

## THE RECONSTRUCTION OF CULTIVARE LUTZ GOLDEN APPLE GRAFTED ON M9 ROOTSTOCK

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**Abstract:** *The first intensive apple orchards in Albania were planted in 1980s. M9 was used as a rootstock and as cultivars were used Golden Delicious, Lutz Golden, Renet Canadian, Red Delicious, Granny Smith, Fuji, etc. The applied planting distance were 4 x 2.5 meters or some 100/plants for hectare with the average production performance reaching 200-250 quintals/hectare. The agrarian reform between 1992- 1998 and the changes to the ownership of the land improved the situation in the existing apple orchards creating new development opportunities. Currently, new owners invest by hiring contemporary technology thanks to financial accumulations from remittances and state projects on the agriculture. In 2000 – 2004 certain important interventions under the IP Vlore and Horticulture Department of the Agricultural University of Tirana were realized*

*aiming at improving the situation in the existing apple planting. To mention here among others, the study of the impact of the reconstruction mass of Lutz Golden apple grafted with the M9 rootstock. The study was realized in a 2 hectare area with apple trees aged almost 20 years. Technically, the experiment was raised by 5 variants X 4 replication/variant where V0 stands for control variants, V1 stands for lowering of aura by 10%, V2 stands for lowering of aura by 20%, V3 stands for lowering of aura by 30%, and V4 stands for reconstruction in mass by 70% and reformation of aura in three consecutive years. In the end, the best variants were found to be V4 45.23 and V3, 33.12 kilograms for each apple tree where the utilized schemes optimized the vegetative-production situation in the apple orchards in an effective way.*

**Key words:** *apple planting, rootstock, distance, technology, reconstruction, grafted.*

### INTRODUCTION

Apples in Albania represent 25% of the total planted trees and provide 32-35% of the total national fruit production. Apples are cultivated in 47,000 farms and 200-300 hectares of new parcels are cultivated intensively every year. (INSTAT 2009) It is widely spread in the southern regions of the country mostly concentrated in the Kolonja-Korca-Pogradec axis (FERRAJ B., et. al., 2009).

During the last ten years governmental projects are used, approved structure of clones and rootstocks. (AU. Tirana & MAFCP, 2009) the new parcels are planted in distances of 3.5 x 1.5 - 1.2 - 1 m or some 2380 – 2850 plants for hectare (ERRANI A., 1994), (LAURI et. al., 2000).

In the new agrotechnology it is predicted a supporting system and a permanent irrigation, an integrated management of the soil and pests are included new equipment of rarefaction, vintage and manipulation. (LESPINASSE J.M., 1989) The most common rootstocks are M9, M26, MM109, MM111, MM106, P1, P1 (BERGAMINI A., 1991), (FERRAJ B, et.al., 2009). The most common forms of cultivation are spindle bush, slider spindle (BERGAMINI A., 1991) free spindle (ERRANI A, et.al, 1994), verticale axise (LAURI & LESPINASSE, 2000). The plants height is 2.8-3.1m and the most common supporting system is the one with columns of concrete with a height of 3.5 m, fixed 50 cm underground. Above them there are four staples in a distance of 75 cm. The crown is amplified in 4 floors that are fixed in four blocks with 5-6 rames with a free disposal in the area between the lines (ROLAND H WALSER, et. al.1994),

(BRANZANTI E.C, RICCI A, 2001), (VALLI R., 2004).

The main part of the production or 60-70% is concentrated in the first and second floor (MACFOT 2000). The average production level in new parcels is 30 kilograms/plant while in the current structure of the clones in new plantings Golden D, L.Golden, Golden Clon - Emla/10, Red D, Starking, Gala, Michgala, Red Chief, Fuji, Granny S. Pink Lady, Renet Canadian dominate (SANSVINI S, et.al., 1986).

### **MATERIAL AND METHODS**

The experiment for the apple reconstruction was realized in 2000-2002 in Korca in an apple orchard involving trees aged 20 years. The cultivar is Lutz Golden while the rootstock is M9, (BERGAMINI A., 1991). The study was based on 5 variants X 4 replication/variant and was placed in the form of a "random block" with occasional distribution. For every replication 5 trees were treated one by one or some 20 trees/variant. After every repetition 10 plants were left as a protective area. After every variant remained a full line of trees. In the study were included 100 trees. The data for the statistical and mathematical analysis were taken and elaborated every year for every two trees/replication, and the study results would be given in details in the following tables and graphics (FERRAJ B., et.al. 2009).

#### **Variants under Study**

In the land parcel planted with trees during the period under study, the annual technological card used by the farmer was applied. The novelty in the experiment is the V4 where the elimination of the 70% of the solid mass of branches was applied together with the adaptation of the form of the low palmete aura through shearing in vegetation for the consecutive years (LAURI, P.É. 2002). In the experiment were selected as variants:

**V0 or the control variant.** It is the way of keeping the aura applied by the farmer. The pyramid aura is preserved with free under branches which revive after winter and summer shearing. Agro - technology is planned in an average production level. For every tree 200-250 fruit/tree are left while the quality of the production is poor and this is reflected in the out of standard production (LESPINASSE, J.M. 1989), (LAURI et. al. 1994.)

**V1 or lowering of aura by 10 percent.** The 10% cutting of the skeleton branches and leading is applied. In the winter shearing, slim and short production scion are left not many in numbers and scions in the shape of bird-feet -like are revived. During vegetation, wooden scions are joined with two buds or lowered aiming at re-establishing the rapport wooden mass/ production mass (RONALD H.et.al., 1994, PETER J. BEDKER et. al., 1995).

**V2 or lowering of aura 20%.** The same is applied as in V2, but the volume of the trimmed wood mass is 20% (second branches, third branches, and leading one). In vegetation the new scions are eliminated, wooden scions are instantly cut in equal rapport while the preserved ones are joined with two buds or lowered. (BRANZANTI E. C, RICCI A, 2001)

**V3 or lowering of aura by 30%.** In this variant it is applied the lowering of aura by 30 % (first branches, second, third, and leading one). It is considered a heavy average shearing concerning the wooden mass taken from the tree. In vegetation, it is intervened in the form of suckling, joining, and lowering of vegetative scions while the productive scions are rare. (PETER J., et. al. NA-FR-01-95), (RONALD H. et.al., 1994).

**V4 or lowering of aura by 75 percent.** It is a French reconstruction practice. The intervention foresees elimination up to 75 percent of the wooden mass and total transformation of the aura completely transforming it in the next three years into a low pyramid with normal parameters. As an obligatory service it includes green shearing in the first year by eliminating around half of the vegetative mass by stimulating auto control of the general state of the tree (ISA, 1994). In the winter shearing in the second and third year, the intervention is directed to

the fulfillment of the production skeleton, control of the main leading branch and other skeleton branches, adding of production branches, etc. (Peter J., et.al. NA-FR-01-95)

### INDICES OF THE RESEARCH

The retrieval of the indices for analysis was carried out according to the methodology of the study. The data were initially registered in the field gazette and by the end of the research the digitalization and statistical elaboration year was carried out. Among main indices are mentioned:

Annual vegetative growth, height of the plant in ml, rapports R1, R2, and R3, production kg/plant, sugar, acidity, dried mass, C vitamin content in fruit and conclusions and recommendations

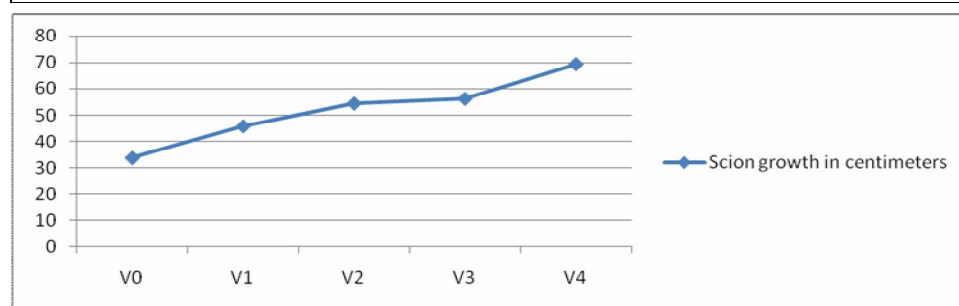
### Scion Vegetative Growth in Centimeters

To realize the assessment of the annual vegetative growth some 100scions/ replication or some 400scions/variant were measured. The measures were carried out in November. And scions were taken from all the sides of the space of the tree. The data in table 6 prove that the length of the scion in mathematical percentages is higher than in V4, V3, and V2. The analysis of the variation verify the creation of three different homogenous groups from V0 (V1, V2, V4) by even proving statistically the impact of the applied schemes. Statistically, there are no proven changes between V2 and V3. (HOGUE, E.J. and NEILSEN, G.H. 1987)

Annual length of scion/in cm

No.	VARIANTS	Scion growth in centimeters	Estimated in percentages	Homogenous groups
1.	V0	33.87	100	A
2.	V1	45.92	135.57	B
3.	V2	54.44	160.73	C
4.	V3	56.21	165.95	C
5.	V4	69.46	205.07	D

DMV = 6.026 - Variants (or replication) marked with the same letter have no proven statistically changes



Graphic 1. Annual growth of scion in centimeters

### Height of Plant

For the analysis of the index of the height of the plant, the data were retrieved through the measuring of the aura from the roots to the end of the leading central branch (ERRANI A., 1994), (LAURI et.al. 2006). From the statistical assessment of the data it can be proven that the variants with a height bigger than the aura are V0 and V1. Other variants are included in the same homogenous group.

Height of the plant in meters				
No.	VARIANTS	Height of the plant - in meters	Estimated in percentages	homogenous groups
1.	V0	4.57	100	B
2.	V1	4.08	89.27	B
3.	V2	3.47	75.92	A
4.	V3	3.13	68.49	A
5.	V4	3.04	66.52	A

DMV = 0.518. Variants (or replication) marked with the same letter have no proven statistical changes

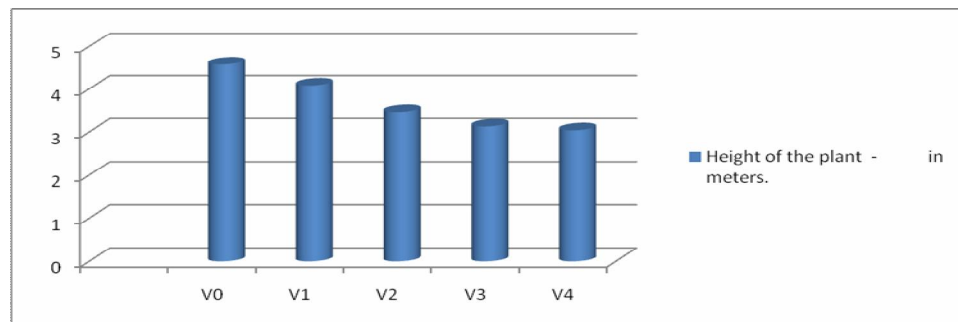
Table and graphic 7, prove the creation of another homogenous group different from V0 (V0=V1) while V2=V3=V4 do not have statistical proven changes between them but they are different from V0.

**R3, or rapport of vintage fruit/tied fruit**

Analysis of variant R3 proves the changing between variant. In V4 there is another homogenous grouping different from V0 while between V1, V2, and V3 there are no proven statistical changing (FERRAJ B., et. al. 2009).

**Production in kilograms/plant**

Production of fruit is estimated through their measured quantity in the land parcel with analytical scale after damaged fruit is taken away. From the vintage production, an average sample of 30 fruit/variant is selected in order to be submitted to further analysis in chemical laboratory (LAURI et. al. 2000) The analysis of the variant proves the creation in V4 of another homogenous group statistically different from V0 (V0=V1=V2=V3 found in the same group) (LESPINASSE & LAURI 2000).

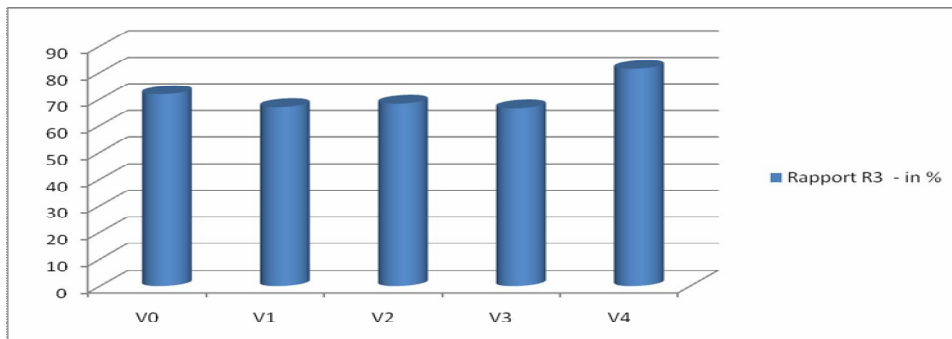


Graphic 2. Height of Plant – in ml

**R3, or rapport or rapport of vintage fruit/tied fruit**

No.	VARIANTS	Rapport R3 - in %	Homogenous groups
1.	V0	71.78	A
2.	V1	67.01	A
3.	V2	68.26	A
4.	V3	66.57	A
5.	V4	81.37	B

DMV = 16.234 - variants (or replications) marked with the same letter do not have proven statistical changing.

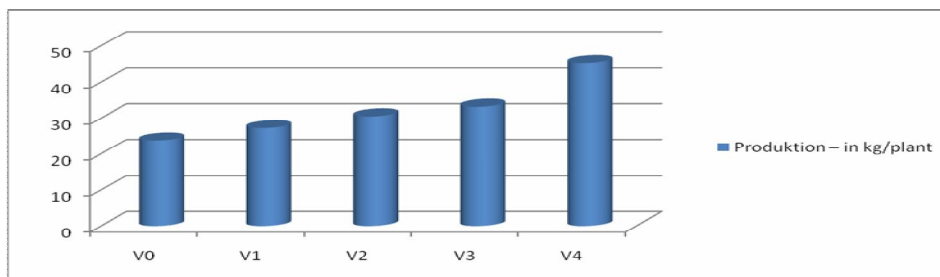


Graphic 3. R3 Rapport or rapport of vintage fruit/contained fruit

Production in kg/plant

No.	VARIANTS	Produktion – in kg/plant	Homogenous groups
1.	V0	23.73	A
2.	V1	27.25	A
3.	V2	30.50	A
4.	V3	33.12	A
5.	V4	45.23	B

DMV = 10.97, Variants (or replications) marked with the same letter do not have proven statistical changing.



Graphic 4. Production - in kg/plant

**Analysis of the fruit indexes**

For the analysis of the fruit, an average sample of 30 fruit for every replication/variant was considered while the tasks in the laboratory continued with specific tests of fruit including, calibration, number of fruit/kilogram, average weight of fruit, average diameter of fruit, content of sugar, acidity, vitamin C, etc.

**Content of Sugar in Fruit**

The analysis of the variant for the index of “sugar percentage” proves statistical changes through the creation of another homogenous group different from V0 (V0, V1, V2, V3 placed in the same homogenous group). This indicates the effectiveness of utilized schemes in

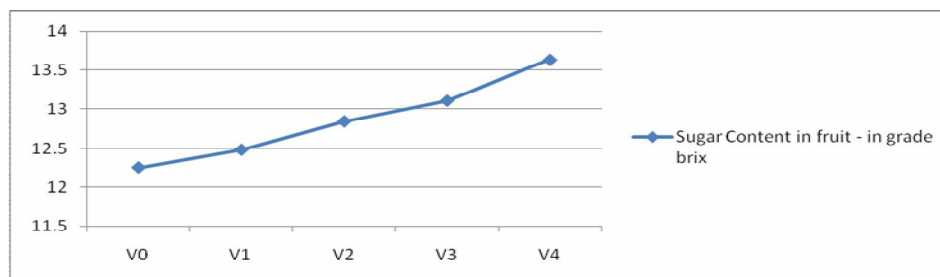
the experiment while the shearing improves the leaf mass which is reflected in the produced quantity of the first quality

From the agronomic point of view, V4 is presented in satisfactory levels by fulfilling the characteristic indexes for “Lutz Golden” and it becomes more effective in case it is better respected the winter shearing, green shearing, and especially the rareness of the fruit. (GIANNINI et.al. 1998), (FERRAJ B., 2009).

Content of Sugar in Fruit

No	VARIANTS	Sugar Content in fruit - in grade brix	Homogenous groups
1.	V0	12.25	A
2.	V1	12.48	A
3.	V2	12.84	A
4.	V3	13.11	A
5.	V4	13.63	B

DMV = 0.492 - Variants (or replications) marked with the same letter do not have proven statistical changing.



Graphic 5. Content of Sugar in Fruit

After the reconstruction it is recommended that should be left 200- 220 fruits with a main weight of 190 - 200 gr or 38-45 kg/plants (350-440 q/ha) ( FERRAJ B., et. al., 2009).

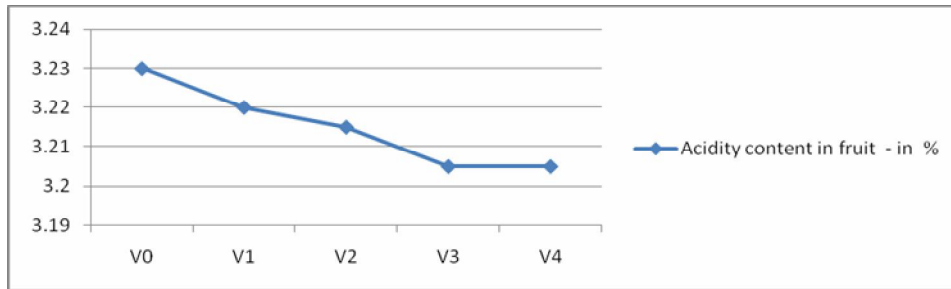
#### Acidity Content in Fruit

Analysis of the variant for this index does not prove changes towards V0. This situation is related to the uniformity of the agro-technique utilized in apple orchards.

Acidity content in fruit- in %

No.	VARIANTS	Acidity content in fruit - in %	Homogenous groups
1.	V0	3.230	A
2.	V1	3.220	A
3.	V2	3.215	A
4.	V3	3.205	A
5.	V4	3.205	A

DMV = 0.0302 - Variants (or replications) marked with the same letter do not have proven statistical changing



Graphic 6. Acidity Content in Fruit- in %

The table of the statistical elaboration and graphic 10.2 places the data in the same homogenous group something which proves that despite the experimental scheme applied, there are no proven statistical differences (GIANNINI et.al. 1998).

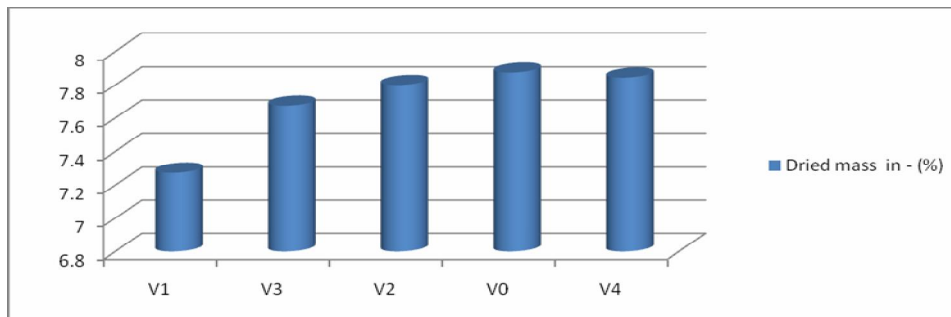
**Content of dried mass in fruit-in %**

Statistically, it is proven the creation of another homogenous group different from V0 (V0=V2=V4), while V1=V3 placed in the same grouping. The data of the table 10.3 prove that V1 and V2 have a lower percentage of the dried mass, while the indices of V3 and V4 improve progressively (SANSAVINI S., 1986).

Content of dried mass in fruit-in %

No.	VARIANTS	Dried mass in - (%)	homogenous groups
1.	V1	7.275	A
2.	V3	7.675	A B
3.	V2	7.800	B
4.	V0	7.875	B
5.	V4	7.845	B

DMV = 0.444 - Variants (or replications) marked with the same letter do not have proven statistical changing



Graphic 7. Content of dried mass in fruit-in %

**CONCLUSIONS**

The three year analysis of the study ‘The reconstruction of cultivare Lutz Golden apple grafted on M9 rootstock released the following conclusions;

▪ Apple on vegetative M9 rootstock and aged over 20 years, following the reconstruction, returns to optimal production conditions and in a good agro-economic state. Albanian reality proves that it can be utilized with effectiveness even for years to come.

▪ The most optimal level of intervention is with the reconstruction which is V4 or the elimination of the wooden mass up to 75% and V3, or the reduction by 30 percent of the wooden mass every year.

▪ Reformation of the aura is realized in three consecutive years through careful and combined winter and summer shearing (FERRAJ B. et. al. 2009).

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*Foto no.1,2,3,4. The apple 20 - 22 years before and after reconstruction – Korçë 2002. (Foto, Ferraj B.)*