

CONSIDERATIONS REGARDING PLANTS PROTECTION BY MEANS OF BIOFERTILIZERS / BIOINSECTICIDES

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ABSTRACT

The paper presents some aspects regarding the utilization of certain ecological substances as an alternative to environmental-friendly insecticides, in order to obtain some ecological products within the context of the increased concern for ecological products.

INTRODUCTION

The environmental –friendly agriculture aims to sustainable, diversified and balanced production systems, for preventing polluting harvest and environment. As for plant crops, the ecological production which avoids the use of usual noxious substances is a special concern of developed countries, in the last decennies. In Romania, also the interest in ecological products and production has been growing more and more lately. Unfortunately, in our country the surfaces cultivated in ecological conditions are still very reduced [1].

In order to extend the ecological agriculture system to Romania, national administrative regulations regarding the production, processing and capitalization of environmental-friendly agro-food products have been established according to relevant international norms. Among these, we must note: Government Emergency Ordinance no. 34/2000, respectively Law no. 38/2001; G.D. no. 917/2001 for approving the methodological norms of these regulations application (including the annexes to methodological norms) etc. For implementing the specifications of these regulations, The National Authority of Ecological Products (ANPE) is operating as specialty department within the Ministry of Agriculture, Food, Forests and Environment, which assures the respect of all legal specific provisions and the control on ecological production methods of agro-food products.

Technologies of field plants are elaborated according to these regulations, being economically efficient, non polluting and preventing environment deterioration and also maintaining the agriculture basic resources [2]. It is recommended to establish the crops on plots converted to ecological agriculture, after the most appropriate plants previously cultivated, some crops which also improve soil fertility (such as the leguminous plants and green fertilizers), utilization of sole fertilizers allowed by environmental-friendly agriculture and excluding all the pesticides which pollute production and environment. By cultivating the strongest varieties/hybrids, ensuring appropriate crop rotation, mechanical and physical control methods, protecting the entomofauna, the diseases, pests and weeds can be removed. The technological solutions provided are based on plants biology knowledge, orienting the specialist to apply them depending on climate and soil conditions. The optimal vegetation conditions, the whole complex of phyto-technical measures are emphasized for enhancing the photosynthetic yield of producing biomass and capitalizing the genetic potential of varieties and hybrids cultivated [3].

Plants included in this guide ensure a great part of products necessary to human food and animals foddering, also representing an important source of raw material for different industries of goods manufacturing.

MATERIAL AND METHOD

Plants cultivated, as well as uncultivated but useful plants have to be protected by special technological measures because their rather reduced self-protection capacity and tendency of intensifying the frequency of certain abiotic factors (freezing, hot weather, draught, water excess, physical, chemical and biological degradation of soils, technological errors, etc) and biotic unfavorable factors (weeds, diseases and pests).

Activities aiming to protect the plants can be grouped, depending on their essential effect in two categories:

- *Preventive measures* comprising the agricultural activities such as: organization of crop rotation, alternating the soil working depth, establishing agro-forestry belts, organic fertilization, optimization of activities related to seeds and sowing, performing plants control works depending on weeds, diseases and pests presence.
- *Curative measures*, which are activities specific to fight against noxious biotic factors and applied in order to remove weeds and pests (especially harmful insects) from crops and cure them by eliminating or removing the diseases after establishing the crops and pests appearing.

RESULTS AND DISCUSSIONS

Up to this moment, agricultural science and practice in terms of plants protection comprise 5 curative methods:

1. Physical and mechanical methods of fighting against weeds, diseases and pests

Physical and mechanical methods of fighting against weeds: they are based on the utilization of physical (temperature, light, human force etc.) and mechanical (animals energy and mechanical energy) factors and which can be:

- Physical and mechanical methods of manual control of weeds by: weeding, grabbing hoe work, hoeing;
- Physical and mechanical methods of control of weeds by : mechanical weeding and mechanical hoeing;
- Physical and mechanical methods of thermal control of weeds by means of installations with liquid propane placed on tractor or portable installations. Burning temperature is of 50–70°C. Soil heats up only a few centimeters in depth. This method is used in leguminous sector, as well as in big culture for fighting against weeds from hoeing crops, before and after cultivated plants spring.
- Physical and mechanical methods of hydric controlling the weeds by flooding the cultivated lands, methods by which many of weeds already sprung or in course of springing, can be destroyed. Method gives good results only in case of crops resistant to bogging and if weeds are of little size, being able to be covered completely by water for several days.

Physical and mechanical methods of fighting against pests such as:

- Thermotherapy used especially to fight against insects by: burning the vegetal wastes after plants harvesting, collecting pests, storing the cereal seeds, collecting pests (snails and beetles) and eggs and/or caterpillars nests and scalding them; storing the seeds of cereals, leguminous for grains and technical plants attacked by moths and

corn weevil in cold spaces and their freezing; radiotherapy, which is used for male sterilizing (removal of sexual glands) by means of X radiations.

- Inundation, as an efficient method in fighting against some pests living under the soil (rats, mice, moles, mole crickets, etc), achieved by water flooding of galleries where they live.
- Sound methods, used for protecting cereals, sunflower, grain leguminous plants, vineyards and orchards, etc, against birds and rodent animals, by installing air-conditioning or carbid apparatus which produce powerful noises (cracks, whistles, strident noises etc.). At the same time, rodent animals from storehouses can be efficiently controlled by ultrasounds apparatus.
- Attractive methods, by achieving of luminous traps and belt traps from orchards, as well as the mechanical traps aimed to catch mice and rats.

Physical and mechanical methods for diseases control:

- Thermosterilization, performed by three thermal sterilization procedures: burning of vegetal wastes after plants harvesting, daily collecting the infested plants and plant parts (bark, leaves, branches, fruits, flowers) and scalding or burning them, hot steaming of seeds and soil mixture used in hotbeds, greenhouses and solariums;
- Solarization, which is a method that gathers the antibiotic effect of caloric and luminous radiations of the sun, aimed to disinfection of seeds and fruits externally damaged and which consists in sunbaths and their periodical scattering by shovel.

2. Biotechnical methods, combining biological procedures with technological ones and are specific to each category of pests.

Biotechnical methods of fighting against the weeds, such as mulching, preparing the field in darkness conditions, because weed seeds taken from soil germinate only in day natural light or artificial light.

Biotechnical methods of fighting against pests, the specialists recommending the utilization of the following methods:

- Installing of biological traps on soil, in soil, in storehouses, etc. , and after collecting pests, the traps are gathered and scalded or burnt;
- Installing of pheromone traps, which are chemical substances secreted and spread to external environment by certain animals, such as insects, being perceived only by individuals of the same species. In case of pheromone traps, chemical pheromones industrially produced mixed with ingestion insecticide, are used.

Biotechnical methods of fighting against diseases, the most used procedure being multiplying the plants without viruses and other pathogene substances by meristem cultures (tissues). It is largely used in horticulture for flowers (carnations) and trees and fruit trees growing.

3. Biological methods

Biological methods of fighting against pests, consisting in utilization of living organisms (including viruses) and products against other plants damaging animals . In other words, the biological control is a “living against living” method type, which does not destroy the whole pests population and is difficult to be controlled by farmers..

Biological methods of fighting against weeds, identifying 3 distinct methods:

- Allelopathic treatment as a very great expectation- method based on pain that some plants provoke one another by means of chemical substances named cholines, secreted by roots and aerial parts of plants. Repelling the own species within crops rotation or soil fatigue are explained by this phenomenon.
- Entomophagous control, which is also a new method and in course of being cleared up, several species of insects being identified up to present for selectively destroying some varieties of horse thistle, devil’s milk, cactus etc.
- Fungic control. Experts are hoping to fight against horse thistle, bindweed and other endemic weeds by means of funguses. In Romania, the horse thistle control studies by

means of *Puccinia punctiformis*, the most destroying among the 11 fungus species, are the most advanced.

Biological methods of fighting against pests, being the richest domain in practical procedures, namely:

- Plants against insects, based on certain plants feature of secreting in soil or/and air substances with repulsive effect for pests. Among such plants types, the most known in Romania are: marigolds (*Tagetes patula*, *T. signata*, *T. Minuta*), pot marigolds (*Calendula officinalis*) and garlic (*Allium sativum*).
- Control by means of natural predators, in this category being included the methods of attracting animals feeding with insects and other living damaging animals. Creation of good shelter and food conditions for useful fauna (frogs, green lizzards, snakes, insectivorous and predatory birds –titmouse, wood-pecker, cuckoo, starling,owl, little owl etc, and insectivorous mammalian animals–bat, moe, common marten, hedgehog,etc.), including their artificial breeding have benefic effects for agricultural producers.
- Microbiological control, consisting in utilization of substances made of living organisms (viruses, bacteria,fungus) which are the parasites of pests and kill them

Biological methods of fighting against diseases, which refer to seed treatment with bacteriological substances, for removing the pathogens from cereal and technical plant seeds.

4. Genetic methods, which are the most important methods for plants protection, as they capitalize the natural (genetic) features of plants, have no negative impact on environment and are relatively cheap. Although the denomination is the same for all damaging creatures,as “Plants melioration”, the genetic methods are very different, being appropraite to each category and species of pests and cultivated plants. Plants melioration results in new plant varietes of high quality, including increased resistance to weeds or/and attack of other biotic damaging factors [7]. Therefore, ecologist farmers are advised to cultivate varieties (populations, species and hybrids) with productive and high quality potential and with bigger resistance to biotic unfavourable factors attack.

5. Biochemical methods of plants protection are achieved by vegetal and mineral phyto-pharmaceutical substances.

Control of weeds: taking into account the ecological farmers request, the agricultural research is in course of defining and testing the bio-herbicides, existing great expectations that they appear on the market the following years.

Control of pests substances used for plants protection against damaging insects can be grouped, depending on raw material used, in two categories: vegetal insecticides and mineral insecticides:

“Vegetal or botanic insecticides”:

- ♦ STINGING NETTLE (*Urtica dioica*): nettle macerate is used against apple aphid (*Eriosoma lanigerum*) every time is needed, not being diluted, and the mixture of nettle macerate and horse tail decoction, against aphids and mites (red spider), before forming leaves and flowers and only 50 times diluted.
- ♦ FERN (*Dryopteris filix –mas*): non diluted leaves macerate is used during winter spraying against apple aphid (*Eriosoma lanigerum*) and ladybird (*Coccinella septempunctata*), and when is needed against snails without shells. At the same time, theses compositions, diluted with water by 10 times are used in late spring treatments against aphids. Undiluted decoction is recommended against apple aphid and every time is needed.
- ♦ WORMWOOD (*Artemisia absinthium*): wormwood products are used nondiluted, every time is necessary, according to pests growing evolution. These substances have a specific action against, for example: macerate against ants, caterpillars and aphids, infusion against mites of blackberry and raspberry and Colorado beetle larvae and

decoction against cabbage maggot (*Chortophila brassicae*) and codlin moth (*Carpocapsa –Cydia pomonella*).

- ◆ TANSY (*Tanacetum vulgare*): tansy infusion is used non diluted when is necessary against ants, aphids., mites and other insects. Decoction is also used non diluted, but only during the flying period of cabbage maggot and codlin moth.
- ◆ WILD GARLIC (*Allium ursinum*): infusion of wild garlic is used non diluted by spraying several times the plants every 3 days, against mites and aphids. The macerate is also used non diluted against carrot fly (*Psila rosae*), but only in its flying period.
- ◆ CHRYSANTHEMUM (*Pyrethrum cinerariaefolium*, *Chrysanthemum cinerariaefolium*): extract of chrysanthemum flowers is used as solution of 0.1% concentration against aphids, Colorado beetle, white fly. It is used non diluted against aphids, Colorado beetle, crickets. Phyrethrum infusion is used non diluted. In order to broaden its action range, it may be mixed with wettable sulphurus, vegetal lecithine and rotenone. It is not recommended to mix phyrethrum with alkaline products (sulfo-calcic solution, potassium soap, basalt flour etc.). At the same time, it should be avoided to perform treatments during maximum insolation periods.
- ◆ BITTER WOOD (*Quassia amara*): bitter wood decoction is used non diluted from spring to autumn for fighting against many pests, including flies in houses and stables (Bălășcuță, 1999) [6]. The improved product is also used against fleas and lice: San Jose louse (*Quadraspidotus perniciosus*), grey louse (*Hyalopterus pruni*) etc. And wooly louse (*Eriosoma lanigerum*). In case of reduced efficiency, treatment can be repeated, but not earlier than 3 days.
- ◆ ROTENONE (*Derris elliptica*; *Lonchocarpus* spp., *Thephrosia* spp.): rotenones are used as solution of 0.01% concentration, or as powder, by spraying, respectively powdeing the plants attacked, during evenings or early in the morning (Bălășcuță, 1999; Aubert, 1981). Many times, rotenones are used mixed with pyrethum [6]. Treatment may be repeated after 3 days in case of low efficiency.
- ◆ NEEM (*Azadirachta indica*): Neem pesticides destroy eggs, larvae and adults of over 75 species of insects and remove many other pests of bean, corn,barley,rice, sugar beet, herbs, tomatoes, tobacco, cotton, etc. At the same time, Neem oil is very efficient in disinfection and cicatrization of animals wounds. In vegetal production, Neem treatments are applied on soil or/and plants, by spraying with different concentration emulsions. Within the category of vegetal insecticides may be also found the materials (watery or ethanolic extracts) from vegetal parts (roots and leaves) of different species of marigolds (*Tagetes patula*, *T. minuta*, *T. erecta*) that cultivators use as nematocides, contact insecticides and repellent products against a lot of species of nematodes and insects. Practically, the marigold roots substance is the most efficient against nematodes, which are a group of pests difficult to control by other means.

Among the **repellent mineral materials** we must mention:

- ◆ ALUM(Double aluminium and potassium sulfate): the compound is used as solution of 0.4 % concentration, with good efficiency against lice and caterpillars. At the same time, by spraying the soil with this compound, we can prevent the attack of snails without shell. Spraying compound is prepared by dissolving 40 g of alum in little hot water, and then is completed by cold water up to 10 l.
- ◆ BASALT ROCK DUST: the main methods of applying is dusting, and when state-of-the art spraying pumps are available, the basalt dust is applied as solution (fine slurry) of 1 –3% concentration(100 –300 g basalt rock dust for 10 l water). The compound has a very good capacity for removing all pests attacking the external part of aerial organs, including sucking pests (Bălășcuță, 1999). Preventing and fighting against pests by basalt dust is explained by:

-changing pH-from surface of aerial vegetative parts, from slightly acid (prefered by most pests), to slightly alkaline pH;

-direct mechanical action of quartz crystals on insects body, eyes and tracheas; dolomite dust and wood ashes, when are finely sieved may have similar but not the same features as basalt dust.

Mineral insecticide products:

- ♦ POTASSIUM SOAP/SOFT SOAP: is successfully used against mites (red spider), caterpillars and shelled, wooly and flour lice (grey leaf lice). Treatment is applied as such or being mixed with other compounds (fermented macerate of horse tail) by repeating spraying of plants with different types of solutions:
 - for fighting against lice: 150 –300 g potassium soap for 10 l water;
 - for fighting against caterpillars, red spider and Colorado beetle larvae: 100 –300 g potassium soap + 0.5 l alimentary alcohol (methylated) + one chalk spoon and one salt spoon for 10 l water.
- ♦ ALUMINIUM SULFATE: it is diluted in 9 l of water and then is used by spraying it against white fly. Spraying solution is homogenized by stirring several times with a besom.
- ♦ PARAFFIN OILS: are used as 1.5 % concentration for late autumn and early spring spraying against San Jose louse and mites hibernated eggs.

Biochemical methods of fighting against diseases

Vegetal fungicides

- ♦ HORSETAIL (*Equisetum arvense*): decoction is used against cryptogamic diseases in soil and plants (mildew, blast, rust, moniliosis, leaves spotting and blistering, etc). For applying this treatment the decoction is diluted with water (one part of decoction for 5 parts of water). Treatments during plants growing period are applied before disease appearing (1 treatment) and several times in spring and summer. Decoction diluted (50 g/l water) is also recommended for treating seeds (especially leguminous seeds) against plants (samplings) falling (melting). Fermented macerate of horsetail, combined with potassium soap (0.3%), is used against pests and for revigorating the plants [4, 6];
- ♦ NETTLE (*Urtica dioica*): is used as fermented extract for enhancing young plants growing (especially leguminous plants) and preventively, against soil cryptogamic diseases (potato mildew) and plants diseases (fruit trees chlorosis). Treatments are made before potato planting, respectively before vegetal or flower burgeoning, and those aimed to stimulate plants growing-before or/and after planting the seedlings. In both cases, a solution of fermented macerate 20 times diluted with water, is used.
- ♦ CHAMOMILE (*Matricaria chamomilla*): infusion or decoction of flowers are used non diluted for strengthening the plants and treating the seeds.
- ♦ ONION (*Allium cepa*): Green leaves or dry skin fermented macerate are used 10 times diluted for strengthening the plants and, in case of potato and strawberry cryptogamic disease;
- ♦ GARLIC (*Allium sativum*): is used as infusion or non diluted chopped bulbs macerated, against cryptogamic diseases (especially bacterial) and young plants falling (melting). Treatment with basic garlic compounds is aimed to seeds and in case of attack directly to plants.

Mineral compounds

- ♦ POTASSIUM PERMANGANATE: is used as 0.01 –0.03% (1 –3 g for 10 l water) concentration for treating seeds, bulbs and roots of seedlings. At the same time, in concentration of 0.15% it efficiently controls the vineyard and roses mildew (Bălășcuță, 1999);
- ♦ CALCIUM POLISULFYDE (Sulph and calcium juice): is used as 2.0% concentration against apple and vineyard mildew;
- ♦ BLUE STONE (Copper tribasic sulfate): is used as blue stone juice, in different concentration for preventing and controlling plum, cherry and sour cherry leaves spotting (1.125%), apricot and peach leaves piercing (1.125%), vineyard mildew

(0.5%), quince, apple and pear tree, bacterial fire (0.5 –0.75%) and stone fruit monoliosis (0.5%, pre-flowering). Treatment with blue stone juice may be repeated after 3 –4 weeks;

- ◆ COPPER HYDROXIDE : is used in different concentrations:
 - 0.4 % for preventing and stopping mildew attack of potatoes (3÷4 kg/ha), tomatoes (1.5 kg/ha), cucumbers (3 kg/ha), vineyard (3÷4 kg/ha) and hop (3÷4 kg/ha);
 - 0.2 –0.3% against bean burnings and quince, apple and pear bacterial fire (pre-flowering treatment);
 - 0.04% against quince, apple and pear bacterial fire (post-flowering treatment);Treatment with this kind of products may be repeated every time is needed;
- ◆ COPPER OXICLORURE: is used in different concentrations :
 - -0.15÷0.20 % against plum leaves spotting and monoliosis and apple scab (pre-flowering);
 - 0.2 ÷0.4 % for preventing and stopping pine needles discoloring and tobacco mildew attack;
 - 0.4÷0.6 % for preventing and stopping potato mildew (4 –5 kg/ha), tomato mildew (4÷5 kg/ha), cucurbitaceae mildew(4÷5 kg/ha) and vineyard mildew (5÷6 kg/ha).

This product treatment may be repeated after 3 weeks;

Number of treatments with copper-based products must be limited so that should not be surpassed 6 kg Cu/ha and per year, because copper, as a heavy metal is polluting the environment.

CONCLUSIONS

In latest years, it has been noticed a re-orientation towards the ecological products field, mostly due to cancer-provoking chemical substances which affect the human body. In this context, vegetal extracts containing substances which can induce in treated plant the stimulation of protection mechanism and determine the crops resistance increasing to pathogen microorganisms and pests causing great economic losses and risking to spread infections; represents an efficient solution to pest control.

Extracts of plants may be also used as insecticide for preventing insect attack of certain crops, following the recent studies, being found out that they may represent a future solution to ecological agriculture support.

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