

# THE EFFECT OF LONG-TERM CROP ROTATION ON THE AMOUNT OF WEED SEEDS IN THE SOIL

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## INTRODUCTION

The spread of characteristic weeds is one of the main factors limiting crop productivity and soil productivity in crop rotations. The similar chemical composition of weeds and agricultural crops leads to interspecies competition in agrocenoses - for nutrients, moisture, heat and light.

The objective of this investigations was to compare the effect of different crop rotations and *Rye Monocultures* as well as fallow on the amount of weed seeds.

**Keywords:** crop rotation, monoculture, weeds, continuous bare fallow

## MATERIALS AND METHODS

Long-term field experiment was established in 1965 at the Experimental Station of Vytautas Magnus University at 54°52'50 N latitude and 23°49'41 E longitude. 9 different crop rotations were arranged in time and space. In addition *Rye Monoculture* and *Continuous bare fallow* were included as control treatment. Soil – *Calc(ar)i-Endohypogleyic Luvisol*.

Investigations were carried out in 2018 (after 53 year term) (Table 1).

**Table 1.** Sequences of crop rotations

| Crop rotation               | Components of crop rotation  |
|-----------------------------|--|
| <b>Cereal</b>               | 1) vetch and oats mixture for green forage, 2) <b>spring wheat</b> , 3) oats, 4) <b>spring barley</b> .  |
| <b>Three-course</b>         | 1) black fallow, 2) <b>spring rye</b> , 3) oats.   |
| <b>Rye Monoculture</b>      | 1) <b>spring rye</b> .   |
| <b>Field with row crops</b> | 1) <b>spring wheat + undersowing</b> , 2) perennial grasses of the 1 <sup>st</sup> harvest year, 3) perennial grasses of the 2 <sup>nd</sup> harvest year, 4) <b>winter rye</b> , 5) sugar beet, 6) <b>spring barley</b> , 7) oats, 8) black fallow.   |
| <b>Fodder</b>               | 1) perennial grasses of the 1 <sup>st</sup> harvest year, 2) perennial grasses of the 2 <sup>nd</sup> harvest year, 3) perennial grasses of the 3 <sup>rd</sup> harvest year, 4) perennial grasses of the 4 <sup>th</sup> harvest year, 5) flax, 6) maize, 7) fodder beet, 8) <b>spring barley + undersowing</b> . |
| <b>Norfolk</b>              | 1) clover, 2) <b>spring wheat</b> , 3) potato, 4) <b>spring barley</b> .   |
| <b>For green manure</b>     | 1) lupine for green manure, 2) winter rye, 3) winter rape for green manure, 4) <b>spring rye</b> , 6) potatoes, 7) spring barley.  |
| <b>Intensive</b>            | 1) vetch and oats mixture for green forage + undersowing, 2) clover, 3) <b>spring rye</b> followed by catch crop – winter rape, 4) potato followed by catch crop – winter rye for green forage, 5) maize, 6) <b>spring barley</b> followed by catch crop – oilseed radish.   |

## CONCLUSIONS

- Seeds of frost-blite (*Chenopodium album* L.), pale persicaria (*Polygonum lapathifolia* L.), cockspur (*Echinochloa crus-galli* L.) and lady's thumb (*Persicaria maculosa* L.) dominated in different crop rotations, monocultures and continuous bare fallow.
- Different crop rotations and *Continuous bare fallow* did not have significant differences on amount of weed seeds. A higher (1.35 and 1.10 times) amount of weed seeds was established in the *Field with raw crops* comparing with other crop rotations in spring wheat crops and continuous bare fallow. A lower amount of weed seeds was established in *Norfolk* and *Fodder* crop rotations (1.80 and 1.46 times) comparing with *Intensive* and *Cereal* crop rotations in spring barley crops. The higher (2.09 times) amount of weed seeds was established in *Intensive* crop rotation comparing with *Rye monoculture*. Pre-crop of rye in *Intensive* crop rotation was clover making negative influence on amount of weed seeds in the soil.

## RESULTS

**Table 2.** The amount and composition of weed seeds in soil, in spring wheat crop (a), spring barley (b) and spring rye (c) at depth 0-25 cm

a)

| The species composition of weeds (thousands vnt m <sup>-2</sup> ) | Crop rotations |                      |                        |                |
|---|----------------|----------------------|------------------------|----------------|
|   | Cereal         | Field with row crops | Continuous bare fallow | Norfolk        |
| <b>Annual</b>   |                |                      |                        |                |
| <i>Chenopodium album</i> L.                                       | 27,32 a        | 29,06 a              | 19,38 a                | 27,51 a        |
| <i>Persicaria lapathifolia</i> L.                                 | 0,00 a         | 0,58 a               | 0,39 a                 | 0,00 a         |
| <i>Persicaria maculosa</i> L.                                     | 0,00a          | 1,16 a               | 0,00 a                 | 0,39 a         |
| <i>Echinochloa crus-galli</i> L.                                  | 0,58 a         | 0,00 a               | 2,71 a                 | 0,78 a         |
| <b>Perennial</b>  |                |                      |                        |                |
| <i>Rumex crispus</i> L.   | 0,00 a         | 0,00 a               | 0,39 a                 | 0,00 a         |
| <b>Total</b>  | <b>27,90 a</b> | <b>30,80 a</b>       | <b>22,87 a</b>         | <b>28,68 a</b> |

b)

| The species composition of weeds (thousands vnt m <sup>-2</sup> ) | Crop rotations |                |                      |                |   |                |
|---|----------------|----------------|----------------------|----------------|---|----------------|
|   | Intensive      | Cereal         | Field with raw crops | Norfolk        | For green manure (after winter rape incorporated) | Fodder         |
| <b>Annual</b>   |                |                |                      |                |   |                |
| <i>Chenopodium album</i> L.                                       | 25,58 a        | 26,35 a        | 18,99 a              | 14,73 a        | 20,34 a   | 14,34 a        |
| <i>Persicaria lapathifolia</i> L.                                 | 0,78 a         | 0,78 a         | 0,00 a               | 0,39 a         | 1,74 a  | 1,16 a         |
| <i>Persicaria maculosa</i> L.                                     | 0,00 a         | 0,00 a         | 0,00 a               | 0,00 a         | 0,00 a  | 1,55 a         |
| <i>Echinochloa crus-galli</i> L.                                  | 8,14 a         | 0,00 a         | 1,16 a               | 3,10 a         | 1,74 a  | 2,71 a         |
| <i>Fallopia convolvulus</i> L.                                    | 0,00 a         | 0,00 a         | 0,00 a               | 0,00 a         | 0,58 a  | 0,00 a         |
| <i>Galeopsis tetrahit</i> L.                                      | 0,00 a         | 0,78 b         | 0,00 a               | 0,00 a         | 0,00 a  | 0,00 a         |
| <i>Thlapsi arvense</i> L.   | 0,38 a         | 0,00 a         | 0,38 a               | 0,00 a         | 0,00 a  | 0,00 a         |
| <b>Perennial</b>  |                |                |                      |                |   |                |
| <i>Rumex crispus</i> L.   | 0,00 a         | 0,38 a         | 0,00 a               | 1,16 a         | 0,00 a  | 0,00 a         |
| <b>Total</b>  | <b>34,88 a</b> | <b>28,29 a</b> | <b>20,53 a</b>       | <b>19,38 a</b> | <b>24,40 a</b>                                    | <b>19,76 a</b> |

c)

| The species composition of weeds (thousands vnt m <sup>-2</sup> ) | Crop rotations       |  |                |                |                 |  |
|---|----------------------|--|----------------|----------------|-----------------|--|
|   | Field with row crops | For green manure (after winter rape incorporation) | Three course   | Intensive      | Rye monoculture |  |
| <b>Annual</b>   |                      |  |                |                |                 |  |
| <i>Chenopodium album</i> L.                                       | 14,31 ab             | 19,88 ab   | 20,34 ab       | 26,73 b        | 11,63 a         |  |
| <i>Persicaria lapathifolia</i> L.                                 | 0,58 a               | 1,74 a   | 0,58 a         | 0,00 a         | 0,00 a          |  |
| <i>Persicaria maculosa</i> L.                                     | 0,00 a               | 0,00 a   | 0,00 a         | 0,39 a         | 0,00 a          |  |
| <i>Echinochloa crus-galli</i> L.                                  | 1,74 ab              | 4,07 b   | 0,58 a         | 0,39 a         | 1,55 ab         |  |
| <i>Sinapis arvensis</i> L.  | 0,00 a               | 0,00 a   | 0,00 a         | 0,00 a         | 0,00 a          |  |
| <i>Galeopsis tetrahit</i> L.                                      | 0,00 a               | 0,00 a   | 1,16 b         | 0,00 a         | 0,00 a          |  |
| <b>Total</b>  | <b>16,63 a</b>       | <b>25,69 a</b>                                     | <b>22,66 a</b> | <b>27,51 a</b> | <b>13,18 a</b>  |  |

Notes. <sup>a-d</sup> Means followed by the same letter for the same measurement did not differ significantly ( $P < 0.05$ ).