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A Survey on the Typical Sample Size for Testing Yield Parameter of Sugarcane

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ABSTRACT

A sample survey was conducted on five strains of sugarcane to determine the minimum sample size of stalk for use which could lead to the accurate estimate of average yield of sugarcane and hence per hectare yield.

The results of the present study show that with the increase of sample size co-efficient of variation comes to some steady point, the length of confidence interval of the mean yield of sugarcane decreases and the error of estimation also decreases leading to better accuracy of estimation. The minimum length of confidence interval with probability 0·95 and smallest error of estimation were obtained with sample size over 50.

INTRODUCTION

Very often it is necessary in the pre-harvest period to estimate the per hectare yield of sugarcane for different varieties and for this, samplings through various processess are practiced. The accuracy in the estimation depends on the size of the sample taken from the variety under study. Sampling procedures devised by Yates (1981), Cochran (1974) and sample size determination procedures given by Cochran and Cox (1972) and Mendenhall (1969) have been followed in the study. Patil *et. al.* (1981) mentioned similar studies to estimate the sample size on crops like cotton, wheat, barley, rice and lentil carried out by several workers. They also mentioned several workers who worked out the size and unit of sample for estimating the yield of cane, height, diameter etc. For more accuracy in the estimation with particular crop it is necessary to determine a minimum size of sample for use in a sample survey.

Therefore, a survey was conducted on a few sugarcane strains to determine the smallest sample size that would produce statistically precise results.

MATERIALS AND METHODS

The sample survey was carried out at Sugarcane Research & Training Institute in harvesting season of 1981-82. Forty eight canes were taken from each strain

planted in a plot measuring 9·14m X 9·14m, where there were eight rows of canes. Six canes were taken at random from each row i.e. a random sample of forty eight canes were taken from the plot of a particular strain.

These forty eight canes were then mixed and each cane was weighed separately. From the weight of these forty eight canes, eight separate random samples of sizes 6, 12, 18, 24, 30, 36, 42 and 48 were taken with replacement. In the same way, the survey was conducted in five plots of five strains.

The data were analysed statistically for the study of(1) the variance, co-efficient of variation and the length of confidence interval of the yield parameter for the sample sizes; (2) effective number of samples for specified accuracy.

RESULTS AND DISCUSSION

The variability of each sample was determined by means of the co-efficient of variation. Table 1 shows that, with the increase of the sample size, there is a smooth and dramatic increase in the co-efficient of variation and further increase in the sample size brought the co-efficient of variation as a whole in a steady stage and the length of 95% confidence interval decreased. From the stage where the sample size was 30, this length of confidence interval decreased with a constant percentage and over this size of the sample, co-efficient of variation was more or less in a steady position and the length of confidence interval reached a minimum value. From this, it may be assumed that for the mean yield of sugarcane, sample size may be over 30 and sample size over 50 would give better precision. These sample sizes were necessary for each of the five strains under study. The length of confidence (95%) interval and co-efficient of variation indicated that it would be better to take a sample of size 40 (no. of cane) and above for each of the five strains (Table 1).

The accuracy in the estimation was closely linked with the size of sample in the survey. Hence it was necessary to know the size of sample required to obtain 5% error of the mean. To bring the error to a minimum, a fairly large nnmber of samples is necessary. Since the sample size required to achieve p% (P=10%, 7% and 5%) efficiency is directly proportional to the square of the co-efficient of variation $[n=(t/p)^2 x(c\ v.)^2]$, an increase in the co-efficient of variation implies an increase in the size of sample. With this standard of accuracy, the effective size of sample was worked out in Table 2.

It may be reasonably certain in the present experiment (with probability approximately equal to 0·95) that the estimate will be within 10%, 7% and 5% of the true average yield. This method of choosing the sample size is approximate for a specified desired accuracy of estimation. It is the best available and better than selecting the sample size on the basis of intuition. Table 2 shows that the percent of deviation of the estimate from the population parameter is decreasing with the increase in the size of sample, i.e. the number of stalks.

Table 1. Co-efficient of variation, length of 95% confidence interval for the mean weight of a cane.

Variety	I-41/75			I-63/75			I-88/75			I-91/75			Co.1158		
Sample size	Variance (s^2)	Co-efficient of Variation	Length of confidence interval	Variance (s^2)	Co-efficient of variation	Length of confidence interval	Variance (s^2)	Co efficient of variation	Length of confidence interval	Variance (s^2)	Co-efficient of variation	Length of confidence interval	Variance (s^2)	Co efficient of variation	Length of confidence interval
6	0.0109	12.41	0.22	0.0078	12.03	0·19	0.1558	54.82	0.83	0.0228	24.78	0·32	0·0744	25.27	0.57
12	0.0151	14.90	0.16	0.0389	32.01	0.25	0.0895	38.06	0.38	0.0526	32.01	0.29	0.0615	29.15	0.32
18	0.0285	19.68	0.17	0.0388	26.31	0.20	0.0874	31.74	0.29	0.0265	23.15	0.16	0.0667	27.27	0.26
24	0.0386	22.18	0.17	0.0368	27.90	0.16	0.0814	31.11	0.24	0.0495	30.91	0.19	0.0594	26.60	0.21
30	0.0208	16.47	0.11	0.0406	29.59	0.15	0.0940	34.92	0.23	0.0335	27.69	0.14	0.541	26.81	0.17
36	0.0292	19.57	0.12	0.0453	33.20	0.14	0.0837	33.25	0.20	0.0326	25.20	0.12	0.0511	24.62	0.15
42	0.0278	19.27	0.10	0.0423	30.98	0.13	0.0808	33.00	0.18	0.0323	25.40	0.11	0.0638	26.58	0.16
48	0.0287	19.63	0.10	0.0395	29.44	0.12	0.0804	32.59	0.16	0.0347	27.20	0.11	0.0596	25.51	0.14
X^2_7		5.75			4.49			1.41			3.75			0.85	
P.V.		0 0274			0.04			0.0859			0.0353			0.0592	
P.C.V.		19.23			29.42			34.31			27.23			26.00	
Observed range		0.754			0.784			1.042			0.842			0.980	
Empirical range		0.662			0.800			1.172			0.752			0.973	

P.V.= Pooled variance

P.C.V.= Pooled co-efficient of variation.

Table 2. Minimum sample size to estimate the mean weight of cane for less than P% error of estimation with a probability of 0·95.

Varieties / Percent of deviation	Expected sample size				
	I-41/75	I-63/75	I-88/75	I-91/75	Co.1158
P=10%	15	34	46	29	26
P= 7%	30	30	90	59	54
P= 5%	57	134	183	115	105

From the Tables 1 & 2 it is also evident that lesser the impirical range (0·662), as found in I-41/75, smaller is the size of sample required for yield estimation. And higher the impirical range (1·172), as recorded in I-88/75, larger is the sample size required for the purpose.

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