

THE POSSIBILITIES AND LIMITATIONS OF ORGANIC FRUIT PRODUCTION

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Abstract

In this review, direct and indirect technological elements of organic production are discussed. Today, there is a growing interest in production prepared without chemicals. We discuss the following issues: site selection, soil, rootstock and cultivar requirements, plant material, planting distances, crown formation, phytotechnical operation, irrigation, soil tillage, soil covering and mulching, nutrition supply. Separate section deals with methods of plant protection.

Keywords: ecological, bio, fruit production, indirect factors, direct factors

INTRODUCTION

Today, there is a growing interest in production prepared without chemicals. This is partly due to the proliferation of healthy diets - which is very welcome, but on the other hand, unfortunately, cancer rate is very high, which is due to pesticides used in large quantities, and food contamination during processing.

In recent decades, a numbers of technological approaches developed which were aimed to reduce pesticide pollution of the environment, production area, and consumers. The best known of the bio, which is officially known as organic farming.

The wider spread of this environmentally friendly technology though is last long, because production is limited by strict roles and the profitability is only modest. Production success is much easier; however, if environmental conditions are fully satisfy the needs of the orchard.

The most difficult area of organic production is plant protection. Plant pathogens and pests can impair significantly the possibility of successful cultivation. However, several factors may play a major role in technology which may further increase these negative effects or, conversely, positive benefits.

The performance in orchards largely depends on the fitness of the trees. Taking into account the strict standards we note that organic production resulted in weaker tree fitness. However, there are factors which determine the success or the total failure at the beginning. Successful production requires the knowledge direct and indirect technological elements.

Indirect technological elements of organic production

Site selection

During organic production, one of the major priorities is the land which fulfill the needs of plantation fully. Preferably, best location is the south or south-west directions for pome fruits or grapes, while for apricot (among stone fruits) north or northeast location is more favorable. The environment should be high, ie, water needs way to flow. Windy area is suitable for plant protection purposes as the crown dry faster after rainy periods thus pathogens have less chance to infect the plants (Soltész, 1997a).



Fig. 1. The advantage of production area can not be replaced anything else

Soil

The higher the soil nutrient capacity and uptake, the more easy the compensation for decreasing tree fitness coming from production technology. The best for this criteria is a deep soil layer with good water and air capacity. 1.5-3% of humus is optimal.

Rootstock

The rootstock provides the necessary nutrients and water for plant uptake. Synthetic foliar fertilizers are not used. Rootstocks with medium-strong or strong growth features are more suitable for selection. The deeper rooting ensures larger soil coverage and can provide a more equal water and nutrient uptake (Hrotkó, 1997). The stronger use of rootstocks will result in stronger growth in the above-ground parts, thus the prolonged shoot growth could help to promote the regeneration process.

Cultivar

General requirements for cultivars are the high yeild productivity and low tendency for yield alternation. The balanced fruit bearing charateristics from year to year is essential in this production system, because yield loss can occur for several years after an overloaded year It is possible to use cultivars with a certain level of disease or pest resistance (Soltesz, 1997b; Holb, 2000a, b, 2002, 2007). Growth characteristics of the cultivar is also an important issue, as pruning, spraying and harvest are much easier in a breezy, loose crown compared to a type of strongly growing up crown.



Fig. 2. Cultivars Topaz and Releika are suitable for organic growing

Plant material

Nowadays it is more and more difficult to buy a virus-free plant material, which is a basis for strong initial growth, better vegetative and generative production, and for early fruit bearing. We should not forget that fruit thinning is an essential task in the first years as if we do not use it the tree fitness can be seriously reduced mainly for young trees.



Fig. 3. Virus free plant material is a basic requirement

Distance between trees and rows

Distance between trees and rows can fundamentally determine the success of production. Neither too narrow and nor too broad distances are good. Narrow distances will cause a lot of labour cost while broad distances will cause low land use capacity as trees will not fill the area available for them. If the trees are planted in the right distances, crown reach a better sun-light, and they become airy and a positive climate can be inside the crown.



Fig. 4. Production can not succeed in extensive grown big trees

Crown form

Reduction of tree fitness can be reached by using the best rootstocks. Larger crown must apply with a larger distances between trees and rows as well as the crown has to be breezy. In order to maintain their rates within the crown of the principles of Zahn has to be applied (Zahn, 1986, 1994). To keep the dominance of central axis, the thickness of later twigs can

not be larger than 50% of the central axis. Similar rates have to be taken into account in the one above branches as well.



Fig. 5. Principles of Zahn for maintaining the crown

Phytotechnical operations

Dormant pruning

Dormant pruning has to be done in the dormant stage of the tree due to weaker fitness of the trees. Late pruning reduces nutrition capacity of the tree, and therefore, shoot growth and fruit setting are influenced negatively (Gonda, 1977).

Methods and intensity of pruning

A more diverse methods of pruning is needed for weaker trees. The cutting back methods have to be used which will increase fruit set and fruit quality. Diverse pruning will result in more smooth water and nutrition supply and the fruit setting will also improve (Gonda, 1979, 1991).

Summer pruning

Pruning is applied 3-4 weeks before harvest and we remove all those tree parts that are planned to cut during winter. In this crown, the sunlight and fruit colouring are better and bud production is also more favourable under these circumstances (Gonda 1984).

Fruit thinning

Fruit thinning can be eliminated according to experiences in the past decades. It can be stated that fruit thinning is a central technological element (Soltész, 1997c). Fruit thinning has to be done as early as possible as large yield can cause large negative effect. During fruit thinning, infected fruits also have to be removed which will reduce the possibilities of further infections (Soltész, 1997c; Holb, 2005).



Fig. 6. Substantial fruit thinning: better fruit quality and stronger tree fitness

Irrigation

Today, there are no plantations, which could operate profitably without irrigation. It also reveals that irrigation has to be started 10-15 days before as usual in order to achieve the necessary quality by harvest (Ligetváry, 1997). In plantations without irrigation, not only yield can be questionable but tree fitness may decrease, which can lead to high level of tree die.



Fig. 7. Irrigation

Soil tillage

Basically, 3 different forms are used in organic farming. In case mechanical removal of weeds in the rows, works with machines and spraying are more difficult. Using grass alley in the row, the best if we use natural weed population and mow it several times in a year. Grass alley will help works with machine and also ensure natural habitat for natural enemies.

Soil covering, mulching

There are also possibilities for artificial soil covering of the soil. However, this can only be successful, if the plant growth can be ensured by irrigation. These plants can compete with the trees but if we cut these plants they can be used as a mulch and they can provide a natural nitrogen source for the trees (Ames & Knepper, 2000; Haynes, 1980). Advantages of artificial plants are as follows:

- Roots help the soil microbial activity and provide nutrition if we plug them into the soil in spring

- Legumes improve nitrogen capacity
- Liveing hiding habitat for beneficial organisms (spiders, spider mites)
- Larger honey bee population which will increase pollination
- Reduce erosion in hilly areas and help maschine work and lower the deterioration of soil structure

Disadvantage of artificial plants:

- Larger labour
- Larger amount of water and nutrition are needed
- Lager risk of spring frost
- Larger damage caused by voles especially if much is close to the trees.



Fig. 8. Grass and mulch in the row ensure a richer soil activity

Nutrition supply

Natural manure has an essetial role in organic farming. Sythetic fertilizers are banned (Anonymus, 1997). In order to reach a good nutrition supply, natural manure have to be used properly and we have to ensure good soil microbial activity and mineralisation of nutritions have to be helped.

Planning nutrition supply, the basis is the nutrition extracted by fruits and plant parts but nutrition supply is more accurate if we plan it on soil and foliage analyses. The harmonic nutrition supply has to be done though the soil and root system as nutrition disorders seriously reduce resistance to pests and pathogens as well.

Direct elements of organic production

Plant protection which contains mechanical, physical, biological, biotechnological and chemical control options. Mechanical and phyiscal control methods are the followings:

- Trunk cleaning
- Dormant pruning, removing diseased plant parts, removing cutted plants
- Wound healing
- Removal and elimination of diseased and dead plants
- Collection and elimination of hosts, inoculum sources e.g. mummified fruits
- Collection of fallen leaves, plugging, composting
- Soil covering, mulching



Fig. 9. Collection of mummified fruits will reduce the possibilities of infection

Biological control agents can reduce or kill pathogens and pests in biological control options. There are more and more virus, bacterium and fungus preparations that can be used successfully in organic production.

Copper and sulphur compounds can be used in organic production as chemical control options. These compounds can cause russetting and they can accumulate in soil but their effect is shorter in time compared to synthetic compounds.

Pests can be controlled by the following methods:

- Fencing the orchard
- Applying vector nets
- Collection of pests
- Mechanical trapping

Pests can be controlled by entomopathogen viruses, bacteria, fungi, insects and mammals. Mammals as biological control agents in the orchard are an important option for a long period.



Fig. 10. Symbols of organic farming

There are biotechnological control options against pests. The most often used options are. Pheromone, fragrance and colour traps. There are also plant and animal extracts that can alarm pests or can reduce propagation or feeding. These compounds are: kvassia, neem, natural pyrethrins, plant extracts such as extracts from stinging nettle, wormwood, garlic and onion. Mineral dusts, soaps, plant and mineral oils and methylated spirits can also be used.



Fig. 11. Larger amounts of pheromone capsules can offer complete protection against pests

Several technical factor can play an important role in organic farming. Reduction of abiotic disorders can be done by using hail netting systems or rain protecting foil but irrigation system can also be applied to avoid frost damage.



Fig. 12. Effective protection against spring frost and in the vegetation period

Timing of control is more accurate if agrometeorological or specific measuring station is available which can predict the timing of damage. However, technical factors can not replace grower knowledge on plant protection..

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