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The Population-Food Squeeze: Education for Survival

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N. Keith Roberts
A basic objective of the Faculty Association of Utah State University, in the words of its constitution, is:

to encourage intellectual growth and development of its members by sponsoring and arranging for the publication of two annual faculty research lectures in the fields of (1) the biological and exact sciences, including engineering, called the Annual Faculty Honor Lecture in the Natural Sciences; and (2) the humanities and social sciences, including education and business administration, called the Annual Faculty Honor Lecture in the Humanities.

The administration of the University is sympathetic with these aims and shares, through the Scholarly Publications Committee, the costs of publishing and distributing these lectures.

Lecturers are chosen by a standing committee of the Faculty Association. Among the factors considered by the committee in choosing lecturers, are in the words of the constitution:

(1) creative activity in the field of the proposed lecture; (2) publication of research through recognized channels in the field of the proposed lecture; (3) outstanding teaching over an extended period of years; (4) personal influence in developing the character of the students.

N. Keith Roberts was selected by the committee to deliver the Annual Faculty Honor Lecture in the Humanities. On behalf of the members of the Association we are happy to present Professor Robert’s paper.

Committee on Faculty Honor Lecture
THE POPULATION-FOOD SQUEEZE:
EDUCATION FOR SURVIVAL

by

N. Keith Roberts*

One in every four people living on our planet goes to bed hungry each day, and many more survive on inadequate diets only to die prematurely. At the same time, many of the world's natural resources are producing food far below their potential. Almost 25 percent of the Earth's adult population are illiterate, and many more are severely deficient in basic educational skills.

As educators, we are confronted with two clearcut choices:

1. We can ignore the ultimate implications of a starving, ignorant race and the waste of productive resources over time. The result would surely be the unleashing of nuclear power in one mighty race-destructive war for control of food and space. Make no mistake; food and space control will be the basic causes of that war no matter how the politicians or philosophers define the conflict.

2. We can engage in a massive, worldwide campaign to eliminate the population-food imbalance. The only reasonable weapons needed for this war are education, time and a deep commitment.

We need the long-range effort in theoretical and applied education found mainly in our land grant university system. Utah State University and its faculties have a moral obligation to participate in exploring the second alternative. We reject the first as unacceptable. We must and can control the race's destiny with respect to population growth, food production and ignorance.

Let us elaborate upon each of the major components — population, food and education. After considering each component, we will finish with a brief statement about other institutional support questions.

*Professor, Agricultural Economics and Bolivian Project Leader, International Programs, Utah State University.
Population

World population has reached a remarkable 4.3 billion people.¹ If that many people were laid end to end around the equator, there would be about 163 rows.

Possibly one billion people or about 25 percent of the world's population suffer from the ill effects of malnutrition as a result of insufficient food. Many more individuals suffer because of improper diets.² In a 1977 report, the National Research Council reported:

Malnutrition causes millions of premature deaths each year. It is a contributing factor to disease in many parts of the world. . . . In some societies, 40 percent of the children die before they reach the age of five, mostly from nutrition related causes. A substantial proportion of the survivors suffer handicaps of learning, behavior, and work capacity because of inadequate diets and recurring illness.³

Besides the large number of people in the world living with hunger, about 800 million adults were illiterate in 1970.⁴ The number has not decreased in the last ten years. Most illiterates live in areas where hunger is also a major problem.

A growing body of evidence suggests that the problem is intensifying; that population growth is increasing faster than our ability to produce and distribute food. Some observers suggest that the Malthusian conclusion is inevitable; that population growth will outstrip food supply.⁵ Others take a more optimistic view.⁶

B. Delworth Gardner, in his Honor Lecture in 1968, took an optimistic position. He argued that population could be controlled by

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⁶Ibid., p. 8.
artificial birth control and family planning techniques as well as by
economic developments which increased incomes. He attempted to
refute the pessimism expressed by William and Paul Paddock in 1965:

Ten years from now (1975), parts of the underdeveloped
world will be suffering from famine. In 15 years the famine will
be catastrophic and revolutions and social turmoil and economic
upheavals will sweep areas of Asia, Africa, and Latin America.

John W. Mellor suggests a dynamic population-food relationship:
capacity production will be reached over a long period of time and
population growth will adjust differently than Malthus thought. Mellor
hypothesizes that initially population will increase at a more rapid rate
than food production, then level off allowing production to catch up,
then increase at a lower rate than production and then stabilize as
production is able to meet food needs.

Of course, Mellor's proposition is more appealing. This model leads
to exalting humanity; the other leads to its degradation. Are either
inevitable or self-generating? Or can conditions be manipulated so that
the more comfortable model can become reality? Is there any evidence
that either model is gaining legitimacy?

If we remember the great amount of press devoted to the drought
and famine in Northern Africa during the mid-1970s and the current
drought and famine in East Africa, we begin to admire the ability of the
Paddocks to predict correctly. We are all aware of the famines in India
and Russia which virtually eliminated our huge stocks of stored grain
during the early 1970s.

Although these events can engender a pessimistic view about the
future, the evidence indicates that the combination of resources, tech­
nology and available energy will result in an improved population-food
balance. In achieving this end, however, we have to differentiate between
two major problems: (1) feeding the hungry and (2) eliminating the
causes of hunger. The first is only a short-term approach that cannot

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7B. Delworth Gardner, Protein and the Pill: A Pivotal Partnership, Honor
8William Paddock and Paul Paddock, Famine 1975 (Boston, Massachusetts:
9John W. Mellor, “Science, Civilization and Survival,” Utah State University
reduce the number of hungry in the future. Such an approach is similar to putting salve on a sore caused by internal infection. It feels good to feed a hungry person or small group of people. They are visible. We can see the results, but it does little if anything to reduce the growing numbers of hungry.

The second approach is a long-run attack on the causes of hunger. Few of us as individuals have the resources to eliminate the causes of worldwide hunger. Only an organized attack by special groups can cure the disease. Universities and international funding agencies can contribute to the cure.

Do not misunderstand. Individuals should help people in need. The sores need attention, but we will never eliminate the sores if we do not place more emphasis on the disease. What is the disease? Simply put, it is too many people for the available food supply.

Looking at the problem from a demographic perspective, we can conclude that things will get worse before they get better. The prognosis is that the present world population of 4.3 billion will reach approximately 6 billion by the year 2000.\textsuperscript{10} One U.N. source estimates that world population will reach “10 to 16 billion before eventually leveling off.”\textsuperscript{11} In 1976 the Population Reference Bureau estimated that population would reach 8 billion by 2014 and double before 2040.\textsuperscript{12} Approximately 90 percent of the population increase between now and the year 2000 will be in the poor, developing countries.\textsuperscript{13}

We can be sure that population will never grow beyond the ability of the earth’s resources to produce food for the surviving group. Either a balance will be achieved as the death rate soars because of starvation,

\textsuperscript{10}Paddock and Paddock, \textit{Famine}, p. 3.

\textsuperscript{11}Quoted in Brown, \textit{Resource Trends and Population Policy}, p. 5.


\textsuperscript{13}\textit{World Food and Nutrition Study}, p. 33.

The terms “developing countries,” “developing market economies,” “less-developed countries,” and “low-income countries” are generally interchangeable. They refer to the market-oriented countries, excluding Canada, the U.S., those in Western Europe, Israel, South Africa, Japan, Australia, and New Zealand. The countries in Eastern Europe, the U.S.S.R., and communist countries of Asia (some of which have low per capita incomes) are termed “centrally planned economies.” See Sterling Wortman and Ralph W. Cummings, \textit{To Feed This World: The Challenge and the Strategy} (Baltimore, Maryland: John Hopkins University Press, 1979), p. 17.
related diseases and wars for food and space, or by massive social, economic and agricultural programs. I believe that human beings have it within themselves and their social organizations to achieve the latter alternative. I also believe that our university community can and must contribute to the achievement of the happier ending. But before we go deeper into the university’s place in all this, let us consider the world’s food production capacity.

Food Production

If we accept current population projections, they are ominous and can lead to pessimism concerning the future of the human race. But people live on a world replete with natural resources. Are these resources capable of sustaining a healthy population as large as predicted? I am philosophically optimistic about the answer to that question.

Some remarkable achievements in food production have been made in selected parts of the world. The ability of our natural resources to yield abundantly depends upon the management and technological forces applied to them. In the developed world, these forces have brought food production to levels approaching the natural resource potential. The United States’ food production model is the envy of the developing world. It is the major reason why the United States is considered the most developed country in the world in spite of the growing number of detractors within and without the country. Agricultural development has allowed us the time, labor and opportunity to produce and enjoy many of the comforts of life. Only relatively small groups of people produce the food for our 222 million people. In addition, that relatively small number also produces agricultural exports for all parts of the world. Other areas beside the U.S. have attained high levels of food production. Western Europe, Japan and Australia, for example, have relatively good production rates given their resources.

The picture is grimmer for other areas. The developing countries of the world are producing far below their potential. Most farmers in the world are still using technologies thousands of years old. These farmers rely on man- or ox-power to scratch a meager subsistence living

14Ibid., p. 2.
from the resources under their control. Unfortunately, world food production per capita for some basic commodities in the developing world has been declining in relation to population growth.\textsuperscript{15}

However, for total food production, Sterling Wortman and Ralph Cummings report:

For both the developed and less-developed countries, world food output has been rising approximately 3 percent per year over the past 20 years. On the average, the 3,800 million people in the world in 1973 had over 20 percent more to eat per person than did the world’s 2,700 million people in 1954. The upward trend has not been smooth for either the developed or the developing countries; during this period, total food production fell below the previous year’s level three times in developed countries and twice in developing countries. Per capita food production of developing countries failed to increase over the previous year in 9 of these 19 years.\textsuperscript{16}

An indication of the spotty changes in world food production is the shift in grain export positions for various areas of the world. Only North America, Western Europe, Australia and New Zealand have improved their positions.\textsuperscript{17}

The message of most of the literature is that millions of people are hungry. The United Nations emphasized the point in 1974 when it reported that over 462 million people received insufficient protein in their diets (see Table 1).\textsuperscript{18} The highest percentage of these starving peoples lived in developing regions of the world. Despite the increased yields in rice and wheat that the “Green Revolution” brought to Asia in the late 1960s, these changes proved to be site specific, and direct transfer to other parts of the world has not resulted in the levels hoped for by many optimists. Since the U.N. presentation in 1974, conditions have not improved.

\textsuperscript{16}Wortman and Cummings, \textit{To Feed This World}, p. 17.
\textsuperscript{17}Ibid., p. 22.
### TABLE 1

**ESTIMATED NUMBER OF PEOPLE WITH INSUFFICIENT PROTEIN/ENERGY SUPPLY, 1970**

<table>
<thead>
<tr>
<th>Region</th>
<th>Population (millions)</th>
<th>People with insufficient supply (%)</th>
<th>People with insufficient supply (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed regions(^a)</td>
<td>1,070</td>
<td>3</td>
<td>28</td>
</tr>
<tr>
<td>Developing regions(^b)</td>
<td>1,750</td>
<td>25</td>
<td>434</td>
</tr>
<tr>
<td>Latin America</td>
<td>280</td>
<td>13</td>
<td>36</td>
</tr>
<tr>
<td>Far East</td>
<td>1,020</td>
<td>30</td>
<td>301</td>
</tr>
<tr>
<td>Near East</td>
<td>170</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>Africa</td>
<td>280</td>
<td>25</td>
<td>67</td>
</tr>
<tr>
<td>World(^b)</td>
<td>2,820</td>
<td>16</td>
<td>462</td>
</tr>
</tbody>
</table>


\(^{a}\) Includes 33 major countries located primarily in Europe and North America plus Australia, Israel, Japan, New Zealand, South Africa and the U.S.S.R.

\(^{b}\) Excluding Asian centrally planned economies — the People’s Republic of China, the Democratic People’s Republic of Korea, Mongolia, and the Democratic Republic of Vietnam.

Part of the world has made remarkable progress in producing food at levels approaching the potential of the natural resources given present levels of technology. Despite these achievements, are there enough resources to adequately feed the 10 to 16 billion people projected for the year 2040? When it seemed important to answer the question, the U.S. President’s Advisory Committee made an estimate of the world’s potential food production land area. They estimated that there were approximately 3.2 billion hectares (8 billion acres) of potentially arable land. Only about 44 percent of this arable land was being cultivated or grazed in 1970 (see Table 2).\(^1\)

### Table 2

**ESTIMATED AMOUNTS OF CULTIVATED LAND BY REGION VERSUS POTENTIALLY ARABLE LAND, 1965**

<table>
<thead>
<tr>
<th>Region</th>
<th>Total</th>
<th>Potentially Arable</th>
<th>Cultivated Land Not As % of Area Person (Hectares)</th>
<th>Cultivated Land As % of Area Person (Hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>3,019</td>
<td>732</td>
<td>158</td>
<td>574</td>
</tr>
<tr>
<td>Asia</td>
<td>2,736</td>
<td>627</td>
<td>518</td>
<td>109</td>
</tr>
<tr>
<td>Australia and New Zealand</td>
<td>822</td>
<td>154</td>
<td>16</td>
<td>138</td>
</tr>
<tr>
<td>Europe</td>
<td>478</td>
<td>174</td>
<td>154</td>
<td>20</td>
</tr>
<tr>
<td>North America</td>
<td>2,108</td>
<td>465</td>
<td>239</td>
<td>226</td>
</tr>
<tr>
<td>South America</td>
<td>1,752</td>
<td>679</td>
<td>77</td>
<td>602</td>
</tr>
<tr>
<td>U. S. R. R.</td>
<td>2,234</td>
<td>356</td>
<td>227</td>
<td>129</td>
</tr>
<tr>
<td>WORLD</td>
<td>13,148</td>
<td>3,189</td>
<td>1,388</td>
<td>1,801</td>
</tr>
</tbody>
</table>

**Source:** Sterling Wortman and Ralph W. Cummings, *To Feed This World: The Challenge and the Strategy* (Baltimore, Maryland: John Hopkins University Press, 1979), p. 17.

Converting arable land estimates to food production indicates that the projected population can be fed. Wortman and Cummings also agree:

The evidence clearly indicates that the overall physical potential exists on earth to feed a vastly larger population than now lives here. Estimates of the carrying capacity of the earth have ranged as high as 76,000 million people, based on a minimum subsistence diet of 2,500 kilo-calories per person per day. Providing an “adequate” diet including high-quality protein (protein with the balanced content of amino acids required by human beings and all other warm-blooded animals except cattle and related ruminants) and “protective” foods such as fruits and vegetables, or the equivalent of 4,000-5,000 kilo-calories per person per day.

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20See particularly, Wortman and Cummings, *To Feed This World*, pp. 164-75.
The potential gross cropped area of the world is estimated (by Revelle) to be sufficient for 38,000-48,000 million people—over 10 times the present human population of the earth. Even in India, for example, which is often cited as one of the more hopeless cases by the professional pessimists, the Indo-Gangetic Plain with its abundant sunlight and water resources and deep, rich soils is estimated to be capable of producing many times the amount of food currently being grown.21

Why is it taking so long to set aside the Malthusian spectre? The optimistic relations estimated between population and production potential are meaningful only if two magnificent assumptions hold: (1) population growth will stabilize at projected levels and (2) food production will reach the potential levels for which the natural resources are capable. Whether the assumptions hold and result in a bright future does not depend on the potential to control population or the potential of the natural resources, but rather on the ability of the human race to solve problems within itself. These problems are far more complex than anything the race has faced before.

When the symptoms of the population-food imbalance are placed before us, we tend to focus on the symptoms and ignore the basic causes. In many public places we see a picture of a small girl in a refugee camp in Cambodia. The large, round eyes staring blankly ahead, the clear outline of the bone structure in her face, the distended stomach and the extremely thin arms and legs tell a visual story of hunger at its worst. Who can look at that picture and not respond emotionally to the cry for help? The starving child, however, represents a symptom, not the basic worldwide problem. I would be the last to say that the symptom should not receive immediate attention, but we must concentrate our attention on the larger problem that creates personal hunger.

Institutions

Human institutions are systems by which people live together in families, communities and nations. Institutions can protect and educate, improve life, sustain the establishment, resolve conflict as well as meet

21Ibid., p. 80.
creative and spiritual needs. Institutions are expressed formally as organizations or informally as traditions. In some societies, fear of change is institutionalized. In others, willingness to change and experiment is important. In still other societies, land tenure systems are traditional institutions. There is hardly an economic, social, political or religious idea that has not been institutionalized by some group of people somewhere in the world.

Fundamental institutional conflicts prevent world food production rates from realizing their potential. There is no question that the technology is available to increase the world’s food supply and that the resources as well as the expertise exist.

Most of us who have worked in countries where food is produced by man- and ox-power recognize that the natural resources are producing far below their potential. In a recent study in Somalia, we conservatively estimated that food crop yields per acre could be increased four times without shifting to capital intensive management techniques. Economic returns per livestock breeding unit could be increased ten to fifteen times by modifying traditional management without introducing modern capital intensive practices. Similar conclusions have been drawn about the food production sectors in Bolivia, Iran, Lesotho and North Yemen. The physical possibility is there, but generally the institutional support for change is missing. Wortman and Cummins note:

> It is important to recognize that the world’s food problem does not arise from any physical limitation on potential output or any danger of unduly stressing the “environment.” The limitations on abundance are to be found in the social and political structures of nations and in economic relations among them. The unexploited global food resource is there, between Cancer and Capricorn. The successful husbandry of that resource depends on the will and the actions of men.22

Trying to change institutions which impede effective resource utilization is a lengthy and difficult process. The durability of these institutions and their conflict with resource management can be illustrated with one example. In several African countries the groom pays the bride’s father a “bride price.” Often the bride is paid for in cattle. Money will not do. Tradition holds that the medium of exchange is one girl

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22Ibid., p. 79.
for approximately twenty head of cattle. With population growing more rapidly than ever before because of medical advances and wider distribution of services, more children survive to marriageable age, and more and more cattle are put on the range because of the bride price tradition. As overgrazing increases, erosion threatens to destroy the natural resource. The government calls for help. Some of us go who have the knowledge and technology to correct the erosion problem. But to suggest reducing cattle on the range is an anathema to the people. Traditional values demand those cattle to cover expected bride prices. Besides, cutting back numbers can reduce a subsistence farmer to abject poverty and result in the death of babies and old people in the first few months of such a program. In addition, the bride price system is supported and protected by other institutions; by the local government and religion as well as by the traditional social and economic system.

Transferring the American Model

Governments and the people in developing countries often do not recognize the numerous conflicts between their institutions and the desires to acquire material well-being. How many times when asked, "What do you want us to do while we are in your country?", will the Minister respond, "We want you to transfer the United States' agricultural model to our country, but stay out of policy (politics) matters and do not try to change our traditions!"

The transfer cannot be made because of the shadowy institutions that control life and mores in every society. A basic premise of our agricultural model is the tradition of change. How did it happen to be our custom to look forward to change? Why is it not common in other societies?

Let us compare some important developmental factors for the U.S. and contrast them with the developing world. Walter Prescott Webb, the historian, develops the frontier concept in U.S. development in detail.23

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United States

1. **People:** They were rebels, outcasts, nonconformists, extremists, tired of the old social systems in Europe and Asia; hungry for land and risk-takers. Breaking with tradition, they were anxious for change. Class conditions were weak. They were relatively literate and mobile.

2. **Natural Resources:** They were abundant and unexploited. The frontier seemed endless. They provided a new life for immigrants. If they wore out, man simply moved further west. Institutional control was minimal. Independence was encouraged. Rewards were high; also failure was frequent. Sharing was a part of life.

3. **Education:** It was for the masses, via the land grant university system. It was philosophical, theoretical and applicable. It was public supported. It lifted the ceiling on opportunity, invention and innovation.

4. **Work Ethics:** Work related to rewards. Work was good and commanded of God. “God helps those who help themselves.” Man was the “captain of his fate and master of his soul.” By working diligently a man could move up the ladder of economic success.

Developing Countries

1. **People:** They are an indigenous population trying to defend old traditions, afraid of change. Innovators are discouraged, cast out, even destroyed. Class arrangements are strong. They are relatively illiterate.

2. **Natural Resources:** They are mostly exploited. Tough institutional controls exist. Their potentials are often limited. No new space exists; costs are extremely high for new development. Traditional controls are imposed and new ideas are not nurtured. Institutions are designed to protect the closed structure.

3. **Education:** It is for the elite classes. It is philosophical and sometimes theoretical. It is an individual, non-sharing experience. It imposes ceilings on opportunity, invention and innovation.

4. **Work Ethics:** Working classes are fixed. Rewards are in the hands of God. Men cannot change life’s patterns. Fate rules man’s work. Progress in work levels is virtually impossible. A man is what God intended him to be.

How are we going to transfer a model among societies with such basic differences? Can we do anything to avoid the Malthusian spectre in such a world of differences? We have two alternatives:

1. Do nothing and wait for the triple catastrophies of hunger, world revolution and death.

2. Do something about it. Foil Malthus. Let us transfer something besides technical assistance. Let us get at it now!
Obligation of University Faculties

University faculties ought to spend more time wrestling with the worldwide problems discussed in this paper. Where else does such a concentrated group of people exist who are trained to solve problems? Do we not enjoy the search and discovery of new ideas and their applications in the real world? At least that is what we teach our students. We profess to have the ability to solve problems by correctly choosing among various alternatives. Does the university community possess the talent to attack the class of problems I have called the population-food squeeze? Are our universities and their faculties truly universal in trying to solve problems? Or are we provincial in our arts and sciences, concerned only with special case problems? Are we so protective and defensive about our disciplines or administrative units that we cannot forge the multi-disciplinary or multi-institutional units necessary to assure a general solution to the immense problem posed in this paper? Are our educational techniques and our subject matter so narrow that when students leave our classes, they know only about special cases and local problems and little about general cases and universal problems? In our zeal to apply everything we discover, have we become professionally provincial without realizing it? In our mass educational attitudes do we force all students into the U.S. mold whether they come from Logan or Timbuktu?

Unfortunately, the answers to the above questions are obvious, although some outstanding faculty exceptions do exist. The irony is that overall we are not doing the job, yet no other body of talent exists anywhere in the world that can do it in the limited time left. We are the critical mass. The world looks to U.S. universities to do the job. Our own government looks to us to solve the worldwide problem. Let other groups put the salve on the sores (take care of the hungry little poster girl from Cambodia). University faculties have an obligation to attack the diseases creating the sores. Are we at Utah State University ready to universalize our approach to life? That effort will require administrative encouragement and support, faculty retooling and a taxed citizenry. We need to help the non-university community recognize the general problems we all face. We cannot solve problems by ignoring their existence.
Utah State University has an enviable record in comparison to most universities in this country. I recently looked over the faculty roster and counted over 200 faculty members who have been on one assignment or another in developing countries. This university was one of the first to get involved with contracts for developing countries. We are still involved in Bolivia, Tanzania, Peru, Cape Verde and Iran, with individual faculty members serving in a number of other countries around the world. The demand for short-term personnel from USU is phenomenal. Someone is out on assignment all the time. There are few countries that have not been visited by somebody from this campus during the last four years. We are doing more than our share of what is being done by American universities, but it is not enough. We still have not institutionalized international development to the extent that we have domestic development.

Education for Change

The population-food squeeze can be solved by education; the kind of education U.S. land grant universities are famous for in the U.S. setting. We need to perpetuate that successful system throughout the world. I speak of education in the broadest sense. It includes on the one hand philosophy, discovery and application. On the other hand, it encompasses research, campus teaching and out-reach programs. A philosophy related to world problems is necessary for researchers to discover solutions which are used by teachers on and off campus through classroom techniques and field demonstrations. Often we find in our universities that theory and application are centered in the same person. It is one of the features of our system that appeals to the developing world. Our system only uses history as a first step in preparing predictions and guidelines for the future. In fact, we spend far more time worrying about tomorrow than we do about yesterday or today. These characteristics of U.S. education are not found in most parts of the world.

We will look at four educational audiences found at USU, critique them and recommend some revisions. Then we will discuss the general education problem as it applies to solving the population-food squeeze.
Once upon a time there was a Latin student who came to Logan to get a Ph.D. degree so he would be able to help his people. For five years he worked closely with his major professor and other teachers who were all well known and respected in their professions. He had had some trouble with English during the first year, but his teachers took the position that he should have anticipated his American experience and been born in an English speaking country. His background for the major he chose was weak. Although his first year's performance was poor, there were no adjustments in the teaching scenario. He was to compete on an equal basis with all the native born students. Even though he knew most of the answers to the questions in the final examination, he had difficulty expressing them in acceptable English. Writing them in his language was not acceptable. His graduate committee suggested that he work harder. He did because failure was repugnant to him. His government and others had sent him to USU, told him what to study and expected him to succeed or else suffer upon his return home.

He did work hard. He spent extra hours in the laboratory. He read extra literature. He wrote a well-developed dissertation on a microscopic problem relating to a situation that he had never seen before coming to the U.S. It was a situation related to a high level of technology. He isolated the cause of the problem in the laboratory, and then developed the solution in the laboratory. He wrote an article for a U.S. professional journal that was well received. He graduated and received the appropriate diplomas and certificates. His major professor was proud of what he had done with this man.

Our new Ph.D. went home anxious to get in the laboratory and save his country. But his country had no laboratory with the sophisticated equipment he needed.

In addition, his country did not have the problem that he had spent five years isolating and solving. His country was still in the ox- and manpower stage. His government appointed him assistant deputy minister, which was the highest non-political appointment possible. The appointment was befitting a new Ph.D. from USU. His responsibilities were to protect the political position of the deputy minister and the minister, read and analyze proposals with respect to their political and economic importance, and occasionally give public speeches on the future of the
country. He gradually drifted into the common practice of selling favors to supplement his very low salary.

When I saw our hero in his country, he was bitter. He felt that he had been used to solve a U.S. problem. He felt that he learned only theoretical things, but nothing to prepare him to solve the problems in his country, nor did he learn anything to help him analyze and evaluate projects which was his main productive function, nor did he learn how to train his countrymen to solve the problems there.

What went wrong at USU for this man? Our professional provincialism dominated his education. In most disciplines we do not do a good job of generalizing our teaching in order to help foreign students when they get home or U.S. students when they go into the developing world. The professional shock is often more devastating than the social shock.

I am not suggesting that we prostitute our disciplines by lowering university standards. Principles and theory are universal. But if all we teach are principles and theory, we have done only part of the job. The application of principles and theories to real world problems is one of the keys to our success; another is our ability and willingness to share our knowledge of application with producers and consumers. Our professional provincialism is not in the area of teaching principles and theory but in teaching how to apply those theories. In the American environment, principles and theories are applied near the top of production functions moving upward on a dynamic production surface. In the developing world, application is near the bottom of production functions on a nearly stagnant production surface.

Problems in the two settings are different. Application of principles and theory is different. We need to pay attention to these differences in the educational process. When we teach, we must recognize the differences between developed and developing environments.

Degree teaching in foreign countries

This has been tried by Utah State and a number of other U.S. universities. It has not had general university support because to do it seriously requires institutionalizing a program that is foreign to us. It requires formulating curricula at a level not understood by us. It means professors daring to think outside the U.S. model. It means recognizing
limitations that we cannot handle so easily. I feel that it is necessary if we are going to be effective in helping "the poorest of the poor" in this world make the most of their resources and institutions.

As an example of what happens to a USU professor going to a developing country to teach a USU course, I will use my own experience. I am sure that many of you have had similar experiences.

In 1974, I went to Bolivia to teach a course for which students could obtain USU credit. Instead of the forty students allowed for the course, over 100 registered. In order to save San Simon University from having a revolution, I agreed to teach two sections a day for five days a week. That teaching load does not seem too strenuous until you realize that for a three credit course each section lasted four hours a day.

The first shock was standing for eight hours a day before 100 critical student who possessed no background in the subject and a spread of educational backgrounds from high school to some with M.S. degrees. The second shock was that I could not sustain a Spanish presentation for eight hours a day. Simultaneous translators helped prevent total collapse. The third shock was that most of the material I had brought with me was useless in the Bolivian environment. Substantial revisions were necessary if I wanted to make the material relevant to the situation in Bolivia. Fortunately, I had by that time spent five years in Bolivia and knew what had to be done to the material and the presentation. Coming up with meaningful illustrations and applications was not difficult except that it took nights and weekends to weld new material into the course in proper places. I do not know how successful I was, but I was more successful than I would have been had I thrown the material and presentation at them which would have been used in the U.S. setting.

The point is that a professor must put his ideas in such a way that students in a developing country can grasp and apply them immediately after the course rather than waiting until their country catches up and becomes like the U.S. model. That may never happen.

*Short-term trainees at USU*

We get many people every year from many countries who want to see the great food production machine that is the U.S. Often their training includes visiting and observing the most successful enterprises available. They talk to farmers, managers and professors who are right-
fully proud of the great U.S. model. Trainees observe the relative smoothness with which everything works. They are told how management keeps everything under control. They may even see how the computer seems to manage irrigation, feed rations, etc. They see farms and livestock enterprises larger than they have ever seen before with machines that make their oxen obsolete in their minds. They see the account books and note the profit line (if any). They say, "This is what we need. We will take it home with us." However, some things they were not told. No one mentioned the three generations it took to paint the picture they see. The great amount of capital required over the years to create the thing they see was not mentioned. The vast marketing and transportation system required to make the visible operation possible was not mentioned. No one told them of the complicated policy supports required to make the picture complete. In other words, the difficult process of getting the enterprise started and finally bringing it to today's level of success was not spoken of, nor the number of years when the profit line was negative.

Process, the most important component of success, was never exposed to the trainees. When they go home, they cannot relate what they learned to their environment. We do things better than they, but we do not tell them how we do it. Too often the process remains our secret.

**Short-term training in-country**

If we take the trainers to the trainees, we have to teach process because there is no U.S. type success available to show them. A thoughtful trainer will shift his thinking and presentation to the starting point of his students and begin developing the process of getting from that point to the point of the U.S. model. He will recognize that he is talking about a process that may take one or two generations before a highly productive model that fits their physical, political, social and economic environment is created. When the professor stands before a group of eager people in their country, that is when he starts to seriously generalize his understanding and teaching. If he does not, he may be chased out of the country or taken hostage.

**University to university**

If our goal is to make the educational system in the developing world more effective, we must attach ourselves to their universities.
USU has had some experience in this area, but we need to make a greater effort in this direction. The universities in developing countries are the institutions where continuity in philosophy, theory and application can be achieved. Practically all the other training techniques discussed above are short-term contingency methods, because the trainees are seldom engaged in training other trainees.

A U.S. land grant university such as USU should be able to make its greatest impact through a long-term relationship with another university. The mutual exchange of professors and students would have a lasting effect upon both institutions. More of our U.S. effort in development should be directed toward lasting university to university activities and less university to technical assistance activities if we want the developing world to create its own problem-solving critical mass.

Can Education Do It?

Can education, American-style, eliminate the population-food squeeze before ultimate starvation and war force an unacceptable balance? Some evidence is available to indicate a positive relationship between the level of education among mothers and number of children:

In almost every country, the more education women have, the fewer children they bear. For example, in a 1972 study from Jordan of women aged 30-34, illiterate women were found to have an average of 6.4 children while those with a primary-school education averaged 5.9. For secondary-school graduates, the average was 4.0; and for university-degree holders, only 2.7 children. Studies in Turkey and Egypt showed the same pattern. . . .

The general acceptance of family planning programs seems to be related to declines in birth rates in some places; in others family planning alone does not seem to be effective. Where a family's only real source of wealth and old age security is related to the amount of con-

25Ibid., p. 25.
trolled labor, reducing the number of children by family planning is not economically acceptable. The fact that 40 percent of the babies die within the first year after birth in some societies only encourages a higher birth rate in order to obtain the necessary level of labor and old age security. In many areas, these economic realities have become part of the religious and social institutions of the poor and illiterate. 26

Dramatic changes in reproduction will not be achieved by stressing family size reduction for the good of the nation, the society or for the health of the mother and certainly not for the good of future generations. In a subsistence setting isolated from real participation in a central society, a large family is an asset which provides economic and social benefits and power in the local environment for the forty to fifty years a father and mother can expect to live. Kathleen Newland puts it this way:

Population programs have often appealed to women's self-interest by pointing out the health benefits of family planning for mothers and their children. . . . Low infant mortality is recognized as a precondition for acceptance of family planning. The benefits for her own health, however, may not be a powerful enough incentive to reduce the number of children a woman wishes to have. Health is not necessarily given top priority in individual decision-making. . . . Some of the objectives that women have in mind when making decisions about fertility may be more important to them than good health. 27

Limiting size of families through economic incentives are necessary conditions but are not sufficient for permanent change. The sufficient conditions include the expansion of the vision of the world by the mother and father, reasonable hope for the future of their children, participation in the broader life of their society, removal of superstition and historical biases, possible class movement, etc. In this respect, Newland reports:

We should not expect rural families to have smaller families merely by promising them it will improve the quality of their lives. The order in which change occurs is crucial. People first need to experience some improvement in the quality of their lives, ideally


through their own efforts, and then see for themselves the potential for more improvement if they have smaller families.²⁸

I believe the population side of the problem can be affected by education which increases the options available to the educated for making a living. The kind of education that we are familiar with—theory and application—is the kind we need to spread to the developing world. For background education we must teach reading, writing and arithmetic as a means for theorizing and applying, not as an end in itself.

On the food production side, the education of those who produce the food is necessary. In America we assume that rural as well as urban people will be educated. In the developing world, too often only the rich and urban people are educated while the food producers remain illiterate. The rich-educated and poor-illiterate are natural antagonists in many countries, and institutions are created to keep the two classes separated. Both classes need our special brand of mass education which goes a long way to eliminating class conflict and makes movement from one class to another possible.

Increased productivity from the natural resources depends upon the education of producers in the arts and sciences of agricultural production and distribution. Vernon Ruttan emphasizes this concept:

Productivity differences in agriculture are increasingly a function of investments in the education of rural people and in scientific and industrial capacity rather than natural resource endowments. Indeed the one inescapable implication of the results of our cross country analysis is the importance of literacy and schooling among agricultural producers and of technical and scientific education in the agricultural sciences.²⁹

The challenge is presented time and time again, "Show us how to feed ourselves." The world comes to our universities for help. Too many times we fail because we do not know how or are not permitted to transfer the educational process from our comfortable, U.S. setting to the uncomfortable, foreign setting. Theoretically, production can be

²⁸Quoted in Ibid., p. 25.
increased, but unfortunately we have to deal with people and their entrenched institutions. To deal with people and their institutions requires some innovative applications of the U.S. educational system. I believe it can be done. Our university faculties hold the keys to providing a comfortable balance between food production and population for the future.

Aid with a Single Motive

Our universities are not self-financed. We need donor support for foreign as much as for domestic development. A great many countries provide money and technical assistance of various kinds to developing countries. The most important agency in the U.S. which is funded from the federal budget is the Agency for International Development (AID). A sizeable share of the billions of dollars that moves through the Agency is put into food production and related activities. Why is it then that such a high motive directed at eliminating hunger, poverty and related suffering does not bind the participant countries into a lasting bond of friendship with us? It is because we do not have a singleness of purpose.

Let us be clear on one point; I do not fault the Agency or the people who work in it (and there are thousands all over the world). After all, AID is a creation of our democratic process. The Congress and administration are under pressure from lobbies from all over the country representing all kinds of groups. Most of the time our laws are compromises between the best and the worst possible; AID is a product of Congress. It is not the best it could be, but it is far from the worst. The diverse views of well-meaning people in Congress and in the lobbies often result in compromising legal structures never intended by anyone. However, they are there and they cost us friends; usually the ones we try to help most. I will discuss some conflicts that I have observed, then give some examples to illustrate how they work against us.

Aid to foreign countries often generates conflicts because of a variety of reasons. Although an uselfish, altruistic motive on the part of the United States plays its part in a variety of health, education and food programs sponsored by AID, that motive is often tarnished in actual operation. A shortage of adequately trained agricultural officers as well
as the very limited time span of specific efforts make the goal of alleviating human misery difficult if not impossible to achieve.

Even if such altruistic motives were not obscured by practical difficulties, they are often tarnished by selfish policy goals which generate suspicion. Unfortunately, aid is tied to political goals. In the tiny African nation of Lesotho, our economic aid has little to do with the desire to eradicate hunger. Rather every U.S. dollar that enters Lesotho ends up in the Republic of South Africa. Although we do not channel direct aid to the Republic of South Africa because of its apartheid racial policy, our country circuitously supports that nation because it is one of the most stable powers on the continent. By giving aid to neighboring Lesotho, the U.S. makes sure South Africa eventually receives financial support, albeit indirectly.

Similarly complex motives obscure the U.S. effort to ameliorate inequities that have little if anything to do with the altruistic desire to help feed the hungry. We have a selfish economic motive. Contracts with developing governments through AID require that all equipment and machinery, etc., be purchased in the U.S. or from U.S. industry-controlled branches in the country or neighboring countries. It does not matter if equivalent materials can be purchased from another source at less cost. Also, materials and people must be shipped on U.S. carriers wherever possible even if less expensive means can be found. About 90 percent of all AID money loaned or granted to a developing country is used to develop our own home markets.30 (Is not that "economic colonialism?" Most countries think so.)

We have another selfish economic motive. We have a food for peace program. In the past we have sent surplus food products to poor countries at subsidized prices. This does not make friends with countries who have been selling the products to the receiving country. It creates a shuffling of the world distribution system which takes time. Often the price in the losing country falls for at least a short time creating hardship on producers, processors and marketers.

The food for peace law usually requires that the product be processed in the U.S. in order that our processing industries do not suffer.

30Boyd E. Wennergren and Allen LeBaron, There Must Be a Better Way: The Anatomy of U. S. (Canada: McGill University, MacDonald Stewart Institute of Agriculture and Department of Agricultural Economics, 1978).
Such action is felt negatively by the processing industry in the receiving country.

This happened in Bolivia. When our wheat surplus was great, we shipped flour to Bolivia. Bolivian wheat producers could not compete with the subsidized flour. The millers closed their plants and went into the flour import business.

When our wheat surplus decreased to the point of concern, we told Bolivia (and other countries) that she must show evidence that she had a program designed to make her more self-sufficient in wheat production, or we would cease shipments of food for peace wheat. Many farmers had shifted to other crops. Their wheat marketing system had virtually disappeared. The milling industry was gone. To revive and improve the old system in Bolivia brought about a large project through AID to USU. Our friends are suspicious of our motives when we flip-flop from one policy to another for obviously selfish reasons.

We try to impose our moral system upon recipients of AID programs. Help is conditional on adherence to our definition of human rights. The coca business in Bolivia has received recent attention. Eligibility for development aid has become tied to changes in traditional attitudes. Democratic process guarantees are stressed over and over again if development aid is forthcoming from the U.S.

There are evils in the world; changes must be forthcoming, but have we not learned that evil cannot be destroyed by legislation, conquest or threats? We have not succeeded in removing inequities from our own system. Other peoples know that and are critical of our attempt to reform the world. The best way to handle this side issue is through an educational process rather than through legislation. We should divorce our zeal to reform morals from our desire to increase the food production in the developing world. Mixing the two, spells failure in both.

Conclusion

Utah State University and the citizens of Utah have a responsibility to contribute to the solution of the growing worldwide population-food squeeze. We need to recognize that if we do not do our share in eradicating the problem, our way of life is endangered. Our institution will
not accomplish the task unless individuals assume their share of the responsibility. Surely USU administrators and faculty members can do more to include the problems of the developing world into their teaching, research and continuing education programs. We can influence decisions made in our state and federal governments regarding conflicting motives, methods and policies in international development if we put forth a united institutional effort. We do not have much time to accomplish that mission.
<table>
<thead>
<tr>
<th>KIND OF VEGETABLES</th>
<th>VARIETIES</th>
<th>Days to Harvest</th>
<th>Germination Temperature Min.</th>
<th>Germination Temperature Opt.</th>
<th>Average Planting Date</th>
<th>Feet of Row</th>
<th># of Seeds Per Foot of Row</th>
<th>Seed or Plants</th>
<th>Planting Depth (inches)</th>
<th>In rows (inches)</th>
<th>Between rows (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP A - HARDY. PLANT AS SOON AS SOIL DRIES OUT IN THE SPRING.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASPARAGUS</td>
<td>- Mary Washington**, Waltham Washington**</td>
<td>Perennial</td>
<td>50</td>
<td>75</td>
<td>Mar. 15 - May 1</td>
<td>100</td>
<td>50 plants</td>
<td>8</td>
<td>24</td>
<td>36 - 48</td>
<td>36 - 48</td>
</tr>
<tr>
<td>CABBAGE</td>
<td>- Golden Acre 84, Emerald Cross, Stonehead, Tastie Hybrid, Market Prize, Ruby Ball, Saturn No. 45, Savoy Ace, Danish Ballhead</td>
<td>62</td>
<td>63</td>
<td>70</td>
<td>Mar. 15 - May 1</td>
<td>30</td>
<td>30 plants</td>
<td>4</td>
<td>12</td>
<td>18 - 24</td>
<td>18 - 24</td>
</tr>
<tr>
<td>KOHLRABI</td>
<td>- Prima Hybrid, Grand Duke Hybrid, Winner Hybrid, Purple Vienna</td>
<td>50</td>
<td>50</td>
<td>55</td>
<td>Mar. 15 - May 1</td>
<td>50</td>
<td>1 ounce</td>
<td>1/4 - 3/4</td>
<td>1 - 2</td>
<td>14 - 18</td>
<td>14 - 18</td>
</tr>
<tr>
<td>ONIONS</td>
<td>- Transplants - Early Ebenezer sets, Utah Yellow Sweet Spanish Seed - Evergreen White Bunching - green onions; Crystal White Wax - pickler Walla Walla, Snow White, Utah Yellow Sweet Spanish, Fiesta, Sweet Sandwich</td>
<td>64</td>
<td>67</td>
<td>68</td>
<td>Mar. 15 - May 15</td>
<td>100</td>
<td>1 pound</td>
<td>1/2 - 1</td>
<td>1 - 3</td>
<td>14 - 18</td>
<td>14 - 18</td>
</tr>
<tr>
<td>(Edible Podded) Oregon Sugar Pod, Little Sweetie, Mammoth Melting</td>
<td>64</td>
<td>67</td>
<td>68</td>
<td>Mar. 15 - May 15</td>
<td>100</td>
<td>1 pound</td>
<td>1/2 - 1</td>
<td>1 - 3</td>
<td>14 - 18</td>
<td>14 - 18</td>
<td></td>
</tr>
<tr>
<td>RADIISH</td>
<td>- Champion, Cherry Beauty, Ronde Rode, Easter Egg</td>
<td>55</td>
<td>58</td>
<td>72</td>
<td>Mar. 15 - Sept. 1</td>
<td>50</td>
<td>1 packet</td>
<td>1 packet</td>
<td>1/2</td>
<td>14 - 18</td>
<td>14 - 18</td>
</tr>
<tr>
<td>Burpee White, Snow Bells, Iceicle</td>
<td>28</td>
<td>28</td>
<td>30</td>
<td>30</td>
<td>Mar. 15 - Sept. 1</td>
<td>50</td>
<td>1 packet</td>
<td>1 packet</td>
<td>1/2</td>
<td>14 - 18</td>
<td>14 - 18</td>
</tr>
<tr>
<td>SPINACH</td>
<td>- Skookum Hybrid, Avon Hybrid</td>
<td>25</td>
<td>28</td>
<td>30</td>
<td>Mar. 15 - May 1</td>
<td>50</td>
<td>1 ounce</td>
<td>1/2 - 3/4</td>
<td>2 - 4</td>
<td>14 - 18</td>
<td>14 - 18</td>
</tr>
<tr>
<td>Melody Hybrid, Synphonie Hybrid</td>
<td>38</td>
<td>40</td>
<td>Mar. 15 - May 1</td>
<td>60</td>
<td>12</td>
<td>1 ounce</td>
<td>1/2 - 3/4</td>
<td>2 - 4</td>
<td>14 - 18</td>
<td>14 - 18</td>
<td></td>
</tr>
</tbody>
</table>

GROUP B - SEMI-HARDY. PLANT A WEEK OR TWO AFTER "A" GROUP.
<table>
<thead>
<tr>
<th>Crop</th>
<th>Varieties</th>
<th>Planting Date 1</th>
<th>Planting Date 2</th>
<th>Harvest Date 1</th>
<th>Harvest Date 2</th>
<th>Seed Pack Availability</th>
<th>Seed Pack Weight</th>
<th>Seed Pack Availability</th>
<th>Seed Pack Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEET - Earlsweet Hybrid, Pacemaker II, Golden Beet</td>
<td>Warrior, Ruby Queen, Detroit Dark Red*, Cylindra</td>
<td>Mar. 20 - July 15</td>
<td>50</td>
<td>12</td>
<td>1 ounce</td>
<td>3/4 - 1</td>
<td>1 ounce</td>
<td>1/4</td>
<td>14 - 18</td>
</tr>
<tr>
<td>CAULIFLOWER - Snow Crown, Early Snowball, Super Snowball</td>
<td>50</td>
<td>52</td>
<td>58</td>
<td>40</td>
<td>80</td>
<td>30</td>
<td>20 plants</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>ENDIVE - Salad King, Green Curled</td>
<td>Imperial, Self-Blanche, Royal Purple, Ravella</td>
<td>58</td>
<td>68</td>
<td>95</td>
<td>95</td>
<td>40 - 80</td>
<td>20</td>
<td>1 packet</td>
<td>12</td>
</tr>
<tr>
<td>LETTUCE - (Leaf) Green Ice, Oak Leaf, Grand Rapids, Red Sails</td>
<td>BUTTERHEAD - Buttercrunch, Prizehead, Crispy Sweet</td>
<td>Mar. 20 - May 1</td>
<td>50</td>
<td>12</td>
<td>1 ounce</td>
<td>1/2 - 3/4</td>
<td>6</td>
<td>1/2</td>
<td>14 - 18</td>
</tr>
<tr>
<td>ENDIVE - Salad King, Green Curled</td>
<td>Imperial, Self-Blanche, Royal Purple, Ravella</td>
<td>58</td>
<td>68</td>
<td>95</td>
<td>95</td>
<td>40 - 80</td>
<td>20</td>
<td>1 packet</td>
<td>12</td>
</tr>
<tr>
<td>PARSLEY - Paramount, Banquet</td>
<td>70</td>
<td>76</td>
<td>40</td>
<td>80</td>
<td>100 - 125</td>
<td>125</td>
<td>20 pounds</td>
<td>12</td>
<td>14 - 18</td>
</tr>
<tr>
<td>PARSNIP - All America*, Model*</td>
<td>PARSNIP - All America*, Model*</td>
<td>105</td>
<td>120</td>
<td>35</td>
<td>70</td>
<td>Mar. 20 - May 1</td>
<td>50</td>
<td>12</td>
<td>1/2 ounce</td>
</tr>
<tr>
<td>POTATO - Red - Norland, Red Pontiac*, LaSoda*</td>
<td>POTATO - Red - Norland, Red Pontiac*, LaSoda*</td>
<td>200</td>
<td>1</td>
<td>125</td>
<td>125</td>
<td>Mar. 20 - May 1</td>
<td>50</td>
<td>12</td>
<td>1/2 ounce</td>
</tr>
<tr>
<td>PARSLEY - Paramount, Banquet</td>
<td>70</td>
<td>76</td>
<td>40</td>
<td>80</td>
<td>100 - 125</td>
<td>125</td>
<td>20 pounds</td>
<td>12</td>
<td>14 - 18</td>
</tr>
<tr>
<td>SALSIFY - Mammoth Sandwich Island *</td>
<td>SALSIFY - Mammoth Sandwich Island *</td>
<td>140</td>
<td>140</td>
<td>12</td>
<td>1 ounce</td>
<td>1/2 - 3/4</td>
<td>6</td>
<td>1/2</td>
<td>18</td>
</tr>
<tr>
<td>SWISS CHARD - Rhubarb + *, Lucullus + **, Fordhook Giant + **, Ruby, Rhubarb</td>
<td>SWISS CHARD - Rhubarb + *, Lucullus + **, Fordhook Giant + **, Ruby, Rhubarb</td>
<td>50</td>
<td>60</td>
<td>60</td>
<td>1 ounce</td>
<td>3/4 - 1</td>
<td>1 ounce</td>
<td>1/4</td>
<td>18 - 24</td>
</tr>
<tr>
<td>KIND OF VEGETABLES</td>
<td>VARIETIES</td>
<td>Days to Harvest</td>
<td>Germination Temperature Min.</td>
<td>Opt.</td>
<td>Average Planting Date</td>
<td>Feet of Row</td>
<td># of Seeds Per Foot of Row</td>
<td>Seed or Plants</td>
<td>Planting Depth (inches)</td>
</tr>
<tr>
<td>--------------------</td>
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<td>------------------------</td>
</tr>
<tr>
<td>GROUP C - TENDER. PLANT ON THE AVERAGE DATE OF THE LAST SPRING FROST, ABOUT WHEN FIRST APPLES BLOOM.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRY BEAN</td>
<td>Great Northern*, Pinto*</td>
<td>90 100</td>
<td>55 75</td>
<td>May 5 - June 1</td>
<td>200</td>
<td>6</td>
<td>1 pound</td>
<td>1 - 1 1/2</td>
<td>3</td>
</tr>
<tr>
<td>SNAP BEAN</td>
<td>Pole Types - Pole Blue Lake, Romano Pole, Kentucky Blue, Blue Lake 274, Oregon Trail</td>
<td>63 60</td>
<td>55 75</td>
<td>May 5 - June 10</td>
<td>150</td>
<td>9</td>
<td>1 pound</td>
<td>1 - 1 1/2</td>
<td>3</td>
</tr>
<tr>
<td>Bush Blue Lake Types - Bush Blue Lake 274, Oregon Trail</td>
<td>65 55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bush Green Types - Slenderette, Slimgreen, Tendercrop, Derby, Strike</td>
<td>53 60 61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wax Types - Gold Crop, Sungold, Kingshorn Wax</td>
<td>54 58 58</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CELERY</td>
<td>Utah 55-70, Summer Pascal*</td>
<td>125</td>
<td>40 70</td>
<td>May 5 - June 15</td>
<td>25</td>
<td>50 plants</td>
<td>3</td>
<td>1 - 1 1/2</td>
<td>12</td>
</tr>
<tr>
<td>(Hardy, but goes to seed if planted too early)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>SWEET CORN</td>
<td>Standard Hybrids (su, su); Earlylee, Golden Earlripak**, Jubilee**</td>
<td>63 73 82</td>
<td>50 85</td>
<td>May 5 - July 1</td>
<td>400</td>
<td>1</td>
<td>1 1/2 lbs.</td>
<td>1 - 1 1/2</td>
<td>12</td>
</tr>
<tr>
<td>Super Sweet Hybrids (su1, su1): Earlivee, Golden Earlripak**, Jubilee**</td>
<td>67 72</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Party Time; Super Sweet 82**, Sweet Temptation**, Honey &amp; Pearl, How Sweet It is</td>
<td>83 86 85</td>
<td></td>
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<tr>
<td>Sugar Extender Types (se se): Remarkable**, Miracle**, Double Delight** (bi-color)</td>
<td>81 85 85</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Platinum Lady** (white), Breeders Choice, Incredible, Maple Sweet, Sugar Buns</td>
<td>80</td>
<td></td>
<td></td>
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<tr>
<td>CUCUMBER</td>
<td>Pickling - Green Star, Liberty, Wisconsin SMR18, Bush Pickle, Calypso</td>
<td>51 54 54</td>
<td>60 75</td>
<td>May 5 - June 20</td>
<td>30</td>
<td>3</td>
<td>1/2 ounce</td>
<td>1 - 1 1/2</td>
<td>24</td>
</tr>
<tr>
<td>Slicing - Dasher Hybrid, Amira, Marketmore 70, Salad Bush, Sweet Slice</td>
<td>45 55 59</td>
<td></td>
<td></td>
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<tr>
<td>Mild Flavored Slicers - Euro-American, Sweet Success, Jet Set</td>
<td>42 50 60</td>
<td></td>
<td></td>
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<tr>
<td>Compact Plant Slicers - Burpless Bush, Pot Luck, Spacemaster</td>
<td>41 50 60</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>SPINACH</td>
<td>Summer - New Zealand**</td>
<td>41 50 50</td>
<td>60 95</td>
<td>May 5 - June 20</td>
<td>20</td>
<td>4</td>
<td>1 packet</td>
<td>1/2 - 3/4</td>
<td>12</td>
</tr>
<tr>
<td>SUMMER SQUASH</td>
<td>Yellow Dixie Hybrid, Goldbar Hybrid, Butterbar</td>
<td>50 52</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Patty Pan - St. Pat Scallop Hybrid, Peter Pan Hybrid</td>
<td>48 48 55</td>
<td></td>
<td></td>
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<tr>
<td>Green - Zucchini Elite, Park’s Green Whopper, Black Jack, Gold Rush, Sunburst Hybrid</td>
<td>50 50 80</td>
<td></td>
<td></td>
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<tr>
<td>Other types - Scallopini, Gourmet Globe, Jersey Golden Acorn</td>
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</table>

Dan Drost, Vegetable Specialist, Extension

HYBRID VS. OPEN-POLLINATED VARIETIES
Most vegetables grown from seeds were produced from open-pollinated varieties (uncontrolled cross pollination). These open-pollinated varieties may have good disease resistance and produce acceptable yields. Recently, more hybrid seeds (controlled pollination – specific male and female parents) have been marketed. Hybrid varieties are generally more vigorous and uniform in growth, possess better disease resistance, and have greater productivity than open-pollinated varieties. However, hybrids are usually more expensive.

DISEASE RESISTANCE
Selection of varieties with disease resistance can reduce crop loss and minimize pesticide use in the home garden. When possible, use varieties with multiple disease resistance. This can help minimize the risk of a disease problem, especially if persistent problems have occurred in the past.

MATURITY CHARACTERISTICS
Early maturing vegetable should develop in most growing areas of Utah. Early maturing varieties of many vegetables do not have the quality of later maturing varieties.

OTHER FACTORS
Spend time planning the garden. It is best to order seed catalogs during the late fall or early winter for next year’s growing season. It is not uncommon for popular varieties to be sold out during the winter. Orders placed during January or February are sure to arrive in time for planting in the spring.
## KIND OF VEGETABLES

<table>
<thead>
<tr>
<th>Group</th>
<th>Name</th>
<th>Varieties</th>
<th>Days to Harvest</th>
<th>Germination Temperature Min.</th>
<th>Opt.</th>
<th>Average Planting Date</th>
<th>Feet of Row</th>
<th># of Seeds Per Foot of Row</th>
<th>Seed or Plants</th>
<th>Planting Depth (inches)</th>
<th>In rows (inches)</th>
<th>Between rows (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GROUP D - VERY TENDER. PLANT WHEN THE SOIL IS WARM, ABOUT TWO WEEKS AFTER &quot;C&quot; GROUP.</strong></td>
<td></td>
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<tr>
<td><strong>LIMA BEAN</strong></td>
<td>- Fordhook 242**, Kingston**</td>
<td>75 65</td>
<td>May 20 - June 10</td>
<td>60 75</td>
<td>May 20 - June 10</td>
<td>100 6</td>
<td>1 pound</td>
<td>1 - 1 1/2</td>
<td>4 24 - 48</td>
<td>18 - 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CANTALOUCHE</strong></td>
<td>- Summer Hybrid, Harper Hybrid, Classic Hybrid, Hales Best, Mission</td>
<td>78 80</td>
<td>May 20 - June 10</td>
<td>60 75</td>
<td>May 20 - June 10</td>
<td>100 6</td>
<td>1 ounce</td>
<td>1 - 1 1/2</td>
<td>4 24 - 48</td>
<td>18 - 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EGGPLANT</strong></td>
<td>- Dusky Hybrid, Early Royal Hybrid, Ichiban</td>
<td>75 85</td>
<td>May 20 - June 10</td>
<td>60 75</td>
<td>May 20 - June 10</td>
<td>45 60</td>
<td>4 plants</td>
<td>30 4</td>
<td>18 24 - 30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PEPPER</strong></td>
<td>- Sweet Park's Whopper, Bell Boy Hybrid, Early Calwonder</td>
<td>75 85</td>
<td>May 20 - June 10</td>
<td>60 75</td>
<td>May 20 - June 10</td>
<td>45 60</td>
<td>4 plants</td>
<td>30 4</td>
<td>18 24 - 30</td>
<td></td>
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</tr>
<tr>
<td><strong>WINTER SQUASH</strong></td>
<td>- Buttercup*, Waltham Butternut*, Pink Banana Jumbo</td>
<td>75 75</td>
<td>May 20 - June 10</td>
<td>60 75</td>
<td>May 20 - June 10</td>
<td>20 1</td>
<td>1 packet</td>
<td>1 - 1/2</td>
<td>24 48</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>WATERMELON</strong></td>
<td>- Sugar Belle, Sweet Favorite, Crimson Sweet</td>
<td>75 75</td>
<td>May 20 - June 10</td>
<td>60 75</td>
<td>May 20 - June 10</td>
<td>20 1</td>
<td>1 packet</td>
<td>1 - 1/2</td>
<td>24 48</td>
<td></td>
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<tr>
<td><strong>GROUP E - SPECIAL PLANTS FOR FALL HARVEST +</strong></td>
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<tr>
<td><strong>BEETS</strong></td>
<td>- Earlisweet Hybrid, Pacermaier II, Detroit Dark Red</td>
<td>49 55</td>
<td>July 1 - Aug. 1</td>
<td>50 12</td>
<td>July 1 - Aug. 1</td>
<td>50 12</td>
<td>1 ounce</td>
<td>3/4 - 1</td>
<td>2 14 - 18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CABBAGE</strong></td>
<td>- Fall - Market Prize, Red Ace</td>
<td>76 76</td>
<td>May 1 - July 15</td>
<td>30 12</td>
<td>May 1 - July 15</td>
<td>30 12</td>
<td>1 ounce</td>
<td>3/4 - 1</td>
<td>2 14 - 18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>KALE</strong></td>
<td>- Vates, Dwarf Siberian</td>
<td>55 55</td>
<td>July 2 - Aug. 15</td>
<td>50 12</td>
<td>July 2 - Aug. 15</td>
<td>50 12</td>
<td>1 ounce</td>
<td>1/2 - 3/4</td>
<td>12 14 - 18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LETTUCE</strong></td>
<td>- Head - Great Lakes, Over-wintering - Great Lakes</td>
<td>80 80</td>
<td>June 1 - Aug. 1</td>
<td>50 12</td>
<td>June 1 - Aug. 1</td>
<td>50 12</td>
<td>1 ounce</td>
<td>1/2 - 3/4</td>
<td>12 14 - 18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ONION</strong></td>
<td>- Over-wintering - San Joaquin, Calred (bulb harvest next June)</td>
<td>80 80</td>
<td>Aug. 1 - Aug. 10</td>
<td>60 10 - 15</td>
<td>Aug. 1 - Aug. 10</td>
<td>60 10 - 15</td>
<td>1 ounce</td>
<td>1/4 - 1/2</td>
<td>1 1 3 14 - 18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RUTABAGA</strong></td>
<td>- American Purple Top*, Maconber*</td>
<td>90 90</td>
<td>June 15 - July 1</td>
<td>60 12</td>
<td>June 15 - July 1</td>
<td>60 12</td>
<td>1 ounce</td>
<td>1/2 - 1</td>
<td>2 4 14 - 18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SPINACH</strong></td>
<td>- Skookum Hybrid, Avon Hybrid, Melody Hybrid</td>
<td>38 40</td>
<td>July 1 - Aug. 15</td>
<td>60 12</td>
<td>July 1 - Aug. 15</td>
<td>60 12</td>
<td>1 ounce</td>
<td>1/2 - 3/4</td>
<td>2 4 14 - 18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TURNIP</strong></td>
<td>- Purple Top White Globe*, Golden Ball*</td>
<td>57 60</td>
<td>July 1 - Aug. 1</td>
<td>25 12</td>
<td>July 1 - Aug. 1</td>
<td>25 12</td>
<td>1 ounce</td>
<td>1/2 - 3/4</td>
<td>1 3 14 - 18</td>
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</tbody>
</table>

* Suitable for common storage.
** Excellent for freezing.
+ These may often be made as garden replantings (following harvest of early radishes, spinach, and peas, etc.)

100 East Center Street, Suite L600, Provo, UT 84606  
Phone: 801-851-8460

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