

## INFLUENCE OF SOME TECHNOLOGICAL SYSTEMS ON THE QUALITY AND QUANTITY OF THE YIELD IN THE INTENSIVE APPLE ORCHARDS

Sarca Gheorghe\*

\*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail: [sarcagheorghe@yahoo.com](mailto:sarcagheorghe@yahoo.com)

### Abstract

*The experiment was organized in 2008-2014 in an intensive apple orchard grown with the cultivars Jonathan and Golden Delicious grafted on the cutting holder M4. In the case of the Jonathan variety the cutting system will be chosen according to the production destination (qualitative requirements), to the mechanization possibilities, to the level to which one can ensure the necessary manpower, and to the existing possibilities of doing the cuttings in winter. In the case of the Golden Delicious variety we recommend the V<sub>4</sub> variant, with a reduced number of operations but with reduction cuttings of higher intensity, which ensures 13.7% higher incomes and reduces with 29.8% the manpower costs for this work.*

**Key words:** apple orchard, cutting system, yield, quality, quantity

### INTRODUCTION

In any fruit-growing technology the cuttings of varieties occupy a distinct and important place. Their importance results from the influence of those works upon the qualitative and quantitative production indexes.

The subject cutting is an always actual subject because of the use of new culture systems, of new varieties and of new cutting holder combinations, of better cultivation technologies and of modified social-economic conditions.

### MATERIAL AND METHOD

The experiment was organized in 2008-2014 in an intensive apple orchard grown with the cultivars Jonathan and Golden Delicious grafted on the cutting holder M4. The cultivation distances were 5 x 4 m and the crown form was that of an even fan/shaped espalier with oblique branches.

The objectives of the research were the following:

- to establish the maximum possible productions which have superior qualitative indexes;
- to grow the work productivity and in this way to reduce the manpower costs for the cutting operations;
- to make possible the mechanization of the cutting works.

The experimental variants:

V<sub>1</sub> – (Ct) – meticulously realized dry cuttings (up to 300 operations/tree for the Golden Delicious variety and 400 for the Jonathan variety) consisting of thinning out the annual growing, the shortening with 1/3 of the growings which are longer than 70 cm. In the case of the Jonathan variety we have additionally eliminated all the growing extremities which have been attacked by mildew;

V<sub>2</sub> – Ct done once in two years;

V<sub>3</sub> – Ct done every two years by alternating it with the green cutting (in the years in which no Ct cuttings are done);

V<sub>4</sub> – dry cuttings with a reduced number of operations, up to 150/tree the Golden Delicious variety and up to 200 for the Jonathan variety;

V<sub>5</sub> – mechanized contour "dry" cuttings, done every two years, alternating with cuttings as at the Ct variant in the years in which the contour cuttings are not done;

V<sub>6</sub> – mechanized dry contour cuttings two years consecutively, supplemented by green cuttings in the same year;

Every three years there will be done cuttings as presented at the variant Ct.

V<sub>7</sub> – trees' height limitation to 2.50 m by eliminating the axes part which has skeleton branches placed above a lateral branch – this work will be done in the first year.

Further, for the Golden Delicious variety the cutting will be done as described at the variant V<sub>4</sub> and for the Jonathan variety a Ct cutting will be done.

## RESULTS AND DISCUSSION

The different cutting systems used for the Jonathan variety were poorly reflected in the obtained physical production, as there were little differences between variants (1.6 - 2.9 %). An exception made the V<sub>7</sub> variant (11.4%), which represents a significant negative difference.

The differences regarding the quality of the obtained production and which are synthetically reflected in the production value are bigger, but statistically insignificant (table 1).

*Table 1*

The obtained productions, divided on qualities and on those value cumulated during 7 years (2008-2014), Jonathan M4 variety

Variants of experiment	Cumulated production (t/ha)	The difference compared to the witness (%)	Signific.	Division on qualities Extra and I	Average price (lei/t)	Production value (Tsd lei/ha)	The difference compared to the witness (%)	Signific.
V <sub>1</sub> (Ct)	292.0	100.0	-	92.4	2900	846.9	100.0	-
V <sub>2</sub>	285.2	97.7	-	87.2	2776	791.8	93.5	-
V <sub>3</sub>	287.2	98.4	-	88.8	2792	801.8	94.7	-
V <sub>4</sub>	28.7	97.5	-	92.5	2875	818.4	96.6	-
V <sub>5</sub>	285.4	97.7	-	85.8	2745	783.3	92.5	-
V <sub>6</sub>	283.5	97.1	-	88.1	2810	796.7	94.1	-
V <sub>7</sub>	170.9	88.6	o	98.5	3036	518.8	95.3	-

LSD<sub>5%</sub> = 11.2; LSD<sub>1%</sub> = 14.6; LSD<sub>0.1%</sub> = 19.1

At the Golden Delicious variety, the differences between variants are more evident. These vary at the physical production between 8 - 10.8% in comparison with the control variant, but are not statistically captured.

The noticed differences in comparison with the control variant reflected by the production value are significant and positive in the case of V<sub>4</sub> (13.7%) variant and also significant but negative in the case of the V<sub>3</sub> (-13.4) variant.

Particularly underlined is the V<sub>7</sub> variant. This has ensured the highest percent of Extra and I quality fruits (96.4%) having a productivity closed to the control variant and a production value of 112.1 % in comparison with it. (table 2)

*Table 2*

The obtained productions, divided on qualities and on those value cumulated during 7 years (2008-2014), Golden Delicious variety/M4

Variants of experiment	Cumulated production (t/ha)	The difference compared to the witness (%)	Signific.	Division on qualities Extra and I	Average price (lei/t)	Production value (Tsd lei/ha)	The difference compared to the witness (%)	Signific.
V <sub>1</sub> (Ct)	274.1	100.0	-	79.5	2632	721.3	100.0	-
V <sub>2</sub>	289.3	105.5	-	66.0	2384	689.8	95.6	-
V <sub>3</sub>	274.8	100.2	-	56.8	2274	624.8	86.6	-
V <sub>4</sub>	303.8	110.8	*	81.4	2699	820.0	113.7	-
V <sub>5</sub>	277.0	101.1	-	68.8	2478	686.3	95.1	-
V <sub>6</sub>	276.3	100.8	-	65.8	2423	669.5	92.8	-
V <sub>7</sub>	181.9	101.8	-	96.4	3128	569.1	112.1	-

LSD<sub>5%</sub> = 10.3; LSD<sub>1%</sub> = 13.4; LSD<sub>0.1%</sub> = 17.2

Regarding the manpower use/t apple very important in the case of the Jonathan variety are the variants V<sub>6</sub> with 43.9%, V<sub>5</sub> with 58.6% and V<sub>2</sub> with 63.4% in comparison with the control variant, and in the case of the Golden

Delicious variety the variants V<sub>7</sub> with 47.9%, V<sub>6</sub> with 52.7% and V<sub>4</sub> with 70.2 %. (table 3)

Table 3

The obtained productions, divided on qualities and on those value cumulated during 7 years (2008-2014), Golden Delicious variety/M4

Variants of experiment	Cumulated production (t/ha)	Difference compared to the witness (%)	Division on qualities Extra and I	Production value (Tsd lei/ha)	Used working time hours/t apples (%)
Jonathan					
V <sub>1</sub> (Ct)	292.0	100.0	92.4	100.0	100.0
V <sub>2</sub>	285.2	97.7	87.2	93.5	63.4
V <sub>3</sub>	287.2	98.4	88.8	94.7	81.0
V <sub>4</sub>	284.7	97.5	92.5	96.6	81.7
V <sub>5</sub>	285.4	97.7	85.8	92.5	58.6
V <sub>6</sub>	283.5	97.1	88.1	94.1	43.9
V <sub>7</sub> *	170.9	88.6	98.5	95.3	76.8
Golden Delicious					
V <sub>1</sub> (Ct)	274.1	100.0	79.5	100.0	100.0
V <sub>2</sub>	289.3	105.5	66.0	95.6	57.7
V <sub>3</sub>	274.8	100.2	56.8	86.6	71.5
V <sub>4</sub>	303.8	110.8	81.4	113.7	70.2
V <sub>5</sub>	277.0	101.1	68.8	95.1	89.0
V <sub>6</sub>	276.3	100.8	65.8	92.8	52.7
V <sub>7</sub> *	181.9	101.8	96.4	112.1	47.9

\*The data refer to the period of time 2008-2014

In order to be able to characterize the production fluctuations from one year to the other, we have introduced the fluctuation year (If) which is equal to the relation between the sum of production differences encountered from one year to the other during the analyzed period of time and the productions cumulated during this period of time multiplied with 100%.

$$If = \frac{Sd}{Pc} \times 100 \%$$

We obtain a fluctuation which is generally higher in the case of the Golden Delicious variety, between 26.6% for the V<sub>7</sub> variant and 51.5 % for the V<sub>4</sub> variant, in comparison with 46.9% for control.

In the case of the Jonathan variety the fluctuations are generally lower 33.2% for the V<sub>5</sub> variant and 40.6% for the V<sub>7</sub> variant. (table 4)

Table 4

The yield average obtained in the experimental years (2008-2014) and the yield fluctuation index

Variants of experiments	Jonathan							Cumulated yield (kg/tree)	Fluctuation index (%)
	Average of the yield obtained								
Jonathan									
V <sub>1</sub> (Ct)	115.0	93.7	20.2	92.5	110.0	73.6	79.1	584.1	38.4
V <sub>2</sub>	100.0	90.1	22.4	111.1	94.4	87.8	64.7	570.5	37.3
V <sub>3</sub>	97.5	94.6	29.6	119.6	98.3	81.2	62.7	574.5	34.3
V <sub>4</sub>	108.7	94.5	25.0	98.3	103.7	79.1	60.2	569.5	36.1
V <sub>5</sub>	106.4	92.8	38.2	104.1	97.8	82.8	58.8	570.9	33.2
V <sub>6</sub>	111.4	80.6	19.3	92.7	111.7	70.4	70.9	567.0	39.9
V <sub>7</sub>	-	-	12.9	92.4	104.4	75.0	57.0	341.7	40.6
Golden Delicious									
V <sub>1</sub> (Ct)	97.7	87.8	31.3	113.8	99.6	103.7	14.3	548.0	46.9
V <sub>2</sub>	105.3	97.8	41.3	120.4	91.6	106.8	17.3	580.5	47.6
V <sub>3</sub>	108.7	83.1	38.4	105.5	95.3	88.7	20.2	549.4	42.3
V <sub>4</sub>	124.2	100.0	39.1	118.1	94.3	117.0	14.9	607.6	51.5
V <sub>5</sub>	110.5	71.7	44.5	114.0	104.7	85.5	22.9	553.8	40.9
V <sub>6</sub>	118.6	74.1	38.8	98.5	105.8	99.8	18.6	552.6	40.5
V <sub>7</sub>	-	-	49.6	92.3	107.2	73.7	61.1	383.9	26.6

## CONCLUSIONS

1. In the case of the Jonathan variety the cutting system will be chosen according to the production destination (qualitative requirements), to the mechanization possibilities, to the level to which one can ensure the necessary manpower, and to the existing possibilities of doing the cuttings in winter.
2. In the case of the Golden Delicious variety we recommend the V<sub>4</sub> variant, with a reduced number of operations but with reduction cuttings of higher intensity, which ensures 13.7% higher incomes and reduces with 29.8% the manpower costs for this work.
3. For the trees where the yield has migrated towards the top, which have a height of over 3 m and poor vegetative growths, we recommend to reduce the height of the trees to 2.5-3.0 m, but only for the Golden Delicious variety, which favorably reacts to this measure.
4. Taking into consideration the big differences between these two varieties regarding their reaction to the cuttings systems applied during the 7 experimental years, we recommend to establish the system and methods of cutting for each variety in part, be it a variety new cultivated or a variety which already exists.

## REFERENCES

1. Bunea A., 2002, Tehnologia înființării și întreținerii livezilor, Universitatea din Oradea Printing House
2. Botu I., Botu M., 2003, Pomicultura modernă și durabilă, Comphys Printing House, Râmnicu Vâlcea
3. Ceapoiu N., 2003, Pomicultură aplicată, Științelor Agricole Printing House Bucharest
4. Drăgănescu E., 2002, Pomologia, Mirton Printing House, Timișoara
5. Ghena N., Braniște N., 2003, Cultura specială a pomilor, MatrixRom Printing House
6. Ghena N., Braniște N., 2004, Pomicultură generală, MatrixRom Printing House
7. Grădinariu G., Istrate M., 2009 , Pomicultură generală și specială, TipoMoldova Printing House
8. Hoza. D., 2000, Pomologie, Prahova Printing House, Ploiești
9. Hoza. D., 2003, Sfaturi practice pentru cultura pomilor, Nemira Printing House.
10. Sarca Gh., 2006, Pomicultură generală, Editura Universității din Oradea
11. Sarca Gh., 2011, Semințosele, materie primă în industria agraolimentară, Editura Universitatii din Oradea
12. Șcheau V., Laslo V., 2003, Biometrie și tehnică experimentală, Universitatea din Oradea Printing House