NORDDEUTSCHE PFLANZENZUCHT
Wir lassen Qualität wachsen.

Comparison of different plot schemes in winter oilseed rape

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Introduction

Winter oilseed rape (WOSR) is a difficult crop in variety trials with high experimental errors and strong genotype x environment interactions. Official VCU testing is more and more subjected to cost pressure and relies on small single plot variety trials. Variety differences in plant length, lodging sensibility and maturity lead to significant neighbouring effects in such trials. Especially short and stiff WOSR varieties get systematically discriminated, although there is a high demand by farmers for them. The objective of this study is to compare three different plot schemes directly with each other in a balanced data structure: (1) Single plot, (2) Double Plot and (3) Plot-in-Plot (Fig. 1).

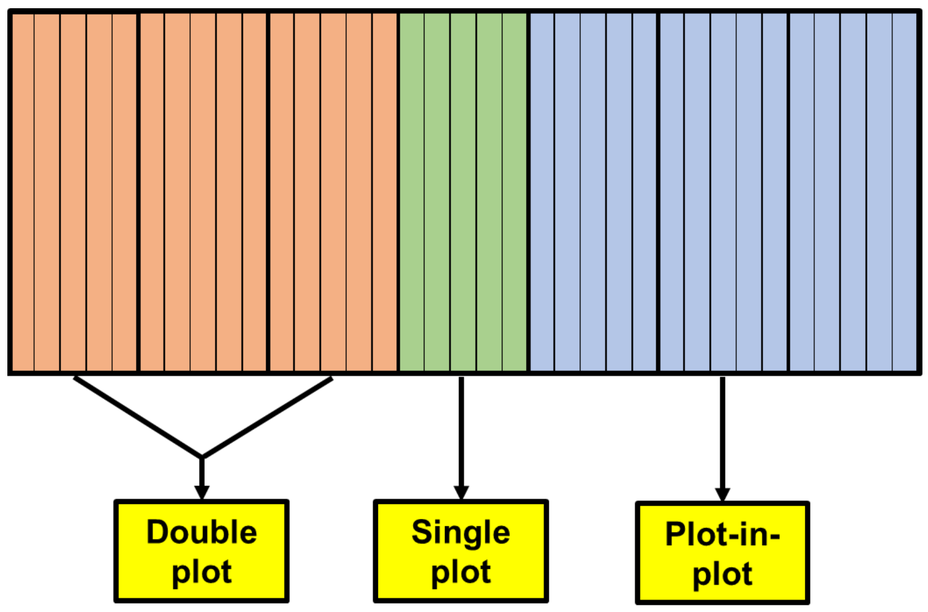

Fig. 1: Different plot schemes used in the experiment

Material & Methods

We used a set of 7 wide-spread commercial hybrids. The testing was performed by using a special neighbour-design, assuring that each variety is once next to each other variety on each location. The method of randomization comes from Azais et al. (1993). It consists of performing the following four operations: (1) total interblock randomization; (2) independently within each block, random circular permutation of plots; (3) random allocation of one element of {0, 1, …, $t-1$} or of {0, 1, …, $t-2,\infty$} to each treatment; (4) addition of border plots so that the circularity condition is met (Fig. 2).

The trial was tested in 2017/18 on 5 locations spread across Germany, Poland and Czech Republic with 3 replications for each plot-scheme-variety-combination. Standard fungicide and insecticide treatments were applied. For 98 plots per locations (including border plots) we scored development after winter, plant height, lodging, begin of flowering and diseases. During the harvest yield and moisture were detected and a sample was taken to analyse also oil-, protein-, and glucosinolate content and thousand kernel weight. Statistical analyses were conducted using PLABSTAT (Utz, 2001).

Border	Trial	Trial	Trial	Trial	Trial	Trial	Trial	Trial	Trial	Trial	Trial	Trial	Border	
B	E	E	E	F	D	D	D	C	A	A	A	B	E	Single Plot
G	E	A	A	A	C	B	B	B	D	G	G	G	E	Plot-in-Plot
E	D	B	B	B	G	C	C	C	F	E	E	E	D	Double Plot
F	G	B	B	B	C	D	D	D	A	F	F	F	G	
G	F	F	F	B	A	A	A	E	C	C	C	G	F	
A	D	D	D	F	C	C	C	E	G	G	G	A	D	
F	A	G	G	G	D	E	E	E	B	F	F	F	A	

Fig. 2: Randomization scheme on first location for 7 varietes (A-G)

Example of height differences in single plot system in Lithuania (left picture) and in Poland (right picture)

Results

On average plant length varied between 139cm and 159cm. Short varieties flowered significantly earlier than tall varieties. For moisture and yield no significant differences were observed between the short and tall varieties. Lodging scores ranged between 6 and 9 (no lodging). The short varieties performed on average slightly better in lodging, 8.2 compared to 7.5 for the tall varieties (data not shown).

All tall varieties had a yield advantage in the single plot system compared to the plot-in-plot system. All short varieties showed a better or equal yield, when comparing single and plot-in-plot schemes (Fig. 3).

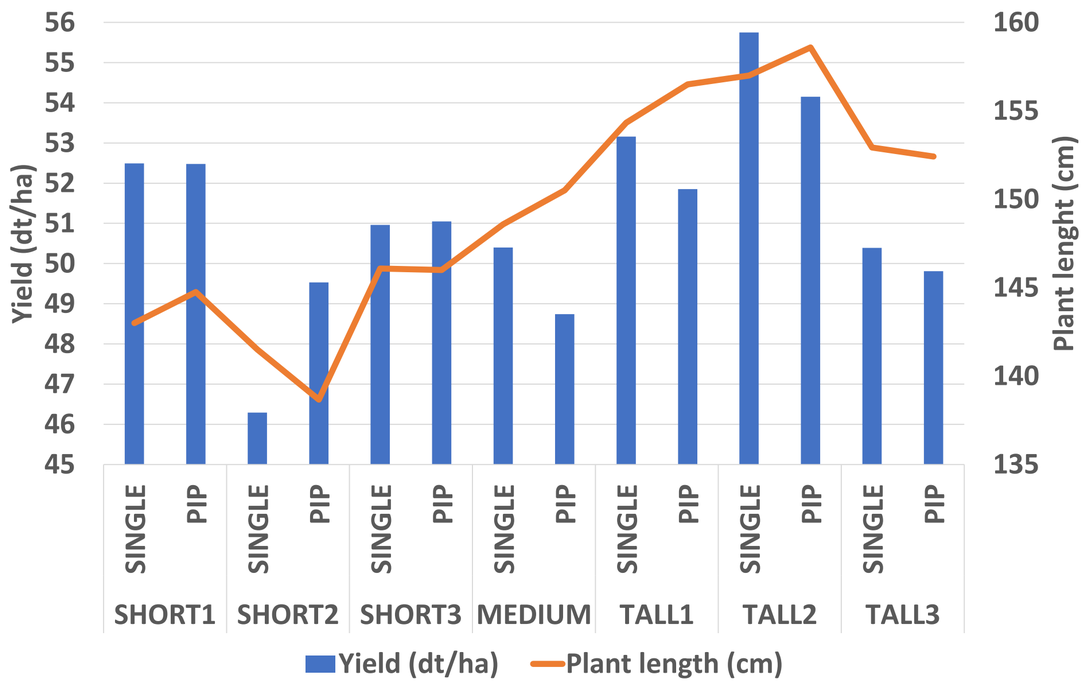

Fig. 3: Comparison of yield in relation to plant length between single and plot-in-plot (PIP) design

Conclusions

The extreme weather conditions in 2017/18 with a wet autumn and a very dry and hot period from flowering to harvest lead to a short crop with small height differences and almost no lodging. Even with these restrictions, we could find a disadvantage of short varieties in the single plot system of 2 dt/ha. In 2018/19 we will repeat the trial to confirm the results in different weather conditions. We already recommend using a plot-in-plot system or at least double plot design to avoid skewed results to the disadvantage of shorter varieties.

J.-M. Azais, R. A. Bailey and H. Monod (1993) A Catalogue of Efficient Neighbour-Designs with Border Plots. Biometrics, Vol. 49, No. 4 , pp. 1252-1261

H-.F. Utz (2001) Plabstat, ein Computerprogramm zur statistischen Analyse von pflanzenzüchterischen Experimenten (in German). Universität Hohenheim, Germany

Pictures: Norddeutsche Pflanzenzucht Hans-Georg Lembke KG

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