

STATISTICAL NOTES FOR AGRICULTURAL WORKERS.*

No. 12. —ANALYSIS OF VARIETAL TESTS WITH WHEAT CONDUCTED AT SAKRAND, SIND, 1931-32.

BY

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Mr. K. I. Thadani, of the Department of Botany in Sind, Sakrand, conducted a varietal trial with 5 varieties of wheat in the Agricultural Research Station, Sakrand. The experiment was laid out on an area of 2 acres, divided into two blocks of one acre each. Each block was divided into 20 plots of 1/20 acre, so that the five varieties were replicated 4 times in each. The lay-out is shown in Fig. 1. Mr. Thadani stated that the plots were randomized. On the assumption of a random sample we may proceed with the analysis.

E	81.0	A	76.2	B	81.3	C	81.8
D	59.5	E	77.7	A	71.9	B	66.1
C	44.1	D	63.4	E	74.3	A	66.6
B	81.2	C	74.7	D	83.3	E	89.2
A	88.0	B	68.0	C	46.6	D	78.2
D	78.9	E	77.3	A	89.0	B	85.2
E	79.8	A	73.3	B	73.3	C	61.4
A	76.2	B	74.9	C	66.7	D	63.4
B	83.3	C	70.8	D	76.4	E	85.9
C	78.5	D	68.0	E	95.1	A	72.5

Fig. 1.

* A large number of enquiries of a statistical nature are being received from agricultural workers in different parts of India. Many of these enquiries are of considerable general interest, and it is proposed to publish notes on selected topics from time to time. These notes will deal mainly with statistical methods and procedure, and it is not intended that they should always contain new matter. [Ed.]

The average area harvested for each plot after excluding border rows and bunds was 1,555 sq. feet (1/36 acre). The yield of wheat in lbs. per plot of 1,555 sq. feet is shown in Fig. 1.

Mr. Thadani noted that in Block II, there were "kalar patches," the area and exact location of which are given in the following table:—

LOCATION			Area of the patch (Sq. foot)
Block	Column	Row	
II	4	4	139
II	4	5	85
II	3	4	74
II	2	4	40

The harvested area included these patches. A glance at Fig. 1 does not suggest that the yield-figures are seriously affected by these patches. The detailed analysis also supports the view that the "patches" may be neglected without introducing appreciable errors.

We may analyse the results separately for the two blocks. The analysis of variance for Block I is given in the next table.

—	D. F.	Sum of squares	Mean square	VALUE OF <i>z</i>	
				Observed	5 per cent.
Varieties	4	700.27	197.57	0.0932	0.5007
Columns	3	110.01	36.94		
Residual	12	1907.38	163.95		
Columns and residual	15	2078.29	138.55		
Total	19	2808.50			

The observed and 5 per cent. expected values of *z* are also given in the same table. The observed value of *z* is much below the 5 per cent. level, so that the varietal differences do not appear to be significant.

The mean yields of the different varieties * are shown in the following table: —

Varieties	MEAN YIELD IN	
	Lbs. per plot	Percentage
A	75.08	101.17
B	74.15	102.05
C	61.80	85.06
D	71.10	97.86
E	80.55	110.86
Mean	72.66	100.00
S. E.	6.40	8.81

A similar analysis for Block II is shown in the next two tables.

—	D. F.	Sum of squares	Mean square	VALUE OF z	
				Observed	5 per cent.
Varieties	4	471.76	117.94	0.3634	0.5907
Column	3	137.38	45.79		
Residual	12	684.25	57.02		
Column and residual	15	821.63	54.77		
		1293.39			

The value of z is below the 5 per cent. level of significance, so that the varietal differences again appear to be insignificant.

* The names of the varieties tested were :—

A=Pusa 12,

C=Pusa 111,

E=Cph 47.

B=Pusa 80/5,

D=Pusa 114,

The mean yields in Block II are shown below.

Varieties	MEAN YIELD IN	
	Lbs. per plot	Percentage
A	77.75	101.18
B	79.18	103.05
C	70.85	92.20
D	71.90	93.57
E	84.53	110.01
Mean	76.84	100.00
S. E.	3.78	4.92

The similarity of the results yielded by a separate analysis of the two blocks suggests that it might be desirable to analyse the data for both blocks taken together. This will give us eight replications which are likely to lead to an increased precision of comparison. The analysis is shown below.

—	D. F.	Sum of squares	Mean square	VALUE OF z	
				Observed	Expected 5 per cent.
Varieties	4	1182.63	295.66	.6009	.4992
Block	1	177.64	177.64		
Column	6	248.20	41.38		
Residual	28	2720.79	97.49		
Columns and residual	34	2978.08	87.59		
	39	4338.35			

The observed value of z now lies between the one per cent. and the 5 per cent. point. That is, such a value of z is likely to occur less than once in 20 trials. We may, therefore, consider the varietal differences to be significant. The mean yields are shown in the next table.

Varieties	MEAN YIELD IN	
	Lbs. per plot	Percentage
A	76.71	102.62
B	76.67	102.58
C	60.32	88.73
D	71.50	96.65
E	82.54	110.42
Mean	74.75	100.00
S. E.	3.49	4.67

We conclude :—

(1) There is no significant difference in yield between A and B or between C and D.

(2) Varieties A and B are significantly superior to C but not to D.

(3) Variety E is significantly superior to Varieties C and D.

The experimental error is of the order of 5 per cent., and hence the critical difference (which may be considered significant) is of the order of 15 per cent.

It will be noticed that the division of the experiment into columns has been totally useless, for the columnar variances are in all three cases actually lower than the corresponding residual variances. This justifies the inclusion in the analysis of the plots with "kalar patches".

Full details of the experimental results with a discussion of their agricultural significance will be published by Mr. Thadani in due course. The object of the present note is to illustrate the method of analysis.

SUMMARY.

Results of varietal experiment with 5 strains of wheat in 8 replications conducted in Sakrand, Sind, have been analysed in this paper. Although the division of the field into eight blocks did not lead to any reduction in the fluctuations due to systematic changes in soil-fertility, the precision of the comparison was 4.67 per cent. It is interesting to observe that the presence of 4 kalar patches within the experimental area did not affect the yield of these plots materially.