INTEGRATED PEST AND DISEASE MANAGEMENT IN APPLE AND PEAR ORCHARDS

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Abstract
Depending on the biological reserve of pests and diseases, the different control methods will be chosen to ensure a good phytosanitary protection in conditions of environmental protection by reducing as much as possible the number of chemical treatments. This goal can be achieved using a combination of cultural, physical/mechanical, biological and chemical management tools.
Cultural control, mechanical control represent the non chemical management of pests and diseases, it means to change the soil and crop environment to become inappropriate for pests and diseases establishment.
Biological control is achieved through the use of living organisms and products of their biological activity in order to regulate populations of pathogens and pests (International Organization for Biological Control).
Chemical control means the use of pesticides in the management of diseases and pests. It is used when cultural and biological control have not been sufficient to protect the culture. If chemical control is required, selective insecticides targeting diseases and pests will be chosen, leaving the entomophagous fauna and beneficial populations unharmed.
The control schemes for pests and diseases of apple and pear trees during the vegetative growth include 13 treatments (8 with chemicals, 5 with biological products) and 9 treatments (5 with synthetic products, 3 with biological products), respectively.
During the dormant stage, 2 treatments must be applied to reduce the overwintering reserve of diseases and pests.

Keywords: apple, pear, control, diseases, pests

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1. INTRODUCTION

The discovery and commercialization of synthetic organic pesticides in the latter half of the 20th century represented a major qualitative change in pest management. Problems began developing, sometimes, the problems associated with the use of these products became apparent after a relatively short time, including environmental persistence and damage (especially the organochlorines), mammalian toxicity (e.g.applicator and farm-worker safety, especially the organophosphates), possible consumer effects from residues on foods (carcinogenicity, teratogenicity, mutagenicity or chronic neural effects), and distruction of pests' natural enemies and selection for resistant pest populations. [1]
An integrated combat has an important role to play in reducing the negative side effects resulting from the irrational use of pesticides [5].
Current apple IPM programs are using pesticides more efficiently, but potential problems which must not be overlooked include pesticide resistance buildup, the continued use of pesticides that are harmful to beneficials and increased importance of minor pests resulting from reduced pesticide use for control of major pests [4].
In recent, apple production system has been changed with implementation of integrated pest management (IPM) in addition to diverse apple varieties and their cultivation [3].
The choice of all methods of controlling diseases and pests and their harmonious combination can reduce the use of pesticides and determine high yields.

2. MATERIALS AND METHODS

Data from the literature were used and pesticides were taken from the catalogs of approved plant protection products.

The synthetic insecticides and fungicides used in the control scheme have low toxicity, and the biological treatments consisted in using of products based on bacteria and fungi, as well as in placement of traps with sexual pheromones.

3. RESULTS AND DISCUSSION

Reducing the number of treatments is a must for all crops. This can be done through a set of methods of prevention and control, in accordance with existing pathogens and pests. Depending on the biological reserve of pests and diseases, the different control methods will be chosen to ensure a good phytosanitary protection under conditions of environmental protection by reducing as much as possible the number of chemical treatments. This can be achieved using a combination of cultural, physical/mechanical, biological and chemical management tools.

In order to establish effective methods of pest and disease control, in apple and pear orchards, phytosanitary control of crops is of particular importance.

Prevention and control of plant pests and diseases is done through several methods. Thus, the use of resistant or tolerant varieties in cultivation is the most effective and non-polluting mean of preventionagainst pests and diseases.

Among the agrotechnical methods, the choice of the cultivation land, the soil works, the use of healthy planting material, fertilization and cultural hygiene are important. Soil work, on the one hand, leads to destruction of weeds that may be intermediate hosts for various pests and pathogens, and on the other hand pests in different stages of development are destroyed either directly due to the action of active parts or indirectly, by changing the microclimate, or by buryingthe remains of infected plants, carrying pathogens.

Sorting and using healthy planting material avoids infestation of nurseries and new crops with pests and pathogens.

Fertilization ensures a good growth and vigor of plants and as a consequence a better resistance to pests and diseases.

Cultural hygiene measures aim to eliminate possible outbreaks of infection or to eradicate pests ready for overwinterin various stages (by destroying the remains of plants left in the field).

Mechanical methods applied in fruit growing are used to remove pathogens from the surface of trees. Thus, the tree trunks are cleaned of lichens, mosses, fruiting fungi. After cleaning the trunk, the branches of the tree should be sprayed with a fungicide.

As physical methods that can be used in prevention and control of pests in apple and pear orchards we can mention hot water (by immersing the grafts for 5 minutes in water at 55^0C in the case of San Jose scale and *Eriosoma lanigerum*), light and visual traps. (*Psilla* spp.), Y-rays which can be used to sterilize males and destroy the insect population (e.g. *Cydia* spp). Thermotherapy can be used to deworm trees. If the seedlings are kept at 38^0C for 3 weeks, this will control the proliferative disease caused by the bacterium *Xillela fastidiosa*.

Biological control is achieved through the use of living organisms and the products of their biological activity in order to adjust populations of pathogens and pests (International Organization for Biological Control). Biological control is the result of active human intervention and consists of the use of various biological means and methods in order to reduce the numerical density of their populations below the economic damage threshold [2].

Classical biological control has been widely applied on a variety of target organisms, but most commonly against insects, using parasitoids and predators, and occasionally pathogens. By the year 2010, 6,158 parasites and predators were introduced against 588 harmful insects, leading to the control of 172 pests. About 55% of these introductions were made against woody plant pests [6].

We can mention the wasp *Prospaltella perniciosi* which is recommended in the control of San - José scale - *Quadraspidiotus perniciosus* larvae, the wasp *Trichogramma embryophagum* can be used to control fruit

moths - *Cydia* spp. (20,000 - 60,000 wasps / ha depending on the degree of attack).
With regard to biological insecticides, we recommend the use of the viral products Carpovirusin (1l / ha), Granupom (300 ml/ha) or Madex Top (in intensive programs a first application with full dosage -100 ml/ha is recommended, followed by 4 to at 6 applications per generation with half dose -50 ml/ha), Cyd - X, against the apple worm. BactoSpeine DF, based on protein crystals of the bacterium *Bacillus thuringiensis* var. Kurstaki is applied in doses of 0.5 - 1 kg/ha (8 treatments can be performed) to control defoliating caterpillars, the codling moth - *Cydia pomonella*, and the winter moth - *Operophtera brumata*.
To control diseases and pests it is necessary to carry out a number of 13 treatments, of which 8 treatments with weakly toxic synthetic products and 5 treatments with biological products: Defense 3, Morpheus SR and traps with sex pheromones type atraPOM (Table 1).
9 pear treatments are required to achieve a high and quality production, of which 6 chemical treatments and 3 biological treatments (Table 2).
It should be mentioned that, for both apple and pear trees, during the period of vegetative rest, 2 treatments will be applied: the first treatment, in the period between October and December; the second, between February and March, before the buds swell. These treatments consist in the application of a copper-based product, and after 8-9 days a horticultural oil will be used. Copper-based products (e.g. Bordeaux mixture) are also very selective for useful fauna, and can be introduced into integrated control schemes.

4. CONCLUSIONS

Depending on the biological reserve of pests and diseases, the different control methods will be chosen to ensure a good phytosanitary protection in the conditions of environmental protection by reducing as much as possible the number of chemical treatments. This can be achieved using a combination of cultural, physical/mechanical, biological and chemical management tools.
Cultural control represent the non chemical management of pests and diseases, it means to change the soil and crop environment to become inappropriate for pest and diseases establishment.
Biological control is achieved through the use of living organisms and the products of their biological activity in order to adjust populations of pathogens and pests (International Organization for Biological Control).
Chemical control means the use of pesticides in the management of diseases and pests. It is used when cultural and biological control has not been enough to protect the crop. If chemical control is required will be selective insecticides are chosen which target the diseas and pest, leaving entomophagous fauna and the beneficial populations unharmed.
The control schemes for pests and diseases of apple and pear trees during the growing season include 13 and 9 treatments, respectively. During the vegetative rest period, 2 treatments must be applied.

5. REFERENCES

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Table 1: Integrated control scheme for apple tree pest and disease control

Treatment	Product	Dosage (l/ha), Concentration (%)	Pathogen	PHENOPHASES
				March / April / May / June / July / August / September
T1	Polyram DF	0.25%	*Venturia inaequalis*	1
T2	Defense 3	1.0 l/ha	*Venturia inaequalis* *Erwinia amylovora*	2
T3	Flint plus 64 WG	0.04%	*Venturia inaequalis* *Podosphaera leuctricha*	3
T4	Voliam Targo	0.25 – 0.3%	*Panonychus ulmi*, *Cydia pomonella*, *Phyllonorycter spp.*	4
T5	Mospilan 20 SG	0.025-0.03%	*Quadraspidiotus perniciosus*	5
		0.02%	*Eriosoma lanigerum*, *Aphis pomi*	5
T6	atrPOM	15 traps/ha	*Cydia pomonella*	6
T7	Defense 3	1.0 l/ha	*Venturia inaequalis*, *Podosphaera leucotricha*	7
T8	Defense 3	1.0 l/ha	*Podosphaera leucotricha*	8
T9	Merpan 80 WDG	0.15%	*Venturia inaequalis*	9
T10	DIPEL WP	1.5 kg/ha	*Cydia pomonella*, mining insects, defoliating insects	10
T11	Morpheus SR	5.0 l/ha	Apple scab, moniliosis, aphids, *Lepidoptera* larvae, wasps	11
T12	Movento 100 SC	1.875 l/ha	*Eriosoma lanigerum*, *Quadraspidiotus perniciosus*	12
T13	Cosavet 80 DF	4.5 kg/ha	*Podosphaera leucotricha*	13

Note: 1 - beginning of bud bursting; 2 - beginning of leafing; 3 - pink button; 4 - 10-15% shocked petals; 5, 6, 7, 8, 9, 10, 11, 12 - every 8-12 days; 13 – 50%

Table 2: Integrated control scheme for pear tree pest and disease control

Treatment	Product	Dosage (l/ha), Concentration (%)	Pathogen	PHENOPHASES																			
				March			April			May			June			July			August			September		
T1	Mospilan 20 SG Serenade Aso	0,0025% 4,0 - 8,0 l/ha	*Quadraspiditiotusperniciosus*, Aphids, *Erwinia amylovora*	1																			
T2	Poleci Alliete 80 WG Chorus 50	0,05% 3,75 kg/ha 0,45- 0,75kg/ha	Aphids, *Anthonomus pomorum,Erwinia amylovora*, *Venturia inaequalis*				2																
T3	Morpheus SR	5,0 l/ha	*Venturia inaequalis*, Leaf-eating pests, *Psylla spp.*, Aphids, Wasps							3													
T4	Affirm Opti/ Movento 100 SC Flanco 10 WP Ksar Max	2,0 kg/ha 1,875 l/ha 50 g/hl (100/l) 0,3 kg/ha	Leafminers, Leaf-Eating pests, Leaf-Eating pests, *Psylla spp.*, Aphids, *Dasyneura spp.*, *Quadraspidiotus perniciosus*, *mites*, *Venturia inaequalis*,										4										
T5	Chorus 50 Mospilan 20 SG	0,45- 0,75 kg/ha 0,0025%	*Venturia inaequalis*, *Quadraspiditiotus perniciosus*, *Psylla spp.*										5										
T6	Morpheus SR	5,0 l/ha	*Venturia inaequalis*, *Cydia pomonella*, mites													6							
T7	Scala Movento 100 SC	0,75 - 1,0 l/ha 1,875 l/ha	*Venturia inaequalis*, *Quadraspidiotus perniciosus*																7				
T8	Defense 3	1,0 l/ha	*Venturia inaequalis*, storage diseases																8				
T9	Champ 77 WG	0,2%	*Venturia inaequalis*, *Erwinia amylovora*																			9	

Note: 1 - beginning of bud bursting; 2 - flowering breathing; 3 - 10-15% shocked petals; 4 - fruit 0.5-2 cm diameter; 5- fruit 2.5-3 cm diameter; 6 - fruit 4 cm diameter; 7 - growing fruit; 8 – before harvesting; 9 - leaves fall