dr hab. Inż. Anna Wenda-Piesik

FACULTATIVE CROPPING OF WHEAT IN THE CONTEXT OF THE RISKS POSED BY PESTS, WEEDS AND DISEASES

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Anna Wenda – Piesik
Dep. of Plant Growing Principles and Experimental Methods

Faculty of Agriculture and Biotechnology
University of Technology and Life Sciences in Bydgoszcz
Poland

Agriculture

In Poland

Number of farms – 1, 543, 000

Total population of people actively farming – 4, 250, 000

Average area of farm – 12 ha (farms with over 300 ha make up 15 % of farmlands)

Growing season in Poland lasts 205-220 days

In total country area :

Farmlands - 57 %

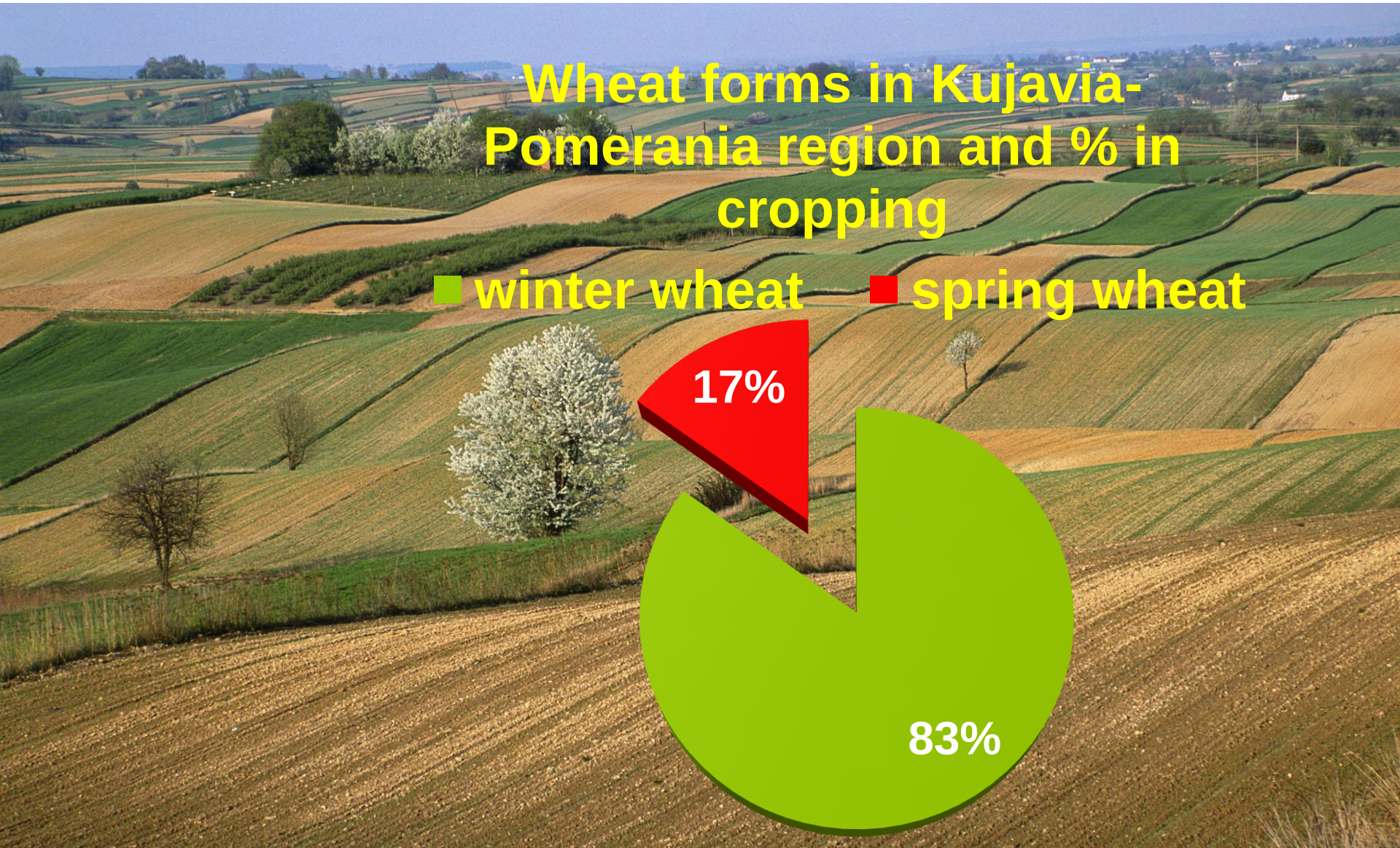
Field crops – 44 %

Meadows &pastures – 21%

Orchards – 1 %

Cereals crops – 71 % of total field crops

In Poland 15,4 mln ha are rural areas, 10,5 mln ha crop land, 2,26 mln ha - WHEAT



SUSTAINABLE AGRICULTURE
Features at the national level:

According to
National Institute of Soil Science and Plant Cultivation in Pulawy

Rational use of agricultural production and maintenance soil capabilities,

Ensure food self-sufficiency of the country

Production of safe food

Production of raw materials with desired, expected by consumers and industry quality parameters

Reduction or elimination of threats to the environment and care the conservation of biodiversity;

Getting in agriculture income allowing for comparable with other sectors of economy fee work

Provide funds for modernization and development

The world grows about 220 million hectares of wheat, of which 75 million ha

Winter and facultative form

Facultative forms of wheat as compared to winter wheat are:

1. less resistant to frost and winter hardiness,
2. require a shorter period of vernalization,
3. faster start vegetation in the spring
4. growth and ripening is faster

SPRING WHEAT CULTIVARs:

CAT.

A. Qualitative
B. Bread
C. General utility

Recognition of facutative wheat in Poland:
This is spring cultivar with atributes :

1. Improved resistance to frost in the early stages of development BBCH 07-13
2. the cold hardiness greater than the other cultivars
3. useful for the late autumn sowings

Yield and winter hardiness of the best varieties in 2010-2012 – region of Kujavia and Pomerania

Research Centre for Cultivar Testing (COBORU)

Cultivar	Grain yield dt/ha	Winter hardiness (%)
Bombona (PL)	75,4	63
Katoda (PL)	76,5	61
Monsun (GE)	73,2	58
Ostka Smolicka (PL)	77,0	71
Tybalt (PL)	76,5	67
Parabola (PL)	65,0	61

1. The main reasons and interest of FACULTATIVE CROP

wheat producers want to overcome the early spring drought

The weather conditions at Mochełek Experimental Station (17°13' E; 53°13' N)

Characteristic	Decade	Months in 2010/2011										
		X	XI	XII	I	II	III	IV	V	VI	VII	VIII
Rainfall (mm)	1	9,2	0	16,8	39	3,3	3,7	11	9,9	11	36	29
	2	4	5,4	18,1	17	13,5	3,5	2,1	16	68	27	2
	3	0	3,6	11,3	7,2	12,8	8,2	13	0	55	53	21
Total in month (mm)		**13,2**	**9**	**46,2**	**63**	**29,6**	**15,4**	**27**	**25**	**134**	**116**	**52**
Average from 1949-2011		32,8	33	31,8	24	19,1	24,5	27	43	54	73	53
Temperature (C°)	1	12,5	5	3,4	3,1	-14	0,6	3,2	14	13	21	18
	2	5,9	-0,1	2,2	1,2	-3,6	5,7	7,6	13	16	16	17
	3	6,9	3	2,6	-4,6	2,5	7,2	14	17	17	20	17
Average in month (C°)		**8,4**	**2,7**	**2,7**	**-0,3**	**-5,4**	**4,6**	**8,4**	**15**	**15**	**19**	**18**
Average from 1949-2011		8,1	3,1	-0,6	-2,3	-1,5	1,9	7,4	13	16	18	18

2. The main reasons and interest of FACULTATIVE CROP

FOLLOWING the forecrops late coming down from the field:

Corn for grain

Sugar beet

3. The main reasons and interest of FACULTATIVE CROP

sandy soil for shallow cultivation

FAVORS

to enter with equipment in the autumn

4. The main reasons and interest of FACULTATIVE CROP

grain quality:
* total protein content
* gluten
* falling number
* sedimentation

are better in these varieties
than
in winter wheat varieties

CULTIVATION BEFORE SOWING

Forecrop

- **Corn**
- tillage is needed to cover a large amount of post-harvest residues and the Campbell's shaft

Forecrop

- **Sugar beet**
- Active tool unit for seedbed with Gruber's section

Forecrop

- **Wheat**
- plowing after harvesting wheat in mid-September, Roundup Energy, tillage with Campbell's shaft

SOWING DATES

NOVEMBER-
DECEMBER

OCTOBER

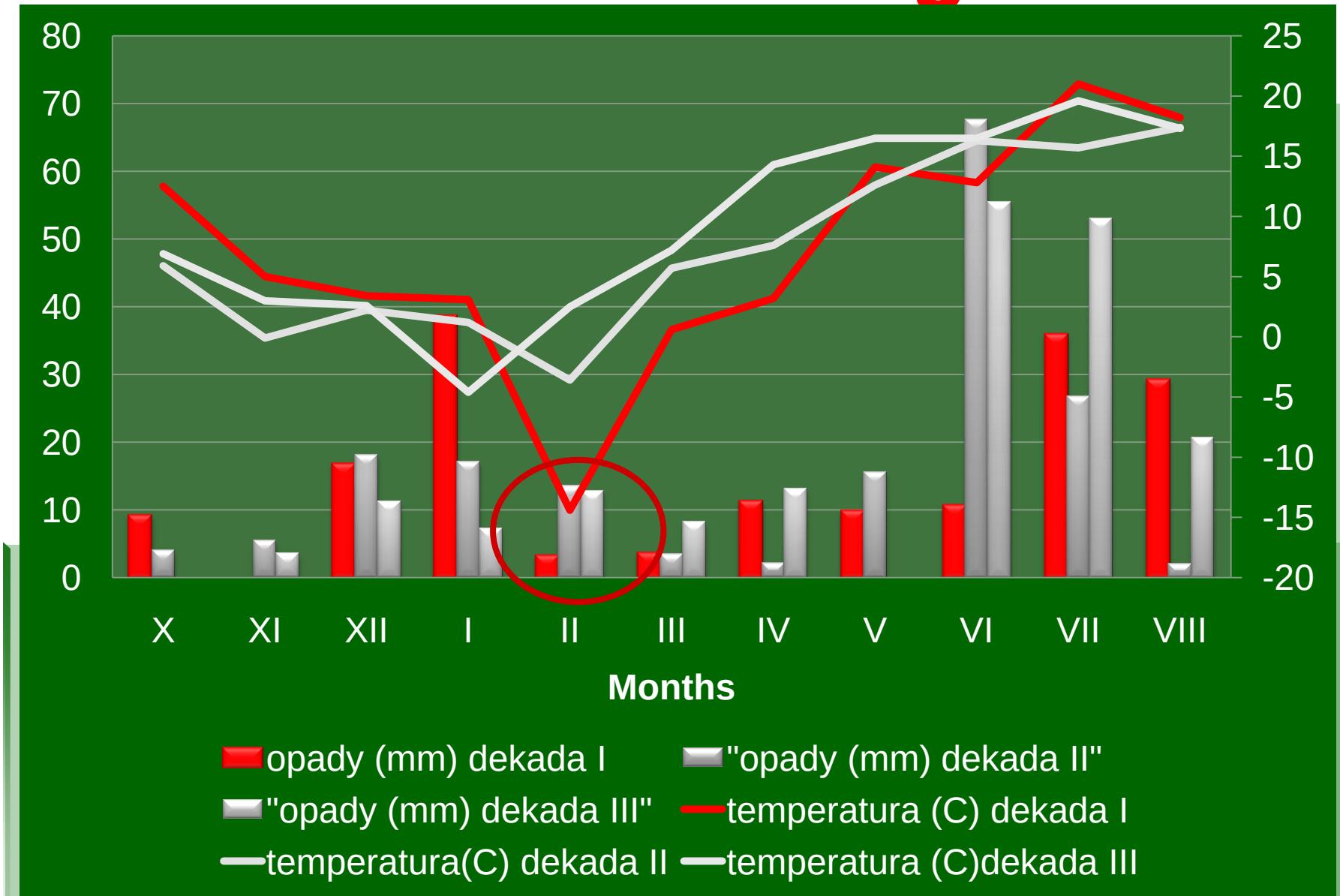
LATE EARLY
FECULTATIVE

Threats...

abiotic stress

Soil	Winter	Spring
• Too heavy • Too wet • Too loose	• Without snow cover • Temperature below -15^{0}C	• Delate in growing season

Harsh winter 2011-2012 – limiting



favorable conditions

Seedlings are in soil, covered by the snow


Good luck ...

Threats...

biotic

Pests	Weeds	Diseases
• Cerael leaf beetle • Cereal aphids	• Monocots • Dicotyledonous (winter, wintering and spring forms)	• Foot root rot complex • Rusts • Powdery mildew • Septoria • FHB (Scab)

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PESTS OF WHEAT

The incidence of wheat pests as a response to the term of sowing and intensity of control

***Oulema* sp.**

Cereal leaf beatles

PESTS OF WHEAT

Aphids

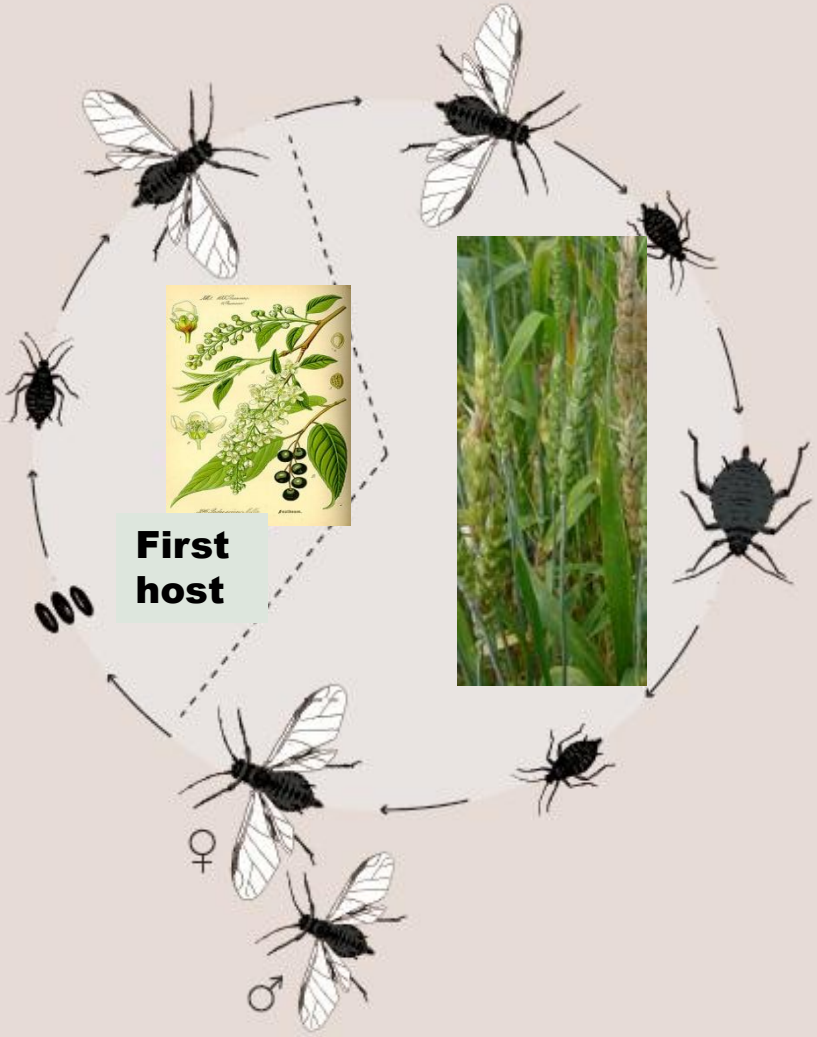
Rhopalosiphum padi

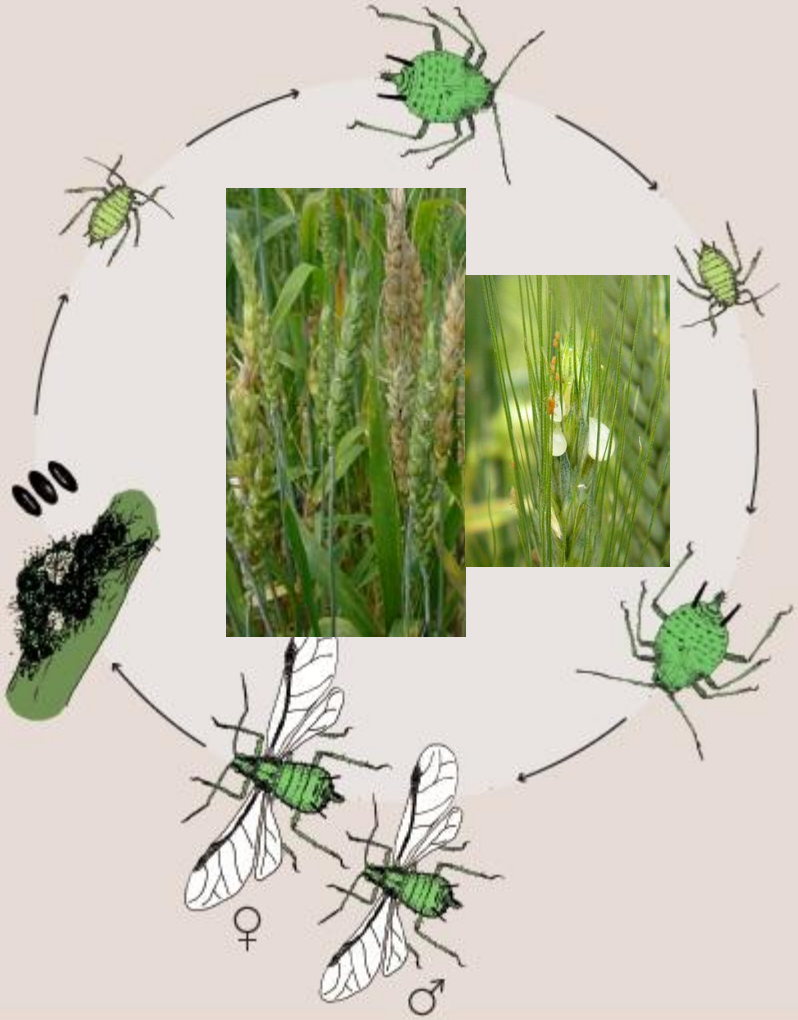
Metopolophium dirhodum

Sitobion avenae

ALERT !

Bird cherry grain aphid anholocyclic forms in the autumn sowings of spring wheat, which can cause infection with the BYDV.





holocyclic

anholocyclic

FIELD EXPERIMENT-pest control program

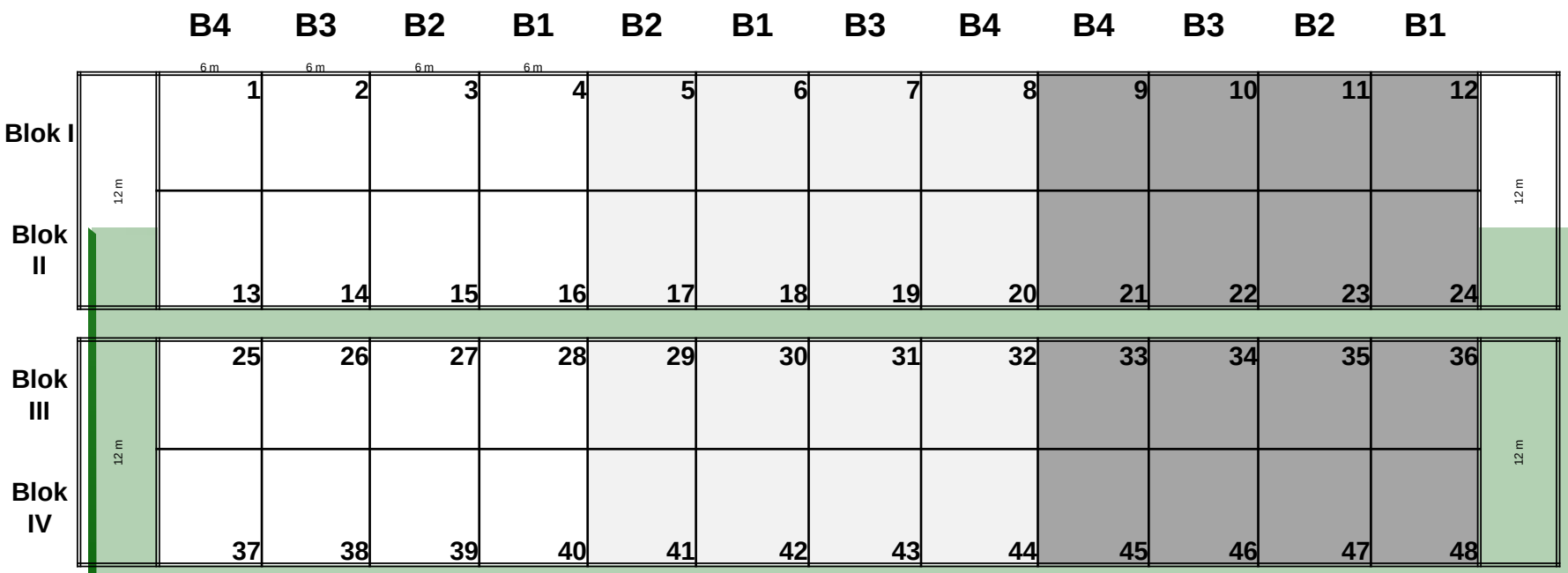
1st - term seeding of spring wheat cv. Monsun:

a1 – early facultative (October 2nd decade),
a2 – late facultative (after November 3rd decade),
a3 - spring (March 25 - April 5),

2nd – treatments against pests:

b1- control, lack of insecticidal seed treatment + no interventional insecticides,
b2 – lack of insecticidal seed treatment + interventional mixtures of insecticides,
b3 – insecticidal seed dressing + no interventional insecticides,
b4 – insecticidal seed dressing + interventional mixtures of insecticides.

Experimental layout



2012 date of sowing

13.10

29.11

23.04

B1 BAYTAN,

B2 BAYTAN + insecticides

B3 ASTEP 225FS,

B4 ASTEP 225FS + insecticides

THIS PROGRAM IS BASED ON:

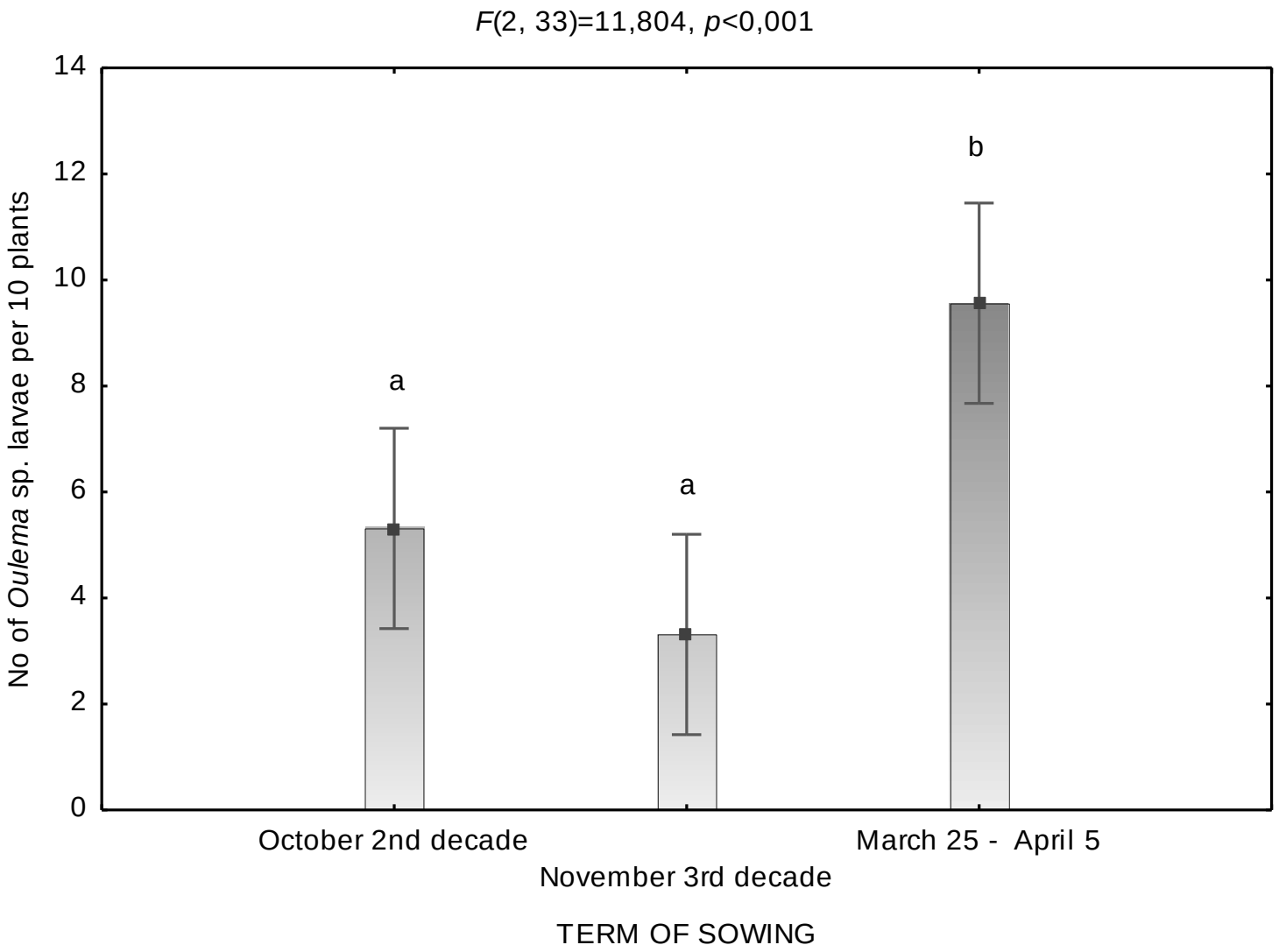
The insectidical seed treatment

Astep FS 225 for wheat having a double track: against diseases (prothioconazole) and against pests containing imidacloprid

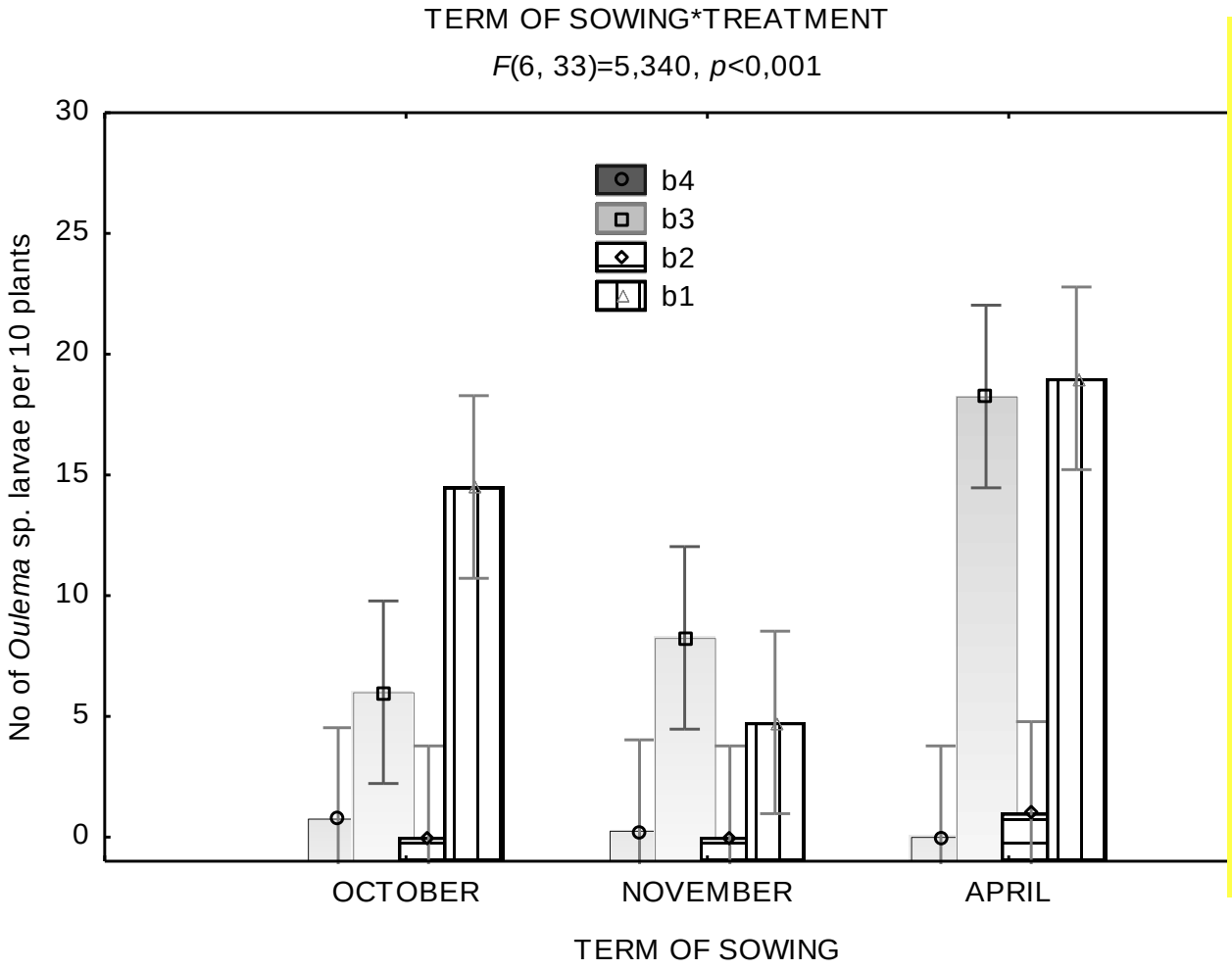
The use of interventional treatment in the form of active substances mixture applied at BBCH 31-34

The active substances:
chlorpyriphos + cypermethrin + dimethoate + pirimicarb towards control of cereal leaf beetles and aphids

The occurrence of *Oulema* on wheat depending on term of sowing.

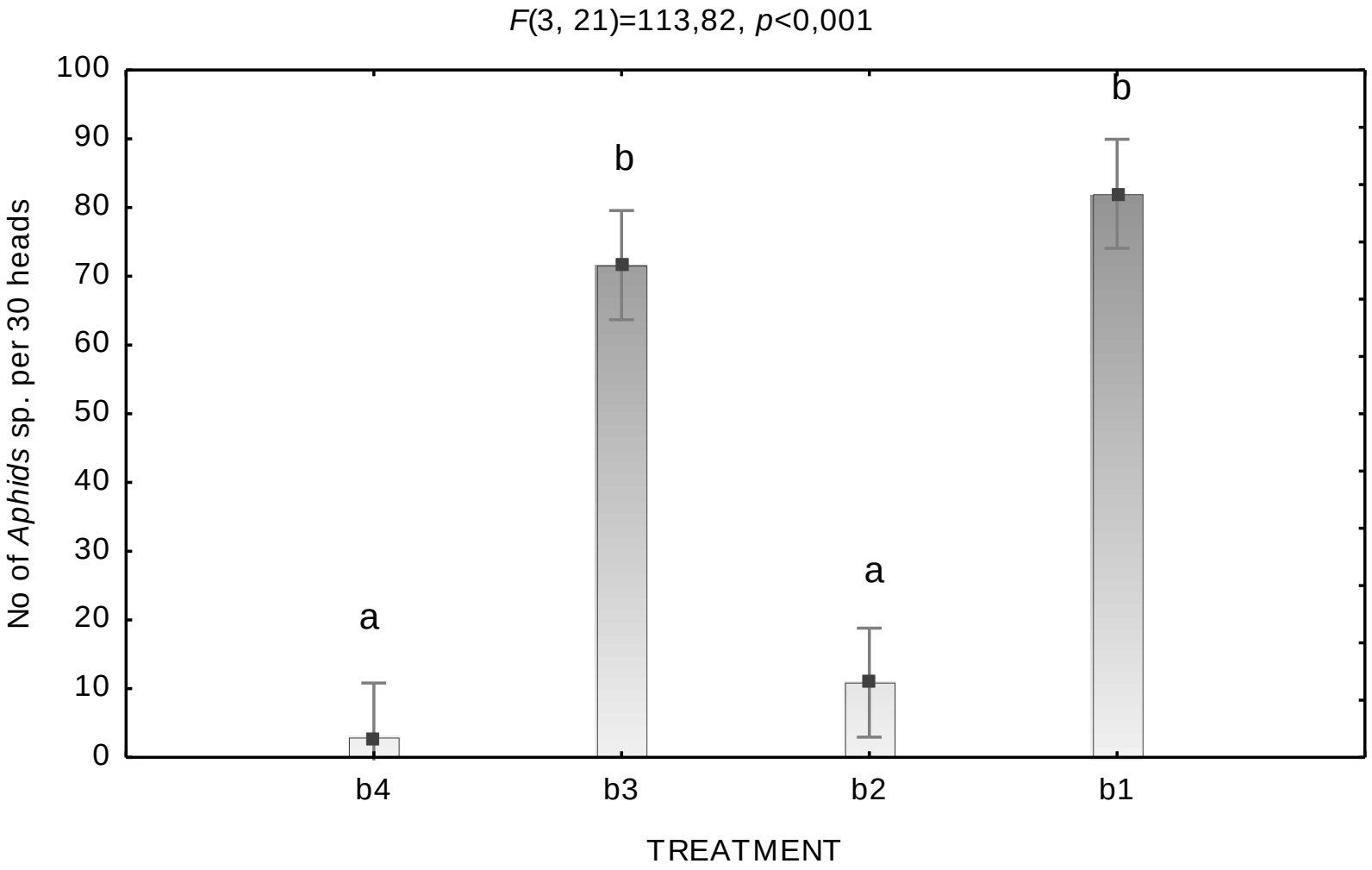


The occurrence of *Oulema* on wheat depending on term of sowing and intensity of plant protection.



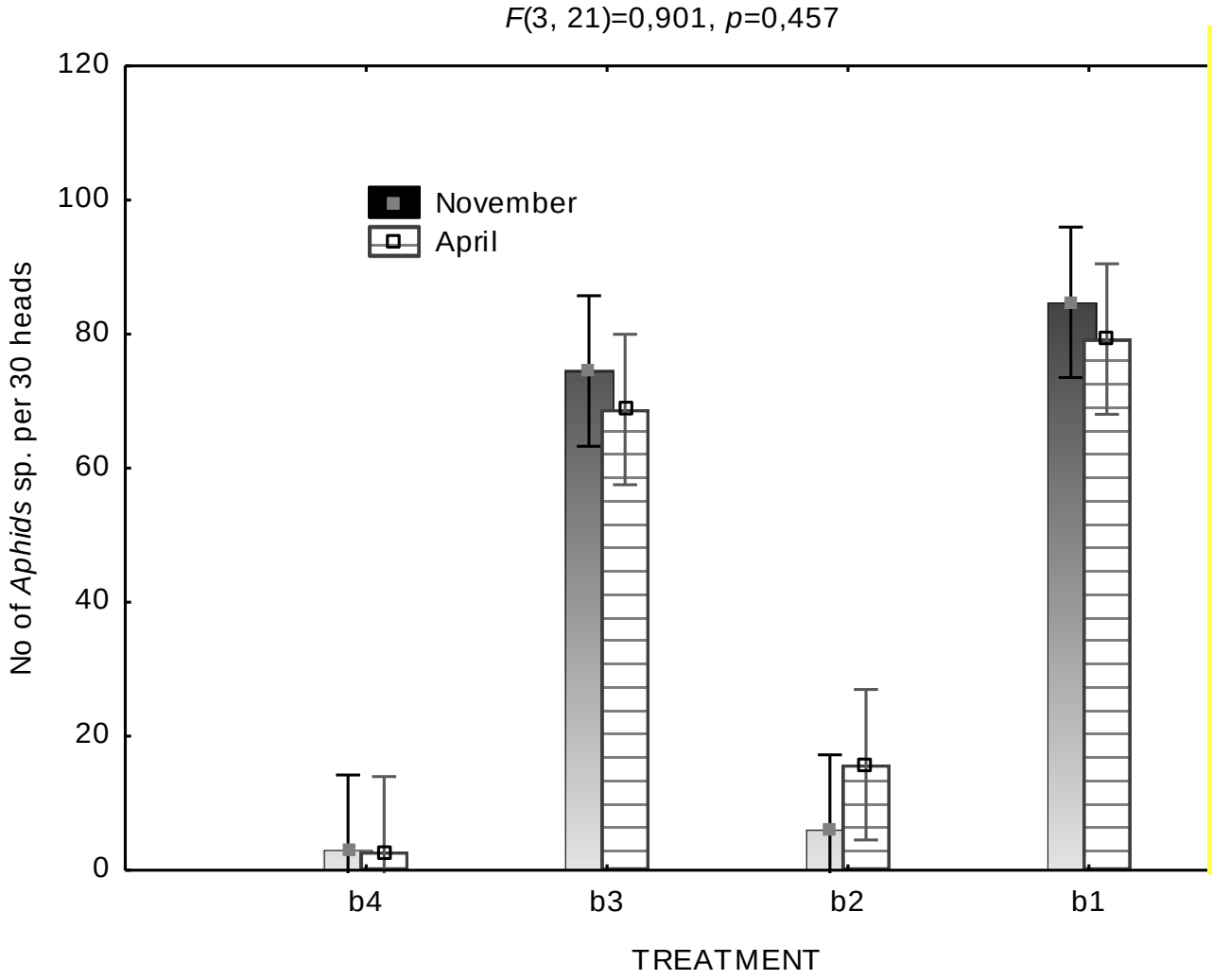
b1- control, no insecticidal seed treatment + no interventional insecticides,
b2 – no insecticidal seed treatment + interventional mixtures of insecticides,
b3 - insecticidal seed dressing + no interventional insecticides,
b4 - insecticidal seed dressing + interventional mixtures of insecticides

The occurrence of *Aphids* on wheat heads depending on intensity of plant protection.



b1 - control, lack of insecticidal seed treatment + no interventional insecticides
b2 - lack of insecticidal seed treatment + interventional mixtures of insecticides
b3 - insecticidal seed dressing + no interventional insecticides
b4 - insecticidal seed dressing + interventional mixtures of insecticides

The occurrence of *Aphids* on wheat heads depending on term of sowing and intensity of plant protection.



b1- control, no insecticidal seed treatment + no interventional insecticides,
b2 – no insecticidal seed treatment + interventional mixtures of insecticides,
b3 - insecticidal seed dressing + no interventional insecticides,
b4 - insecticidal seed dressing + interventional mixtures of insecticides

Conclusions regarding pests

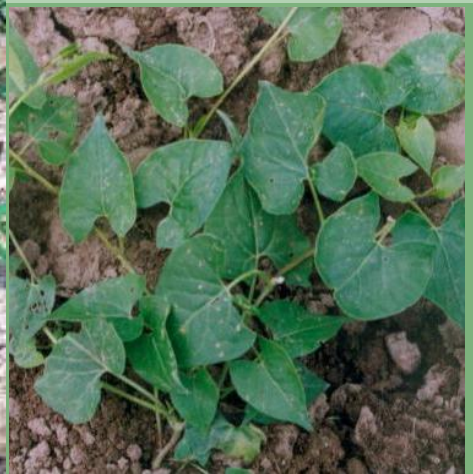
Wheat sown in facultative terms was less susceptible to *Oulema* sp. larval damage than sown in April due to faster growing in the spring.

Anholocyclic form of cereal aphids occurred in one year at the ratio 1/10 – 1/3 not giving any damaged effect in the next year.

The number of aphids on wheat heads under insecticidal control (chlorpyriphos + cypermethrin + dimethoate + pirimicarb) was 7-8 fold lesser than on wheat treated with imidachloprid in seed dressing.

Significant efficacy of imidachloprid in control of cereal leaf beetles without application of insecticides was proved only in the earliest term of facultative sowing.

WEEDS OF FACULTATIVE WHEAT



Lp.	Round up	Herbicide	Liczba chwastów na 2 m kw – Chwasty dwuliścienne: Fiołek polny	Komosa biała	Babka zwyczajna	Rdest powojowy	Rdest ptasi	Bodziszek drobny	[illegible]	...pospolita Żółtica	Tasznik Gwiazdnica	Tobołki	Przetacznik perski	[illegible]	Koniczyna, Przetacznik	Krzywpszyj	Perz właściwy	Bylica pospolita	Mniszek	Rumian	Rzepak	Ostrożeń	Ostropest	Przetacznik orzankowy	Rdest kolankowy	Jasnota różowa	[illegible]	Maruna, Fałusznik	Bylica pospolita	Przytulica czepna	SUMA DWULIŚCIENNE	powietrznie sucha masa (g) dwuliścienne	Liczba chwastów na 2 m kw – Jednoliścienne: Wiechlina roczna	Chwastnica jednostronna	Miotła zbożowa	SUMA JEDNOLIŚCIENE	powietrznie sucha masa (g) jednoliścienne
1	BR	B6		1		9		3															8								**21**	25,52	3	21		24	4,77
2	BR	B5	6										2										8			1			1	4	**22**	7,18	14	21	1	36	19,13
3	BR	B4	11					4					5										10							4	**34**	2,75				0	
4	BR	B3	7	20	1			1											1			4	11								**45**	27,4				0	
5	BR	B2	17			7																								2	**26**	6,85				0	
6	BR	B1	39	92	7	2		4	1		9		1									4								1	**160**	174,6		13	4	17	15,54
7	ROUND	B1	28	72	5		4	2			4																	3			**118**	229,5				0	0,97
8	ROUND	B2	43			1							5															1			**50**	18,79	14	2		16	4,71
9	ROUND	B3	30	39	13								4																		**86**	36,81				0	
10	ROUND	B4	40	3	2			5					4					2								1					**57**	19,45	5	16	1	22	28,15
11	ROUND	B5	35					2																							**37**	4,06				0	
12	ROUND	B6	28	2	1	5		2					7																		**45**	8,03	91	40		131	35,73
13	BR	B6			2		1	2					14										8							2	**29**	15,06		287		287	22,48
14	BR	B5	1		1	1																5	8							3	**19**	5,5		33		33	4,29
15	BR	B4	10								1												8			2					**21**	10,74	7	6	3	16	17,22
16	BR	B3	18	15	2			1			2		2									25	12								**77**	94,34	5	3		8	5,28
17	BR	B2	28	13		1		4					1										1	1		1					**50**	20,3	2	29		31	3,11
18	BR	B1	37	16	1			11	2	10	38		3				1				1										**120**	564,4	12	61	5	78	60,16
19	ROUND	B1	38	33	1			17	8		8	1																			**106**	253		16		16	3,93
20	ROUND	B2	30			1		3					1																		**35**	7,54	3			3	0,33
21	ROUND	B3	16	11	6			2																							**35**	26,17	10			10	4,6
22	ROUND	B4	22			2		7																							**31**	3,23	5	16		21	1,03
23	ROUND	B5	10		1													2													**13**	2,29	1	8	1	10	8,03
24	ROUND	B6	7	2	1	3		1																							**14**	1,52		98		98	3,63
25	ROUND	B6	1			2														6			8								**17**	8,71	4	42		46	25,57
26	ROUND	B5	11				3																	5							**19**	1,92	22	115		137	17,47
27	ROUND	B4	14		1			1											1				11	24		3				2	**57**	17,31	11	170		181	17,73
28	ROUND	B3	35	12	3								6	1									4		3						**64**	43,59	1	36		37	2,05
29	ROUND	B2	31	8	2	4	14	6												1											**66**	51,08	3	205		208	22,55
30	ROUND	B1	23	74	3	8	14	7			16											20			1			2			**168**	763,5				0	44,19
31	BR	B1	40	70	1	13	1	24	2	1	23								1			8						8			**192**	695,44		272		272	84,46
32	BR	B2	81	1		3	1	8	4							3				2			10					11		4	**128**	32,43	19	100		119	11,15
33	BR	B3	69	39	14			5																							**127**	91,01	4	188		192	10,07
34	BR	B4	60					7														10				3					**80**	59,78	4	624		628	61,22
35	BR	B5	31									6														1					**38**	4,98		682		682	39,39
36	BR	B6	40	5	5	17		4					3													1					**75**	11,47	6	981		987	51,97
37	ROUND	B6	1			16	1	3					1										31								**53**	13,12	7	37		44	4,58
38	ROUND	B5	5										1						2				7								**15**	2,24	5	20		25	2,2
39	ROUND	B4	3				2	8					4										9	4		2					**32**	4,72	9	16		25	5,59
40	ROUND	B3	21	30	1								1							1		1	4		3						**62**	66,26	5	26		31	3,19
41	ROUND	B2	10	3		2	10	2					1		3										2						**33**	34,34	4	47		51	8,41
42	ROUND	B1	28	51		4	6	4			3											5		1		1					**103**	724,9		61		61	8,49
43	BR	B1	13	91		2	27	10	5																		2	1			**151**	1422,2	1	266		267	51,64
44	BR	B2	33	11		4	2						1						1					2							**54**	34,92		9		9	0,68
45	BR	B3	22	33				1																				3			**59**	750,93	3	80		83	12,53
46	BR	B4	13	2	3		7	5																							**30**	9,29	14	66		80	27,39
47	BR	B5																													**0**	1,18				0	210,75

FIELD EXPERIMENTS (2010-2014)

Weed control program

Experimental Station in Mochełek

The weed infestation in facultative wheat crop as the response to herbicidal active substances

A – post harvest glyphosate application

a1 – Roundup Energy 450 SL at a dose of 2.0 l per ha

A2 – No Roundup

B - application and herbicide active ingredient

b1 - no herbicidal control,

b2 - MCPA (Chwastox Extra 300 SL 1.5 l per ha) + sulfosulfuron (Apyros 75 WG 15g per ha) + adjuvant Atpolan 80 EC at 25-29 BBCH,

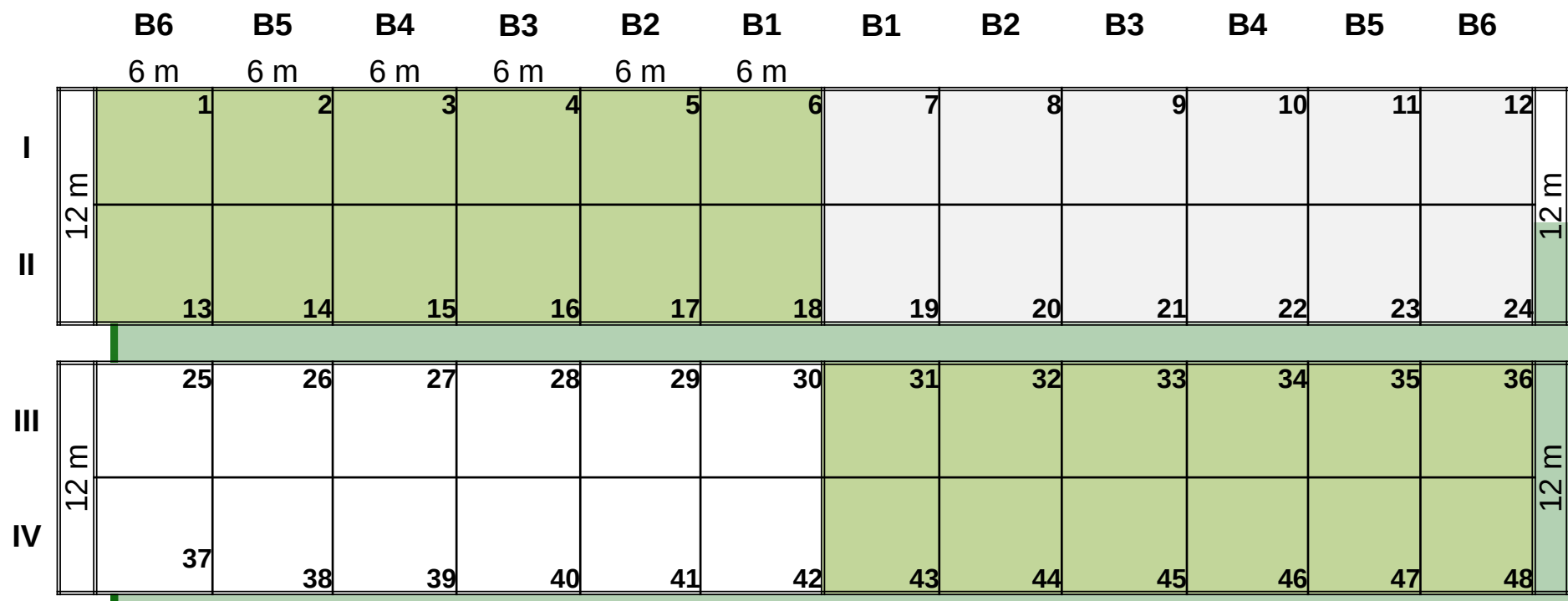
b3 - fluoksypyr and florasulam (Starane Super 101 SE 1l) + sulfosulfuron (Apyros 75 WG 15g per ha) + adjuvant Atpolan 80 EC at 25-29 BBCH,

b4 - diflufenican and isoproturon (Mustang 600 SC 1.25 l per ha) at 23-25 BBCH,

b5 - thifensulfuron-methyl and chlorsulfuron (Chisel 75 WG 40 g per ha) + sulfosulfuron (Apyros 75 WG 15g per ha) + adjuvant Trend 90 EC,

b6 – tribenuron methyl (Helmstar 25 g per ha) + adjuvant Atpolan 80 EC at 25-29 BBCH.

Experimental layout



no glyphosate

glyphosate

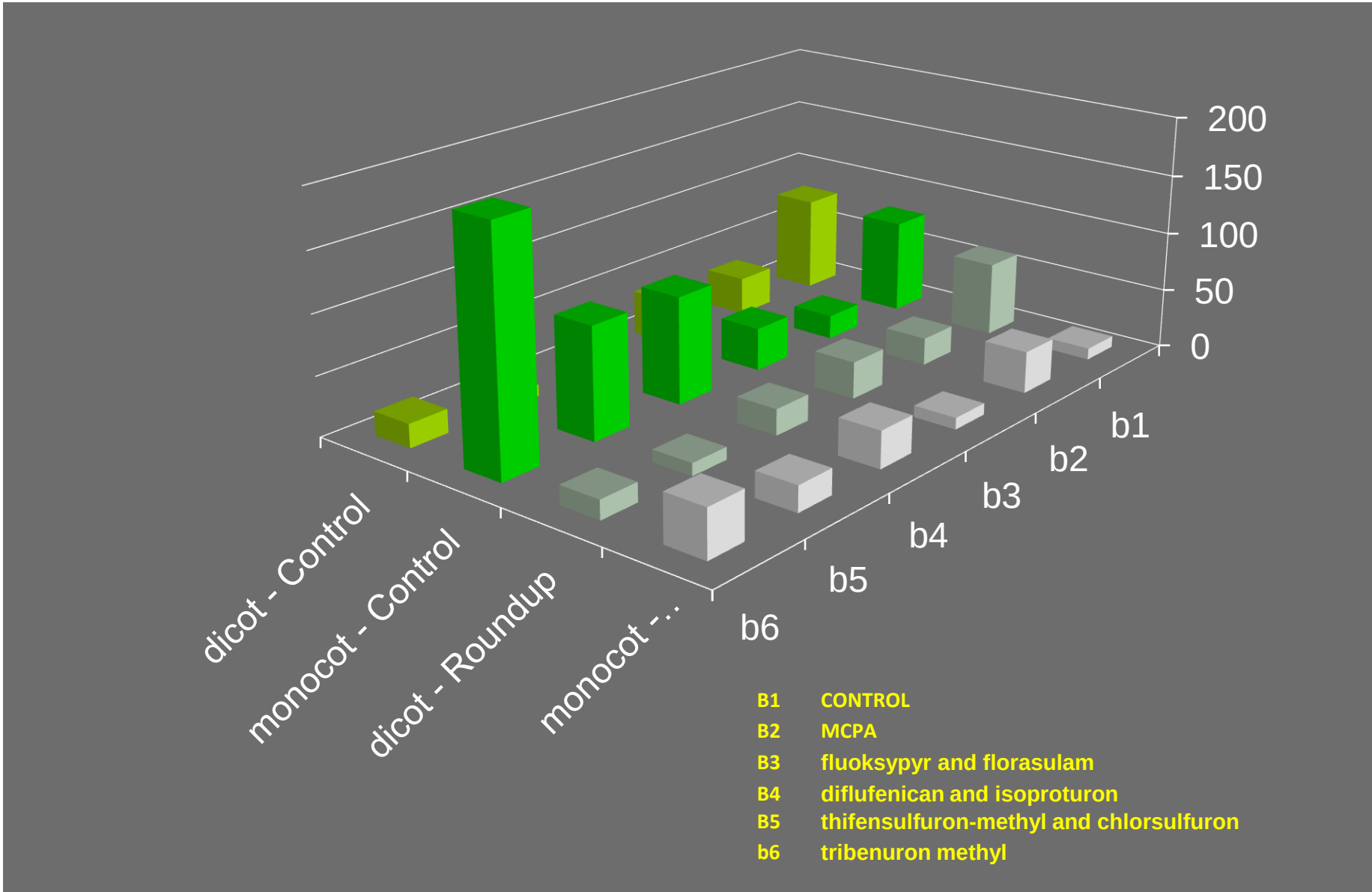
B1	CONTROL
B2	MCPA
B3	fluoksypyr and florasulam
B4	diflufenican and isoproturon
B5	thifensulfuron-methyl and chlorsulfuron
B6	tribenuron methyl

Number of individuals and the biomass of weeds in dicot- and mono-cotyledon classes depending on the herbicidal control in facultative wheat.

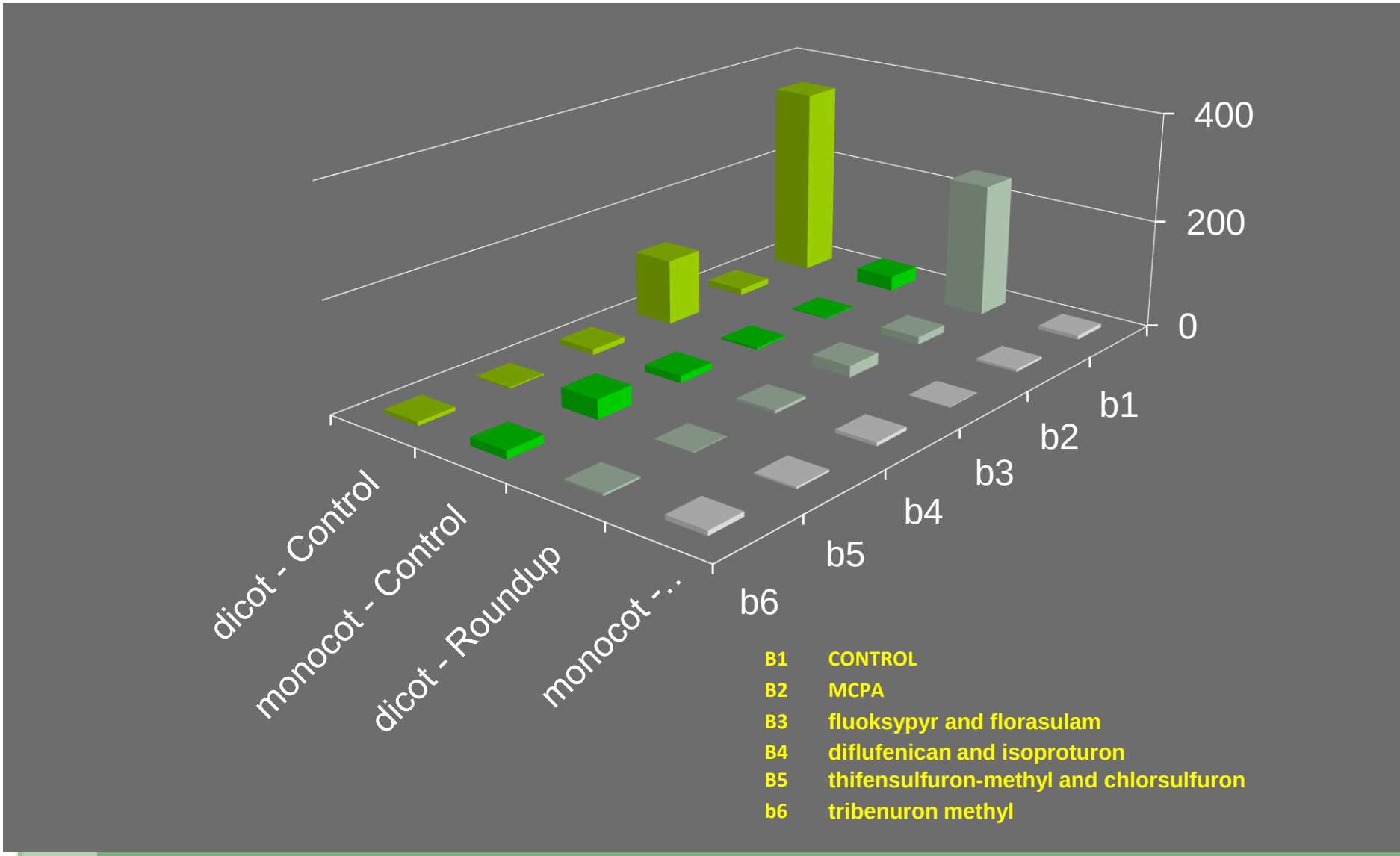
Herbicidal treatment	Number of dicotyledonous per sqm	Weight (g) of dicotyledonous per sqm	Number of monocotyledons per sqm	Weight (g) of monocotyledons per sqm
b1	**69.9±5.7 d**	**301.7±72.19 b**	44.4±20.3	16.84±5.44
b2	27.6±5.7 bc	12.89±2.63 a	27.3±12.9	3.18±1.36
b3	34.7±5.0 c	71.03±43.75 a	22.6±11.6	2.36±0.8
b4	21.4±3.5 abc	7.95±3.32 a	60.8±37.6	9.89±3.54
b5	10.2±2.2 a	1.83±0.37 a	57.7±41.2	19.39±13.12
b6	18.0±3.7 ab	5.52±1.29 a	**128.4±57.9**	11.88±3.26

B1 CONTROL
B2 MCPA
B3 fluoksypyr and florasulam
B4 diflufenican and isoproturon
B5 thifensulfuron-methyl and chlorsulfuron
b6 tribenuron methyl

Number of dicotyledonous and monocotyledonos weeds per sqm depending on herbicide control



Dry weight (g) of dicotyledonousand monocotyledonos weeds per sqm depending on herbicide control



Conclusions regarding weed control

The use of herbicides in facultative wheat plantation only within the spring does not guarantee effective protection against weeds.

The glyphosate (e.g. 2.0 l per ha of Roundup Energy 450 SL) controlled effectively mono and dicotyledonous weeds by reducing their numbers and biomass in more than 75%.

The most effective active substances against dicotyledonous weeds revealed two combinations: thifensulfuron-methyl + chlorsulfuron + sulfosulfuron, and tribenuron methyl.

The application of sulfosulfuron in mixture with MCPA or fluoksypyr + florasulam reduced the monocot weeds more efficient than the other herbicidal substances.

DIAGNOSIS OF THE RISKS POSED BY SOIL BORNE PATHOGENS

FUNGAL DISEASES OF WHEAT

Root rot complex

Fusarium crown rot

Rhizoctonia sp.

FIELD EXPERIMENTS (2010-2014)

1stFACTOR - FORECROP

a1 - monoculture of wheat forms,
a2 - seed corn crop,
a3 – sugar beet.

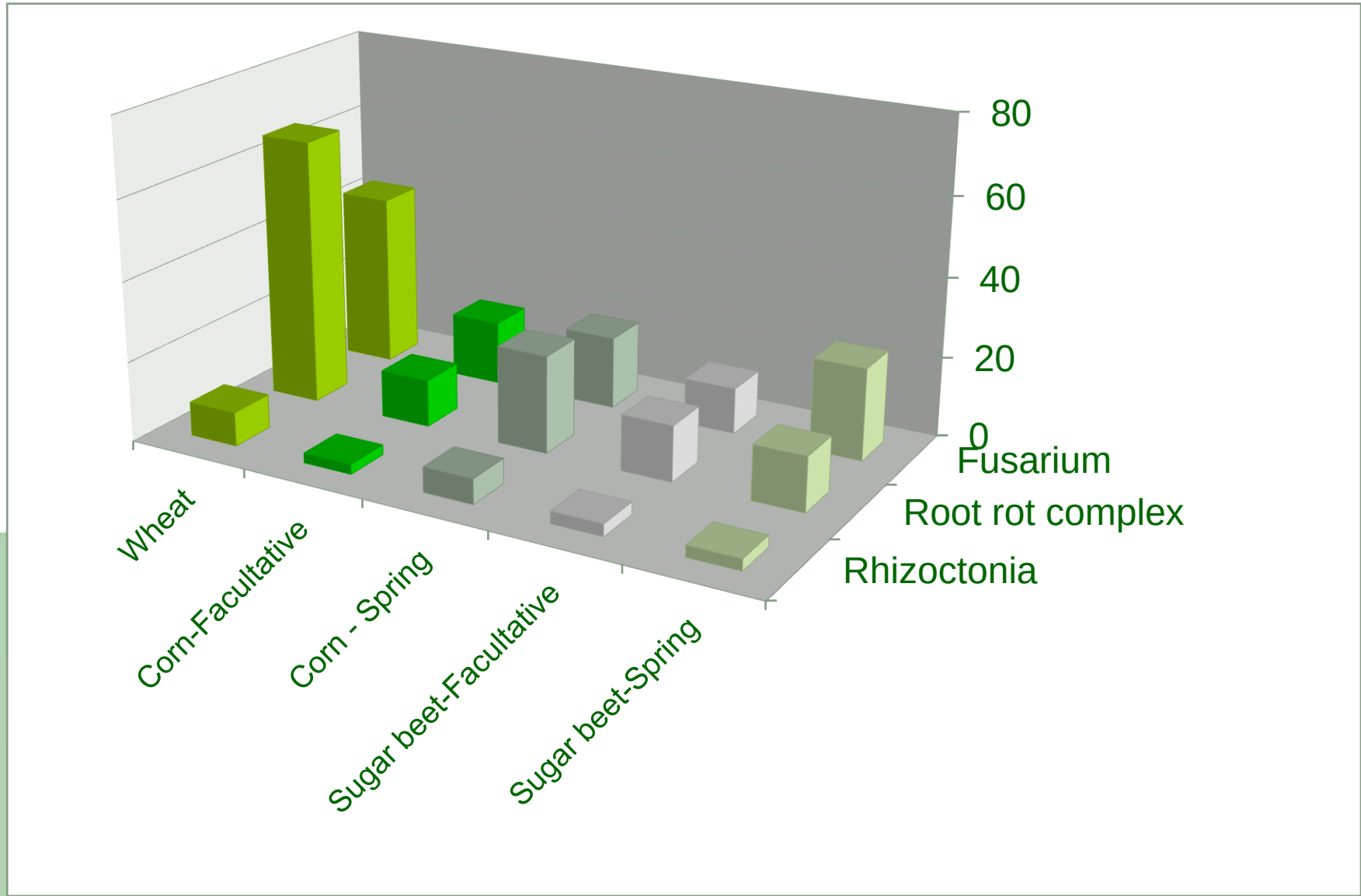
2nd FACTOR - TERM OF SOWING
b1 – facultative
b2 – spring,

Seed dressing
Triadimenol+ imazalil+ fuberidazol

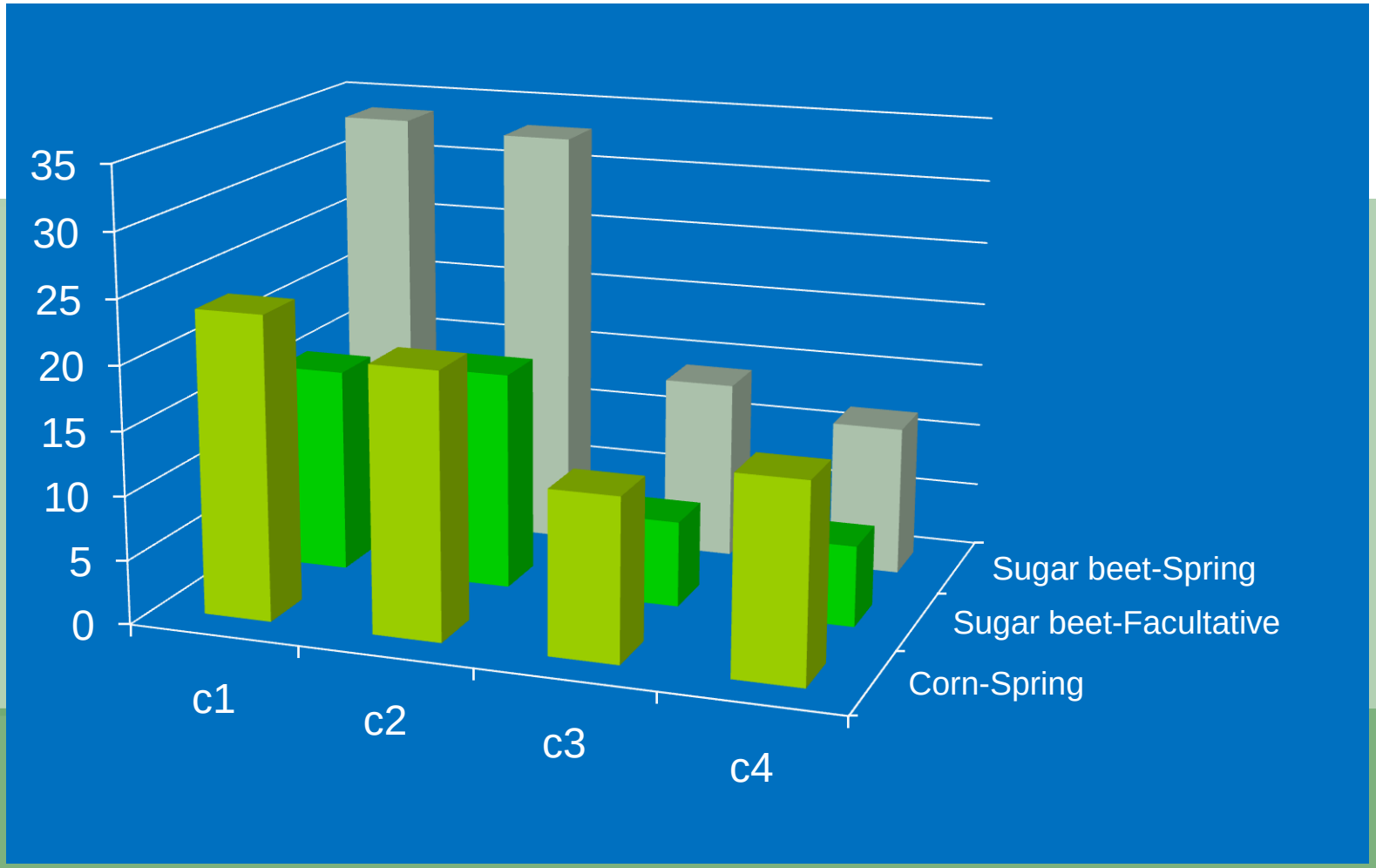
3rd FACTOR – INTENSITY AGAINST DESEASE CONTROL

c1 - control, without protection treatments
c2 – T2 (BBCH 32-65) with prothioconazole and fluoksastrobine,
c3 - T1 (BBCH 30-32) + T2 (BBCH 41-65) with spiroxamine and prothioconazole, and mixture of fluoksastrobine and prothioconazole,
c4 - T1 (BBCH 29-31), T2 (BBCH 37-51) and T3 (BBCH 65-69) for the full protection of stem base and roots, leaves and heads
(+ tebukonazole)

Disease indexes (DI) depending on the for-crops, and term of sowing.



DI of *Fusarium* crown rot (%) depending on fore-crops, term of sowing and fungicidal control of wheat



c1 - control,
c2 - prothioconazole and fluoksastrobine at T2 stage,
c3 - spiroxamine and prothioconazole at T1 stage + fluoksastrobine and prothioconazole at T2 stage,
c4 - T1 + T2 (as above) + T3 (tebuconazole).

Micotoxins profile

Treatment			Metabolites (ppb)									
Fore-crop	Fungicide	Cultivar	DON		NIW		ADON		HT-2		ZEA	
			S[1]	F[2]	S	F	S	F	S	F	S	F
Wheat	Control	Monsun	49,75	nw	<3,00	nw	10,80	nw	<2,00	nw	1,76	nw
		Cytra	300,00	nw	6,05	nw	42,40	nw	7,40	nw	7,89	nw
	T1 + T2	Monsun	116,50	nw	3,86	nw	7,27	nw	<2,00	nw	5,67	nw
		Cytra	261,75	nw	12,60	nw	22,46	nw	8,06	nw	3,26	nw
Corn	Control	Monsun	79,30	29,60	3,29	nd	11,60	nd	<2,00	nd	1,07	1,61
		Cytra	707,00	360,00	7,78	nd	103,00	6,53	1,43	<2,00	17,46	24,20
	T1 + T2	Monsun	108,00	11,00	<3,00	nd	21,10	nd	nd	<2,00	0,53	<0,20
		Cytra	702,40	71,60	13,80	3,81	85,50	nd	0,65	nd	5,66	6,22
Sugar beet	Control	Monsun	66,65	169,10	5,58	4,90	14,70	17,30	3,13	4,26	0,71	0,52
		Cytra	260,50	333,00	7,58	12,70	20,63	29,78	13,50	2,9	3,73	3,44
	T1 + T2	Monsun	39,70	71,55	4,66	4,14	6,08	15,30	<2,00	2,51	0,76	1,53
		Cytra	360,50	120,00	7,02	nw	43,80	5,30	11,50	nw	3,01	3,58

Conclusions regarding diseases control

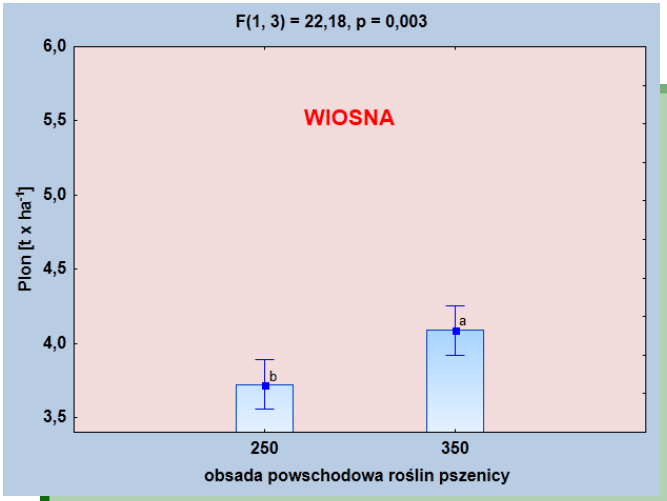
The severity of soil-borne pathogens is more pronounced after fore-crop of wheat than after corn or sugar beet. The strongest symptoms were related with the root rot complex.

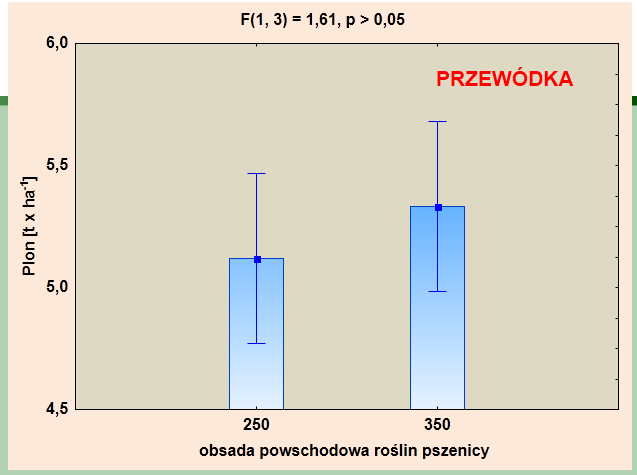
The highest severity of *Fusarium* crown rot pathogens performed on wheat plants cultivated after wheat regardless on the intensification of the fungal control.

Intensive chemical protection with the spiroxamine and prothioconazole at T1 stage + fluoksastrobine and prothioconazole at T2 stage resulted in better reduction of wheat infection by *Fusarium* sp.

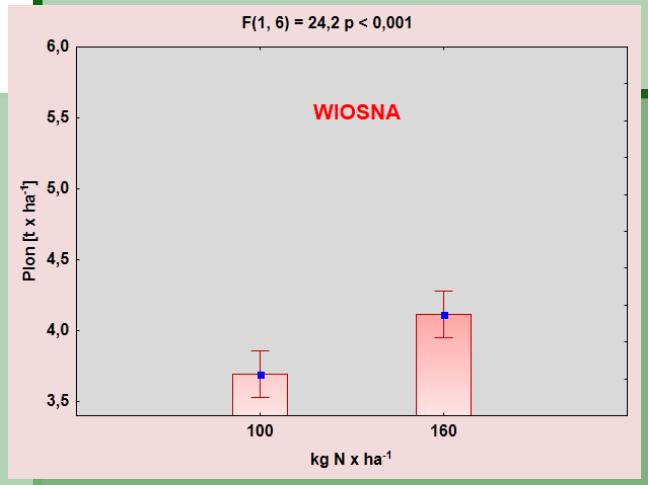
Results of yielding

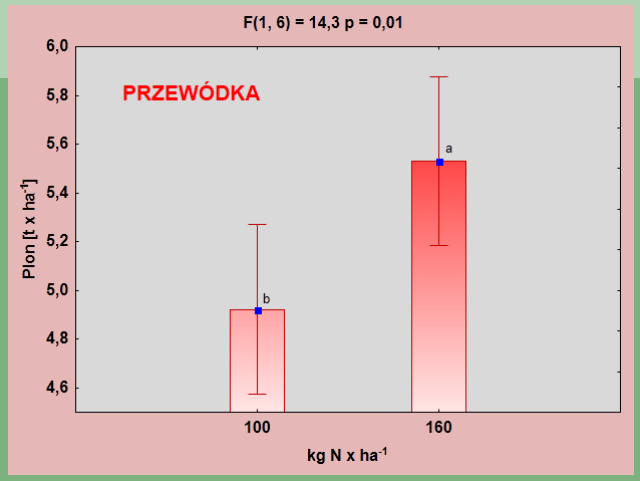
Data from 2009/2010





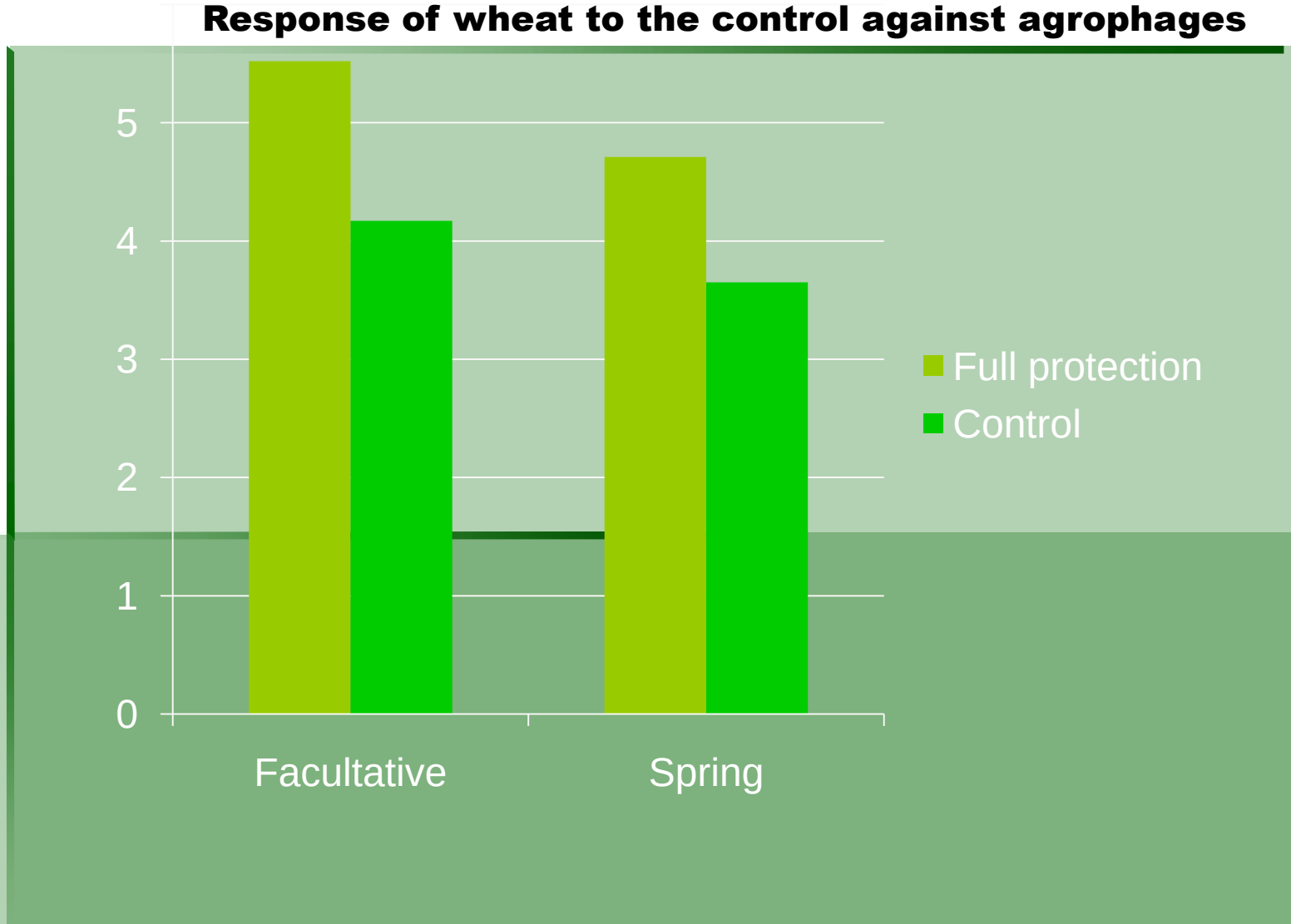
Response to the plant density

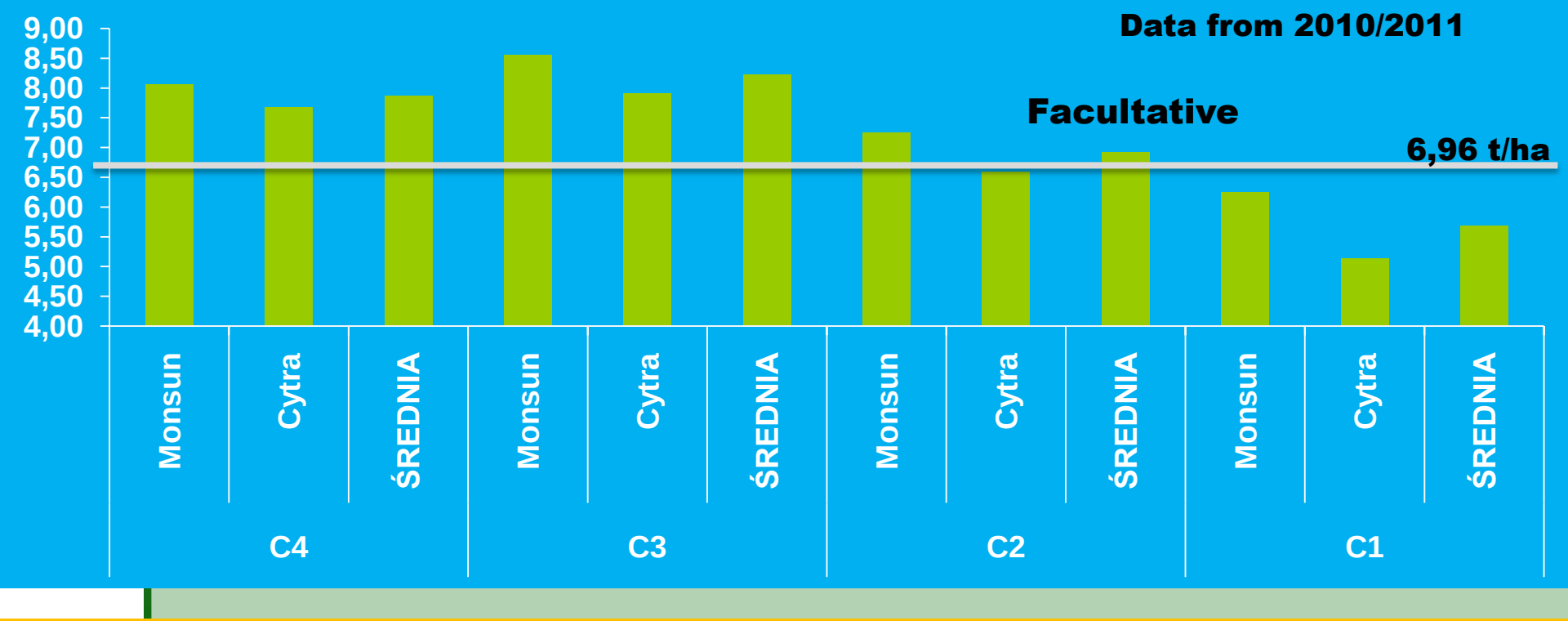


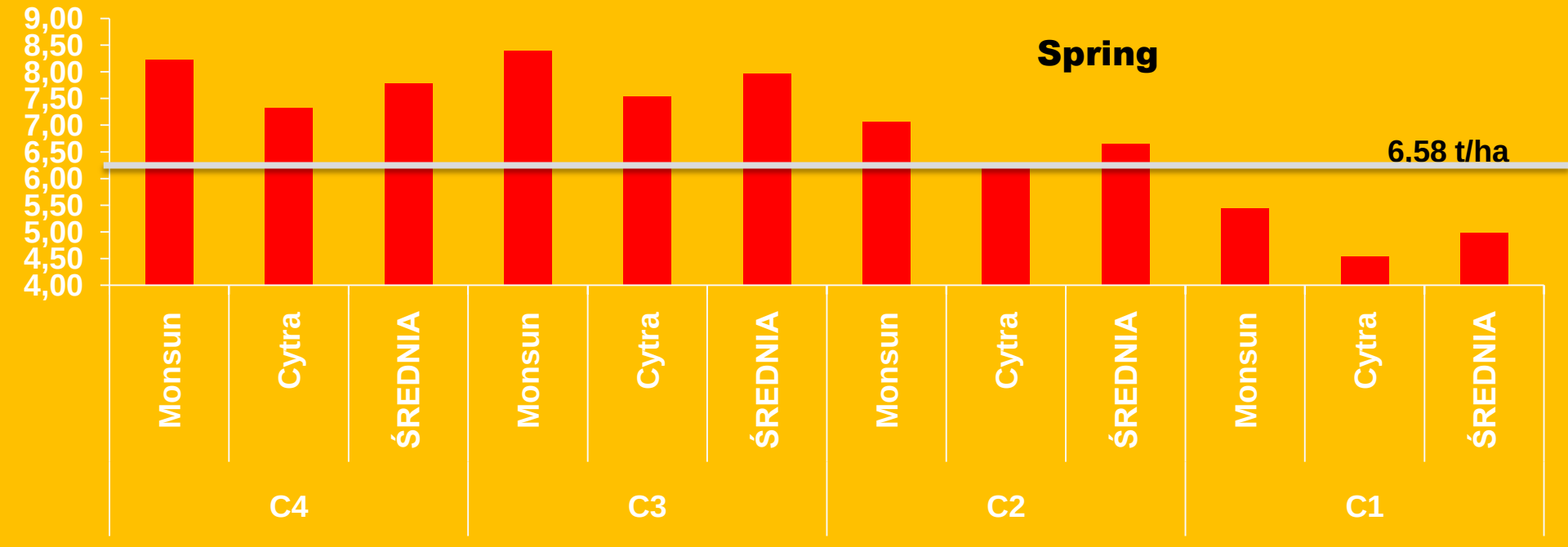


Response of wheat to the N dosage

Data from 2009/2010




Data from 2010/2011
Facultative
6,96 t/ha
9,00
8,50
8,00
7,50
7,00
6,50
6,00
5,50
5,00
4,50
4,00
Monsun
Cytra
ŚREDNIA
C4
C3
C2
C1


Spring
6.58 t/ha
9,00
8,50
8,00
7,50
7,00
6,50
6,00
5,50
5,00
4,50
4,00
Monsun
Cytra
ŚREDNIA
C4
C3
C2
C1

Conclusions

At the current stage of research, more risks for these crops is on the side of abiotic factors.

It is justified to search for varieties with higher frost resistance.

Upon completion of these studies the protection program against agrophages will be elaborated for facultative wheat.

The intention is to continue research into the testing of new varieties.


Thanks for your attention