

EFFECTS OF LONG TERM CROP ROTATION AND FERTILIZATION ON WEED INFESTATION IN WINTER WHEAT

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RESEARCH METHOD

- Long-term and stationary experiment was initiated in 1967 on a leached chernozem at the Research Institute Fundulea (Romania);
- Treatments:
 - Crop rotation:
 - continuous wheat (monoculture)
 - wheat-maize (2-yr rotn)
 - wheat-maize-peas (3-yr rotn)
 - wheat-sugar beat-maize-sunflower (4-yr rotn)
 - Fertilization:
 - N_0P_0
 - $N_{90}P_{60}$
- Determinations:
 - weed density and weed dry biomass/m²
 - floristic composition (%)
 - time of determinations: beginning of April and before harvesting

Table 1. Meteorological data during the period of investigation

Precipitation, mm						
Year/month	March	April	May	June	July	Total
1975	28	69	64	88	77	326
2016	55	74	81	44	31	285
2017	48	74	66	96	114	398
2018	14	2	34	121	85	256
55-year mean	36	44	60	73	73	286
Temperature, °C						
Year/month	March	April	May	June	July	Mean
1975	7.1	12.0	17.6	21.2	22.2	16.0
2016	7.3	13.9	15.9	22.9	24.1	16.8
2017	8.6	10.6	16.8	22.2	23.3	16.3
2018	3.4	15.8	19.3	22.6	22.8	16.8
55-year mean	4.7	11.1	16.9	20.7	22.7	15.2

**Table 2. Weed infestation of winter wheat depending on crop rotation and fertilization,
7 April 1975**

Weed species, %	No Po				N9o P6o			
	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn
<i>Polygonum convolvulus</i>	40	71	78	42	33	51	70	29
<i>Veronica hederifolia</i>	30	19	3	33	17	2	0	3
<i>Sisymbrium sophia</i>	12	3	8	0	27	18	21	49
<i>Anthemis arvensis</i>	0	0	0	0	0	0	0	0
<i>Papaver rhoeas</i>	5	1	7	6	6	3	0	2
<i>Cardaria draba</i>	2	1	0	0	1	6	0	0
<i>Sinapis arvensis</i>	5	1	0	5	11	1	6	6
<i>Centaurea cyanus</i>	2	2	2	11	1	16	1	10
<i>Gallium aparine</i>	1	1	1	0	1	1	1	0
<i>Vicia villosa</i>	2	0	0	0	2	0	0	0
<i>Alyssum hirsutum</i>	1	1	1	3	1	2	1	1
Weeds/m²	461	348	237	94	516	264	259	81
Weed dry weight, kg/ha	139	49	24	20	237	63	33	13

Weed density: LSD 5%: Cropping system (CS) – 6.8; Fertilization (F) – 6.2 CSxF –
5.0

**Table 3. Weed infestation of winter wheat depending on crop rotation and fertilization,
5 July 1975**

Weed species, %	No Po				N9o P6o			
	Monocrop	2-yr rotrn	3-yr rotrn	4-yr rotrn	Monocrop	2-yr rotrn	3-yr rotrn	4-yr rotrn
<i>P. convolvulus</i>	44	41	38	46	62	84	58	36
<i>Setaria glauca</i>	15	26	37	35	13	3	29	28
<i>Anthemis arvensis</i>	7	0	10	1	0	3	0	4
<i>Centaurea cyanus</i>	0	3	6	0	0	3	0	0
<i>Sisymbrium sophia</i>	0	2	0	1	6	0	0	4
<i>Papaver rhoeas</i>	5	7	0	0	0	0	4	2
<i>Gallium aparine</i>	0	5	0	0	13	0	0	0
<i>Sinapis arvensis</i>	6	6	0	0	0	3	4	4
<i>Lathirus tuberosus</i>	7	7	9	0	0	0	0	0
<i>Thlaspi arvense</i>	0	0	0	1	3	1	0	0
<i>Rubus caesius</i>	0	3	0	0	3	3	4	4
<i>Convolvulus arvensis</i>	0	0	0	6	0	0	0	20
<i>Gallium aparine</i>	16	0	0	0	0	0	0	0
Weeds/m ²	45	64	43	53	31	31	24	30
Weed dry weight kg/ha	295	119	74	69	204	88	39	34

Weed density: LSD 5%:

Cropping system (CS) – 5.0;

Fertilization (F) – 4.0

CSxF – 3.6

Table 4, 5, 6. Weed infestation of winter wheat depending on crop rotation and fertilization

4 April 2016

Weed species, %	No Po				N9o P6o			
	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn
<i>P. convolvulus</i>	28	28	53	26	38	43	62	37
<i>Veronica hederifolia</i>	5	63	35	72	26	50	21	62
<i>Centaurea cyanus</i>	6	1	1	0	25	0	0	1
<i>Matricaria inodora</i>	5	2	5	1	6	2	7	0
<i>Ranunculus acer</i>	6	3	2	0	1	0	0	0
<i>Papaver rhoeas</i>	0	3	2	0	3	4	10	0
<i>Gallium aparine</i>	0	1	1	0	1	0	0	0
<i>Vicia villosa</i>	0	0	1	1	0	1	0	0
Weeds/m ²	161	60	112	82	138	106	114	54
Weed dry weight kg/ha	140	65	170	121	415	280	110	95

10 April 2017

Weed species, %	No Po				N9o P6o			
	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn
<i>P. convolvulus</i>	30	14	22	31	33	11	17	23
<i>Veronica hederifolia</i>	48	63	26	69	33	77	8	61
<i>Centaurea cyanus</i>	0	3	5	0	10	0	2	0
<i>Matricaria inodora</i>	5	3	34	0	12		35	3
<i>Papaver rhoeas</i>	0	10	10	0	2	9	3	0
<i>Gallium aparine</i>	2	3	3	0	4	0	25	0
<i>Vicia villosa</i>	5	2	0	0	2	0	10	12
<i>Ranunculus acer</i>	10	2	0	0	4	3	0	1
Weeds/m ²	241	140	156	119	356	94	118	108
Weed dry weight kg/ha	170	120	110	99	270	90	140	130

13 April 2018

Weed species, %	No Po				N9o P6o			
	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn
<i>P. convolvulus</i>	27	11	11	42	29	13	15	29
<i>Veronica hederifolia</i>	45	70	41	38	36	54	31	45
<i>Centaurea cyanus</i>	4	5	2	3	4	3	6	3
<i>Matricaria inodora</i>	5	3	30	5	13	7	15	7
<i>Ranunculus acer</i>	9	0	2	5	3	2	2	2
<i>Papaver rhoeas</i>	3	6	6	5	9	15	18	10
<i>Gallium aparine</i>	2	2	6	2	5	2	11	2
<i>Vicia villosa</i>	5	3	2	5	1	4	2	2
Weeds/m ²	373	178	186	97	379	228	265	86
Weed dry weight kg/ha	270	130	160	100	450	320	165	140

Table 7. Weed infestation of winter wheat depending on crop rotation and fertilization, April 2016-2018

Weed species, %	No Po				N9o P6o			
	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn
<i>Veronica hederifolia</i>	50	66	34	58	34	60	20	56
<i>P. convolvulus</i>	29	17	29	33	33	22	31	30
<i>Matricaria inodora</i>	5	3	23	2	11	1	17	4
<i>Papaver rhoeas</i>	1	4	6	2	5	3	10	3
<i>Gallium aparine</i>	1	1	3	1	3	4	12	1
<i>Centaurea cyanus</i>	3	2	3	1	11	6	3	1
<i>Ranunculus acer</i>	8	6	1	2	2	1	3	0
<i>Vicia villosa</i>	3	1	1	1	1	3	4	5
Weeds/m²	258	126	151	86	293	143	214	81
Weed dry weight kg/ha	193	105	146	106	398	230	138	122

Weed density: LSD 5%:

Cropping system (CS) – 5.4;

Fertilization (F) – 5.0

CSxF – 4.6

Table 8, 9, 10 - Weed infestation of winter wheat depending on crop rotation and fertilization

1 July 2016

Weed species, %	No Po				N9o P6o			
	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn
<i>Setaria glauca</i>	86	85	64	77	0	96	53	91
<i>Centaurea cyanus</i>	2	2	3	0	11	0	0	3
<i>Sorghum halepense</i>	3	1	0	4	0	3	9	2
<i>P. convolvulus</i>	8	12	30	0	71	0	33	0
<i>Matricaria inodora</i>	0	0	0	0	0	0	5	2
<i>Papaver rhoeas</i>	1	0	0	0	4	0	0	0
<i>Convolvulus arvensis</i>	0	0	3	19	4	1	0	2
Weeds/m ²	258	258	214	94	190	152	120	86
Weed dry weight kg/ha	1220	790	800	720	910	400	420	310

12 July 2018

Weed species, %	No Po				N9o P6o			
	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn
<i>Setaria glauca</i>	73	22	44	96	27	56	17	60
<i>Centaurea cyanus</i>	0	14	8	0	33	0	20	0
<i>Sorghum halepense</i>	7	43	32	4	13	6	13	0
<i>P. convolvulus</i>	17	21	0	0	27	28	50	40
<i>Matricaria inodora</i>	3	0	0	0	0	0	0	0
<i>Papaver rhoeas</i>	0	0	0	0	0	0	0	0
<i>Convolvulus arvensis</i>	0	0	0	0	0	0	0	0
<i>Vicia villosa</i>	0	0	0	0	0	10	0	0
<i>Xanthium spinosum</i>	0	0	16	0	0	0	0	0
Weeds/m ²	120	96	100	112	62	72	60	71
Weed dry weight kg/ha	1190	1150	610	540	4440	2230	2550	1740

10 July 2017

Weed species, %	No Po				N9o P6o			
	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn	Monocrop	2-yr rotn	3-yr rotn	4-yr. rotn
<i>Setaria glauca</i>	88	90	83	90	33	58	98	77
<i>Centaurea cyanus</i>	1	0	0	0	9	3	2	0
<i>Sorghum halepense</i>	0	0	0	0	0	0	0	0
<i>P. convolvulus</i>	10	10	17	10	58	36	0	23
<i>Matricaria inodora</i>	0	0	0	0	0	0	0	0
<i>Papaver rhoeas</i>	1	0	0	0	0	3	0	0
<i>Convolvulus arvensis</i>	0	0	0	0	0	0	0	0
<i>Vicia villosa</i>	0	0	0	0	0	0	0	0
<i>Xanthium spinosum</i>	0	0	0	0	0	0	0	0
Weeds/m ²	458	216	206	202	311	152	84	90
Weed dry weight kg/ha	4320	2310	1780	1480	4180	2260	1380	580

Table 11. Weed infestation of winter wheat depending on crop rotation and fertilization, July 2016-2018

Weed species, %	No Po				N9o P6o			
	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn	Monocrop	2-yr rotn	3-yr rotn	4-yr rotn
<i>Setaria glauca</i>	82	66	64	86	23	70	56	76
<i>Centaurea cyanus</i>	1	5	4	0	19	2	7	1
<i>Sorghum halepense</i>	3	15	10	4	4	2	8	1
<i>P. convolvulus</i>	12	14	16	3	52	22	37	21
<i>Matricaria inodora</i>	1	0	0	0	0	0	2	1
<i>Papaver rhoeas</i>	1	0	0	0	1	1	0	0
<i>Convolvulus arvensis</i>	0	1	1	7	1	0	0	0
<i>Vicia villosa</i>	0	0	0	0	0	3	0	0
<i>Xanthium spinosum</i>	0	0	5	0	0	0	0	0
Weeds /m²	279	190	173	136	188	125	77	82
Weed dry weight, kg/ha	2243	1416	1503	1246	3177	1630	1450	877

Weed density: LSD 5%:

Cropping system (CS) – 6.0;

Fertilization (F) – 5.4

CSxF – 5.0

- **Cropping system and fertilization** had an obvious effect on weed infestation measured by weed density and biomass, floristic composition and dominance. In a long-term field experiment involving monocrops and crop rotations of varying diversity, the greatest weed infestation occurred in continuous monocrops and decreased significantly according to the increasing diversity of crops in the rotation.
- Generally, *the fertilization favoured the weed infestation*, but this depended on the crop and the weather.
- Over the years, weed density increased and the number of species decreased.
- The dominant arable weeds are black bindweed (wild buckwheat) *Polygonum convolvulus*, ivy-leaved speedwell *Veronica hederifolia*, and yellow foxtail *Setaria glauca*.
- In view of the imperative of reducing pesticide usage and production costs, it is recommended to avoid continuous monocrops and adopt diverse crop rotations that diminish weed infestation, and the incidence of pests and diseases, as well as substantially reducing production costs.



**THANK YOU FOR YOUR
ATTENTION!**