that should prove beneficial throughout their lives.

Benefits to IANR:

1. The faculty developed an increased awareness of microcomputer technology and its role in agriculture and education.
2. The course increased the usage of microcomputers at all levels within the institute.
3. The course prompted further investigation and application in the use of microcomputer assisted instruction (CAI).
4. A source of technical, agribusiness-oriented programs that may be adaptable to instruction, research or extension was made available.
5. A cooperative effort was made across all departments within IANR to develop computer awareness and skills.
6. The IANR computer advisory committee broadened its scope to include a wide variety of agricultural computing problems.

Benefits to the Departments:

1. Faculty involvement with microcomputer applications in both educational and agricultural areas was enhanced.
2. A means to purchase microcomputers on a cost-share basis for use within departments was made available since staff members were involved with assisting students enrolled in the computer course.
3. A means to secure microcomputer programs needed within departments was developed.

The greatest benefits are yet to come. In a coordinated effort, IANR faculty will plan the future role of Ag 271 and make necessary adjustments in the objectives and content to meet the ever-changing needs of agriculture and IANR.

Future Considerations: Initially Ag 271 was regarded as a "stop gap" measure for those students not receiving computer instruction in Nebraska secondary schools.

A similar course will most likely be needed with periodic modifications as technology changes. The initial course may need to be divided into a basic, remedial offering to address students entering UNL with no computer skills, and then into a higher level programming course with more sophistication and difficulty. A higher level course would allow greater exposure to a variety of microcomputer systems and allow greater application of commercial software for agriculture.

The Institute of Agriculture and Natural Resources at the University of Nebraska believes this method of providing microcomputer instruction to undergraduate students has been very effective. In three semesters, approximately 350 students have completed the course and exhibit excellent programming and user skills. An additional 150 are enrolled for spring '84, and about 50 faculty have also participated in the course.

One of the underlying reasons for this success is the cooperative approach allowing participation of faculty from each of the technical departments in providing assistance and supervision of Ag 271 students. These efforts have made this course a truly college-wide effort in which students and faculty alike can take pride.

This is a model for microcomputer education which is easily adaptable to other educational disciplines and/or institutions. The keys are cooperative planning and involvement to address not only student needs, but also the comprehensive microcomputing needs of a particular educational setting.

CASE REPORT

Toxicity Terminology And Dilution Factors Taught by Simple Formulae

S. Warwick Fisher

Modern Agriculture has become an increasingly technical field in which an instructor is inevitably pressed to explain terms or processes which are themselves sophisticated and technical. Two such problematical areas are expressions of toxicity, such as LD_{50}, LC_{99}, KD_{50} etc., and the means of diluting concentrated solutions. Both concepts are of relevance to agricultural education whether the student wishes to pursue basic experiments in a laboratory or apply the principles to tank mixtures in a field setting. The teaching of these ideas, however, is fraught with much confusion as a result of the multiplicity of seemingly interchangeable terms as well as the lack of standardized methodologies for carrying out related procedures. The confusion can be eliminated if the instructor reduces expressions of toxicity and the calculation of dilution factors to derivatives of simple formulae.

Toxicity Expressions

In the case of the first principle, namely expressions of toxicity, we find that the term LD_{50} is most frequently used as a measure of toxicity. Here the amount of compound (mg) needed to kill 50 percent of individuals in a test population (individual weight given in kg) is calculated by exposing groups of organisms to graduated doses of the toxicant; the mortality of each group is scored subsequently. In this type of experiment, the experimental variable is the dosage of

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compound administered, and the parameter used to evaluate toxicity is death.

While death may be a convenient endpoint for the assessment of toxicity, it is rather crude. An investigator may prefer instead to measure the effect of a toxicant upon an organism's fecundity, liver function, tail length, or general behavior. Similarly, the researcher may choose to hold the dosage of the toxicant constant, and vary instead the period of time which he will allow to elapse before assessing the toxicant's impact. Moreover, 50 percent is not always the extent to which the test population succumbs to the toxicant. These changing conditions and variables give rise to a plethora of confusing terminology, e.g., KD_{50}, LT_{10} etc.

All expressions of toxicity can in fact be derived from a simple formula consisting of two letters followed by a numerical subscript (Fisher, 1983). The first letter denotes the type of response being measured: for example, the L in LD_{50} (where L stands for "lethal") indicates that the toxicologist will be monitoring the mortality rate among his test populations. The second letter stands for the experimental variable: in LD_{50}, the D indicates that the experimenter, while holding other factors constant, will inflict varying dosages upon his test organisms. Lastly, the numerical subscript gives the percentage of the experimental population which will exhibit the response in question: the 50 in LD_{50} thus shows that a particular dosage will prove fatal to 50 percent of the test organisms.

The formula also makes possible the analysis and understanding of more obscure terms: KD_{75}, for example, indicates that a particular dosage of a toxicant will produce "knockdown" (lack of movement, but not death) in 75 percent of a population. In LT_{75}, on the other hand, the formula tell us that 75 percent of the population has died, but here the experimental variable is the amount of exposure time to a constant dosage of toxicant. Where an effect other than death or knockdown is sought, the designation E (for "effect") is used. Thus, EC_{99} indicates that a certain concentration of a toxicant will produce an effect, specified elsehwere, in 99 percent of the test population. If the student will simply remember that the first letter denotes the type of response, the second gives the experimental variable and the numerical subscript tells the percentage of the population responding, even unusual toxicity expressions are easy to evaluate.

Dilution Factors

Turning to the second matter- i.e., the calculation of dilution factors — one finds that students are frequently mystified when asked to make, for example, a 1 mg/ml solution from a stock concentration of 5mg/ml. The difficulty is further exacerbated when the concentration is expressed in percent weight/volume or some other form which must first be translated into more workable units. In any event, the need to make dilutions is so common in agricultural endeavors that it must become a skill in each student's repetoire of techniques.

Instruction of this principle is facilitated by the use of a formula:

$$C_1 V_1 = C_2 V_2$$

Where C_1 = Original stock concentration
C_2 = Concentration of desired dilution
V_1 = Volume of stock solution
V_2 = Volume of dilution

Thus, if one starts with 5 ml of a 5 mg/ml solution and wishes to end up with a solution of 1 mg/ml, the correct dilution is described by the following equation:

$$5\ \text{mg/ml} \times 5\ \text{ml} = 1\ \text{mg/ml} \times V_2$$

Solving for V_2:

$$V_2 = \frac{25\ \text{mg}}{1\ \text{mg/ml}} = 25\ \text{ml}$$

One must therefore add 20 ml of solvent to the original 5 ml of the 5 mg/ml solution to achieve the desired dilution. Using this formula, it is a simple matter to compute dilutions not only for relatively elementary dilutions such as the previous example, but also for more esoteric conversions: e.g., diluting an 87 mg/ml solution to a concentration of 85 mg/ml.

Given the complexity of technical language and the richness of technical terminology, it is important to seek instruction methods which minimize such complexity. The use of elementary formulae for describing toxicity terminology and in the calculation of dilutions reduces a surfeit of analytical jargon to a manageable level. The job of the agricultural instructor in relating and explicating these phenomena is likewise facilitated.

Literature Cited

Fisher, S.W. (1983) **Experimental Insect Toxicology.** Kinko's Professor's Publishing. 220 pp.