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Comparison of Sampling Methods for Estimating Lucern Yield

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ABSTRACT

The efficiency of three sampling methods, viz., stratified random sampling, double sampling and component sampling over simple random sampling was compared for estimating total green forage yield of lucern (Cv. Anand 2). The uniformity trial data of the years 1988-89 and 1989-90 were used for the purpose. In all six cuts were obtained in each year. The results revealed that the stratified random sampling and component sampling were more efficient than the SRS. The double sampling could not prove effective for this purpose.

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INTRODUCTION

Several sampling methods have been developed for crop survey to estimate total production with a view to get maximum information at a minimum cost. Generally simple random sampling (SRS), stratified random sampling etc are employed depending upon the situation. It become easy to collect data of crops having single cut. But for crops like lucern having multi-cut harvest, it becomes difficult to collect the data because of transport and supervision difficulties. Such surveys are time consuming and costlier. Goel *et al.* (1978) and Kaistha and Goel (1981) showed that it is feasible to utilize partial harvest data collected through double sampling and component sampling to estimate total production of crops having multi-harvest nature. However such information is lacking for lucern crop. The results presented herein relate to the relative efficiency of stratified random sampling, double sampling and component sampling in comparison to SRS for estimating total green fodder yield of lucern variety Anand 2, being the most popular variety among farmers.

MATERIALS AND METHODS

The data generated through uniformity trial conducted at the Forage Research Farm, GAU, Anand during the crop seasons of the years 1988-89 and 1989-90 were utilized for the purpose. The analysis of yield data of 1200 and 400 basic units each of one sq. m. revealed that a sampling plot of 10 sq. m. area (1 m length x 10 m width) was the optimum size for recording green fodder yield. The adjacent basic units were combined to form plots each of 10 sq. m. area, making 120 and 40 plots in

first and second year respectively. Cut-wise green fodder yield data for these plots were generated and used in comparing efficiency of various sampling methods. In all six cuts were obtained in both the years.

Sampling plans

In *stratified* random sampling, the data of six cuts were grouped into three strata on the basis of mean yield. The first two cuts formed stratum 1; the third and fourth cut formed stratum 2 and last two cuts formed stratum 3. Thus each stratum size was of 240 plots (observations) in the first year and of 80 plots in the second year. A random samples of size equivalent to 10 and 20 per cent of the total plots were selected from each stratum to workout average total yield and variance of mean (Cochran, 1972) and relative efficiency (RE).

RE = S^2/Sw^2 where S^2 is the overall (total) mean square and Sw^2 is the within strata mean square in analysis of variance.

In *double* sampling a small number of plots were selected for recording yield data for all the cuts (n") whereas large number of plots were selected for only one cut (n') which was highly correlated with the total yield. The datails about samples selected for analysis were as under :

Year	No. of plots per unit	n'	n"	
			10%	20%
1988-89	120	75	12	24
1989-90	40	25	4	8

The average total yield based on all cuts, variance of mean and efficiency of double sampling compared to SRS were estimated following methods given by Satyapal and Srivastava (1983).

The relative efficiency (RE) of double sampling estimate $\bar{Y}_{ds}$ as compared to SRS estimate $\bar{Y}_{SRS}$ is estimated by

$$R.E. = \left[\frac{1}{\sqrt{1-r^2} + \frac{2}{\sqrt{(K^{-1}}}} \right]^2$$

Where r is the correlation coefficient between j th cut yield and total yield for n" fields (j th cut yield has maximum correlation with total yield).

k is the number of cuts (k = 6).

The procedure for (*component* sampling consists of selecting independent random samples of size n1, n2,.... nk plots (but not fixed plots) and recording yield data of each cut 1, 2, ..., k. Here also 10 and 20 per cent plots were sampled from each cut for recording yield data for analysis. An estimate of average yield for each cut was obtained first ($\bar{Y}_j$) and then an estimate of average total yield over all cuts was obtained by adding the estimates of average yields in individual cuts. $\bar{Y}_c = \Sigma \bar{Y}_j$ (j = 1, 2, ..., k) (Satyapal and Srivastava, 1983). The relative efficiency of this plan in relation to SRS was estimated by

$$R.E. = \frac{K S_y^2}{\left(\sum_{J=1}^{k} S_j^2 \right)}$$

Where S_y^2 is the variance of Y_{SRS} in SRS
S_j is the standard deviation of the j th cut
(j = 1, 2, . . . , 6)

RESULTS AND DISCUSSION

The estimates are presented in Table 1.

TABLE 1

The estimate of total average yield (kg/10 sq. m) and relative efficiency of different sampling methods %.

Year	Sampling methods	Av. total yield		Relative efficiency	
		Size 10 %	Size 20 %	Size 10 %	Size 20 %
1988-89	1. Stratified random sampling	51.91	52.23	191	178
	2. Double sampling				
	— Third cut	55.92	52.29	67 *	
	— Fourth cut	53.61	53.02	118 *	
	3. Component sampling	56.01	52.50	128	167
	Population	52.93			
1989-90	1. Stratified random sampling	64.43	64.16	223	168
	2. Double Sampling				
	— Third cut	64.17	64.41	74 *	
	— Fourth cut	64.40	65.47	75 *	
	3. Component sampling	64.35	64.48	192	113
	Population	64.29			

* The reduction in cost was not estimated

The results revealed that the stratified random sampling and component sampling were more efficient than the SRS for estimating total yield of lucern. The relative efficiency of stratified random sampling over SRS was 191 and 178 per cent during first yeat and 223 and 168 per cent during second year. The component sampling was 128 and 167 per cent more efficient than SRS during first year, while these estimates were 192 and 113 per cent during second year. It is worth noting that during second year the efficiency of these two sampling methods was higher when sample size taken was 10 per cent of the total plots than that when sample size taken was 20 per cent of the total plots (for this deviation reason could not be resolved). Of these two methods, stratified random sampling appeared better

than component sampling for estimating total yield of lucern. The latter is better for partial harvest data.

The double sampling had lower efficiency than the SRS. The efficiency of former depends on the correlation between yield of individual cut and total yield. The yield of a cut having high correlation with the total yield is given more weightage in double sampling. This might be the reason for low efficiency of double sampling. The results indicated that the double sampling should not be followed for estimating total green fodder yield of lucern crop.

For the estimation of total green fodder yield of lucern (Cv. Anand 2), stratified random sampling and component sampling proved efficient in both the years of study. For partial harvest data, component sampling proved better, while double sampling could not. These results are indicative in nature and actural field survey needs to be undertaken for indepth study.

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