

## **NEW ENVIRONMENTALLY SAFE GAME DETERRING TECHNOLOGIES IN SLOVENIA AND HUNGARY**

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### **ABSTRACT**

Losses caused by game have significantly increased during the past decade in Slovenia and Hungary. A new technology has been developed by the research fellows of the Institute for plant Protection at Pannon University of agriculture in Keszthely. The new products named Vadoc and Vadicell are more effective and more persistent than the materials applied heretofore. They have been tested in Hungary since 1988 and in Slovenia since 1993. Weather has no effect on the materials. The developed products had decreased the game damages by 35-50 percent both in forests and on agricultural lands. Positive results were obtained in Slovenia in vegetables, wheat, potatoes, fodder beet, sugar beet, maize and vine in small fields of farms, but worse results were obtained in wheat, maize and sugar beet in large fields. Best results can be obtained in Hungary with sunflower, vine, potatoes, wheat, soya bean, maize and forest cultures. The efficacy of both substances proved to be acceptable for 30 days, then can be changed with the new scents. It is suggested use of deterrents in combination with electric fence.

### **IZVLEČEK**

#### **PROUČEVANJE OKOLJU PRIJAZNEGA NAČINA VARSTVA RASTLIN PRED DIVJADJO, V SLOVENIJI IN NA MADŽARSKEM**

Škoda, ki jo povzroča divjad na kmetijskih in gozdnih rastlinah v Sloveniji in na Madžarskem, v zadnjih desetih letih naglo narašča. Strokovnjaki z Inštituta za varstvo rastlin Agrarne univerze iz Keszthely-ja so razvili novo okolju prijazno tehniko varstva pred divjadjo s pripravki, kot sta vadóc in vadicell, ki sta obstojnejša in učinkovitejša v primerjavi z doslej znanimi sredstvi in se preizkušata na Madžarskem od leta 1988, od leta 1993 pa tudi v Sloveniji. Delovanje sredstev ni odvisno od vremena. Odvrčala so zmanjšala škodo od divjadi za 35 do 50%. V Sloveniji so bili doseženi zelo dobri rezultati pri varstvu vrtnin, pšenice, krompirja, krmne pese, sladkorne pese in koruze pred divjadjo, zlasti na njivah,

prav tako pa tudi v vinogradih ter manj zadovoljivi v dosedanjih poskusih na večjih njivskih kompleksih, posejanih s pšenico, koruzo in sladkorno peso. Na Madžarskem pa so dosegli dobre rezultate pri varstvu sončnic, vinske trte, krompirja, ozimne pšenice, soje, koruze, pa tudi v gozdnih drevesnicah. Sredstvo deluje odvrčalno le določen čas (do 30 dni), nakar ga je treba zamenjati z novimi vonjavami. Priporočajo pa se tudi odvrčala v kombinaciji z mehaničnimi načini varstva, npr. z električnim pastirjem.

## 1 INTRODUCTION

The damages caused by various game species (deer, roe, wildhog, mufflon, fallow) overpropagated for hunting in Hungary have significantly been increasing in agriculture as well as in forestry (Tables 1, 2). It can out of the data be stated that the annual damages come to about 144 million Forints in agriculture and even more in forestries.

Table 1: The stock of big game in Hungary from 1969 to 1989 and the natural game keeping capacity in 1989 (Fatalin 1990)

| Species                              | Year                 |       |       | Natural game keeping capacity |
|--------------------------------------|----------------------|-------|-------|-------------------------------|
|                                      | 1969                 | 1979  | 1989  |                               |
|                                      | thousand individuals |       |       |                               |
| Deer ( <i>Cervus elaphus</i> L.)     | 29.6                 | 39.4  | 51.3  | 22.0                          |
| Fallow ( <i>Dama dama</i> L.)        | 2.3                  | 5.7   | 23.8  | 3.2                           |
| Roe ( <i>Capreolus capreolus</i> L.) | 136.0                | 195.0 | 229.0 | 239.0                         |
| Mufflon ( <i>Ovid ammon mus.</i> P.) | 2.6                  | 5.6   | 9.6   | 4.8                           |
| Wildhog ( <i>Sus scrofa</i> L.)      | 13.7                 | 20.3  | 37.0  | 16.5                          |

Table 2: Nation-wide game damages in agriculture and forestry from 1980 to 1990 (MFt) (Walterné 1990; Pintér 1991)

| Game damagings | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989  | 1990 |
|----------------|------|------|------|------|------|------|------|------|------|-------|------|
| Agriculture    | 75   | 87   | 84   | 87   | 109  | 121  | 124  | 121  | 144  | 233.5 | 315  |
| Forestry       | 45   | 39   | 48   | 35   | 63   | 67   | 58   | 76   | 154  | n.d.  | 71   |
| Total          | 120  | 126  | 132  | 122  | 172  | 188  | 182  | 197  | 298  | n.d.  | 387  |

The damages are resulted from and related to various manners of life of the game (Kölüs, 1986). In agriculture and forestry, numerous forms of damaging can be found such as mastication, trampling, peeling, breaking, rubbing, treading, grubbing, plant drawing, bud chewing, acorn scraping etc. (Szécsi 1892, Smotzer 1985, Nagy 1990, Walterné 1990, 1991).

Nowadays, a number of materials, substances, methods or mechanical instruments are available for game deterring purposes. Various forms of mechanical, biological and chemical control are known.

Among the technical and mechanical equipments of game control, electric fences or frighten-cords and carbide cannons have been used recently. Imitation of some alarm signals of the game is also often in use. Some of these equipments did, however, not fulfill the hopes (frighten-cords), and some other of them proved to be too expensive (fences).

The biological game control is assigned to prevent or at least reduce game damages by restoring biological equilibrium as well as recreating a correct proportion between the capacity of keeping and the quality of game within a certain area.

Among the methods, the chemical control is mostly known at present. Products of best flavour effects are Cervacol (polyvinylacetate), Dendrocol 17 SK (natural resin and coppery resin soap) and Nevibes (chinine-hydrochloride). Among the products of scent effect Fekama SWM (60% oil of animal origin) and Silvacol K (Chlorcresonite) are known, while Dendrocol 17 SK (natural resin + coppery resin soap) is of flavour as well as scent effect.

The flavoured substances become spread or sprayed upon the surfaces of the plants to be protected. The products of scent effect will by means of skirt treating be sprayed on the plants or blotted up by textile pieces.

By all means, the game deterrent substances have to be long-lasting and weatherproof. The methods applied presently such as spraying and absorbing do not allow the substances to comply with the requirements. Even in optimal cases, the areas can be protected

from game damages for 5-7 days only. After a week, the scent effect of substances will be over, the treating has, therefore, to be repeated every week. The losses will considerably increase by the material demands of the spraying. A good deal of substances will be absorbed by the textile pieces unnecessarily with being the drop level increased.

Setting out flavoured substances requires a lot of manpower and thus causes difficulties.

To eliminate the disadvantages mentioned above, our researches were done with the aim of elaborating a technology by which the permanence of the game deterring substances of scent effect could be prolonged. The start-point of our tests was to look for an ingredient by which the losses might be eliminated and an intensive effectivity is guaranteed.

## **2 MATERIALS AND METHODS**

The experiments assisted by BEFAG and OMFb were carried out in various farmers' cooperatives in Hungary as well as in Austria and Slovenia. The tests were accomplished in winter wheat, oats, corn, potato, sugar beet, sunflower, strawberries, vine, cabbage, melon, green beans, lettuce and seedling gardens (oak, pin).

A technology elaborated by the colleagues of the Institute for Plant Protection of PATE (Nádasy et al. 1990, 1991) was assigned as test method. It essentially consists of a process in which various game deterring substances become carried upon a Mavicell (cellulose pearl) or perlite stuff to prolong the scent effect. A 40-50 days scent permanence of the various deterring substances has been achieved. Another advantage of the new technology is its nature-friendliness (no direct contact with environment). It also is inexpensive and independent of weather conditions (moisture or frost).

### **The process elaborated by us**

The game deterrent substances were blotted up with the carrying stuff and put in nylon bags. Each bag contained 200 ml (50 g) stuff. The bags were hermetically sealed. The prepared product

became placed in the areas to be protected. The bags can be hung up on tight cords, pales, fences, trees or shrubs. Placing and distancing bags from each other (generally about 10 m) as well as height and number of them depend on the species and density of the game population existing in the area. Around the trails, the number of bags is to be increased. Three to five holes are to be made on the walls of each bag to increase the scent effect.

Various deterring substances were applied in the tests. As base, Dendrocol 17 SK with flavour as well as scent effects has been used. We added to it some other substances of game deterrent quality used by us which are standing under patent process just at present, furthermore, a deterrent substance obtained from the Austrian firm Avenarius authorized for Austrian experiments only (Silvacol T). The Austrian products stood at our disposal on the basis of a valid contract over mutual and common experimenting between the PATE and the firm Avenarius. The game deterrent products were nominated as follows:

- a) Vadicell
- b) Vadóc

The cause of applying different substances was that the single materials had to be used alternately. Although the substances added to Mavicell are keeping scent effect for a long time (60-90 days), some games such as roes, deers or wildhogs get accustomed to the strange scent within a short time (0-14 days) and will cause damages again.

The examinations were done from 1989 to 1994.

### **3 RESULTS AND DISCUSSION**

#### **Spring prevention of damaging by roes and deers in young oak forest**

The experiment was carried out in a young oak forest (5 ha) of the forestry of Keszthely by means of area control technology. The deterrent Vadóc has been used. The control area was only at about 1 km distance from the area to be saved. The areas were damaged

by the roe and deer. The results of the experiment (Table 3) show that the Vadóc product is very successful in reducing damages caused by the game for 30 days. After 3 months, with the efficiency decreasing, the substance has to be substituted.

Table 3: The results of the experiment carried out in forestry Várvölgy

| Treatments | Degree of damaging           |          |          |
|------------|------------------------------|----------|----------|
|            | Average of 4 repetitions (%) |          |          |
|            | 7th day                      | 30th day | 90th day |
| Vadóc      | 1.25                         | 6.50     | 14.25    |
| Control    | 6.25                         | 13.00    | 16.25    |
| SD 5%      | 4.33                         | 5.79     | 8.53     |

### Spring prevention of damaging by deers and wildhogs in winter wheat

Since 1989, regular preventive controls have been done against game damagings in winter wheat. The examinations were done in various territories of the country (Bakonyszentlászló, Ugod, Barcs, Bölcske). Every test has given good results, this is the reason of having done only a single examination in Keszthely (Újmajor) in 1991. The tests were set up with area control technology on the 23th April 1991. Vadicell and Vadóc deterrent products were used. The area of the cooperative society "Új Élet" (Sármellék) near by Újmajor was pointed out as control zone. The treatment had to be repeated once. The data on Table 4 show that the preventive measures were, successful just like in previous years. Both products proved to be effective.

Table 4: The results of the experiment carried out in Újmajor in springtime

| Treatments | Degree of damaging           |          |          |
|------------|------------------------------|----------|----------|
|            | Average of 4 repetitions (%) |          |          |
|            | 7th day                      | 30th day | 60th day |
| Vadicell   | 2.00                         | 5.25     | 4.25     |
| Vadóc      | 0.75                         | 2.00     | 3.25     |
| Control    | 9.50                         | 14.50    | 17.50    |
| SD 5%      | 2.24                         | 1.83     | 3.47     |

### Spring prevention of damaging by wildhogs in maize

Since 1989, systematical experiments have been done against damagings by wildhogs in maize.

The experiment with area control technology has been started in the maize fields of the State Estate Nagyberék on the 7th May 1991. This moory area consisted of many plots (10-40 ha). Since these plots were set apart by ditches, the single treatments could easily be isolated from each other. The area has above all been damaged by the wildhog. Four treatments were set up such as Dendrocol 17 SK, Silvacol T, Vadicell, Vadóc and the control. On the area 4x100 m, lengths of grubbing were reckoned. The test results are shown by Table 5. According to the data, the products used by us have, with the exception of Dendrocol 17 SK, reduced the damages caused by the game. The products Vadóc and Silvacol T proved to be the most successful. The results obtained after 7 days were much better than those after 30 days, thus it has been proved once again that no longer than 15 days protection could be guaranteed without substitution against the wildhog.

Table 5: The results of the experiment carried out in SE Nagyberék

| Treatments      | Degree of damaging                    |          |
|-----------------|---------------------------------------|----------|
|                 | Average of 4 x 100 m <sup>2</sup> (%) |          |
|                 | 7th day                               | 30th day |
| Vadicell        | 5.25                                  | 16.25    |
| Vadóc           | 2.25                                  | 6.75     |
| Dendrocol 17 SK | 9.50                                  | 25.00    |
| Silvacol T      | 3.00                                  | 7.25     |
| Control         | 20.00                                 | 26.00    |

### Late spring prevention of damaging by the hare in soya bean

In accordance to the valid contract between the PATE and the firm Avenarius, the experiments were carried out in Austria. The tests repeated 4 times were done on two farms (Trautmannsdorf and Gramatneusiedl). Each plot was of 100 m volume. Dendrocol 17 SK, Silvacol T and Vadóc were used. In addition to effectivity

testing, the examinations also were assigned to invest a new technology. The Austrian farmers feel disturbed when being enclosed by fences, therefore alternative technologies have to be applied:

- I. Traditional technology (fenced area) - technological control.
- II. Area encircled by 20-50 cm high pales without cords. Pales were at 10 m distance from each other. The bags with deterring substances were fixed by gum bands on the pales.
- III. The pales of 20-50 cm height were placed chessboardlike on the edges of the control plot and inside, too. The bags with substances were fixed on.

Forty bags were placed in each plot. Estimation has been made one time on the thirtieth day only. Based on the test results (Table 6), it can be stated that:

- 1) Relatively little damages are caused by the hare in Austria.
- 2) Among the products used by us Silvacol T proved to be the most successful and Vadóc and Dendrocol 17 SK gave also good results.
- 3) No unambiguous differences among the effectiveness of the various technologies were found, perhaps because of the little damagings. Therefore, we are going to examine these technologies once again in more damaged areas.

Table 6: The results of the experiment in Austria (Gramatheusiedl)

| Technology | Treatments      | Degree of damaging on the 30th day after treating |
|------------|-----------------|---|
|            |                 | Average of 4 x 100 m <sup>2</sup> (%)             |
| I.         | Silvacol T      | 3.25  |
| II.        | Dendrocol 17 SK | 5.00  |
| III.       | Vadóc           | 5.75  |
|            | Control         | 1.50  |
| I.         | Silvacol T      | 2.50  |
| II.        | Dendrocol 17 SK | 3.25  |
| III.       | Vadóc           | 4.25  |
|            | Control         | 12.00   |
| I.         | Silvacol T      | 4.00  |
| II.        | Dendrocol 17 SK | 5.75  |
| III.       | Vadóc           | 6.00  |
|            | Control         | 15.50   |



- 4) The results would also be influenced by the fact that some other plant cultures favoured by the hare were also present around the soya plots on both farms.

#### Spring prevention of damaging by the rabbit in sunflower

Our main purpose was to prevent damagings by the hare overpopulated in the Hungarian Plain. On the eastern country parts, serious damages are caused by the small game. The experiments have been done in the areas of the Institute for Grain Researches (Szeged) and on hybrid sunflower plots of the State Estate Mezöhegyes. The areas to be protected were of 10-20 ha volume each. As control, commercial sunflower plots were set up. The experiment began on the 23th April 1992. Vadicell and Vadóc products were used. The treatments could not be repeated because the sunflowers grew very fast and the older (higher than 50 cm) plants could not be damaged significantly by the hare any more. The test results are shown by Table 7. According to the data, both Vadóc and Vadicell can be used successfully against hares' damagings. The effectiveness of Vadicell is better than of Vadóc. The efficacy of both substances proved to be acceptable for 3 weeks.

Table 7: The results of experiments carried out in sunflower

| Spot            | Treatments | Degree of damage in average of 100 plants (%) |          |          |
|-----------------|------------|---|----------|----------|
|                 |            | 7th day                                       | 14th day | 30th day |
| PCS Kiszombor   | Vadicell   | 2.00  | 3.00     | 3.00     |
|                 | Vadóc      | 4.00  | 5.00     | 7.00     |
|                 | Control    | 10.00   | 14.00    | 15.00    |
| PCS Gyomaendrőd | Vadicell   | 6.00  | 8.00     | 10.00    |
|                 | Vadóc      | 8.00  | 9.00     | 14.00    |
|                 | Control    | 13.00   | 18.00    | 20.00    |
| PCS Kamut       | Vadicell   | 1.00  | 2.00     | 4.00     |
|                 | Vadóc      | 2.00  | 3.00     | 5.00     |
|                 | Control    | 5.00  | 7.00     | 7.00     |
| AC Mezöhegyes   | Vadicell   | 5.00  | 7.00     | 9.00     |
|                 | Vadóc      | 6.00  | 8.00     | 10.00    |
|                 | Control    | 12.00   | 18.00    | 20.00    |

### Spring and summer prevention of damagings by deers and roes in vineyard

The experiment were done in the areas of Balatonboglár. The test were set up with Vadóc on the 4th May and the treatments with Vadicell were repeated on the 20th May. The results are shown by Table 8. It can be concluded that the Vadóc and Vadicell products reduce the game damagings successfully.

Table 8: The results of the experiments carried out in the vineyards in Balatonboglár

| Spot       | Area (ha) | Degree of damaging in average of 10 x 100 vinestocks (%) |     |      |                   |      |      |         |      |      |
|------------|-----------|--|-----|------|-------------------|------|------|---------|------|------|
|            |           | Vadóc (4. V.)  |     |      | Vadicell (20. V.) |      |      | Control |      |      |
|            |           | 3th  | 7th | 10th | 3th               | 7th  | 10th | 3th     | 7th  | 10th |
|            |           | day  |     |      | day               |      |      | day     |      |      |
| Vízpuszta  | 96        | 0,6  | 1.3 | 5.5  | 5.7               | 6.0  | 6.0  |         |      |      |
| Péntekhely | 67        | 0.3  | 0.8 | 2.1  | 2.2               | 2.4  | 2.4  |         |      |      |
| Rádpuszta  | 224       | 0.5  | 1.1 | 4.3  | 4.4               | 4.7  | 3.9  |         |      |      |
| Berencse   | 117       | 0.4  | 1.0 | 3.4  | 2.6               | 2.8  | 2.9  |         |      |      |
| Ordacsehi  | 25        | 0.3  | 4.1 | 10.8 | 13.1              | 14.0 | 15.5 |         |      |      |
| B.-boglár  |           |  |     |      |                   |      |      | 10.0    | 15.0 | 18.0 |

### Protection of oats sown together with lucerne against red deer

The trial was set up at Rakitnica (Ribnica). The deterrent Vadóc was used on April 24, 1994, because there were many red deer in the vicinity. Till May 22, 1994, the protection was effective but later considerable damage was caused by red deer and wild boars. When oat was harvested on August 12, 1994, the yield was greatly reduced.

The application of Vadóc is effective for a month, then it should be replaced by another scent.

### Protection of silage maize against red deer

The trial was set up at Kočevska Reka in a plot of 3 hectares sown with maize, when plants were at four leaf stage. Bags containing Vadóc were hung at a height of 1 m and at a height of 2 m at

the distance of 5 m from another in combination with electric fence. As there was a lot of wild game in the vicinity of agricultural land, we examined the application of the deterrent in which part of the plot that was endangered by wild game most of all. Results have not been completely evaluated as yet for objective reasons. But it can be concluded that the effect of the deterrent was evident.

#### **Protection of silage maize against roe deer and red deer**

The trial was set up at Ortnek near Ribnica in two locations nearby (a and b). One of the plots measured 1.2 ha (a) and the other 1.0 ha (b). The deterrent Vadóc was applied on August 3, 1994, at a height of 1.5 m and at the distance of 6-8 m. In site of (b) the application the deterrent was effective until maize was ready for silage. In location (b), however, damage was observed after the first month of its application. Therefore we started using another deterrent, Vadicell, on September 8, 1994.

#### **Protection of some crops against red deer and roe deer in late summer and autumn**

The trial was set up in fields with the following crops: wheat, potato, maize, sugar beet, and fodderbeet. The deterrent Vadóc was applied in the total area of 15 hectares in Prekmurje. The deterrent was given to farmers, who used it according to instructions. Forty farmers did not report any damage to crops, which indicates that the application of the deterrent was effective.

In an area of 5 ha sown with wheat (1.5 ha), maize (2 ha) and sugar beet (1.5 ha), which was fenced off with a rope, the deterrent Vadóc was used at a height of 0.5 m and 1 m. Although the fence was repaired whenever it was torn by deer and the deterrent was applied again, the damage to wheat was 25%, to maize 20% and to sugar beet 10-15%.

#### **Spring protection of green beans against roe deer**

The trial was set in a plot of 0.24 ha in the surroundings of Ljubljana. Bags containing the deterrent Vadóc were hung on a rope placed round the plot at a height of 1 m from the ground on May

25, 1993, when the first four proper leaves grew on bean plants. The plants were well protected (100%) against deer during the whole period of flowering when they are most vulnerable. They were not threatened by deer any more when podding started.

#### **Protection of lettuce against wild game in late spring and early summer**

The trial was set up in the vicinity of Ljubljana, in a plot of 0.5 ha in size, a week after the plants were transplanted. The deterrent, used in combination with electric fence, was placed in bags that were hung on a wire at the distance of 6 m from one another. The plot was protected in this way until the plants were harvested at the end of June.

#### **Protection of strawberries against roe deer in late summer**

The trial was set in the vicinity of Ljubljana in the first ten-day period of July 1994 before the flowering of strawberries, that is in the beginning of the critical period. The deterrent was used in the same ways as above in combination with electric fence. Strawberries were completely protected against roe deer.

#### **Spring and summer protection of vineyards against red deer and roe deer**

The trial was set up in Kobilje in Prekmurje. The deterrent Vadóc was applied in an area of 5 hectares in size in the second ten-day period of May 1994, when the shoots were 15-20 cm long. Bags containing the deterrent were placed at the distance of 5 m from one another. Vadóc was 100% effective and thus the vineyard was completely protected against wild game.

Table 9: Protection of some crops against roe deer and red deer by using deterrents, Vadóc and Vadicell<sup>1)</sup> in Slovenia

| Crop or plant  | Trial location   | a) Growth phase<br>b) Trial time<br>c) Critical period                               | Size of trial plot   | a) Assessment of damage or<br>b) Efficacy of the use of deterrents  |
|--|--|--|--|---|
| Oats   | Ribnica - surroundings   | a) Tillering<br>b) 25/4/1994<br>c) Until earing                                      | 0.12 ha  | a) 0.0%<br>b) Very effective for 30 days, then another scent should be used. Before harvesting, the study site was ravaged by wild boars. |
| Silage maize   | Kočevska Reka  | b) 26/5/1993<br>c) After germ shoot - 4th leaf and from tesseling time to harvesting | about 5 ha <sup>2)</sup>                                   | Quite effective during the first critical phase.<br><br>A lot of wild game in the vicinity.   |
| Silage maize   | Ribnica - Ortnek   | b) 3/8/1994 - 8/9/1994<br>application of another deterrent - Vadicell                | 1.2 ha   | a) 25% damage caused by brown bear (6-7/9/1994)   |
| Silage maize   | Ribnica - Ortnek   | b) 5/8/1994  | 1.0 ha   | a) 0.0%<br>b) Very effective until harvesting   |
| Wheat<br>Maize   | Markovci   | b) First and second ten-day period, July, 1994                                       | 1.5 ha<br>2.0 ha   | a) 25% damage<br>a) 20% damage  |
| Sugar beet   |  | c) Until harvesting  | 1.5 ha   | a) 10-15% damage  |
| Wheat<br>Potato<br>Fodder<br>beet<br>Maize<br>Sugar beet | Adrijanci<br>Budinci<br>Čepinci<br>Dolenci<br>Hodoš<br>Mačkovci<br>Šalovci | b) First and second ten-day period, July 1994  | Total 15 ha; several plots from 0.15 ha to 0.30 ha in size | Very effective in smaller plots. Damage was reported by just 36% of owners who used a deterrent.  |

1) in one location only

2) in combination with electric fence

Note: In fields in which a deterrent was not used damage was 35-40%.

Table 10: Protection of some horticultural plants against roe deer and red deer by using deterrent, Vadóc in Slovenia

| Vegetable or fruit | Trial location           | a) Growth phase<br>b) Trial time<br>c) Critical period                  | Size of trial plot | a) Assessment of damage or<br>b) Efficacy of the use of deterrents |
|--------------------|--------------------------|---|--------------------|--|
| Green beans        | Ljubljana - surroundings | a) First four proper leaves<br>b) 25/5/1993<br>c) Until podding         | 0.24 ha            | a) 0.0%<br>b) Very effective                                       |
| Lettuce            | Ljubljana - surroundings | b) Ten days after transplantation<br>13/5/1994<br>c) Until harvesting   | 0.5 ha             | a) 0.0%<br>b) Very effective                                       |
| Strawberries       | Ljubljana - surroundings | a) Beginning of flowering<br>b) 8/7/1994<br>c) Until ripeness           | 0.5 ha             | a) 0.0%<br>b) Very effective                                       |
| Vine               | Kobilje (Prekmurje)      | a) Size of long shoots 15-20 cm<br>b) Mid May 1994<br>c) Until ripeness | 5 ha               | a) 0.0%<br>b) Very effective                                       |

## 5 SUMMARY

Out of the results of our experiments carried out from 1991 to 1994 the following main conclusions are to be drawn:

- The new nature-friendly technology elaborated by us for game deterring is suitable to reduce the game damagings in agriculture and forestry.
- Among the game species existing in our country, the best results were obtained in springtime against the wildhog and hare, but the results related to the roe and deer were also acceptable.
- Our new technology is able to provide reliable shelter from damagings by roes, deers and hares for 15-30 days and from those by wildhogs for 7-14 days, respectively.

- It has been proved in all areas that no good results can be obtained by one single treatment. In spite of the long permanence of the scent of the various treatments applied alternately the games accustomed to the scent in a short time.
- Best results can be obtained with potatoes, winter wheat, sunflower, soya bean and spring corn. In forest cultures, our technology did not provide successful protection for long time. In cultures like these, the area controlling method combined with individual control processes is suggested.
- The efficacy of control measures is better in springtime than in autumn. It is probably consistent with the fact that much more food is available at that time for game, thus its attention will be distracted from the plant cultures to be damaged.
- The successful control is also influenced by the surface of area. The greater an area is the less successfully a control can be done. The scent effect is going to disappear on a wide surface. In such cases, a crosswise control is also suggested.
- The technology applied by us can be modified as follows: The bags are not to be hung upon tight cords but directly on the plants. The cords could disturb the work in the fields. The bags are not to be perforated. By this measure the scent effect will be kept and a negative influence of rain drops sickening inside avoided.
- We succeeded in developing three products. The substances Vadicell and Vadóc have been patented. Granting a concession for them is under way. The Vadóc can reduce above all the big game damages while the Vadicell can be used mainly against the small game. The Antivad is for individual treatment of woody plants to be applied.
- The frost had no influence on the efficacy of control.
- By game deterring products of scent effect the damages caused by games cannot be reduced properly. Using different methods such as mechanical and chemical (etc.) together is suggested. In addition to direct control measures, using some indirect methods such as modern game economy and foddering is also very important.

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