

A Note on Experimental Factors Influencing Variability in Research Data of Pulse Crops

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SUMMARY

The results of 1841 experiments conducted during 1980-90 on seven pulse crops at different locations in Gujarat State were scrutinized. The experimental variability (C.V.%) was influenced by locations, crops, plot size, field layout and number of treatments as well as replications. Crop and location based research need has been discussed.

Key words : Variability, C.V.%, Experimental factors, Pulse crops.

Field experimental data show variation because of fertility variation among experimental units, treatment effects, climatic variation and man-made factors. Among experimental factors plot size and shape, block size, number of replications, number of treatments and design are playing significant role in the precision of experiment. Of course crops, locations (soil type), seasons are also contributing variables. From practical view point, it is necessary therefore to study the experimental factors influencing variability in data (C.V. %) for improving precision of the new experiments. This paper deals with this aspect for 1841 experiments conducted on seven pulse crops viz., Arhar, cowpea, gram (chickpea), cluster bean (Guar), green gram (mung), Black gram (Urid) and kidney bean (Moth) at different locations in Gujarat state during the years 1980-1990 in the area of Plant Breeding, Agronomy, Entomology, Pathology and Physiology. The distribution of C.V.% was studied from crops, locations, plot size and number of replications as well as treatments view points. The stations having less than five experiments were pooled together as others; their C.V.% were not estimated.

The average C.V.(%) values for experiments conducted on different crops at different centres are presented in Table 1. Experiments conducted at Waghai (28.2%), Derol (27.6%) and SK Nagar (27.5%) had high average C.V.%, whereas experiments at Navsari and Junagadh centres showed acceptable range of variation in the data. The remaining centres had 17 to 23% C.V. The results in general indicate that experiments on pulse crops conducted in Gujarat state

Table 1. Location-wise and crop-wise average C.V.% and number of experiments

Location	Arhar	Cowpea	Gram	Guar	Moth	Mung	Urid	Average
Anand	20.8 (66)	21.2 (13)	24.2 (25)	-	-	18.8 (11)	18.5 (11)	21.2 (126)
Amej	21.9 (12)	-	16.1 (67)	28.6 (02)	-	21.2 (05)	-	17.5 (86)
Baroda	22.3 (133)	23.1 (06)	-	-	-	20.2 (19)	20.8 (16)	22.3 (174)
Bhachau	17.2 (01)	-	-	20.3 (17)	28.7 (08)	21.2 (07)	06.7 (01)	22.0 (34)
Bharuch	20.7 (47)	-	22.9 (04)	-	30.8 (01)	19.8 (07)	13.8 (08)	20.0 (67)
Deesa	13.2 (02)	17.8 (12)	-	18.2 (15)	-	16.4 (20)	12.6 (01)	17.1 (50)
Derol	30.0 (53)	32.6 (16)	22.3 (37)	-	-	26.4 (24)	35.1 (03)	27.6 (133)
Dohad	15.2 (24)	15.2 (02)	21.5 (82)	-	-	15.3 (07)	16.7 (16)	19.3 (131)
Junagadh	14.2 (76)	11.3 (24)	12.6 (86)	-	-	13.2 (76)	13.8 (49)	13.2 (311)
Kothara	-	-	-	16.0 (19)	31.4 (08)	21.5 (04)	-	20.6 (31)
Navsari	12.2 (35)	08.6 (01)	14.5 (23)	-	-	8.7 (20)	10.8 (13)	11.8 (92)
SKNagar	33.3 (104)	23.1 (61)	29.9 (28)	21.3 (108)	35.1 (34)	27.2 (168)	61.5 (02)	27.5 (505)
Talod	21.8 (02)	-	-	-	-	20.6 (04)	24.3 (12)	23.2 (18)
Tanchha	24.2 (07)	-	15.8 (12)	-	-	18.5 (01)	-	18.8 (20)
Waghai	26.7 (04)	-	31.3 (02)	-	-	-	-	28.2 (06)
Others	(20)	-	-	(13)	(14)	(02)	(06)	(57)
Average	22.9 (586)	21.2 (135)	18.7 (379)	20.5 (175)	33.4 (53)	21.6 (379)	17.2 (134)	(1841)

Note : Figures in parenthesis indicate number of experiments.

Table 2 : C.V.% as influenced by crops and plot sizes (sq.m.)

Plot size	Arhar	Cowpea	Gram	Guar	Moth	Mung	Urid	Average
1-3	30.8	22.2	25.8	25.4	63.9	24.0	20.3	26.7
3-6	28.4	22.4	17.9	22.4	43.9	21.8	19.0	22.1
6-9	25.4	20.7	17.9	18.4	35.1	19.8	16.5	20.6
9-12	21.5	16.9	16.3	19.7	29.8	19.2	14.4	20.0
12-15	21.6	20.7	11.2	22.2	34.8	22.0	21.5	21.3
15-18	18.2	41.1	25.3	38.0	26.6	25.7	-	20.7
18-21	17.7	20.2	14.9	21.2	29.6	35.5	-	22.7
21-31	18.1	22.1	13.4	25.5	20.8	17.5	23.7	18.1

had low precision and the recommendations based on such results have low reproducibility.

Plant Breeding discipline shared 1297 (71%) experiments followed by Agronomy (13%), Entomology (9%) and Pathology (6%). Experiments on plant protection and physiology had high C.V.% (> 25%), while Agronomy had the lowest C.V.% (< 17%).

The C.V.% as influenced by crops and plot sizes are presented in Table 2.

The results (Table 2) indicated that average C.V.% decreased from 26.7% for the smallest sized plot of 1 to 3 sq.m. area to 18.1% for the plot of 21 to 31 sq.m. area. The decrease in C.V. was observed consistently upto the plot size of 9 to 12 sq.m., in all crops barring gram; thereafter consistency was not observed.

The data were also scrutinized to study the influence of plot size and number of treatments on C.V.%. The number of treatments did not show expected trend in C.V.% (Table 3). This inconsistency could not be resolved. Experiments with 11 to 15 treatments had the lowest C.V.%.

Table 3. C.V.% influenced by number of treatments and replication in pulse crops

Treatments	Replications					
	2	3	4	5	6	Mean
Upto 5	15.6	35.6	20.3	-	-	21.8
6-10	26.6	23.6	21.8	32.0	17.3	22.4
11-15	26.5	21.3	18.7	67.4	-	19.9
16-20	27.7	22.5	20.4	-	-	21.2
21-25	24.1	22.4	23.8	-	-	23.1
26-30	21.9	20.4	20.9	-	-	20.7
> 30	23.0	24.1	17.2	-	-	22.7
Mean	24.9	22.4	20.4	42.1	17.3	-
No. of expts.	65	626	1099	7	14	-

The data in Table 3 showed decreasing trend in C.V.% due to increase in number of replications (barring five replications). Precision of the experimental data depends on block size and number of replications. This has been reflected in the present analysis. As evinced, 3 or 4 replications are not sufficient for reliable results of pulse crops. The results presented in Tables 2 and 3 indicated that there is a need to determine optimum plot size, block size and replications for field experimentations on pulse crops.

Experimental design also plays significant role in the precision of the results. But in the present case randomized block design and split plot design, the commonly used designs did not show marked deviation in C.V.%.

Based on the results, it could be generalised that the experiments on pulse crops conducted in Gujarat state showed poor precision. Therefore there is a need to work on location based plot technique including block size for different pulse crops with a view to improve efficiency of field experimentation.