

IMPROVEMENT OF THE TECHNOLOGICAL CHARACTERISTICS OF THE TIRANA'S BLACK OLIVE THROUGH THE CLONE SELECTION.

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Abstract

The olive is among the oldest cultivated trees in the world, olive cultivation is associated with several countries of the Mediterranean Sea basin and plays an important role in the diets, economies and cultures of the region. There are different regions in Albania that are suitable for olive cultivation in our country. The olive growing is very ancient in Tirana district and constitutes an important sector of economy. "Black of Tirana" olive cultivar has originated from Tirana district and occupies about 30% of variety structure. This cultivar has mean oil content and is destined for olive oil industry; its fruit is with average weight. The present study has the objective the selection of "individual trees" with features of high production constant, oil production, and a heavy average fruit weight. The base method for realizing of this study was Classical method of "clone" selection which was applied in two stages: The first stage: General Selection was carried out by evaluation of blossom flowers and bearing fruits index on a population of 255 olive trees every year for a period of 5 consecutive years. The Second stage, "Clone candidates" resulting from general selection (first stage) were evaluated individually every year for: production kg / tree / year, the oil content as % of fresh matter, average fruit weight (g). Periodicity of production was analyzed through Dobersek-Urbane method, based on the final output data. The results had shown that the "clone candidates" indicated difference in "production constant" PC against the average of the population. Six individual trees have had "production constant" between (PC 0.00 to 0.30). Fruit weight variability was from 0.10 to 0.51g more than the standard, which include 17 individual trees. Six individual trees were selected with the highest percentage of oil, that had differences more than 0.2 to 2.3%. The final assessment resulted in: 12 clones with superior PC, 6 clones possess PC + Superior OP, 4 clones possess three features selection (PC + FW + OP).

Key words: Clone; Variety, Olive oil; Cultivar; rooting capacity;

1. Introduction

The area of Tirana is characteristic area for olive growing and there are some important olive cultivars that constitute olive resources of Tirana, but only two of them have economic importance "UBT" olive cultivar and "Black of Tirana" olive cultivar. The study has analyzed the cultivar "Black of Tirana", which occupies 30% of the olive

grove surface cultivated throughout central of Albania. It has a periodically average production, [4] with the average oil content (22%) and average fruit weight (2.8g).

The population of this cultivar has individual trees that have different production, with highest uniformity and highest percentage of oil. The selection process was realized according assessing the

advantageous genotypes in its population. [5].

2. Materials and Methods

Diversity of individual trees was used for general selection for the features:

- high production constant (PC 0.0-0.30).
- higher oil percentage over the average population (OP).
- fruit weight over (0.2 g) [3].

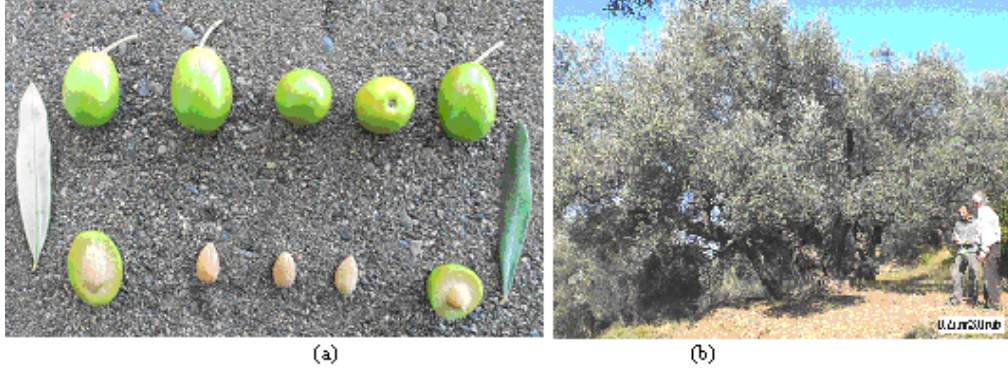


Figure 1: a) “Black of Tirana” olive cultivar (fruit); b) “Black of Tirana” (clone tree).

Clone selection was performed in both population area of the “Black of Tirana” olive cultivar (Figure 1), (Veshmodh and Kuleks) with 255 trees, in period of ten consecutive years (1998-2007). General selection was based on external appearance for quality traits (fruit shape, symmetry, resistance to C. Oleaginum, etc.) and for quantitative traits (fruit weight and production etc.). General selection is performed in two stages:

Phase I: (five years): *General selection:* was performed by estimation of individual trees for blossomed flower index and bearing fruit index. According general selection, were selected 23 individual trees which had yearly fruit production, that “merit” the status “Clone candidate”.

Phase II: (five years): Clones candidates were analyzed each year for

quantitative and qualitative traits that certify qualitative differences.

- fruit tree production kg/tree/year,
- oil percentage, was analyzed on a pastry amount of 5 kg/tree/year, estimated as % of fresh raw materials, (soxlet, extracted with petroleum ether).
- the average fruit weight was calculated on 100 fruits of each tree/year
- the report of pulp and endocarp (P / E)
- frequency coefficient (FC), calculated from Pearce and Dobersek-Urbank on: production/tree/year, according to the formula [5]:

$$I = \sqrt{\frac{1}{n-1} \sum_{i=1}^n \left(\frac{P(i) - P(\bar{P})}{P(i) + P(\bar{P})} \right)^2}$$

Where: n-represents the number of observations and P (i) production of the year (i)

2.1 Selection of individual trees

Selection process was realized based on estimation and testing of clones with differences from the average population, for constant production (at values 0.0 -0.3 of CP), and simultaneously oil % (OP) and the average fruit weight (FW). Variables results are analyzed in SAS version 2008. (Statistical Analysis Software) [8].

3. Results and Discussion

The result of this study demonstrated high variability in the population of "Black of Tirana" olive cultivar. The best olive individual trees were selected systematically (every year) by general selection and then by individual assessment. The population of 255 olive trees surveyed show that there was great variability in the first year of general selection. The best trees represent only 9% of each plot against base trees. Dynamically by applying the intention "criteria" selection, there were qualified (69%) in the second year, (44%) in the third year, (22%) in the fourth year. Definitively there were 23 clone candidate trees, which comprise 9% of the base population at the end of the first stage. Only (9%) of trees have had variability from the average population because they have blossomed and fruition in every year homogenously. These trees were studied individually to ensure variability. [3]

3. 1 Evaluation of Clone Candidate - second stage

The results of quantitative and qualitative traits of Clone candidates, analyzed during 5 years have confirmed qualitative differences compare to the average population.

The estimated total production. (TP) individual productivity of each tree and each year has presented a wide variance. Total production, kg/tree implemented in five years has been different, (from 124 kg to 380 kg). Production has been a function of fruition tree-surface and its level of regularity. Individual trees; Uzi17, Uzi20, Uzi12,Uzi4, Uzi2, had higher global fruit production. [6]

Production constant (PC), regularity of fruit production has been change and according to (PC) "**marker**" has shown the level of trees proficiency for a constant production. [7]. Olive trees have a constant production when the value of the coefficient of periodicity (CP) was at the values (0.0-0.3).

According this reason, only 6 individual trees (Uzi20, Uzi17,Uzi16, Uzi12, Uzi9, Uzi4), had constant production level, because their (PC) value is: (0:13, 0:14, 0:19, 0:22, 0:27, 0:27). The clone's PC value resulted in obvious differences compared with the average standard population (0.45). Many of Clone candidates had higher value than PC (0.3). Five clone candidates had PC values (0.3-0.45), 12 Clone candidates (about 0.45). Olive fruits with PC-value (0.0- 0.3) have quite constant production. They represent

distinct differences to other Clone candidates whose value is under (0.3) of the PC and also with the value of the standard population, even if they derive from the same population and are grown in the same environment. At the selected trees "clones" it was confirmed, that during all years of study, the level of productivity has been constant and we were

not able to discern statistical differences. In this case the phenomenon of their production constitutes the genetic character. The selection of several years based on a large population, has completely eliminated those destructive gene trees, regard to the coefficient of periodicity [6].

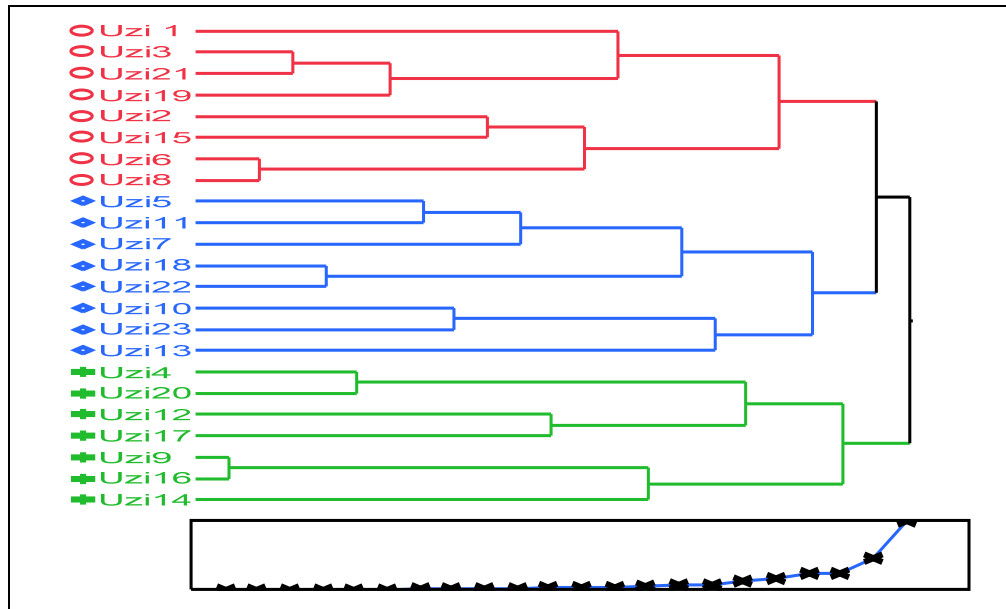


Figure 2. Dendrogram Hierarchical Clustering for the similarity of the Clone candidates for the ratio (PC), Method = Ward.

Coefficient of periodicity value, has oriented Clone candidates in three homogeneous groups according average hierarchical clustering (Figure 2), at the level of distance, was variable which has fluctuated from 0.13 (Uzi20) to 0.27 (Uzi9):

- accessions with production coefficient (PC) 0.13 to 0.30. Which are characterized for constant production. (annual production).

- accessions with production coefficient (PC) 0.30 to 0.45 which are characterized for constant production
- quotient group with production coefficient (PC) on 0:45, characterized for non constant production.

Improvement of the technological characteristics of the Tirana's black olive through the clone selection.

The diversity of trees represents a shift in the population's genetic equilibrium of "Black of Tirana" cultivar and its evolution simultaneously. Through analytical assessment of differences in individuals "clones", genetic composition was different from the parent trees population. Clone selection through quantitative traits represented by production, expressed by the coefficient of periodicity (CP), make us sure for the heredity of these traits. On the other hand the number of accessions that differ from the standard varietal has given us assurance that we have large deviations from real values of the population. Reasons for deviations are related with internal genetic reasons and with the level of their relationship with the environment. Standard deviation of varietal for PC expressed by the letter Sigma (σ), and analyzed with the formula:

$$\sigma = \sqrt{\frac{\sum(X - \bar{X})^2}{n - 1}}$$

Where: (x)-all values, (X)-average value, (n) - No. of variables, and (n-1) - No. of variables minus one

has shown the level of distribution in the population of "Black of Tirana" olive cultivar.

Quantitative characteristics of the majority individual trees are near to the average value (μ) of the population. Interpreting this distribution (figure 3) shows that over 72.2% of the values are found in the limit $\mu \pm 1\sigma$ toward average the limits $\mu \pm 2\sigma$ values are 94.3% and in the limits $\pm 3\sigma$ are found 98.8% of values (Figure 2). Variance analyses on the traits of PC, % oil, fruit production, has characterized an interactive variance, which is expressed in the differences of phenotype, as effect of interaction of genotype with the environment. In the final analysis the main index (PC), confirmed that only a small proportion of the population was selected. The results of many years about average value of the Clone candidate's PC and the difference with the arithmetic average of the population has confirmed the difference of selection [7].

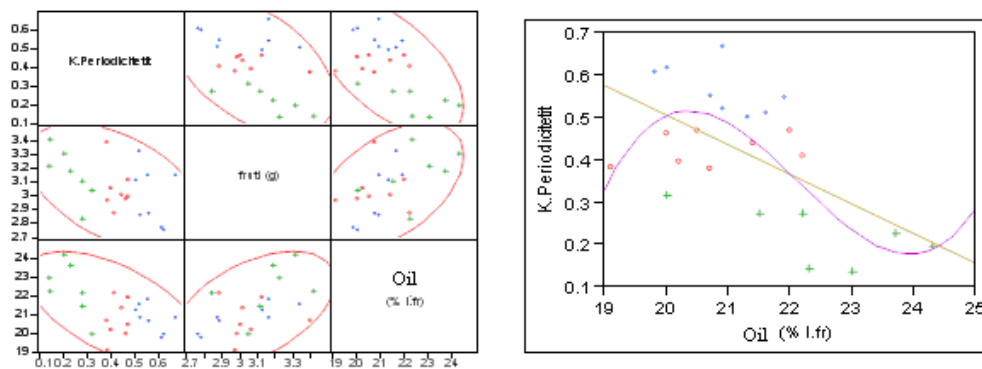


Figure 2. Scatter plot Matrix, Correlations dhe Regression of Clone candidates for CP, OP, FW. (The correlations are estimated by REML method).

Table1. Five-year data about Clone candidates, for PC, OP,

<i>Plot Clone candidate</i>	<i>Kg/ Individual/year</i>					<i>Global Production (kg) (I - V)</i>	<i>P.C</i>	<i>Weight, (g)</i>		<i>Oil %</i>	(+) by stand		
	2006	2007	2008	2009	2010			Fr	End		Fruit (g)	Oil (%)	(PC)
KP1	52	20	24	55	34	185	0.4410	3.01	0.36	21.4	0.11	-	0.010
UZ2	74	30	25	50	30	209	0.4112	2.88	0.37	22.2	-	0.2	0.04
UZ3	35	15	22	40	28	140	0.4712	3.12	0.38	22.0	0.22	-	-
UZ4	60	52	55	54	57	278	0.1422	3.41	0.37	22.3	0.51	0.3	0.31
UZ5	70	15	22	45	18	170	0.5131	3.33	0.38	21.6	0.43	-	-
UZ6	44	12	18	32	45	151	0.3812	3.39	0.38	20.7	0.49	-	0.17
UZ7	75	18	28	45	15	181	0.5021	3.12	0.39	21.3	0.22	-	-
UZ8	33	10	16	40	25	124	0.3837	2.97	0.38	19.1	0.07	-	0.17
UZ9	30	25	25	40	40	160	0.2749	2.84	0.37	22.2	-	0.2	0.28
UZ10	60	15	75	5	35	190	0.6194	2.76	0.38	20.0	-	-	-
UZ11	58	15	40	30	45	188	0.5218	2.87	0.37	20.9	-	-	-
UZ12	52	38	45	50	40	225	0.2274	3.18	0.38	23.7	0.28	1.7	0.23
UZ13	75	28	12	0	60	175	0.6690	3.16	0.38	20.9	0.26	-	-
UZ14	40	60	35	25	22	182	0.3180	3.04	0.39	20.0	0.14	-	0.14
UZ15	60	40	60	15	20	195	0.3975	3.06	0.36	20.2	0.16	-	0.06
UZ16	44	55	45	38	40	222	0.2738	3.11	0.36	21.5	0.21	-	0.28
UZ17	80	70	85	75	70	380	0.1971	3.31	0.36	24.3	0.41	2.3	0.26
UZ18	60	20	10	17	40	147	0.5509	3.16	0.38	21.9	0.26	-	-
UZ19	60	30	50	70	20	230	0.4631	2.98	0.37	20.0	0.08	-	-
UZ20	55	60	46	45	50	256	0.1357	3.22	0.38	23.0	0.32	1.0	0.32
UZ21	65	24	30	15	70	204	0.4684	3.00	0.37	20.5	0.10	-	-
UZ22	45	20	50	5	30	150	0.5545	2.88	0.39	20.7	-	-	-
UZ23	85	13	8	40	55	201	0.6101	2.78	0.37	19.8	-	-	-

FW Stand: PC=0.45; OP=22%; FW= 2.8g

Average fruit weight; Yield of clone trees has been linked with the weight of fruit, and biological stability of the tree in terms of the environment. [2] The performance traits are the fruit weight, the ratio P/E and the number of fruits/ branch. We have considered the average weight as a second request, and the level of variability has fluctuated from 2.84 g at 3.49 g. There have been some individual trees with high average weight which take a dominant position in relation to the others. Trees no. 4, 5, 6, 17, 20, had differences with the arithmetic average (2.8g). Although they have been 17 dominant clones against the average value, only three of them have had a different (bigger) value 3.49g, 3.39g, and 3.33g, ie 0.4-0.5 g more than varietal average, These differences were verified with greater distance compared to the varietal standard.

Oil content. Analysis to find individual trees which have stable feature of the high oil percentage, has put in different positions compared with PC. Oil percentage has been a stable feature for individual tree every year. Highlights of rapprochement between oil percentage and fruit weight in each identity, according binary analyses Density Ellipse P = 99, have identified constant individual trees with high oil percentage and fruit weight. The accessions variables which possess oil percentage and fruit weight over the average of five years study are presented at Table 1.

Selection of clones. The Clone candidates are in different position according the analyses of stable trait (KP) and its

relation with secondary traits oil percentage (OP) and main fruit weight (FW). Correlative analysis distinguished similarity points, distance level and has selected accessions with PC, OP, FW value different from the varietal standard value, which make a sustainable feature. (Figure 2)

4. Conclusions

The selection process of "Black of Tirana" olive cultivar, according the results of the analysis has made possible the certification of differences within the population of olive cultivar, the determination of similar features and level of distance between each other.

There are some differences between Clone candidates about the coefficient of periodicity, oil percentage and main fruit weight. The results are: 12 clones that possessing PC value on superior level, 6 clones that possess PC + OP, 4 clones that possess PC + FW+ OP:

In population of Clone candidates were selected and "certified" 6 individual trees possessing connections regarding all three features no. 4, 9, 12, 16, 17, 20.

5. Referencess

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