Comments on “Evaluation of Statistical Estimation Methods for Lognormally Distributed Variables”

This paper presents an evaluation of methods of estimating the population mean, variance, and coefficient of variation of lognormally distributed data. The authors make the point that the frequency distributions of many measured soil properties have been found to be positively skewed and conform reasonably well to a lognormal probability density function. However, they imply that soil scientists are not knowledgeable about the best way of characterizing such skewed distributions.

The paper compares the efficacy of Finney’s (1941) method for estimating the mean, variance, and coefficient of variation of lognormal data, with that of the more common “methods of moments” (calculation of mean and variance assuming a normally distributed sample population) and the “maximum likelihood method,” which should have been attributed to Fisher (1921). The paper acknowledges that Finney (1941) and Sichel (1952) independently developed the method for determining an unbiased estimator, with minimum variance, of the arithmetic mean of a lognormally distributed sample population, but mistakenly states in the Summary that “Finney’s method has not been previously applied by soil scientists.”

In a paper published by White et al. (1987) in Fertilizer Research 11:293-308 and referenced by Parkin et al. (1988), two of the authors and the reviewer of this paper were not aware of this previous work. Unfortunately, this galleys proof correction was overlooked when the article went to press.

Reply to “Comments on ‘Evaluation of Statistical Estimation Methods for Lognormally Distributed Variables’”

We would like to thank Dr. White for his comments concerning our paper. They have prompted us to carefully review our paper as well as his work. Dr. White’s main concern appears to be with the degree of recognition our paper attributed to his recent work which appeared in Fertilizer Research (White et al., 1987). This matter may be clarified by a brief review of the chronological development of our work.

We initiated our work on the evaluation of statistical methods for lognormally distributed data in 1985, and submitted the original manuscript to the Soil Science Society of America Journal in 1986. At the time the original paper was written, the sentence in the abstract stating that Finney’s method had not been previously applied to soils data was true. The original draft underwent some major modifications and was subsequently resubmitted to the Soil Science Society of America Journal in 1987. In this later revision we acknowledged the work of White et al. (1987) in the introduction. Specifically, “Finney’s method for estimating the mean, variance, and coefficient of variation of lognormal data has only rarely been applied to soils data (White et al., 1987; Parkin, 1987; Parkin et al., 1987).” The sentence in the abstract was not corrected in the resubmitted version of the manuscript; however, this sentence was corrected in the galleys proofs. Unfortunately, this galleys proof correction was overlooked when the article went to press.

With regard to our incorrect reference to work of White et al. in Table 1 of our paper, Dr. White is absolutely correct. In the body of Table 1, line 11, column 4 should read 1, 2, 3, instead of 2. We regret this clerical oversight, but we are confident that Dr. White understands that mistakes do occasionally occur. For example, Eq. [9] of White et al. (1987), which defines the variance of the maximum likelihood estimator of the mean, is incorrect. The correct expression for the variance of the maximum likelihood estimator of the mean (m_b, our notation) is given by Eq. [18] of Parkin et al. (1988). Thus, all subsequent statements made by White et al. (1987) concerning the efficiency of the Sichel estimator (\( x_s \)) relative to the maximum likelihood estimator (\( x_t \)) must be viewed with caution.

The final point we would like to respond to concerns Dr. White’s view that our work confirmed his earlier conclusions concerning the efficiency of the Finney-Sichel estimators. We disagree with this comment completely. In their work, White and coworkers (1987) did not evaluate these statistical methods but simply applied the techniques to sample data sets. Unless the underlying population parameters are known (which is not the case with sample data), a comparison of methods can yield no conclusions concerning the suitability of a given estimation procedure. With such an approach, the only valid conclusion that can be reached is that the estimation procedures are different. In addition, White and coworkers only focused on the bias and efficiency of the mean, and did not discuss the statistical properties of the variance or the coefficient of variation. The primary objective of our study was to bring to light, in the soil science community, the fact that better estimators for lognormally distributed

References


