | 7.1 | 292.3 | 503.0 | 16.2 | 34.7 | 2.1 |
| | 45 | 0.66 | 9.0 | 290.7 | 607.3 | 15.7 | 33.3 | 2.8 |
| **Vineyard average** | | 0.90±0.2 | 8.6±1.8 | 318±44 | 484±47 | 15.3±0.6 | 30.8±2.7 | 1.9±0.5 |
| 4th Vineyard | 2 | 1.25 | 10.4 | 337.0 | 550.3 | 17.1 | 36.6 | 1.8 |
| | 13 | 0.78 | 7.5 | 355.0 | 605.0 | 16.7 | 35.6 | 2.7 |
| | 36 | 0.98 | 7.4 | 325.7 | 601.3 | 17.6 | 35.7 | 1.9 |
| | 37 | 0.74 | 6.6 | 293.0 | 537.3 | 18.5 | 45.7 | 1.6 |
| | 38 | 1.31 | 8.4 | 322.0 | 634.3 | 16.2 | 30.0 | 1.5 |
| **Vineyard average** | | 0.87±0.2 | 7.5±1.9 | 340±61 | 563±58 | 16.8±0.7 | 32.2±4.4 | 2.0±0.4 |
| 5th Vineyard | 1 | 1.13 | 12.7 | 296.3 | 356.7 | 18.3 | 45.0 | 1.7 |
| | 11 | 0.92 | 6.9 | 341.3 | 306.0 | 21.8 | 51.0 | 1.5 |
| **Vineyard average** | | 0.65±0.2 | 4.9±2.6 | 267±66 | 270±32 | 20.2±1.9 | 41.9±5.8 | 1.2±0.4 |
| 6th Vineyard | 3 | 1.24 | 9.0 | 277.7 | 291.3 | 18.1 | 39.4 | 1.4 |
| | 4 | 0.71 | 15.3 | 445.0 | 290.7 | 19.4 | 35.8 | 2.9 |
| **Vineyard average** | | 0.81±0.2 | 8.5±2.9 | 280±76 | 291±15 | 17.9±2.1 | 34.2±5.7 | 2.0±0.6 |
| 7th Vineyard | 28 | 0.33 | 5.7 | 361.5 | 472.5 | 18.5 | 47.6 | 3.1 |
| | 29 | 0.37 | 5.1 | 333.5 | 487.5 | 16.6 | 33.0 | 4.3 |
| | 30 | 0.48 | 5.2 | 343.0 | 457.5 | 17.6 | 38.7 | 2.9 |
| | 34 | 0.51 | 7.4 | 360.0 | 466.0 | 18.0 | 38.5 | 3.0 |
| | 45 | 0.69 | 7.5 | 347.0 | 469.0 | 17.8 | 42.6 | 2.9 |
| **Vineyard average** | | 0.56±0.1 | 6.6±0.9 | 345±22 | 466±26 | 16.8±0.7 | 34.7±3.8 | 2.4±0.6 |

**Table 4.** Differences of selected candidate clones from the vineyards from which they were selected,%
***Çizelge 4.*** *Seçilen klon adaylarının seçildikleri bağa göre ortaya çıkardıkları farklar (%)*

| Vineyard | Candidate Clone | Bearing rate | Yield | Cluster weight | Berry weight | Solible solid | Maturity index | Pruning weight |
|---|---|---|---|---|---|---|---|---|
| 1st Vineyard | 4 | 3.3 | 26.5 | 18.1 | 6.5 | -8.6 | -4.7 | 14.3 |
| | 17 | -20.7 | 45.5 | 31.6 | 11.2 | 1.2 | -4.2 | 50.5 |
| | 26 | -6.7 | 49.2 | 10.1 | 9.8 | 2.4 | 7.1 | 56.3 |
| | 29 | 30.4 | 48.6 | 31.0 | 31.7 | 9.1 | 6.0 | 57.7 |
| | 33 | 19.4 | 97.5 | 47.4 | 7.0 | -10.4 | -16.9 | 100.4 |
| | 37 | 49.5 | 51.6 | 13.3 | 2.8 | 4.2 | 12.9 | -35.6 |
| 2nd Vineyard | 1 | 0.5 | -20.3 | -19.4 | 1.5 | -4.8 | -9.2 | 38.0 |
| | 2 | -18.5 | -13.9 | 16.3 | 17.6 | -0.4 | 46.4 | 16.9 |
| | 22 | -9.0 | 38.3 | 57.2 | -10.3 | 7.9 | 13.4 | 37.2 |
| | 33 | -6.3 | 3.7 | -14.8 | -2.4 | -2.9 | -25.0 | 57.6 |
| | 51 | 29.0 | 77.1 | 18.1 | 11.7 | 1.6 | -5.2 | 28.0 |
| 3rd Vineyard | 2 | 43.7 | 7.5 | -2.5 | 3.3 | -1.5 | 8.7 | -59.0 |
| | 3 | -18.7 | -19.4 | -6.3 | -5.0 | 5.0 | 6.8 | 58.4 |
| | 10 | - 28.8 | -5.8 | -14.2 | -10.6 | -3.3 | 7.9 | 5.7 |
| | 45 | -26.5 | 5.1 | -8.5 | 25.4 | 2.4 | 8.1 | 45.4 |
| 4th Vineyard | 2 | 43.6 | 38.0 | -1.0 | -2.2 | 2.0 | 13.8 | -10.0 |
| | 13 | -10.4 | -0.5 | 4.3 | 7.5 | -0.4 | 10.7 | 37.0 |
| | 36 | 12.6 | -1.8 | -4.3 | 6.8 | 5.0 | 11.0 | -2.4 |
| | 37 | -15.0 | -12.4 | -13.9 | -4.5 | 10.4 | 42.0 | -19.1 |
| | 38 | 50.5 | 11.5 | -5.4 | 12.7 | -3.3 | -6.8 | -22.7 |
| 5th Vineyard | 1 | 74.6 | 159.6 | 10.9 | 32.1 | -9.5 | 7.5 | 46.4 |
| | 11 | 42.2 | 41.0 | 27.8 | 13.3 | 7.8 | 21.8 | 27.4 |
| 6th Vineyard | 3 | 53.9 | 6.4 | -0.9 | 0.1 | 0.9 | 15.4 | -31.5 |
| | 4 | -11.9 | 80.9 | 58.8 | -0.1 | 8.1 | 4.8 | 39.5 |
| | 28 | -40.9 | -13.9 | 4.6 | 1.4 | 9.9 | 37.2 | 28.0 |
| 7th Vineyard | 29 | -33.8 | -23.0 | -3.5 | 4.6 | -1.4 | -4.9 | 77.2 |
| | 30 | -14.1 | -21.5 | -0.7 | -1.9 | 4.6 | 11.5 | 16.9 |
| | 34 | -8.7 | 11.8 | 4.2 | 0.0 | 6.9 | 10.9 | 21.4 |
| | 45 | 23.5 | 13.3 | 0.4 | 0.6 | 5.7 | 22.8 | 17.3 |

In the 1st vineyard, weighted-rankit scores of vines varied between 610-730. Considering the ranked scores, the first six ranks, including the vines 33 (730 points), 26 (690 points), 29 (690 points), 37 (690 points), 4 (690 points) and 17 (670 points) were selected as candidate clones (Table 2). While the average yield of the 1st vineyard was 16.4 kgvine$^{-1}$, the greatest yield of candidate clones was obtained from clone 33 with a yield level of 32.3 kg vine$^{-1}$ (Table 3).

Such a yield means 98 % increase in yield compared to vineyard average (Table 4). Average cluster weight of the 1st vineyard was 359 g, berry weight was 4.3 g, maturity index was 36 and pruning weight was 3.4 kg vine$^{-1}$. Considering these average values, while there was 32 % increase in berry weight of vine 29, the increase in cluster weight of selected candidates was between 9-40 %, the increase in maturity index was between 6-7 % and the increase in pruning weight was between 14-100 %.

In the 2nd vineyard, based on Weighted-Rankitscores, the first five ranks including the vines 23 (680 points), 51 (680 points), 22 (670

points), 1 (650 points) and 2 (650 points) were selected as candidate clones (Table 2). While the average yield of the 2nd vineyard was 14,2kg vine$^{-1}$, the greatest yield of candidate clones was obtained from clone 51 with a yield level of 25.1 kg vine$^{-1}$. Such a yield provided 77 % increase in yield compared to vineyard average. Average cluster weight of the 2nd vineyard was 392 g, berry weight was 4.9 g, maturity index was 37 and pruning weight was 7.0 kg vine$^{-1}$(Table 3). Considering these average values, while 18% increase was observed in berry weight of vine 2, the increase in cluster weight of selected candidates was between 16-57 %, the increase in maturity index was between 13-46 % and the increase in pruning weight was between 17-58 % (Table 4).

In the 3rd vineyard, Weighted-Rankitscores of vines varied between 590-660. Considering the rankit scores, the first three ranks, including the vines 45 (660 points), 2 (640 points) and 3 (620 points) and the vine 10 (610 points) with the greatest berry weight (8,5 g) in 2013 were selected as candidate clones (Table 2). While the average yield of the 3rd vineyard was 8.6 kg vine$^{-1}$, the greatest yield of candidate clones was obtained from clone 2 with a yield level of 9.2 kg vine$^{-1}$. Such a yield means 7 % increase in yield compared to vineyard average. Average cluster weight of the 3rd vineyard was 318 g, berry weight was 4.8 g, maturity index was 31 and pruning weight was 1.9 kg vine$^{-1}$(Table 3). Considering these values, while there was 45 % increase in berry weight of vine 45, the decrease in cluster weight of selected candidates was between 2-14 %, the increase in maturity index was between 7-9 % and the increase in pruning weight was between 5-58 % (Table 4).

In the 4th vineyard, Weighted-Rankitscores of vines varied between 500-630. Considering the rankit scores, the first five ranks, including the vines 2 (630 points), 38 (620 points), 13 (610 points), 36 (610 points) and 37 (610 points) were selected as candidate clones (Table 2). While the average yield of the 4th vineyard was 7.5 kg vine$^{-1}$, the greatest yield of candidate clones was obtained from clone 2 with a yield level of 10,4 kg vine$^{-1}$ (Table 3). Such a yield means 38 % increase in yield compared to vineyard average. Considering these average values, while there was 13 % increase in berry weight of vine 38, the decrease in cluster weight of selected candidates was between 1-14 %, the increase in maturity index was between 10-42 % and the increase in pruning weight was 37 % (Table 4).

In the 5th vineyard, Weighted-Rankitscores of vines varied between 310-650. Considering the rankit scores, the first two ranks, including the vines 1 (650 points) and 11 (600 points) were selected as the candidate clones (Table 2). While the average yield of the 5th vineyard was 4.9 kg vine$^{-1}$, the yields of selected candidate clones 1 and 11 were respectively observed as 12.7 and 6.9 kg vine$^{-1}$ (Table 3). These yield levels indicated respectively 41 and 160 % increase in yield compared to vineyard average (Table 4). Average cluster weight of the 5th vineyard was 267 g, berry weight was 2.7 g, maturity index was 51 and pruning weight was 1.8 kg vine$^{-1}$ (Table 3). Considering these average values, while there was 32 % increase in berry weight of vine 1, the increase in cluster weight of selected candidates was between 11-28 %, the increase in maturity index was between 8-22 % and the increase in pruning weight was between 27-46 % (Table 4).

In the 6th vineyard, Weighted-Rankitscores of vines varied between 560-630. Considering the ranked scores, the first two ranks, including the vines 3 (630 points) and 4 (620 points) were selected as candidate clones (Table 2). While the average yield of the 6th vineyard was 8.4 kg vine$^{-1}$, the yields of candidate clones 3 and 4 were respectively observed as 9.0 and 15.3 kg vine$^{-1}$ (Table 3). Such values means respectively 6 and 81 % increase in yield compared to vineyard average (Table 4). Average cluster weight of the 6th vineyard was 280 g, berry weight was 2.9 g, maturity index was 34 and pruning weight was 2.04 kg vine$^{-1}$. Considering these average values, while there was 59% increase in cluster weight of vine 4, the decrease in maturity index was between5-15% and 40% increase was observed in pruning weight of vine 3

and 32 % decrease was observed in pruning weight of vine 4 (Table 4). In the 7th vineyard, Weighted-Rankitscores of vines varied between 590-650. Considering the rankit scores, the first five ranks, including the vines 28 (650 points), 45 (650 points), 29 (640 points), 30 (640 points) and 34 (640 points) were selected as candidate clones (Table 2). While the average yield of the 7th vineyard was 6.6 kg vine$^{-1}$, the greatest yield of candidate clones was obtained from clone 45 with a yield level of 7,5 kg vine$^{-1}$ (Table 3). Such a yield means 13 % increase in yield compared to vineyard average (Table 4). Average cluster weight of the 7th vineyard was 346 g, berry weight was 4.7 g, maturity index was 35 and pruning weight was 2.4 kg vine$^{-1}$ (Table 3). Considering these average values, while there was 5 % increase in berry weight of vine 29, the increase in cluster weight of selected candidates was between 1-5 %, the increase in maturity index was between 11-37 % and the increase in pruning weight was between 17-77 % (Table 4).

Weighted-ranked scores of candidate clones were the primary criteria in selection stage. The vine 33 of the 2nd vineyard had a remarkable value with regard to vine development (6.6 kg vine$^{-1}$) and the vine 2 had remarkable berry weight (5.8 g); vine 10 of the 3rd vineyard had remarkable berry weight (8.49 g) in 2013.

Considering the vineyard averages and standard deviations, current findings revealed significant variations among candidate clones. Despite the variations based on the owner of the vineyard, age of the vine, location and position of vineyards, such a case also indicated a significant variation in yield and quality of the same variety (Yağcı et al., 2014).

Increasing yield and quality have already been proven with selections carried out in several previous studies. Previous researchers indicated bud fertility as a significant criterion in selecting candidate clones (Özek and Uslu, 1972; Troshin, 1990). Uslu (1985) reported 92 % difference between the highest and the lowest bearing rate of 13 clones selected in Müşküle grape variety. Similarly, 100 % difference was reported in bud fertility of candidate clones of Narince grape variety (Yağcı et al., 2014), 130 % difference in clones of Boğazkere grape variety (Karataş et al., 2015a) and 127 % difference in candidate clones of Öküzgözü grape variety (Karataş et al., 2015b).

Yılmaz et al (1997), Uslu and Samancı (1998) and Özışık et al (1998) pointed out that superior individuals could be selected through clonal selections and significant improvements might be achieved in cluster weights. Beside quite large clusters, Hajdu (1990) reported also quite small clusters in clones of Ottonel grape population (60-340 g). Kader et al. (2004) reported that high yield and pruning weights might present together in clones 1 and 2 of Çal Karası grape variety. Researchers also indicated more than 100 % difference in cane weights of Çal Karası clones. Similar findings were also reported in clonal selections of Özışık et al. (1998).

In weighted-ranked, the parameters may vary based on the intent of use of the grape variety and such parameters may significantly affect the total scores of candidate clones. A decrease in yield may not necessarily indicate a negative attribute for that candidate clone. For instance in Hatun Parmağı grape variety, while the clone 2 of the 2nd vineyard exhibited 16 % decrease in yield, the same clone had 16 % increase in cluster weight, 18 % increase in berry weight, 46 % increase in maturity index and 17 % in development. A reverse case may also exist. While there was 38 % increase in yield of clone 22 of the 2nd vineyard, there was 4 % decrease in number of clusters, 10 % decrease in berry weight and 15 % decrease in number of clusters/shoot ratio.

## 4. Conclusion

In this study, 28 candidate clones were identified in Hatun Parmağı grape variety of the Southeastern Anatolia Region. Then, they were grafted over clone-originated 1103 Paulsen rootstocks and planted in 3 replications with 6 vines in each replication. According to yield and quality, the superior clones will be determined among the clone candidates in the next phase of study. These clones will be tested for grapevine viruses (ArMV, GFLV, GLRaV-1, 2, 3, 6, 7; GFkV, GVA, RpRSV, SLRSV, and TBRV), infected clones will be removed by meristem culture, and mother blocks will be established

with these clean materials. Selections based only on the number of shoots and inflorescences may not be sufficient in identification of candidate clones. Besides, "selected clones or candidate clones may not be expected to be superior in all aspects. They may be prominent with specific characteristics for specific purposes (based on weighted-rankit scores)".

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