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INFLUENCE OF CROP ROTATION UPON WEED DEVELOPMENT ON CORN, WHEAT AND SOYBEAN CROPS

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Abstract

In every type of culture or group of cultures we can observe specific weeds. These weeds are adapted to the particular biological characteristics of the cultivated plant and at the specific technological issues. Monoculture or short crop rotations fulfill this mentioned above conditions for a longer period of time infesting the soil with weed seeds. On the other hand, long crop rotation leads to a proper development of technological changes for each type of crops. This aspect is obvious at corn and soy bean where the crop rotation for two years leads to a weed development of 110-116% compared with the four year crop rotation. The differences are reduced at the three year crop rotation, with a weed development level of 13-64% higher compared with the four year crop rotation.

In the four year crop rotation compared with the two year one, the structure of weed development on the wheat culture involves significant modifications. The frequency of the following weeds was reduced: Centaurea, Adonis, Thlaspi, Sinapis, Vicia, Viola, Matricaria, Galeopsis şi Raphanus. On the other hand, the intensity of appearance with perennial weeds is: Agropyron repens, Cirsium arvense, Convolvulus arvensis and Symphitium officinale.

INTRODUCTION

Crop rotation is considered one of the most important technological measures for increasing soil fertility, suppress weeds, and fight against weed development, pest and diseases. Nowadays crop rotations are considered crucial for sustainable agriculture, seen as prime objective for accomplishing optimum yields without negative effects upon the ecological balance and environment stability. During 1985-2003 [1, 2, 3], in the experimental plots focused on crop rotation on different types of soils and different structures of crops the agrotehnical protocols where followed for the improvment of technological aspects. Good results where obtained by conducting a four year crop rotation (soy bean-autumn wheat-potato-corn) for soil tillage, fertilizers usage, herbicides usage, with optimum conditions for suppressing perennial weeds.

MATERIAL AND METHODS

The research objectives consisted in the determination of crop rotation influence upon weed development on a corn, wheat and soy bean crop.

The present results where obtained in the experimental plots of the Agricultural Faculty from Cluj-Napoca, Soil Science Department on a Faeoziom soil, with a humus content of 4.72 % a pH of 6.8 sandy-loam texture (43-45% loam in the Ap horizon) (V-74%), medium content of nitrate (0.204%), good content of potassium (149 ppm) and good content of phosphorus (18 ppm). The state of hidrostability on the soil depth 0-20 cm is 75-80%. The apparent density is 1.20-1.22 g/cm^3, and the total porosity 54.81%.

From the climatic point of view the experimental plot area is characterized by multi annual precipitation with values between 550-650 mm. The thermal regime has values between 8.0-8.2^{0}C.

The experiment was conceived as a monofactorial one.

Experimental factor A (soil rotation) with 3 graduations:

a_1 - 2 years (corn - wheat);

a_2 - 3 years (soy bean - corn - wheat);

a_3 - 4 years (soy bean - corn - wheat - sun flower).

RESULTS AND DISCUSSION

Between cultivated plants and weeds is a constant competition for fertilizers, water, light, space etc.

The crop rotation influences the weed appearance intensity. An alternate option between large varieties of crops with different technological needs combined with chemical weed control represents the key to success. It seems that crop rotation represents the best solution for weed control, diseases and pests. These aspects are based upon the obtained results in table 1. It is scientifically proved that on a wheat crop it's reduced the weed development before applying herbicides and after harvest once with the enlargement in time of the crop rotation. At the 2 year crop rotation (alternation between cereals and harrow plants) the no. of weeds is situated between 305-365/m^2, on the 4 year crop rotation it is reduced at 213-236 weeds/m^2.

In any crop or group of crops with specific technological aspects are existing specific weeds. These weeds are adapted at biological particularities of the cultivated plant and at specific technology.

Monoculture and short crop rotation maintain the possibilities of weed infestation in the terrain. This aspects are observed at corn and soy bean crop (table 2), when the 2 year crop rotation leads to a weed development of 110-116% higher than the 4 year crop rotation. The differences are reduced at the 3 year crop rotation, with a weed development rate of 13-64%, higher compared with the 4 year crop rotation.

Table 1

Influence of crop rotation upon weed development on a wheat crop

Crop rotation duration	Before herbicide applying		At harvest	
	No. of weeds/m^2	Dry mass of weeds (kg/ha)	No. of weeds/m^2	Dry mass of weeds (kg/ha)
2 year crop rotation	305	311	164	365
3 year crop rotation	287	276	152	344
4 year crop rotation	213	143	107	236

Table 2

Weed development rate in corn and soy bean crops influenced by crop rotation period

Species	No. of weeds/m^2			No. of weeds/m^2		
	Corn in a 2-3-4 years crop rotation			Soy in a 2-3-4 years crop rotation		
	2	3	4	2	3	4
Echinochloa crus-galli	17	14	10	14	13	7
Setaria sp.	103	76	56	128	104	59
Agropyron repens	30	4	28	24	12	12
Amaranthus retroflexus	4	2	6	8	6	10
Atriplex patula	-	2	-	2	4	-
Chenopodium album	8	6	4	10	8	6
Xanthium strumarium	12	7	3	14	12	10
Galeopsis tetrahit	2	-	2	4	2	-
Polygonum aviculare	2	2	2	-	-	-
Polygonum convolvulus	2	4	2	6	12	2
Polygonum lapathyfolium	84	12	10	52	16	10
Raphanus raphanistrum	-	2	2	-	6	-
Stellaria media	2	2	-	18	16	12
Viola arvensis	2	2	-	-	-	2
Daucus carota	-	2	2	-	-	-
Cirsium arvense	3	2	1	4	4	2
Convolvulus arvensis	8	10	4	14	12	6
Total weeds/m^2	**279**	**149**	**132**	**298**	**227**	**138**
Total weeds (%)	**211**	**113**	**100**	**216**	**164**	**100**

From the adopted research, it is obvious that on the wheat crop frequently appear annual weeds like: *Polygonum convolvulus*, *Papaver rhoeas*, *Centaurea cyanus*, *Veronica* sp., *Matricaria* sp. and many others and on the corn and soy bean crop like: *Setaria* sp., *Digitaria sanguinalis*, *Echinochloa crus-galli* and others. The

mentioned above weeds appear later when the soil is warmer. By a proper crop rotation decreases the no. of specific weeds.

When the wheat and corn crop alternates, the specific weeds of wheat (with autumn germination and winter dormancy) cannot develop, because after the wheat harvest the soil is tilled, and is maintained free of weeds till spring when the corn is seeded. So, through the specific soil tillage works for the corn crop, we can reduce the development of autumn germination weeds that can resist in the winter time.

It is known that every cultivated species reduces the number of weeds and the succession of the agricultural crops reduces the weed development. In the 4 year crop rotation, compared with the 2 year crop rotation, the weed development on wheat is different.

It has been reduced especially the weed development for the following species: *Centaurea, Adonis, Thlaspi, Sinapis, Vicia, Sonchus* and others, but has been raised the development of the following weeds (*Stellaria, Viola, Veronica, Matricaria, Galeopsis* and *Raphanus*). The perennial weeds development has been raised for weeds like: *Agropyron repens, Cirsium arvense, Convolvulus arvensis* and *Symphitium officinale*.

It is remarkable that every annual weed species that have a proper development are autumn weeds, or early spring weeds. For the corn crop the weed development on the 4 year crop rotation decreases compared with the same crop on the 2 year weed development.

This fact is based on crop rotation period, tillage technology that are maintaining the weed development.

In the second part of the vegetation period, it is more obvious the influence of crop rotation, because after the soil tillage are developing weeds with late germination as: *Echinochloa crus-galli, Convolvulus arvensis, Digitaria sanguinalis, Setaria* sp. etc.

In the 2 year crop rotation with the same usage of herbicides and the same soil tillage works, are created favorable conditions for certain weed development especially weeds resistant to the used herbicides.

In the wheat crop propagated monocotiledonated weeds like: *Apera spica venti*, *Avena fatua* and others.
Crop rotation is also in this case the most efficient way of reducing the perennial weed development (*Cirsium arvense, Convolvulus arvensis*, *Symphytum officinalis*) and especially for the sun flower and soy bean crop that don't have homologated selective herbicides that can't control this problem weeds.

CONCLUSIONS

1. On the wheat crop it is showed that the weed development is reduced before herbicide applying, and after harvest, once with the enlargement of the crop rotation. If on the 2 year crop rotation (the alternate between wheat and corn) the no. of weeds is 305-365/m^2 on the 4 year crop rotation it is reduced at 213-236 weeds/m^2.
2. The relation between crop rotation and weed development has been obvious on the corn crop, and on the soy bean crop, where the 2 year crop rotation leads to a weed development higher than 110-116% compared with the experimental plots where the 4 year crop rotation has been adopted.
3. In the 3 year crop rotation the weed development is lower compared with the 2 year crop rotation, but higher with 13-64% compared with the 4 year crop rotation.
4. The crop rotation technology must be looked as a prior measure for controlling the weed development in any kind of crops.
5. The period of crop rotation contributes significantly to the reducing of weed development; in the 4 year crop rotation compared with the 2 year crop rotation. The structure of weed development is significant with decreasing values for: *Centaurea, Adonis, Thlaspi, Sinapis, Vicia,* and *Sonchus*.
6. The soil tillage specific for the corn crop significant contributes at reducing the level of weed development; especially the weeds with autumn germination witch can persist through the winter period of time.
7. The agro technical works proper established, and crop rotation influences the intensity of weed development from the wheat crops and soy bean crops.
8. During the crop rotation for maintaining a balanced development of weeds we must be concerned about herbicide alternation for avoiding the usage of a single herbicide witch determine through time resistance of the weeds.

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