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OPTIONS OF CONTROL OF PESTS AFFECTING ROOTS AND BULBS

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Abstract

Knowing that we have respected the 3-4 years crop rotation, in the previous years we did not realise the damages caused by pests of the potato. In some cases, even knowing that the land was pest-free, we found that certain species are present, such as globodera wireworms, ditylenchus, meloidogyne and pratylenchu. Root mites /rhizoglyphus echnopus/ can cause serious damage. Their damage is twofold, the first one being direct and the second one indirect. Indirect damage consists of the fact that the pests open the doors to secondary infections which reach the lesions by clinging to the insects. Afterwards the fungi and bacteria can cause to these lesions bigger damage than the primary pests. Looking for the reasons of such infestation and presence of pests in the soil, asking for other experts' opinions on soil analysis, it was earnestly started to think about controlling these pests. Being aware of the existence of biological pest control, it was contacted the company BIÓVÉD 2005 kft which provided the hyperparasitic fungus Arthrobotris oligospora. The research performed in parallel on crops such as tomatoes, cucumbers, cabbage, cauliflower, peppers, carrots, parsley, in the vegetable fields in the South-East of Hungary and in the Covasna County depression. The purpose of the paper was to monitor the activity of the A. Oligospora fungus in the soil at various temperatures, at various stages of the life cycle of the potato crop and to apply the optimal dosage of fungus on a preset surface. The conclusion was that the treatment split between autumn and spring gives the best results because the rains falling in August – September and March respectively help the hyperparasitic fungus to penetrate the soil at the proper depths for it to take effect.

Key words**:** *tuber nematode, germination, humidity*

INTRODUCTION

Controlling most pests that attack the potato is very difficult. The most dangerous are the species of wireworms such as globodera, ditylenchus, meloidogyne and pratylenchus.[4] Root mites /rhizoglyphus echnopus/ can cause serious damage.[5].
So far the basis of control was adequate crop rotation which is not always effective because among the pests there are multiple hosts organisms.
Chemicals don't offer sufficient protection and are a rather expensive solution.
Pest control is hindered by the fact that some species remain viable for several years even without the host plant and some of them can migrate over a large area.
Researchers have been working to fight them using hyperparasitic fungi. [8] Most research are focused on species of arthrobotris.

MATERIALS AND METHODS

Research was conducted with the sample product of company Biovéd 2005 Kft-Hungary, labelled AO. [7]
The experiment surfaces were highly infected with the species globodera rostochiensis, ditylenchus destructor, meloidogyne and pratylenchus. [4] Root mites were also present on all experiment surfaces.

Photo 1. Infested potatoes
Source: Own source.

A three year crop rotation was maintained on the host surface, soil and plant analysis proving the existence of the aforementioned pests. The mentioned surface is located in Romania, Covasna County in Transylvania. [9] The following image is not unique in Transylvania. The damage doesn't stop with the harvest, but continues in storage. In a lot of cases, the presence of secondary pests leads to moist putrefaction.

The following damages can be seen at harvest time.

A large quantity of crop remained on the ground, leading to a guaranteed spread of infection.

The only solution to eliminate the pests would be leaving the land fallow for several years. Most farmers don't consider this an option, which is why major losses are recorded every year. Using nemathorin is extremely expensive and doesn't represent the perfect solution.

My experiments concerned these surfaces which were treated with AO. The outcome is rather ambiguous because we were not familiar with the application process.

AO had no effect on root mites, the damages being identical after each treatment.

But the aforementioned wireworms were completely eliminated after certain treatments with AO. It was subsequently identified the reason of the varying success. Also, it was found the reason of failure to be the application method. If AO and pesticides are properly applied, we can successfully control wireworms such as Meloidogine incognita, regular wireworms attacking the potato, the potato rot nematode Ditylenchus destructor and migratory species. [1]

RESULTS AND DISCUSSIONS

The outcome of timely and proper AO treatment could be observed on the field, and the laboratory analysis showed a lack of cyst and warms. The crop measured at harvest time included a surplus of 16 tons, in favour of the treated crop. On cultivated land where the crude crop is around 32-36 tons, a 16 tons surplus is a significant result.

We hope that losses resulting from the storage of potatoes on treated surfaces will also be significantly lower than for untreated ones. The measurements will be recorded after the potatoes are removed.

On similarly infected land with the surface presented, we have implemented a cultivation experiment on 12 ha, where the treated surface will have a preset area. In view of this year's results, the land owner is willing to leave only ½ ha as control surface.

Practically, the arthrobotris application technology is finalized, the possibility of usage on a large scale depending on the product authorization.

Chemicals authorized nowadays are very expensive and not efficient enough. They are a burden on the environment and their application requires major precautions.

Arthrobotris is a fungus that can be found in nature and has no impact on the environment.

Arthrobotris oligospora [10] is first of all a fungus specialised in capturing nematodes. The formulation made from it is suitable to control the infection with certain species of nematodes. The fungus itself is saprohytic in nature and lives in the soil and in the presence of a convenient living organism it captures it with a loop formed specifically for this purpose. In this case it functions as a predator as long as it can find prey. We might call it a lion of the soil.[6]

It tolerates frost rather well, germination starts at temperatures around 10°C, the optimum temperature for reproduction being 22-25°C. Its activity slows around 30°C, and it completely ceases at 35°C.

After application it tolerates very well the light of day, being spread on dry soil it stays alive a long time and it starts to activate only when the soil humidity reaches the proper level. Soil drying quickly after germination significantly decreases its effectiveness.

Species of nematodes against which it can be used successfully:

(i)Potato/bulb nematode /species Ditylenchus./

(ii)Root-knot nematode /species Meloidogyne./[3]

(iii)Wireworms/beet phylloxera /heterodera sch./

(iv)Potato nematode /heterodera ro./

(v) Radicle nematodes /pratylenchus/.[4]

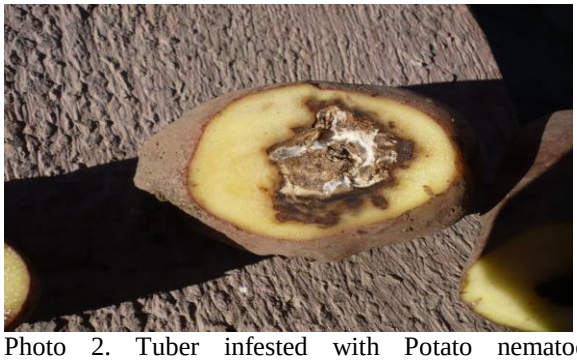

Photo 2. Tuber infested with Potato nematode (Ditylencus)
Source: Own source.

Photo 3.Tuber attacked by the wireworm (Agriotes)
Source: Own source.

With respect to the listed species, it was obtained experience on an industrial scale. The usage technology was developed on crops of potatoes, carrots, green vegetables, celery, peppers, tomatoes, beets, onion, cucumbers, cabbage.

The formulation might be effective as well against other species of nematodes, but we didn't have an opportunity to assess this on an industrial scale or on small plots.

During the experiments, it was noticed that Arthrobotris o. can also be used successfully against various types of insects, such as: (i)greenhouse whitefly, (ii)against pepper thrips and (iii)against bulb mites.[4].

Suggestion of utilisation:

On highly infected surfaces, against known pests, split treatment had the best outcome every time.

-It is recommended to apply the first treatment starting with the end of August, the end of October at the latest. For an effective protection /on a highly infected surface, for example where the previous damage was of 30% for potatoes or 40-50% for carrots/ the recommended dose is 1-1,5 kg/ha.

-In the spring, when the soil is prepared, 8-10 days before seeding or sowing, we apply and mix in the soil Arthrobotris in quantity of 1 kg/ha.

-On highly contaminated soil, after seeding but before using herbicides, we apply again 1 kg/ha. We introduce this treatment in the soil by irrigation. For less infected soil, the third treatment can be omitted.

The formulation Arthrobotris is sensitive to certain herbicides, slows down germination, its reproduction decreases, making it less effective. To avoid any adverse effects of chemicals, the sprayer must be cleaned very well to eliminate any traces of solution and the formulation must be applied on its own, mixing it with the soil by making use of agricultural machinery. After seeding or sowing, the Arthrobotris spread will be irrigated in the soil with a precipitation of 8-10 mm. Herbicides and anti-fungi solutions should be preferably used afterwards.

The effectiveness of the formulation depends greatly on the soil humidity after the application. Neither the fungus nor the nematodes are active on dry soil. We can expect the best results if the treatment is applied on good weather, from the end of August until the middle of September, as in this period the soil usually receives enough precipitation for the fungus to activate. The soil temperature is also high enough to allow the fungus to reproduce quickly.

The fungus doesn't die on frosted soil, but it doesn't activate either. The germination starts in the spring at a temperature over 10°C. The application must take place before this, on soil with a lower temperature, for proper mixing. The fungus doesn't travel far in the soil, therefore it is very important to spread it as evenly as possible.[8]

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A substantial crop surplus can be obtained by feeding nutrients according to the plant requirements. It is recommended to dose N in several stages, to avoid having the excess N lead to a decrease in crop quality.[9]

CONCLUSIONS

Following the extended drought in the spring, the activity of Arthrobotris could stop definitively, land irrigation being required to prevent this.

It is not yet clear for what period the fungus remains active, what is certain is that it works very well when using a consistent technology.

The crop on the treated land is significantly bigger than on land that wasn't treated, since the plant doesn't „feed" the worms. It's worth noting that the plants' need of nutrients also changes. We recommend a leaf analysis during the proper stages of the phenophase, based on which the nutrients should be administered to the plant.

The crop's storage period increases considerably, especially for plants with edible roots. Very few pests reach the storage room, hence very little damage occurs in storage. It doesn't create the proper conditions for fungi and bacteria.

Observations were also made on crops of grapes, raspberry, apple, peach, but additional research is needed. It was found that it is highly applicable on field as well as on horticultural plants and on flower gardens.

The formulation Arthrobotris o. can be used with very good results on numerous industrial plants. The technology isn't very different, but change is often justified depending on the type of soil, infection level or soil sensitivity.

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