THE USE OF PARTIAL LINEAR REGRESSION TO ANALYZE
THE CURVILINEAR RELATIONSHIP BETWEEN THE
YIELD OF VEGETABLE CROPS AND THE CONTENT OF NUTRIENTS IN THE LOWER MAIN
STEMS

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THE application of correlation methods to the analysis of the relationship between yield and fertilizer additions of a given element or between yield and the availability of a nutrient is complicated by the presence of other limiting factors, as the amount of the nutrient is increased, and by the fact that the relationship is curvilinear instead of linear. Partial correlation methods enable one to take into account the effects of other factors, provided a record of these factors is kept. This means much additional work, especially if several factors are known to exert influence, but even additional work will not solve the problem of the curvilinear relationship.

Some rather laborious mathematical methods have been devised for curvilinear correlation which give the statistics called the correlation index and the correlation ratio. The determination of the correlation index necessitates a knowledge of the equation of the curve previous to starting the correlation computation. This index simply tells how well the data fit a certain curve which is thought to approximate the actual relationships of the population involved. For instance, the nutrient-yield relationship resembles a simple logarithmic curve. If this curve could be used it would simplify matters greatly because the log value of the nutrient could be used with yield, curvilinearity would disappear, and the usual linear partial or multiple regression methods could be applied to the whole nutrient range. However, the ordinary log curve has one rate of flattening out and only one. Environment and other limiting nutrients influence very greatly the rate of flattening out or the degree to which the law of diminishing returns applies. Hence the log curve might apply under a certain set of conditions but would not apply at all under another set. If it is always applied to the set of conditions which are most likely to occur, it would be of value, but this is not likely. Of course by means of introducing a change of base or certain constants in the proper manner it might be possible to adjust the curve. Adjusting the curve for each set of conditions, however, would require an exceptionally well-skilled mathematician, would consume much time in collecting enough data to show how to adjust the curve so it would fit and in performing actual curve fitting calculations, and would complicate the biological interpretation very much.

The correlation ratio devised by Karl Pearson tells how well the

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