Integrated Fruit Production in Bulgaria – State-of-the-Art, Tendencies and Ecologically Sound Approaches for Producing Safe Fruits

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**Abstract:** The present study treats some major elements of integrated fruit production as a modern approach for obtaining top quality, ecologically pure fruit produce – choosing the suitable cultivar and cultivar-rootstock combination, integrated approaches for control of diseases, pests and weeds, systems of irrigation and of maintaining the soil surface in the fruit plantations. The combined approach for pest control, the application of good agricultural practices and the use of pesticide products with confirmed selectivity, suitable for application under the conditions of integrated fruit production, as well as the search for alternative approaches to limit the use of agrochemicals, ensure that the crops are maintained in a good agrotechnical and ecological condition. Integrated fruit production as an organizational form in fruit-growing, is the modern ecologically-oriented fruit production. The knowledge on its basic principles is a necessary condition for adapting fruit-growing to the European requirements for the production of competitive fruit produce, preservation of the environment and the biodiversity.

**Key words:** fruit growing, cultivars, pest control, integrated fruit production.

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Introduction

Fruit-growing is among the major sub-branches of agriculture in Bulgaria and its development is favoured by the suitable soil and climatic conditions, rich genetic fund of local and introduced cultivars, production experience and established national traditions. It is known that growing of fruit crops increases crop production efficiency by raising the profit per unit of area, reclaiming poorer in humus areas and sloping terrains (Zhivondov et al., 2008).

The rapid development of mechanization and chemization in the middle of 20 c. and their higher rate of diffusion in fruit-growing in parallel with the positive effect on the intensification of the production processes, caused a number of negative consequences in an ecological aspect– soil erosion, contamination with nitrates, accumulation of residual pesticides in soil and in produced fruits (Zhivondov et al., 2009). Modern fruit-growing is still directed to the intensive cultivation of fruit plants with the aim of achieving high quality and competitive fruit production. On the other hand, a greater attention is paid to food quality and safety, including in fruit production.

As a full EU member state, Bulgaria entered the global market of fresh and processed fruits. In that aspect Bulgarian fruit-growing faces the necessity of complying with the European fruit quality and safety standards.

According to data of the Ministry of Agriculture and Foods, the areas occupied with fruit plantations were slightly above 45795 ha in 2011, out of them 38778 ha were harvested, that makes about 60% increase compared to 2009 and it could be determined as a favourable tendency in the development of the sector. The most considerable increase was registered in walnut, plum and cherry production.

The areas with young fruit plantations are over four thousand ha. The tendency observed in the last years, has been maintained, showing that the largest share of the total area is planted with cherries – 21.3 % , plums – 16.1%, apples – 7.8 % and peaches 8.2 %. The young fruit plantations included in the miscellaneous group, are mainly soft-berry fruits (such as raspberries and aronia), as well as almonds, hazelnuts and pears (Bulletin No. 176 of June 2011). The areas intended for the production of fruit planting material are 125 ha.

According to data of the Ministry of Agriculture and Foods, fruit production is concentrated in the South-East region – 32% of the total fruit production in the country, followed by the South Central region – 28% of the total fruit production. The South Central region is the main producer of apples, plums, sweet and sour cherries and raspberries.

The soil and climatic conditions in Bulgaria favour the development of fruit-growing represented by a large number of fruit species, cultivars and cultivar-rootstock combinations.
The economic factors also play a considerable role for the development of the fruit-growing sector and for the increasing interest of the agricultural producers to grow fruit crops. Among those factors are the home and foreign markets, the developed processing industry and the available energy sources, agricultural machinery, etc.

Favourable conditions for the development of an European type of fruit-growing are available – suitable soil and climatic conditions in the country for growing fruit species, rich genetic fund of local and introduced cultivars, proper regional distribution of the fruit species according to the soil and climatic conditions and according to the specific biological characteristics of the cultivar-rootstock combinations, the established national traditions in growing fruit species and the investment opportunities available at present. The development of that sub-branch and its establishment as a European type agricultural sector also contributes to stimulating the interest of the farmers and owners of agricultural lands in restoring fruit production. It is known that growing fruit crops is a capital consuming business, needing much labour and a considerable amount of planting material. It is necessary to continue the initiatives for stimulating and financing the ecologically sound approaches with the aim of increasing the share of organic production.

The annual fruit consumption in Bulgaria amounts to approximately 38 kg per capita, while the World Health Organization recommends 147 kg annual consumption of fruits and vegetables (Zhivondov, et al., 2007).

At present, only countries like Greece and Italy reach this level (http://ec.europa.eu/agriculture/capreform/fruitveg/index_en.htm).

Including fruit and vegetable production in the Single Payment Scheme raises also the necessity of implementing measures to protect the environment and, as each operational programme, it should spare at least 20% of the costs to promote such activities.

From the analysis of fruit production in Bulgaria, it can be concluded that the process of transferring fruit-growing to the European requirements for a modern and environmentally-oriented fruit production should continue. For this purpose, it is necessary to identify specific approaches for fast synchronization of Bulgarian fruit-growing to the European standards for high quality, competitiveness of the fruit production, safe food production against the background of improving the living standards of people engaged in the sector. That reflects the “sustainable development of fruit-growing” as a logical development trend in the context of the Common Agricultural Policy applied in the country.

It is known that on a world scale, fruit production is realized by three major systems – conventional, integrated and organic.

Conventional fruit production is practiced by using the traditional technologies for growing fruit plants, applying large amounts of agrochemicals –
mineral fertilizers, pesticides and growth regulators. That system of fruit-growing achieves the highest production efficiency but the fruit produce is of degraded quality in an ecological aspect, characterized by the presence of pesticide residues, nitrates, heavy metals, etc. (above the alert threshold).

The adverse effects of intensive chemization in fruit-growing in the 80s of the last century are already known – soil and groundwater were contaminated with pesticide residues and nitrates. The increased application of pesticides has led to the development of resistant biotypes of pests – insects and weeds. Their control is hard, often ineffective and it requires rotation of pesticides having varied chemical contents and spectrum of activity. The harmful effects of accelerated mechanization for maintaining the soil surface in the orchards in black fallow and the mechanical destruction of weeds are also quite serious. Frequent passing of agricultural machinery causes soil compaction and worsens its water and physical characteristics. Soil structure is strongly deteriorated due to a decrease of the humus content and the reduced amounts of organic matter going back in soil after cultivation.

Against the background of the global tendencies towards ecologization of the production processes in fruit-growing and conservation of biodiversity, it is necessary to adapt it to the requirements of the integrated fruit production. According to the definition of the International Plant Protection Organization, integrated fruit production is an economically profitable production of high quality fruits, in which a priority is given to ecological approaches for minimizing the side effects of the used agrochemicals in order to protect the environment and human health (Djouvinov et al., 2008). Integrated fruit production is the primary method for fruit production in Europe. One of its main goals is to produce top quality and competitive fruits by protecting biodiversity, soil fertility and health of the farmers and the consumers.

When implementing integrated fruit production practices, it is essential to make the right choice of suitable cultivars and cultivar-rootstock combinations according to the specific conditions of the region, for guaranteeing the success of fruit-growing. This allows to grow the cultivars under such conditions that enable them to show the maximum of their productive capacities and to get the best use of the available vegetation factors – temperature, precipitation, sunshine duration, risk of late spring frosts, etc. In ecological terms, it is appropriate to include cultivars with confirmed resistance to economically important diseases and pests. This reduces the risk of deteriorating the quality of the fruit production by caused injuries and creates a real opportunity to reduce pesticide use.

The Fruit-Growing Institute – Plovdiv stores, studies and manages the major share of the national genetic fund of fruit species, forms and cultivars, including local samples showing a high level of resistance to pests and abiotic stress. As a result of continuous enrichment of the genetic fund and the profound studies,

conditions were created in 80s for initiating new breeding programmes, the aims of which are constantly updated according to the changes in the genetic fund and the market requirements for fruit quality. The significant progress in the development of biotechnologies during the same period provided new, much larger opportunities, for the combined application of conventional and in vitro methods for the creation of hybrids and cultivars of early ripening parental combinations. The introduction of molecular technologies in the processes of breeding new fruit cultivars, is a guarantee for a better success of the breeding programmes. Cultivars exhibiting resistance or tolerance to economically important diseases and pests are recommended as suitable for growing in the country under the conditions of integrated fruit production.

The dessert cultivars ‘Aheloy’ and ‘Remil’ and the canning ones ‘Malo Konare’ and ‘Stoyka’, are resistant to powdery mildew as the most economically important disease in peach. That also refers to the latest breeding results in the group of dessert cultivars – ‘Laskava’ and ‘Evmolpiya’, the latter being also resistant to peach curl leaf disease. Among the newest cultivars, the dessert one ‘Puldin’ and the nectarine ‘Gergana’ show a marked resistance to drought (Zhivondov et al., 2004; Zhivondov et al., 2008).


Referring cherry production, cultivars bearing large-size fruit combined with a very early period of ripening should be chosen for new plantations, as well as very late self-fertile cultivars with large fruits, all of them with a marked resistance to fruit cracking and to the diseases cylindrosporiosis and monilia. The latest Bulgarian very early cultivars ‘Kossara’ and ‘Rosita’ best meet those requirements. From the later ripening groups, priority should be given to the new Canadian self-fertile cultivars ‘Sunburst’, ‘Sylvia’, ‘Samba’, ‘Santina’, ‘Sweet Heart’, ‘Celeste’, ‘Canada Giant’, ‘Lapins’, etc. The new Bulgarian late-ripening cultivars ‘Rosalina’ and ‘Trakiiska Hrushtyalka’ are particularly interesting.

The major problems in apple fruit production are caused by the diseases powdery mildew, scab and fire blight. The drastic reduction of pear production in the country is due to the last two diseases and to the key pest pear psylla. The apple cultivars ‘Prima’, ‘Primrouge’, ‘Florina’ and ‘Pinova’ have a high complex resistance to the causative agents of the three major diseases. Referring the pear cultivars, ‘Beurre Hardy’, ‘Beurre Giffard’, ‘Beurre Bosc’, ‘Abate Fetel’, etc. are less susceptible to fire blight disease.
Concerning walnut production, it is important to choose cultivars that are highly resistant to the diseases bacteriosis and walnut anthracnose.

The success of modern fruit production is related to the application of good agricultural practices that provide the best suitable conditions for the demonstration of the biological and economic qualities of the cultivar-rootstock combinations and at the same time preserve the environmental resources in a good ecological condition.

The application of modern ecologically sound technologies for growing the fruit crops enables the transition from conventional to integrated fruit production. Ecologically sound plant protection is based on the right choice and use of permitted in the country pesticide products, rates and dates of application, monitoring of the residual amounts of pesticides in the fruits and fruit products.

In that aspect the introduction of the Principles of Good Plant Protection Practice would help to organize the production in compliance with the European ecological criteria. Applying herbicides and fertilizers with irrigation water increases their effectiveness and economic efficiency without any undesired consequences for the cultural plants and for the environment (Rankova et al., 2009). Herbigation and fertigation are efficient technological decisions for using the microirrigation systems in accordance with the principles of ecologically sound fruit production and sustainable agriculture.

That ecological approach could be applied both in integrated and organic fruit production.

Under the conditions of integrated fruit production it is appropriate to apply modern systems for maintaining the soil surface (black fallow, a sod-mulch system, natural grassing, etc.) for protecting soil structure and soil fertility and enabling the restricted use of herbicides and mineral fertilizers with high mechanization of the production processes (Rankova, 2006; Rankova et al., 2011).

Grassing systems in fruit-growing (natural grassing, cultivated grassing using a sod-mulch system) are suitable for application in damp areas and in areas under irrigation. Permanent grass sod grows in the inter-row space and the regularly mown grass is left in place and serves as mulch and green manure. Most often the grass sod is left in the inter-row space while the in-row strips are maintained free of weeds by mechanized soil tillage (rotary tillers with deviating sections) or by applying herbicide treatments. The following grass mixtures are recommended for the inter-row space – ryegrass (*Lolium perenne* L.), meadow fescue (*Festuca pratensis* Huds.), smooth meadow grass (*Poa pratensis* L.), meadow timothy (*Phleum pratense* L.), separately or in a mixture with white clover (*Trifolium repens* L.) or red clover (*Trifolium pratense* L.).

The predominant use of leaf-applied herbicides of a short persistence and without a residual effect provides an efficient control on weed vegetation and it
is recommended for use in sloping terrains as a suitable approach for limiting soil erosion.

The ecologically sound plant protection activities under the conditions of integrated fruit production should be economically efficient. The basic principle when applying them is maintaining the pest populations below the economic damage threshold. On its turn, that requires good knowledge on the biological characteristics of the pests, of the causative agents of the diseases and of the weed species and necessitates the use of good agricultural practices with the aim of preserving biodiversity.

Preventive measures for limiting the incidence and spread of pests are of utmost importance for the success of the plant protection activities – location of the fruit orchard, special isolation and regular observations on the development of the pathogens. Their control should be carried out by combining agrotechnical, biological and chemical methods. An important point when choosing the pesticide products is the requirement of applying only permitted active substances. For that purpose the so-called “green list” has been prepared, including the active substances permitted to be applied in integrated plant protection; the “yellow list” with the substances permitted with restrictions and the “red list” – not permitted pesticide products (Stancheva el al., 2008). Applying the restrictive measures in using pesticides allows obtaining fruit products consistent with the latest requirements of the European standards for integrated fruit production.

Continuing the activities for realizing the transit to integrated fruit production necessitates further training of the farmers on the basic requirements for its organization.

Conclusion

Integrated fruit production is a modern ecologically oriented production of fruits. Knowledge and introduction of its basic principles is a necessary precondition for adapting fruit-growing to the European requirements for producing competitive fruit products and preserving the biodiversity and the environment.
References


Integralna proizvodnja voća u Bugarskoj – najnovija dostignuća, tendencije i ekološki pristupi proizvodnji zdravstveno bezbednog voća

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Rezime

U ovom radu razmatraju se neki od najglavnijih elemenata integralne proizvodnje voća kao savremenog pristupa dobijanju ekološki čistog proizvoda vrhunskog kvaliteta – izbor odgovarajuće sorte i kombinacije sorta-podloga, integralni pristup suzbijanju bolesti, štetocina i korova, sistemni navodnjavanja i održavanja površine zemljišta u voćnim zasadima. Kombinovani pristup suzbijanju štetocina, primena dobrih poljoprivrednih praksi i korišćenje pesticidnih preparata potvrđene selektivnosti, pogodnih za primenu u uslovima integralne proizvodnje voća, kao i iznalaženje alternativnih pristupa u cilju ograničavanja primene agrohemikalija – obezbeđuju dobre agrotehničke i ekološke uslove u ovoj proizvodnji. Integralna proizvodnja voća kao organizacioni oblik u voćarstvu primenjuje savremeni ekološki pristup voćarskoj proizvodnji. Znanje zasnovano na njenim osnovama neophodan je uslov za prilagođavanje voćarstvu evropskim zahtevima u proizvodnji konkurentnog voćnog proizvoda i očuvanju životne sredine i biodiverziteta.

Ključne reči: voćarstvo, sorte, suzbijanje štetocina, integralna proizvodnja voća