



# THE BEHAVIOR OF GALA, JONAGOLD, GOLDEN DELICIOUS AND GRANNY SMITH APPLE VARIETIES IN ORGANIC FARMING SYSTEM

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## INTRODUCTION

As eating healthy and life quality becomes more and more important, the market shifts its focus and the business owners reorient themselves towards the organic products and services that satisfy the clients needs. The organic farming in Romania is still at its beginning, the dynamic of organic production indicators showing different fluctuations, except the organic fruit and vineyard areas, where the trend was constantly ascending (MADR, 2018). Although the total organic area cultivated in Romania decreased with 21.5% in the period 2012-2016 (EUROSTAT, 2017), the organic orchard and vineyard area tripled in the same period (Burghelca et al., 2016). Romania makes serious efforts to support and promote organic farming, including advantages offered by different EU structural funds measures for agriculture for those activating in the organic sector. For the period 2007-2013 the percentages of the European Union subsidy received by Romania was 52.02% in average (Marinas et Prioteasa, 2016). For the measure 1.2.1 (agriculture), in October 2016, in Romania, out of 8738 projects proposals, 3849 were approved and 2789 finalised, with a total of 662.274.906 euro payments.

Apple is the most important fruit species in Romania, our country having the second highest area cultivated with the apple in Europe (after Poland), representing a share of 10.2% of the total EU-28 production area and only a share of 3.6% of the total EU-28 harvested production (EUROSTAT, 2016). Organic fruit growing has increasingly gain interest both from Romanian and European farmers or investors, although uncertified organic food (as farmers' market, self-production etc.) is considered by consumers to be more "organic" than certified organic food (Petrescu et al., 2016). The company Fruit4you, Belgian investors, which owns the 3.275 ha of organic apples in Horia village, Vladimirescu commune, Arad county, received more than 350.000 euro for the implementation of their organic apple orchard.

In this paper, we present the economic results of the organic apple orchard in Arad County, in terms of production, productivity, income in the 2011 – 2017 period and we compare these results with the previsions made in the structural funds business plan

## MATERIALS AND METHODS



**Fruit4you apple orchard**

(lat: 46.1986, long: 21.4285).

The investors preferred to plant at 2.6 m x 0.8 m, for a „fruit wall shape” high density orchard, with 4,000 trees/ha, having 3.5m high concrete poles and 5 lines of wires. The poles were distributed every 10 m, for 360 m, with a space in the middle of the orchard, where the tractor can make the “U” turn. The varieties were planted by groups of four rows, starting and the scheme repeated for 27 lines. The inter rows were mowed mechanically and the row was cleaned by hand. Fertigation was insured by drip irrigation lines placed directly at the ground level, working on 4 sectors, every day, with 2 hours of watering per sector. The hail and pest protection was insured by a hail protection net that covers the top and the four laterals of the orchard (Figure 2). No tree pruning was done in the first year. In the second year the trellis system was put in place, the first three wires, followed by the next fourth and fifth wires in the third year. The canopy forming prunings were performed after the Belgian method, during the flowering time, which also implies slow shoot growths of around 30 cm/year. As the orchard is included in the organic farming system, the insects were controlled with pheromone disruptors and the hail nets, that were kept closed from May 1<sup>st</sup> to September 30. 800 units/ha of Isomate CLR mating disruptors (active substance codlemone), were used each year, being placed at height of the 3<sup>rd</sup> wire (~ at 1.8 m), one every 3 trees, one the edges and one every 5 or 8 trees in the centre of the orchard. Every year the dispensers were put in place at the beginning of May (Bujdei et al., 2016). The insects attack was estimated under 1%, in the flowering period only, when the net is still closed, for a better pollination.

The trees were imported from a Belgian nursery, transported in a temperature-controlled cargo and kept at 25-28°C (the normal temperature environment), after arrival, with the roots in water for 24 hours to get hydrated. The planting was done in June-July 2011, because of the delays in trees delivery. The late planting period caused a premature period of dormancy, which made the young trees apparently looking as they were died in the autumn. The delay in plants delivery also forced the investor to build a buffer for the irrigation system that collects the water from the well and reduce the water temperature difference before the irrigation. The planting machine, with a potential efficiency of 4,800 trees/day manage to plant the orchard (3.275 ha) in four days. On the 90 m x 360 m plot 3 years old plants of Gala, Jonagold (Red Prince) Golden Delicious and Granny Smith varieties, grafted on M9 rootstock, were planted.



## RESULTS AND DISCUSSIONS

Year	Estimated yield (t)	Real yield (t)	Difference (t)	Difference %
2011		3.03		
2012	30.00		-14.10	-47.00
2013	55.00	23.40	-31.60	-57.45
2014	70.00	27.30	-42.70	-61.00
2015	70.00	42.60	-27.40	-39.14
2016	70.00	41.40	-28.60	-40.86
2017	70.00	159.00	89.00	127.14
Total yield	365.00	312.63	-52.37	-14.35
Total annual yield	60.83	52.11	-8.73	-14.35
Annual yield/ha	18.58	15.91	-2.67	-14.35

**Table 1. The estimated and the realized apple production**

### Yield, productivity and economic efficiency

The average fruit production/ha was estimated at 18.58 t/ha in the business plan and the realized production was of 15.91 t/ha, with 14.35% less. The differences were much higher in the first five years, only 50% of what was estimated was realised until 2016. The year 2017 was a very good year for apple growing in the region with an average annual production of 48.55 t/ha, which represented a record. A similar high yield was reported by Sumedrea et al. in 2016, a production of 44.40 t/ha for Golden Delicious Clone B.

Year	Golden (t)	Gala (t)	Jonagold (t)	Granny Smith (t)	Total yield (t)
2011	1.00	1.00	1.00	0.30	3.30
2012	4.50	5.40	5.10	0.90	15.90
2013	3.00	9.00	11.40	-	23.40
2014	8.40	8.40	10.50	-	27.30
2015	13.50	16.50	12.60	-	42.60
2016	15.00	17.40	9.00	-	41.40
2017	48.60	53.00	57.40	-	159.00
Total yield/variety	94.00	110.70	107.00		312.90
Average yield/ha	14.35	16.90	16.34		

**Table 2. The estimated and realized productions of each apple variety in the 2011-2017 period**

As in the period 2012-2015, the productions were lower than expected, the producer tried in one year, on one row, a production without thinning. The result was promising, with 35% higher production on that row, but in the following year no production was obtained, as no flowering buds were differentiate. Gala variety was the most productive one, with a productivity of 16.90 t/ha, calculated for the 2011-2017 period.

The Granny Smith variety was replaced after the first 2 years, due to its scab sensitivity and low production. Because of scab attack, the general aspect of the trees and apples was unsatisfactory, which forced the producer to sell the Granny Smith apple at a reduced price (50% lower than expected). Although this variety should produce big apples, no fruit was bigger than 65+ mm (Figure 3). Jonagold had a lower productivity when compared with Gala, but the apples were in majority of 1<sup>st</sup> category (80+ calibre).

Year/ to	Estimated income (euro)	Real income (euro)	Difference (euro)	Difference (%)
2012	17,523	4,437	-13,086	-74.68
2013	32,126	5,986	-26,140	-81.37
2014	40,887	13,029	-27,858	-68.13
2015	40,887	17,427	-23,460	-57.38
2016	40,887	14,113	-26,774	-65.48
2017	40,887	42,400	+1,513	+3.70

**Table 3. The estimated and actual orchard incomes in the 2011-2017 period**

Golden delicious had in average 65% scab free apples, with fruits varying in size between 65 and 80+mm. Gala was more affected by scab, with around 45% scab free apples and the calibre between 60 and 70 mm. Regarding the income, in the period 2012-2016 all our estimations were unrealistic, as the real income between 39 and 61% of the estimated one (table 3). The average price of apples was 2.5 lei/kg (55 euro cent/kg) and the producer was able to maintain this price only because he has built through the structural funds a cold storage, that allowed him to keep and sell the fruits later than all the other producers in the area and also to deliver in high quantities at once, loading a full truck. Still, the price was not as expected. Another issue was the lower production obtained in comparison with the estimated one. Beside the stress, this fact leads to the loss of important contracts and direct income losses.



### Crop issues

The most frequent crop issues that the producer faced were sunburns, cracking and scab (figure 5 (a, b), 6 and 7) and the most susceptible variety was Gala. Regarding scab, more than 45% of the Gala, more than 35% of Golden and more than 15% of Jonagold fruits had the disease marks, a fact which led to a loss due to the lower selling price.



**Figure 5. Cracking on Gala variety (b)**



**Figure 6. Scab symptoms on Gala variety leaves**



**Figure 3. Small fruits produced by Granny Smith**



**Figure 4. The calibre measurements for Jonagold apples**

### Selling strategies

The producer mainly used two selling strategies: “buy locally” and “pick it yourself”. The main retailer client was Real Hyper Market Arad, but a part of the fruits also were bought by the Belgian fruits and vegetables dealer, Fresh Fruit Service BvB.



## CONCLUSIONS

The estimations in the business plan when the producer applied to structural funds were more optimistic than the results obtained in reality, especially regarding the income and this had a negative impact on the business. The highly scab sensitive varieties: Gala, Jonagold (Red Prince) Golden Delicious and Granny Smith faced serious problems under a high infection pressure and the lack of good protection products. Cooper sulphate couldn't offer an effective protection against scab and the percentage of affected fruits was extremely high, from 15-45%. Granny Smith was eliminated for this reason, after two years of cropping. Insects attack on fruits was kept less than 1% by using winter oil treatment, matting disruption and net closed orchard. The level of fruit production and its poor quality affected seriously the orchard incomes, the results being with 57.38-81.37% lower than the estimated ones. Only in 2017, the income overpassed the estimation, due to an exceptional production.

Taking in consideration our experience, we recommend to other farmers:

- to set up of the irrigation drip line at 60-80 cm height instead of laying directly on the soil - no rats eating the tube and no need to massive replacement due to destruction during weeding;
- to use higher planting distances between rows, to at least 3.2 m;
- to use mechanical equipments for weed control on the fruit tree row;
- to associate in growers groups, in order to fill the eventual gaps that some may have in some years, reduce the cost of cold storage and not at last, to be able to negotiate with the buyer for fair selling prices.

The general conclusion is to avoid the cultivation of scab sensitive varieties in organic apple orchards and to replace them with scab resistant ones. A proper orchard management is needed to control the phytosanitary issues, to ensure a proper fertilization and a rational tree growth and fruit bearing.

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