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CURRENT VIEWS ON THE WORLD FOOD AND POPULATION DILEMMA

D. G. SISLER

If I had been talking to you four years ago, let us say in the spring of 1967, there would have been no shortage of quotes from the popular press relative to the importance and magnitude of world hunger. Such statements as "half of the world goes to bed hungry", or "global famine by 1975" were commonplace. Today when we scan the press -- Vietnam, the Middle East, Super-Sonic Transports, and Ecology -- are headliners, with little space allocated to hunger and population. Does this mean we have licked the problem, or just that it is more fashionable to talk about man's ~~other~~ many other ills?

I suspect it is a little of both. Certainly other issues are extremely important and some of the pressure has been taken off the food and population problem. Let me hasten to say that it is by no means solved, and certainly, in such places as the large cities of Asia, intolerable dietary conditions prevail, but I feel we have a brief reprieve -- time to catch our breath.

The food and population problem has a numerator and a denominator. The numerator is the quantity of food available, and the denominator is the population among which it must be divided. Let's take a look at the denominator first. Today there are about 3.4 billion people on the planet. If world population is growing approximately 2.0 percent annually as demographers estimate, this means 70 million additional people on the earth each year. This rate of growth is staggering. It means an increase equivalent to one third the U.S. population each year, and we are the fifth most populous nation in the world. In terms of grain, it means that the rice, wheat, and corn fields of the world must produce about

eighteen million tons of additional food grain to feed people at a standard of living comparable to that of Asia.

We might ask the question, how did we reach a situation where world population is doubling in less than 30 years on a base of 3.4 billion. Archaeological evidence is sketchy, but historical demographers with more intestinal fortitude than facts state that world population at the time of Christ might have been about 200 million. They contend that it might have taken 1200 years for world population to double. In the century between 1850 and 1950 world population doubled, but starting from a base of 1.2 billion. Between the end of the Korean War, recent history to those of you who are old hands at driving airplanes, world population rose by more than 1 billion. Why? Well, in the simplest terms because we have learned how to regulate deaths, but relatively little progress has been made in the regulation of births on a global scale. In amplifying this I will make a point that is central to my entire talk. Science is much easier to produce than to adopt. In the case of techniques to reduce infant mortality, communicable disease, and preharvest starvation, we have made tremendous strides. We can establish a midwife service, innoculate for a variety of diseases, aerial-spray malarial swamps, and transfer massive quantities of food from storage to needy people halfway around the world. There are no family, religious, or national barriers to efforts which reduce the death rate. Our Judean-Christian ethics tell us it is "good" to keep children alive and lengthen life expectancy. It is possible to go into a country where living conditions are abominably poor and significantly reduce the death rate in a matter of fifteen or twenty years.

In a strict technical sense it may be easier to reduce the birth rate than the death rate. At the present time there are a large number

of contraceptive techniques available and, for most, they are safe. Unfortunately most techniques are poorly suited for low-income illiterate people of the developing nations. At wholesale prices, the pill may cost 25 percent of the income earned by a subsistance farmer. It is far more than inability to purchase birth control devices in most countries. The tapestry of life for countless generations has put emphasis on the large family. Those who did not are now the subject of archeological digging. For to have fewer births than the maximum number possible was tantamount to becoming extenct when death rates were high. There are some indications that the present unprecedented rate of population growth may slow down.

We have often been told that peasants will not reduce their birth rate because both tradition and religion have taught them the virtues of large families. Peasants may be illiterate, but they are not ignorant. They realize that as death rates decline, families are becoming very large. They see their farms divided into smaller units, and jobs becoming increasingly scarce.

A few years ago Western scholars were wringing their hands over the population problem while the leaders of developing nations seemed to ignore the impact of population growth on education, housing, and food supply. Today more than 60 percent of the population of the newly developing countries live under governments which have activated programs to stimulate the reduction of fertility.

Until recently the available methods of birth control were too expensive and ill-adapted to meet the needs of illiterate low-income couples. The situation has changed dramatically with the development of plastic interuterine devices. This method is safe for widespread use

where there is proper medical support. The device is inexpensive, and is currently being manufactured in developing countries for about $.03 per unit. In Taiwan and South Korea more than 250 thousand devices are now in use, and the leaders of both countries hope that within five years one third of the women of child bearing age will be using this method of birth control. I do not mean to imply that the road to a substantial reduction in the rate of population growth is easy. Quite the contrary. Frankly, the government or a planning agency cannot come into the bedroom. A couple must wish to have fewer children. This means widespread attitudal changes on the part of hundreds of millions of couples. Their horizons must be broadened, their attitude of fatalism must be removed; in short, poverty must be overcome. As conditions become more and more acute, it is conceivable that governments will elect to control births, perhaps even without the consent of a majority of the citizens. Is it inconceivable that the water supply of a city like Calcutta, India could be used as the carrier of a substance which made all women barren? The act of child bearing would then become positive. A prescribed number of men and women could apply each year to the public health service for an antidote which would make pregnancy possible. You may be outraged and scream, "what would happen to the whole fabric of life if indiscriminate sexual relations were not tempered by the fear of pregnancy?" I do not know how plastic our moral code is, nor am I able to blueprint a new life style which would preserve the presently accepted life style while reducing population growth. I do know that the problem is critical and historically some of the things which man held to be most sacred proved malleable in times of great stress. Recall that less than 300 years ago the making of a profit, or receiving interest on money loaned were

considered despicable sins by many groups of Christians. Today we may spend billions annually to insure that the free enterprise system is operative here and abroad.

Man obtains well over half of his calories from grain. Cereals are truly the staff of life. World grain production last year was estimated at nearly 1 billion tons. ~~Food grain production must expand by nearly 20 million tons per year merely to keep pace with present rates of population~~ growth. The countries which are developed and have plenty of food can't sit piously on their backside, and say "we increased our food supply more rapidly than we increased our population, why can't they do the same". The ball game is different today. The U.S., Canada, and other surplus countries were able to apply essentially the same techniques of farming to ever expanding acreages. There was a vast hinterland to conquer and people, rather than being super abundant, were too few. As we open the decade of the 1970's, the heavily populated countries of Asia must increase yield per acre; they have little new land to exploit. Even in Latin America and Africa where land is available, the cost of bringing it into production is high. Although U.S. grain shipments to developing nations have been massive in recent years, chronic grain shortages will not be solved by international grain movements. If the developing nations are to have enough rice, wheat and corn, it will come primarily from internal production obtained through expanded yields per acre.

If I asked you to vote on the most significant technical breakthrough in your lifetime, what would it be? Television, computers, conquering polio, or the landing of Armstrong and Aldrin on the moon? If our measuring device for "the most significant" were the number of people favorably affected, I would cast my vote for the recent breakthroughs in the production of rice, wheat, and maize.

Until 1965, virtually all scientific advancements in farming were mainly geared to the agriculture of temperate zones. The word "revolution" is greatly abused, but I do not think that any other term adequately describes the effect of the new seeds in the poor countries where they are being used. At the heart of this agricultural revolution are new high-yielding grains developed in Mexico, the Philippines and the United States. Widely adapted to the conditions of tropical and sub-tropical areas, the new wheat and rice seeds have proven capable of doubling yields when properly managed. The new "opaque" or "high lycine" corns may make it possible to provide additional protein to diets which are now predominately composed of cereals. I would like to briefly sketch the history of these breakthroughs in plant breeding, and indicate what I think they may mean to the world's hungry people.

While wheat is not native to the Western Hemisphere, Mexico has provided the world with outstanding new varieties. Early in 1943 the Mexican Ministry of Agriculture asked for scientific help to produce more wheat, corn and beans. Under the auspices of the Rockefeller Foundation the Cooperative Wheat Improvement Program was launched by Dr. George Harrar. In October of 1944, Harrar brought a young plant breeder, Dr. Norman Borlaug to Mexico. Borlaug immediately started to work on the wheat breeding program. Its success is a tribute to the dedication and perseverence of this man. By 1949 Borlaug had identified eight superior wheat varieties and by 1951 nearly 70% of Mexican wheat acreage was planted to new varieties and yields were double those of a decade before. The fight was not yet won. Borlaug knew that in wheat stem rust he had a formidable enemy. It was inevitable that a new rust would evolve and break the resistance of the improved wheat varieties. The Mexican wheat breeders had developed 50,000 varieties and new lines; no, this is not a misstatement -- 50,000. The breadth of the wheat breeding program was vindicated. On

several occasions rust ravaged the established varieties, but Borlaug's team had new back-up lines available. Semi-dwarf varieties, Sonora 64 and Lerma Rojo 64 were developed. These short, stiff strawed varieties proved to be high yielding, and responded to fertilizer without the problem of lodging.

The greatest impact of the Mexican wheat breeding program, when measured in numbers of people who are better fed, may be still to come. Seed of the Mexican varieties was introduced in Pakistan and India during the 1964 crop year. In field trials conducted in both of these countries yields have been over 100 bushels per acre. By the spring of 1966 Mexican wheat had proven their merit in both countries. On April 18, 1966 India spent precious foreign exchange to make the world's largest purchase of seed wheat. India paid over $120 per ton for eighteen thousand tons of seed wheat. The Indian purchase remained a record for only one year. In the summer of 1967 Pakistan purchased 41,650 tons of seed wheat from Mexico. These new varieties have already made a significant contribution to the grain needs of these nations. An important plus factor is the fact that the early maturity of the wheat varieties is permitting the establishment of a rotation where wheat follows rice. In one of the most spectacular advancements in cereal production ever recorded by any country, Pakistan increased its wheat harvest nearly 60 percent between 1967 and 1969. The increase in India's wheat production is only slightly less remarkable. It climbed by over 50 percent from 1965 to 1969. Today both nations, whose combined populations approach 700 million, are self sufficient in wheat. It is a fitting tribute that Dr. Borlaug was awarded the 1970 Peace Prize, the first agriculturalist to be so honored.

To most of us living in the West, bread is the staff of life. The 1.7 billion people living in Asia are nearly entirely dependent upon rice. In the spring of 1962, after ten years of preliminary work, the International Rice Research Institute was established by the Ford and Rockefeller

Foundations. The Institute is located at Los Banos, Philippines in the heart of the great rice producing areas of the world. The first priority of the Institute, now known by its initials I.R.R.I., was clear: to develop a rice variety which would produce more per acre under a wide range of conditions. Specifications for such a variety were outlined. It must have a high yield potential and respond to fertilization. It must have a short, stiff straw to prevent lodging, it must be resistant to disease, it must be widely adaptable through Asia, and finally, it must have cooking qualities acceptable to millions of rice eaters. Peter Jennings, an American plant breeder, took pollen from a short, stiff strawed variety and placed it on the pistil of a high yielding tall rice variety. By 1964 the world had I.R. 8, the so-called miracle rice. The new variety was entered in the 1965 yield trials in both the Philippines and Thailand. Of the 256 varieties tested in the Philippines, I.R. 8 produced the top yield of 5,850 pounds per acre. In Thailand, I.R. 8 not only outproduced all other varieties, but set a new yield record of 6,120 pounds per acre. By way of comparison, in the same experiment Peta, I.R. 8's tall parent, yielded 2,200 pounds per acre. The most striking characteristic of I.R. 8 is its response to nitrogen. The traditional tall varieties frequently respond to low levels of nitrogen, but yields decline as the result of lodging as more plant nutrients are added. I.R. 8 paved the way, and since its introduction several improved varieties have been developed.

Some may point out that the high yields of the newly developed wheat a nd rice varieties bave been attained under systems of management which are not practiced inthe developing countries. This is true but what the new seeds do provide are varieties which have the capacity to take advantage of new cultural practices. The older indigenous varieties were inherently incapable of high performance even when carefully tended. The yei yield increases of the new varieties is striking enough to be convincing to tradition-bound farmers who fear the risk of taking a chance on the new.

The plant breeders have instigated a true revolution -- the potential for higher yields throughout the "third world".

It is not enough for new technology to be developed, it must be adopted. What about this? Between 1965 and 1970 the area planted to the new varieties of wheat and rice in Asia expanded from 200 acres to more than 35 million acres. It has been estimated that the new varieties have increased food grain production by about 37 million tons. How much is this? To put it in perspective, the added output is roughly twice the entire food grain production of Kansas, North Dakota, Arkansas and Louisiana, our leading wheat and rice producing states. Perhaps more significantly, Pakistan, the Philippines, and Kenya are now self-sufficient in food grain production. India may be self sufficient next year. Ceylon, Burma, Nepal, Turkey and the Ivory Coast head a long list of nations where food production has increased dramatically in the past five years.

Accompanying the increased use of improved grain are important advancements in irrigation and the use of fertilizer. Paralleling the improvements in seeds was a giant step forward in fertilizer production. In the early 60's, engineers at the M. W. Kellogg Company, of Buffalo, New York developed a more efficient process for synthesizing ammonia from atmospheric nitrogen. The new process uses huge centrifugal compressors which reduce by a third both the initial capital cost and the operating costs of ammonia plants. The use of plant nutrients in the developing countries has increased at a compound rate of 16 percent per annum for the past four years. In India and Pakistan more than 74,000 new irrigation wells were installed between 1966 and 1968. Each of these wells has the capacity to irrigate about 200 acres. All in all the seeds, the fertilizer, and the improved water

handling capacity offer a most encouraging package as the world strives to meet its burgeoning food requirements.

As you are lulled to sleep by my monotonous drone and an exceptionally fine meal you are aware that food is more than merely calories. Fruit cocktail, salad, roast beef and pie indicate dietary quality. Improved quality of diet is costly and difficult to obtain, but here too there have been important advancements in the past decade. Protein is the most limiting component of a good diet in many developing countries. There may be an insidious circle of poor diet, low achievement, low income and back to poor diet. There is an increasing body of evidence that a low level of protein injestion by pregnant mothers and children under four may lead to serious mental retardation. If this is the case, then the very dietary problem contributes directly to the lack of economic development, and in its turn impedes efforts to improve the diet. You have all heard of a variety of methods proposed to expand the availability of low cost protein: protein from the sea, from livestock, from soybeans and dry milk. In addition, several more exotic sources are sewage, crude oil and green plant material. All may have their place; however, I will say a word about two. Soya flour and the protein isolates from soybeans appear to provide a viable low cost source of inexpensive protein of acceptable quality. In no small measure the difficulty is not one of technology, but one of distribution. How do we get the protein additive into the diet of those who need it most? How do you convince an illiterate mother in the Andean Highlands that this white powder, if added to her cornmeal, will improve the health of her family? How do you distribute, market, and price it? Who defrays the cost of this extraordinarily tough distribution and extension job?

While still in its infancy there is yet another improvement provided by plant breeders which may contribute to dietary quality in the future. Professor Edwin Mertz working not in some exotic country, but in the flat cornfields of Indiana has succeeded in producing Opaque #2 or high-lycine corn. This corn is significantly higher in protein than conventional hybrids. To date the advantages have been primarily directed to livestock feeding, but it may have real significance to humans. The great merit of evolving new strains of corn, wheat, rice or other grains which have a high and well balanced protein content lies in the fact that diet can be improved with no change in eating habits and no complex problems of marketing or salesmanship.

As I come to the end of my remarks, a sobering word of caution is in order. Partly because it would be foolish to be overly optimistic, and partly because your profession may be in the vanguard of solving a problem should it arise. Today is Saint Patrick's Day -- those Henneseys, Tenneseys, Donnelys, Connelys, O'Malleys, O'Herns, Kellys, and other Irish Americans who were whooping it up today, came to the United States as the result of a great famine. Starting around 1844 the Great Irish Potato famine caused by a fungus with the catchy name of phytophthora infestans occurred. Hundreds of thousands either starved or fled Ireland. The potato was not native to Ireland, but was imported from the New World. It thrived, but had no natural resistance to fungus and disease problems amplified by the humid Irish climate. There were few, if any, control mechanisms available and, once started, the fungus ravaged the land. Today we are introducing wheat and rice varieties over vast acreages of the tropics and semi-tropics. Previously there were thousands of locally adopted varieties indigenous to small areas. They had been selected by nature and man for countless generations to be adapted to local conditions.

Now, we may have the same rice variety over a million contiguous acres. Are we opening ourselves to the phenomenon of Ireland in the 1840's and '50's? I hope not but the conditions are there and they are worrysome to thoughtful agriculturalists. If dams, roads, fertilizer plants, experiment stations, and agricultural extension services are legitimate avenues of public expenditures, why not plant protection supplied by aerial applicators? We do not stop to ponder what individual farmers will benefit from an irrigation facility or a fertilizer made less expensive by a government subsidy. Would it not be rational for a government to purchase light aircraft, and aerial spray equipment to control pests, diseases and fungus infestations? Perhaps your group should explore and ponder this question.

In conclusion, let me say that I am cautiously optimistic concerning the world food problem. Science has given us a new set of tools which have pushed back the threshold of widespread famine. We may have ten or fifteen years of breathing time before the stork and the plow are again on a collision course. Let's work to see that the frontiers of food production and population control are pushed back again rather than flying into the cloudbank of pessimism.