COMPUTER

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Vaniaperu is a tiny village some 60 miles from Ahmadabad, in Western India. Perhaps a hundred people live there in mud huts with thatched roofs. One or two even have corrugated roofs. Naked babies sit in the dust under the porches while the women cook the food and tend the buffalo. The men work in the fields. Brass pots shine out of the dim interiors—pots that will be used twice every day to hold the milk from the buffalo, perhaps 10 or 12 lbs. daily.

Not much. But enough to make the villagers relatively happy. They won't join India's growing statistics of people starving to death.

"GOOD MORNING. 3,336 PEOPLE STARVED LAST NIGHT."

Many experts are becoming acutely concerned with the population vs.food problem. In a full page advertisement in the New York Times recently, the headline read, "Good Morning. While you were asleep last night 3,336 people died from starvation." The ad, which was placed by the Campaign to Check the Population Explosion, came right to the point: From the time we go to bed, to the time we get up each morning, an estimated 3,336 people in undeveloped nations die of illness caused by malnutrition. Mostly children.

Hard facts to believe in a country where the food problem is viewed as too many calories. But the United Nations estimates that more than 300-million children are retarded physically—and in some cases mentally—because of a deficiency of proteins and calories in their diets.

Recently, the Food and Agriculture Organization of the United Nations conducted its third world food survey. The survey concluded that although the quality of average food diets had improved slightly since before the second world war, up to one half (about 1.5 billion) of the world population suffered from hunger or malnutrition, or both.

Since then, world population has continued to increase by 8,000 every hour or approximately 70 million people per year. A number equal to the population of France, Belgium and Holland taken together is added every year to the people living on this earth. It is estimated that the population of the world, which in the year 1900 was only 1.5 billion, will be close to 7 billion by the year 2,000 (and that estimate is considered by many to be conservative). Experts estimate that food production has to be tripled by the year 2,000 to provide adequately for all the world's inhabitants.

Here's the impact population growth has on food production. The much publicized Aswan Dam in Egypt, built by Russia, is one of the most spectacular leaps forward in food production anywhere in the world. The dam increased Egypt's agricultural production by 15 per cent — a boon for the starving *fellahin*. The somber truth, however, is that during the 12 years it took to build the dam, Egypt's population increased 35 per cent.

The dimensions of the food problem are staggering.

• America's granaries—once spilling over with surplus—are down to the reserve point, considered adequate for our own needs, right now.

• U.S. cities take at least 1.5 million acres of open land each year—50 per cent more than a decade ago—reducing prime farmland.

• Barring major war or famine, the World will be "standing room only" by the time the 21st Century rolls around. More people will be alive in 2,000 AD than all the preceding generations combined.

While the sociological and biological implications of this are incomprehensible, nothing is even remotely as important as the problem of feeding this multitude.

While America's crop yield continues to improve the world's situation worsens. Latin America, with the highest birthrate in the world, is actually producing less food today than 10 years ago.

MEETING THE PROBLEM

Fortunately, as the problem grows so do the means of meeting it. Modern technology has already put into man's hands some of the tools necessary to solve the problem:

Research into new varieties of plants and livestock which produce a much greater yield than the varieties they replaced;

New agricultural machinery and ways of automated farming which will produce more food with less human effort;

Modern methods of forest management, and scores of radically new forest products;

New fish-finding and fish-catching techniques, and new ways of getting the catch to the consumer in the freshest condition;

Research into cultivating seaweed and other forms of algae—"mariculture"—which are rich in protein.

All this and other similar developments are designed to meet the threat of this simple but menacing equation—if food production continues merely to match growth of population, there will be about twice as many hungry people in the world in the year 2,000 as there are today.

It looks pretty somber. But technology in the United States has already taken huge strides in increasing food production and developing economic systems for farmers.

A closer look at American utilization of modern farm technology may provide some clues to broader applications in less productive areas of the world. The main thrust of U. S. agriculture has been to increase efficiency in the production of present foods. The biggest single advance is the use of computers in agriculture. In fact, experts predict computer usage in agriculture will be widespread by 1975.

A CLOSE UP: THE COMPUTER ON THE FARM

When the Rural Electrification Program was put into effect in the 1930's most people thought it was simply a Depression "make-work" program. It is doubtful that anyone thought the wall outlet in the quaint farmhouse would be used to plug in communications to a third generation computer. Nor is it likely that today's farmer, even five years ago, suspected the very nature of his occupation would be radically changed by the introduction of sophisticated computer systems. But it was.

U. S. farming has changed. Since the end of the second world war, the number of farms has declined from 5.9 million to 3.3 million—well over 40 per cent—while output soared.

Today, U. S. farms with sales over $40,000 — the so called big farms — produce about 40 per cent of all agricultural output. And those big farms represent only 1 out of every 25 registered farms.

Farming is big business — and sophisticated. For example, a recent IBM Agricultural Symposium in San Jose, California, covered such diverse subjects as automated sensing, computer control of farm machinery of the future, decision making and simulation applied to a California range-feedlot operation; as well as, linear programming, mathematical models, budgeting, and EDP management.

FARM MANAGEMENT

"Applications of computers in solving farm management problems may prove to be the most significant technological development in agriculture during the next 15 years," says L. S. Fife, International Harvester economist.

Many of these innovations have already been designed to give the farmer a working management information system. With these contemporary management controls and procedures farmers can manage their farms as the big businesses they are, and as a result, increase crop and livestock production.

Accurate farm records are essential in meeting federal income tax regulations. With accurate records the farmer can analyze sound and weak points in his business and adjust his efforts accordingly. Universities have played a significant role in developing farm record systems using computers. The Michigan State TEL-FARM project was one of the pioneers in this area. Farmers using the TEL-FARM system choose up to eight confidential summaries from data they feed the computer. The summaries include such things as quarterly and annual financial data on all farm income and expenses, reports on loans and credit ratings, a net worth statement and many more valuable management data. Local banks all over the country are beginning to offer similar management systems to farmers — REC-CHEK and PAM (Personal Accounting Management) for example.

Wendell A. Clithero of IBM told the 14th National Agricultural credit conference of the American Bankers Association that there are over 10,000 farmers now using electronic data processing in the processing of their farm records and farm analysis.

In addition to citing the Greely National Bank's work in feed inventory, Mr. Clithero pointed to Wachovia Bank and Trust Company of North Carolina as an example of computerized farm record keeping and analysis.

Wachovia B & T manages farm property accounts totaling about 60,000 acres of land. They also manage one feeder pig operation with 200 sows and one trust account that has approximately 50 commercial brood cows. These accounts are handled on computers just as any other bank operation—however bookkeeping-coding has been redefined to take into account special farm needs.

HARVESTING THE CROPS

Even Newton would be amazed to see how the apples are being shaken from the trees these days. At Rutgers University's Department of Agricultural Engineering, a computer is being used to find out how much force is needed to shake ripe fruit from trees while leaving the unripe ones on the branches. Present automated fruit harvesting methods, such as ultrasonic and mechanical tree shaking and air blasting, do not accurately control the amount of force necessary. The Rutgers' researchers are employing a small analog computer, to simulate fruit trees and to learn their reactions to varying forces.

The computer amplifies signals from gauges placed on an actual fruit tree and then records the signals on tape. Next, it analyzes the data from which equations are derived profiling the tree. These are placed in the computer for mathematical computation of the varying amounts of force necessary to apply to the tree.

THE COMMON HERD — "BEWARE"

It might be safe and even comfortable for humans to be part of the common herd—but it's dangerous for a milk cow. It's no secret that in dairy farming the name of the game is productivity. The common herd is out. A farmer must make constant plans and utilize the latest technology to improve his herd. Computer usage is playing a significant role in this area in a massive Federal and State dairy herd improvement program.

CUC, working with the Dairy Herd Improvement Association, provides research, statistical and programming aid to improve the efficiency of U. S. dairy herds. CUC provides production records from which the dairyman can cull low producing cows, feed each cow most economically, and select the animals from which he can breed replacements.

Essential to the production of high yield herds is the identification of superior bulls and cows. A bull can be evaluated only by analyzing the milk production records of his daughters. Cows are evaluated on the quantity and quality of their milk production.

Working with dairymen's figures and standard milk test results, CUC works on a Dairy Herd Improvement Registry for use by dairymen and artificial insemination organizations.

Does it work? According to the U. S. Department of Agriculture, the average production in DHIA herds (over 75,000 herds or about 3 million cows) is 4,000 pounds of milk per cow more than the average for other U. S. cows.

THE GOOD EARTH

Like everything else, the good earth is as good as what you put into it—time, planning and above all fertilizer. Many of the large food produce firms have been using computers to improve crop quality and output for some time. At H. J. Heinz Company, computers are being used for nutrient analysis in 10 States. Using input such as soil analysis, fertilization history, crop rotation, and crops yield goals, computers print-out soil requirements almost instantly. The result—bigger, better and redder tomatoes. And more of them.

Working with W. R. Grace's Washington Research Center, CUC analysts and programmers developed a statistical procedure which provides a quality control check on the manufacture of fertilizers.

You've seen ingredients and percentages listed on the labels of processed foods available in supermarkets. How do you know these data are accurate? To the crop farmer profit depends on getting maximum crop yield from minimum investment in seed, fertilizer, and labor. To him, the question of label reliability is one of economic survival.

Almost 200 fertilizer manufacturers and State agencies submit results of chemically analyzed fertilizer samples to the CUC developed computer program. Each sample is graded with all others, using the same methods of chemical analysis. Results are reported back to manufacturers and State agencies to permit appropriate action regarding the accuracy of manufacturing processes and testing programs.

IT AIN'T CHICKEN FEED

"If it ain't got corn or soybean meal in it—it ain't chicken feed." Many of the old timers will tell you that you can't grow healthy chickens without these ingredients. But experiments with birds at the University of Maryland proved you could.

What was the combination of feeds used? A mixture made up mostly of ground wheat and blood meal. And it took a computer to come up with it.

Poultry scientists asked the University's computer to come up with a low-cost ration that would supply all known food essentials for chickens. They fed the machine a list of 50 ingredients and the market price of each. They programed it to analyze 56 requirements that the feed must meet and wanted the cheapest mix that would meet the specifications.

"If you give a computer free rein, it will sometimes come up with some pretty fantastic mixtures," says, Perry F. Twinning of the University of Maryland's Poultry Science Department. It is very unlikely, he believes, that anyone would have ever thought to try such an unlikely mix as wheat and blood meal.

The program with Maryland's feed processors is still in a pilot stage, but Twinning believes it indicates the kind of programs that will be developed for using the computer to solve the complex problems of farming in the space age.

BEEFING UP

Like the dairy farmer whose food product—milk—is a result of proper diet and breeding procedures, the cattle farmer is "beefing up" on new technology.

As a result the control of cattle feed procedures is another area in which computer usage is spreading. It takes something like eight pounds of grain to produce a pound of beef. And the cost of that grain can make or break the farmer.

Computers are therefore put to work in the "kitchen" figuring what to feed livestock for maximum dollar return. This "least cost" rations calculation requires three kinds of information:

1. Requirements of ration to be formulated
2. Approximate chemical analysis of available feed ingredients; and
3. Cost of the ingredients at the point of mixture.

While such calculations can be made "by guess and by golly" for small herds, such practices would quickly lead the modern farmer down disastrous paths. For example, meat scraps—ranging from $5 to $5.20 per hundredweight—are frequently mixed with soybean meal ranging in cost from about $4.30 to $4.50 a hundredweight. Whenever possible, since meat scraps are cheapest when soybean meal is most expensive, the computer determines the least expensive mix that has equivalent nutritional value.

THE FUTURE

"The computer farmer is a manager," says Anthony E. Casino of International Minerals & Chemical Company. "The owner of a farm of the future will no more be out riding a tractor than the president of General Motors is out on an assembly line tightening bolts."

L. S. Fife sees the farm landscape spotted with television towers used to scan the fields, keeping an eye on robot tractors criss-crossing about in numerically precise patterns.

Mr. Fife has also referred to the development of sensing devices to relay information on fields and crop conditions to a computer which will be able to send back orders to speed up or slow down operations, alter the depth at which seeds are being planted and regulate intensities with which fertilizer is being applied.

These are only some of the areas where computer technology is having an impact on food production, quality, and planning in the U. S. However, the problems of a world power with starving billions at its gates are not likely to be solved through the application of current, limited-objective programs. If Malthus is to be proven wrong—if we're not destined to be decimated by war, famine, or flood—then the key to man's very survival on this planet lies in the application of computer technology to agricultural technology in all the countries of the world.

Recently, Dr. Roger Revelle, Director of the Center for Population Studies at Harvard University, proposed the creation of two government agencies to bring the modernization of agriculture to underdeveloped areas. Dr. Revelle has led efforts to increase food production in Pakistan and India. According to him, "The only way we can be assured of a stable world in which the United States can live peaceably, is to work for a diminution of poverty and misery everywhere."

IT CAN WORK

Past efforts to aid countries in their farming practices have not been too successful. But the success of the Rockefeller Foundation, whose specialists worked directly with Mexicans on their corn and wheat production, is an exception. In 1941 Mexican farmers produced 11 bushels of wheat an acre and the country had to import wheat to avoid starvation. Today production is up to 35 bushels an acre and Mexico exports wheat. Mexico has also sent its own agricultural team to India and Pakistan.

Crossbreeding is familiar to every farmer. Breeding in the best of a variety of traits and breeding out weak traits has produced hardier animals and more nutritious crops.

Crossbreeding those technologies having to do with the production, storage and distribution of food is, perhaps, the single most important task facing men today. A vast job of information cataloging and communications has only been started.

The future is being sowed now. And the message is clear: The Director-General of the United Nations Food and Agriculture Organization, Binay Sen, says: "Either we take the fullest measures both to raise productivity and to stabilize population growth, or we face a disaster of unprecedented magnitude . . . Problems of hunger and malnutrition which afflict more than a half of the world's population . . . pose a serious threat to peace."

Nothing miraculous will alleviate the present food shortage. The pooling of diverse disciplines represents our only hope to avert the violent upheavals sure to result from world-wide starvation.

George C. Tolis is manager of CUC's Washington operation. Appointed to this position in 1967, he is responsible for the entire Washington staff. He was formerly manager of the Chicago office when that branch opened in 1966. Mr. Tolis previously had the responsibility for development and programming of a variety of large-scale commercial applications. He has been with CUC since 1963. He is a graduate of Rensselaer Polytechnic Institute, Management Engineering and the University of Hartford, Business Administration.

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