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NEW INSTRUMENTATION IN AGRICULTURE

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Instrumentation available for research, especially, is rapidly becoming computerized and miniaturized. Costs seem to be going down rapidly, and most of it can be taken directly to the field. At a recent NATO institute on advanced agricultural instrumentation, I was struck by the number of young people attending the institute and their interest in agriculture, a factor too seldom seen in the U.S.

The North Atlantic Treaty Organization (NATO) sponsors each year a number of special institutes in various scientific areas. One, organized by an electrical engineer from the University of Arizona, covered advanced agricultural instrumentation, held for two weeks at El Ciocco, near Pisa, Italy. The sessions consisted of six lectures and three working laboratories each day. Researchers and a manufacturer's representative shipped their equipment to the meeting place and demonstrated its use (Figures 1 through 3).

There were two impressive generalizations: 1) the microcomputerization of much of the equipment in a fashion so that it could be taken directly into the field, and the data directly recorded, and 2) the general age of the participants which was usually young and vitally interested (Fig. 3). Much of the instrumentation was scientific and not likely to be seen in commercial greenhouses — such as photosynthetic fluorescent equipment. However, a number of items in Fig. 2 are nearing actual application. Several square miles of cotton fields in Arizona are using the palladium probe to measure cotton plant electrical potentials as a means to indicate when to irrigate. The data is sent by telemetry to a central location with the farmer having his own terminal. Infrared thermometry is also being examined for irrigation scheduling, and the device made by the Dutch is a significant price reduction which is rapidly bringing it into reason for greenhouse application. The development of specific ion electrodes, with special membranes for such nutrients as ammonia, potassium, calcium, magnesium, etc., when combined with a computer, opens an extremely good possibility of eventually practicing precision nutrition. The significant reduction in size of infrared gas analyzers even suggests the idea that it might be a means by which a grower could assess the status of his crop as to health and vigor, or fine-tune his environmental control system. The Vaisala and Phillips' humidity probes are probably the best available today, and are rapidly decreasing in price. Problems remain with these due to some of the things we put into the atmosphere in greenhouses. However, they represent a significant improvement in reliability and accuracy over the usual wet-bulb method of determining relative humidity. The vibrating microelectrodes, developed over the past several years by University of California investigators, promise to open a vital new area in nutrient uptake by plant roots. These latter new instruments allow one to look at pH

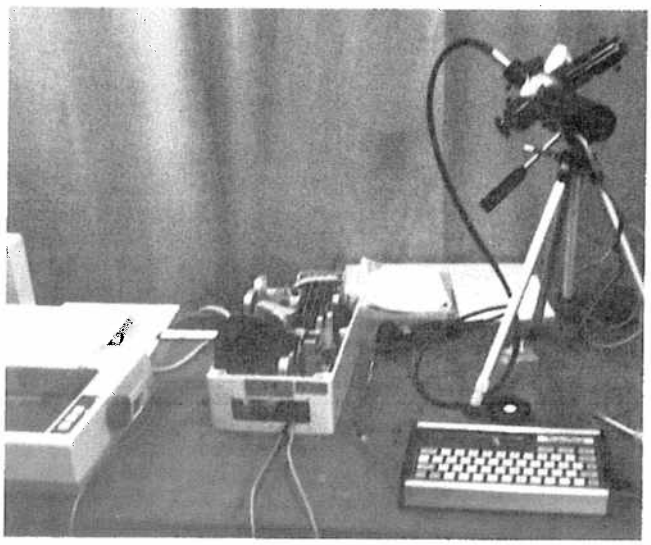

Fig. 1: LI-COR's digital spectroradiometer for measuring spectral energy at different wavelengths. An integration sphere is mounted on the tripod which allows measurement of reflectance and transmittance. A printer is on the left. This equipment can be taken to the field.

[1]*Professor*

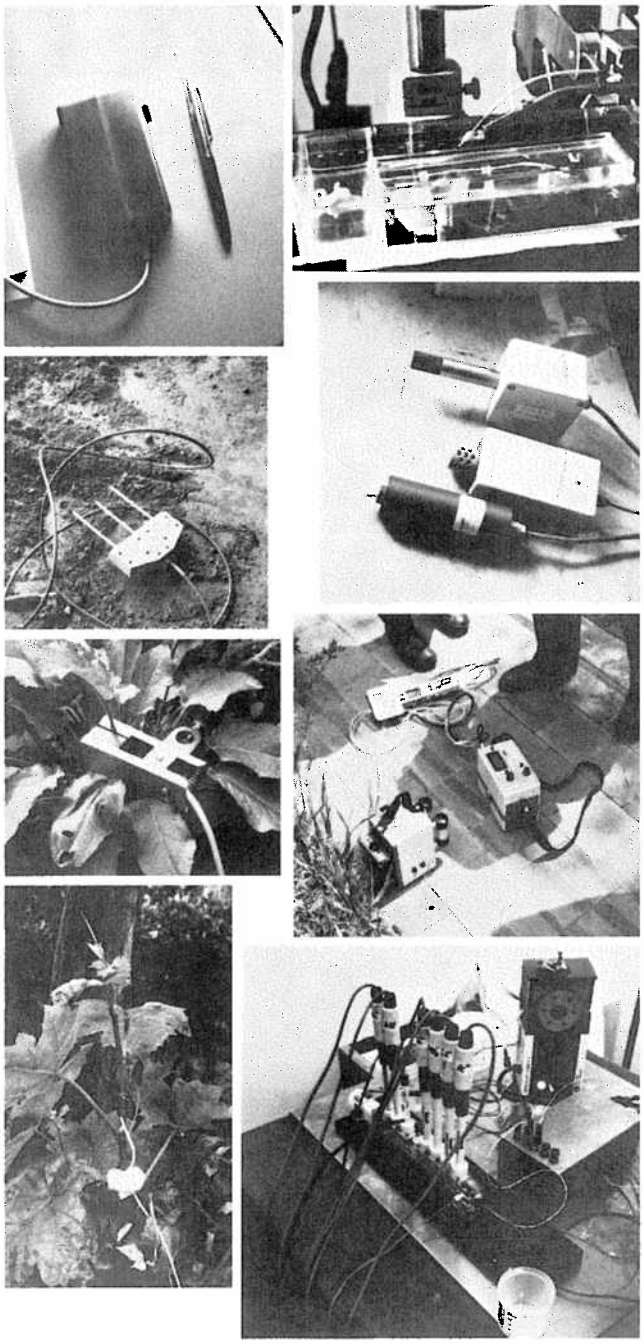

Fig. 2: Examples of recent equipment demonstrated at the NATO conference on Advanced Agricultural Instrumentation.

Top, left:
- Dutch infrared thermometer with a wide field-of-view, less than $500.00.
- Dutch soil moisture probe which depends upon the electrical field about the probes.
- Device to measure sap flow in stems. Still in developmental stage.
- Palladium wire probe in a grapevine to measure plant electrical potential.

Top, right:
- Vibrating micro-electrode, mounted on a microscope stage and used to measure potassium uptake along the length of a plant root.
- Three readily available humidity probes.
- Infrared CO_2 gas analyzer with pump (bottom-left) and leaf clamp (top) for measuring photosynthesis of individual leaves in the field.
- Specific ion probes for measuring and automatically controlling nutrient solution concentration in hydroponic systems.

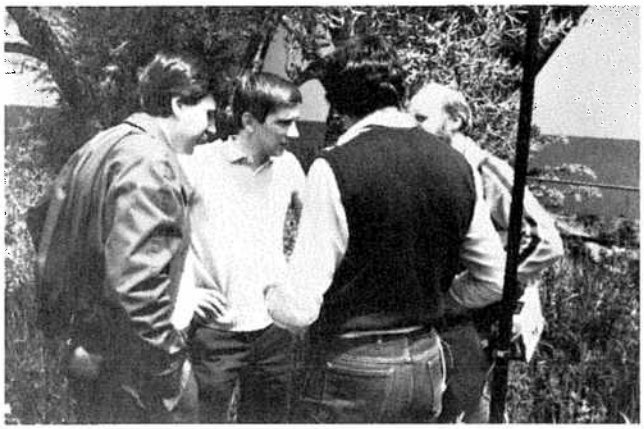

Fig. 3: Group of young scientists discussing a demonstration. The man on the left is Spanish, the center individual is French, and the two on the right are from England.

and potassium uptake by individual root cells. As an interesting side-light, shipping germinating corn roots by air is not suitable for experimental material. They lost their geotropic response and wound up curled when they arrived at the institute. At CSU, we have one of the first spectroradiometers manufactured in the U.S. There is no comparison with the new systems now available (Fig. 1) which do much more with less time and trouble and provide one with an automatic plot of the measurement.

This does not begin to mention all the different equipment types shown at the institute, but it was an eye-opener and made me wish that we had an unlimited budget for all those goodies. Perhaps more important was the average age of the participants. People came from all over Northern Europe, Spain, Portugal, Turkey, Greece and Egypt. The majority of them were just beginning their careers, usually what I might say "wet behind the ears". But, anyone who can speak English better than I can as a native has my respect. There were a few old "duffers", but the situation was usually very informal and the usual good Italian wine to taste.

Following the institute, there was an opportunity to visit Athens (first time) and Cyprus (second time). Both of these countries have serious problems, but they are working hard with dedicated people. In particular, it was a delight to see the greenhouse progress since 1978 in Cyprus (Figures 4 and 5). The greenhouses going up are modern construction of the type best suited for the Mediterranean climate. Although two days was not long enough to see much, many of the Cypriot entrepreneurs seemed to be relatively young and active, even though I didn't always agree with what they were doing.

In general, this was one of the most interesting three weeks spent in recent years, full of new ideas to bring home and try out.

Fig. 4: Common and uncommon:
Top: A field of out-door carnations in Cyprus in June.
Bottom: An exceptionally vigorous strawberry crop on Cyprus in a modern, soft-plastic greenhouse.

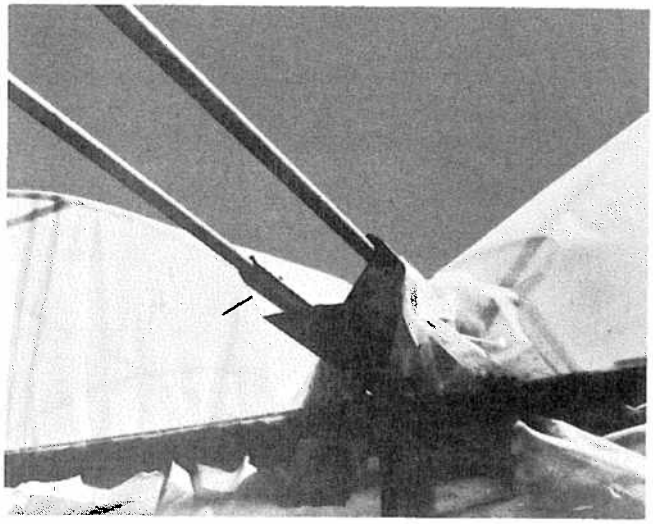

Fig. 5: Rather interesting means of fastening soft plastic to a ridge-and-furrow greenhouse roof. The gutter is heavy galvanized steel with the edges rolled over. The plastic is wound around a ¾" galvanized steel pipe and fitted under the rolled gutter edge. A nail, as shown, keeps the pipe from falling out of its slot, as well as preventing rotation.

U.S. BASIC INDUSTRIES ARE HINDERED BY LOSS OF SCIENTIFIC TALENT: T.F. P'BOYLE

From the Wall St. Journal, CXI(19), July 27:

"...mature industries have in common basically four characteristics that can frustrate competent people: They often exhibit less willingness to adopt new technologies, in part because they have high fixed investments in older manufacturing methods; they are likely to be populated with older top managements who often aren't receptive to innovation; they frequently have a cultural bias against entrepreneurship and risk-taking, and they have limited growth opportunities, which can impede career development."

Editor's Note: Anything about greenhouses that makes the above comments a little too close to home?

ADLER'S LAWS

Venture capitalist Fred Adler has condensed his experience into a few epigrams that could serve as guidelines for dealing with a venture capitalist.

1. The probability of a company's succeeding is inversely proportional to the amount of publicity it receives before it manufactures its first product.
2. An investor's ability to talk about his winners is an order of magnitude greater than his ability to remember his losers.
3. If you don't think you have a problem, you have a big problem.
4. Happiness is positive cash flow. Everything else will come later.
5. The probability of success of a small company is inversely proportional to the size of the president's office.
6. Would-be entrepreneurs who pick up the check after luncheon discussions are usually losers.
7. The longer the investment proposal, the shorter the odds of success.
8. There is no such thing as an overfinanced company.
9. Managers who worry a lot about voting control usually have nothing worth controlling.
10. There's no limit on what a man can do or where he can go, if he doesn't mind who gets the credit.

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