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# Effects of integrated and ecological growing technologies on the growth and development of fruiting structures in new apple plantations

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***Summary:*** On the Horticultural Station of the Debrecen University, Pallag, two year old apple plantations of two varieties ('Pinova', 'Golden Reinders') have been studied, in autumn 2011. The growth of the cross section area of the trunk and the central axis were measured and compared to evaluate the effect of two alternative growing technologies: integrated and/or ecological. 'Pinova' proved to grow more intensely than 'Golden Reinders' independently from the growing technology. The effect of the technology, however, was expressed in 'Pinova', where the integrated technology produced more vigorous growth than the ecological one. The effect of varieties on growing intensity was more distinct than the effect of growing technologies. Under the ecological growing system, the difference between the varieties studied is more accentuated regarding growing intensity. By that reason, in ecological growing plantations of varieties with moderate vigour ought to be stimulated by all possible techniques (as pruning, nutrition etc.).

***Key words:*** apple, integrated production, ecological production, vegetative growth

## Introduction

The integrated as well as the ecological growing systems require serious measures to be observed by the growers. The prescriptions of both systems tend to be restrictive as the chemicals admitted especially for phytosanitation are limited; meanwhile the negative consequences of global climatic changes are increasing the environmental hazard of horticultural production.

All those difficulties are even more critical in the environmentally concerned growing system. Nutrition as a means for stimulating growth is recommended but only as organic manure, however, its disclosure is delayed (*Holb* et al., 2005ab).

The integrated growing system offers quite a few solutions for intensified nutrition either through the foliage or directly through the root system, moreover, the list of admitted phytosanitary compounds is longer than in the ecological system. In our experiment, the effects of the two growing systems on two varieties are compared in a young plantation before entering production as their fruiting capacities are developed. As the two growing technologies caused different effects on the varieties, the specific technological elements ought to be modified purposefully in order to improve the conditions of a regular development of the yielding potentials, in other words, to harmonise the physiological moments (*Gonda,* 1980, 2004.).

In the case of apple, the grower should pay attention to the risk of being too "eager" and to want early yields on the young pants endangering the anticipated yielding capacity. The capacity on the long run is expressed by the vegetative development of the trunk and the system of branches, which have their optima in yielding (*Lafer,* 1999). Therefore, the choice of technological elements influencing yielding capacity is of prime interest (*Gonda,* 2005).

## Materials and methods

The experiments have been performed on the Horticultural Station of the Debrecen University, Pallag. Two year old apple plantations of two varieties ('Pinova', 'Golden Reinders') have been studied, in autumn 2011. Planting started in the autumn of 2009 next to a 13 year old apple assortment grown throughout its lifetime according to either the integrated or the ecological system of technology. The two new varieties are planted in 4 rows each.

| | |
|---|---|
| Rootstock: | M26 |
| Variety: | 'Pinova' |
| | 'Golden Reinders' |
| Design: | 4 m x 1.5 m (1666 tree/ ha) |
| Crown form: | slender spindle |

The whole plantation received the same phytotechnical care, i.e. nutrition and tillage as the neighbouring apple assortment, according to either integrated or ecological

technology. The differences experienced between the plants are univocally attributed to the growing systems.

Measurements are performed at the end of the second year, November 2011:

- Cross section area of the trunk ($cm^2$)
- Cross section area of the main axis (50, 100 and 150 cm above the soil level, $cm^2$)

## Results

*Figure 1* shows the complex vegetative performance of the trees according to the cross section area of the trunk and the central axis.

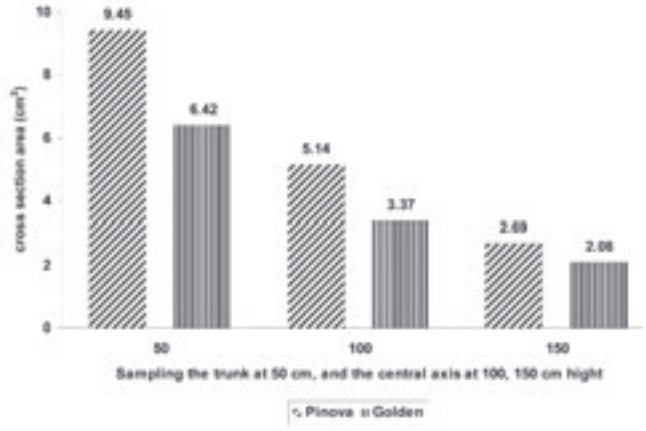


***Figure 1.*** Cross section area of trunks and central axis of 'Pinova' and 'Golden Reinders' trees (Debrecen-Pallag, 2011)

The difference between the varieties is evident in all positions, most thick at the base of the trunk as well as in higher positions on the main axis. Everywhere, the superiority of the variety Pinova is expressed by the larger cross section area regarding vegetative vigour. (Soltész & Szabó, 1998). The inferior cross section area of 'Golden Reinders' is a sign of its less vigorous vegetative growth, at the same time its generative tendency. The trunk, 50 cm high above the soil level, reaches only 47% of the cross section area of that of 'Pinova'. The ratio varies at the higher positions of the main axis between 53 and 29%

*Figure 2* shows the cross section areas of the variety 'Pinova' comparing the effect of the growing technologies.

The comparison of the effects shows a slight superiority of the ecological growing system over the integrated one. The difference between the varieties was much more evident than the difference caused by the growing technologies. Differences between fruit load may be regarded as the immediate cause of alternative growth. 'Pinova' is regarded as tolerant to plant diseases, but the trees under the ecological growing system yielded (i.e. set) less fruits, 3–5 apples (about 1 kg), whereas under the integrated system 10–14 (2–2.5 kg).

The cross section area of the trunk was diminished by 7–8% by the fruits set under the integrated growing technology. At 1 m height, the difference diminished to 3%, at 150 cm, to more than 8%.

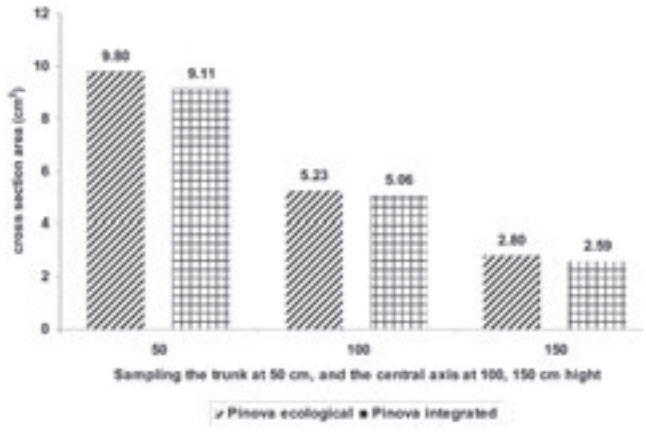


***Figure 2.*** Effects of two growing technologies on the vegetative growth intensity expressed by the cross section area of 'Pinova' trees (Debrecen-Pallag, 2011)

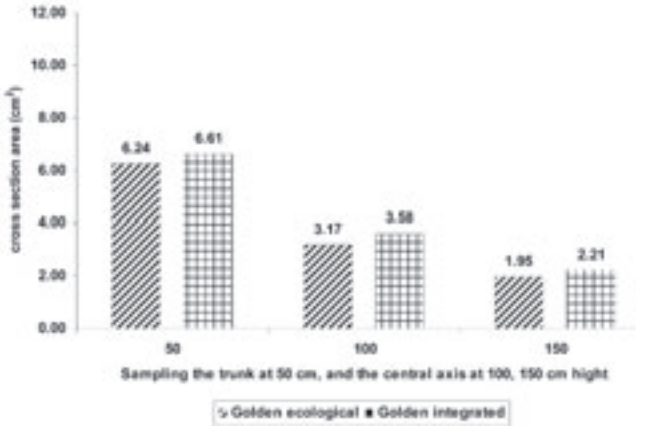


***Figure 3.*** Cross section areas of trunks and central axes of 'Golden Reinders' modified by the growing technologies (Debrecen-Pallag, 2011)

In the case of 'Golden Reinders', the slightly higher values of cross section areas appear in the integrated growing system. At 50 cm height the difference was 5–6%. The central axis followed the same tendency with 12–13% differences. The opposite tendency of the two varieties, regarding the reaction to the growing systems deserves attention. In 'Golden Reinders', however, the fruit set cannot explain the differences because in both systems, the fruit load was equally 2–5, i.e. about 1 kg. As a likely reason of the difference, the disease resistance of 'Pinova', which may be coupled with some tolerance to poorer conditions, could be accused. The variety 'Golden Reinders' though did not suffer under fruit load, but tolerated less the effects of the ecological growing system, and reacted with reduced vigour.

Next, the *figure 4* compares the varieties under the integrated growing system expressed in cross section area as a sign of vegetative vigour.

In *Figure 4,* the superior vigour of 'Pinova' is unequivocal also in the integrated growing technology. At 50 cm, the relative difference in cross section area was 37–38%, at 100 cm, more than 41%, at 150 cm, 17–18%.

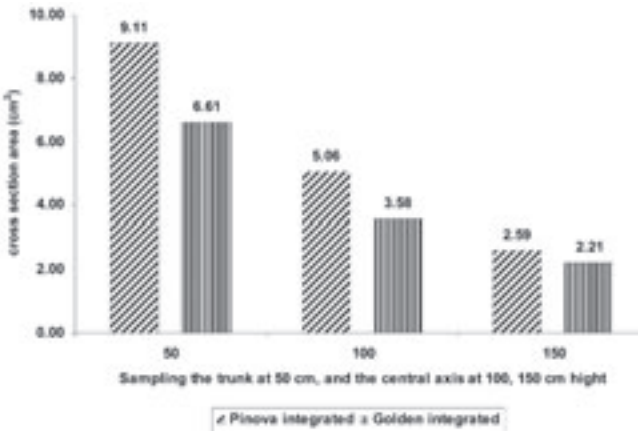


***Figure 4.*** Cross section area of trunk and central axis in 'Pinova' and 'Golden Reinders' trees grown under integrated growing system (Debrecen-Pallag, 2011)

In *Figure 5*, the cross section areas of trees are shown under ecological or biological growing systems.

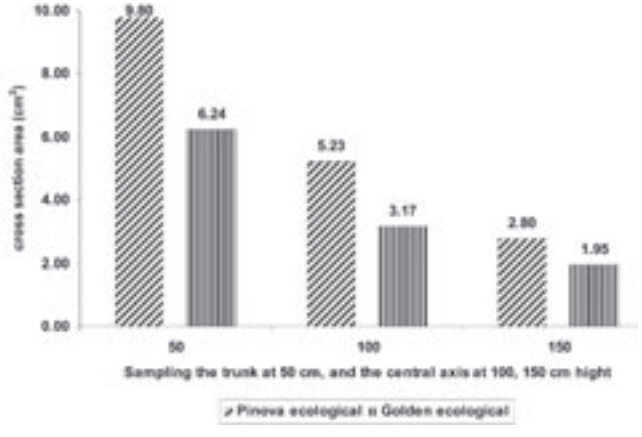


***Figure 5.*** Cross section area of trunk and central axis in 'Pinova' and 'Golden Reinders' trees grown under ecological growing system (Debrecen-Pallag, 2011)

As the ecological technology stimulates much less the vegetative growth, the vigour of 'Pinova' is still more evident. As a robust variety, its superiority is even more emphasised under less favourable conditions as compared with 'Golden Reinders'. At 50 cm, the difference in cross section area was nearly 60%; at 100 cm, 65%; and at 150 cm, 43%.

On the basis of results presented above, we have proved that growing technologies ought to be adapted to the apple varieties chosen, as their reaction may differ substantially. Under conditions of the integrated growing technology, the differences between the reaction of varieties are less pronounced than under the ecological technology regarding the vegetative performance of young trees. Under the moderate ecological conditions, the differences in native vigour are more accentuated. It is recommended that for varieties of moderate vigour all possible conditions favouring vegetative growth should be secured beginning with the plantation.

As a conclusion, we state that difference between varieties regarding their vegetative vigour are much more important than between the effect of current growing technologies on the mean of dominant varieties.

## Acknowledgement

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