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THE EFFICIENCY OF DIFFERENT DESIGNS IN DUS TRIAL ON PEA VARIETIES

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Summary

The efficiency of different designs in experiment on pea varieties is investigated on the basis of the results of pea trial conducted for DUS purposes at experimental station Słupia Wielka, Poland, in 1999. Because of the shape of experimental field and its equipment (plastic net running in the middle of 14 neighboring plots) the experiment was established in row-column design. The variances of error are compared for different factors (rows, columns and both) included in the mathematical models of observations.

1. Introduction

Incomplete blocks are widely used for many years in VCU trials in many countries as they proved their advantages over complete blocks, Patterson and Hunter [1983], Pilarczyk [1991]. Lately some attempt can be observed towards use of these designs also in DUS trials. For example Kristensen [1998, 1999] reported the efficiency of resolvable incomplete block designs in DUS trial on spring rape and yellow mustard conducted in Denmark, whereas Pilarczyk [1999] reported relatively low efficiency of such designs in experiment conducted in Poland on French bean. The post-blocking technique was used as a tool for comparisons of efficiencies of designs with different block sizes.

2. Description of an experiment

In an experiment on pea conducted at variety testing experimental station at Słupia Wielka in 1999 there were 120 varieties compared. The experiment was established in kind of row-column design in two replicates. The plots were arranged into rows (referred as blocks). Each row comprised of 14 plots. There was a plastic net running in the middle of plots along rows. Rows were placed in parallel lines. So the plots formed row-column design with rows consisting of 14 plots. The field scheme is illustrated in Fig. 1. The plots were 3m length and 1.5m width. Every row was 42 metres long. Varieties were randomized according to restrictions imposed by row-column design. Plants were sown on one side of the net in 5 cm distance from each other. There were 60 plants sown in each plot. Additional guard plots were placed at every side of experiment. And additional gaps of 15 cm between plots were also introduced. From every plot 15 plants were chosen at random and all measurements were made for these plants. So there were 30 measurements for every variety. (Figure 1 follows.)

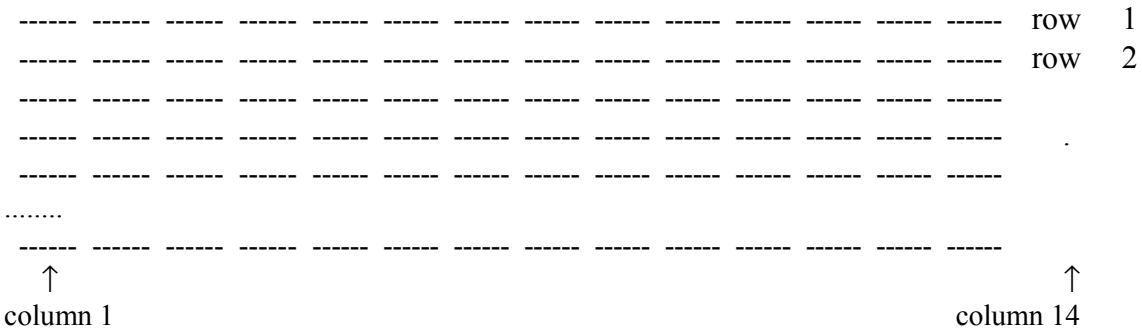

Figure 1
Arrangement of plots in experimental field in pea trial

3. The data and the results of analysis

As mentioned earlier 30 plants for every variety mere measured. There were some characteristics included in UPOV guidelines observed and some additional characteristics as well. All the analyses were performed for following characteristics:

Number	UPOV number	Description of characteristics
C1	12	stem length
C2	---	stem length up to first fertile node
C3	---	length of internode between first an second fertile node
C4	13	number of nodes up to and including first fertile node
C5	48	pod length
C6	49	pod - maximum width
C7	60	pod – number of ovules

For every characteristic in turn the analysis of variance was performed according to the following models of observations (see Table 1):

CB - completely randomized design,
RCB – randomized complete blocks,
IB – rows – incomplete blocks with rows as blocks,
IB-columns – incomplete blocks with columns as blocks
IB-(R+C) - incomplete row-column design.

The results of performed analyses are summed up in Table 1. In column E the mean harmonic efficiency factors are given for respective designs. These are equal to 1 for complete (orthogonal) designs and are smaller than 1 for incomplete blocks. In Table 1 the mean squares for error (MS_e) received for different designs are given. The smallest values

are given in bold. The averages of variances of treatment comparisons can be easily received from the data presented in Table 2 according to formula:

$$Var(comp)=2*MS_e/(r*E)$$

where r stands for the number of replicates.

It is easy to notice that for characteristics C1, C2, C3, C5 and C7 the smallest mean square for error in incomplete blocks with rows as blocks was received, but the gain in comparison to complete blocks was too small to compensate decreasing of mean harmonic efficiency factor E. For every characteristics involved the variance of comparisons was the smallest for randomized complete blocks or for completely randomized design. Incomplete blocks analyses both for rows and columns used as incomplete blocks were less effective than the randomized complete block analysis.

4. Conclusion

Performed analyses of variance of the results of experiment concerning seven characteristics of pea varieties shoved that randomized complete blocks and completely randomized design were more effective than incomplete blocks.

Table 1

Mean squares for error of different (complete and incomplete) block designs in DUS trial on pea for different characteristics

Design	E	Characteristic						
		C1(12)	C2(---)	C3(---)	C4(13)	C5(48)	C6(49)	C7(60)
CR	1	602.7	106.1	3.678	**3.363**	0.2271	0.0072	0.5280
RCBD	1	608.8	107.6	3.689	3.388	0.2261	**0.0071**	0.5344
IB-Rows	0.8339	**565.4**	**96.74**	**3.504**	3.491	**0.2140**	0.0076	**0.5212**
IB-Columns	0.8766	660.6	114.9	3.930	3.539	0.2305	0.0077	0.5731
IB-(R+C)	0.8757	622.3	103.4	3.764	3.695	0.2143	0.0082	0.5740

Ci(jj) means characteristic number i, jj – characteristic number according to UPOV Test Guidelines whereas --- denotes characteristics not included in UPOV Test Guidelines.

Literature

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