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EFFECT OF GROWING SITE ON THE HEALTH STATUS OF HYPERICUM (*HYPERICUM PERFORATUM* L.) IN CROP CULTIVATION

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A b s t r a c t: This paper presents results of previous research, which may prove useful for the re-introduction of hypericum to crop farming. Climatic conditions for growing this herb in Poland are quite good. It requires fertile soil, with light or medium firmness (compactness), which is permeable and sufficiently wet, and has a slight acidic reaction. The forecrop is very important in this case. Hence, this paper evaluates its effect on the healthiness of plants and thus time-scale for plantation usage. The studied plantations were established after potatoes and wheat. It was observed that hypericum grew very slowly in the first year and was labour consuming due to weed control. A two-year old plantation gave dense herb growth independently of the forecrop. However, in the spring of the third year, hypericum sprouted irregularly. Herb plants in the after-wheat plantations showed retarded development in 39% and up to 34% of the plants in the after-potato plantation. Moreover, single stalks, decreased height or poor foliage was also observed. Laboratory diagnostic tests showed that stalk bases, root necks and main roots were intensively infested by the fungi that are pathogenic for most crops, i.e. the species of *Botrytis, Fusarium, Phoma* and *Rhizoctonia.*

K e y w o r d s: hypericum (St. John's wort, forecrop, healthiness, fungi.

INTRODUCTION

Hypericum (*Hypericum perforatum* L., also known as tutsan or St. John's wort) has been known since the ancient times and is still used as a valuable medicinal herb. It has been used for healing diseases of alimentary system, bile ducts, blood vessels, as well as arteriosclerosis and neuralgia. Its red ingredient, hypericin, is beneficial for biochemical processes as an anti-neoplastic substance [5,6,7,9,12]. The herbs were gathered from the natural habitats of dry and sunny hills and meadows, balks, shrubbery and forest peripheries. Wide-spread collection of the herb at its blooming stage resulted in a significant reduction of its natural

habitats in many areas of the country and forced foundation of commercial plantations. Climatic conditions for this herb in Poland are quite good. It requires fertile soil, with light or medium firmness or compactness, which is permeable and sufficiently wet, and has a slight acidic reaction [2,3,10,11,13]. In the 1980-ties, hypericum was grown in the Rzeszów region in the area of about 20 hectares. It was considered a valuable crop and was collected by the "Herbapol" Company. However, economic changes in the 1990-ties limited collection of that herb from farmers and most of them stopped growing. It is only in recent years that a renewed interest in various herbal medicines, including hypericum, is again noticeable.

The paper presents effects of the forecrop and plantation age on the healthiness of the crop plants, as well as on the number of fungi, in particular pathogenic species of fungi at stalk bases, root necks and the main roots of tutsan.

MATERIALS AND METHODS

The research material was tutsan crop cultivated by individual farmers in the Łańcut area. Observations were conducted on the following tutsan crop cultivations:

Specification	1	2	3	4	5
Plantation age	2 years	2 years	3 years	3 years	5 years
Forecrop	potatoes	wheat	potatoes	wheat	wheat

Cultivation plots covered from 0.20 ha to 0.35 ha and were at short distances from each other. Plantations were interspersed with the fields of cereals, potatoes, and multiyear papilionaceous plantations. Soils in the region were of good wheat complex - alluvial soils formed of silt with low contents of phosphorus and potassium and slightly acidic reaction. Tutsan was sown in rows spaced every 40-45 cm. Cultivation was manual.

The research was conducted in two stages. The first stage comprised field observations during vegetation period in respects to plant growth, development and healthiness, the second consisted of laboratory diagnostic tests.

Prior to tutsan harvest, samples of 20 plants were taken from five points at each plantation. The samples included healthy, retarded and withered plants which were subjected to mycological evaluation of their stalk bases, root necks and main roots. Mycological analyses were performed in accordance with the methods used in phyto-pathological research. The obtained fungi colonies were marked with their species or genus based on respective monographs [1,4,8].

RESULTS

Tutsan vegetation started perceptibly over the turn from March to April. The most intensive *Hypericum perforatum* L. growth was observed in May. At that time, differentiation in the plant morphological characteristics was observed in plant height, number of developed stalks and in their leafage. Tutsan on 2-year old plantations was developed best. The above-ground parts constituted a uniform and compact cover. On the 3-year and 5-year old plantations, plants could be divided into the following three groups:

I. healthy plants: high plants with numerous stalks and rich leafage;
II. slow growers: shorter plants with single stalks and poorer leafage, with leaves yellowing and withering at their bottoms;
III. dying plants: plants which no longer grew or such which still grew but their stalks already turned yellow and were drying.

Shares of these groups on the observed plantations are presented in Fig. 1. The data obtained show that the above-ground parts were best developed on 2-year old plantations, and less developed on 3-year old plantations where 34-39% of plants belonged to group II - slow-growers. Besides, the latter plantations had spots where plants had died or had only single stalks which were also withering. More dying plants were found on the plantations established after wheat forecrop. Plants on the 5-year old plantation were the poorest, with 56% of slow growing and 37% of completely dead plants.

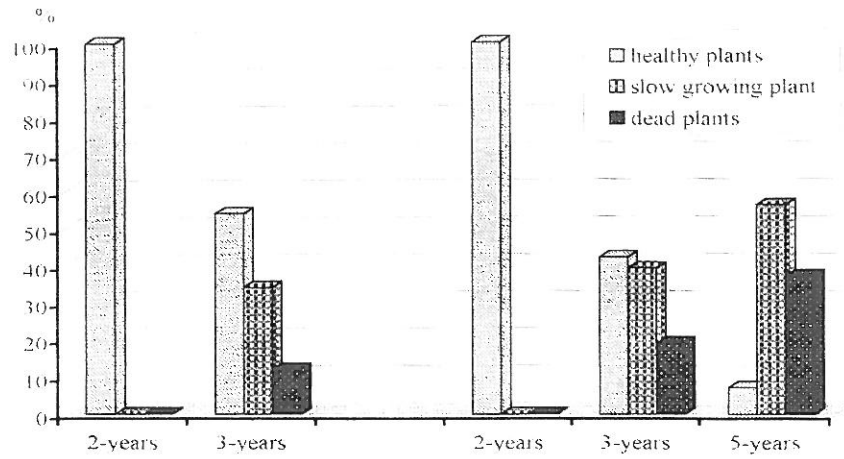

Fig. 1. Effect of the growing station and plantation age on the plant healthiness.

Evaluation of the root system performed prior to first crop harvest showed that healthy tutsan had well-developed main root and side roots, and only a few plants had brown patches on the longitudinal section of the root neck. In slow-growing plants, the main root was shorter and it had smaller number of side roots. There were also numerous colour changes on the sections of root neck and the main root. Dying plants had the weakest and completely brown roots.

In the mycological analysis, 1745 colonies were isolated, including 572 colonies from stalk bases, 595 from root necks and 578 from the main roots. Most fungi, 522, grew on the plants sampled from a 5-year old plantation, plants from other plantations had between 24% to 60% less fungi (Fig. 2). More numerous colonies and greater gamut of species were obtained from the plants grown after potato forecrop, when compared to those cultivated after wheat forecrop (Table 1).

Species considered to be pathogenic for many kinds of plants from *Botrytis, Fusarium, Phoma* and *Rhizoctonia* genera deserve special attention. The share of those fungi was greater in the colonies derived from older plantations (Fig. 3). Besides, those species were isolated more frequently from the tutsan grown after wheat forecrop. Clear differences in their quantity were also observed in relation to plant condition (Fig. 4). In the total, the number of colonies from healthy plants 23.6% were pathogens, while 58.3% pathogens were found on slow growers and 40.7% on dead plants. Fungi of *Botrytis, Fusarium* genera occurred more frequently in stalk bases and in root necks, while *Phoma* sp. and *Rhizoctonia* sp. genera were more numerous in the main roots. A significant share of pathogens in

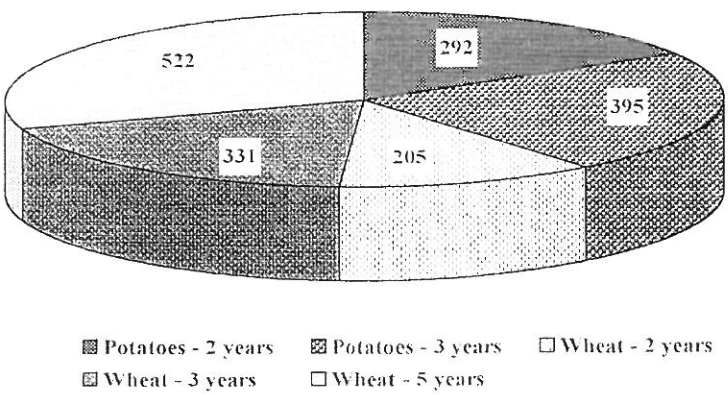

Fig. 2. Effect of the growing station on the number of fungi isolated from *Hypericum perforatum* L.

T a b l e 1. Effect of the growing station on the number of species and fungi genera found on *Hypericum perforatum* [item]

Plantation age	Forecrop	Number of fungi	
		Species	Genera
2 years	Potatoes	36.0	2.0
2 years	Wheat	20.0	3.0
3 years	Potatoes	22.0	1.0
3 years	Wheat	19.0	1.0
5 years	Wheat	18.0	2.0

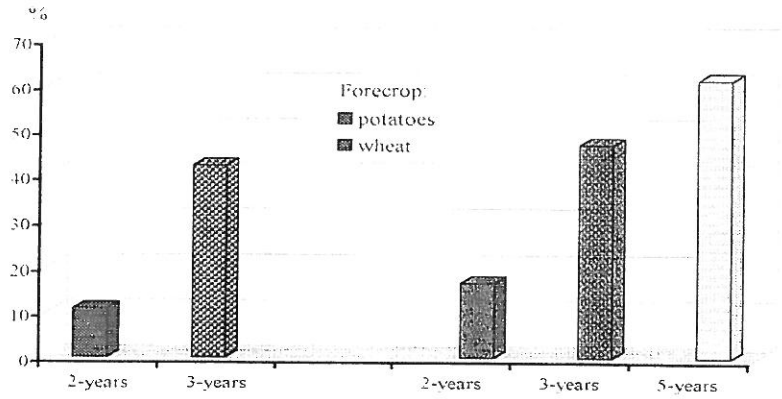

Fig. 3. Influence of forecrop and of age of plantation on participation of fungi pathogenic among isolated from *Hypericum perforatum.*

the 2-year old plants and their pronounced build-up in older plants confirms susceptibility of *Hypericum perforatum* to those fungi (Table 2).

Frequent occurrence of pathogenic species in the tested parts of slow growing plants suggests that they could well be the cause of the initial slow-down of growth and subsequent dying of *Hypericum perforatum* plants. The results of this research confirm a significant role of the proper selection of the growing station for this crop.

CONCLUSIONS

1. Tutsan (*Hypericum perforatum* L.) plants in crop cultivation were subjected to degeneration processes which progressed as the plantation was ageing. The rate of this process was faster in the after-wheat cultivation.

2. One of the reasons for plant degeneration could be pathogenic fungi that occupy stalk bases, root necks and the main roots.

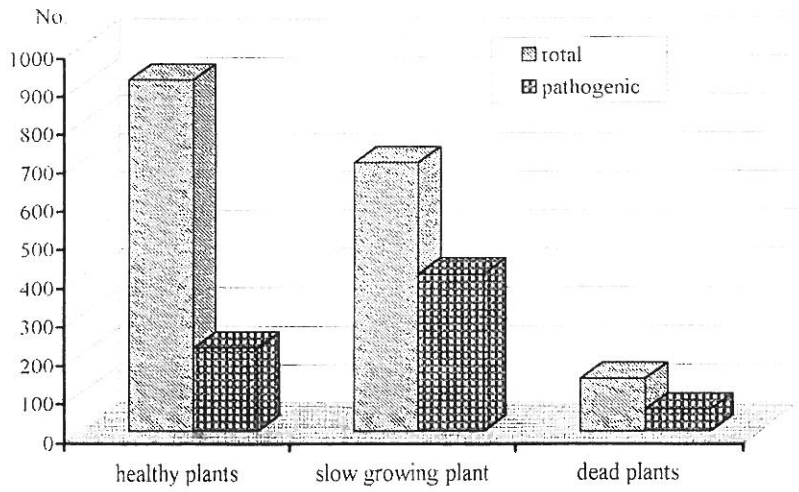

Fig. 4. Effect of plant healthiness on the number of fungi - in total and pathogenic fungi in particular.

T a b l e 2. Effect of the growing station and plant healthiness on the share of pathogenic species among fungi isolated from *Hypericum perforatum* plants [%]

Plantation age	Forecrop	Pathogenic species								
		I*			II			III		
		A	B	C	A	B	C	A	B	C
2 years	Potatoes	15.7	11.6	4.9	-	-	-	-	-	-
2 years	Wheat	19.7	13.0	26.0	-	-	-	-	-	-
3 years	Potatoes	21.1	25.3	27.5	67.5	35.9	49.3	50.5	16.6	23.5
3 years	Wheat	31.0	31.7	25.0	75.8	70.6	42.1	55.5	31.1	21.4
5 years	Wheat	56.0	48.5	44.7	82.1	57.8	58.1	66.6	33.3	42.8

*Explanations: Plants: I-healthy, II-slow growing, III-dying; A - stalk base; B - root neck; C - main root.

3. In the multi-year tutsan (*Hypericum perforatum* L.) crop cultivation, proper forecrop selection and combination of all the agrotechnical measures applied that affect diversification of the soil biological environment, are of great importance.

REFERENCES

1. **Barnett H.L.:** Illustrated genera imperfect fungi. Minneapolis, 1962.
2. **Czabajska W., Dąbrowska J., Ludowicz E.:** Topaz - pierwsza krajowa odmiana dziurawca zwyczajnego. Wiad. Ziel., 5, 4, 1986.
3. **Golcz L., Kordana S.:** Potrzeby pokarmowe dziurawca zwyczajnego. Wiad. Ziel., 1, 8-9, 1977.
4. **Gilman J.C.:** A Manual of Soil Fungi. The Iowa State University Press, USA, 1962.
5. **Nartowska J.:** Ziołowa apteczka domowa cz.V. Wiad. Ziel., 7, 12-14, 1987.

6. **Niedworok J., Janko wska B.**: Farmakologiczne działanie wyciągów z dziurawca zwyczajnego. Wiad. Ziel., 6, 20, 1997.
7. **Ożarowski A.**: Dziurawiec zwyczajny jako roślina lecznicza. Wiad. Ziel., 2, 7-8, 1981.
8. **Raillo A.I.**: Griby roda *Fusarium*. Moskwa, 1950.
9. **Rumińska A., Ożarowski A.**: Leksykon roślin leczniczych. PWRiL, Warszawa, 1990.
10. **Rumińska A.**: Poradnik plantatora ziół. PWRiL, Warszawa, 1976.
11. **Studziński A., Mikolajewicz M.**: Choroby i szkodniki roślin zielarskich. Cz. IV. Wiad. Ziel., 7, 4-7, 1989.
12. **Tyszyńska-Kownacka D.**: Dziurawiec zwyczajny. Wiad. Ziel., 6, 20-21, 1987.
13. **Zalęcki R.**: Uprawa dziurawca zwyczajnego. Wiad. Ziel., 2/3, 1-2, 1984.