

Impact of Agricultural Development on Population Growth and Economic Progress

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It is a great pleasure, and indeed a privilege, to be in attendance at the Second International Congress of Plant Pathology. The Congress represents for all of us a golden opportunity to renew our personal international acquaintances and to review our own profession from a world-wide vantage point. Let us hope that the tone of this Congress will be truly international and not appear to be mainly concerned with the problems of one or two continents.

A meeting such as this International Congress does not fall together without effort. We are mindful of the arduous advance-planning by the International officers and local committee members that has been put into preparations for this Congress. We are indebted to all who have worked so diligently.

The assigned topic, "Impact of Agricultural Development on Population Growth and Economic Progress", is a very broad one upon which virtually everyone has basis for his own conclusion. Certainly the publication and popular informational media have been active in covering the statistical projections of availability of food and of the importance not only of quantity but also the importance of caloric content and protein needs as well. The subject of human population growth has been the center of formal and informal discussions almost everywhere. Economic development or material progress has been the deep concern of every governmental unit on earth. It is clear that these topics also concern us mightily, both professionally and personally. The three items in the title clearly have direct interrelationships. But it is also

clear that there is no direct, universal, infallible coupling. The relationships are not only complex, but highly transitory.

The increase in number of human beings on earth and the projected figures for estimated further populations have great shock effects, largely because the numbers run beyond our comprehensions. Each one of us is conscious of our population densities today. Many of us digest the projections not only in terms of food requirement figures but also in terms of the teeming world in which our children and grandchildren will live. The prospects are not heartening. To most serious students of the problem, the outlook is rather grim. As a layman in this field, I get the impression that some of the national and international programs designed to control the rates of increases are just beginning to show some results. Unfortunately, there seems to be evidence also that the rates of increase have only been slightly slowed world-wide and that the total population is continuing its steep climb. One can be fairly certain that long before the "standing room only" sign is hung out, other reductive processes will emerge. All of the ones I can think of that *might* occur are highly undesirable.

From our professional agricultural standpoint, our responsibilities include lending every effort to aid the dependable and economical production of nutritious food. More on this point later, but there are many improvements that can and should be made in production, harvesting, storage, and marketing methods. Substantial areas of land not now productive can and will

be utilized. Many governmental revisions that would be helpful can be, and might be forcibly implemented—all serving significantly to increase the potential total production of food and fiber. Each of these developments leading to increases in production will come replete with its own special problems. Many of these special problems may be new and most, one is inclined to predict, will be unexpected.

Before anyone concludes that my outlook is completely doleful, let me quickly add that far from being pessimistic, I am most optimistic. I continue to have an unbounded respect for the resiliency, adaptability, and innovativeness of my brother *Homo sapiens!!!* We're just beginning to sort out our problems!!!

As plant pathologists, we are here to consider ways in which our researches and ideas may usefully contribute to the increase in production of food and fiber as well as to the advancement of knowledge of living things. A review of titles of papers, symposia, and colloquia scheduled for this Congress as well as reading the paper to be presented by my esteemed fellow speaker this morning, graciously made available in advance, all indicate a vigorous, dynamic, and broadly-scoped review of our professional activities.

I propose to forego discussion of economic progress and to direct the remainder of my remarks to the problems that are with good reason causing increasing concern to more and more people. These problems are directly related to the production of food. As plant pathologists we have been involved in food crop disease control over the years. We will unquestionably become even more involved as time goes on. Well-fed people have been lulled by repeated dire predictions into believing that food shortages are fictitious and that the possibilities of insufficient food are unlikely. There is no avoiding the fact that we are moving into a period when world-wide food supplies may be generally insufficient and, given any one of a number of combinations of unfortunate circumstances, the specter of insufficiency could become a catastrophic reality on a broad front. In recent decades the marked increase in production of field crops has been accompanied and perhaps accomplished by markedly intensified monocultural plantings. In efforts to increase productivity further the likelihood appears to be a continuation of this trend. Although plant genetics and plant breeding have advanced rapidly and resistances of broader natures are being incorporated in crop germ plasm, with increases in monoculture practices the vulnerability to widespread disastrous pests and disease attack also increases. To forestall the possibilities of disaster, vigilance even greater than in the past is called for.

Most of the world's agricultural production is subject to the vagaries of weather. The vast proportion of cultivated land is rain-fed and as such is dependent upon the amount and distribution of rainfall. Even many irrigated areas depend upon the annual snowpack for water and their reservoirs require annual replenishment. Largely because of weather factors, food supplies within continents often vary from abundance to scarcity within a year's time. Adequate food production, even now, is often on a very thin margin of supply over demands of no more than one to several percent, and even this bare overage

serves to give a sense of complacency.

Forsaking any statistical discussion, it takes no imagination whatever to recognize that, even in the short view, a doubling of our present population within the next several decades seems inevitable. For instance, the United Nations Economic Commission for Asia and the Far East last year stated that the population of this (the ECAFE) region is expected to rise from 1,994 million in 1970 to more than 3,568 million by the year 2000. This is compared to 915 million in 1900. There is no reason to elaborate on the additional amounts of food that will be needed.

Fortunately, there are still substantial areas of unused arable lands that can be brought into cultivation. In addition, in all countries universal application of our present knowledge and technology could serve to increase production markedly. Through research, improved and more adapted varieties as well as more dependable pest and disease control and cultural methods are being made available. Additional dams which are now being built or being planned will serve to provide irrigation to areas not now highly productive. Lands in tropical irrigated zones are being utilized, or can be utilized for two, three, or even four crops per year where, at present, usually only a single crop is cultivated. These possibilities, as well as others, may serve to delay or postpone catastrophic and widespread food shortage for the immediate few years ahead.

Favorable results, however, are not going to be forthcoming without attendant problems. While unused land is available, it is likely that most of it is less desirable than the land now being used. Its cultivation will be more expensive, and yields likely will be lower than on more desirable lands. New problems of soil management and new or unexpected pest and disease problems will surely be encountered. Furthermore, most unused areas are located greater distances from centers of population and increased transportation costs can be expected. Any broadly-based comments on world-wide land use should also reflect that some areas now being used for annual crops should be reassigned to pasturage or tree crops to aid in erosion control or improved watershed utilization.

The utilization of water, either from dams or from wells, inevitably affects the historical water runoff and problems of seepage and drainage often become acute. Unfortunately, many of the newly constructed dams, and those being planned, have made little or no specific provisions for drainage. Nor has adequate attention always been given the possible problems of alkalinity or salinity that may ensue.

Multiple cropping, or the use of irrigated land for two or more crops per year, has immediate effects on the soil microflora and microfauna. Moreover, it provides new and continuously present host plants for insects and plant pathogens. Soil used for rice paddy does not automatically become a cultivatable field for row crops during the rest of the year after the water recedes and the rice is harvested. None of these problems defies solution, but some will be found more stubborn than others.

Problems confronting additional continued increase of food and fiber lend themselves to solutions when disciplined and well-trained research workers, carrying out their laboratory and plot investigations under

stimulating circumstances, have their findings carried to the field by skillful and observant technicians.

Unfortunately, in many parts of the world, professional salaries are low, working conditions often are most primitive, libraries are poor or practically nonexistent, and scientific journals are too expensive. Not unusually, the yields from experimental plantings have to be relied upon to support the so-called research activities. Oftentimes the few trained scientists find themselves victims of a top-heavy bureaucracy with overlapping departmental functions with each department striving to be a kingdom unto itself. Instruction, extension, and research are frequently treated like unrelated activities. The longest distances and most impenetrable jungles in the world can sometimes be found in the few meters or few kilometers separating these various segments of what should be a smoothly functioning cooperative effort.

The achievements that led to the development of the dwarf wheats and rice varieties constitute the latest and most dramatic achievements in a long list of improved crop plant varieties over the years. The successes of dwarf stiff-strawed wheats and dwarf rice when use is made of their increased tolerance for fertilizer applications have made a great impact on cereal grain production. The genes for dwarf characteristics are being incorporated into local varieties with success in many instances.

It has been my privilege to visit pathologists in a number of countries during the past four years. Often times they work in remote field stations with quite primitive equipment, and have only occasional professional contacts. All too often they are hampered by inadequate education and lack awareness of modern research findings.

The two oldest international research institutes, IRRI in the Philippines and CIMMYT in Mexico, have given notable accounts of themselves and have shown what can be done when clear objectives, inspiring leadership, and adequate facilities are made available to a qualified professional staff. A most heartening personal experience for me has been to meet back in their own countries the men and women who have had the benefits of 6 months or a year's training at one of these international centers. It is inspiring to note how they have developed their own objectives, and to see how the enthusiasm and acquired technology is carrying over.

The invitation to participate in this program was made to me more than a year ago. The title of these remarks has been in my hands for months. During this period, the topic took various forms. Rapid changes in international understandings, international monetary gyrations, bumper crop reports from some areas, reports of famine from others all provided a most perplexing feeling that it would be difficult to treat the subject in an up-to-the-minute manner. During recent months several trends seemed to be discernible. It is possible that I am reflecting the impact of the most noticeable situations.

World-wide, there seems to have been a reduction of stored grain reserves. Coupled with this has been the disastrous droughts in widespread areas of the world. Population figures continue to become more ominous with time. While signs of economic progress seem to continue in evidence, no one can be unaware of the world-wide inflation in food costs. There are other factors

involved but recent \$12 per bushel soy bean and \$5 per bushel wheat prices in the U.S. certainly speak in part to supply and demand. These all-time record prices are reflected immediately in food prices in the market place.

The wife of an acquaintance has a small vegetable food stall in Bangkok. Each morning she sets out at three o'clock to buy fresh produce at the central wholesale market to be resold later in her stall. Whereas her daily supplies were costing about 300 Baht (\$15) before, during the last month she has had to pay about 450 to 500 Baht for the same items. On the first day of August this year white rice was unavailable for purchase in the food stores of Bangkok—and this is one of the traditional surplus rice-producing countries in southeast Asia. Responding to the emergency, the government reported the next day that it had uncovered 134,000 tons of rice in warehouses allegedly being withheld for more favorable prices. Newspapers reported on August 10 of this year, "(Manila, UPI) Government troops fanned out yesterday in metropolitan Manila in search of hoarded rice and took position in stores to oversee distribution of limited rice stocks to crowds of people."

In India in April I saw a tremendous wheat crop being harvested in the Punjab and Uttar Pradesh states. I do not know the final production figures but whereas the record crop was 25,000,000 tons a year or two earlier, it was expected that this year's crop would reach nearly 30 million tons. So far, (15 August) according to the newspapers, the Government of India has been able to purchase only about 2.5 million tons for distribution. The rest of the crop seemingly has disappeared into small local storages, to be sold later, hopefully, at more favorable prices. I should add that in the examples of grain scarcity cited, the respective governments set the market price in efforts to keep food costs down. The examples are intended to provide simple graphic illustrations of the way food production and market prices are immediately translated to the ordinary family.

Scarcity of food and governmental actions to control distribution is not new. In the days of World War I in the U.S. we had meatless days and wheatless days. During World War II, all food was under government ration control in the United States. Other countries have had similar situations. All were situations of temporary shortages and were accepted with reasonable gracefulness. One is driven to the view that we are moving rapidly toward a time when scarcities will be continuing circumstances, more often than not on continental or world-wide scale.

For the past several decades there have been many, many schemes for increasing food production and for developing self-sufficiency in various countries. There have been attempts to transfer institutions, to transfer technology, to train nationals who were to return to their countries with new techniques. Experts and consultants of many kinds and from many countries have been supplied in large numbers. Successes have been modest at best, although several outstanding successes can be cited. More often, however, little or only modest improvement of a lasting nature has resulted.

There is a growing realization that sustained improvement in food crop production is more complex than mere transfer of technology. Situations vary widely

from country to country, of course, and there is wide variations in the zeal with which different countries and different cultures attempt improvement in their food production. In some instances, transfer of technology or the use of a few consultants was effected with the hopes of bringing about lasting improvements. One is inclined to the view that improvements of these types offer temporary favorable results at best and that more fundamental changes in practice as well as changes in attitudes are called for. Among the several types of change that seem to require most careful consideration are: (i) land reform or land redistribution, (ii) improved education and educational system reforms, (iii) adoption and initiation of sound population policies and (iv) a critical review of, and (if necessary) an overhaul of the agricultural organizations and agencies dealing with instruction, research, and extension. There is no intention on my part even to suggest that these should be organized in the same way in each state or country. Cultures and historical backgrounds vary widely. But there is an urgency to devise organizational patterns that in individual situations permit and encourage objectivity and effectiveness, that encourage maximum individual effort, and which encourage development of problem-solving teams to work on items of appropriately identified priorities.

Justification for this discussion, here in an

international congress, of the topics in the several preceding paragraphs is found in phytopathology's intimate concern and responsibilities for food production. Fulfillment of our role in plant disease control will be of little import, if other matters directly or indirectly related to crop production and the availability of food are permitted to lag.

Reference was made earlier to some obstacles that are frequently encountered by working plant pathologists. Hopefully, we as individuals and our profession as a whole will be guided by our own actions to assist proper and effective development wherever opportunity presents itself.

It seems unquestionable that the magnitude of the issues before the world are of such proportions that only by the combined efforts of men and women of all states, of all cultures, and of all disciplines will we be able to meet the challenges to our very existence.

May those of us in attendance at the Second International Congress of Plant Pathology address ourselves vigorously to the technical and scientific discussions, but may we also bear in mind the important role we can have individually and professionally in the larger sphere of serving the full needs of mankind, and in striving for responsible and responsive societies of men and women.