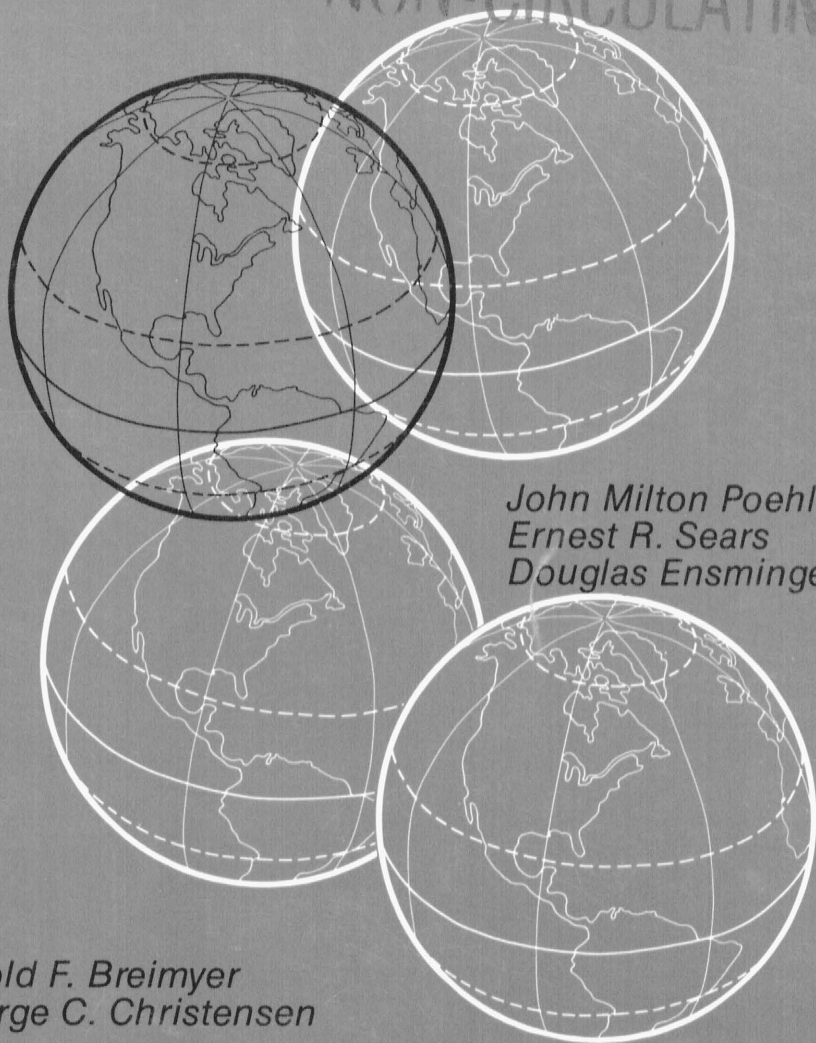


U. S. Agriculture and the World Food Economy

Papers from Recognition of Excellence Seminar
April 7, 1981

NON-CIRCULATING



*John Milton Poehlman
Ernest R. Sears
Douglas Ensminger*

*also
Harold F. Breimyer
George C. Christensen*

U. S. AGRICULTURE AND THE WORLD FOOD ECONOMY

On April 7, 1981 an afternoon seminar and an evening ceremony held on the UMC campus were devoted to "Recognition of Excellence" -- the excellence of the contribution three members of our College of Agriculture faculty have made to world food and agriculture. The three members are John Milton Poehlman, Ernest R. Sears, and Douglas Ensminger. Our associates on campus and leaders of agriculture and agribusiness in Missouri were invited to join in the celebration. Many did so.

By chance and not design, the three honorees now hold emeritus standing. All continue professionally active.

We are pleased to present here the seminar papers of the three honorees, although that of Dr. Sears is a digest owing to his absence from the country. Also made available are the background paper written by Harold F. Breimyer, and the address of the evening delivered by George C. Christensen.

A. Max Lennon
Dean of Agriculture

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THE WORLD FOOD ECONOMY AT THE
BEGINNING OF THE 1980s

Harold F. Breimyer
Professor of Agricultural Economics
University of Missouri-Columbia

"When there are people dying from famine . . . [and] you do not issue the stores of your granaries for them . . . and you say, 'It is not owing to me; it is owing to the year,' in what does this differ from stabbing a man and killing him, and then saying, 'It was not I; it was the weapon?'"

-- Mencius (372-289 B.C.)
to King Hui of Laing

"I support . . . establishing a national policy for protecting good agricultural land."

-- John R. Block, Secretary
of Agriculture, 1981

". . . I believe the need for conservation of our natural resources and the preservation of prime agricultural land for agricultural use must take a high priority during the 1980s."

-- James B. Boillot, Director
of Agriculture, State of
Missouri, 1981

Most Americans entered the decade of the 1980s with an honest sense of reality. They knew our nation, and indeed the whole western world, was facing sterner times. They were ready to admit that hopes must sometimes be bridled and that horizons have limits, even ours.

The contrast with a decade before is incisive and instructive. In 1970 our citizens were preoccupied with the Vietnam quagmire but their unease did not extend to questioning national purpose or destiny. Still lying ahead, unforeseen, were the corn blight, devaluation of the U. S. dollar, the Soviets' raid on our grain stocks, OPEC's cartelizing of oil prices, and even our runaway inflation.

But those shocks and others came in the 1970s. They jolted our confidence. They shook us up. Nor are they any longer seen as isolated, temporary, quickly passing. On the contrary, we now know the scene has changed.

So, to repeat, we marched into the 1980s chastened and sobered. And that is good.

Whether we are prepared to take the next step and respond wisely is a different matter. It is also, as the line goes, "why we are here."

The Danger of Attempted Withdrawal

Disturbing events of the last ten years have in common that they respect no national boundaries. Many are international in origin, such as the OPEC petroleum trade, or shared with trading neighbors, such as inflation.

Traditionally, Americans have withdrawn from problems having a foreign taint, as reflexively as from a hot stove. Anyone of my vintage can attest thereto. My education began just after World War I. All pupils learned President Washington's farewell admonition to the American people to stay out of entangling foreign alliances. (In reality the teaching was inaccurate. The exact language was that we should "steer clear of permanent alliance with any portion of the foreign world.")

Presidents Harding and Coolidge governed by the precept of avoiding alliances, entangling or otherwise. Then came the isolation of the Depression years, when we sought to solve our internal problems by erecting external barriers. Trade was stifled. Secretary of State Cordell Hull got us to loosen trade a bit. It remained for the Japanese to instruct Americans that we are a part of the world. They did so December 7, 1941. Never since have we allowed ourselves the delusion of non-involvement.

Nonetheless, old reflexes persist. Just now we are flirting with the impulse to run from trouble, even though the thinking lobes of our brains tell us there is no place to run to. American citizens in their frustration are begging to retrench, both domestically and internationally. They said so with their votes in the 1980 elections. The officials they elected, more disposed to acquiesce than to importune, are pulling in U.S. horns. The national posture of the moment is to disengage, to withdraw.

The wish may be natural but the cause is futile. The United States cannot stay aloof. The option is not open. Apart from moral and political ties with the rest of the world, and apart too from obvious communication linkage as Borneo connects with Boston by satellite, the United States has joined in heightened interdependence among nations.

Much of the interdependence is coldly economic. An example is our dependence on imported minerals to keep not only our manufacturing industry going but our modern agriculture too. In addition to our advertised appetite for imported oil we draw on imports for 93 percent of our bauxite (for aluminum), 81 percent of our tin, 77 per-

cent of the nickel we use, 50 percent of tungsten, 29 percent of iron ore, and 19 percent of copper. For agriculture we import from Canada a sizable part of the potash for fertilizer nutrients, and before long we will have to get more of our phosphate from Morocco.

Our agriculture also depends on the rest of the world for markets. And although we may rejoice in how burgeoning export demand benefits at least part of our agriculture, the associated cost is a heightened sensitivity to economic and political developments beyond our shores. In view of our national history this side effect is not welcomed.

At the 1980 Agricultural Outlook Conference Carol Tucker Foreman, then Assistant USDA Secretary, warned of the vulnerability of export markets to world events:

We are fooling ourselves if we think it possible over the next several years to avoid the foreign policy implications of our food exports. Further, we must understand that we are not the only actors on the world scene. . . . We cannot make the blithe assumption that . . . statistical projections will be translated automatically into stable, dependable markets abroad. . . .

In the past, farmers only had to worry about weather, pests, and irate American consumers. They are now vulnerable to the even more capricious pressures of palace intrigue in unpronounceable foreign capitals. . . . It is clear that food export policy must go hand-in-hand with diplomacy.¹

In March of this year Agriculture Secretary Block echoed the same theme. Applauding cooperative business-government "ventures" abroad he declared, "It is important to recognize that our agricultural trade development projects with other nations will be linked to our relations with those countries." By "relations" he meant "evidence of support for the goals and objectives of the United States;" in other words, political accord.²

Language such as that used by Mrs. Foreman and Secretary Block bring to mind the debate about using food as a weapon. The coinage is understandable yet unfortunate. It suggests that the political role of food is solely negative, even punitive. On balance our food resources serve better to woo friends than to spank enemies.

¹ Carol Tucker Foreman, "Food and Agriculture Policy in the 1980s," USDA, Nov. 20, 1980, p. 5.

² John R. Block, remarks before the Joint Agricultural Consultative Committee, March 4, 1981.

During four days in Egypt last summer I learned a fact of international life, that our ally Anwar Sadat holds his strong position as President of Egypt partly by virtue of the P.L. 480 wheat we make available to him. Our wheat baked into cheap bread for Cairo's unemployed is essential to economic and political stability in that country. We want Mr. Sadat strong and on our side. U.S. wheat helps.

Although we declare that our nation is deeply and irrevocably involved internationally, we also admit some loss of influence. That trend too is irreversible. Professor Tillema of our political science department commented at the 1980 UMC-Perry seminar that even as our nation has become more internationally oriented it has lost some of its earlier "capacity to shape international events." We are still a great power, stronger than any other, but we can't make everyone dance to our tune. Therefore, "in order to protect our interests we must play the game of international politics," even as other nations do, and with "all the risks of costs and failures" that go with that game.³

Seeing through a Glass Darkly

My final opening note is a precautionary caveat. The analysis that follows relates primarily to the outlook for world trade in farm products and especially the grains, and our likely place in it. The best available information will be summarized. But knowledge is always an exercise in probabilities. The most likely prospect for the 1980s is that the world will compete for our grain and other farm products, that domestic consumers will insist on having their wants met (or will try to do so), and that the decade will be marked by more instances of relative scarcity than of burdensome surplus. To repeat, this is the most likely prospect.

But it is far from certain, assured. Not only can developments be affected by the palace intrigues Mrs. Foreman whimsically refers to. There can also be casualties in demand, or unexpected developments in production (positive or negative), or perhaps even international conflict. Events of these kinds can upset not only the best-laid plans of men but their prognostications. In statistical language, there is a sizable error term to all the observations that will be made henceforth.

On the other hand, it is not necessary to be precisely accurate to set forth how dramatically the overall out-

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Herbert K. Tillema, "America and the World, 1980," in International Affairs and U. S. Agriculture, Univ. of Missouri-Columbia, Agr. Exp. Station Special Report 259, 1980, p. 13.

look can affect the future course of events at home and abroad. Put succinctly, whether or not the actual situation will be one of comparative scarcity or of a return to surpluses is a matter of immense meaning. If surpluses were to recur we would go back to old debates about land retirement, export subsidies, and such. But if shortages persist we will face new issues.

Our past experience has prepared us better for surpluses than for shortages. Persistent shortages would lead to a three-way tug-of-war among claimants for our food- and feedstuffs. One is the new export demand, amplified by the diplomatic overtones mentioned above. The second is U. S. consumers, who will clamor for secure access to food supply. Third is a new arrival on the scene, one that is welcome during surplus but potentially annoying during shortage, namely, diversion of feed grains to ethanol.

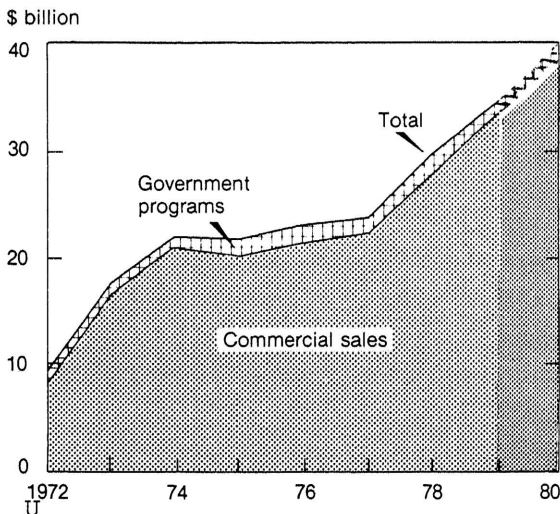
Data bearing on these possible panoramas will be presented below.

The Export Boom

A starting point is the boom during the 1970s in exports of U. S. farm products. The chart below tells the story. The export value in 1979-80 (year ending September 30) was \$40 billion. During the 1970s the value multiplied approximately five times. The increase is attributable about equally to larger volume and higher prices.

The great bulk of exports is commercial. Concessional sales, primarily made under P.L. 480, stayed at around five percent of the total.

Government Programs and Commercial Sales
of U. S. Agricultural Exports

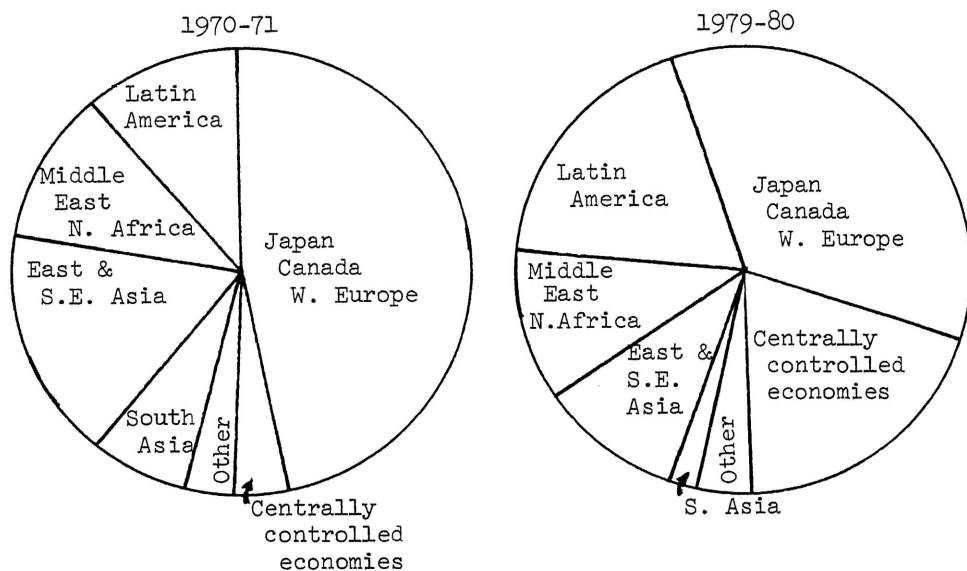


USDA data.

All farm products joined in the gain in export values during the 1970s. But the food and feed grains and soybeans were in the lead and they now account for two-thirds the value of all farm products exported. These products will be at the center of future export policy.

Changes in export destinations are noteworthy. For the grains the charts below compare destinations in 1979-80 with those of 1970-71. Although all markets increased their buying, the traditional markets of Japan, Canada, and Western Europe lost ground relatively. Latin America took a larger share in 1979-80; the Middle East held even; but the really big gain was in sales to centrally controlled economies, principally the Soviet Union and Peoples Republic of China.

Destinations of U. S. Grain Exports



Many factors underlay the uptrend in exports of U.S. farm products. At our 1980 UMC-Perry seminar Professors Womack and Bredahl listed several contributing causes and they took particular note of increased trade with Eastern Europe. They specifically cited "decisions in centrally planned economies to increase meat supplies to consumers; . . . /a new/ U. S. policy that encouraged exports to /those/ economies beginning in the early seventies; . . . and the current U.S. farm program based on a managed buffer stock policy."⁴

⁴ Abner W. Womack and Maury Bredahl, "The World Dimension to U.S. Agricultural Trade," in International Affairs and U.S. Agriculture, Univ. of Missouri-Columbia, Agr. Exp. Station Special Report 259, 1980, p. 19.

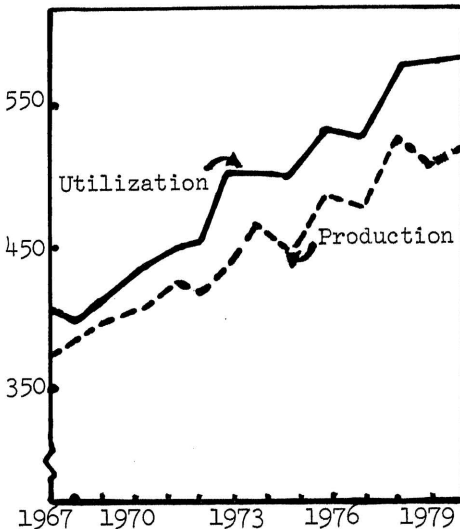
Devaluation of the U.S. dollar early in the 1970s definitely added to trade with countries whose currencies remained relatively strong. Consumer demand for meat increased also in Western Europe and some other developed countries, contributing to growing exports of feed grains and soybeans.

In developing nations of the Third World, which are major markets for our wheat and rice, rising export trade is explained mainly by urgent needs for food. There the cereals are consumed directly. Those nations buy approximately half our exports of the two grains; and, contrary to popular impression, they pay hard dollars for the largest part of their purchases. (Some get their dollars by borrowing from private banks and international lending agencies, however; and their pyramiding debt structure is a disturbing element in the trade outlook.)

Not least among factors involved in our exports are shortfalls in agricultural production worldwide. It is not that agricultural economies stagnate; all show continued gains in output. But yields lag behind need.

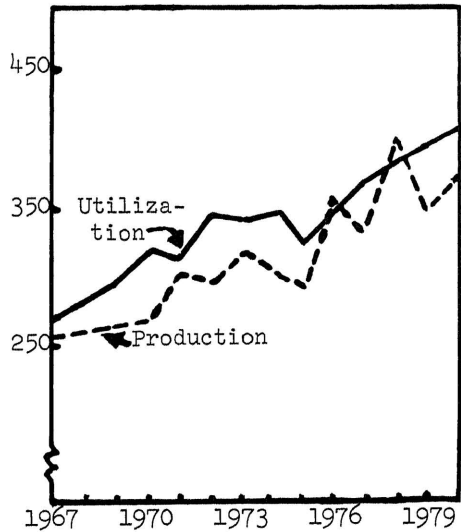
Production and Utilization
of Feed Grains,
World Outside U. S.

Mil. metric tons



Production and Utilization
of Wheat, World
Outside U. S.

Mil. metric tons



The charts above present the world picture dramatically. In the left hand chart annual consumption and production of feed grains are shown for all countries of the world outside the United States. Manifestly, the gap between consumption and production has widened steadily. Professor Womack estimates that the deficit increases by

more than two million metric tons each year, or almost 100 million bushels. The United States has filled that gap. Translated into acreage, a million more acres of corn, sorghums, and other feed grains are required each year to supply that quantity of grain for export -- assuming only slow trends in per-acre yields.

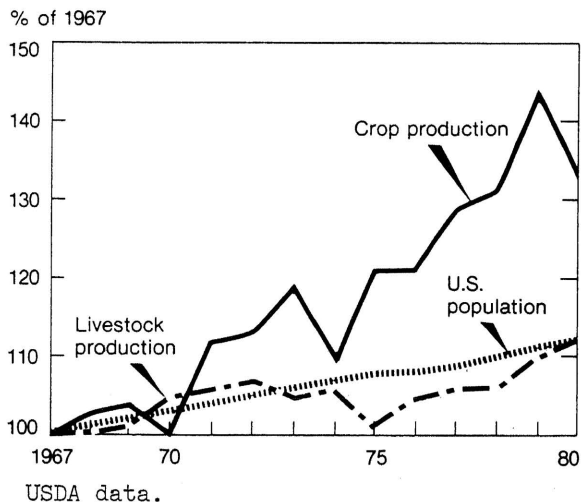
For wheat the situation is less critical. However, the two good-harvest years of 1976 and 1978 obscure the slow worsening of the wheat supply-demand balance in the world outside the United States. According to Professor Womack, longer trends indicate that on the average the world will draw on the United States for about 35 million more bushels of wheat each year.

The story for soybeans is similar to that for feed grains. If anything, the United States position is even more strategic for soybeans than for the grains, as we are by far the largest supplier of beans and their products into foreign trade.

Feedback Effect on the U. S. Food Economy

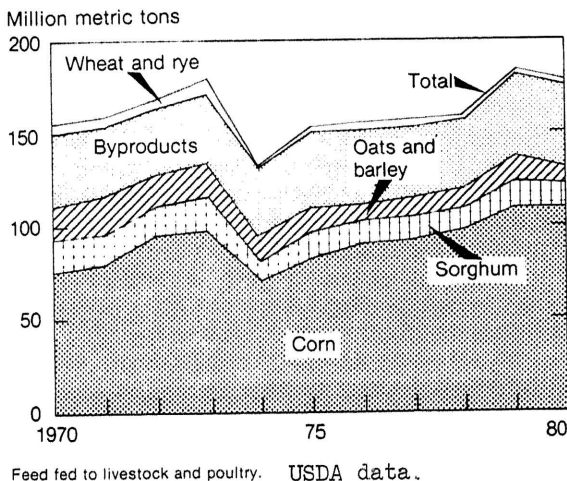
It has been politically popular to rejoice in the big growth in agricultural exports. Grain and soybean farmers have seen it as underpinning the price structure for their products. The dollar exchange earned by those exports has helped to bolster the U. S. dollar in the face of rising costs of petroleum imports.

Crop and Livestock Production



But there are negative factors too. Clearly, every increase in price received by feed grain and soybean farmers has constituted a matching increase in cost to livestock and poultry producers. Animal agriculture, heralded after World War II as savior to farmers and blessing to consumers, has lapsed into comparative shadows. We have been loath to admit how much the growing export trade has detracted from our livestock and poultry operations. The statistical fact of the matter is that very nearly all the increase in production of grains and soybeans the last 10 years has moved into export channels. The chart on the previous page shows clearly the uptrend in crop production but near-stability in livestock output. The chart below explains the lagging livestock output. The quantity of feed concentrates fed to livestock and poultry has increased very slowly. More feed has not been fed at home because export demand has bid it away.

Feed Concentrates Fed

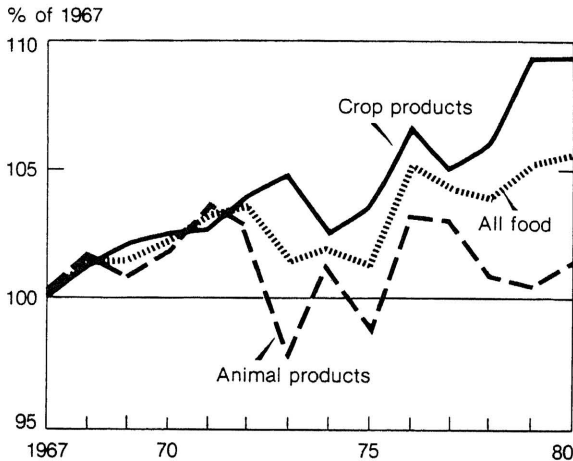


The chart on the next page reveals that as a consequence the average consumption of animal products has stayed about level for more than ten years. Even as Eastern and Western Europeans have moved toward more animal foods in their diets, we have eaten more crop products.

Whether U. S. consumers have changed their dietary habits because of changing preferences -- witness the aversion to breakfast eggs -- or have reluctantly responded to price signals is a moot question. Probably both factors have been at work. However, the protests raised occasionally against high prices of beef suggest that not all dietary changes have been voluntary and welcome. And in a nation that formerly regarded foods of animal origin as superior and mark of a good life, the

retrenchment carries a meaning -- and perhaps a portent.

Per Capita Consumption of Food



Grain for Fuel

Something relatively new under the farm-policy sun is the increasing diversion of feed grains into ethanol and the grand ambitions sometimes expressed. In early 1980 the farm community felt high excitement. There was enthusiasm about home distillation as hedge against scarce motor fuels. Following the embargo on shipping over-quota grain to the Soviet Union, many farmers endorsed commercial production of ethanol from grain (for gasohol) for its market-strengthening effect.

Ardors have since cooled a bit. Stills have not worked too well. Ethanol remains non-competitive with even higher priced gasoline, and its production still rests on subsidy. But the soberest reflections on potential use of grain for fuel reveal the piercing contrast between how much even a modest ethanol program could disturb the present market equilibrium in agriculture, and how little even a large program would contribute to the energy supply.

Bluntly put, grain is not an economically sound alternate source of motor fuel. Other biological materials that are not themselves foodstuffs are a more promising alternative energy source. In 1980 some 80-100 million bushels of corn went into manufacture of ethanol. The product of about one million acres, that quantity provided about 200 million gallons of ethanol. But we use more than 100 billion gallons of gasoline each year, not to mention diesel as a second fuel. Hence the million acres of corn contributed one fifth of one percent of the

motor gasoline supply of 1980.

Former President Carter advocated building capacity to produce 10 billion gallons of ethanol. A yearly output of that scale would require half the U. S. corn crop. Granted, distillers' grains would be recovered as a by-product, but even so the consequence to both our corn export trade and our livestock/poultry industry would be devastating. And that big a program would supply less than a tenth of all motor fuel needs and would amount at most to only two percent of the total energy supply -- and probably less.

It is possible that many U. S. citizens, pressed to get fuel for their automobiles, boats, and lawnmowers, will opt to put corn-alcohol into those motors and bread and rice instead of meat into their own stomachs. Rarely, though, is the issue now expressed in those terms. The easy assumption is that we can have both ethanol and meat, not to mention continuing to export farm products. The assumption is not valid.

A modest ethanol program could be accepted rather readily but grandiose schemes would pose a major policy problem. They would do so because they would almost certainly put agriculture into a shortage mileau and claimants on farm output into contention.

Prospects for More Production

I now touch briefly on prospects for increased agricultural production.

Wonderful achievements in increasing food production in nearly all countries have been a heartening experience of the last generation or two. They have made it possible for a steadily growing world population to be fed without recurring or widespread famines. Admittedly, many hundreds of millions continue to live on a diet of minimum adequacy. But the overall record is not bad.

In developing nations a third of the increase in agricultural output is attributed to expansion of cultivated area. In developed nations virtually all the increase has come from a combination of new technology and new resources -- mainly motor fuel, fertilizer, other chemicals. Most of these newer resources are derived from fossil fuels. As fossil fuel sources become scarcer and more costly, grave dilemmas are posed.

Already in the United States, one recourse has been to add to cultivated acreage. Yet most surveys show that we have only a small reserve of land that can be cultivated without severe problems of conservation. At the same time, good farmland is steadily lost to nonfarm uses.

In its 1977 Potential Cropland Study the Soil Conservation Service estimated that 127 million acres have a

high or medium potential for addition to cropland. Of this only 36 million acres could be converted readily. The SCS also believes that three million acres of rural land are lost to non-agricultural uses each year and that almost a third is prime agricultural land.⁵

Whether another round of explosive new technology can somehow be induced or invented, sparing mankind the perils of inadequate food supply, is a question better left to the two agronomists, Dr. Poehlman and Dr. Sears. For my part I am impressed by the statistic that of the solar energy falling on a corn field only one percent is constituted in the harvested grain. Somehow it should be possible to do better.

There is yet another facet to estimates of potential production. The new technology and new nonfarm inputs that have revolutionized farming in the United States and many other places have a distinctive cultural pattern: they are capital-intensive. So-called modern technology rests on and glorifies intensive use of capital inputs ranging from steel in machines to electric power to petroleum in its many forms.

This kind of agriculture is labor-extensive. It is also somewhat land-extensive. Its goal and highest achievement has been to lift output per man to impressive levels. It has not maximized output per acre or in total.

An agriculture of such a make-up was long appropriate to the United States, where industrial materials could be made available at unbelievably low cost. It was economic to use machines that burned fuel by the barrel. Also, in a nation with immense land resources, and one where annual output tended to outrun markets, it was defensible to confine the land in cultivation to flat or gently sloping expanses where those big machines could turn a long furrow, and where costs of protecting soil from surface damage could be kept small.

In short, the United States has been under no pressure to maximize utilization of its land or farm labor, or its total output.

Pressures of the future will force a turn-about. Although we will not revert to horse and mule farming or human drudgery, the imperious trend will be toward a somewhat more land-intensive and labor-intensive agriculture. This means bringing into cultivation tracts of land that do not accommodate huge machines, or that require soil conserving practices to protect them. It also means servicing smaller and diversified farms, thus slowing the trend toward ever larger monoculture units.

⁵ Potential Cropland Study, U. S. Department of Agriculture, Soil Conservation Service, Statistical Bulletin No. 578, 1977.

Intensification of our agriculture could add significantly to total output. I have said often, only half facetiously, that Japanese farmers could feed Columbia by farming the median of Interstate 70. The image is not too far fetched.

The same moral about cultural practices can be applied to our teaching of farmers in other nations, particularly those of the Third World. In past years much of our technical aid has featured transfer of our variety of technology. Highlight has been the techniques of the Green Revolution. But the majority of the world's farmers are small operators for whom expensive nonfarm inputs are uneconomic, especially at rising prices. They need help with ordinary techniques, not more capital-intensification.

Implications for Policy

If the future should bring back a surplus situation in agriculture, policy issues will not be absent but the territory will be familiar.

Not so if the future truly will be one of relative shortages. The terrain will be unfamiliar indeed. Although it is tempting to suggest that the "market" will do all allocating of resources and distributing of product, sparing us the travail of policy decisions, the grim reality is not so reassuring. Policy decisions already are deeply involved in our agriculture and agricultural trade. New policy contentions are inescapable. I touch on a few.

Terms of international trading are surely a candidate for controversy. Will trade henceforth be essentially multilateral or bilateral? We subscribe to the former but in the last five years have entered into three bilateral agreements for grain trade. Each agreement is justified on grounds of being unique and not precedent-setting. A new Soviet agreement might be signed in 1981.

If grain proves to be abundant we can live with part-multilateral, part-bilateral trade policy. If grain is scarce, my prediction is that we cannot. During a period of scarcity our old reliable (and politically friendly) export buyers will clamor for bilateral protection of their access to our stores. It will not be strategically possible to deny them.

Moreover, multilateral trading is a policy but bilateral involves agreements. If we bilaterally commit ourselves to export specified volumes of grain a problem arises of holding reserve stocks to ensure fulfillment. The present farmers' reserve program, although well designed in some respects, could readily prove incapable of meeting heavy demands on it. One proposal is to set up a separate export-contract reserve.

At this point I offer a personal interpretation that presses ever harder on my mental retina. It seems to me that old tradition and new paradigm in international trade are in conflict. Traditionally, world buyers of farm products have looked on imports as residual supplements to domestic food sources, and sellers have regarded exports as residual disposal of domestic surplus. Year by year a paradigm emerges wherein buyers seek dependable if not pre-scheduled sources, and sellers want equally reliable outlets. The contrast between the old tradition and new paradigm is obvious. In the newer setting nations grope to modify their institutions of trade.

Policy topic two is non-commercial trade relations. These may be no more facile than the commercial. For a quarter century concessionary trade and technical aid have been extended for the multiple purposes of helping people, winning or keeping friends, and strengthening our markets. When grain is plentiful the programs are supported readily, or even enthusiastically. When grain is scarce, the impulse is to retrench. But pervasive world tensions give cause to keep these instruments of our world role.

Priority to Our Consumers?

A third policy topic is the consideration to be shown our own citizens in the event of competitive grasping during relative shortages. Do we first provide for "our own"? An attractive feature of an export-reserve program, mentioned above, is that it would facilitate a two-price policy -- a different price for exports than for domestic use. During the 1950s and 1960s when surpluses were our burden, export buyers often bought at discount. We subsidized exports. During a future shortage it is conceivable that export buyers will be charged a premium.

Fourthly I turn to the touchy issue of use of energy -- the so-called biomass debate. Ethanol is as much a product of subsidy as of corn. As energy becomes scarcer and more costly, pressure will intensify to convert farm products to the alcohols. But resistance will be thrown up as food supplies diminish. There is no way to avoid a confrontation.

Fifth and sixth on my list are policy issues bearing on capacity to produce. How much and what kind of support will we give to research and accompanying education? Some scientists allege a tight connection between level of research in production technology and level of gross farm output. The claim may be a bit smug. Even so, I have previously sounded an alarm regarding not just the downward drift in research funding but the gradual shift to a contractual system of funding. Does contractual funding promise continuity in a combined

basic-and-applied research program? I doubt it does.⁶

The final policy area is soul searching indeed. It relates to protection of our resource of productive land. In the United States we still hold to a pioneer philosophy of land. According to it, land is abundant, and once occupied it is eligible for protection or plundering as the title-holder sees fit. The philosophy is outdated and cannot survive; for if its worst features survive, human beings will not. Protection of our good farmland from every threat is an undeniable injunction for our national future. This applies to potential damage from water and wind, chemical saturation, loss to non-farm uses, and even inappropriate cropping patterns.

A retinue of policy issues such as those just sketched, with their many international complications, invites our old reflex of denial and disengagement. We may dream that energy will again be plentiful and cheap. We may imagine that open prairies still await the pioneer's plow. We might even suppose that George Washington's injunction against alliances, entangling or otherwise, can be adhered to.

A few years ago a librettist for light opera pled, "Stop the world: I want to get off." The wish may be natural but gravity prevents its fulfillment. A pull akin to gravity surrounds the place of the United States in the world food trade. We can't pull loose from it, however great be our desire.

We can't detach ourselves because we are human beings possessed of sympathy, and we can't do so for the further reason that our security is interconnected with that of peoples from Greenland to Singapore. But lest this be too grim an ending to this paper, let's rejoice that food is our resource in relation to both our own and other populations. It touches humanity deeply, and our food-producing capacity is a source of strength at home and of confidence in world affairs.

⁶ Harold F. Breimyer, "Education in Public Policy: Eight Years of the UMC-Perry Foundation Seminar," in International Affairs and U. S. Agriculture, Univ. of Missouri-Columbia, Agr. Exp. Station Special Report 259, 1980, p. 57.



JOHN MILTON POEHLMAN

Dr. Poehlman was born on May 9, 1910 at Macon, Missouri. His higher education was at the University of Missouri, where he received a B.S. in Agriculture in 1931 and a Ph.D. in Botany in 1936. He has been associated professionally with this University since 1935. He attained full professorship in 1950, and became Professor Emeritus of Agronomy in September 1980. During this tenure he served as Associate Chairman of the Agronomy Department, 1967-69; Research Advisor, Orissa University of Agriculture and Technology, India, 1963-65; Acting Group Leader, UMC/USAID Team in India, 1964-65; and Director of a UMC/USAID International Program, 1968-76. He served short term consultancies in Romania, India, Mali, Jordan, the Philippines, Korea, Tanzania, and Tunisia from 1971-1980.

Dr. Poehlman's contributions to the world food economy in his state and nation and internationally have been manifold. His research has resulted in the release of 18 varieties of barley, oats, wheat, and rice -- some with international use. His research findings have been made available to others in 131 publications. He was advisor to more than 200 undergraduate, 21 M.S. and 19 Ph.D. students. His text books on plant breeding have been widely used both nationally and abroad.

Dr. Poehlman developed a modus operandi by which the Land Grant College professor can combine thesis research to train graduate students in plant breeding and international agriculture with assistance to developing countries. He developed an International Mungbean Nursery with linkages involving local research workers in more than 25 countries. He is a member of ten scientific Agricultural Societies and has received numerous honors and awards, including the University of Missouri Thomas Jefferson Award in 1978 and the UMC Alumni Association Distinguished Faculty Award in 1980.

FOOD: THE CHALLENGE TO AGRICULTURE

John Milton Poehlman

Agriculture encompasses a broad spectrum of activities. If all of these activities could be identified, sorted out, and piled into their respective categories, the pile representing food would certainly overshadow all others. While food is equally essential for survival of all members of the animal kingdom, only man developed the capacity to grow, harvest, process, store, and utilize food in a systematic manner. As agricultural science expanded, it became possible to reap richer harvests of grain, and to feed livestock more efficiently for the production of milk or meat. Where this knowledge has been applied, there have been rapid gains in the production of food, certainly greater than could have been predicted even 50 years ago.

Unfortunately, some other changes, as in population growth, have been frightening. Present rhetoric on world food scarcity stems from the growing specter of population's outstripping food production, even as it is recognized that much of the present widespread hunger results from inequitable distribution of the food produced. Additionally, pressures of the larger population affect many other resources, such as availability of land, metals, chemicals, energy, and water; and the quality of life too.

Many books have been written on "world food and hunger." Conference and symposium proceedings have been published. Predictions, extensively documented, have been given, on every side of the question. Unfortunately, the crisis still exists. Yes, it even grows worse. So more conferences and symposiums are held. It is with some trepidation and humility that I add to the rhetoric when action, not rhetoric, is needed. Even so, I capsule here a few views about the present population and food production situation. The two are inseparable, since the quantity of food needed is determined by the number of people and their level of nutrition.

The Population/Food Situation

World population has exploded.

One billion people in 1830, two billion in 1930, three billion in 1960, four billion in 1975: the statistics are familiar to many, yet nonetheless alarming. If the present rate of population growth continues, the 1980 world population will double in 30 to 35 years, and triple in a little over 50 years.

Pressures of population affect many facets of the environment. But as an agronomist, I address only one -- production of food. Can food be produced to feed the growing population? The questions, "Who gets the food?", "How much of the cereals will be diverted to feeding livestock?", "Or to producing ethanol?", are additional sets of perplexing, although not unrelated, problems.

Population is increasing most rapidly in the poor countries.

During the 20 year period, 1960 to 1979, population increased 52 percent in the poor countries compared with 32 percent worldwide. Population is growing most rapidly in the countries with the least resources to develop a productive agriculture and to expand food production capabilities. Neither do they have the resources to import large quantities of food. It is in the poor countries that hunger and malnutrition are most common.

The poor countries are losing in the struggle to feed their people.

Food production in the poor countries, where population is expanding most rapidly, is not keeping pace with the rest of the world. Cereal grains -- principally, rice, wheat, corn, barley, sorghum, and millet -- are the major source of man's food. Worldwide, the cereals supply, directly, about 53 percent of the food energy. The cereals constitute a much higher percentage of the diet in the poor countries than in the rich ones. While cereal production, during the past 20 years, has increased 53 percent worldwide, and 56 percent in the developed and centrally planned countries (China, U.S.S.R., Eastern Europe), it has increased only 45 percent in the poor or underdeveloped countries. This production pattern enables the affluent countries to continue to eat well, with a small margin to sell or to share, but in the poor countries, hunger and malnourishment increase.

Food production is not infinite.

Growth in food production during the past few decades has exceeded all expectations. The harvest is still growing. Its limits in growth are still unknown. But resources to expand food production are not infinite. Scarcity of new fertile land, vagaries of weather, spiraling costs of fertilizer and energy, and many other factors combine to limit growth in food production. We must also be aware that food production alone does not conquer world hunger; hunger is not eliminated until food gets into the belly of the hungry. But we can be positive on one point, that hunger and malnutrition will not be conquered unless sufficient food for everyone is produced.

Food production will eventually lose the race unless population growth is drastically curtailed.

If population growth worldwide continues at its present pace, it will certainly, someday, exceed the capacity for world food production. Speculations on how far and how fast food production may be increased may be misleading. The potential for increasing food production varies widely in different areas of the world and in different countries, due to population level, available land and water resources, level of technology, and level of the economy. While population is growing rapidly in all of the poor countries, not all of the poor countries are densely populated. The less so enjoy a period of grace in attempts to achieve a population-food balance. The potential for increasing food production in India, with its monsoon rains and agricultural educational system, is far greater than in the Sahel of Africa, where drought is perpetual and agricultural education in its infancy. Eventually, it must be recognized in all countries that population control is as essential as increasing food production in achieving a population-food production balance.

For many countries, a solution will not come in time to avert widespread poverty, hunger, and misery. I have never been to China, but from what I read, that country, having one of the oldest civilizations and being the most populous country, appears to be making a greater progress in solving the population-food problem than most countries, although it is still far from being self-sufficient in food.

The problem of world hunger will not be solved by production and export of food from the rich to the poor countries, although shipments may avert much misery in times of disaster. There are limits to the amount of food that rich countries can produce and give away, and to the amount that poor countries can buy. Someone must bear the cost of food production. Neither will the food problem be solved by export of a mechanized production technology to lands with abundant labor and without resources to import energy. For them a more labor intensive system will prevail. The greatest gains have been made within the countries where there are the innovation, the determination, and the financial resources to develop a technology that will maximize food production within the land and cultural resources available.

Agricultural research, education, and extension programs stimulated innovative solutions that have contributed greatly to the success of agriculture in the U.S.A. Unfortunately, resources to develop similar innovative programs in most of the Third World countries are lacking. Our most important contribution will be the help we can give the Third World countries in developing agricultural research and education programs, in order to contribute to a solution of their specific food production problems.

The Lesson for Missouri Agriculture

Let us now focus on Missouri agriculture. What lessons are there here for us to learn? We live in a young country compared with India or China; we are just over 200 years old. The U. S. agricultural system developed in a setting where land was rich and plentiful and labor scarce. What will our land and population ratio be when the United States is as old as India or China? Or just 50 years from now? Individually, you and I are not going to have much influence on increasing food production in India, or Bolivia, or Mali, but perhaps we can have some influence on maintaining a productive agriculture in Missouri.

We are blessed by living in the world's largest and richest agricultural area, where temperature and rainfall conditions are favorable for a productive agriculture. Missouri, and our neighboring states, are major contributors to recent increases in world food production. In cereals, this has been accomplished, largely, by higher per-acre yields. During the past 50 years, corn yields in Missouri have increased fourfold, from 0.5 tons/acre to over 2 tons/acre. Wheat yields have doubled, having increased from 0.5 tons/acre to around 1 ton/acre. Grain sorghum yields have followed closely behind those of corn, and soybean yields have followed closely those of wheat. While acre yields of corn have quadrupled during this 50 year period, total production has only doubled because fewer acres are planted. The situation is similar with wheat. Many acres formerly planted to corn and wheat, as well as to crops that were less competitive such as oats and barley, have been diverted to soybeans and grain sorghum. The total acreage in the five grains, corn, wheat, oats, sorghum, and soybeans, has remained relatively constant, around 8 million acres, over the past 50 year period, except for the last 5 years, 1974-1979, when it increased to 10 million acres.

I have referred frequently to the past 50 year period. The 50-year span is symbolic to me. This spring marks the 50th anniversary of my University of Missouri graduating class, that of 1931. I, as well as my fellow honorees Dr. Ensminger and Dr. Sears, have been privileged to witness and to have been associated professionally with agriculture during this momentous period. When I view the food production problems in other areas of the world, I am thankful for our heritage, and rightfully proud of the accomplishments of Missouri and U. S. agriculture during this 50-year period; and I pray that we may keep our agriculture strong.

This is the challenge to Missouri agriculture that I see. I could not have predicted the advances that have been made in the past 50 years. Neither will I attempt to predict what will happen in the next 50 years. In

this regard, I think agronomists may be less bold than our friends in the social sciences. But if we are to maintain a productive agriculture, some hard commitments must be kept, about which we cannot be complacent.

Let me enumerate a few. They are not new. Anyone can add to this list.

1. Reduce loss of prime crop land to non-agricultural uses.

According to the National Agricultural Lands Study, during 1967 to 1977 Missouri lost annually to non-agricultural use an average of 43,000 acres of cropland, of which 14,300 acres was prime land. Based on 1975 to 1979 average yields, this constitutes an annual loss in production capacity equivalent to 94,000 tons of corn, 47,000 tons of wheat, or 36,000 tons of soybeans. Over the next 50 years, with no increase in the rate of loss, Missouri would lose the equivalent of all of the land presently planted to corn. This is not just an agronomic problem. It is a problem for rural and urban citizens alike, if future generations are to eat at present nutritional levels.

2. Reduce soil erosion.

One statistic of which Missouri cannot be proud is that it ranks third, after Hawaii and Tennessee, among all states in soil loss from erosion. I would list soil erosion as the major agronomic problem confronting Missouri agriculture. Former Dean M. F. Miller was a pioneer in soil erosion research. A 1924 Missouri Agricultural Experiment Station Bulletin contains the statement, "A deed to the land won't hold the soil." An aggravating result of the current trend in increasing row crop production, particularly soybeans, is the greater susceptibility to soil erosion.

3. Conserve genetic resources.

The genetic improvement of crop plants is dependent upon the genetic variability to the plant breeder. An enormous reservoir of useful genes was accumulated in all major crops through local varieties, or "landraces," that evolved over centuries of cultivation in different climatic areas. This has been the source of basic germ-plasm from which present day crop varieties have been developed. These local varieties have become the casualty of expanded cultivation of improved varieties.

Another source of genetic variability is the wild relatives of the cultivated plants. Dr. Sears reports on the wild relatives of wheat and their utilization. The wild relatives, too, are threatened with extinction. Many grow as weeds in waste areas and are eliminated as cultivation of crops is extended, or as cultivation

practices are improved so that the weedy species are eliminated from the cultivated fields. It is important that extensive genetic resources be collected and maintained, if wide genetic variability is to be available for future use by plant breeders. Like our soil resources, they cannot be re-created.

4. Utilize fertilizer resources efficiently.

A major increase in crop production has resulted from expanded utilization of fertilizer amendments. With refinements in soil testing techniques, recommendations have become more precise, but they also call for far higher rates of application. If food production in the underdeveloped countries is to be increased greatly, fertilizer use there must be expanded. While nitrogen is recycled, phosphate and potash, like oil, come from nature's deposits. I don't know how extensive are the phosphate and potash reserves, but they, like oil, surely are not inexhaustible. Recently, large offshore deposits of phosphate have been reported, but like offshore oil, recovery will be expensive. Both from an economic and conservation viewpoint, we must learn to utilize these elements more efficiently. More extensive study of utilization of organic wastes to reduce dependence upon expensive chemical amendments is needed.

5. Develop and conserve water resources.

Dr. Etheridge, former chairman of the Department of Field Crops at UMC, was a strong proponent of utilizing farm ponds to reduce runoff and conserve water resources. To an air traveler in Missouri, the results are clearly visible. The 1980 and 1981 weather patterns highlighted dramatically the wisdom of water conservation in Missouri.

6. Maintain a strong agricultural research and education program.

The increase in crop yields cited earlier is the fruit of agricultural research, and of adoption of new ideas and technology by innovative farmers. Similar advances may be cited in the horticultural crops, in the animal sciences, in farm mechanization, in plant disease and insect control, and in all other agriculturally related fields.

Agricultural research has special characteristics. It integrates basic and problem-solving research. Alone, neither is adequate. Agricultural research is conceived, designed, and systematically conducted for the benefit and advancement of agriculture, and packaged for delivery in the classroom and in the field. This is its heritage.

Agricultural research requires a long term commitment. It cannot be turned off and on like a spigot, or bounced around with the whims of a granting agency. Let me give you an example with which I am familiar, the Hart variety

of wheat. Hart originated from a succession of crosses made in 1942, 1948, 1954, and 1958. The final selection was made in 1966. That selection was yield tested, purified, increased, named, and distributed in 1976 by Dr. Dale Sechler. During the early years, the background of genes for winter hardiness, disease and insect resistance, grain quality, and yield potential were patiently assembled. The key to success was the cross with the French variety, Etoile de Choisy, a variety not sufficiently winter hardy for Missouri, but one with genes for short straw, earliness, and yield potential. An interruption in the research process would have resulted in not having Hart wheat.

Hart wheat is not an isolated example. Spectacular research break-throughs are rare indeed. Progress comes from a succession of small advances as a result of long term research. When the last increment is added, it is popularly hailed as a breakthrough.

I express tribute to the commitment of my colleague of many years, Dr. Sears, and his long painstaking research in the genetic engineering of wheat. He has increased our understanding of the evolution of wheat, and provided techniques by which genes from related species may be utilized in the commercial production of higher yielding varieties.

If I have concerns for the capacity of our agricultural research and educational system to cope with the food production problem in the future, they lie in the following areas:

First, how do we insure that our agricultural teachers and researchers do not become isolated from the action of agriculture? With current emphasis on publication, which will have the stronger lure and commitment for them -- contributing to the solution of an agricultural problem, or publishing a refereed paper?

Second, with our increasing dependence upon grants for financial support, will research priorities continue to be given to those problems most beneficial to agriculture, or to the problems for which the most grant dollars are made available?

Third, are we providing the nonrural student with the experiences and understanding that will enable him to cope with agricultural problems that he has not witnessed firsthand? I enjoyed a rural heritage and found it indispensable to understanding agricultural problems in many Third World countries.

Fourth, efficiency in American crop production has been achieved by cultivation of more acres per farmer and by getting higher acre yields. With shrinkage in the agricultural land base, and the high cost of land and of big machinery and energy with which to operate it, should we not be directing more research toward increasing the efficiency of intensive cultivation?

The strength of agricultural research has been its interface with utility. This interface must be retained if Missouri's agriculture is to remain strong and to continue to contribute its share to the world's production of food.



ERNEST ROBERT SEARS

Dr. Sears was born on October 15, 1910 in Bethel, Oregon. He received the B.S. degree in Agronomy from Oregon State University in 1932, the M.A. degree in Genetics (1934), and a Ph.D. in Genetics (1936) from Harvard University. He came to the University of Missouri in 1936 as an Agent, U.S.D.A., and Research Associate in the Department of Field Crops. In 1949 he was promoted to Research Geneticist, U.S.D.A. In 1959 he received full professorship in the University of Missouri, and held both titles until he became Professor Emeritus in September 1980.

Dr. Sears has been engaged in cytogenetic research with wheat for 44 years. He is the author or joint author of 90 publications in this field. He pioneered in the use of wheat aneuploids for locating genes on chromosomes, developed techniques and genetic materials that increased the efficiency of wheat genetic research many-fold, including a clearer understanding of its evolutionary relationships. He identified one of the three wild ancestors of common wheat. Using a new x-irradiation technique, he transferred from a wild relative to common wheat a gene for leaf rust resistance that is used in commercial varieties. His methods and materials are used worldwide.

Dr. Sears served as President, Genetics Society of America, in 1978-79. He is a member of ten professional scientific societies, and has honorary membership in the Genetics Society of Japan and the Indian Society of Genetics and Plant Breeding. Dr. Sears is the only current staff member of the University of Missouri who has been awarded membership in the National Academy of Sciences (1964). His many honors and awards include an Honorary Doctor of Science degree, University of Goettingen, Germany (1970), and the \$10,000 Hoblitzelle National Award in Agricultural Sciences (1958).

IMPROVEMENT OF WHEAT THROUGH UTILIZATION OF ITS WILD RELATIVES

Ernest R. Sears

World production of wheat has increased greatly as a result of the replacement of low-yielding, impure "land races" by high-yielding, pureline varieties. However, this process has greatly reduced the genetic variability available to breeders for further improvement. Fortunately, wheat has many relatives, ranging from wild grasses to cultivated rye and barley, with which it can be hybridized and which are possible sources of a wealth of potentially useful characters.

The transfer of characters from wheat's closest relatives, most notably the wild emmer wheat of Israel and adjoining Middle Eastern States, presents little difficulty; following crossing, the chromosomes pair and cross over, putting the genes concerned into wheat chromosomes. But more distant relatives, although they may cross with wheat, have chromosomes which almost never pair with those of wheat. Simple crossing and backcrossing therefore only results in the addition of one pair for one wheat pair. Such materials are seldom acceptable, because the alien pair almost always carries deleterious genes as well as the gene or genes desired. Suitable transfer can be obtained, however, by either (1) using ionizing radiation to break up the chromosomes or (2) inducing pairing of homoeologous (non-homologous but related) chromosomes.

X-rays and other ionizing rays break chromosomes. The pieces may rejoin in novel ways, making it possible for a broken-off segment of an alien chromosome carrying a desired gene to attach itself to the broken end of a wheat chromosome. The resulting mostly-wheat, part-alien chromosome may be an acceptable carrier of the alien gene, provided that the wheat segment lost in the process did not carry any essential genes. In practice, unless the wheat segment was quite short, it can only be replaced successfully by a homeologous alien segment. This means, since chromosomes are broken at random by radiation and strongly tend to rejoin at random, that alien segments introduced into the wheat genome in this way usually have deleterious effects. Many transfers must therefore be produced in order to ensure that even one will be acceptable.

The second method of making transfers of alien genes to wheat chromosomes is that of induced homoeologous pairing. This method is made possible by the fact that

pairing of alien chromosomes with those of wheat is normally prevented by a specific gene on wheat chromosome 5B. Deletion of this gene (or of the entire 5B chromosome) or suppression of its effect allows each alien chromosome to pair with the particular wheat chromosomes to which it is related. Each resulting cross-over involves the exchange of an alien segment for a related wheat segment, and the wheat genes lost in the replaced segment are to a large extent compensated for by corresponding genes in the alien segment.

The advantage of induced homoeologous pairing over radiation for the transfer of alien genes has been amply demonstrated, and various methods have been devised for its use. A mutation, already induced, which consists of a deficiency for the locus of the pairing suppressor, figures in the most promising schemes. To date, only genes for disease resistance have been transferred, but breeders will surely turn eventually to alien species for many other characteristics needed for wheat improvement.



DOUGLAS ENSMINGER

Douglas Ensminger completed an illustrious career in agricultural development as he returned to the University of Missouri, his alma mater, in 1970 to serve as professor of rural sociology. Although he officially retired in 1980, he continues active association with the UMC as president of Mid-Missouri Associated Colleges and Universities and as coordinating director of the Tunisia Transfer Project.

Dr. Ensminger won world renown for his leadership of the Ford Foundation development program for India from 1951 to 1970. With support from Prime Minister Jawaharlal Nehru and later Indira Gandhi, he guided an India-wide project in economic development. The venturesome, innovative India activity remains the most ambitious and one of the most successful programs of economic development ever undertaken.

Dr. Ensminger spearheaded institutional development in India. He characterizes the significant features as showing (1) the importance of putting together a package of agricultural practices in contrast with a single practice, (2) the need to develop institutional services needed to carry out those practices, and (3) the need for comprehensive governmental policies of which producer incentive prices for agriculture are essential.

The Government of India has perpetuated the rural institutions set in motion under Dr. Ensminger's guidance, and the principles that emerged are being encompassed in agricultural development programs throughout the world.

Prior to his India service Dr. Ensminger served with the Bureau of Agricultural Economics and Extension Service of the U. S. Department of Agriculture, in Washington, D. C. At the University of Missouri-Columbia since 1970, he has taken part in several technical aid missions, headed a world-wide study of population and food that culminated in a 1976 symposium in Rome, and joined with Chester Bowles in raising funds for refugees of the 1972 India-Pakistan war.

The latest tribute to Dr. Ensminger was the Edward W. Browning award, conferred annually for "achievements in the improvement of food sources anywhere in the world."

WORLD HUNGER, POVERTY AND FOOD:
THE PERSPECTIVE OF RURAL SOCIOLOGY

Douglas Ensminger

The topic of this paper, world hunger, poverty, and food, has been an obsession with me throughout my professional life. I will address the topic as a professional rural sociologist, to be sure; from experience and direct involvement with hunger, poverty, and food issues, most certainly; from opportunities I have had to interrelate with and therefore understand the varied and complex cultures of the world, most assuredly; and finally, I will address the topic from values deeply rooted in a caring and loving family where religious teachings and ethical and human values were a part of everyday living.

As a person, I am the product of my environment. I have been inspired and challenged by people who opened windows of the world and doors for new opportunities.

Two people influenced my decision first to explore and later to train as a rural sociologist. One of these was Dr. E. L. Morgan, Head of the Department of Rural Sociology-UMC when I was a junior in college in search of a life's mission. The other was Dr. Dwight Sanderson, Head of the Department of Rural Sociology at Cornell University. He guided my doctorate studies and impressed upon me the importance of understanding first, that the family is the basic social institution, the guardian of values as well as the acceptor and motivator for change, and second, that all development of lasting value takes place through people and people participating in institutions.

From Cornell, I went to the U. S. Department of Agriculture in Washington where three people opened to me new avenues to learn and understand that living experiences are the great laboratories where sociologists may understand human values and interrelationships.

Dr. Carl C. Taylor, Head of the Division of Farm Population and Rural Life of the Bureau of Agricultural Economics, provided insights in understanding about the interrelationship between sound sociological theory and applied sociology. Dr. Taylor held strongly to the view that, providing sociological theory was sound, it could be applied; and if you could not put what you were applying into a theoretical frame, you had better examine both the theory and the application. Dr. Taylor was fond of saying, "Sound sociology is systematized common sense."

M. L. Wilson, who was Under Secretary of Agriculture under Henry Wallace and later Director of the Federal Ex-

tension Service, introduced me to the importance of understanding culture, particularly family values and the role of religion, when introducing new programs -- either within the United States or in the developing countries of the world. M. L. also had a great impact on my understanding the importance of keeping the farm family central to all agricultural programs. From the early days of U. S. involvement with the developing countries, through what was then called the Point IV Program, M. L. emphasized that the most important part of Extension which should be transferred to the developing countries was its philosophy of service to farm people and that the development of farm families' competence to analyze and understand problems and make decisions based on alternatives was what Extension was all about.

Howard Tolley, Chief of the Bureau of Agricultural Economics, a committed humanist, combined sound economic theory and its application in his philosophy with the importance of having social programs rooted within the people whom they were to serve. He believed the people who were to be the beneficiaries of social programs should understand that a viable economy was essential to support social programs.

Paul Hoffman, the first president of the Ford Foundation, in offering me the opportunity to open and head the first Foundation office outside the United States, shared with me his thinking about world security and world peace. Mr. Hoffman made sure I understood that he saw world peace and security achievable in our lifetime only if the great masses of poor people who inhabited the new nations then emerging from the decline of Colonialism had opportunities to work themselves out of poverty. He felt that peace and world security were directly related to the poor people of the world who must be able to look forward to living as human beings having respect for self. Mr. Hoffman's concern was that as the United States as a nation emerged out of World War II, we were behaving internationally as if military and defense expenditures, both for the United States and our hoped-for allies, were surely the only way to secure world peace.

Out of my association with Prime Minister Nehru and his commitment to remove the conditions that held at least 40 percent of India's people in poverty, I both understood and accepted that hunger, poverty, and food were ethical questions. They were solvable only if policies, political commitments, and chosen development strategies were coordinated and directed toward making it possible for all the people either to have access to land to produce enough to meet the family food needs or to have an opportunity to work and earn enough to pay for a minimum nutritional diet.

Early in my stay in India, I sought out the true Gandhian followers. I knew that I could not understand

new, independent India without understanding Gandhi's basic teachings. The most important part of Gandhi's teachings which I early accepted as applicable to development, and which still remain sound, relate to the question of ethics when selecting and applying technology.

No question has haunted both the developing and developed nations more the past three decades than that of the transfer and application of the most advanced and complex technologies of the industrialized Western nations. In Gandhi's search for technology appropriate for application in the village and agricultural development programs in the pre-independence period, he said the technology which he sought for adoption by the people had to meet two criteria: it had to be a technology that most of the people had the resources and managerial capability to apply, and it had to benefit most of the people.

After returning to the United States in 1970 and joining the University of Missouri, I was privileged to attend the Club of Rome's "Alternatives to Growth" Conference in Houston, Texas, October 2-5, 1977. The pervasive theme that impacted most on my mind was that the top scientists of the world were saying in panel after panel that we had to re-think our policies with respect to the application of technology. They said that in the past, we asked only if the application of the technology would be profitable. They were forceful in their insistence that in the future, we must ask a second question of technology before recommending its application -- that question being, "If applied, will the recommended technology contribute to a more just society?" If the answer is no, it should be applied only under extraordinary circumstances.

People having dissimilar values, vastly diversified experience, and looking at the world through varying cultural eyes will differ greatly in the conclusions they draw from the past three decades of development experience in the developing countries. Before proceeding to distill from those decades of development experience some of the major lessons we should have learned that have implications when applied for the future, I will summarize the status of world food, hunger, poverty, and population as we enter the decade of the eighties.

Food

In 1981, the world food situation is as fragile as it has been at any time since the food crisis in 1973-74. The only hope of averting a disastrous world food crisis in 1981-82 is a good harvest in the main cereal producing areas of the world. Grain imports for the developing countries are expected to reach 94 million tons in the year ending June 1981 and will likely continue to increase through the eighties. Only those developing countries

which have foreign exchange with which to purchase food will be able to meet their market demand needs; and within the food deficit countries, only people who have money to pay for food will avoid destitution. Six years after the World Food Conference, and its pledge to eliminate hunger, world security is back on a wing and a prayer.

Poverty and Malnutrition

The International Food Policy Research Institute report of July 1977 stated that some 1.2 to 1.5 billion people in the developing countries were suffering from malnutrition. This is two-thirds of the population in these countries.

The World Bank estimates there are 780 million people in the developing countries living under conditions of absolute poverty. Mr. Robert McNamara, past-president of the World Bank, describes those in absolute poverty in these terms:

The absolute poor are severely deprived human beings struggling to survive in a set of squalid and degraded circumstances almost beyond the power of our sophisticated imaginations and privileged circumstances to conceive.¹

Hunger

The most comprehensive analysis of world hunger was reported by the Presidential Commission on World Hunger in March 1980.² The Commission concluded its report by saying that "the central and most intransigent cause of hunger is poverty." Given the number of people living under conditions of absolute poverty (780 million) and the number who are malnourished (1.2 to 1.5 billion), one can assume that more than one billion of the developing countries' two billion people live in continuous fear of hunger. The Commission also said that "the major world hunger problem today is not famine or starvation but the less dramatic one of chronic malnutrition."

¹ Address to the Board of Governors by Robert S. McNamara, President, World Bank Group, Manila, Philippines, October 6, 1976, page 5. Published by the International Bank for Reconstruction and Development, 1818 H Street, N.W., Washington, D. C., 20433, U.S.A.

² Overcoming World Hunger: The Challenge Ahead, Report of the Presidential Commission on World Hunger, Presidential Commission on World Hunger, 734 Jackson Place, N.W., Washington, D. C. 20006, March 1980.

Population

The 1980 world population data sheet of the Population Reference Bureau projects an ultimate world population of 9,832,000,000 compared with today's population of 4,414,000,000. China is projected to have ultimately a population of 1,530,000,000; and India, 1,642,000,000.

Implications of Hunger, Poverty, Food, and Population Trends

What are the implications of the present state of the world's food, hunger, poverty, and population growth? In answering this question, I have chosen appropriate quotes from recognized world authorities.

The June 1980 issue of Science magazine ran an editorial under the heading of "Food, the Hidden Crisis" which spoke directly to the implication of the food and hunger issues.

In many ways, world hunger is a hidden crisis, for it comes to our attention only in a sporadic fashion. Yet it probably represents a more explosive threat to world peace than does nuclear proliferation.³

About hunger and national security, the Presidential Commission on World Hunger stated that:

. . . promoting economic development in general, and overcoming hunger in particular, are tasks far more critical to the U. S. national security than most policymakers acknowledge or even believe. . . . Military force is ultimately useless in the absence of the global security that only coordinated international progress toward social justice can bring.

I know of no person who has addressed the implications of persistent hunger and poverty with greater authority than President Dr. Julius Nyerere of Tanzania. In his address before the Royal Commonwealth Society in London in November 1975 President Nyerere said:

. . . the question as the poor see it is not whether there should be changes in the present economic situation; changes will come one way or the other. The question is when, how, they will be brought about.⁴

³ Clifton Wharton, Jr., Chancellor, State University of New York.

⁴ Publication of the Government of the Republic of Tanzania, Dar es Salaam, Tanzania.

About the implications of overpopulation, the distinguished biologist and writer Julian Huxley wrote:

Overpopulation is a world problem so serious as to override all other world problems, such as soil erosion, poverty, malnutrition, raw material shortages, illiteracy, even disarmament.⁵

Given the facts that the world's production resources are finite and shrinking and that the world's population will increase by about 70 million a year during the decade of the 1980s, the conclusion is inescapable that in the future, population will be the major constraint in meeting the world's food needs.

I was both an observer and an active participant as the developing countries were emerging out of their tightly woven cocoons as colonies into the twentieth century as new, independent, self-governing republics. Instead of playing the role of a fault-finder in examining and evaluating the past three decades of experience, I have chosen to view it as a learning experience. To me, the issue is not what mistakes can be documented but rather what did we learn from this great worldwide experience in moving complex and varied cultures from their traditionalisms into the modern world where science and technology are increasingly accepted as ways of solving problems.

In drawing lessons from the past three decades of development experience, I am focusing only on what we should have learned that will have bearing on the developing countries' (1) growing enough food to meet the nutritional needs of all the people, (2) removing the conditions that create poverty, and (3) providing the people in poverty opportunities to work their way out of poverty. What follows is not meant to be all inclusive but rather to present a frame of reference.

-- One of the most important conclusions to be drawn from the past three decades of developing experience, one with implications for the future, is that food to feed the people is not so much a production problem as a problem of gross inequalities within individual developing countries. The victims are the small subsistence farmers, the artisans, and the landless laborers.

-- Food, hunger, and poverty are all interrelated; and their solutions require an integrated systems approach within a framework of rural development. This integrated approach must be accepted as the nations' top development

⁵ Quoted by Fairfield Osborn, Our Crowded Planet: Essays on the Pressures of Population, Garden City, N.Y.: Doubleday, 1962.

priority and must be backed by both political leaders and political institutions.

-- While plans are conceived in material, economic, and social terms, their achievement necessitates that all development be accepted as being first and foremost, human resource development. Only as this process provides for the development of people to become self-reliant and self-respecting human beings will the material and economic components of development be achieved.

-- Selection of technology in the future must be accepted as an ethics issue. One of the criteria for selection or rejection of technology must be whether it will contribute to a more just society.

-- The implementation of land and institutional reforms and the development of trustworthy institutions to serve all segments of agricultural and rural development must be accepted as prerequisites to achieving food enough, and to opening up opportunities for the tillers of un-economic land holdings and landless laborers to become economically and socially self-reliant. Only following major changes can those rural poor obtain food enough for their families.

-- The backdrop influencing all phases of development must be understood and accepted as being the process of transforming traditional societies and moving them toward modern societies. In realizing this, we must accept a long time frame for change to take place and development goals to be achieved. While some goals can be met within a decade, the basic and fundamental cultural changes must be viewed as requiring generations.

If I have accurately portrayed the present state of world food, hunger, poverty, and population, as I think I have, you could conclude that the trends I have presented cannot be reversed and you could become a committed pessimist. A better course would be to join a concerned minority who are growing in understanding that world peace and security for the present and future generations are likely to be determined by whether, how, and when we confront world food, hunger, poverty, and population issues.

I hold strongly to the belief that the United States has a very strategic role to play in assisting, and one we should seek to play, if we will heed the lessons of the past three decades of experience. We need to accept a long time frame to move toward the development of a world community where freedom from the fear of hunger will be a way of life for all.

I commend the first recommendation to come from the Presidential Commission on World Hunger that, if implemented, can offer a non-military path to world peace. World history teaches that national security has never

rested on military strength alone.

The major recommendation of the Presidential Commission on World Hunger is that the United States make the elimination of hunger the primary focus of its relations with the developing world In the Commission's view, there are significant reasons for the United States to place the elimination of hunger at the top of its list of global concerns.

In operational terms, the implementation of this recommendation would require a foreign policy which makes clear that our interest and commitment to the developing countries in the future will be directed toward assisting those countries which themselves make the commitment to carry out land and institutional reforms and provide all the people opportunities to work and to earn enough to meet basic human needs.

I think the evidence is on my side in saying that there are presently many developing countries where the rumblings of discontent and frustrations from unfulfilled expectations are creating the conditions that will lead to political instability and eventual uprisings which military force cannot hold in check for long. If the political leaders in these countries were assured of our commitments and continuity of assistance over a long enough time period to carry out land and institutional reforms and to begin the process of providing viable opportunities for the people to work their way out of poverty, I feel confident they would invite our assistance to join in the crusade against hunger and poverty.

In thinking about the forces at work in providing the stimulus for change, it is important to understand that more frequently than not, the great changes come from great crises. Timing and opportunity must either exist or be created to provide both the stimulus and guidance for change. The time is now; we must work to create opportunities.

I conclude my address by joining the Presidential Commission on World Hunger in conviction and commitment:

The outcome of the war on hunger, by the year 2000 and beyond, will be determined not by forces beyond human control, but by decisions and actions well within the capability of nations and people working individually and together.

OUR GOAL IN RECOGNIZING THE HONOREES

J. Wendell McKinsey
Assistant Dean and
Director, International Programs

The major purposes of recognizing the outstanding contributions of our three honorees are:

To develop an appreciation among the faculty at large for outstanding scientists among us who appear to us to be ordinary people, but whose life has made a difference in the world.

To instill a sense of pride among constituent groups of the University, especially the College of Agriculture, in the institution and its faculty.

To extend the international horizons of our faculty and to increase commitment to an international dimension in research and teaching programs.

To strengthen faculty acceptance of the proposition that the pursuit of excellence through dedicated, consistent, persistent, and honest effort is open to all, and is the pathway to achieving both personal and University goals.

Milton Poehlman has never deviated from his goal of transforming basic research in varieties of small grains into benefits to Missouri farmers, but he had a vision of benefits to consumers also and of the challenge presented by the hungry world beyond our boundaries.

Ernest Sears' career has been devoted to basic research in genetics. He has sought to learn ever more about the functioning and manipulation of genes, primarily for the sake of knowing. Yet the diligent search for knowing has led him to unlock and expand knowledge essential to the work of other scientists.

Douglas Ensminger is a people-oriented person. He has devoted his career to the management of science in agriculture to the end that it makes a difference for people, reflected in a better life. His dedication to the idea that a better way can be found led him, and the Ford Foundation, to challenge the most deep seated traditions in India with innovative programs in health, farming, population control, and rural development.

The University of Missouri-Columbia is grateful to Vice President Christensen of Iowa State University for his contribution to our Recognition of Excellence event.

THE LAND GRANT UNIVERSITY:
TRADITION, TALENT, AND RESOURCE FOR OUR TIMES

George C. Christensen
Vice President for Academic Affairs
Iowa State University

It is a privilege to be invited to participate in the College of Agriculture's Recognition of Excellence seminar, with its emphasis on U. S. agriculture and the world food economy. The honorees, professors Douglas Ensminger, John Milton Poehlman, and Ernest Sears are richly deserving of this recognition.

I am somewhat amazed that I agreed to discuss "the land grant university," which is not exactly an unknown quantity at the University of Missouri. It is, however, one of my favorite subjects. First, though, I congratulate Professors Ensminger, Poehlman and Sears. They are all world leaders in their fields of expertise.

Professor Ensminger has dedicated his career to helping people, through the management of science in agriculture. He has, among countless other things, challenged deep seated traditions in India with innovative programs in health, farming, population control, and rural development. I was privileged to be present when he addressed the 1976 World Food Conference on problems facing small farmers in developing countries. He is an eloquent spokesman for the Third World countries.

Professor Poehlman has dedicated himself to transforming basic research on grain varieties into benefits for Missouri farmers, to organizing international research, and to teaching plant breeding to citizens of the Third World.

Professor Sears is an outstanding geneticist. He has unlocked knowledge that has been the foundation for the work of other scientists who have received world wide acclaim for their contributions to increased production of food crops. He teaches scientists what they need to know.

My topic, "The Land Grant University: Tradition, Talent, and Resource for Our Times," could be covered quite adequately by reviewing the careers of the honorees.

I also commend those responsible for initiating this recognition ceremony. May it become a long-lived tradition.

I begin by sharing a personal experience. One bitterly cold day a few years ago I found it necessary to travel to

Washington, D. C. Thanks to the subzero temperature, my flight from Des Moines to Chicago was delayed. So it was with a sigh of relief that I actually made my connection in Chicago, after a frantic sprint through the corridors of the O'Hare Airport. I breezed by the attendant at the ramp, waving my boarding pass at him, and reached my seat on the Washington-bound aircraft just before it taxied out of the runway. At that point, with the doors locked and the motors picking up speed, the flight attendant calmly announced, "Welcome to Flight 412, non-stop to Honolulu, Hawaii."

I recall that some of my fellow travelers, blissfully buried in their magazines, newspapers, and paperbacks, reacted as I did. They sat upright, some with distressed, agonized expressions on their faces; others exhibited sheer, unadulterated joy.

After the longest of pauses, the attendant stated, "This is really Flight 498, bound for Washington, D. C. But, now that I have your attention, I would like to tell you about the safety features of this aircraft."

Since then, I have often wondered how many of us really pay attention to where we're going. How many of us are perfectly content to leave the driving to someone else? Sometimes we need someone, like the flight attendant, to jar us into paying attention, to charting our own directions.

The land-grant approach to teaching, research, and service has long served as society's activator. Those of us serving land-grant institutions will never find time to rest on our laurels.

I once heard a colleague discuss the life style of Bushmen in the Northern Kalahari region of Southern Africa. Youthful Bushmen begin a long day of instruction before daybreak. They are taught to stalk and kill wild game. Their instructors are parents and other adults proficient in the simple arts of survival. If they are successful, they and their families will have established a new home at the site of the kill. There they will live until the meat is consumed. Then the process will be repeated. For centuries each generation of Bushmen has passed its talents and knowledge to the next generation.

The elder Bushmen work hard to teach the young the arts of survival. The young know that they must master these arts. The grading is pass-fail. Their sense of achievement comes from success in the hunt.

A similar learning process is repeated daily, in some form, in rural and urban societies throughout the world. Success is often measured by the ability to survive another day.

But man is a curious, thinking, creative animal. Survival is not the only goal of most peoples. Education,

leading to greater fulfillment and greater purpose, has become the vehicle for the advances made by mankind. For Western society, formal education is reputed to have got its start in ancient Greece with the founding of the Academy of Plato about 390 B.C. Classroom education was brought to the New World by the early settlers, who represented a diversity of Old World countries. Americans became the recipients of knowledge duly recorded and passed on by many generations of wise people.

As we look at the contributions made by Americans to world society, we may think about Coca Cola, blue jeans, western music, and films made in Hollywood. Upon further reflection, we may also think about the contributions of our educational system to human welfare.

I am going to tell you about a success story, one that has had a huge impact upon our lives. It is the story of a successful idea which, I believe, was and is one of this country's greatest contributions to mankind.

The idea led to a document which was signed by President Abraham Lincoln in 1862 and which became known as the Morrill Act, or the Land-Grant Act.

Remember that the generation before the Civil War was full of disappointment, confusion, and pessimism, but full too of a belief that a miraculous spirit would, somehow, revitalize the nation. No country had so intense a belief in progress as the United States of America. This, despite the fact that many aspects of national life were discouraging and depressing: the vulgarities and abuses of Jacksonian democracy, the spoils system, the 1837 depression, the human weaknesses revealed in the Mexican War and, of course, the bitterness over slavery.

Most Americans, however, kept their integrity and their exuberant hopes alive. Zeal for reform flourished. Prison reform, temperance, women's rights, workingmen's rights, religious reform, world peace, and other causes were enthusiastically pursued. However, no area of life had a greater need for reform than did higher education. The time was right for an idea to be born. The Morrill Act became a reality.

Any factual discussion of the origins of the Morrill Act would involve an endless variety of ideas and people. We would have to examine the growing opposition to classical and theological studies which had dominated higher education. We would be forced to review the growth of Rousseau's belief that education results not only from listening to lectures, but directly from nature, machines, tools -- and from stockyards and cornfields.

Others have noted that the spirit of science and the spirit of democracy were the deities under which the land-grant institutions were born. Science is not democratic; it is simply scientific. It allows no com-

promise with superficiality, immaturity, and sloppy work. As the new land-grant colleges developed, scientific thought conflicted with the ideas of men who were convinced that physical toil on the farm and in the factory could somehow be instantly converted into university-level instruction.

Simply put, we had no science of agriculture, nor was there a science of machine operation. These had to be developed and high standards of instruction had to be imposed.

The land-grant institutions also recognized the need to incorporate the spirit of the humanist tradition. The humanities could not be excluded.

An idea was born and became a success. The land-grant universities united the desire for democracy, the desire for science, the desire to continue the ancient tradition of humanistic studies. The blend was new. The growth of these institutions is one of the most impressive chapters in the history of higher education throughout the world. It offered higher education on the broadest scale to the children of the rich and the poor, giving every capable and ambitious person an opportunity to reach his or her upper level of achievement. The land-grant idea prospered because of its unique approach to education, involving classroom and laboratory instruction, research, and extension teaching.

Have the land-grant universities felt any sense of responsibility toward peoples of other countries? Russell Thackery, former executive director of the National Association of State Universities and Land-Grant Colleges, has declared:

It is no exaggeration to say that in all those countries of the free world which are striving toward a better life for their people, for the establishment of an educational and economic basis on which democracy can exist, the idea of the land-grant university is America's most popular export.

A university administrator in India told American educators in 1962, "We want your know-how in bringing the results of science to every farm and every household. We want to give the same opportunities to the sons and daughters of our farmers and industrial classes that you gave to yours and we want to adopt the methods you perfected. We want the assistance that only the land-grant colleges can provide."

Today's land-grant universities contain talented people, generous of their time, who are dedicated

to the people-to-people philosophy of education and service. They are truly the "resource for our times."

Agriculturists, engineers, home economists, and other faculty at land-grant institutions have literally changed American society. Not only has investment in land-grant universities resulted in an educated population, the best investment Americans have ever made, but it has been paid back, many times over, in dollars. Clearly, the relationship between agriculture and the building of the United States of America is an unparalleled success story.

As Harold Enarson has recently pointed out,

American agriculture now sustains the food and fiber needs of a growing America while providing the nation's major export. It is our only cushion against the huge costs of massive oil imports.

Agricultural productivity is in large part the result of the investment Americans have made in agricultural research. Ours is a uniquely American system in which government support is geared not only to providing research opportunities but also to distributing the fruits of that research in a timely fashion to the users -- the farmers and ranchers of the nation.

It is estimated that agricultural research has had an annual rate of return something in excess of 35 percent per year. For example, scientists at Iowa State University developed an inbred corn line called B-73. This inbred line combines well with other lines and results in a 10-15 bushels per acre per year increase in yield, every year. It is used in 40 percent of the Cornbelt. In Iowa this represents a \$50 million increase of our corn crop as compared to what it would be if B-73 had not been developed. This \$50 million comes in year after year. You can cite similar examples in Missouri.

Our land-grant institutions are not only a prime educational and research resource. They also offer the best means we have, as Americans, to foster peaceful relations with other countries. They clearly need the continued financial and moral support of our government and of our citizens.

In my view, international education and service must be ranked among the highest of priorities at our land-grant institutions. We simply cannot defer this responsibility to some time in the vague future when the economy might be better. International education and service is an essential component of our people-to-people educational process. Its absolute and relative value is increasing daily.

You may have read the annual report of the Overseas Development Council, a private organization concerned with U. S.-Third World relations. Theodore Hesburg, of Notre Dame University, chairs the Council. He has commented, "For those of us who are committed to the development of the poor countries and the elimination of poverty and hunger, it is a frustrating time."

The report illustrates that the future of our country is dependent upon developments in the Third World. The report also shows that the United States is showing less and less concern for the Third World. In 1949, the U. S. devoted almost 3 percent of its gross national product to foreign economic assistance. We now spend 0.19 percent of our GNP for this purpose, putting us behind 15 of the 17 major Western industrial nations.

We are warned that if the U. S. refuses to recognize the challenges facing us, "the problems we will be confronted with 50 years hence will dwarf those we now feel are so important." We may find ourselves in a world "engulfed in a disastrous combination of growing protectionism, slow economic growth, rapid population growth, inflation, monetary instability, food and energy shortages and worsening social inequities among and within nations."

The Brandt Commission, chaired by former West German Chancellor Willy Brandt, expressed similar concerns. Also, the Global 2000 Report to the President recently warned that the quality of life for most people in this world will experience significant declines by the year 2000. Clearly, the United States, and its quality of life, is dependent upon how international challenges are met.

Our economic growth is dependent upon our willingness to help promote economic growth in the Third World. The Third World's expected 200 percent increase in demand for commercial energy will have a decided impact upon the amount of imported oil available to the United States. The possibility of pegging prices to inflation, along with the population crisis, will result in the elimination of 40 percent of the remaining forests in the Third World and a 20 percent expansion of deserts. These, and other problems relating to grain import needs, tell us that the Third World cannot be dismissed as being irrelevant, if we want to avoid some extremely unpleasant surprises.

As Dr. Ensminger stated at the 1976 World Food Conference, "It is upon the millions of small farmers, perhaps as many as 200 million, in the Developing Countries that the world community must now depend for increases in agricultural production -- enough to meet the nutritional requirements of a tenaciously increasing population."

Dr. Poehlman has warned us that the "crisis still exists" and that "action, not rhetoric, is needed." In addition, if we are to respond correctly and properly to international events, we must improve our understanding of foreign cultures through personal contacts with citizens of other nations. Mutual understanding, economic cooperation, and an "extension" approach to international education and agricultural research are essential to human survival. Despite the great achievements of space engineers, we are not able to stop the world and get off.

Last spring, the Egyptian government invited me to organize a workshop that would assist Egyptians to understand how the land-grant, extension approach to education might help solve some of their major problems involving food, fiber, and water needs. Iowa State faculty members, the President of the State Board of Regents, and the Governor of Iowa went to Egypt with me to help coordinate university, industrial, and governmental programs and to bring the fruits of research in agriculture, engineering, home economics, and veterinary medicine to rural and urban residents. This was the first time in the long history of Egypt that representatives from all these segments of Egyptian society were brought together to coordinate efforts to improve the living standards of Egyptian citizens. The land-grant philosophy has been planted and sprouts are beginning to show. It became clear that the peasant, the subsistence farmer, must be deeply involved in the agricultural research and extension process as the focal point in making research relevant. The small farmers' knowledge of their land and animals is critical. There must be a firm link between laboratory and field research and the hopes of the subsistence farmers.

This is not the time for U. S. citizens to become financially ultraconservative and to jeopardize our considerable investments in agricultural research and in international education and service. This is the time to present governing boards, legislators, and institutional donors with the rationale for increased commitments to international service. A long-term investment will pay handsome dividends.

American society is no worse off now, economically or politically, than it was when the Morrill Act was implemented. Should we not display courage and commitment equal to that of our forefathers?

Clark Kerr has said, "It is deeply embarrassing to ask a woman about her age; a man about his wealth; a teenager about his or her pimples; an old person about his sex life; and a university about its goals." Most university administrators will acknowledge some degree of uncertainty when goals are discussed. We agree, however, that goals are essential.

The University of Missouri has a long and distinguished record in the field of international service. Iowa State University has also provided expertise to India, Peru, Thailand, Mexico, Egypt, and many other countries. But as we looked over our commitment to international activities, we recognized that we needed to coordinate our efforts. We needed to define our international mission. We needed goals.

Thus, in 1969 we established our first ten-year plan for international education and service. Our second ten-year plan, entitled "Iowa State University's Role in International Affairs," was published in 1978.

We appointed a university-wide Council on International Programs, established a World Food Institute, conducted a World Food Conference, improved foreign student advisory functions, enlarged our program in international studies, coordinated foreign visitor services, and located funds to support foreign travel by faculty members and students. Faculty members learned that they had colleagues possessing similar international interests, that it was acceptable to have such interests, and that their international activities conformed with the university mission and actually enhanced their opportunities for promotion and salary increases.

The first published ten-year plan was a visible indication to the public and to granting agencies that Iowa State University had a global commitment. The visible commitment to international education and agricultural research had a positive impact upon foreign students. They were recognized as valuable resources and as cultural informants in interdisciplinary courses. They helped to develop proposals for international contracts. They also served as institutional informants for visitors from foreign agencies, industries, and governments.

The formal recognition of our international mission had a positive impact upon all of Iowa. Certainly, rampant inflation and diminishing institutional resources force us all to give more serious consideration to planning and to setting programmatic priorities. We must constantly re-examine our institutional missions. But we must not forget our land-grant, people-to-people responsibilities to citizens of all nations.

Despite our economic problems, the United States of America must be totally committed to the war on world hunger. We have an unmatched resource in the agricultural faculties of our universities. Many hundreds of faculty members have in-depth experience in building agricultural universities in Third World countries. The obligation of our land-grant universities to be totally involved in fighting world famine is incorporated in the basic law governing the foreign assistance program (Title XII).

Yet, as Harold Enarson has stated, "Without Congressional support and funding for institution-building overseas, we must fight token skirmishes."

Developments throughout the world demand that educational activities stress international affairs, agricultural research, and Third World studies as basic and important parts of education at all levels. We must serve citizens who need to understand, appraise, and participate in international affairs; citizens who serve in foreign countries as employees of U. S. firms, organizations, and governmental agencies; foreign nationals who come to our institutions as students; and foreign nationals who remain at home and seek the educational help and assistance of our universities in developing their resources and in improving the lives of their people.

According to Ernest Boyer, president of the Carnegie Foundation for the Advancement of Teaching, "We simply must do a better job of alerting our students to the larger contours of their world, of helping them to see the broader ramifications of their actions, and of conveying the urgent need to marshal all our resources as we confront the critical choices of the future. Is there hope for man? Of course there is, provided we can extricate ourselves from immediate preoccupations that loom so large, to confront creatively the issues that urgently press upon us."

I ask, can the land-grant universities afford to support international education, international agricultural research, and international service in their institutional scale of values? They cannot afford to do otherwise! The land-grant universities, through hard-won tradition, through the acquisition of a reservoir of great talent, and through their compassion for the welfare of all the peoples of the world, have and will continue to have a unique, self-imposed responsibility to all people, regardless of nationality.

The land-grant institutions have earned an international reputation for service to humanity, as exhibited by the careers of Drs. Ensminger, Poehlman, and Sears. Let us do our part to keep this tradition of excellence and service alive and flourishing.