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Sampling Technique for Measuring Pod Characters of Okra

J. N. Patel and K. C. Dalal

Gujarat Agricultural University, Anand Campus, Anand-388 110

ABSTRACT

To improve efficiency in collecting data on pod attributes of okra, the sampling technique (size) was studied. A sampling plan of selecting 8 plants at random and measuring 2 pods per selected plant (i. e. 16 pods per plot) appeared optimum and econonical for taking measurements of pod attributes in field experiments on okra. It saves time required for constant vigilence on opening of flower and subsequent observations.

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INTRODUCTION

In any field experiment, the researcher has to face the problem of optimum (efficient) sample size for measuring plant characters. The optimum sampling technique depends on the variability associated with variable and the cost of reducing that variability. Rigney and Nelson (1951) in cotton and Patel (1966) in wheat estimated the size of the sample needed in taking measurements of plant characters. No such information is available on okra (*Abelmoschus esculentus* L. Moench). This paper deals with sample size study in okra, particularly for taking measurements of pod characters (length and weight). The investigation was carried out at the Plant Breeding Research Farm, Gujarat Agricultural University, Anand Campus, Anand.

MATERIALS AND METHODS

The experiment was conducted with 28 genotypes (seven parents and their 21 diallel crosses) in randomised block design with three replications. The genotypes were grown at 45 cm x 30 cm spacing, each plot had two rows of ten plants each. End border rows were provided in each replications. The crop was fertilized @ 60-30 kg NP/ha.

For deriving optimum sampling technique, the observations on pod weight (g) and pod length (cm) were taken only from 10 plots selected at random from each replication. Three plants were tagged at random per plot for recording observations. The tagged plants were inspected daily in the morning hours. The flowers which were found open on tagged plants were labelled with date of opening of flower. The six days old pods, being more prefered by the consumers, developed from labelled flowers were harvested separately for taking pod weight and pod length. The six days period was fixed to control extraneous errors entering in the measurements.

The pod weight and length of first ten pods from botom (i. e. first pod of plant) to top of a plant were utilized in analysis. The there were 30 pods (3 plants per plot x 10 pods per plant) per plot and 300 pods per replication. Considering the time factor, the data of two replications were collected for deriving optimum sampling plan. (Optimum in the sense of time involved in taking pod measurements).

Since plots (genotypes) were selected at random in both the replications, the data were analysed replication-wise by analysis of variance technique (Table 1) to estimate variance components associated with plots (σ^2a), plants (σ^2b) and pods (σ^2c).

TABLE 1
Form of analysis of variance.

Sources of variation	*d.f.*	*m.s.*	*expected mean squares*
Among plots	a-1	M_a	$\sigma^2c + C\,\sigma^2b + b.c.\,\sigma^2a$
Plants/plot	a (b-1)	M_b	$\sigma^2c + C\,\sigma^2b$
Pods/plant/plot	ab (c-1)	M_c	σ^2c

Where, a = number of plots, b=number of plants/plot and c=number of pods/ plant /plot.

The concept of variance of mean ($S^2_{\bar{y}}$) was used in deriving optimum sampling plan (Snedecor and Cochran, 1967). The variance of mean ($S^2_{\bar{y}}$) was worked out using the relation :

$$S^2_{\bar{y}} = \frac{\sigma a^{\wedge 2}}{a} + \frac{\sigma b^{\wedge 2}}{a.b} + \frac{\sigma c^{\wedge 2}}{a.b.c.} \quad \text{...Eq. 1}$$

$\sigma a^{\wedge 2}$, $\sigma b^{\wedge 2}$ and $\sigma c^{\wedge 2}$ for the trait were obtained from the analysis of variance (Table 1).

The same variance of mean can be altered for the mean by using various combinations of b and c in Eq. 1.

$$\text{i.e. } S^2_{\bar{y}} = \frac{\sigma a^{\wedge 2}}{a} + \frac{\sigma b^{\wedge 2}}{ab'} + \frac{\sigma c^{\wedge 2}}{ab'c'}$$

Where b' and c' are the altered values of b and c, respectively.

The component $\sigma a^{\wedge 2}$ was assumed as contant, as it represented variation due to genotypes.

$$\text{Efficiency of new sampling plan i} = S^2_{\bar{y}} / S^2_{\bar{y}i} \quad \text{...Eq. 2}$$

While selecting the optimum sampling plan, the emphasis was given to the total time (indirectly cost) of making measurements of pod weight or pod length without sacrificing precision.

RESULTS AND DISCUSSION

The results (Table 2) revealed that pod weight had large variation as compared to pod length. These estimates (Table 2) were utilised in derving alternate sampling plans (i.e. altering the value of b from 1 to 10 plants per plot and c from 1 to 10 pods per plant, making total 100 sampling plans). The relative efficiency of each plan was worked out in relation to original plan (3 plants per plot and 10 pods per plants). Using Eq. 2 for bravity, the relative eficiency of few alternate sampling plans is given in Table 3.

The results (Table 3) indicated that the relative efficiency of new sampling plans increased with the increase in number of plants per plot and/or pods per plant. The rate of increase in relative efficiency was more with the increase in number of plants per plot than number of pods per plant.

TABLE 2

The estimates of variance components for plots (σ^2_a), plants (σ^2_b) and pods (σ^2_c).

Variance component	*Pod weight*		*Pod length*	
	Repl. I	*Repl. II*	*Repl. I*	*Repl. II*
σ^2_a	7.44	11.81	1.38	2.38
σ^2_b	18.11	10.46	2.53	1.41
σ^2_c	67.48	78.67	11.22	13.06

TABLE 3

Relative efficiency for some of the alternate sampling plans.

Number of		*Pod weight*		*Pod length*		
Plants per plot	*Pods per plant*	*Repl. I*	*Repl. II*	*Repl. I*	*Repl. II*	*Average over both traits*
1	1	16.9	27.8	17.2	19.5	17.8
1	5	40.3	47.1	42.2	51.3	45.2
5	1	64.0	60.5	62.9	62.3	62.4
1	10	48.7	59.5	51.6	64.5	56.1
10	1	98.3	86.5	94.3	85.8	91.2
2	5	67.7	71.9	68.9	74.8	70.8
5	2	88.3	82.3	86.3	82.8	84.9
3	5	91.3	87.2	87.4	89.3	88.5
5	3	101.0	93.6	98.6	93.0	96.5
2	8	75.9	81.6	77.6	84.2	79.8
4	4	97.2	92.6	95.7	92.6	94.5
8	2	114.4	99.4	108.3	97.4	104.9
3	6	91.3	91.1	91.2	91.9	91.4
6	3	110.6	100.0	107.1	98.3	104.0
2	9	77.7	83.7	79.1	87.9	82.2
9	2	92.8	103.3	113.4	100.7	102.5
2	10	91.1	85.4	81.0	87.9	83.3
4	5	102.5	97.6	100.9	97.0	99.5
5	4	108.9	100.5	106.1	99.1	103.6
10	2	124.5	106.7	118.4	103.5	113.3
5	5	114.2	105.1	111.2	103.2	108.5
3	10	100.0	100.0	100.0	100.0	100.0
10	10	158.4	131.3	148.8	123.9	140.6

Among different sampling plans, a plan with 8 plants per plot and 2 pods per plant (total 16 pods per plot) had on an average 104.9 per cent efficiency i. e. almost equal (rather slightly more) efficiency when compared with original plan of 3 plants/plot and 10 pods per plant (30 pods per plot). By adopting this new plan 46.7 per cent work load (time) could be saved without sacrificing precision.

The other alternate plan with 6 plants per plot and 3 pods per plant (total 18 pods per plot) had also 104.0 per cent efficiently in comparison to original plan but had 40 per cent less amount of field work.

The results thus revealed that work load for field operation like tagging of flowers, harvesting and measurement of individual pod could be reduced effectively without sacrificing efficiency by selecting proper sampling plan. The sampling of selecting 8 plants at random per plot and measuring 2 pods per each selected plant appeared optimum and efficient. The other plan which can be employed with same efficiency is to select 6 plants at random per plot and measure 3 pods per each selected plant but work load will be about 7 per cent more than the plan with 8 plants x 2 pods per plant. Similarly a sampling plan of selecting 10 plants per plot and measuring 2 pods per plant (i. e. 20 pods per plot) can be used as an efficient plan but work load will increase by 12.5 per cent more than the plan with 8 plants x 2 pods per plant.

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