



Institute of Plant Protection - NRI



PRODIVA

CROP DIVERSIFICATION AND WEEDS

Work package 2:

Crop mixtures for weed suppression

Roman Krawczyk, Sylwia Kaczmarek

Institute of Plant Protection - National Research Institute, Poland

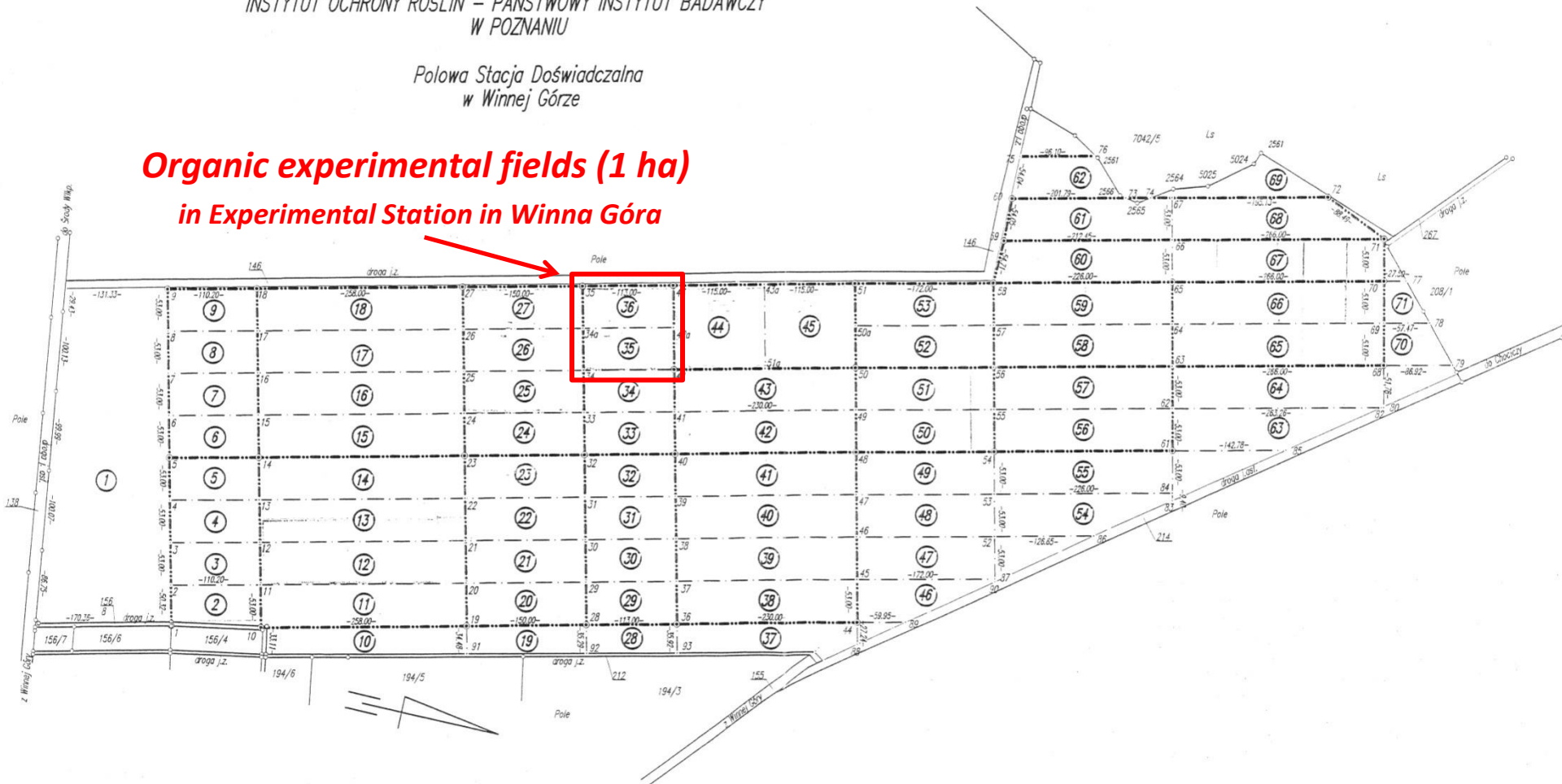
Annual meeting PRODIVA, 23-24.01.2016, Riga, Latvia

MAPA SYTUACYJNO-POGLĄDOWA POLA DOŚWIADCZALNEGO skala 1:5000

INSTYTUT OCHRONY ROŚLIN – PAŃSTWOWY INSTYTUT BADAWCZY
W POZNANIU

Polowa Stacja Doświadczalna
w Winnej Górze

**Organic experimental fields (1 ha)
in Experimental Station in Winna Góra**



An aerial photograph of a large agricultural field divided into many small, rectangular plots. The plots show various shades of green, indicating different crops or treatments. A road runs along the right side of the field. In the top center, a small drone is shown flying, with blue curved lines representing its signal or flight path. A white arrow points from a text box to a specific area in the field, which is outlined with a red dashed line.

**Organic experimental fields (1 ha)
in Experimental Station in Winna Góra**

Fot. IWING, 2015

Scheme of the experiment, 2016

	15 801	13 802	16 803	12 804	11 805	14 806	
	12 701	11 702	14 703	16 704	15 705	13 706	
	5 601	3 602	6 603	2 604	1 605	4 606	
	2 501	1 502	4 503	6 504	5 505	3 506	

	3 401	6 402	5 403	1 404	4 405	2 406	
	1 301	2 302	3 303	4 304	5 305	6 306	
	13 201	16 202	15 203	11 204	14 205	12 206	
	11 101	12 102	13 103	14 104	15 105	16 106	

Number tretment	System	Crop species	Seed rate No./m ²
1	Organic	Barley	350
2		Pea	110
3		Barley + pea (70%/30%)	245 + 33
4		Barley + pea (50%/50%)	175 + 55
5		Barley + pea (30%/70%)	105 + 77
6		Without crop- only natural weeds	
11	Conventional (IPM)	Barley	350
12		Pea	110
13		Barley + pea (70%/30%)	245 + 33
14		Barley + pea (50%/50%)	175 + 55
15		Barley + pea (30%/70%)	105 + 77
16			

Field experiment

Field experiment:

- four replication,
- plots size 10 m x 1,5 m;

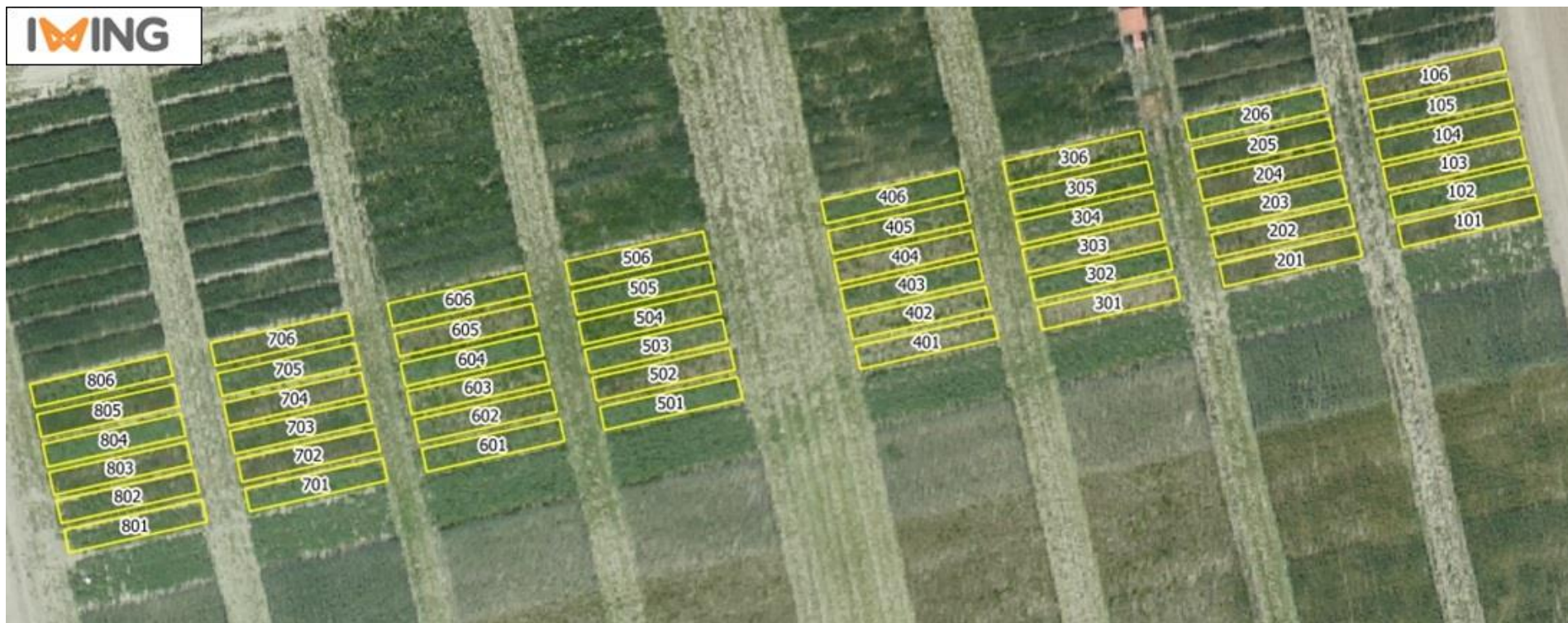
Analysis performed regarding to:

- dry weight of crops and weeds (above the ground)
- LAI, SPAD, gNDVI (***Green Normalised Vegetation Index***)
- number of ears/grain and pods/seeds (No/m²)
- quantity and quality of yield

Photos using unmanned aircraft systems



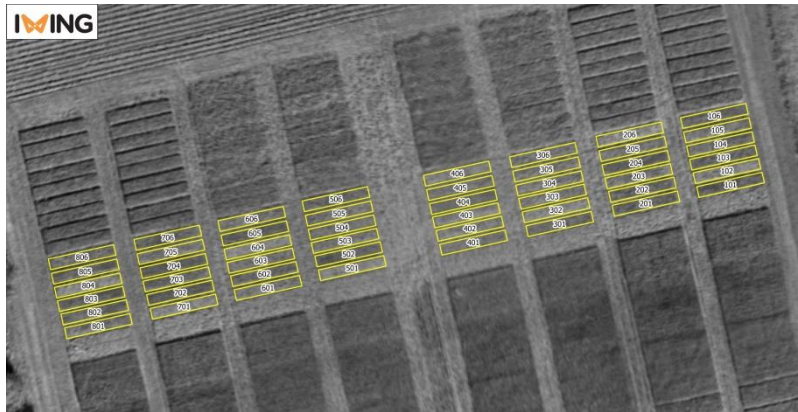
Fot. IWING, 08.06.2016



Aerial imagery in panchromatic (gray scale) imagery

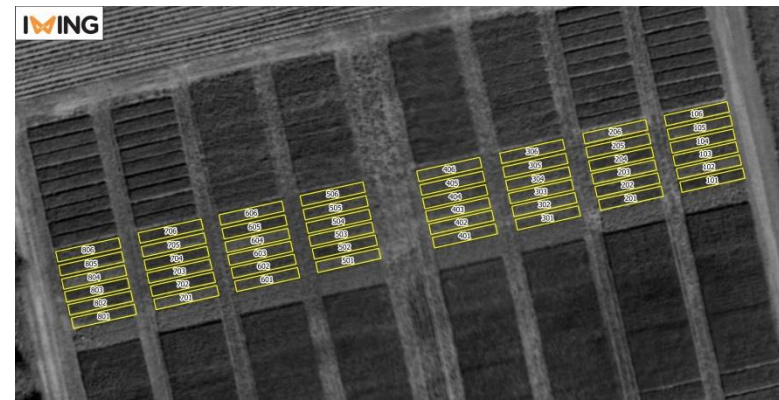
Photos using airborne passive imaging systems that detect and record specific wavelength (λ) ranges of reflected solar radiation, which are sections of the electromagnetic spectrum visible light in the range of the spectral reflection:

Green

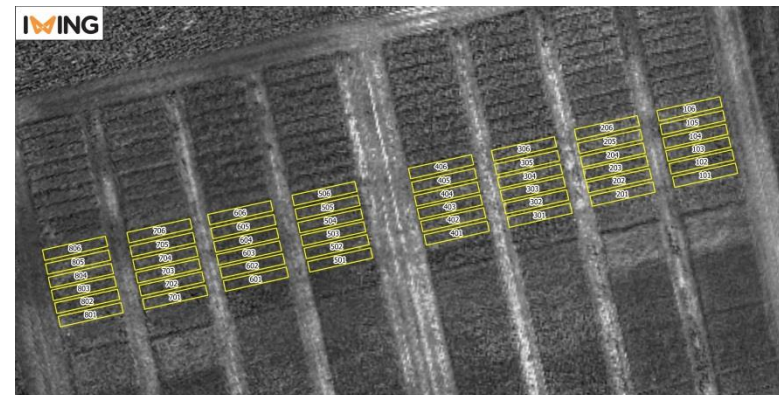
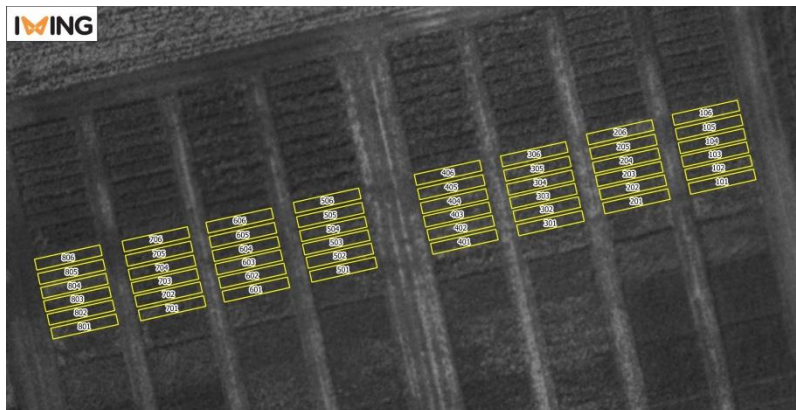


Fot. IWING,
08.06.2016

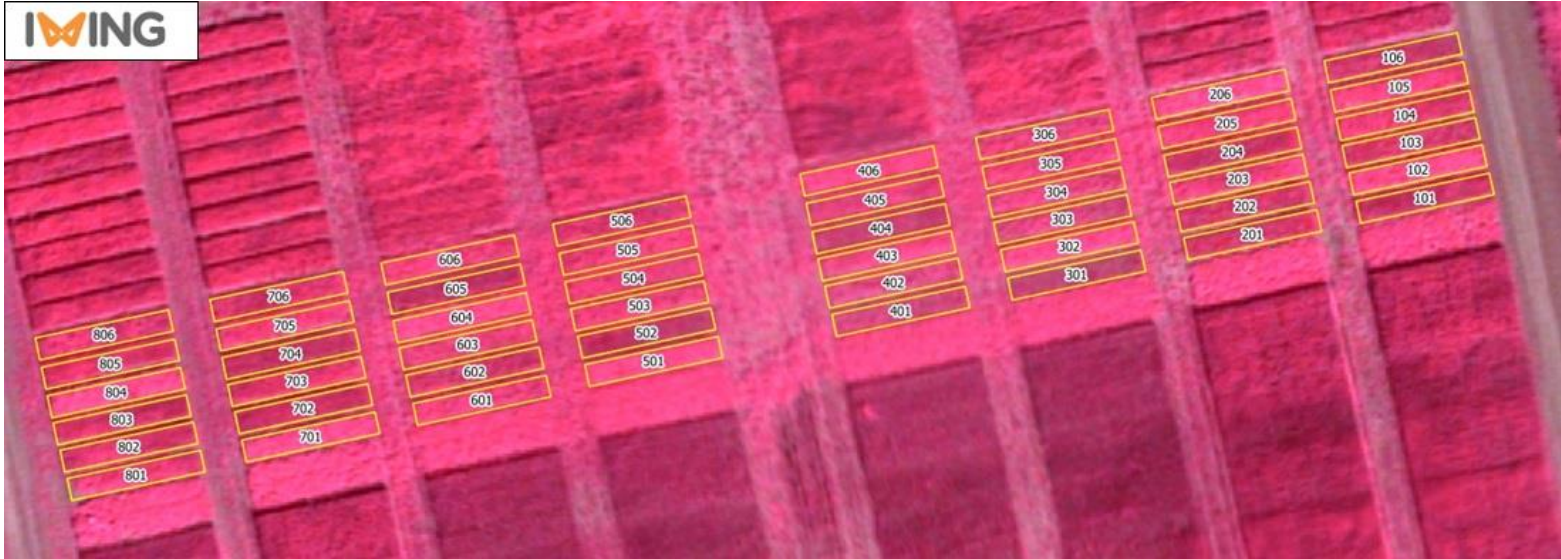
Red



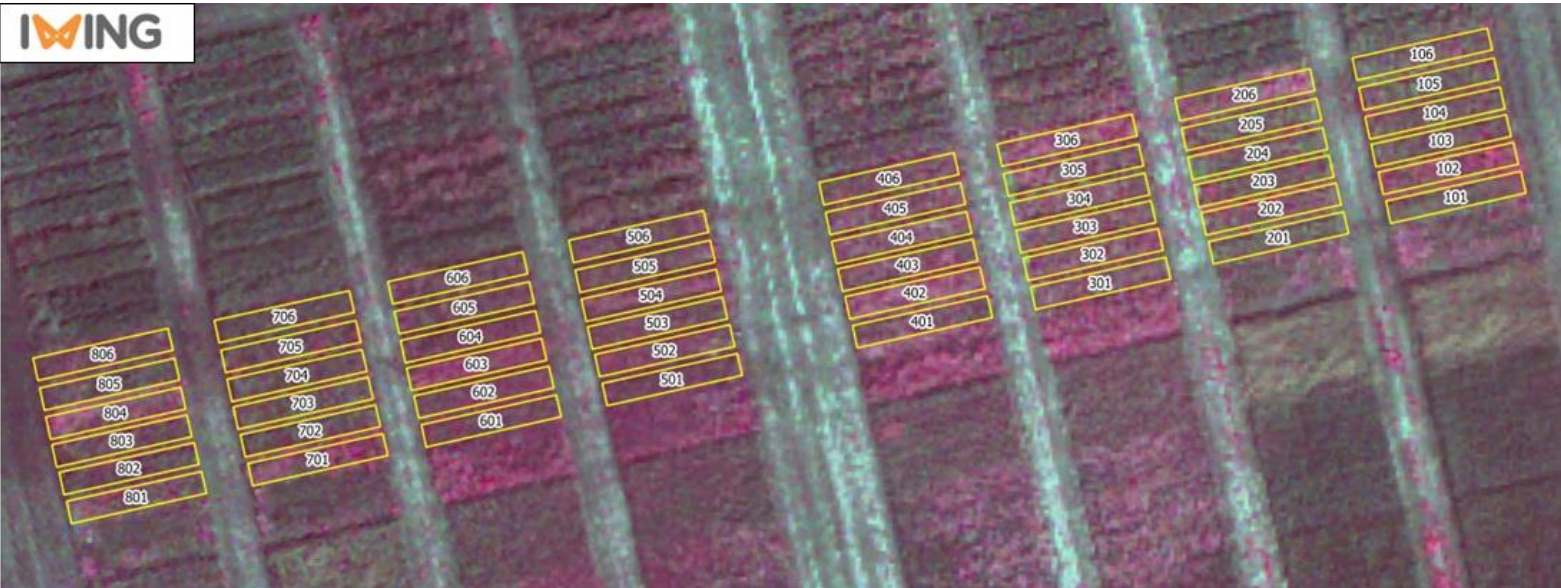
Fot. IWING,
17.07.2016



Spectral reflectance of Vegetation - Using Color Infrared (CIR) Imagery

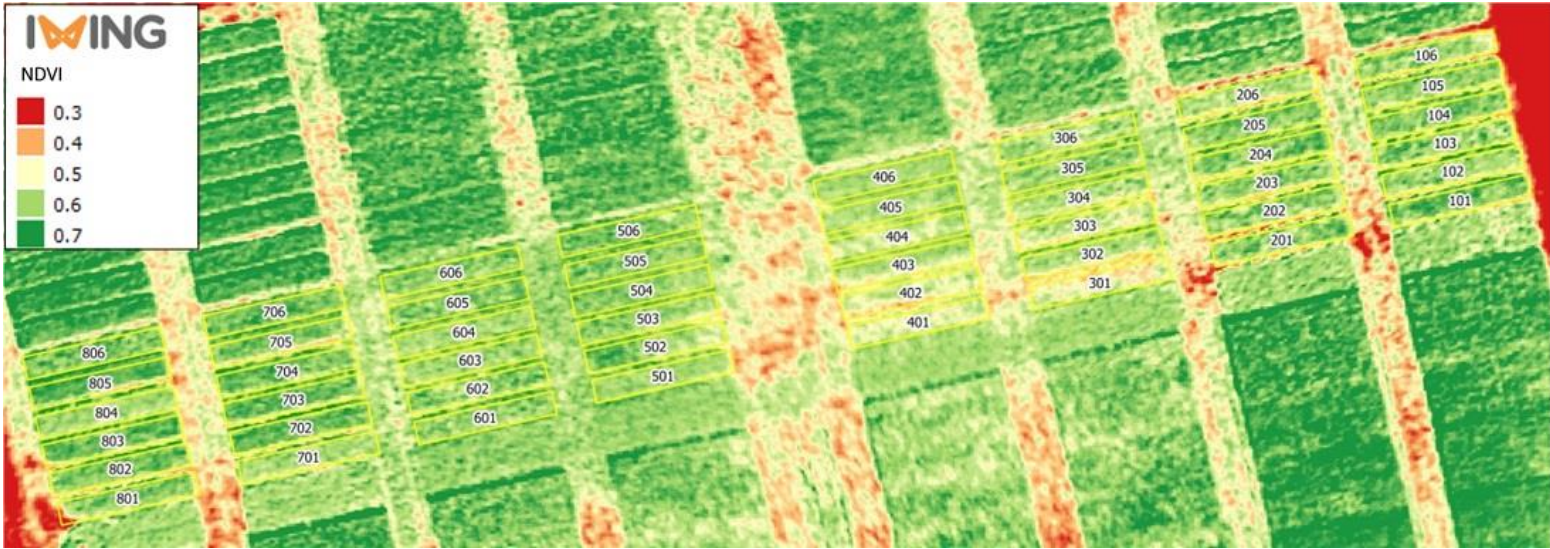


Fot. IWING,
08.06.2016

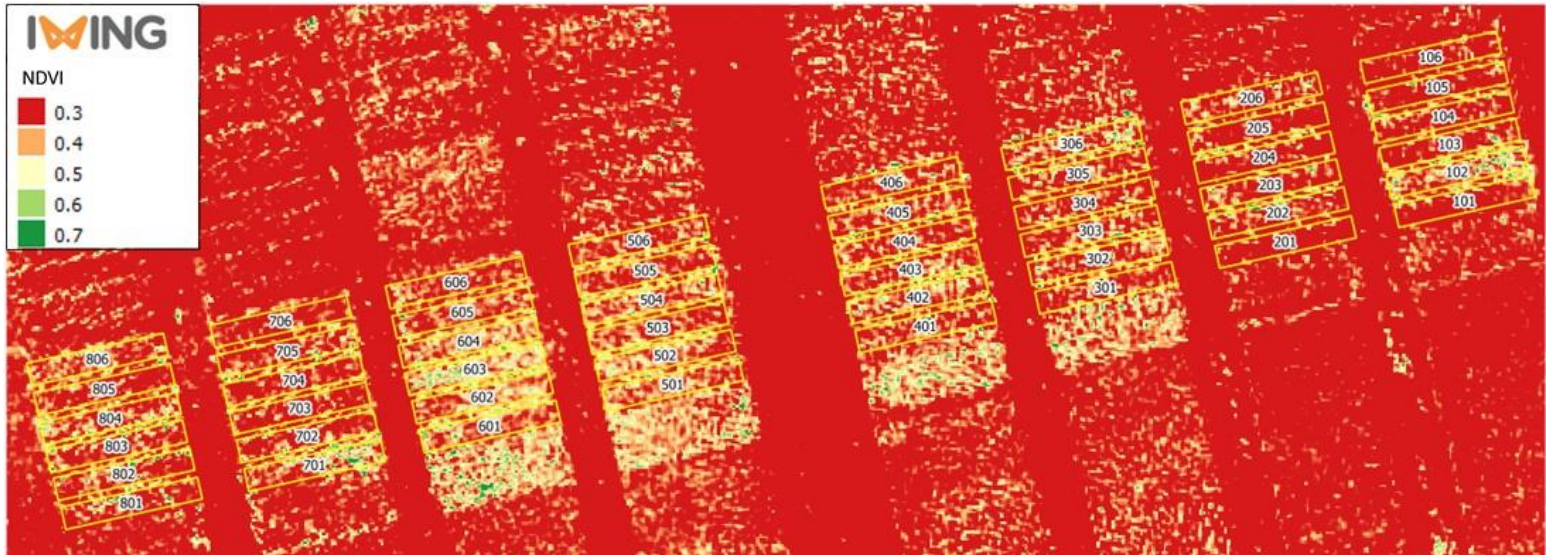


Fot. IWING,
17.07.2016

Spectral reflectance of Vegetation – NDVI (Normalized Difference Vegetation Index)



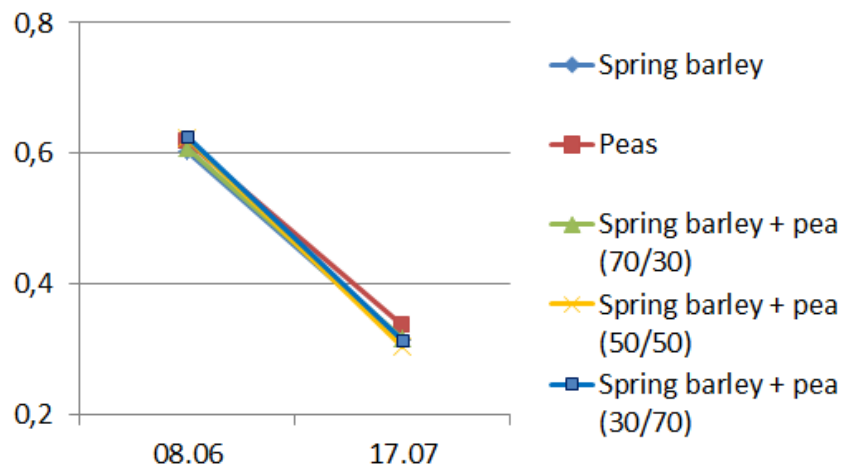
Fot. IWING,
08.06.2016



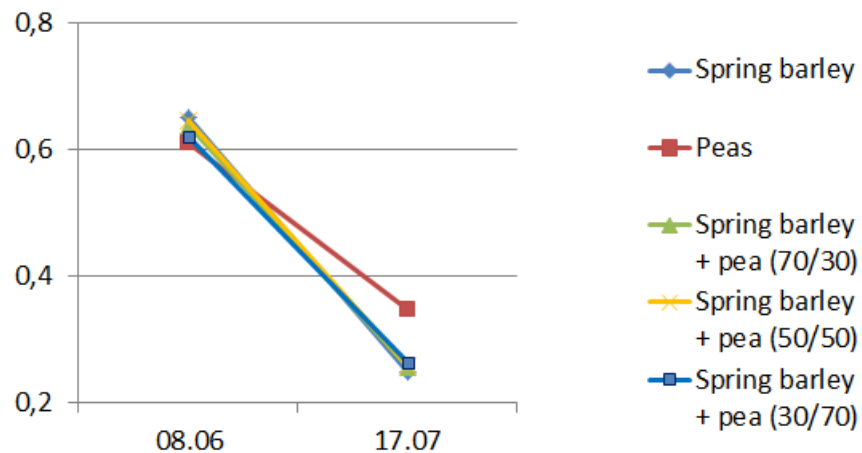
Fot. IWING,
17.07.2016

Index NDVI (Normalized Difference Vegetation Index)

Organic system

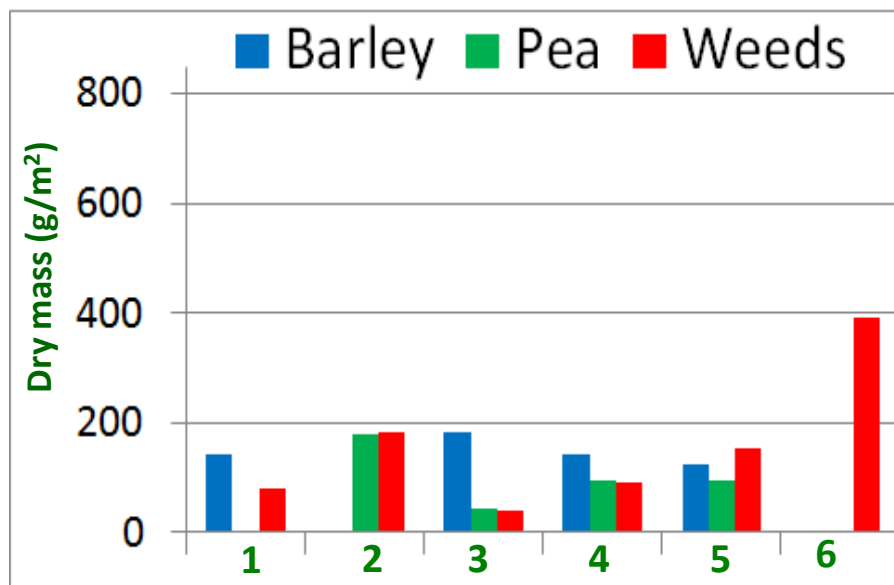


Conventional system

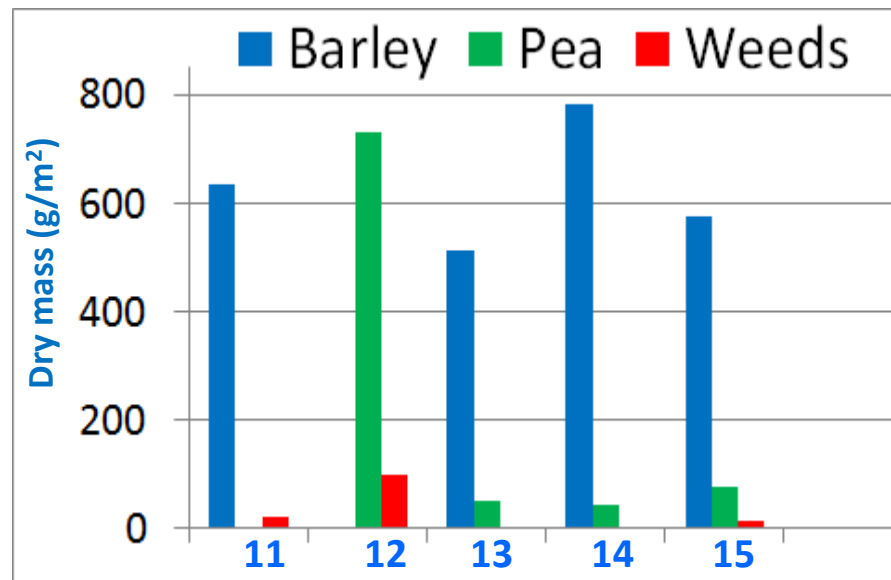


Dry mass of plants (g/m²)

Organic system

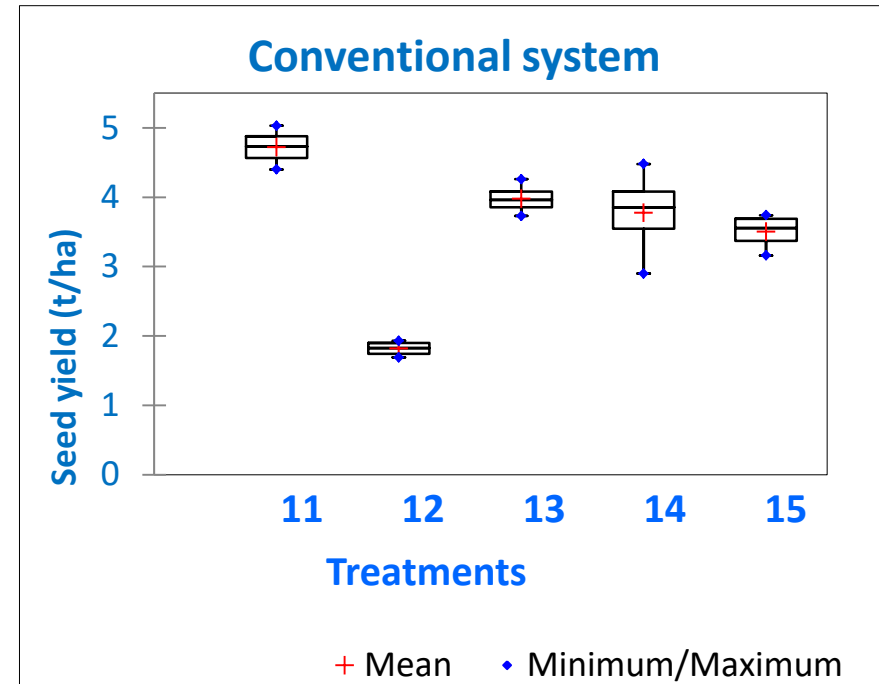
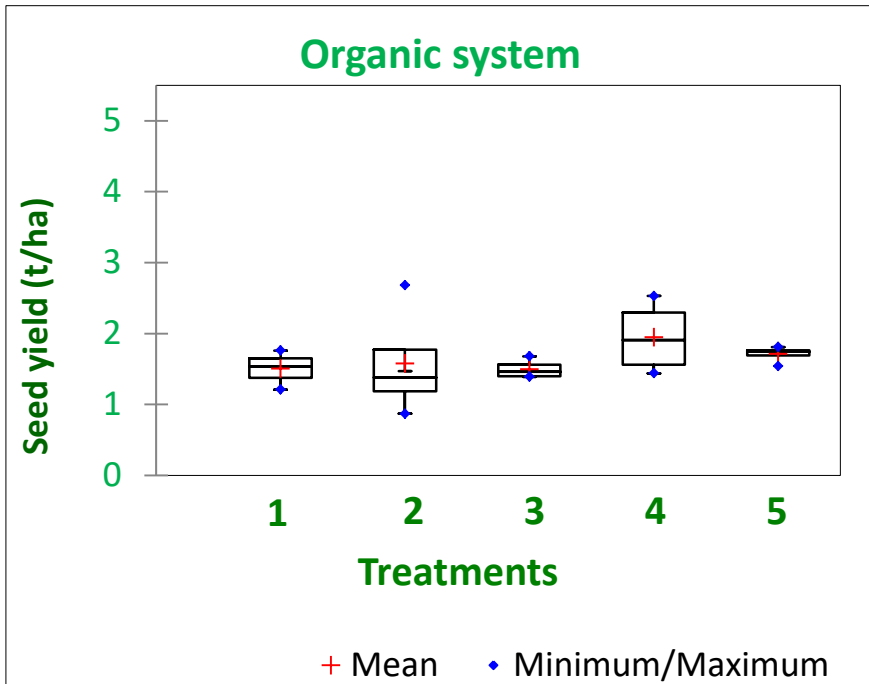


Conventional system



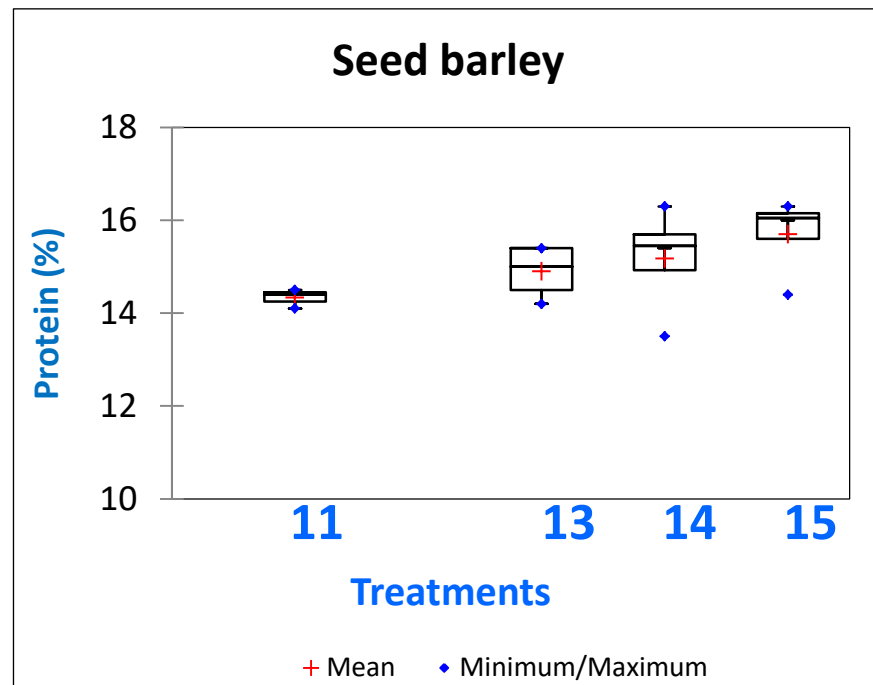
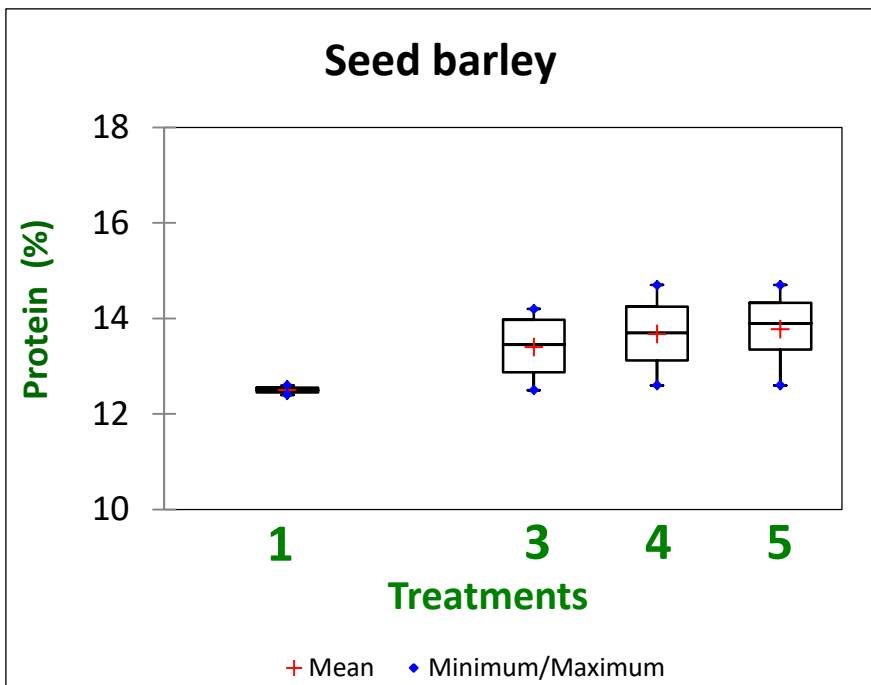
Organic sys.	Conventional sys.	Crop	Seeds rate (No/m ²)
1	11	Barley	350
2	12	Pea	110
3	13	Barley + pea (70%/30%)	245 + 33
4	14	Barley + pea (50%/50%)	175 + 55
5	15	Barley + pea (30%/70%)	105 + 77
6	-	Without crop - <i>only natural weeds</i>	-

Seed yield (t/ha)



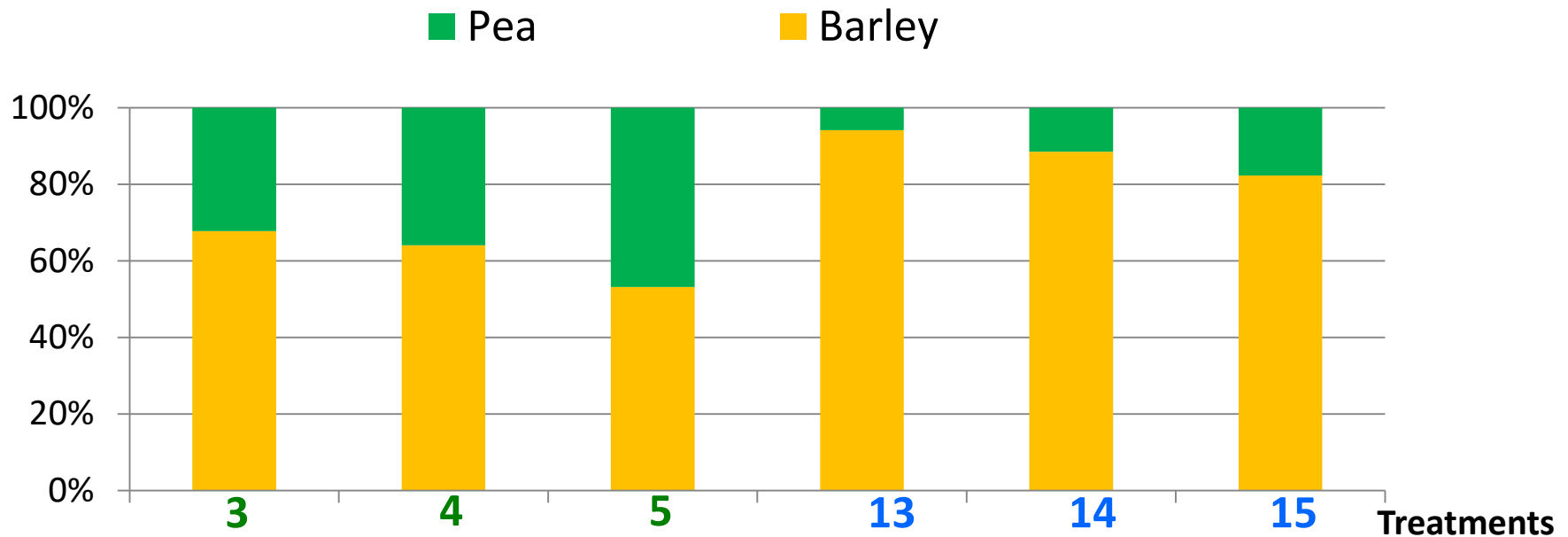
Organic sys.	Conventional sys.	Crop	Seeds rate (No/m ²)
1	11	Barley	350
2	12	Pea	110
3	13	Barley + pea (70%/30%)	245 + 33
4	14	Barley + pea (50%/50%)	175 + 55
5	15	Barley + pea (30%/70%)	105 + 77
6	-	Without crop - <i>only natural weeds</i>	-

Seed barley- protein content (%)



Organic sys.	Conventional sys.	Crop	Seeds rate (No/m ²)
1	11	Barley	350
2	12	Pea	110
3	13	Barley + pea (70%/30%)	245 + 33
4	14	Barley + pea (50%/50%)	175 + 55
5	15	Barley + pea (30%/70%)	105 + 77
6	-	Without crop - <i>only natural weeds</i>	-

Percentage of seeds in yield (%)



Organic sys.	Conventional sys.	Crop	Seeds rate (No/m ²)
1	11	Barley	350
2	12	Pea	110
3	13	Barley + pea (70%/30%)	245 + 33
4	14	Barley + pea (50%/50%)	175 + 55
5	15	Barley + pea (30%/70%)	105 + 77
6	-	Without crop - <i>only natural weeds</i>	-

Controlled experiments with mixtures of barley and pea

1/ Glasshouse experiment : weed- *Elymus repens*

2/ Growth chamber experiment: *Sinapis alba* as a model weed

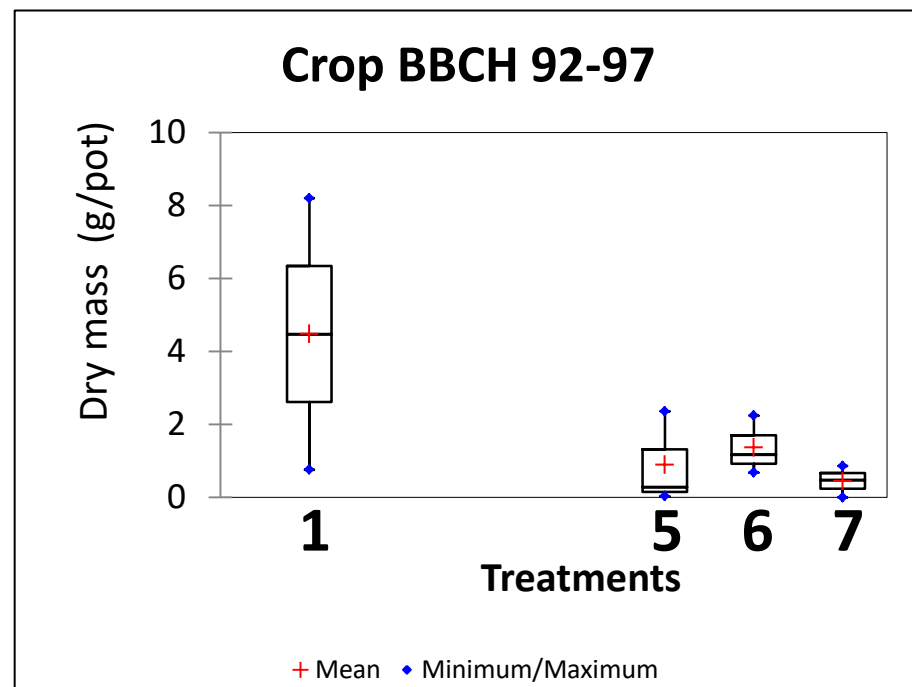
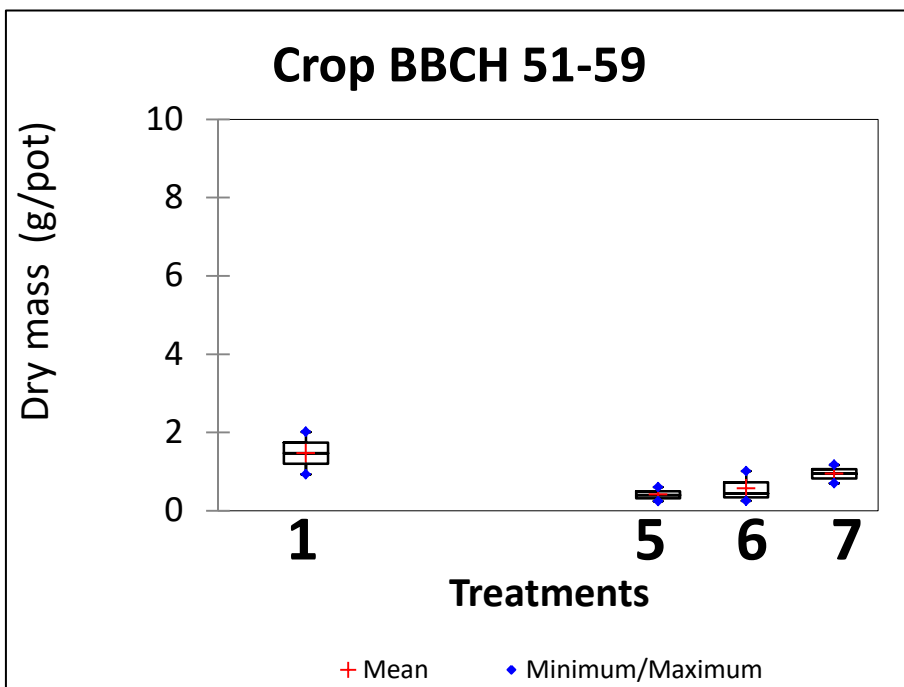
Scheme of controlled experiments (six replications)

1. **Weeds** (*Elymus repens* and *Sinapis alba* as a model weed)
2. Solo pea
3. Solo barley
4. Barley and pea (50% / 50%)
5. Barley + **weeds**
6. Pea + **weeds**
7. Barley and pea (50% / 50%) + **weeds**

Analyses

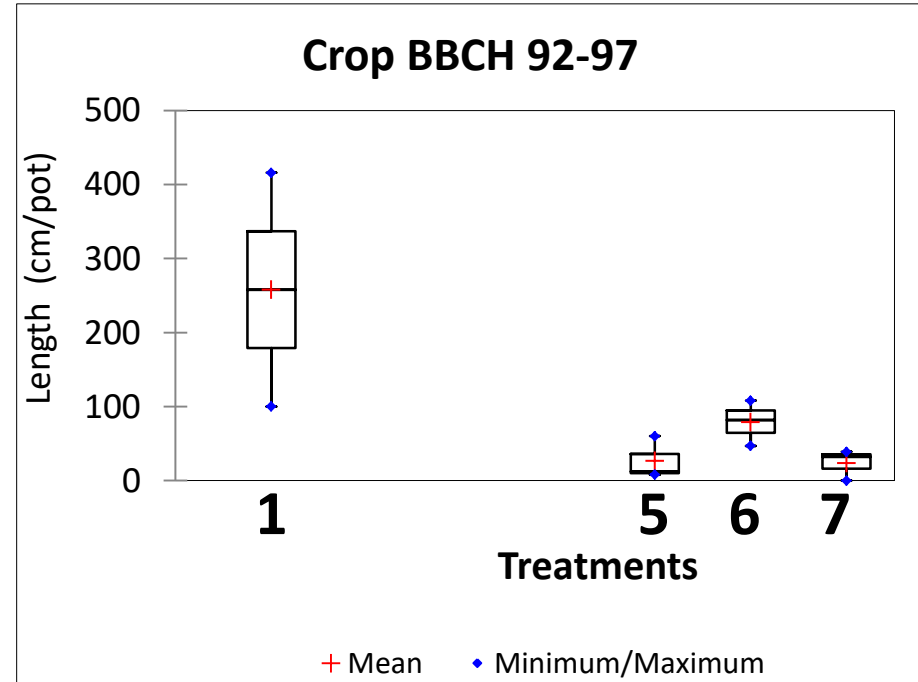
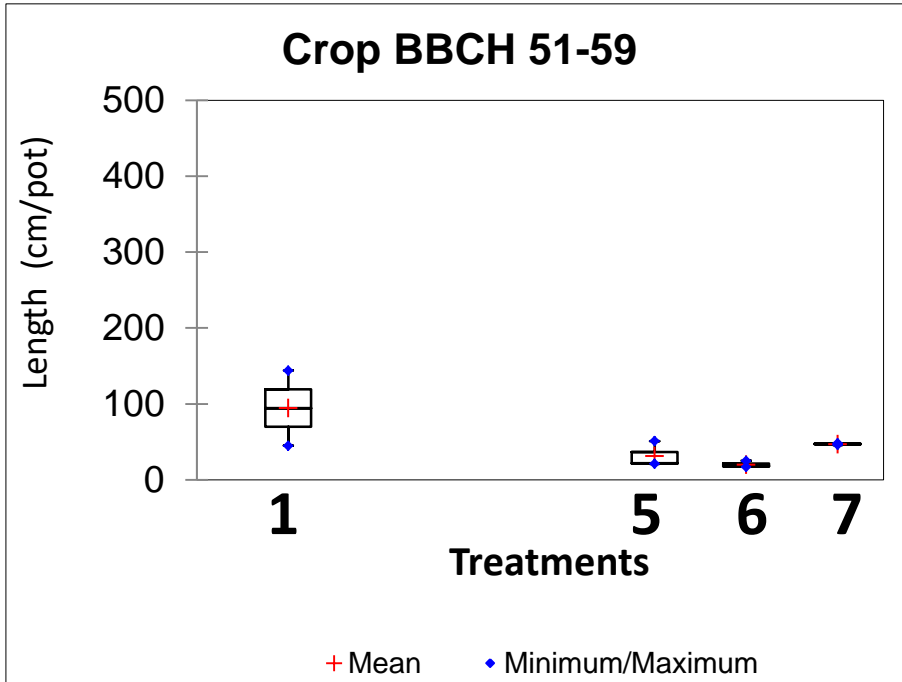
- Dry mass of crops and couch grass
- Couch grass rhizomes weight and length per unit
- Number and weight of seeds per unit
- Number of ears/grain and pods/seeds (No/pot)
- Yield quantity

Glasshouse experiment- rhizomes dry mass of AGRRE



1. **Weeds** (*Elymus repens* and *Sinapis alba* as a model weed)
2. Solo pea
3. Solo barley
4. Barley and pea (50% / 50%)
5. Barley + **weeds**
6. Pea + **weeds**
7. Barley and pea (50% / 50%) + **weeds**

Glasshouse experiment- rhizomes length of AGRRE



1. Weeds (*Elymus repens* and *Sinapis alba* as a model weed)
2. Solo pea
3. Solo barley
4. Barley and pea (50% / 50%)
5. Barley + weeds
6. Pea + weeds
7. Barley and pea (50% / 50%) + weeds

Thank you for your attention