NO TIME TO RELAX

COROMANDEL LECTURE

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President Giri, Dr. Bharat Ram, Dr. Swaminathan,
Your Excellencies, Ladies and Gentlemen :

It is a real honor for me to have this opportunity to speak to you today concerning one of the recent developments in agricultural food production, namely the Green Revolution. I would like, at the outset, to say that in accepting the Nobel Peace Prize, I did so in the name of agriculture, in its broader sense, for I well know that ten fingers and one very mediocre brain cannot accomplish what has been achieved in increasing the world food production, especially that of wheat in the last few years. It is the result of the collective interdisciplinary efforts of hundreds of scientists in many parts of the world. Indian scientists have played a major role in launching the Green Revolution.

In addition to the contributions of scientists, extension workers and officials, we must also recognize that food is produced on the land by the farmers themselves. My heart goes out to the millions of small farmers in many parts of the world who in recent years have had the courage to accept the new discoveries of science, to apply them on their small plots of land and struggle onward striving to increase their standard of living. These people are the real heroes of the Green Revolution.

I would like to say something about where and how the research that produced the seed and technology upon which the Green Revolution was based began and how it came to produce fruitful results in what seemed to be a very short period of time. Some of the discoveries that have been applied here in

India with great success, go back to the "Quiet Revolution" that began in Mexico more than 27 years ago. At that time, back in 1943, at the invitation of the Government of Mexico and with the financial assistance of the Rockefeller Foundation, a very modest program was begun to try to bring science and technology to bear on the food production problems of Mexico. The crops chosen in the beginning were maize, wheat and beans. Subsequently, other crops were added. The program had a two-fold function – firstly to find out what could be done as soon as possible to increase food production and secondly, to train a whole corps of new scientists. It was a long, slow process and it took twelve years to produce enough wheat to meet Mexico's needs. From that day, in 1956, to this, Mexico has been self-sufficient in this crop. The same has come to be true in the other basic food crops of the Republic of Mexico.

Now in looking back, to 1960, when I was invited by the Food and Agriculture Organization of the U.N. to make a survey of the wheat production needs from Morocco as far as India, you see, I did so with great concern. We had come to believe that it would take 18 to 20 years, based on the Mexican experience, to develop the varieties, and technology, and train the whole corps of new scientists necessary to assume the responsibilities of carrying these results to the farm to solve the food problems. In most countries we visited, it became obvious that there were very few trained scientists and consequently shortcuts had to be found to overcome the food deficits. India, unlike the others, was very fortunate in this respect, in that it had a large corps of well-trained scientists. Thus in 1963, when I had the good fortune and privilege of coming to India a second time, at the invitation of the Government, we looked at the wheat production problems in greater detail in many parts of the country. It became apparent that there were certain similarities of conditions here and in Mexico and I felt it might be possible to increase wheat production more rapidly and dramatically than was possible in Mexico. I won't go into details, simply I will say this, that a big effort was made to bring in relatively small

quantities of seed of many types of wheats to test on research stations here in India in 1963, followed by larger quantities of those that showed most promise in 1964. Based on very promising results, the Government of India moved to import 250 tons of seed in 1965, after only two years of testing. This laid the base for the break-through that followed. After the third year of widespread succcssful testing, it seemed advisable in 1966 to bring in even larger quantities of seed. This was done when Food Minister Mr. C. Subramaniam imported 18,000 tons with the spectacular results that are now history.

Never before in the history of world agriculture had such large quantities of seeds of varieties of any crop developed in an entirely different part of the world been introduced successfully into another country, half way around the world. This effort became a great success. The reason for this success was the outstanding research that had been done here by the Indian scientists and extension workers and its transplant to the farms. The value of the varieties and the production program tactics have been clearly and spectacularly established. There were many people in the world who thought that great risks were involved in this undertaking. There are always risks involved when you are dealing with biological entities and biological systems. This is inherent with change, but change we must or perish.

There are many lessons that were learned from this transplantation of new technology from one part of the world to another. If we look back and survey what has happened, we will find that first of all to be successful the scientific and technological information that the new changes depend on, must be thoroughly reliable. This can be determined only through extensive experimentation under different soil, ecological and climatic conditions where the varieties are being introduced.

But you can have the best science and technology in the world, and it won't automatically produce more food. Sound

economic policy must also be established by the Government so as to stimulate the production of the crop. The economic policy must stimulate the application of the new science and technology, so that both small and large farmers can be encouraged to participate. This, of course, includes a reasonable price and stable price for the grain that the farmer will sell. The inputs must be available, especially fertilizer. Credit must also be provided for the purchase of these inputs.

Demonstrations are very important and they must show spectacular differences in yield as compared with the old technology and the old systems of growing the crop. If this is shown there is little doubt in the mind of the farmer as to its worth. The farmer, who has lived close to starvation, will not risk making change for an increase in production of five or ten percent. If one can demonstrate, however, on the farmer's own land, that it is possible to double,triple or quadruple the yield, and if Government policy is such that it will make it economically feasible for him to apply the new technology, he will move. This now has been vividly demonstrated by Indian farmers.

The pre-Green Revolution record harvest of 1965, achieved in an ecologically favorable year was 12.3 million metric tons. The 1968, 1969, 1970 crops each have been record breaking, culminating in a harvest of more than 20 million tons during 1970 This is a tremendous increase.

The increased production has done many things to change the total economy of the country. It has not simply produced more food, more bread, and more chapatis, but it has opened new vistas in overall economic development. It has had indirect effects on other crops. Speaking of wheat, you see, it was not that this great increase in production came from the cultivation of increased acreage, but was for the most part the result of increasing the yield per acre. This fact becomes of particular significance as the world population increases. It is already impossible in many countries to put more land under

the plough. There is a growing and ever-increasing shortage of land suitable for agricultural production. Thus, for the foreseeable future, in most of the densely populated areas of the world, the increases in food production must come from increasing yields per unit of cultivated area. It is, therefore, very gratifying to see that from the all time previous high of 1965 when the average yield per hectare was of the order of 900 kilos, it increased to approximately 1400 kilos during 1970, a very significant increase indeed. It also indicates that there is still a great possibility for increasing yields even further if science, technology, and research is carried forward, if demonstrations are extended to other areas with vigor, and if sound economic policy prevails.

Now, what has happened in other crops ? What are the indirect effects? First of all, before there can be much effect on other crops, additional new technology must be developed. But there is, nevertheless, a certain carry-over, as for example in the use of fertilizer. If a small farmer sees that he has doubled or tripled his yield of wheat by applying the recommended technology, it takes little imagination on his part - and they are all very smart indeed - to give similar treatment to his other crops. I have great respect for the traditional farmers all over the world. They are all too often underestimated. They are very intelligent. Many may be illiterate, but to have survived, as they have, they must have imagination, versatility, and an ability to adapt to new situations when it is worthwhile doing so. When the small farmer has seen the value of the fertilizer on his wheat crop, he immediately begins to explore the possibility of what it will do on the other crops that he cultivates. He will do this much faster and more efficiently, however, if the research and extension service is prepared to tell him how it is to be done. But even if this assistance is not forthcoming, he will improvise and make many adjustments, and so you see, soon indirect beneficial effects are also felt on other crops. Of course, if new high yielding seeds are also available

in these other crops it immediately permits greater efficiency in the use of fertilizer.

Now it so happens that some people think that the Green Revolution is due to magic seed. Let me say this that **there is no magic seed.** In order to change the production of any crop, seed is only the catalyst. The short-strawed wheat varieties do have a built-in capacity for high grain yields when they are properly grown, when they are properly fertilized, sown at the right time and in the right density. They can respond to this new technology and, therefore, produce much more grain per kilo of plant nutrient applied. So they are much more efficient than the old types; they are a catalyst for change, but nonetheless there is no magic seed. The success of the wheat production program in India resulted from applying the data developed by the strong interdisciplinary research program designed to attack all factors limiting grain yields. Genetics and plant breeding, have produced the new model of plants. The agronomists and soil scientists have determined what type of fertilizers and what quantities should be applied for different soil types, and how to manipulate and handle the moisture most efficiently. The plant pathologists have contributed to the understanding of the resistance to disease. The same goes for the entomologists. Both have assisted in the formation of the new varieties or in protecting them against epidemic infestation. Scientists from all of these disciplines have contributed to the development of the varieties. Of course, the cereal chemists have contributed also from the standpoint of how best to utilize these new grains.

What has the revolution in wheat production meant to other aspects of economic development ? Until the last five or six years, I have worked in trying to improve agriculture in many different countries without fully comprehending what a valuable and important tool crop production can be for overall economic development. This is particularly true in those countries of the world, you see, where you have very large

proportion of the total population engaged in agriculture - in some cases sixty to eighty percent. Now where one has this vast sector engaged in agriculture, where many are living outside the economy, subsisting on a small plot of land with very little to sell and having no purchasing power, the whole economy lags. In the last three years, however, if one considers the wheat crop alone, approximately 1.8 billion dollars was added to the gross national product above that of the all time high level of 1965. This has gone directly into the pockets of the farmers. They have money for the first time; they begin to buy things that they never purchased before. They begin to demand and get small machines that are not necessarily labor-displacing in order to better handle their crops, thresh it more rapidly, get it under cover, and prepare the land for their next crop. Many goods that, I am sure, they felt they could never have in their lifetime, suddenly are found in their own homes, a transistor radio, a sewing machine and many other things that many of us privileged people take for granted. This has a way of affecting the whole economy. I can sense it, I have seen it here in the villages in the last two years. It brings a different rhythm to the whole economic life of the community. This is something that we must strive to spread to a larger segment of the population and to increase in rhythm. If we do so, and can simultaneously slow population growth, I have great faith that we will see within the next two decades a change which hardly seemed possible only a short time ago.

One of the other very interesting and I think significant changes that has been brought about by this rapid change in crop production, is its indirect effect on the scientist and the farmer and how they now work together. It has been my experience in many countries that before science proves its worth in helping to solve his problems, it is not accepted by the farmer. This is understandable. Science must serve human needs, if it is to be respected and if it is in turn to obtain proper support from Government. Here I have seen Indian scientists in the

national demonstration programs carrying these new results to the farms. I have seen a great change in the relationship between the farmer and the scientist and vice versa. To win the respect of the farmer is difficult - to retain this respect is equally difficult. There is no way of putting a value on this psychological change, but I am sure that if these contacts are maintained and strengthened, it will in turn lead to further development.

Now despite the fantastic achievements of the past five years, **there is no time to relax.** The future has many problems. We must extend the so-called Green Revolution to other crops. Wheat must not continue to carry a disproportionate amount of the load. It is my understanding that progress is now being made, and that rapidity of change will surely increase in the next two years in rice and sorghum; maize is moving. Unfortunately, there are certain adverse effects, you see, when one crop moves faster than others. One crop tends to displace one or more of the other crops where the new technology is absent. This has actually been happening in the case of wheat with relation to pulse crops. Pulses are very important in nutrition in India. They supply much of the protein and help to balance the cereal diets which are deficient in lysine, tryptophane and certain of the other amino acids. Together, they complement each other nutritionally very well, but if yields, you see, of one crop, in this case pulses, are stagnant and not increasing and the yield of wheat that is competitive with it in the winter season moves forward, you get displacement. The only way to correct this is by aggressive research in the development of higher yielding varieties of pulses. Some progress has been made in this direction in recent years, especially in the pigeon-pea. I hope that it will be forthcoming in other pulses, so that the balance between pulses and wheat will return to the required equilibrium. I am sure that there are certain places also where there has been displacement and replacement of other crops such as cotton. If cotton yields are stagnant, and if rice becomes high yielding, a similar situation will evolve

between these two crops, wherever water is not a limiting factor. So in order to assure continued progress, we must have balanced programs in research, and in both education and extension in all the crops that are important to the economy of the nation. It is not good enough to make a breakthrough on one crop. It can pave the way to progress in others but there will be increased need for more productive scientists, and more adequate budgeting to support research and extension, if we are to keep pace with the growing needs.

What are the possibilities of increasing production? What are the needs? First of all, we cannot be complacent with the progress that has been made even in wheat. There is always the danger of loss from diseases. The breadth of disease resistance must be broadened and increased in depth if we are to avoid disastrous epidemics. There are many who think that the wheat breeding program here in India has a narrow genetic base. This is not true. I would like to say here and now that the current research program on wheat in India is the broadest in the world, both in genetics and in breadth and scope of agronomic research; it also now has a very good balance in plant pathology research, it is broadening out to include cereal chemistry, and the same goes for entomological research.

Nevertheless, even where there has been a long research heritage, where vast quantities of money have been poured into research, you can have accidents, if not disasters. During the past year, in the U.S.A., there was a tremendous epidemic of Southern leaf blight of maize. Various estimates put the reduction of the crop at from 400 million to 700 million bushels over what was anticipated when the crop was flowering. The United States was very fortunate indeed, in having very large warehouse stocks to bridge the gap. Maize is used there mainly as a feed grain for producing livestock products. It has not become a disaster, but even now the seeds with built-in resistance are not present in adequate quantities to convert more than 20% of the total area to be planted during the

coming year. If the environmental conditions are right, the country will be vulnerable for the second straight year and there could be a "magnificent disaster". What I am trying to say here is that there is a continuous struggle when trying to produce more food and at the same time safeguard production. We cannot rest on the accomplishments that have been achieved. We must look forward and build greater safety into our programs. The only way to do this is to continue research in plant breeding and through the development of chemicals that can be used, in certain cases, to protect the crops.

Research must also be broadened to reduce losses from wheat insects. This is more true of other countries since India is fortunate in not having some of the more harmful insects. Insect resistance can be built in, but it is time consuming.

Despite the spectacular wheat production achievements of the past five years far too little money is being budgeted and appropriated for agricultural research in India.

We do not know what the yield potentials are for the main crop plants we grow. We must struggle to increase these but must also explore the possibilities of forming new plant species.

Let us take a look at what has happened in food production in the world. Agriculture is new in a relative sense. It is only nine to ten thousand years old. Before that time, man lived as a member of a wandering small tribe or family of people, living from hunting or fishing and food gathering. It was not until nine to ten thousand years ago - and curiously enough, this change took place very rapidly - that man, I should rather say, almost certainly woman, became farmer and animal husbandryman. It was almost certainly woman, since she was largely the food-gatherer who found that by planting seeds she had collected for food, at the right time of the year, she could insure the food supplies for the family. Before that time, it was not possible to develop villages or cities and so all of the

things that we take for granted, the large cities and our very civilization, and all the complexities of modern life have taken place to a large extent in these ten thousand years.

I have been speaking now about our present food supplies, but stop to think of the implications of those nine to ten thousand years. We have not added one single crop species of any significance to those plants that our unnamed benefactors brought into cultivation. The same is true for animals. All of the major animal species that serve as food were domesticated at about that same time. What we have done in the last few hundred years and especially in the last hundred years is to improve the efficiency of some of these plants and animals - the important ones - but we have not created any new ones of substance.

The question now is how much more can we increase the total capacity of production of wheat, rice, maize. sorghum and millets which are the main food crop cereals ? How much more can we increase the milk production of our dairy cattle ? How much can we increase the efficiency of our poultry produtions ? We don't know how close we are to the maximum amount that scientists can squeeze out of these species of today, not only genetically but also by manipulating soils, fertilizers and feeds. We have seen within the last ten to fifteen years that wheat yields under controlled conditions have been doubled and tripled. Can we do this again ? I doubt it. The same is true of rice. In an earlier period, hybrid maize doubled the potential capacity of this crop or increased it to two and a half times what was formerly thought to have been the maximum possible. As we approach the higher limit, it is more and more difficult to move the yields higher, but we must continue to struggle on because our life, our very existence is tied to what we are able to achieve in increasing productivity.

We must explore new possibilities. If the present crop plants came into being before scientific man evolved, we should

be able with all of our modern techniques to produce entirely new food crops that will outperform those that are grown today.

For the last six years, in the International Maize and Wheat Improvement Center, we have been working cooperatively with the University of Manitoba in Canada on a man-made species called Triticale. To make this species one begins with a cross between rye and wheat. It is then manipulated with certain alkaloids which double its chromosome number enabling it to develop as a partially futile plant. This is a different kind of plant, a plant which has certain characteristics in common with the two parents, but others which are different. It seems possible that we may be able soon to develop a Triticale which will have certain advantages over its parent species. If this can be done with Triticale, it behoves those of us who are working in this field to attempt to produce many other new combinations.

There are new techniques that have been developed in laboratories which permit the crossing of species that have never been crossed before. There are techniques now available where it may be possible to cross species by somatic cell hybridization. We must explore all of these as we are faced by ever-increasing problems in our effort to meet food production needs.

One of the most interesting and fascinating aspects of agricultural research in the last four to five years has been the possibility of increasing the nutritive value of cereal grains. You see, in affluent countries where animal products are available, and sold at a reasonable price, diets are more or less automatically balanced by eating a combination of cereals, fruits, vegetables and such animal products as milk, cheese, eggs or meat. Among the high income groups balanced diets are automatic; but among the low income groups, especially the small peasant farmer, this is not true since he obtains 70 to 80

per cent of his calories and 65 to 75 per cent of his protein from cereal grains. It so happens that all the cereal grains are deficient in some of the essential amino acids, the building blocks from which proteins are made. This means that people especially children, who do not obtain animal proteins in their diets, are likely to be malnourished.

About six years ago, a young graduate student, Lynn Bates, of Purdue University, was analyzing a series of maize samples. He found one, called Opaque-2, which we students 35 years ago had seen in our genetics laboratories. It was considered only a curiosity because it did not transmit light. When Bates analyzed this particular sample, he found it had twice the ordinary level of lysine, the most limiting amino acid for animal and human growth. When he took it to his research Professor, Dr Mertz, the Professor said: "You must have made a mistake. You better go back and analyze it over again." He did, but got the same result. Needless to say, many research scientists and professors have not had their noses out of the test tubes since, and have been analyzing hundreds and thousands of samples of corn from that day to this. When this particular sample of maize was fed to white rats, with the added necessary minerals and vitamins, they grew at twice the normal rate of those fed on ordinary maize. When it was fed to young piglets, they too grew at twice the normal rate. But the most significant tests of all were those conducted at the Children's Hospital in Cali, Columbia where young children who were dying from protein malnutrition were fed with gruels of Opaque-2 maize, and within seven to eight weeks, recovered spectacularly.

There are certain difficulties in producing or incorporating this particular nutritive value into high-yielding varieties of maize. All of these have not been surmounted even to this time. Progress is being made. The original varieties that were developed yielded 10 to 12 percent less because the kernels were of lower density. Moreover, the kernels were softer in texture and consequently damaged more by insects.

They were more vulnerable to rot in the ear before the grain was harvested. Within the last two years, in our research center in Mexico, our researchers have found modifying genes that can be incorporated to overcome these defects. We hope that within the next two or three years there will be maize varieties that will be fully equivalent to the best types formerly available - hybrids or open-pollinated synthetics - which will have this very great improvement in nutritive value. If this can come about, the small peasant farmer in the hills of Asia, Central America, Peru, Bolivia, or any part of the world can greatly improve the nutritional standard of his family through planting, reharvesting and replanting such a variety.

Since everyone now has become conscious of the possibility of improvement in nutrition, it has been found that there is variation in lysine level also in barley. One called "Hyproly" of Ethiopian origin, has been studied extensively at the University of Lund in Sweden. I think Dr. Lars Monck who is collaborating in this research program is visiting here today. Barley, therefore, also looks very promising.

Let us consider the nutritional value of Triticale, the new man-made species about which I spoke earlier. Within the last six months, our scientists Dr. Frank Zillinsky and Dr. Evangelina Villegas in collaboration with Dr. Fred Elliot in Michigan State University, have been conducting some nutritional tests with this grain. Here again, ten or twelve lines have been found that, when fed to rats, appear even more nutritious than Opaque-2 or Hyproly barley. We don't yet know enough about their potential, but, you see, this has opened the door to new possibilities of improving the nutritional standard for the people of the world who live primarily on cereals. This research program must be pushed forward aggressively in the years ahead.

But food is not enough. One can live only approximately three weeks without food. I am deeply concerned about world population growth. I think we have the possibility now if we work diligently and aggressively in our agriculture, to buy 20 to

30 years of time. For this period I foresee we can produce the quantities of food that are needed in this world, assuming proper financial support by Governments.

There is still, however, also the problem of food distribution. I have the feeling that if it were only total food production that was the issue it could be solved by simply increasing the world cereal production by thirty percent. This is probably the increase that is now needed to meet the food needs of the world's cereal eating people. But this is not the only problem. We have difficulties in distributing food and this is why it is so important to increase the production capacity of the small farmer, especially in the developing nations. He must have some purchasing power to start the wheels of economic development turning. I have the feeling, if we can maintain this new momentum, and expand and increase its rhythm, the peasant farmer will consume more food, and will become a purchaser of industrial products thereby expanding commerce and exchange - first nationally, and then internationally - and all of this will accrue to the benefit of the entire world within the next ten to twenty years.

Before this can be realized, there are a series of interrelated problems that we must confront relating to the whole question of population growth. We will destroy ourselves unless employment opportunities keep pace with the needs of the growing population. In many developing countries of the world, it is estimated that 20 per cent of the male labor force is unemployed now, and the total number of unemployed is growing. This is not a very nice picture. In addition, there are probably 20 per cent of the people who are illiterate and this is growing. I have seen in some countries, where despite the fact that although illiteracy has been cut in the last 25 years from 50 percent of the population to 25 per cent today, there are still more illiterates today than there were 25 years ago, because of the very rapid increase in total population. In addition to this growing problem of education, what about health and medical care, housing, clothing, transportation; we have seen the

consequences of the vast build-up of cities with all their built-in problems of stress and crowding; we have seen the unrest in many cities of the world. This does not refer only to this part of the world, it is an increasing problem for all nations. Vast segments of the people have little or no opportunity of relaxing even for a few hours or minutes a day.

Everyone in the western world at least, is talking now about the degradation of the environment. We have done a miserable job by polluting many of our rivers, streams and lakes. This is true. There is an ever increasing problem with the atmosphere-the smog from the industrial smoke-stacks and automotive exhausts. I am sure that if we put our minds and financial support to it, many of these abuses can be corrected temporarily; but there are many that are built-in and will continue to be problems in the future with expanded population growth.

There are now, I must be frank with you, certain purists in the world who are saying that we must discontinue the use of chemicals in agriculture. With this I totally disagree. There have been a few accidents in agriculture with pesticides. Very few indeed. The plus side of that ledger is heavily weighted toward the benefits. If one takes a product like DDT, one can see that it has reduced malaria to a manageable level in vast areas of the world. It may have had some adverse effects on a few bird species since it goes into the food chain, but up to now there is no good evidence that it has had any detrimental effect on human beings **per se.** We need to use commonsense when we talk about pesticides. There have been people poisoned with certain kinds of pesticides no doubt, but there are, in the U.S.A. between fifty and sixty thousand people who are killed by automobiles each year. This has not caused them to discontinue the use of automobiles. So what I am saying, is that if we cast common sense to the wind in considering the use of agricultural chemicals, we will starve. It would be to condemn the world to death to say that chemical fertilizers cannot be used. It is ridiculous and yet there are some extremists today advocating such an approach.

One other aspect of this growing problem of population is political unrest. I have a feeling that there will be more and more of this in more and more countries of the world, irrespective of types of Government, unless we come to grips with the population problem. You see, as the clock ticks off each second, there are 2.2 more people in this world that need food and all of the other amenities for a decent life. By 1980, the rhythm will increase to about 2.7. By 1990 to 3.3 and by the year 2000, to 4 persons more per second with all that this implies; this assumes only two percent population growth. Since I have been talking, the population has increased by something on the order of 6000 additional people that need to be provided for. Not a small order! It means that at the present time the world population is growing 70 million per year and, you see, this has happened relatively recently, and it is getting progressively more frightening.

If we take a look back to the beginning, to the time of Adam and Eve whenever that was, take your choice, two million years ago, or even farther back, population must have grown very slowly because of man's inability to control his environment. First, his food supply was unreliable; he had virtually no control over his shelter; he had no control over diseases; he had a whole host of problems so population certainly must have grown very slowly. As I mentioned a few minutes ago, it was only about 10,000 years ago that he became a farmer and animal husbandryman. Only then did he gain some control over his environment and his food supply. Then population must have begun to increase rather rapidly. Villages, and subsequently cities, began to be built. Most demographers estimate that the world population at the time of Christ was not more than 250 million. From those 250 million people, the population doubled to 500 million by the year 1650. The next time we did much better, for we doubled our number only in 200 years and reached a total of 1 billion by 1850. It was about this time that modern medicine came

into the picture and death rates dropped dramatically. This contributed to an even faster increase. Within 80 years, from 1850 to 1930, the population doubled again to 2 billion. World population now stands at 3½ billion and the self-destructive course we now steer will bring us to a total of 6½ billion people by the year 2000.

The current so-called population explosion is now not so much due to the increase in birth rate as to the reduction in death rate and infant mortality. And so, the way things are going now, we will double our world population every 37 years. This tick, tick, tick of the clock grows louder and more menacing. Where will it all end?

You see, in virtually all animal species, there are built-in population control mechanisms which take over when crowding becomes too great. There are many different kinds of mechanisms and they are automatic. But man has one great advantage. He has an intelligence that surpasses all other animals. Sometimes he does not use it very well. He can think ahead, he can project, he can see what is likely to happen. Although we don't seem to have any automatically built-in mechanisms in our own species, to regulate our increase in numbers to reasonable levels, we do have instead this wonderful mental device. Man has the ability to reason, which no other animal has and this should enable him to adjust his population growth, to a level which will allow a decent standard of living for all peoples of all nations in the years ahead. The question remains will he use this ability to think, reason and project ahead to build a better world, or will he destroy the species?

I have talked much too long, but in closing I would like to use the words of Sir Kenneth Clark to express my feelings concerning many of the problems that we face in the world today:

"I believe that order is better than chaos; creation, better than destruction; I prefer gentleness to violence and

forgiveness to vendetta. On the whole, I think that knowledge is preferable to ignorance and I am sure that human sympathy is more valuable than ideology. I believe that in spite of the recent triumphs of science, men have not changed much in the last 2000 years and in consequence we must still try to learn from history - history of ourselves. I believe in courtesy, the ritual by which we avoid hurting other people's feelings, by satisfying our own egos and I think we should remember that we are part of a great whole which for convenience we call nature, all living things are brothers and sisters and above all, I believe in the God-given genius of certain individuals and I value a society that makes their existence possible to help all others."

I thank you.

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