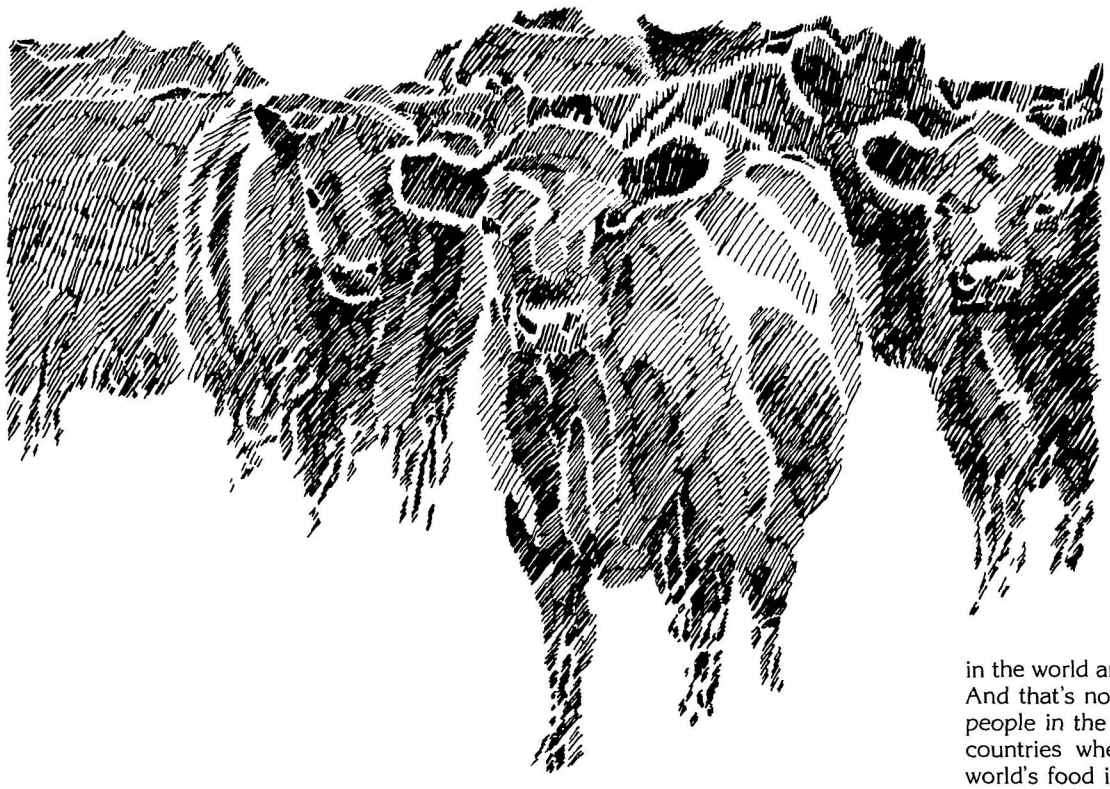


What's Ahead In 2100?

by Dr. M.E. Ensminger

Known world-wide as a livestock scientist, Dr. M.E. Ensminger is as qualified as anyone to address, "What's Ahead in 2100 A.D.?" Ensminger looks at agriculture's challenge to feed a growing population by giving some very specific predictions. Ensminger has a long list of accomplishments to his credit, but the former college professor is probably best recognized as an author and lecturer. He has written 17 books and has lectured and conducted seminars throughout the United States as well as abroad. He currently lives in Clovis, Calif., where he and his wife operate Consultants-Agriservices.

It's projected that there will be 30 billion people in the world in 2100 A.D. It follows that population growth, along with geographical location, will be the major determinant of what's ahead in 2100 A.D.

It took from the dawn of man until 1,600 years after the birth of Christ for the number of people in the world to reach one-half billion. The population of the world first topped 1 billion in 1830. And it took another 100 years—until 1930, for the population to reach 2 billion. In 1960, it was 3 billion; in 1975, it was 4 billion; and in 1983, it was 4.5 billion. Even more frightening in the people-numbers game is the estimation of population experts in the years ahead. By the year 2000, it's predicted the world will have 6.35 billion mouths to feed; by 2030, 10 billion; by 2050, 12 billion; and by 2100, 30 billion (see Fig. 1).

Do these population figures foretell the fulfillment of the doomsday prophesy of Thomas Malthus, made in 1798, that world population grows faster than man's ability to increase food production? For almost 200 years, we proved Malthus wrong. Disease had a major role in holding population down; and as population increased, new land was brought under cultivation; and machinery, chemicals, new crops and varieties, and irrigation were added to step up yields. Now science has given us the miracle of better health and longer life. Was Malthus right?

The ominous challenge of our children is that the demand for food will triple in their lifetime; and the frightening challenge of our great grandchildren is that we shall need over six times more food in 2100 A.D.

Even now, in 1983, the Food and Agricultural Organization (FAO) of the United Nations estimates that 500 million people in the world are "severely undernourished." And that's not all! Seventy percent of the people in the world live in the developing countries where only 40 percent of the world's food is produced. More disturbing yet, this is where most of the world's increase in population is occurring. The developing countries now account for 89 percent of the world's annual population increase—their accelerated population growth further impoverishing the earth.

Where we have come from

Winston Churchill once said, "The further back you can look, the further forward you are likely to see." So, before crystal ball gazing into the future, let us look back; let us see what progress we have made.

- From 1935 to 1982, the number of farms decreased from 6.8 million to 2.4 million, and the size of farms increased from 155 acres to 429 acres. Thus, within a span of 47 years, 65 percent of the farms disappeared, and the average size of farms nearly tripled. With this transition, herds, flocks and feedlots became bigger.
- Science and technology have made for greater efficiency of production; fewer farm workers have produced more food and fiber. In 1820, each farm worker supplied products for 4.12 persons, including himself. In 1983, the figure was 78.
- Today, plant products constitute 93 percent of the human diet of the world; the remaining 7 percent comes from animals. Today, nearly 99 percent of the world's food comes from the land, only slightly more than 1 percent comes from oceans and inland waters.
- The American colonist valued cattle for their work, milk, butter and hides; but little importance was attached to their meat. The work requirement led to the breeding of large rugged cattle, with long legs, lean though muscular bodies, and heavy heads and necks.
- Throughout the colonial period, and past the middle of the 19th Century, dairy-

ing was limited to a few cows cared for by family labor. But soon after 1850, the following developments paved the way for the modern U.S. dairy industry of today: The foundation animals of our present breeds were brought to this country; milk was pooled by neighboring farm families to make cheese; condensed milk was developed by Borden in 1856; the centrifugal cream separator was invented in 1878; the Babcock test for fat evolved in 1892; followed by the adaptation of pasteurization to milk, mechanical refrigeration, homogenization, and modern packaging and transportation.

• The colonists promoted the sheep industry in order to furnish wool rather than meat. The 1836, fleeces produced in this country averaged only 2 pounds. Half a century later, lamb and mutton became important, and the black, brown and spotted sheep were replaced by modern meat- and wool-type animals.

• Using mongrel sows descended from colonial ancestry as a base, the American swine producer crossed them with imported boars. Thus, the Arkansas razorback was replaced by improved meat-type swine, and several genuinely American breeds of swine were created.

• A hundred years ago, the poultry industry consisted of small farm flocks. Chickens were tenderly cared for by the farmer's wife who fed them on table scraps and the unaccounted-for grain from the crib; a hen produced only 100 eggs per year; hatching was done by nature's way—a setting hen hovering over eggs; the chicken meat was mainly the by-product of egg production, birds which were no longer producing eggs at a satisfactory rate were sold for meat purposes, and cockerels raised with the pullets were disposed of as fryers, or roasters, at weights of 3 to 6 pounds.

• With the advent of rail transportation and improved care and feeding methods, the ability of animals to travel and fight diminished in importance. It was then possible, through selection and breeding, to produce meat animals better suited to the needs of more critical consumers.

• During the 1850s and the 1860s, grain bins bulged with surpluses, and consumers were willing to pay for choice, grain-fed beef, which was ably promoted and merchandized by self-service chain stores. The time was ripe for the "chain reaction" that spawned the era of grain-fed cattle. In 1947, only 6.9 million head of market cattle were grain fed. In 1978, the peak year of grain feeding, more than 30 million head of cattle were grain fed.

What's ahead?

In the year 2100 A.D., the world will be much more crowded, much more polluted, much less stable ecologically, and much more vulnerable than the world in which we now live. More specifically, my crystal ball shows the following:

• People will largely determine their own destiny through population control—or lack thereof, futuristic research, and infusion of science, technology and education—by self-help programs—so they can produce more of their own food. Other approaches will only prolong and aggravate the existing disparities.

• Producing enough food of high nutritional value to meet the demands of an ever-expanding population is the world's greatest challenge in the decades ahead; feeding a hungry world will continue to be of concern to all people of all races, all religions, and all political and economic philosophies. Indeed, man's concern about food—ages old and 20th Century new—will be the major global issue in the decades to come.

People in some of the developing countries will starve to death because of population growth outrunning food production.

• But production alone will not be enough. Hand in hand with it, there must be proper food distribution and adequate income with which to buy food; otherwise, poor people will go hungry.

• Little new land can be brought under cultivation in a practical manner, so most of the increased output must come from higher yields—and higher yields depend heavily on oil and gas.

• Regional water shortages will become more severe, mandating more efficient water use in agriculture, such as can be achieved through drip or trickle irrigation, which waters the individual plant instead of the surrounding soil.

• Serious deterioration of agricultural soils will occur worldwide due to erosion, loss of organic matter, salinization, alkalinization and waterlogging.

Increased application of conservation tillage and "no till" systems will be made in order to control erosion, maximize land cover, and conserve energy, labor, water, soil, fertility and organic matter.

• Atmospheric concentrations of carbon dioxide and ozone-depleting chemicals will increase at rates that could alter the world's climate and upper atmosphere.

• Many plant and animal species will become extinct—they will be irretrievably lost as their habitats change.

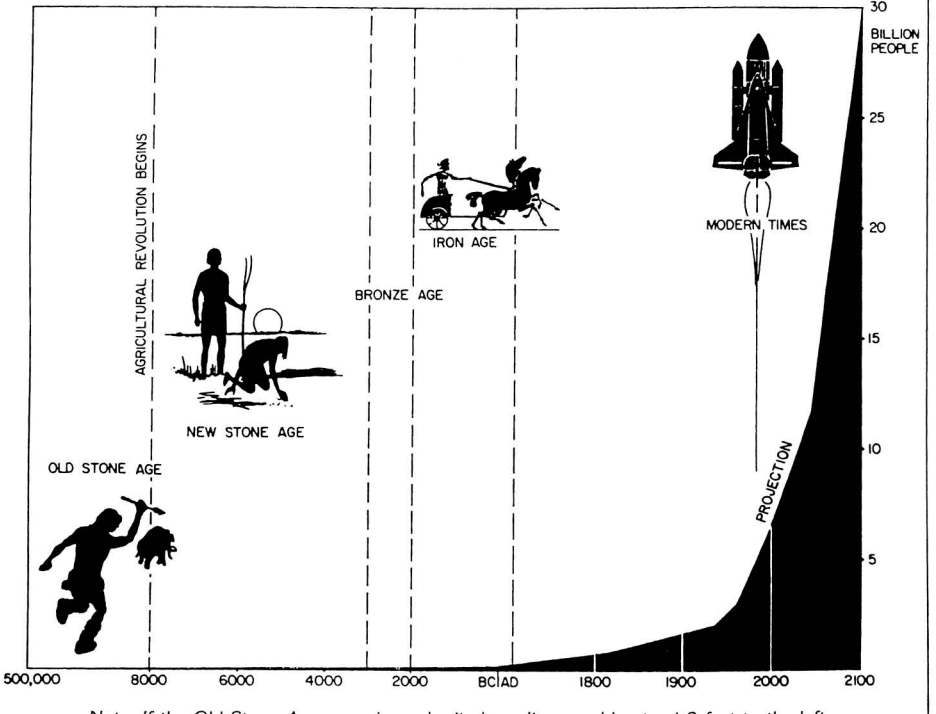
• More stable yields of the 29 major crop species on which the people of the world are largely dependent will continue to be one of the most sought goals of humanity. Much will be done to improve disease and insect resistance, enhance tolerance to environmental extremes, and increase genetic yield potential.

• New and improved crops will be promoted as future food and feed sources; among them, amaranth, triticale, African wing bean, sunflowers, and high-lysine corn. Also, wide crosses between plant species, and crosses between domesticated and related wild species, will be expanded in an effort to increase yields and dependability.

• Increasingly, pest management strategies will turn to biological control to reduce the need for large amounts of pesticides and other agricultural chemicals.

• The United States will continue to produce more than enough food for its people, but in the manufacture of chemicals, machine tools and farm equipment, the U.S. will steadily lose ground to foreign competition.

Fig. 1. Human population growth over the past 1.5 million years, with projections to 2100 A.D.



Note: If the Old Stone Age were in scale, its base line would extend 8 feet to the left.
*(From: **Foods & Nutrition Encyclopedia,** published by Ensminger Publishing Co.)*

• The world will conserve scarce and costly energy. The chief forms for energy conservation in future food production will be in food processing, marketing, and home cooking—steps which require more energy than growing the products.

Also, in the future, increased use will be made of photosynthesis to fix energy, and increased use will be made of animals to store energy. It follows that grazing land, which is highly efficient in the capture of solar energy, will lead the way, and that more ruminants—cattle, sheep, and goats—which can utilize large quantities of roughage, will be used to step up and store energy.

• Masses of people shouldering each other for food, space, wealth and dignity will continue to be at the root of most wars.

• Countries that are low in total protein will strive to produce more animal protein, which generally has a higher biological value than plant protein. Animal agriculture will be maximized by the use of roughages and by-product feeds—products that are not suited to human consumption.

• Many of the technological advances that have made it possible for U.S. farmers to produce food animals at current levels and efficiency will increasingly become points of conflict between the agricultural industry and animal rights and welfare activists; among them, veal and swine confinement production; the caged layer system in egg production; such management practices as dehorning and castrating; animal transport; slaughter practices; and the use of animals for research. Changes in these policies in order to satisfy militant animal rights and welfare activists will force some producers out of business and increase product prices to consumers.

• Health, or "wellness," will become a way of life for most people. Life-styles will include regular exercise, good habits and proper selection of foods.

• New techniques, such as genetic engineering and tissue culture, will make great payoffs in food animals and food crops, through improved yields, increased nutritional value and disease resistance. All the major biological processes will be involved, including genetic improvement; resistance to diseases, parasites and environmental stresses such as heat, cold and air pollution; reproductive efficiency and hormonal mechanisms; photosynthesis; and nitrogen fixation.

Recently, a Mighty Mouse, twice the size of a normal mouse, was produced by a new genetic engineering technique. Why not a giant cow, sheep or hog, with Paul Bunyan as the caretaker?

But 2100 A.D. is far in the future! Nevertheless, in one form or another, I shall be present at that time to defend my forecast, for I love a good fight. Either Armageddon will come first, ending the world; or I shall be there in my next reincarnation. For the present, all those who wish to take issue with me are invited to do so, but they must be prepared to prove me wrong. AJ