MICHIGAN ENVIROTHON

Teacher's Guide to Sustainable Agriculture Component

MICHIGAN ENVIROTHON

SO WHAT.....WHY DO I NEED TO KNOW ABOUT AGRICULTURE........I AM NOT GOING TO BE A FARMER !

Look around...agriculture is everywhere! The food we eat, the clothes we wear, even the homes we live in are all part of agriculture. In fact, you just can't have an ag-less day! Even so, most people forget how important agriculture is in their daily lives. NO FARMS...........NO FOOD?

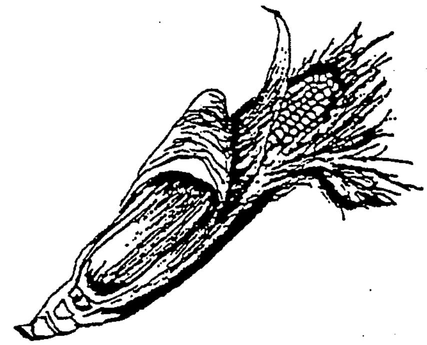
Agriculture is our life-line and a major player in a strong economy. With farmers making up less than two percent of the U.S. population, it is more important than ever to enhance agricultural literacy by providing learning opportunities for youth, educators and the general public. Many people who are and will be making decisions about local, state, national and world affairs have no idea what agriculture is or of its importance to society.

Agriculture is the most basic and essential enterprise of our society. It is agriculture that converts natural resources—soil, water, air, sunlight, and minerals—into the foods that nourish us and keep us healthy. If we manage these resources properly they will sustain us forever.

The efficiency of American Agriculture gives us most of the luxuries we enjoy. Less than two percent of the work force in the United States produces the food it takes to feed all of us and part of the rest of the world. Farmers provide the safe and economical food supply that allows the other 98 percent to concentrate on the other important enterprises. These enterprises—medicine, computer and information technology, space exploration, and industrial technology and production—are the ones that make us world leaders.

Tomorrow's citizens, consumers, business leaders, legislators, and educators must be agriculturally literate in order to protect and preserve the advantages we gain from a strong agriculture. Even thought most of our citizens will continue to live in cities, all of us will continue to be dependent on agriculture for the most essential things in our lives.

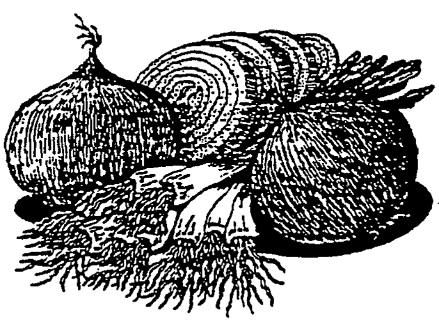
MICHIGAN AGRICULTURE



Few Michigan residence are aware of the role agriculture plays in our state's economy. Agriculture is important to every citizen in Michigan because it is an essential to our fiscal health as it is to our physical health.

The agriculture and natural resources industries play a major role in maintaining the vitality of Michigan's economy. To assure sound public policy regarding issues effecting agriculture and natural resources, there is a need for all citizens to possess a minimum level of understanding about the scope, and social and economic importance of agriculture and its interrelationships with the state's abundant natural resources.

The food and agricultural sector is Michigan's second leading industry. Tourism is number one if they are having a good year, contributing over $30 billion annually to the state's economy. As the state's second largest employer, well over one million Michigan citizens are employed in the production, processing and distribution of food and agricultural products. Each year, our state exports nearly $1 billion in agricultural products.

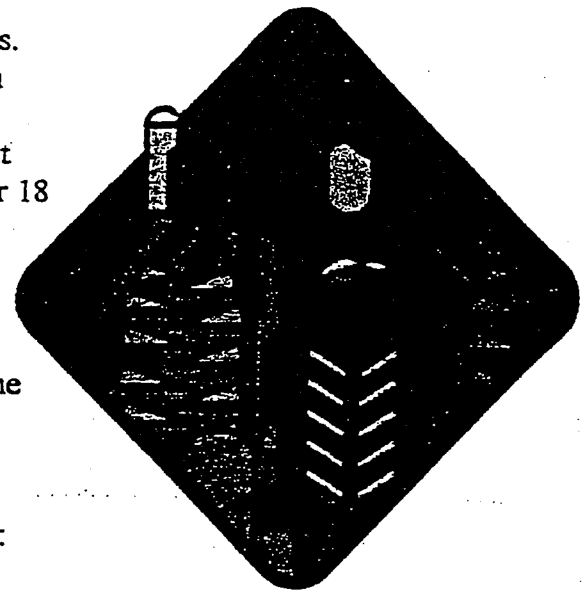


Nearly one-half of the total U.S. and Canadian population is within 500 miles of the state's border, resulting in a marketing advantage for Michigan's raw and processed commodities.

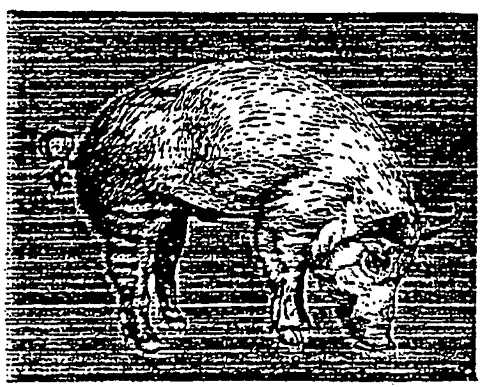
Thanks to the special emphasis in Michigan to improve and expand the animal agriculture industry, it's expected that another 22,000 additional jobs will be created. Based on current trends, the pool of youth drawn into agriculture will not be sufficient to supply the work force needed.

A word about "farming" and "agriculture".......they don't mean exactly the same thing. Growing crops and raising livestock are a part of agriculture, but agriculture also includes the manufacture of farm supplies, and the processing and the distribution of farm commodities and products.

Because of mechanization and computers, fewer and fewer people work directly on farms in our country. But agriculture is a major source of job opportunities. It encompasses the entire U.S. food and fiber system and includes 20 million workers...everyone from farmers to food processors to grocery store checkout clerks. In total, agricultural employment accounts for 18 percent of all the jobs in the nation.



When we talk about production agriculture, we're talking about farmers. In Michigan there are nearly 50,000 farmers and another 100,000 full and part-time farm workers and family labor. They produce the widest variety of crops in the nation outside of California. Over 125 commercial commodities! Michigan ranks first in the production of seven crops: red tart cherries, pickling cucumbers, navy beans, cranberry beans, black turtle beans, Christmas trees and potted geraniums. We are also in the top 10 in the nation in production of many other agricultural commodities.



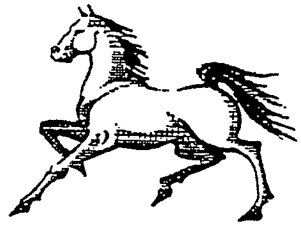
Agriculture's manufacturing and processing sector includes production inputs, farm and garden machinery; lumber to build your homes and decks, paper and other wood products like plywood.

Food processing is meats like hams and hot dogs, provided by companies like Koegel and Thornapple Valley; dairy products like milk, cheese, cottage cheese; grain mill products like fine white wheat bakery flower, preserved fruits and vegetables, sugar, fats and oils.

Agriculture in the Michigan is also retail trade. Yes, McDonald's and other fast food outlets are a part of our agri-business system.

Agriculture is the wholesale trade industry as well...grocery and related products, grain elevators, farm product raw materials, farm supplies; beer, wine and liquor wholesaling; floriculture and supplies.

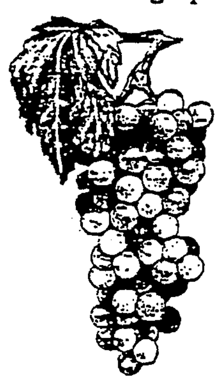
The agricultural services industry is soil preparation, veterinary and other animal services, farm labor and management services, machinery, fertilizers, pest scouters, and landscape and horticultural services for facilities like office buildings, plus many others.



The equine industry means horses, donkeys, and burros, do you visit DRC or other race tracks around the state? One-half-billion dollars a year in pari-mutuel wagering is made there. This helps support, among other things, the county fairs across the state.

The export industry is also an important part of Michigan agriculture. Three million acres devoted to exports, and over 100 companies sell nearly 200 products. These include familiar names: Kelloggs, Gerbers, Frederick Herrod meats, Chef Pierre, Pioneer and Big Chief sugar, Leprino Foods, Vlasic pickles, Mr. Turkey/BillMar food and Thank You brands.

Forestry means 17 and a ½ million acres of pulpwood, sawlogs, veneer logs, fuelwood, maple syrup and Christmas trees. Next time you read a book, think about the woods of northern Michigan and the Mead Paper company of Escanaba. They produce fine magazine and book-grade paper like that used in the National Geographic.



The grape and wine industry is 15 or more wineries and around 50,000 tons of grapes for juice and preserves. Michigan's best wines compete with the best from around the world.

The rapidly expanding horticulture industry is bedding plants, nursery products, potted flowering plants and cut flowers, sod, mushrooms and greenhouse products.

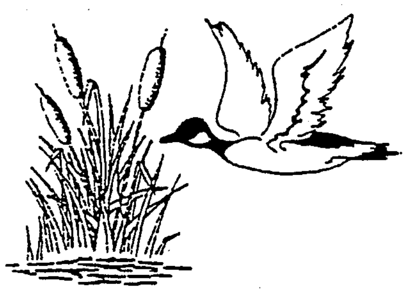
In total, our incredibly diversified farm, food and fiber product industry in Michigan is responsible for employing nearly one out of every eight people and creating over $30 billion each year in economic impact. AGRICULTURE IS A TERRIFIC RESOURCE OF ECONOMIC STABILITY FOR MICHIGAN.

Farmers are taking better care of the earth that provides our food and much of our fiber, and those changes mean environmental benefits that are enjoyed by the American public. Many farms today emphasize conservation practices that maintain and improve soil, water and habitat for wildlife.

As people have become more removed from the farm, people may not look at all sides of farming versus environmental health. For example, many farmers are utilizing a modern farming method called Integrated Pest Management, also known as IPM. IPM uses a full range of biological, cultural, mechanical and chemical methods to reduce pest populations. (See more under PRESENT CATEGORIES).

Modern farming is also better for the soil than farming in the past. New tillage techniques, like minimum tillage, are being widely adopted to help reduce erosion and enrich the soil.

Some Michigan farmers are learning more about what's happening on the ground beneath their feet by picking up signals from satellites in space. "Precision farming" uses an information technology know as the Global Positioning system, or GPS. A GPS receiver mounted on a tractor or combine receives signals from a number of satellites in a U.S. Defense Department network. The signals are used to determine the location of the equipment in the field with nearly pinpoint accuracy. A computer in the cab of the tractor or combine can be used to record time, location and information from sensors. Crop yield, fertilizer application, plant population or any number of things can be precisely measured. Some are calling it prescription farming or farming by the foot. But what it really means is that farmers can be more productive, more efficient and more environmentally sound, while reducing costs.



Modern farming also has less impact on water quality than in the past. Farmers are becoming more efficient in water usage by using more precise plant nutrition and irrigation practices and tools. Because this efficiency means less waste, farmers are keeping our rivers, lakes and streams cleaner.

Modern farming is better for wildlife, too. As the human population increases, food demands increase as well. But farmers are able to produce more food to feed that population on fewer acres. This efficiency saves millions of acres on which wildlife may live and thrive.

Farmers want non-farm neighbors to have a better understanding of the farming industry, because there are many issues in the future that agriculture and communities will need to cooperatively deal with. Few agricultural areas in the nation face the kinds of development pressures that we have here in Michigan. Our unique position as a leading industrial and tourism state, and the importance and wide diversity of our farming industry, leads to constant conflicts over land use. These conflicts, if not resolved, can threaten the land resources on which the prosperity of our industry and much of the Michigan economy is based.

Please be sure to read "The Status of Michigan Agriculture" from the Michigan Farmland and Agriculture Development Task Force for more details on **land use patterns and the**

effects on Michigan farmland. This article is included in the Teacher's Guide.

AGRICULTURE VERSUS SUSTAINABLE AGRICULTURE

What is the difference between Agriculture and Sustainable Agriculture?

Today's modern agriculture has come to rely on a number of off-farm inputs (such as fertilizer and pesticides) to produce the food that feeds America. This approach as a production system has become known as "**Industrial Agriculture**". As an industry it is best described in Dr. George Bird's paper on Sustainable Development which is a part of this Teacher's Guide. Industrial agriculture views our natural resources as components of the environment that are to be used for the benefit of humans. It tends to ignore the effects on the environment and can consider these effects as acceptable consequences of this system.

This is not saying that farmers are trying to glut the environment. Most, if not all farmers recognize that to stay in business they must be good stewards of the land. They implement a number of conservation/best management practices that reduce the impact of their farm operation on the environment. However, the emphasis on maximum yield and acres farmed are the measure of success.

In the 1930's, crop yields in the developed nations and third world countries were essentially the same. Since that time, researchers, scientists, and a host of federal policies have helped U.S. farmers drastically increase yields of corn, wheat, soybeans, and most other commodities. Today, fewer farmers feed more people than ever before. This success, however has not come without costs.

The U.S. Environmental Protection Agency has identified agriculture as the largest non-point source of surface water pollution. Pesticides and fertilizers (nitrates) have been detected in the water wells in many agricultural regions. Soil erosion continues to be a concern in many states. Pest resistance to pesticides continues to grow, and pesticide residue in food has yet to be resolved. Purchased input costs account for a significant portion of production costs and federal farm programs are under fire from cost-cutting legislators.

Because of these concerns, many farmers have begun to adopt alternative farming practices with the goals of reducing input costs, preserving the natural resource base, and protecting human health. These practices have become known as "Sustainable Agriculture".

In contrast to Industrial Agriculture, Sustainable Agriculture utilizes a number of practices that reduces the reliance on off-farm inputs for food production. Sustainable Agriculture is not a single system of farming practices. It includes a spectrum of farming systems, ranging from organic systems that attempt to use no purchased synthetic chemical inputs, to those involving the prudent use of pesticides or antibiotics to control specific pest or diseases. Practices using low off-farm input include those where nutrients are recycled and/or produced with cover crops, conservation tillage and cultivation are the norm for weed control, and integrated pest scouting is used to identify problems with insects, diseases, and weeds. Mechanical, cultural and biological solutions are used first, due to little if any cost (both monetarily and environmentally) before pesticides are used. Sustainable farming encompasses, but is not limited to, farming systems known as biological, low - input, organic or regenerative.

The emphasis in Sustainable Agriculture is on maintaining the balance within the system. Yields are just as important as in Industrial Agriculture, but greater focus is on the profit per acre and the quality of life for the farm operator, family, and community.

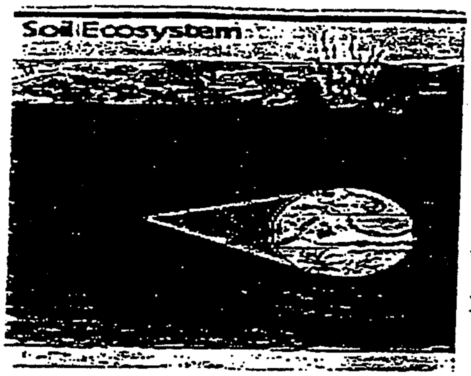
It is difficult to describe the differences between Sustainable Agriculture and what one might say has been Traditional/Industrial Agriculture. All farmers strive to be sustainable financially as well as environmentally. Successful farmers do what all good managers do - they apply management skills and information to reduce costs, improve efficiency, and maintain productive levels. Most strive to prioritize their goals to include the communities that they belong to, as well.

In the past 25 years, our society has recognized the impacts of all of our production systems on the environment and the quality of our lives. As this awareness and knowledge has grown, so has society's demand to be more sustainable in food production and in the growth of our cities. It takes time to move toward these new "norms" that society is still developing. The direction is clear, however the path is still being built.

PRESENT CATEGORIES AND EXAMPLES OF SUSTAINABLE AGRICULTURE METHODS

As mentioned, sustainable farming can include a variety of methods and technologies. The following are some of the more prevalent categories included in the topic Sustainable Agriculture. This is not meant to be an inclusive list, but rather a handy reference to get you started. One factor common to perhaps all Sustainable Farming is the health of the soil for that is the basic building block for all agriculture.

MAINTENANCE AND IMPROVEMENT OF SOIL AND PREVENTION OF EROSION



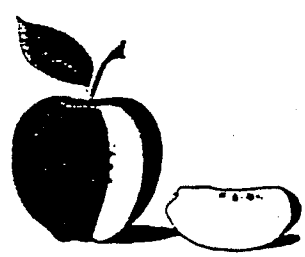
Soil is not just dirt!

Soil is not just the dirt that gets under your fingernails, or on the kitchen floor. Soil is a living - breathing ecosystem upon which we depend for food, shelter, and clothing.

Soil constitutes the outermost solid layer of the planet. We build on it. We raise food in it. We mine mineral resources from beneath it.

Apparently unchanging and lifeless, soils are dynamic mixtures, teeming with life. One teaspoon of soil in your backyard can contain billions of organisms ranging from simple bacteria and fungi to more advanced forms. Earthworms, insects, and spiders are examples. Bedrock is continually fractured, dissolved, and changed into soil; but the process occurs slowly, over hundreds of years, so we usually never notice.

An apple a day...



Here's a nifty way to think about and demonstrate the importance and fragility of our soil resources (especially, when you consider we need soil to provide our food) - it requires an apple. Take the apple and cut in half. Set half of the apple aside. Cut the remaining half of an apple in half again and set aside. The part of the apple you have set aside represents 3/4 of the apple. Consider the apple is the planet Earth. The 3/4 you have set aside represents all of the surface water on the planet. If it is water it isn't soil - so the 1/4 of the apple remaining represents all of the land surface of the Earth. Cut the 1/4 of apple in half - set aside this 1/8 of the apple. This represents all of the Earth's surface which is too dry, too rocky, or too frozen to produce food. You now have 1/8 of an apple left. Cut this piece in half again and set half aside. The 1/16 of an apple you have set aside represents all of the land surface covered with cities and developed land. Of the 1/16 of an apple you have left - remove the peel. This peel represents all of the soil of the Earth upon which we depend for our food and fiber resources. It is important to note in Michigan we are losing 10 acres of farmland per hour to development. Our food producing "peel" is shrinking.

Plants and animals have important roles to play in soil. Both plants and animals change the composition and structure of soil in many different ways. Plants with roots obtain nutrients and moisture from soil through their roots. As the roots grow they produce cracks, fissures, and drainage ways throughout the soil. The pressures of roots are often great enough to cause large boulders to fracture.

Although plants are the most visible large organisms, many animals also inhabit soils. Earthworms are perhaps the best known of this group. It is estimated that between 200 and 1000 pounds of earthworms can be found in an acre of soil. Aristotle (he was an ancient Greek scientist and philosopher) called them "the intestines of the earth". Earthworms eat organic matter and any other soil particles that get mixed in. They digest the organic matter and pass nutrient-enriched soil through their bodies. This recycles nutrients and makes soil richer. In addition, their tunnels allow air and water to penetrate the soil more rapidly. Earthworms - like many other organisms- are vital to soils. They keep them rich and productive.

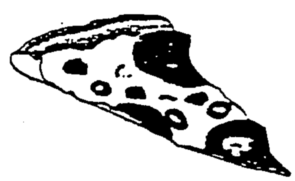
We depend upon soils.

Each person cannot produce all of the food, obtain all of the energy sources, or manufacture all of the products used in our modern society. A system of producing goods has evolved to supply these basic requirements. Often this system involves many steps between extracting the resource from the land and using the manufactured product at home. Many soils throughout the world are affected.

Producing the goods we use can be categorized into two steps: obtaining, then processing resources. First resources are obtained from the land and its soils. For example, vegetables are grown in soil. Animals are raised on grasses, grains, and soybeans that are grown in soil. Mineral resources - coal, iron ore, petroleum, and many others - are mined from beneath the soil and the bedrock below.

Processing, the second step, usually occurs in industrialized locations that may be far removed from the resource. The end result of the various steps in processing is a consumer good and usually waste by-products that need to be recycled or discarded.

Consider, as an example, the production of a pizza. The crust is made from flour. The flour started as wheat growing in the field. The wheat was harvested and taken to a milling facility, where it was cleaned and milled (ground into powder we know as flour). The flour was then mixed with yeast and sent to the pizza maker as a pre-made pizza mix. The cheese started out as milk from a cow. A cow which ate about 70 pounds of hay, grass, corn silage (all grown in the soil) and drank about a bathtub full of water 20-25 gallons to produce about 6 gallons of milk per day. (Cows produce milk for about 10 months per year.) The milk was then transported to a cheese processing plant where the solids were separated from the liquids and the solids were pressed and aged. It takes about a gallon and a half of milk to produce one pound of cheese. Enough for two medium sized pizzas. Think about the other items on a pizza and the process it takes to get them to your pizza. Pepperoni starts out as a pig. Where do mushrooms grow? What do you do with your pizza boxes? Think about this - if there were no productive soils, where would we get our pizzas?



How people have used soils . . .

People have always used the plant and animal resources of the land to supply themselves with food and shelter. Ancient Native Americans which inhabited Michigan and much of what is now the United States, had a limited technology to alter the land and soils to produce items they needed. In general, their cultures evolved to fit the environment. For instance, in areas of favorable climate and soils, local tribes established a stable agrarian culture with organized villages. Some tribes even irrigated their fields. Others developed a nomadic lifestyle where individual tribes followed the primary food sources.

In contrast, modern technology can alter the land and the soil in both beneficial and detrimental ways on a massive scale. For example, large-scale, intensive monoculture (one crop type i.e. corn) of grain crops and extensive urbanization can be detrimental. These practices increase the erosion potential and can deplete the soil, or remove large acreage from farming.

With our tremendous technological ability to alter land and soil comes a responsibility. This responsibility must be seriously considered to balance the benefits of the land use with the possible detriments it may cause.

History of United States was affected by soils...

The land is the surface of the earth and all its natural resources: the plants, the animals, the underlying minerals, and most important, the soils. Plants grow in soil and ultimately animals depend upon the nourishment of these plants. Thus, the plants, animals, and minerals are products of the soil: a more basic resource than any of the others.

The land and the soil have had a dramatic effect upon United States history. In the 1500's and the 1600's the New World was viewed as a utopia, a land of abundance. This was due primarily to reports of rich, fertile soils and the vast amount of timber, fur pelts, and other resources that could be obtained from the land and the soil. This perception of abundance continued throughout our very early period of settlement and expansion when many nations claimed large tracts of American land. The perception of abundance and plenty lasted through the Revolutionary War period and culminated in the 19th century.

Many believed it was our nation's right and duty to expand and to reap the benefits of the land and the rich soils of the West. The expansion was judged essential to meet the needs of a young, growing nation. Pioneers moved west seeking flat, fertile land at little or no cost.

Although the trip was rough and the life on the Plains difficult, land rushes, the Homestead Act, and several inventions urged settlers ever westward. Three key inventions during this period were the steel plow, barbed wire, and the windmill. Barbed wire helped control the grazing of cattle on cropland and windmills provided water for parched soil and livestock. But the steel plow, which made it possible to break up the tough matting of the prairie grasses, is the invention that did more than anything else to spread the intensive agriculture that has been practiced on the Plains and elsewhere ever since. During this period agriculture changed. It was no longer subsistence level because farmers were selling crops. This was the beginning of modern agribusiness.

When the railroads ventured west of the Mississippi River they carried the products of western soils - cattle and grain - to their markets in the rapidly industrializing East. Clearly, the land and its rich soils have had a remarkable impact on U.S. history.

How we degrade soils. . .

The quality of soils can be reduced by human actions. Soil degradation usually occurs because people do not understand soils and how they act under various conditions. Often poor decisions are made and soils cannot support a particular land use practice. Such soil degradation can occur in both rural and urban locations.

When a farmer removes an agricultural crop from a field, the soil can degrade. The tires of heavy equipment may compact the soil. If the whole plant is removed, valuable organic matter is lost. These actions can reduce not only the nutrients available in the topsoil (the top most layer of soil) but also the ability of the soil to hold water and air, both essential to plant growth. In addition, a plowed agricultural field left without plant cover will erode more rapidly. Certain agricultural chemicals, like pesticides, can also build up in the soil. In short, highly mechanized, intensive agriculture without proper soil conservation tends to reduce soil quality. Farmers must spend more time and money to raise crops on the poorer soil.

In urban areas, soils are also degraded by human activity. For example, on construction sites, all trees and other vegetation are often removed, exposing the soil to erosion. Homes, factories, stores, and roads are built on the land. This land, for practical reasons, can never be used for agriculture.

Food is our nation's largest export commodity. In many nations the lives of millions of people depend on our food and the productivity of our soil. It is important to preserve the quality and quantity of soils and to carefully protect and conserve agricultural land.

Soil Erosion: How it occurs. . .

Erosion is the process which moves soil from one location to another by wind, water, or other natural action. It is a natural process until accelerated by our actions. It has several harmful effects. Farmers harvest a smaller crop per acre, fields become less productive if large gullies develop, and silt from eroded soil builds up in our waterways, causing more frequent flooding, higher costs for navigation, and degradation of water quality.

Water erosion usually starts with the impact of a raindrop on the soil particles. Similar to an explosion, the force of the drop cause soil particles to dislodge, and gravity pulls them downhill. Millions of raindrops cause millions of soil particles to move.

It is usually easy to find evidence of soil erosion that is caused by moving water; soil scientists have identified three types: sheet, rill, and gully.

Sheet erosion is the most difficult to see. It is the gradual wearing away of a thin, uniform layer (or sheet) of soil. - One ton of soil eroded from a one acre field is approximately the thickness of a sheet of paper. - There are no channels formed by the moving water. Sheet erosion occurs where there is not enough vegetation covering the soil to stop erosion completely, yet there is enough cover to prevent rill erosion. It is seen as muddy runoff water.

Rill erosion occurs on slopes where the runoff water accumulates into small channels. Rill erosion can be seen as many small channels of a few inches depth. Yet the channels are not large enough to interfere with the movement of farm equipment. Rill erosion occurs on slopes that are gentle or have little protective vegetation.

Gully erosion is the most dramatic form of soil erosion. Gullies form when the runoff water accumulates into channels to grow wider and deeper. Gullies may become too deep for farm equipment to cross. Gully erosion occurs on steeper slopes which have little or no vegetation.

Although gully erosion is the most evident, sheet and rill erosion are a greater concern. Sheet and rill erosion remove an average of 5 tons of soil from every acre of cultivated cropland each year. (A pickup truck can hold about 1-2 tons of material; an acre is about the size of a football field.)

In addition to sheet, rill, and gully erosion by water, soil is also eroded by the action of the wind. Most wind erosion occurs in areas of high prevailing wind speeds which are relatively flat and open. The soils have a smooth surface and are composed of particles that are easily moved by the wind. In addition, there is limited vegetation cover. A good way to control wind erosion is to plant a cover crop or windbreak that decreases the speed of the wind at the soil surface. Windbreaks can be rows of evergreen trees planted at a perpendicular angle to the wind, narrow bands of tall grasses, or grasses planted in fields instead of row crops.

Soil Erosion: How it affects us...

Almost no one benefits from soil erosion. It is costly to us all. It often raises the price of food. It increases the possibility of flooding, increases the need for fertilizer (to replace lost nutrients) and pesticide use. It increases the need for dredging of our waterways. It decreases the quality of our surface water. The most dramatic example of how soil erosion can affect the individual and society occurred during the 1930's - the Dust Bowl.

Before the 1930's much of the tough, drought resistant grasses that grew naturally in the Plains States, were plowed under. In place of these grasses - which were ideally suited for this environment - corn and wheat were planted. These crops were less drought-resistant and could not protect the soil from erosion as effectively as the native grasses. In addition, some of the rangeland in the Plains was overgrazed by cattle and sheep. This left weakened vegetation and bare soil.

In 1931, the first of several droughts of that decade hit the region. Crops failed as the weakened plants died. Vast areas of bare soils were exposed to the strong prairie winds. The autumn of 1933 marked the first of many dust storms. Soil was picked up and blown as far away as Washington D.C., and to other East Coast areas. From two inches to one foot of topsoil were lifted and eventually piled up over roads, houses, farm equipment, and trees. The summer temperatures were hot, the weather dry, and the sun shown blood red through the gray haze caused by the dust.

The worst erosion occurred in parts of Colorado, New Mexico, Kansas, Oklahoma, and Texas. Out of disgust and despair, thousands of farm families left the Dust Bowl areas. Some headed west to California and its lush, green agricultural valleys. Some became migratory farm workers living in encampments as they followed the harvests. Many eventually found jobs in cities or started over in farming.

In his novel "The Grapes of Wrath", John Steinbeck describes the dust storms and the effects of runaway erosion on people.

Why conserve soils?. . .

There are many reason why we should conserve soils:

Humanitarian Reasons -

These reasons concern human welfare and social reform, in particular providing an adequate supply of nutritious food for the hungry. The U.S. has traditionally been the largest contributor of food aid to developing nations. Food constitutes about 30 percent of all our foreign aid. Providing enough for exports, food aid, and domestic use requires a high soil productivity.

Economic Reasons -

Economic reason concern expenses incurred on the farm to produce food, the cost of goods to the consumer, and exports. Loss of soil productivity through poor management practices and erosion creates the need for continually increasing outside inputs into the farming system (fertilizers, pesticides, and other soil additives) - this increases the cost to the farmer and long term decreases the productive capacity of the soil.

Stewardship Reasons -

Stewardship refers to our responsibility to manage natural resources to assure an adequate supply for future generations. Stewardship connotes the practice of wise use, conservation, and preservation.

Environmental Reasons -

Soils should also be conserved for environmental reason. It is a societal benefit to have a clean environment with adequate supplies of pure drinking water, clean air, productive soils, and recreational areas.

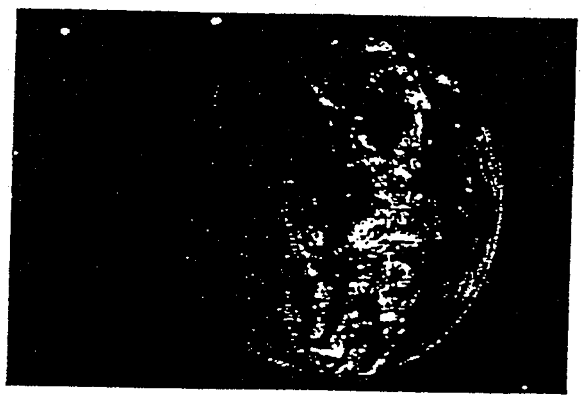
Aesthetic Reasons -
The environment should be maintained as a beautiful site to experience. Most people would like to avoid unsightly scars and bare eroded soils on the landscape. Green fields, clear streams, blue skies ease our minds and reduce our stress.

Soil Conservation Practices . . .
Soils can be conserved when crop rotations and conservation tillage are used. Crop rotation refers to planting different crops in the same field in future years. For example, a rotation of one year of corn, one year of wheat, and one or two years of hay is used in a field instead of continuous corn. Conservation tillage is the practice of harvesting only the grain from a field and leaving the remaining parts of the plant on the soil. This provides mulch during the off season and reduces erosion. Next year the new crop is planted through the mulch without plowing under the old plant material.

Growing enough food: Sustaining soil productivity. . .
The United States is the world's leading exporter of agricultural goods. Since 1950, the total amount of agricultural goods produced has changed by over 150 percent. At the same time, the number of acres harvested has stayed about the same while the number of farm workers dropped from 12.2 percent to 2 percent of the labor force. Technology largely accounted for the increase: better hybrid seed and animal stocks; more powerful machinery; a greater use of agricultural chemicals; and new tillage practices. This technology has resulted in increased yield of crops per acre and greater farm output per hour of labor. This means larger amounts of food can be produced at lower prices. For instance and average United States family (3.28 persons) spends 17 percent of its annual budget for food. A similar family in Japan spends 25 percent; and in Russia, 50 percent. This use of advanced technology also allows us to export the products of 2 out of every 5 acres harvested.

But this high level of productivity has been attained at a cost. The quality of soils has paid the price with increased levels of soil erosion and decreased amount of humus (highly decomposed plant and animal residue that is part of soil). Soils are also experiencing salt and alkaline chemical buildup from irrigation; compaction under the tires of heavy equipment; and possible contamination from acid rain and increased use of agricultural chemicals.

Over the past 50 years, soil productivity has increased because technology has overcome the reduction in soil quality. Can this situation continue into the future? Indications are changes in farming practices are needed, however, scientists, farmers, agribusiness, policy makers, and consumers are divided in their opinions. It is clear, for ours and future generations, we must maintain our soil productivity in order to grow food for ourselves and millions of other people around the world.



COVER CROPS

A cover crop is a crop of close-growing grasses or legumes established for seasonal protection of the soil and soil improvement. It is usually planted for soil protection when regular crops are not grown on a tract of land. Rye, clover and vetch are examples of cover crops. Cover crops improve soil organics, increase infiltration, improve water quality, and build soil structure.

Many benefits may be derived from the use of grasses and legumes for soil cover and soil improvement. These benefits will vary with the crop selected and its use in the cropping system.

Wind/Water Erosion - The ground cover provided by these plants will reduce raindrop splash erosion and run-off, increase the infiltration of water, and prevent wind erosion especially on sandy or muck soils.

Within the Soil - Production and incorporation of these plants will add organic matter, improve the soil tilth. minimize the leaching of plant nutrients and remove excess moisture.

Weed Control - Established cover crops can improve weed control be competing with and shading out undesirable weed species.

Less Use of Fertilizer - Small grains such as wheat, oats. and rye can be used as cover crops. They can capture and hold excess nitrogen not utilized by the previous crop. This fertilizer can then be made available for a future crop. This is an environmental benefit legumes can naturally produce nitrogen fertilizer. A producer can then plant a crop that requires nitrogen, therefore utilizing this natural process. This will result in protecting our environment by less use of commercial fertilizer, and an economical benefit to the producer by having to purchase less inputs.

Improved Crop Yield - In past Kentucky experiments, winter cover used with no-till planting markedly increased corn yield. For instance, 3-year average continuous corn yields were 8 bushes per acre greater when planted into a winter cover of rye and 25 bushels per acre greater when planted into hairy vetch than yields were credited to the extra nitrogen (N) received from the hairy vetch cover crop. In Michigan, similar yields can be recognized when sweet and mammoth clover are seeded as a cover crop. A sweet clover crop will add 50 to 80 pounds of nitrogen per acre, if burned off a year after establishment (preferably in early fall).

Wildlife Benefit - Cover crops also provide valuable feed and nesting opportunities for several species of wildlife including deer, quail, rabbits, and pheasants.

Summary - Too much of Michigan cropland acreage are left unprotected and exposed to be ravaged by water and wind, causing off-site damages to many lakes and streams by depositing pollutants like sediment and nutrients. Based on the most recent National Resources Inventory made in Michigan there is an estimated 3,448,000 acres of cropland in need of conservation treatment through various conservation practices, including winter cover crop, to insure the productivity on these acres in the future.

CROP ROTATION - Crop rotation is the practice of alternating different species of crops grown on a regular schedule. It is used to control various problems including erosion, insects, disease, and to reduce the risk of water contamination by agricultural chemicals and fertilizer.

Wind and Water Erosion Control - Erosion from both wind and water is greatly reduced with the regular intervention of a sod crop or cover crop.

Insect and Disease Prevention - Many diseases and insects are specific to certain plants, so if you plant a crop in the same area year after year, you increase the risk of infestation from the previous year's crop. Crop rotation can then result in the reduction of pesticide application.

Increased Yields - Some plants produce a toxin that decrease or prevents that same plant from growing in the same area.

Improved Soil Condition (Tilth) - Some crops produce more fodder or plant residue, which increases soil organic matter, other plants have deeper rooting systems, both of these improve soil structure so water and air can flow easier.

Less Fertilizer Use - Some plants such as alfalfa or soybeans can naturally produce nitrogen fertilizer. By rotating to a crop that requires a high rate of nitrogen for growth such as corn. The Producer can utilize the natural nitrogen left over, therefore, benefiting both economically and environmentally.

Additional Resources:

Agriculture and the Environment - The 1991 Yearbook of Agriculture.

Crop Yields as Affected by Cropping Systems and Rotation. (MSU /Extension Publication RR5216).

INTEGRATED PEST MANAGEMENT (IPM)

Integrated Pest Management is the use of all appropriate and economical strategies to manage pests and their damage to acceptable levels with the least disruption to the environment. Using a variety of tactics to manage a pest problem tends to cause the least disruption to nontarget organisms and the surroundings at the application site. Relying on pesticides alone can cause pests to develop resistance to pesticides and may cause outbreaks of other pests by killing beneficial organisms. IPM provides the producer with a diverse pest management program that avoids sole reliance on one technique and its potential shortcomings. Examples of pests include: insects, diseases, animals, weeds and volunteer plants from previous crops.

IPM involves monitoring, identifying pests, determining threshold levels, selecting management tactics and evaluating the results. To solve pest problems, farmers and advisors must:

* Determine pest management goal(s).
* Detect, identify and quantify pest populations or their damage and determine whether control is warranted.
* Know what management strategies are available. (Host resistance, cultural control, biological control, mechanical control, sanitation and chemical control).
* Evaluate the benefits and risks of each tactic or combination of tactics.
* Choose a strategy that will be most effective and will cause the least harm to people, nontarget organisms and the environment.
* Use each tactic in the strategy correctly.
* Observe local, state and federal regulations that apply to the situation.
* Evaluate the strategy and make adjustments as necessary.

ADDITIONAL RESOURCES:
Michigan Department of Agriculture "Right to Farm" guideline on pesticides

MSU - Extension - Publications catalog and county offices
USDA - NRCS and conservation district offices

INTEGRATED CROP MANAGEMENT

Integrated crop management is a systems approach to food production. ICM utilizes and integrates a number of conservation practices to lessen the environmental impact of agriculture. The successful application of ICM must also improve farm profitability. This is accomplished due to the efficient/reduced use of commercial fertilizers, pesticide and manure resources. Soil quality/health is improved through the use of cover crops and crop residue management, livestock rotational grazing and crop rotations.
The use of integrated crop management relies on the principles and process described above for integrated pest management. The eight steps listed are utilized in the process or applying the various components/practices used in ICM.

Although this systems approach is relatively new in agricultural operations, many of the individual practices have been used for years. The environmental and economic benefits are greatly enhanced due to the synergistic effect with the combined application of these practices.

ADDITIONAL RESOURCES:

MDA's "Right to Farm" Nutrient Management Guidelines
MSU-Extension Publication catalog and county offices
USDA-NRCS and conservation district offices
E-896 N-P-K Fertilizers (Ext. Bulletin)

ROTATIONAL OR CONTROLLED GRAZING

The basic concept of managed rotational grazing is to use the animals to manage pasture growth and move them so they always have high quality grass or forage.

Animals are confined in a lot or paddock at a high stocking density for a short period of time, usually one to three days, then moved to a fresh paddock. Grass in the grazed paddock is then allowed to regrow while the animals are moved through other paddocks in the pasture.

Enough growth is left, usually 2-4 inches, when the animals are removed from the paddock to allow rapid regrowth of the grass without depleting energy reserves stored in the roots. When the animals are returned to the paddock, the grass is at a palatable nutritious growth stage.

LIVESTOCK MANURE MANAGEMENT/COMPOSTING

There still exists the perception that manure is a waste and not a resource to be utilized for its nutrient and organic values. This is exemplified by the title of "Waste Management/Application" that various agencies have given this area. This is changing appropriately to manure nutrient management, since with proper credit, many farms can eliminate off-farm purchases of fertilizers.

There are a number of various methods and storage systems used by livestock farmers to manage manure. These vary from the traditional daily scrape and haul, to liquid storage - haul or irrigate, to flushing to separators, to composting. There are numerous factors that influence the decision as to what system an operator implements on their farm. The most critical are the ease of management, initial investment along with the daily operating costs and the labor/time requirements.

The structural/earth pit (liquid) systems are the most expensive to build and maintain due to the pumps, tank wagons and fuel requirements. A composting management system costs less than one half of a liquid system. The major investment is in a turner, which will last 3-4 times longer than the equipment used with a liquid system. The cheapest system is with rotational grazing where the cattle do all the work. The drawback is the limited distribution, unless all crop fields can be grazed in the crop rotation and are close to the main buildings.

The rotational grazing and composting systems are somewhat new to livestock operations. Although grazing has been used for years, the intensive/rotational approach does a better job with forage and manure management. Although there may be some loss in production, there is an increase in net return and available time. These qualities have increased the use of grazing throughout Michigan, and with any size operation.

Whether grazing is utilized or not, the composting of livestock manure is the next best choice for manure management. In the past four years composting has been introduced to producers as a viable alternative to the more expensive systems. With the addition of a carbon source (straw, sawdust, leaves, apple pumice, etc) and aeration, the raw manure is changed to humus in about 50-60 days. The water in manure is removed, reducing the volume to 30-40% of the original, eliminating numerous trips to the fields. Flies, slop on the road, odors and labor are greatly reduced. The end project of compost is easier to handle, weed free and a desirable product of consumers for lawns and gardens and bulk or bag sale off the farm.

ADDITIONAL RESOURCES:

Composting Information Packet
Michigan' s Right to Farm - Manure Management and Utilization Guidelines
MSU- Extension Publication Catalog and County Office
USDA-NRCS and Conservation District Offices

Depending on the management intensity, the benefits from rotational grazing can vary from farm to farm, however, all grazing systems can enhance our environment.

Less Erosion - good ground cover, such as pasture decreases water and wind erosion. Grazing can be a productive use of our hilly or more highly erodible lands, keeping them protected in permanent pasture.

Improved Soil Quality - As with any crop rotation program, switching a field from row crops to pasture for a year or two can reap various benefits. The grass can improve the soils organic fertility. A break from row crops will also interrupt crop pest life cycles, resulting in less pesticides.

Energy Savings - Rotational grazing allows the animals to harvest their own feed. Such a system avoids the conventional practice of harvesting feed mechanically, storing it, and then moving it to the animals, who remain stationary. Instead, the livestock are moved to the forage during its peak production periods.

Farmers spend less time driving tractors and more time walking the animals to a new paddock. Also, for the most part, animals spread their own manure. This results in considerable fuel savings.

Lower Investment - By building fences to facilitate grazing, an operator can save a substantial amount of capitol compared to a confinement system. Less machinery for harvesting the crops will also result in significant savings.

References for this section:

Appropriate Technology Transfer for Rural Areas
(ATTRA)
P.O. Box 3657
Fayetteville, AR 72702
(800) 346-9140

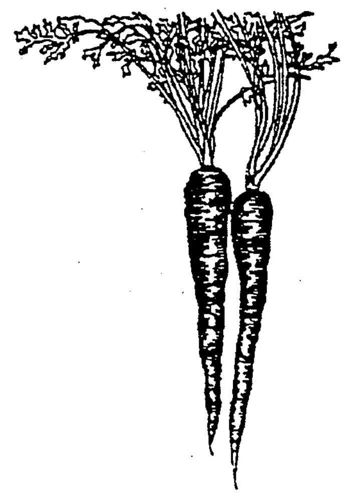
The Stockman Grass Farmer
P.O. Box 9607
Jackson, MS 39286
(800) 748-9808

Bill Bivens
MSU Extension Agricultural Agent - Jackson Co.
(517) 788-4292 ext. 319

Larry Dyer
Ecological Agronomist, NRCS

ORGANIC FARMING

Organic farming is a special type of sustainable farming where growers do not use synthetic chemicals to raise their crops and animals. To be classified as an Organic Grower of Michigan (OGM) , a grower must meet the following criteria: Growers classified as certified have not used any synthetic chemicals on their land for at least the past three years and have instituted a system of sustainable and environmentally sound production practices that enhance soil life and create habitat for beneficial insects and wildlife. Transitional growers have less than three years of using no chemicals on their land and are still working into rotation programs, green manuring and other cover cropping practices to control weeds and recycle nutrients back into the soil without resorting to herbicides and synthetic fertilizers. Today there are more than 150 certified Michigan organic growers who manage organic farms from 4 to 1800 acres.



Organic certification standards (1992) define a common set of principles inherent in organic farming: encouragement of good stewardship of the earth, production practices that work in harmony with natural ecosystems, and developing stability through diversity, complexity, and recycling of energy and nutrients. In addition, synthetic and toxic materials detrimental to soil and ecosystem health are prohibited. Many natural food stores are requiring organic certification for organic food sales.

POLLUTION PREVENTION IN AGRICULTURE

Over the past few decades, agricultural technology has maximized efficiency and productivity. We have seen a steady pattern of larger, more specialized farms with a shrinking number of growers. Like other human impacts, the benefits of these changes have also brought adverse consequences. An abundant, low cost and nutritious food supply, farm mechanization, improvements in plant and animal breeding and pest control has increased our reliance on non-renewable fossil energy, fertilizers and fuels, and brought environmental and natural resource degradation.

Our traditional environmental focus has been on pollution control, what to do with the wastes or pollution after it has been generated. As a result, we have made great strides in cleaning up our water and air from point sources or direct discharges of wastes. Now, a new approach called pollution prevention in which the focus is to not generate waste, or at a minimum, recycle or reuse.

Pollution prevention is a component of Sustainable Agriculture, where profitability, productivity, environmental quality and rural community are balanced. Typically sustainable farms protect water, soil, air and wildlife by:

- reducing the use of pesticides whether by substitution with cultivation and rotation or other management strategies or by improved application and scouting;
- managing manures and legumes for both crop nutrients and soil building (erosion reduction as well as water quality protection);
- practicing longer crop rotations which include grasses and legumes in addition to row crops and small grains (reduces use of synthetic fertilizers and reduces erosion and fuel consumption); and,
- adopting low-input livestock production systems which reduce energy consumption for machinery and buildings.

Farmers and their families are directly affected by the quality of the water, soil, air and other natural resources on their farms. Today, Michigan agriculture recognizes it's actions, like all other human activities, are part of the nonpoint source pollution (NPS) problem and that they need to be part of the solution. Some strides have been made in Michigan agriculture to incorporate voluntary pollution prevention efforts, a few specific examples include:

- The Farm Assessment System (Farm*A*Syst). This voluntary program helps growers assess various risks on their farm. The assessment consists of 21 worksheets for well condition/location, pesticide storage and handling, petroleum product storage, livestock yardwaste management, hazardous wastes and other related topics.

- Integrated Pest Management (IPM). IPM blends chemical, biological and cultural pest control practices to produce a sound economic and environmental strategy. This practice can lessen our dependence upon nonrenewable resources and can make more efficient use of our on-farm resources while integrating, where possible, natural biological cycles and controls. An IPM program could include such practices such as scouting, selection of resistant varieties, pest suppression rather than elimination based on economic thresholds, selection of a pesticide that protects the natural enemies of the pest being controlled, utilizing appropriate application techniques, considering alternative tillage practices and modifying irrigation scheduling.

- Integrated Crop Management (ICM). Promotes the combination of pests and nutrients because they are usually applied together to promote crop production and retard competition from weeds, disease, insects, other invertebrates and vertebrates. Nutrient management addresses the amount, form, placement and timing of applications of plant nutrients. (Including organic and biological materials, commercial fertilizer, legume crops and crop residues) All nutrient applications should be based upon a soil and/or tissue testing program. Fertilizer and pesticide equipment should be calibrated and inspected for wear and damage each spray season. Manure spreaders should be calibrated every five years.

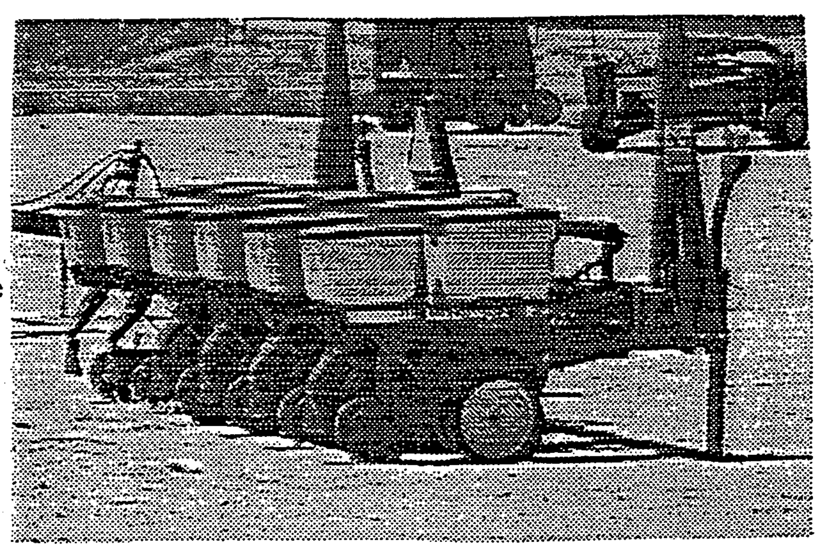
- Intensive Rotational Grazing (IRG). IRG efficiently utilizes the on-farm lands as pastures. This practice brings less off-farm feed and commercial fertilizer purchases, less or no manure handling, thereby decreasing or eliminating hauling, storage and transportation costs, the use of manure as a fertilizer and soil conditioner and little or no machinery is needed. Fencing livestock out of the streams, or reducing their access to surface waters decreases soil erosion and sedimentation.

- Filter Strips are vegetative (perennial grasses/legumes) barriers that should be used in areas of high environmental risk, such as: fields adjacent to surface waters; soils with high leaching indexes; irrigated fields; highly erodible soils; and shallow aquifers.

- Composting is a method for converting manure into soil-building humus while saving time, money and fuel. It also reduces agricultural wastes and creates more stable forms of nitrogen for use in growing crops.

- Irrigation Water Management Systems include the BMPs of controlled irrigation scheduling, method of application, and the management of drainage water. Irrigation Scheduling provides accurate measurements of application timing, amount and rate.

- Crop Residue Management utilizes the plant residue (dead mulch left from the previous crop or a live covercrop that has been suppressed) to maintain ground cover, thus decreasing soil erosion, especially during the period from harvest until the following crop provides protective cover.



Conservation Tillage (leaves a minimum of 30% residue on the soil surface after planting) is used to achieve crop residue management. (No-till, Mulch-till, Strip-till or Zone-till, Ridge-till)

- Conservation Cropping Sequence utilizes crop rotations. This practice can reduce buildup of nitrogen and reduce soil loss. An example would be rotating soybeans, that requires little or no nitrogen, with corn which requires large amounts of nitrogen.

- Agrichemical Containment Facilities that have adequate primary and secondary containment. These areas include chemical/fertilizer/petroleum storage, handling, mixing and un/loading, transport and cleaning/storage of equipment. Primary containment holds contents in approved secured and clearly marked storage containers, and segregates the agrichemicals. Secondary containment includes the structures built to provide a safety back-up system that will prevent them from moving into the soil, surface or groundwater. Portable mixing and loading pads provide secondary containment in the field.

- Container Recycling program provides a mechanism to collect empty, clean plastic pesticide containers for processing at state wide collection sites. Materials generated by collection and processing are recycled into a variety of production resources, while reducing the number of containers disposed at landfill sites.

- Site specific management is an emerging technology that allows farmers to adjust their fertilizers, herbicides and seeding rates on-the-go to match the soil characteristics as he/she drives over them. This includes the use of earth orbiting satellites and in-tractor computers. Precision agriculture is a broader concept that includes site specific farming, along with the type, rates, timing, and method of applications of chemicals, type of machinery selection, and quality control of equipment. Although precision agriculture is in its initial phase, there is great hope that it will help farming become even more efficient, both in profit and for the environment.

- Source reduction assessments, (AGRITAP) is a new pollution prevention tool designed for the agribusiness sector. It is a free, voluntary confidential visit made by a retired agribusiness professional. Although waste reduction is the primary focus, reuse and recycling opportunities are also suggested.

Because pollution prevention can increase profitability while decreasing environmental degradation; these technologies are rapidly growing in many industries. Overall environmental quality is achieved when a variety of systematic approaches are utilized. Pollution prevention should be viewed as a component of an overall strategy of environmental protection which also includes pollution control approaches that have been developed as a result of such laws as the Resource Conservation and Recovery Act, the Clean Air Act and the Clean Water Act. The adoption of these and other preventative measures will ensure a safe and sustainable future for our environment, our state and beyond.

Pollution Program, MDEQ, SWQD, NPSU, (517) 373-2867.
MSU IPM Fact sheets

AGRICULTURAL OPPORTUNITIES

How do you suppose farmers have been able to improve their industry? With EDUCATION......and people like yourself. Whether you enter production agriculture or the legislature, you more than likely will have an impact on agriculture. We need you to be aware of the full impact agriculture has on the local, state and national economy.

Agricultural career opportunities:

Scientist, engineers, and related specialists

Agricultural Engineer
Animal Scientist
Biochemist
Cell Biologist
Entomologist
Food Engineer
Forest Scientist
Geneticist
Landscape Architect
Microbiologist
Molecular Biologist
Weed Scientist
Nutritionist
Agronomist
Resource Conservationist
Pathologist
Physiology
Plant Scientist
Rangeland Scientist
Quality Assurance Specialist
Research Technician
Statistician
Toxicologist
Veterinarian
Waste Management Specialist
Water Quality Specialist
Natural Resources Scientist
Soil Scientist
Biologist

Managers and Financial

Accountant
Appraiser
Auditor
Manager
Banker
Business Manager
Contract Manager
Credit Analyst
Retail Manager
Economist
Financial Analyst
Government Program Manager
Grants Manager
Human Resource Development
Food Service Manager
Insurance Agency Manager
Insurance Risk Manager
Landscape Manager
Policy Analyst
Customer Service Manager
Research and Development Manager
Wholesale Manager

Marketing, Merchandising, and Sales Representative

Account Executive
Commodity Broker
Export Sales Manager
Grain Merchandiser
Insurance Agent
Market Analyst
Purchasing Manager
Sales Representative
Advertising Manager
Consumer Information Manager
Food Broker
Forest Products Merchandiser
Landscape Contract
Marketing Manager
Real Estate Broker
Technical Service Representative

Communication and Education Specialists

College Teacher
Conference Manager
Editor
Educational Specialist
Illustrator
Journalist
Training Manager
Public Relations Representative
Radio/Television Broadcaster
Computer Software Designer
Computer Systems Analyst
Cooperative Extension Agent
High School Teacher
Information Specialist
Information Systems Analyst
Personnel Development Specialists

Social Services Professionals

Career Counselor
Conservation Officer
Consumer Counselor
Food Inspector
Naturalist
Park Manager
Regional Planner
Regulatory Agent
Youth Program Director
Caseworker
Community Development Specialist
Dietitian
Labor Relations Specialist
Nutrition Counselor
Outdoor Recreation Specialist
Peace Corps Representative
Rural Sociologist

Agricultural Production

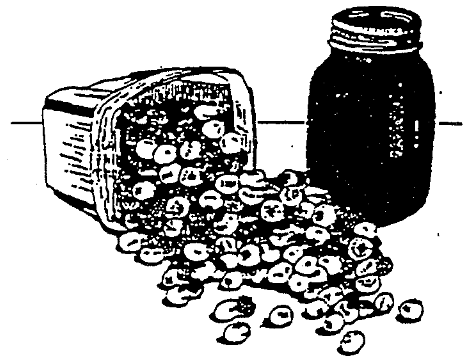
Aquaculturalist
Feedlot Manager
Greenhouse Manager
Farm Manager
Rancher
Viticulturist
Farmer
Forest Resources Manager
Fruit and Vegetable Grower
Nursery Products Grower
Turf Producer
Wildlife Manager

Americans spend 11.4% of their personal income on food, compared with:

Japan....21% **Greece....42%** **Italy....26%** **China....53%**

In 1993 Americans ate, per capita:

64 lbs. of beef, veal and lamb
50 lbs. of pork
53 lbs. of poultry
17 lbs. Of fish and shellfish
19.5 dozen eggs
264 lbs. of fruit
102 lbs. of vegetables



There are more than 150,000 U.S. supermarkets, and they offer over 26,430 different foods.

A family of four eats about 5,000 pounds of food each year.

Non-food uses

Within 25 years, non-food uses for agricultural products are expected to create 750,000 new jobs, increase farm income by $30 billion per year and contribute $100 billion annually to the economy.

Seven plants in the U.S. used cheese whey to make ethanol in 1993.

Glycerin, a by-product derived from vegetable oils and animal fats, has more than 1,500 commercial applications from cosmetics to drugs.

Environmentally friendly biodegradable plastics are being produced from corn and other crops to make adhesives, coatings and films.

Technology

Today's crop protection products prevent 50% of our crops from being lost to bugs, weeds and plant diseases each year.

Integrated Pest Management enables farmers to employ environmentally friendly practices and the most efficient use of inputs in farming methods.

Farmers use reduced tillage practices on more than 72 million acres to prevent erosion.

AMERICAN AGRICULTURE - FURTHER BACKGROUND

The Economy

Each year one American farmer provides food and fiber for 129 people - 97 in the U.S., and 32 abroad. U.S. farmers and ranchers produce more than 200 raw commodities yearly for domestic and export markets.

American agriculture employs 21 million people or 18.5 percent of the labor force in:

wholesaling and retailing	50%
farm production	20%
marketing and processing	15%
agribusiness	12%
farm supplying	3%

By the year 2000, agriculture is expected to generate 25% of the U.S. gross domestic product.

One-fourth of the world's beef, and nearly one-fifth of the world's grain, milk and eggs are produced in the U.S.

About 17 % of raw U.S. agriculture products are exported yearly, including:

83 million metric tons of cereal grains
1.6 billion pounds of poultry
1.4 million metric tons of fresh vegetables

Today's Farm Profile

The U.S. has less than seven percent of the world's landmass but produces 13% of the world's farm commodities.

Less than 5 million people live on the farm today, compared to 29.8 million in 1900.

Families or individuals own 87% of today's farms, totaling 65% of total farm acreage.

Women are involved in the operation of more than 130,000 farms.

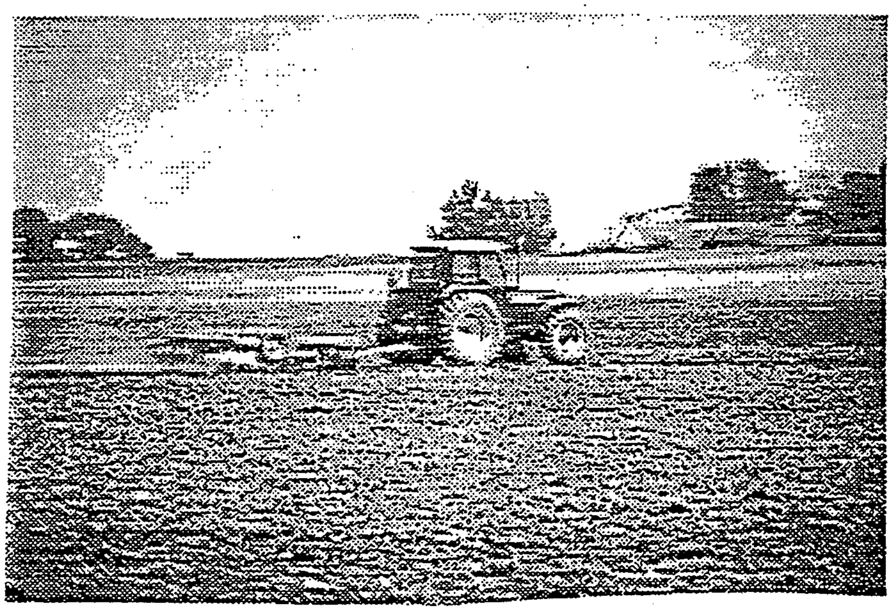
American Consumer

Americans spent $606 billion for food in 1992, 45% going to away-from-home meals and snacks.

With modern methods, one acre of land in the U.S. (about the size of a football field) can produce:

42,000 lbs. of strawberries
OR 24,000 lbs. of navel oranges
OR 11,000 heads of lettuce
OR 25,400 lbs. of potatoes
OR 8,900 lbs. of sweet corn
OR 640 lbs. of cotton lint.

(This information was supplied by the Agriculture Council of America, Washington, D.C.)



GLOSSARY

Acre: A parcel of land, containing 4,840 square yards or 43,560 square feet.

Aeration: The process of creating air space in the soil.

Animal Unit: A unit of measurement of livestock, the equivalent of one mature cow weighing 1,000 lbs. The measure is used in making comparisons of feed consumption. Five mature ewes are also considered an animal unit.

Animal Unit Month: The amount of feed needed by one animal unit for good growth and production during one month.

Available Nutrients in the Soil: The part (%) of the supply of the required plant nutrients that can be taken up by the plants at rates and amounts required for optimum plant growth.

Beneficial Species: Plants and animals that make a positive contribution to a crop.

Browse: Small woody plants with tender shoots used as feed by goats, sheep and cattle.

Bovine: Pertaining to cattle.

Calf: Young (Up to yearling or sexual maturity) animal of the bovine species.

Cash Crop: Any crop that is sold off the farm to yield ready cash.

Compost: The process of decomposing organic wastes such as table scraps, straw, or manure for use as fertilizer.

Confinement: Livestock kept in "dry-lot" for maximum year-round production.

Crop Nutrition: The process by which nutrients are made available to plants through the maintenance and addition of minerals and organic matter.

Crop Rotation: The practice of changing the type of crop grown in a particular field from season to season.

Complete Fertilizer: A fertilizer containing the three macro nutrients (Nitrogen, Phosphorous, and Potassium) in sufficient amounts to sustain plant growth.

Cow: Mature female bovine, usually 2 years of age.

Cull: Remove from the herd or flock, usually undesirable and/or inefficient (unprofitable) breeding stock.

Erosion: Soil movement through water and wind action.

Forage: Plants used for feed by livestock.

Germination: The process of a seed becoming a plant.

Grade: An animal of common or mixed breeding; an animal which is not a purebred.

Graze: Livestock and wild animals consume standing vegetation.

Green Chop: Mechanical harvesting (gathering and chopping) of forage crops (entire plant) and delivery to feed bunks for livestock consumption. Animals are kept in confinement in "dry lot" corrals.

Green Manure: Growing legumes, such as peas, that fix nitrogen into the soil. When the crop is harvested or ploughed back into the soil, the nitrogen remains in the topsoil, available for the next crop.

Heifer: Young (less than 3 years) female of the cattle species that has not borne a calf.

Hybrid Vigor: The tenancy of crossbred offspring to perform better, in certain traits, than the average of their parents.

Legumes: Crops that draw nitrogen into their roots such as peas and beans.

Low or zero-tillage: Minimizing ploughing and ground breaking in order to deter erosion.

Mixed Farming: The practice of growing crops and raising livestock on the same farm.

Net Energy: Measurement of digestible energy that is actually used by an animal for maintenance and production.

Nutrient: A chemical element or compound that is essential for normal body metabolism, growth and production. Includes: carbohydrates, fats, proteins, vitamins, minerals and water.

Organic Farming: A farming technique that avoids all synthetic chemical inputs.

pH: The relative level of acid or base, as indicated by the presence of hydrogen ions.

Plough-down Crops: Crops that are ploughed back into the soil and allowed to decompose in order to fertilize the soil. Some, such as peas, can also produce a harvestable crop.

Pre-emergent: Applied to a field before the plant has broken the top of the soil.

Post Emergent: Applied after the plant has emerged from the soil.

Purebred: An unadulterated or pure strain of any breed of livestock.

Silage: Prepared by chopping green forage (grass, legumes, field corn, etc.) Into an airtight chamber, where it is compressed to exclude air and undergoes an acid fermentation that retards spoilage.

Substrates: The separate layers of the soil.

Till: The cultivation or ploughing of the land.

Top Dressing: Lime, fertilizer, or manure applied after the seedbed is ready, or after the plants are up.

Trace Elements: Elements that are necessary for healthy growth, but in very small amounts.

Value Added Farming: Producing and direct marketing products on the farm, such as producing and selling spaghetti sauce from farm-grown tomatoes. Eliminating the middle man results in higher earnings for the farmer.