DOI: 10.22620/agrisci.2020.27.014

MANAGEMENT PRACTICES FOR BIOPRODUCTION OF APPLES IN THE PLOVDIV REGION

(in relation to the implementation of Task 1 of Component 1, Working Package 1.2 of the National Science Program "Healthy foods for a strong bioeconomy and quality of life" of the Ministry of Education and Science)

Galya Dobrevska*, Manol Dallev, Tatyana Bileva, Ekaterina Valcheva

Agricultural University – Plovdiv

***E-mail: galysd@abv.bg**

Abstract

The current study summarises information regarding previously applied agricultural practices in the field of apple cultivation. The presented practices have been conducted for a period of five years in an orchard with Florina variety – grafted on MM106 rootstock – as a part of bio production of fruit at the Agroecological Centre of the Agricultural University - Plovdiv.

This information, combined with future studies of soil composition, as well as vegetative and reproductive manifestations of plants, can be used to develop a database enhancing the access to knowledge and experience in the future and facilitating the comparison and selection of the most appropriate agricultural practices for apple cultivation.

Keywords: apple, agricultural practices, organic production.

REVIEW

In the context of intensive fruit growing, numerous synthetic plant protection and fertilizing products are applied with the aim of achieving good health of fruit planting material, strength, enhanced transportability and storage length capacity (Kovachevski et al., 1987; Stancheva, 2001; Andreev and Ignatiadis, 1997). Nevertheless, the use of various chemical products and application technologies leads to permanent pollution of the environment and violation of biological equilibrium (Giordano et al., 2007; Staneva and Gospodinova, 2018). In relation to this, the latest advances in fruit growing technologies explore alternative ways for better resource utilisation without interfering in ecological balance (Arnaudov et al., 1998; Andreev et al., 2001; Andreev and Rasheva, 2009; Tsolova, 2019). The production of high-quality fruit, which remain pure and healthy, is becoming increasingly relevant (EEC Regulation No 2092/91; EEC Regulation No 834/2007; Obradović et al., 2013).

The preservation of natural resources and soil fertility, especially in the context of rapid climate change nowadays, is a key goal of every type of agriculture in Europe, including our country. In recent years, organic orchards have been created where mineral fertilizers and synthetic pesticides are no longer used. In this case, the maintenance of soil fertility is based on the application of organic fertilizers. Crops for green fertilization are cultivated, which contribute to the reduction of soil erosion and washing of mineral nutrients, as well as deliver a large amount of easily degradable organic substances into soil during plowing. This organic substance supports soil ecosystem which in turn mineralizes the organic matter and provides digestible nutrient forms to plants (www.ec.europa.eu; Karov and Andreev, 2000; Sanches et al., 2007).

In this study, information regarding previously applied agricultural practices in the field of apple cultivation is presented to your attention. The practices have been conducted for a period of five years with Florina apple variety orchards, grafted on MM106 rootstock, as a part of the bioproduction process at the Agroecological Center of the Agricultural University - Plovdiv, located nearby the village of Yagodovo, Plovdiv region.

This information, combined with future studies of soil composition, as well as vegetative and reproductive manifestations of plants, can be

used to develop a database enhancing the access to knowledge and experience in the future and facilitating the comparison and selection of the most appropriate agricultural practices for apple cultivation.

Nowadays, the simultaneous production of high-quality fruit, which remains pure and healthy, is becoming increasingly relevant (www.europa.eu.int/comm/agriculture/foodqual/index_en.htm). First of all, mankind faces the issues of protecting the environment and recovering it from the harmful effects of human activity which adversely affects its balance. In this respect, the main task of organic growing is to maintain ecological balances and produce fruit without violating soil fertility and other natural conditions (www.mzh.government.bg/Eco/bio.html; www.mzgar. government.bg/Eco/bio.html; Angle et al., 2007; Kostadinova and Popov, 2012; Staneva and Gospodinova, 2018).

It is evident that the control of economically important diseases and pests in apple orchards is greatly reduced in comparison to conventional production when the case with the experimental test area with Florina apple variety is taken into consideration. Plant protection practices are based on pesticides which exclude the use of synthetic compounds (Tables 6, 7, 8, 9 and 10).

During the entire period, with the exception of the third and fourth years, only one winter spray treatment was conducted in March. In the third and fourth years, the hibernating forms of Venturia inaequalis and Podosphaera leucotricha were treated by applying Shampion VP – 0,15% (end of November) and Funguran ON – 0.3% (contact broad-spectrum, containing 77% Cu-hydroxide) combined with Colloidal sulfur – 1:400. Trifolio S Forte 0.3% (50% vegetable oil + 50% emulsifier) and Acarzin 3% (85% mineral oil + 15% emulsifier) were used against the hibernating forms of aphids, apple fruit worm, etc.

The information from table 6 shows that only in the first year of the period, during the month of April, Agrofayt contact 23 was applied against fungal diseases, whereas Piretrium – 0.075% (a broad-spectrum insecticide extracted from dry chrysanthemum) was used against economically important pests.

Post-blossoming treatments in May against apple diseases and pests mainly target Venturia inaequalis, Podosphaera leucotricha, aphids and apple fruit worm. The biological product Kuore 200g/dka (contains 10% Cu and 1.1% Zn, acts not only against frugal, but also targets bacterial pathogens), Colloidal sulfur – 1:400, Nimazal T/C - 200 ml/dka (a bioinsecticide that acts not only on the eggs of pests, but also on some spores causing diseases) + Trifolio S Forte - 0.3%. Pheromone trapping was used to control apple fruit worm. The method prevents the risk of attacks on the fruit prior to becoming a serious issue.

Later, June treatments once again include Colloidal sulfur – 1:400 against economically important diseases and Nimazal T/C - 200 ml/dka and emulsion concentrate Madeks 10ml/dka + 0.5% sugar solution against pests.

In July, plant protection measures include fungicides Funguran ON 50 VP - 0.3%, alone or in combination with Colloidal sulfur – 1:400, as well as, insecticides Nimazal T/C - 200 ml/dka and Maxec 10ml/dka + 0.5% sugar solution.

Plant protection measures in August are restricted. The ability of Nimazal T/C - 200 ml/dka to form a protective cover on leaf surface and prevent spores from sprouting is used against Venturia inaequalis and Podosphaera leucotricha. Nimazal T/C in the same concentration and Madeks 10ml/dka + 0.5% sugar solution are applied against economically important pests in the orchard with Florina variety applies.

Growth and fruit production in the orchard, which operates at full capacity, are regulated by regular annual winter pruning during each year of the five-year period. Pruning activities took place in February - March.

Turf-mulching system is applied in the context of the studied plants. The former is a system for planned soil grassing by planting appropriate grass varieties which are repetitively mowed during vegetation and the mowed leaf mass is left on the grassed area. The information from the above-mentioned tables shows that periodic mowing was performed during May, June, July, August and September during the five-year period. The inter-row strips are kept clear of weeds by treatment.

Every bio-plant requires fertilization. The latter influences growth and fruit production. Nowadays, in the context of intensive organic fruit

development, sufficiently digestible forms of fertilizers have been developed; thereby, excluding synthetic compounds which may to a greater or lesser extent violate eco-balance.

In the studied orchard, the liquid Hemozim Bio No. 5 was applied through the irrigation water. Hemozim Bio No. 5 (organic-nitrogenous liquid fertilizer obtained from the treatment of beef blood for the food industry), which had been previously diluted with 5 parts of water at a dose of 5 l/4 dka in all five years of the study, was used during the various main phenophases of plant development. In the second year, leaf fertilization with CORE bio fertilizer was performed in the month of May.

Summers are hot and dry in Bulgaria. The rainfall volume is quite insufficient to grow fruit. Irrigation in the studied apple orchard is local, drip irrigation. The information from tables 6, 7, 8, 9 and 10 shows that irrigation begins in April-May and continues till August. The irrigation activities align with some major phenophases related to the development of apples. Irrigation frequency also depends on weather conditions. Overall, they are also insufficient in the field with bioproduction.

There are forthcoming studies in the monitored test area with apple variety Florina, which is bioproduced at the Agroecological Centre of the Agricultural University – Plovdiv, located near the village of Yagodovo, Plovdiv region. These will be fulfilled according to the assigned tasks of Component 1, FP 1.2 of the National Science Program “Healthy foods for a strong bioeconomy and quality of life” of the Ministry of Education and Science.

CONCLUSIONS

The results of future studies on soil composition (nutrients, humidity, micro flora), vegetative and reproductive manifestations of plants, etc., together with collected and presented information for certain previously applied agrotechnical activities can be a source of knowledge, experience and selection of the most appropriate agricultural practices for apple cultivation.

REFERENCES

Andreev, R., I. Lecheva, R. Angelova, 2001. Biodiversity of predatory insect and mites species in apple agrocenose in biological agriculture.) Animal Science, 38 (2) 161-163.

Andreev, R., D. Rasheva. 2009. Natural regulators of aphids on the apple in the area of Plovdiv. Scientific works AU, 54: 171-176.

Andreev, R., G. Ignatiadis, 1997. Plant protection systems for the control of apple fruit worm.VSI - Plovdiv, Scientific works, v. XLII, 3 (1), 13-20.

Angle D., N. Gadjalska, I. Mateeva, 2007. Preliminary evaluation of the program for development of rural areas in Bulgaria 2007-2013, v. II, Report on the environmental assessment of the rural development program 2007-2013 g.

Arnaudov, V., R. Andreev, H. Kutinkova, Y. Dimitrov, 1998. The role of natural antagonists in systems for integrated fighting in fruit crops. Crop Science, 35, 149-153.

Borovinova, M., V. Dzhuvinov, 2013. Plant protection, 10, 28-30.

Dobrevska, G., 2010. Features of some apple rootstocks in relation to production intensification, Agricultural science ”, 3, p. 5 – 10, Agricultural University – Plovdiv.

Dobrevska, G., 2013. Apple,s clone,s rootstocks, ISBN 978-619-90128-1-9. Plovdiv, Publishing house UCHI.

Djordano A., N. Gadjalska, I. Mateeva, 2007. Report for the environmental development assessment of rural areas 2007-2013 г.

Dzhuvinov, V., S. Gandev, V. Arnaudov, Z. Rankova, L. Nacheva, G. Dobrevska, 2016. Apple, ISBN 978-954-91865-5-0, Publishing house Biofrut – EOOD.

Karov S., R. Andreev, 2000. Plant protection for natural, organic and integrated garden. In a row „ Organic gardening “ №2, AEC, VSI – Plovdiv.

Kostadinova P., V. Popov, 2012. Basic principles and methods of biological farming. New knowledge, Agribusiness edition and development of the regions, No. 3, July - September.

Kovachevski, I., A. Lazarov, A. Balevski, S. Ivanov, V. Karova, 1987. Diseases and enemies of fruit tree species. Publishing house Zemizdat, 334.

Mitov, P., G. Pepelyankov, D. Dyakov, 1996. Fruit growing. Academic Publishing House of VSI, Plovdiv.

Obradović A., D. Radivojević, D. Vajgand, E. Rekanović, 2013. Handbook of integral production and protection of apples. Institute for the Application of Science in Agriculture Belgrade, p. 135-162.

Regulation (EIO) № 2092/91. REGULATION (EIO) № 2092/91 THE COUNCIL OF THE EU

since June 24, 1991 on organic production of agricultural products and its designation on agricultural products and foods (OB L 198, 22.7.1991 p. 1).

Regulation (EIO) № 834/2007. REGULATION (EIO) № 834/2007 THE COUNCIL OF THE EU since 28 June 2007 on organic production and labeling of organic products and to repeal the Regulation (EIO) № 2092/91.

Sramatov, I., V. Todorov, K. Gogova, Z. Makariev, 1982. Systems for maintenance on the soil in the orchards Publishing house „Hr. G. Danov", Plovdiv.

Stancheva, Y., 2001. Atlas of agricultural diseases. Vol: Diseases of durable crops, Pensoft, ISBN: 954-642-122-7.

Staneva, I., M. Gospodinova, 2018. Organic fruit production. Crop Science, 55 (2), 53-62.

Sanches E. E., A. Giayetto, L. Chichon, D. Fernandes, M. Aruani, M. Curetti, 2007. Cover crops influence soil properties and tree performance in an organic apple orchard in northern Patagonia. Plant Soil, 292, 193 – 203.

Stoilov, G., 1976. Minerally nutrition to the plants and methods for controlling it. Publishing house „Hr. G. Danov", Plovdiv.

Todorov V., Belyakov V., Grozdin A., Stamboliiski K., Manov S., Ivanov S., Ivanov V., Petrov A., Vassilev V., Milanov B., Georgiev V., Yoncheva M.,1974. Industrial Technologies in Fruit Growing. H. G. Danov, Plovdiv.

Tsolova E., 2019. The European Agricultural Fund for the development of rural areas „ Europe is investing in rural areas". Part 4. Organic fruit production.

www.ec.europa.eu. EU Structural and Investment Funds. Environmental protection and efficient use of resources.

www.europa.eu.int/comm/agriculture/foodqual/index_en.htm. The European Commission's agriculture and food website.

www.mzh.government.bg/Eco/bio.html. National plan for the development of organic agriculture in Bulgaria 2006-2013.

www.mzgar.government.bg/Eco/bio.html. Regulation № 22 from 4 June 2001 for organic production of plants, plant products and foodstuffs of plant origin and its marking on them. Issued by the Ministry of Agriculture and Forestry. Published–State newspaper, No. 68 from 3 August 2001, Changed-State newspaper, No.13, 10 February 2006.

Table 1. AGROECOLOGICAL CENTRE, AU – PLOVDIV, APPLE TREE VARIETY FLORINA

APPLIED AGRICULTURAL PRACTICES (2014)

№	Agricultural practices		Months											
			I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1.	Winter and vegetative, phytosanitary measures	Pests			Venturia inaequalis; Podosphaera leucotriha	Venturia inaequalis; Podosphaera leucotriha Cydia (Carpocapsa) pomonella Aphis spp								
		Pesticides			Funguran ON 50VP-0,3% Trifolio S Forte – 0,3%	Agrofayt kontakt 23. Piretrium – 0,075%	Kuore – 200g/dka Nimazal –200 ml/dka	Nimazal –200 ml/dka Madeks – 10 ml/dka + 0,5% sugar Madeks – 10 ml/dka + 0,5% sugar	1Madeks – 10 ml/dka Funguran - 0,3 % + Koloidna syara Madeks – 10 ml/dka	Nimazal – 0,3 %				
2.	Pruning			*	*									
4.	Fertilizing				Hemozim Bio № 5 - 5 l/4 dka		Hemozim Bio № 5 - 5 l/4 dka	Hemozim Bio № 5 - 5 l/4 dka		Hemozim Bio № 5 - 5 l/4 dka				
5.	Irrigation						*	*	*	*				
6.	Mowing						*	*	*	*	*			

Table 2. AGROECOLOGICAL CENTRE, AU – PLOVDIV, APPLE TREE VARIETY FLORINA

APPLIED AGRICULTURAL PRACTICES (2015)

№	Agricultural practices		Months											
			I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1.	Winter and vegetative, phytosanitary measures	Pests			Venturia inaequalis; Podosphaera leucotriha		Venturia inaequalis; Podosphaera leucotriha 2. Cydia (Carpocapsa) pomonella Aphis spp		Venturia inaequalis; Podosphaera leucotriha 2. Cydia (Carpocapsa) pomonella Aphis spp	Venturia inaequalis; Podosphaera leucotriha Cydia (Carpocapsa) pomonella Aphis spp				
		Pesticides			Funguran ON 50VP-0,3% Akarzin - 3%		Nimazal –200 ml/dka + Trifolio S Forte – 0,3% Feromonova ulovka – 1br. Nimazal –0,3 %	Koloidna syara-1:400	Madeks – 10 ml/dka Nimazal – 0,3 % Madeks – 10 ml/dka Madeks – 10 ml/dka Funguran - 0,3 %	Nimazal – 0,3 % Madeks – 10 ml/dka				
2.	Pruning			*	*									
4.	Fertilizing				Hemozim Bio № 5 - 5 l/4 dka		Hemozim Bio № 5 - 5 l/4 dka		Hemozim Bio № 5 - 5 l/4 dka					
5.	Irrigation						**	*	**	**				
6.	Mowing						*	*	*	*	*			

Table 3. AGROECOLOGICAL CENTRE, AU – PLOVDIV, APPLE TREE VARIETY FLORINA

APPLIED AGRICULTURAL PRACTICES (2016)

№	Agricultural practices		Months											
			I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1.	Winter and vegetative, phytosanitary measures	Pests		Venturia inaequalis; Podosphaera leucotriha	Cydia (Carpocapsa) pomonella Aphis spp		Venturia inaequalis; Podosphaera leucotriha	Cydia (Carpocapsa) pomonella Aphis spp					Venturia inaequalis; Podosphaera leucotriha	
		Pesticides		Funguran ON 50VP-0,3%	Akarzin - 3%		Koloidna syara-1:400	Madeks – 10 ml/dka +0,5% sugar					Shampion-0,15 %	
2.	Pruning			*	*									
4.	Fertilizing				Hemozim Bio № 5 - 5 l/4 dka		Leaf fertilizer - CORE		Hemozim Bio № 5 - 5 l/4 dka					
5.	Irrigation						*	**	**	**				
6.	Mowing						*	*	*	*	*			

Table 4. AGROECOLOGICAL CENTRE, AU – PLOVDIV, APPLE TREE VARIETY FLORINA

APPLIED AGRICULTURAL PRACTICES (2017)

№	Agricultural practices		Months											
			I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1.	Winter and vegetative, phytosanitary measures	Pests			1. Venturia inaequalis; Podosphaera leucotriha Cydia (Carpocapsa) pomonella Aphis spp									
		Pesticides			1. Funguran ON 50VP-0,3% Akarzin - 3% + Koloidna syara-1:400									
2.	Pruning				*	*								
4.	Fertilizing				Hemozim Bio № 5 - 5 l/4 dka				Hemozim Bio № 5 - 5 l/4 dka					
5.	Irrigation					*	*	**	**	**				
6.	Mowing						*	*	*	*	*			

Table 5. AGROECOLOGICAL CENTRE, AU – PLOVDIV, APPLE TREE VARIETY FLORINA

APPLIED AGRICULTURAL PRACTICES (2018)

№	Agricultural practices		Months											
			I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1.	Winter and vegetative, phytosanitary measures	Pests		1. Venturia inaequalis; Podosphaera leucotriha Cydia (Carpocapsa) pomonella Aphis spp										
		Pesticides		Funguran ON 50VP-0,3% Akarzin - 3%										
2.	Pruning			*	*									
4.	Fertilizing				Hemozim Bio № 5 - 5 l/4 dka				Hemozim Bio № 5 - 5 l/4 dka					
5.	Irrigation						*	**	**	**				
6.	Mowing						*	*	*	*	*			