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AGRICULTURE

Agriculture (a term which encompasses **farming**) is the process of producing food, feed, fiber and other goods by the systematic raising of plants and animals.

Agri is from Latin ager, meaning "a field", and culture is from Latin cultura, meaning "cultivation" in the strict sense of tillage of the soil. A literal reading of the English word yields: tillage of the soil of a field. In modern usage, the word Agriculture covers all activities essential to food/feed/fiber production, including all techniques for raising and processing livestock. Agriculture is also short for the study of the practice of agriculture – more formally known as agricultural science. The history of agriculture is closely linked to human history, and agricultural developments have been crucial factors in social change, including the specialization of human activity.

Farming refers to a wide range agricultural production work, covering a large spectrum of operation scales (acerage, output, etc), practices, and commercial inclination. At one end of this spectrum, the subsistence farmer farms a small area with limited resource inputs, and produces only enough food to meet the needs of his/her family.

At the other end of the spectrum is commercial intensive agriculture, including industrial agriculture. Such farming involves large fields and/or numbers of animals, large resource inputs (pesticides, and fertilizers, etc.), and a high level of mechanization. These operations generally attempt to maximize financial income from produce or livestock.

Modern agriculture extends well beyond the traditional production of food for humans and animal feeds. Other agricultural production goods include cut flowers, ornamental and nursery plants, timber, fertilizers, animal hides, leather, industrial chemicals (starch, sugar, ethanol, alcohols and plastics), fibers (cotton, wool, hemp, and flax), fuels (methane from biomass, biodiesel) and both legal and illegal drugs (biopharmaceuticals, tobacco, marijuana, opium, cocaine).

The 20th Century saw massive changes in agricultural practice, particularly in agricultural chemistry. Agricultural chemistry includes the application of chemical fertilizer, chemical insecticides (see Pest control), and chemical fungicides, soil makeup, analysis of agricultural products, and nutritional needs of farm animals. Beginning in the Western world, the green revolution spread many of these changes to farms throughout the world, with varying success.

Other recent changes in agriculture include hydroponics, plant breeding, hybridization, gene manipulation, better management of soil nutrients, and improved weed control. Genetic engineering has yielded crops which have capabilities beyond those of naturally occurring plants, such as higher yields and disease resistance. Modified seeds germinate faster, and thus can be grown in an extended growing area. Genetic engineering of plants has proven controversial, particularly in the case of herbicide-resistant plants.

Engineers may develop plans for irrigation, drainage, conservation and sanitary engineering, particularly important in normally arid areas which rely upon constant irrigation, and on large scale farms.

The packing, processing, and marketing of agricultural products are closely related activities also influenced by science. Methods of quick-freezing and dehydration have increased the markets for farm products.

Animals, including horses, mules, oxen, camels, llamas, alpacas, and dogs, are often used to cultivate fields, harvest crops and transport farm products to markets. Animal husbandry means breeding and raising animals for meat or to harvest animal products (like milk, eggs, or wool) on a continual basis. Mechanization has enormously increased farm efficiency and productivity in Western agriculture.

Airplanes, helicopters, trucks and tractors are used in Western agriculture for seeding, spraying operations for insect and disease control, Aerial topdressing and transporting perishable products. Radio and television disseminate vital weather reports and other information such as market reports that concern farmers. Computers have become an essential tool for farm management.

According to the National Academy of Engineering in the US, agricultural mechanization is one of the 20 greatest engineering achievements of the 20th century. Early in the century, it took one American farmer to produce food for 2.5 people.

Today, due to advances in agricultural technology, a single farmer can feed over 130 people. This comes at a cost, however. A large energy input, often from fossil fuel, are required to maintain such high levels of output.

In recent years, some aspects of intensive industrial agriculture have been the subject of increasing discussion. The widening sphere of influence held by large seed and chemical companies, meat packers and food processors has been a source of concern both within the farming community and for the general public. Another issue is the type of feed given to some animals that can cause Bovine Spongiform Encephalopathy in cattle. There has also been concern because of the disastrous effect that intensive agriculture has on the environment. In the US, for example, fertilizer has been running off into the Mississippi for years and has caused a dead spot in the Gulf of Mexico, where the Mississippi empties. Intensive agriculture also depletes the fertility of the land over time, potentially leading to Desertification.

The patent protection given to companies that develop new types of seed using genetic engineering has allowed seed to be licensed to farmers in much the same way that computer software is licensed to users. This has changed the balance of power in favor of the seed companies, allowing them to dictate terms and conditions previously unheard of. The Indian activist and scientiest Vandana Shiva argues that these companies are guilty of biopiracy.

Soil conservation and nutrient management have been important concerns since the 1950s, with the best farmers taking a stewardship role with the land they operate. However, increasing contamination of waterways and wetlands by nutrients like nitrogen and phosphorus are of concern in many countries.

Increasing consumer awareness of agricultural issues has led to the rise of community-supported agriculture, local food movement, Slow Food, and commercial organic farming.

History

Ancient Origins. Developed independently by geographically distant populations, evidence suggests that agriculture first appeared in Southwest Asia, in the Fertile Crescent area of Mesopotamia. Around 9,500 B.C., farmers first began to select and cultivate food plants with specific characteristics. Though there is evidence of earlier use of wild cereals, it wasn't until after 9,500 B.C. that the eight so-called founder crops of agriculture appear: first emmer and einkorn wheat, then hulled barley, peas, lentils, bitter vetch, chick peas and flax.

By 7000 B.C., sowing and harvesting reached Egypt. By 6000 B.C., farming was entrenched on the banks of the Nile River. About this time, agriculture was developed independently in the Far East, with rice, rather than wheat, the primary crop. By 5000 B.C., Sumerians had developed core agricultural techniques including large scale intensive cultivation of land, mono-cropping, organized irrigation, and use of a specialized labour force.

Evidence suggests that Maize was first domesticated in the Americas around 3000-2700 B.C. The potato, the tomato, the pepper, squash, several varieties of bean, and several other plants were also developed in the New World, as was extensive terracing of steep hillsides in much of Andean South America.

Roman agriculture built on techniques pioneered by the Sumerians, with a specific emphasis on the cultivation of crops for trade and export.

Agriculture in the Middle Ages. During the Middle Ages, Muslim farmers in North Africa and the Near East developed and disseminated agricultural technologies including irrigation systems based on hydraulic and hydrostatic principles, the use of machines such as norias, and the use of water raising machines, dams, and reservoirs. Muslims also wrote location-specific Farming manuals, and were instrumental in the wider adoption of crops including sugar cane, rice, citrus fruit, apricots, cotton, artichokes, aubergines, and saffron. Muslims also brought lemons, oranges, cotton, almonds, figs and sub-tropical crops such as bananas to Spain.

Renaissance to Present Day. The invention of a three field system of crop rotation during the Middle Ages, and the importation of the Chinese-invented moldboard plow, vastly improved agricultural efficiency.

After 1492, a global exchange of previously local crops and livestock breeds occurred. Key crops involved in this exchange included the tomato, maize, potato, cocoa, tobacco, and coffee.

By the early 1800s, agricultural practices, particularly careful selection of hardy strains and cultivars, had so improved that yield per land unit was many times that seen in the Middle Ages. With the rapid rise of mechanization in the late 19th and 20th centuries, particularly in the form of the tractor, farming tasks could be done with a speed and on a scale previously impossible. These advances have led to efficiencies enabling certain modern farms in the United States, Argentina, Israel, Germany and a few other nations to output volumes of high quality produce per land unit at what may be the practical limit.

Crops

World production of major crops in 2004

Top agricultural products, by crop types (million metric tons) 2004 data		**Top agricultural products, by individual crops (million metric tons) 2004 data**	
Cereals	2,264	Sugar Cane	1,324
Vegetables and melons	866	Maize	721
Roots and Tubers	715	Wheat	627
Milk	619	Rice	605
Fruit	503	Potatoes	328
Meat	259	Sugar Beet	249
Oilcrops	133	Soybean	204
Fish	130	Oil Palm Fruit	162
Eggs	63	Barley	154
Pulses	60	Tomato	120
Vegetable Fiber	30		

Crop improvement. Domestication of plants is done in order to increase yield, improve disease resistance and drought tolerance, ease harvest and to improve the taste and nutritional value and many other characteristics. Centuries of careful selection and breeding have had enormous effects on the characteristics of crop plants. Plant breeders use greenhouses and other techniques to get as many as three generations of plants per year so that they can make improvements all the more quickly.

Plant selection and breeding in the 1920s and '30s improved pasture (grasses and clover) in New Zealand. Extensive radiation mutagenesis efforts (i.e. primitive genetic engineering) during the 1950s produced the modern commercial varieties of grains such as wheat, corn and barley.

For example, average yields of corn (maize) in the USA have increased from around 2.5 tons per hectare (40 bushels per acre) in 1900 to about 9.4 t/ha (150 bushels per acre) in 2001. Similarly, worldwide average wheat yields have increased from less than 1 t/ha in 1900 to more than 2.5 t/ha in 1990. South American average wheat yields are around 2 t/ha, African under 1 t/ha, Egypt and Arabia up to 3.5 to 4 t/ha with irrigation. In contrast, the average wheat yield in countries such as France is over 8 t/ha. Variation in yields are due mainly to variation in climate, genetics, and the use or non-use of intensive farming techniques (use of fertilizers, chemical pest control, growth control to avoid lodging). [Conversion note: 1 bushel of wheat = 60 pounds (lb) ≈ 27.215 kg. 1 bushel of corn = 56 pounds ≈ 25.401 kg]

In industrialized agriculture, crop "improvement" has often reduced nutritional and other qualities of food plants to serve the interests of producers. After mechanical tomato-harvesters were developed in the early 1960s, agricultural scientists bred tomatoes that were harder and less nutritious. In fact, a major longitudinal study of nutrient levels in numerous vegetables showed significant declines in the last 50 years; garden vegetables in the U.S. today contain on average 38 percent less vitamin B2 and 15 percent less vitamin C.

Very recently, genetic engineering has begun to be employed in some parts of the world to speed up the selection and breeding process. The most widely used modification is a herbicide resistance gene that allows plants to tolerate exposure to glyphosate, which is used to control weeds in the crop. A less frequently used but more controversial modification causes the plant to produce a toxin to reduce damage from insects.

There are specialty producers who raise less common types of livestock or plants.

Aquaculture, the farming of fish, shrimp, and algae, is closely associated with agriculture.

Apiculture, the culture of bees, traditionally for honey-increasingly for crop pollination.

Environmental problems. Agriculture may often cause environmental problems because it changes natural environments and produces harmful by-products. Some of the negative effects are:

- Surplus of nitrogen and phosphorus in rivers and lakes
- Detrimental effects of herbicides, fungicides, insecticides, and other biocides
- Conversion of natural ecosystems of all types into arable land
- Consolidation of diverse biomass into a few species
- Soil erosion
- Depletion of minerals in the soil
- Particulate matter, including ammonia and ammonium off-gasing from animal waste contributing to air pollution
- Weeds - feral plants and animals
- Odor from agricultural waste
- Soil salination
- Agriculture is cited as a significant adverse impact to biodiversity in many nations' Biodiversity Action Plans, due to reduction of forests and other habitats when new lands are converted to farming. Some critics also include agriculture as a cause of current global climate change.

Policy. Agricultural policy focuses on the goals and methods of agricultural production. At the policy level, common goals of agriculture include:

- Food safety: Ensuring that the food supply is free of contamination.
- Food security: Ensuring that the food supply meets the population's needs.

- Food quality: Ensuring that the food supply is of a consistent and known quality.
- Conservation
- Environmental impact
- Economic stability

Agronomy is a branch of agricultural science that deals with the study of crops and the soils in which they grow. Agronomists work to develop methods that will improve the use of soil and increase the production of food and fiber crops. They conduct research in crop rotation, irrigation and drainage, plant breeding, soil classification, soil fertility, weed control, and other areas.

Selective Breeding

Agronomy involves selective breeding of plants to produce the best crops under various conditions. Plant breeding has increased crop yields and has improved the nutritional value of several crops, including corn and wheat. It also has led to the development of new types of plants. For example, a hybrid grain called triticale was produced by crossbreeding rye and wheat. Triticale contains more usable protein than does either rye or wheat.

Agronomy and Soil

Main article: Agricultural soil science

Agronomists study ways to make soils more productive. They classify soils and test them to determine whether they contain substances vital to plant growth. Such nutritional substances include compounds of nitrogen, phosphorus, and potassium. If certain soil is deficient in these substances, fertilizers may provide them. Agronomists investigate the movement of nutrients through the soil, and the amount of nutrients absorbed by a plant's roots. Agronomists also examine the development of the roots and their relation to the soil.

Soil Preservation

In addition, agronomists develop methods to preserve the soil and to decrease the effects of erosion by wind and water. For example, a technique called contour plowing may be used to prevent soil erosion and conserve rainfall. Researchers in agronomy also seek ways to use the soil more effectively in solving other problems. Such problems include the disposal of human and animal wastes; water pollution; and the build-up in the soil of chemicals called pesticides, which are used to kill insects and other pests.

Employment of Agronomists

Most agronomists are consultants, researchers, or teachers. Many work for agricultural experiment stations, federal or state government agencies, industrial firms, or universities. Agronomists also serve in such international organizations as the Agency for International Development and the Food and Agriculture Organization of the United Nations.

Agrophysics

Agrophysics is a new branch of science bordering on physics and agronomy, whose objects of study are the ecosystem and the biological objects affected by human activity, studied and described using the methods of physical sciences.

Agrophysics is closely related to biophysics, but is restricted to the biology of the plants and animals involved in agricultural activities and biodiversity. It is different from biophysics in having the necessity of taking into account the specific features of the research objects, which involves the knowledge of agricultural technology, biotechnology and genetics.

Agrophysics is close to certain fundamental sciences like biology, whose methods and knowledge it utilizes (especially in the field of environmental ecology and plant physiology), and physics, from which it acquires the research methods, especially that of physical experiment and model. The scope of interest of Agrophysics is not focused solely on technical problems of agronomy and on practical implementation of sciences and that are aspects that makes it different from research of agricultural engineering which provides grounds for classifying Agrophysics as the fundamental sciences.

Physical models are ready to solve either local or global aspects of behaviour of the complex systems to be studied, including of energy consumption, food safety etc.

The needs of agronomy concerning the study of the complex soil-plant-atmosphere system lay at the root of the emergnece of Agrophysics. The scope of the branch of science, originally limited to the study of relations within the ecosystem, expanded over time onto influencing the properties of agricultural crops and produce as foods and raw postharvest materials, and onto the issues of quality assessment in food science.

A research centre that is focused on the development of the science and defines its unique character is the Institute of Agrophysics, Polish Academy of Sciences in Lublin.

Agrophysics, utilizing the achievements of exact sciences for solving major problems of agriculture, is involved in study of materials and processes occurring in the production and processing of agricultural crops, with particular emphasis on the condition of the environment and the quality of farming materials and food productions.

Agricultural engineering

Agricultural engineers develop engineering science and technology in the context of agricultural production and processing and for the management of natural resources.

Agricultural engineers design agricultural machinery and equipment and agricultural structures. Agricultural Engineers may perform tasks as planning, supervising and managing the building of dairy effluent schemes, irrigation, drainage, flood and water control systems, perform environmental impact assessments and interpret research results and implement relevant practices.

Some specialties include power system and machinery design; structures and environmental science; and food and bioprocess engineering. They develop ways to conserve soil and water and to improve the processing of agricultural products.

A large percentage of agricultural engineers work in academia or for government agencies such as the United States Department of Agriculture or state agricultural extension services. Agricultural engineers work in production, sales, management, research and development, or applied science.

Intensive farming

Intensive agriculture is an agricultural production system characterized by the high inputs as relative to land area (as opposed to extensive farming). It usually relies heavily on the use of chemical fertilizers, herbicides, fungicides, insecticides, plant growth regulators and pesticides. It is associated with the increasing use of agricultural mechanization, which has enabled a substantial increase in production. Mechanized agriculture has become the key to the success of contemporary farming.

Advantages

Intensive agriculture made it possible to greatly increase productivity during the twentieth century, and helped ensure a proper and stable food supply for the growing population while at the same time decreasing the amount of land needed. Agricultural productivity gains allowed for the reduction in the farming population, mostly in developed countries. Intensification of agriculture from the forties to the sixties is also known as the green revolution. Developing nations often could not profit from the advantages of modern agriculture particularly because of poor climate and lack of funds.

The increased agricultural productivity has lead to a sharp decrease of food prices.

Disadvantages

Firstly, intensive farming is often at the expense of environmental considerations, which explains its rejection from some producers and consumers. The use of Intensive farming by farmers damages the environment and food chain in a number of ways:

- Removal of hedges to make large fields for maximum efficiency. This destroys the natural habitat of some wild creatures and can lead to soil erosion.
- Use of fertilizers pollutes rivers and lakes (e.g., the Gulf of Mexico dead zone created by nitrogen fertilizer)

- Pesticides disturb food chains and reduce many insect, bird and mammal populations, pollutes the water table.
- Intensive farming of animals such as battery-hens, and crated veal calves (see Industrial agriculture) is considered by some to be cruel.

Monoculture crops are more susceptible to massive crop failure due to disease.

Industrial agriculture

Industrial agriculture, also known as **factory farming**, refers to the industrialized production of livestock, poultry, fish, and crops. The methods employed are geared toward making use of economies of scale to produce the highest output at the lowest cost. The practice is widespread in developed nations, and most of the meat, dairy, eggs, and crops available in supermarkets are produced in this manner

History

The practice of industrial agriculture is a relatively recent development in the history of agriculture, and the result of scientific discoveries and technological advances. Innovations in agriculture beginning in the late 1800s generally parallel developments in mass production in other industries that characterized the Industrial Revolution. The identification of nitrogen and phosphorus as critical factors in plant growth led to the manufacture of synthetic fertilizers, making possible more intensive types of agriculture. The discovery of vitamins and their role in animal nutrition, in the first two decades of the 20th century, led to vitamin supplements, which in the 1920s allowed certain livestock to be raised indoors, reducing their exposure to adverse natural elements. The discovery of antibiotics in the 1940s facilitated raising livestock in larger numbers by reducing disease. Chemicals developed for use in World War II gave rise to synthetic pesticides. Developments in shipping networks and technology have made long-distance distribution of agricultural produce feasible.

Animals

Arguments in favor

Proponents say that large-scale, intensive farming is a useful and proven agricultural advance.

- **Low cost** — Intensive agriculture is necessary to meet demand for affordable food.
- **Efficient** — Animals in confinement can be supervised more closely than free-ranging animals, and diseased animals can be treated faster. Further, more efficient production of meat, milk, or eggs results in a need for fewer animals to be raised, thereby limiting the impact of agriculture on the environment.
- **Safe** — Properly run factory farms meet and exceed the government standards for safe and humane food production of the countries in which they are located. Sometimes, as with the case of regulated aquaculture, it can actually be more environment friendly since it reduces the dependence of deep sea fishing and trawling ships that cause damage to the ecosystem and the catch in the long run.
- **Economic contribution** — The high input costs of agricultural operations result in a large influx and distribution of capital to a rural area from distant buyers rather than simply recirculating existing capital. A single dairy cow contributes over $1300 US to a local rural economy each year, each beef cow over $800, meat turkey $14, and so on. As Pennsylvania Secretary of Agriculture Dennis Wolff states, “Research estimates that the annual economic impact per cow is $13,737. In addition, each $1 million increase in PA milk sales creates 23 new jobs. This tells us that dairy farms are good for Pennsylvania's economy.”
- **Industry is responsible and self-regulating** — Organizations representing factory farm operators claim to be proactive and self-policing when it comes to improving practices according to the latest food safety and environmental findings. A 2002 article by a representative of the U.S. Poultry & Egg Association, arguing against increased CAFO regulation, stated, "Poultry growers, largely free of regulatory controls, are managing their litter in an environmentally sound, agronomically beneficial manner."

Proponents also dispute the foodborne illness argument. They note the fact that *E. coli* grows naturally in most mammals, including humans, and that only a few strains of *E. coli* are potentially hazardous to humans. They also note that diseases naturally occur among chickens and other animals. Properly cooking food can effectively remove risk factors by killing bacteria. Proponents argue that there is widespread demand for a cheap, reliable source of meat.

Arguments against

Opponents say that what they refer to as *factory farming* is cruel, poses health risks, and causes environmental damage.

In 2003, a Worldwatch Institute publication stated that "factory farming methods are creating a web of food safety, animal welfare, and environmental problems around the world, as large agribusinesses attempt to escape tighter environmental restrictions in the European Union and the U.S. by moving their animal production operations to less developed countries."

Arguments and claims include:

- **Disease** — Overpopulation may lead to disease. In natural environments, animals are seldom crowded into as high a population density. Disease spreads rapidly in densely populated areas. Animals raised on antibiotics are breeding antibiotic resistant strains of various bacteria ("superbugs"). The use of animal byproduct feeds, including bone meal, directly resulted in the spread of Bovine spongiform encephalopathy, which has affected over 180,000 cattle and 170 people.
- **Air and water pollution** — Large quantities and concentrations of waste are produced. Lakes, rivers, and groundwater are at risk when animal waste is improperly recycled. Pollutant gases are also emitted. Dust, fly, and odor problems can be created for people living in the immediate region.
- **Cruel** — Crowding, drugging, and performing surgery on animals. Chicks are debeaked hours after birth, commonly by slicing off the beak with a hot blade. Confining hens and pigs in barren environments leads to physical problems such as osteoporosis and joint pain, and also boredom and frustration, as shown by repetitive or self-destructive behaviour known as stereotypes.

- **Resource overuse** — Large populations of animals require a commensurately large amount of water and are depleting water resources in some areas.
- **Tracking** — With the intensive farming system it is difficult to track the source of food, let alone food borne disease, back to particular animals. Sometimes food purchased on one side of the country may have been produced on the other side. Hamburger meat may contain the meat of as many as 1000 cows.[9] This causes concern among consumers concerning the origin of foods and among government officials concerning the origin of disease. The National Animal Identification System is one proposed way the USDA is attempting to remedy this problem. With traditional farming techniques this problem is eliminated because the consumer can buy directly from the producer.

Opponents believe that intensive farming is responsible for many foodborne illnesses and many food safety risks. An estimated one out of every four cattle that enters a slaughterhouse may host toxic forms of the bacteria *E. coli*, and this is blamed on fecal contamination resulting from closely confined animals wallowing in their own manure. A *Consumer Reports* study of nearly 500 supermarket chickens found campylobacter in 42 percent and salmonella in 12 percent, with up to 90 percent of the bacteria resistant to antibiotics. Eggs pose a salmonella threat to one out of every 50 people each year. In total, the Centers for Disease Control and Prevention estimates that there are 76 million instances of foodborne illness each year, and more than 5,000 deaths.

Crops

Features

- **large scale** — hundreds or thousands of acres of a single crop (much more than can be absorbed into the local or regional market);
- **monoculture** — large areas of a single crop, often raised from year to year on the same land, or with little crop rotation;
- **agrichemicals** — reliance on imported, synthetic fertilizers and pesticides to provide nutrients and to mitigate pests and diseases, these applied on a regular

schedule; the use of fertilizer recycled from toxic waste and other hazardous industrial byproducts is common in the US.[12]

- **hybrid seed** — use of specialized hybrids designed to favor large scale distribution (e.g. ability to ripen off the vine, to withstand shipping and handling);
- **genetically engineered crops** — use of GMOs varieties designed for large scale production (e.g. ability to withstand selected herbicides);
- **large scale irrigation** — heavy water use, and in some cases, growing of crops in otherwise unsuitable regions by extreme use of water (e.g. rice paddies on arid land).
- **high mechanization**

Criticism

Critics of intensively farmed crops cite a wide range of concerns. On the food quality front, it is held by critics that quality is reduced when crops are bred and grown primarily for cosmetic and shipping characteristics. Environmentally, factory farming of crops is claimed to be responsible for loss of biodiversity, degradation of soil quality, soil erosion, food toxicity (pesticide residues) and pollution (through agrichemical build-ups, and use of fossil fuels for agrichemical manufacture and for farm machinery and long-distance distribution).

Origins of the term "factory farming"

The origin of the term *factory farm* is not clear, although the Oxford English Dictionary attributes the first recorded use to an American journal of economics in 1890, while it didn't enter pejorative use until the 1960s. [13] A 1998 documentary film, *A Cow at My Table*, showed the term being used within the agricultural industry as descriptive of "factory-like" farming operations. In recent decades, the term has been widely used by environmental and animal rights movements, and thus has a negative connotation, at least in public forums. However, it has also been included in modern dictionaries as simply referring to "large-scale agriculture". The term is generally used in opposition to the term *family farm*.

Alternatives

The definition of industrial agriculture is somewhat variable, and therefore the proposed alternatives to industrial agriculture are not sharply defined. In general, critics of industrial agriculture advocate decentralized approaches to food production, such as smaller farms serving local farmer's markets or community supported agriculture, and the reduction or elimination of synthetic agents in agriculture.

Some have proposed genetically modified foods as a solution in alleviating some of the issues of industrial agriculture, particularly excess use of pesticides and fertilizers.

A number of countries, including the United States, the member states of the European Union, and Japan have legislated organic production standards. These detailed regulations cover all aspects of agricultural production, processing, storage and transportation. Requirements such as minimum open pasture area for livestock (e.g. cows may require two acres per animal to meet organic standards) effectively preclude factory farming practices. Organic regulations are, however, in the domain of consumer protection, not agricultural policy, and are entirely voluntary.

Food and Agriculture Organization

The **Food and Agriculture Organization** (FAO) is a specialized agency of the United Nations that leads international efforts to defeat hunger. Serving both developed and developing countries, FAO acts as a neutral forum where all nations meet as equals to negotiate agreements and debate policy. FAO is also a source of knowledge and information, and helps developing countries and countries in transition modernize and improve agriculture, forestry and fisheries practices, ensuring good nutrition and food security for all. Its Latin motto, *fiat panis*, translates into English as "let there be bread!".

FAO was founded on 16 October 1945 in Quebec City, Quebec, Canada. In 1951 its headquarters were moved from Washington, D.C., United States, to Rome, Italy. As of 11 April, 2006, it had 190 members (189 states and the European Community, List of FAO members)

What the FAO says about itself

Mission

FAO's mandate is to raise levels of nutrition, improve agricultural productivity, better the lives of rural populations and contribute to the growth of the world economy. Achieving food security for all is at the heart of FAO's efforts – to make sure people have regular access to enough high-quality food to lead active, healthy lives.

Structure

FAO is governed by the Conference of Member Nations, which meets every two years to review the work carried out by the organization and approve a Programme of Work and Budget for the next biennium. The Conference elects a Council of 49 Member Nations to act as an interim governing body. Members serve three-year, rotating terms. The Conference also elects the Director-General to head the agency. FAO is composed of eight departments: Administration and Finance, Agriculture, Economic and Social, Fisheries, Forestry, General Affairs and Information, Sustainable Development and Technical Cooperation. Since 1994, FAO has undergone the most significant restructuring since its founding, to decentralize operations, streamline procedures and reduce costs. Savings of $50 million a year have been realized.

Budget

Member states froze FAO's budget from 1994 through 2001 at $650 million per biennium. The budget was raised slightly to $651.8 million for 2002-03 and jumped to $749 million for 2004-05, but this nominal increase was seen as a decline in real terms[1]. In November 2005, the FAO governing Conference voted for a two-year budget appropriation of $765.7 million for 2006–2007; once again, the increase would only partial offset rising costs due to inflation.

Special Programme for Food Security

The Special Programme for Food Security (SPFS) is FAO's flagship initiative for reaching the goal of halving the number of hungry in the world by 2015 (presently 852 million people), as part of its commitment to the Millennium Development

Goals. Through projects in over 100 countries worldwide, the SPFS promotes effective, tangible solutions to the elimination of hunger, undernourishment and poverty. Currently 102 countries are engaged in the SPFS and of these approximately 30 are operating or developing comprehensive National Food Security Programmes. To maximize the impact of its work, the SPFS strongly promotes national ownership and local empowerment in the countries in which it operates.

Growing Role in Emergencies

FAO is a key player in emergencies. Its focus is on food production and agriculture, reflecting its specialization and responsibility within the United Nations family. Assisting in preventing disaster-related emergencies, providing early warnings of food emergencies and helping in rehabilitation of food production systems are FAO's predominant roles in humanitarian aid. The main forms of FAO's intervention include needs assessments, provision of agricultural inputs and technical assistance for the planning and management of sustainable recovery and rehabilitation of rural production systems. Conscious of the high costs of emergency operations, FAO continuously seeks to prevent disaster-related emergencies; however, should they occur, FAO seeks to mitigate their impact and to accelerate a recovery process that will lead to sustainable agricultural development. FAO's delivery of relief and rehabilitation assistance has more than tripled in the past ten years. FAO's work in emergencies began in the Sahel region of Africa in the early 1970s and developed quickly after the 1994 conflict in Rwanda. Other emergency activities have ranged from helping vulnerable farmers in Angola, Indonesia and Sierra Leone, ex-soldiers and the rural poor in the Philippines and Tajikistan, small-scale subsistence fishers in Sudan, flood-affected households in Cambodia, Ecuador and Viet Nam, and drought-affected families in Nicaragua and Sri Lanka. FAO is currently engaged in emergency programmes including Tsunami reconstruction, Avian influenza and locust control.

Transboundary Pests and Diseases

In transboundary animal diseases, FAO was providing leadership and technical expertise as far back as 1954, when foot-and-mouth disease ravaged postwar Europe. Agricultural pests and diseases often migrate or spread across borders and cause major losses and emergencies. In the past, such damage has on occasions been catastrophic, leading to famines and sometimes triggering trade restrictions. Developing countries are frequently unable to react sufficiently quickly to such events, and extensive emergency operations as well as international assistance becomes necessary. Although effective control methods usually exist now against these pests and diseases, such crisis management inevitably involves delays, a low efficiency/cost ratio and an inability to contain the problem at an early stage. In 1994, FAO established an Emergency Prevention System (EMPRES) for Transboundary Animal and Plant Pests and Diseases in order to minimize the risk of such emergencies developing. Another example is The Global Rinderpest Eradication Programme (GREP), which is a time-bound programme to eliminate rinderpest from the world by 2010. It commenced throughout the world in the 1980s with mass immunization campaigns, which extended control to a point where the remaining foci of endemicity are few, distinct and isolated. In the avian influenza crisis that began in Asia in late 2003, FAO's roles are many: technical assistance, policy advice, provision of laboratory equipment, protective clothing and training, agency and donor coordination, contingency planning, technical information and guidelines, and public advocacy. FAO works hand in hand with the World Organization for Animal Health and, because of the threat to human health, with the World Health Organization.

Integrated Pest Management

During the 1990's, FAO took a leading role in the promotion of integrated pest management for rice production in Asia. Hundreds of thousands of farmers were trained using an approach known as the Farmer Field School (FFS)[14]. Like many of the programmes managed by FAO, the funds for Farmer Field Schools came from bilateral Trust Funds, with Australia, Netherlands, Norway and Switzerland acting as the leading donors. FAO's efforts in this area have drawn praise from NGOs that have otherwise criticised much of the work of the organization.

FAO Statistics

The FAO Statitical Division produces FAOSTAT, an on-line multilingual database currently containing over 3 million time-series records from over 210 countries and territories covering statistics on agriculture, nutrition, fisheries, forestry, food aid, land use and population. The Statistical Division also produces data on World Agricultural Trade Flows.

TeleFood

Raising awareness about the problem of hunger mobilizes energy to find a solution. In 1997, FAO launched TeleFood, a campaign of concerts, sporting events and other activities to harness the power of media, celebrities and concerned citizens to help fight hunger. Since its start, the campaign has generated close to US$14 million in donations. Money raised through TeleFood pays for small, sustainable projects that help small-scale farmers produce more food for their families and communities.

The Right to Adequate Food

FAO's Strategic Framework 2000-2015 stipulates that the organization is expected to take into full account "progress made in further developing a rights-based approach to food security" in carrying out its mission "helping to build a food-secure world for present and future generations." When the Council adopted the Voluntary Guidelines in November 2004, it also called for adequate follow up to the Guidelines through mainstreaming and the preparation of information, communication and training material.

International Alliance Against Hunger

In June 2002, during the World Food Summit, world leaders reviewed progress made towards meeting the 1996 Summit goal of halving the number of the world's hungry by 2015; their final declaration called for the creation of an International Alliance against Hunger (IAAH) to join forces in efforts to eradicate hunger. Launched on World Food Day, 16 October 2003, the IAAH works to generate political will and concrete actions through partnerships between intergovernmental and non-governmental organizations and national alliances. The IAAH is a voluntary association of international organizations, national alliances against hunger, civil society organizations, social and religious organizations and the private sector. The global activities of the IAAH focus on four major themes: advocacy, accountability, resource mobilization and coordination. The International Alliance is made up of the Rome-based UN food organizations – FAO, the International Fund for Agricultural Development (IFAD) and the World Food Programme (WFP) – and representatives of other intergovernmental and non-governmental organizations. Individuals cannot directly join the IAAH, though they can work with national alliances against hunger. In less than two years, 36 countries have established national alliances, some of them already very active like those in Brazil, Burkina Faso, France, India and the United States.

Goodwill Ambassadors

The FAO Goodwill Ambassadors Programme was initiated in 1999. The main purpose of the programme is to attract public and media attention to the unacceptable situation that some 800 million people continue to suffer from chronic hunger and malnutrition in a time of unprecedented plenty. These people lead a life of misery and are denied the most basic of human rights: the right to food. Governments alone cannot end hunger and undernourishment. Mobilization of the public and private sectors, the involvement of civil society and the pooling of collective and individual resources are all needed if people are to break out of the vicious circle of chronic hunger and undernourishment. Each of FAO's Goodwill Ambassadors – celebrities from the arts, entertainment, sport and academia such as Nobel Prize winner Rita Levi Montalcini, actress Gong Li, singer Miriam Makeba, and soccer player Roberto Baggio, to name a few – has made a personal and professional commitment to FAO's vision: a food-secure world for present and future generations. Using their talents and influence, the Goodwill Ambassadors draw the old and the young, the rich and the poor into the campaign against world hunger. They aim to make Food for All a reality in the 21st century and beyond. See also FAO Goodwill Ambassadors

SOIL

Soil plays a vital and important role the life of the world and mankind. It is in fact a highly organized physical, chemical and biological complex all of us are dependent on. As the supporter of vegetable life, the soil plays the most fundamental of roles in providing food for all animals and men.

Soils develop under the influences of climate, vegetation, slope and drainage, time, the nature of the parent material, and the culture. Climate influences plants, animals and soil directly. Plants influence the soil, the animals and the climate near the ground. Animals play a considerable role in soil development, the type of soil often influences the animals which are present in it, while the animals also influence the vegetation which is growing in the soil. Finally climate, through weathering, influences the rocks, which in time become part of the soil through the processes of soil formation.

All soils do not have the same utility, but man uses different soils in different ways. “Good” land for the production of food-stuffs must lie well and have good depth, for yields are dependent upon the ability of the soil to take up and use fertilizers and water. Man has done much to adapt crops to the soil and to provide various kinds of fertilizers for plant growth and development. Soils that are not good for the production of food – stuffs may elevations are poor for crops but they comprise excellent forest soils.

Each soil series requires skilful handling if it to produce to its maximum potential; but no two series make the same demands. From season to season conditions of temperature and moisture change, so the farmer must change his management to produce better drainage, improve filth, prevent erosion, and test his soil to identify the proper kind and the correct proportion of fertilizer needed. Only by careful study of the soil, resulting in an understanding of the complexity of its nature and uses, will man be able to provide food for all the people who will inhabit the earth. The soil cannot reproduce itself. Therefore, man should improve it through good management and treatment so that future generations can farm more efficiently than their fathers and grandfathers have done. Man can improve the soil now in use and even discover haw more kinds of soils can be utilized more productively.

So, the results obtained in soil science can be applied to practical problems in agriculture, horticulture, forestry, engineering, and in planning the future use of land.

Mashqlar

I. Tekstdan so'z va so'z birikmalarining sinonimlarini toping.

To supply, soil, requirement, correct, vegetable life, to absord, food elements, usefulness.

II. Tekstdan quyidagi otlarning o'zagi bir xil bo'lgan fe'lini aniqlang.

Farm, utility, influence, identification, usefulness, development, play, adaptation, production, study.

III. Tekstdan foydalanib nuqtalar o'rnini to'ldiring.

...is the one basic farming material. Everything depends on it and on its productivity. To handle … properly, and to produce the most and the best from it, we must know it well.

A… is a living thing. It must be living to grow plants, and to make all the chemical changes need in the substances that are added to it.

Different factors play their role in … improvement, good management being the most important one.

IV. Tekstga qaysi gaplarning mazmuni mos kelmasligini aniqlang.

1. Soil science is only of theoretical value. 2. Different soils have the same utility. 3. To improve the soil one should study it thoroughly. 4. Soil requirements are always

the same. 5. Soils that is not valuable for grain crops may be very good for some other purpose. 6. Climate is influenced by soil.

V. “Soil” tekstiga rejalar tuzing va tekstni rejalarga qarab gapirib bering.

Lug‘at-minimum

soil – tuproq
drainage – drenaj, quritish uskunasi
complex – kompleks, murakkab tajriba
vegetable – sabzavot
slope – o‘rib olingan ozuqa
to comprise – saqlab turmoq
influence – ta’sir etish, ta’sir etadi
rock – tog‘ jinsi, tog‘li hudud tuprog‘i
utility – foydaliligi, afzalligi
to adapt – o‘zlashtirmoq
podzols – qumloq tuproq
vital – hayotiy

PHYSICAL PROPERTIES OF SOILS

The physical properties of a soil are determined largely by its texture, or the size of the particles of which it consists. And its structure, or the arrangement of these particles.

For a soil to be in good physical condition for plant growth, the air, water, and solid particles must be in the right proportions at all times. Every cubic foot of soil that supports plant life must be:

1) well enough aerated to permit all plant root cells to obtain oxygen at all times, but not excessively aerated to the point of preventing a continuous contact of roots with moist soil particles:
2) open enough to permit the right amount of rain – water or irrigation water to enter the soil, but not so open as to allow excessive loss of water and plant nutrients by deep percolation;
3) sufficiently retentive of moisture to supply roots with all needed water, but not so retentive as to create undesirable suspended water-tables.

Soil texture has to do with the fineness or coarseness of soil particles. Mineral particles make up the bulk of soil vary greatly in size. The four principal size categories are “gravel”. “sand”, “silt”, and “clay” , Some soils , for example sand, consist largely of particles of approximately the same size. Most soils, however, have two or more groups, classified by size of particles, usually with one group dominant. Thus , in grouping soils into texture classes, the proportion of particles belonging to different size groups, as well the particle sizes themselves, are important.

In most soils texture varies greatly from the surface down-ward. The subsoil usually contains more clay and other fine material than does the surface soil, although this is not always the case. In soil classification, the texture of the surface soil seems more significant than of deeper layers. Therefore, soils are usually classified according to the texture of a six – to eight – inch thick surface layer, approximately the “plow layer”. Six major texture groups are “sand”, “Sandy loam”, “silt loam”,

“loam”, “clay loam”, and “clay”. Each of these groups may be subdivided when it is useful to do so.

Many soil qualities are closely related to texture. Since fine-textured soils have greater pore space and larger surface area than coarse-textured soils, they provide greater storage space for water and better feeding zones for plant roots. Thus, in a broad way, relatively fine-textured soils are more productive agriculturally than are soils with coarse texture. Too fine a texture, however, adversely affects tillage. Sands and sandy loams are more easily tilled than clays and clay loams because the tiling of the former requires less power and is hindered less by wetness.

Soil structure refers to the manner in which the individual soil particles are arranged. Structure has much in common with texture, although structure is much more complex. As a property of soil, structure in some instances may be even more important that texture. Physical, chemical, and biological forces in nature work together arranging soil particles into a great variety of structural patterns.

Good structure is valuable in any soil. Some soils have structures that make them difficult to manage and render them practically worthless agriculturally. Because of structural differences, some soils require much more care than others. Preventive measures often check structural breakdowns, and careful management can restore deteriorated structures to normal.

Water is the most variable property of the soil. The citrons of soil water are varied. Soil water is vital to plant life, since all nutrients that plants take from the soil are dissolved in it. Water aids in the decomposition of organic and mineral matter and in bringing about chemical changes within the soil.

Soil water is a very significant factor in planting, tilling, and harvesting cultivated crops. It often determines the time and the depth at which seeds should be planted for proper germination. Water may be so abundant in the soil as to restrict machine cultivation, thus making the control of weeds difficult to plow. Too much soil water at harvest time often delays or completely prevents the use of harvesting machinery.

Soils range in color from white to black, but the most common colors are the different shades of red, yellow, and brown. These colors indicate the different digress of hydration and the concentration of iron and aluminum oxides which stain the soil grains.

Dark – colored soil are considered to suggest higher productivity than light – colored ones, though it is not always the case.

Mashqlar

I. Tekstdan quyidagi gaplarning aniqlovchisini toping.

1. Very small parts of soil. 2. The size of particles the soil consists of. 3. Soils with greater pore space and larger surface area. 4. Food elements needed for plant growth. 5. The arrangement of soil particles.

II. Quyidagi so‘z va so‘z birikmalarini lug‘atsiz tarjima qiling.

a) wet-wetness, useful-usefulness, fine-fineness, coarse-coarseness, intensive-intensiveness, extensive-extensiveness;

b) worth-worthless, colour-colouress, use-useless, power-powerless, structure-structure less.

Lug‘at-minimum

property – sifat, belgi, mulk, yer uchastkasi
determine – aniqlamoq, o‘rnatmoq
texture – strukturasi, tuzilishi (tuproq) tarkibi
arrangement – joylashish, tuzilish
supports – tayanch, qo‘llab-quvvatlash

excessive – haddan tashqari
nutrients – foydali ozuqa, vitaminlar

moisture – namlik
to supply – oziqlanmoq
undesirable – mos kelmaydigan
suspended – o‘lchangan holatda bo‘lmoq

silt –tuproq qoldig‘i, tuproq changi
root – ildiz
clay – loy
sand – qum
percolation – singish
retentive – ushlab turuvchi

SOIL TYPES

In practical farming, the two main types of soil are light soils and heavy soils. Light soils are easy to work, need less power to cultivate, can be worked at most times of the year, and do not hold water so much. Sands and gravels belong to this group. Heavy soils are more difficult to work, need much more power to cultivate, can only be worked at certain times when they are in the proper condition, and hold water. They are usually more productive and grow heavier crops. Heavy soils usually contain much clay.

I. Savolga javob yozing.

What is the difference between soil structure and soil texture?

II. Tekstga annotatsiya yozing.

"Physical Properties of Soils".

PLANT FOODS IN THE SOIL

All the main plant foods are found in a normal soil. Some of each plant food is there in such a form that the plant can use it. This is known as available plant food. Some more of it is in a from which the plant cannot use at the moment. Such plant food is said to be unavailable. To become available it may need to be changed chemically in some way.

Trace elements, the other plant foods which are needed in very small quantities, are found naturally in most soils. Sometimes one particular plant food is short and this deficiency can cause damage to crops, livestock or both.

USES AND CARE OF SOILS

Soils are used in a great variety of ways, agriculture being the leading soil use.

There has always been great variation in the quality of soils available for agriculture. In most instances, the better soils are used for crops, and the less suitable ones are kept for pastures or timberlands.

Properties that determine the agricultural quality of soils include: 1) ability to produce high crop yields under good management and careful handling; 2) the ease with which they can be used careful handling; 2) the ease which they can be used profitably; 3) the amount and kind of care they require. Good soils respond well to proper management, which involves correct cropping practices, use of fertilizers, and effective protection against damage. Without good care all crop land deteriorates with continuous use. The loss that results from improper care of good soils is greater than from improper care of poor soils, since the former are more valuable. Nevertheless, it is highly important to give the best possible care to all soils, and particularly to the best soils. This is one the first essentials of good farming methods.

The systemizing alternating of crops from field to field is known as crop rotation, which is one of the methods of soil conservation. A good rotation system consists of adjusting the crop arrangement to the physical nature of the land and, in the same time, maintaining a balanced economic farming program. Rotation implies the growing of more than one crop on a farm. In other words, rotation and diversification go hand in hand.

Since no two crops make identical demands on the soil, one crop may require excessive amounts of a given nutrient which another crop may be able to supply. For example, legumes return nitrogen to the soil, but most other crops require more nitrogen than the soil can normally supply. Thus a rotation program involving clovers and other legumes combined with cotton, corn, small grains, and other legume combined with cotton, corn, small grains, and other heavy users of nitrogen may meet most nitrogen requirements.

Crop rotation and associated diversification help improve the economic status of farming in many ways. Besides maintaining the soil in a good state of productivity, rotation and diversification help reduce the risks of economic, losses from low yields. Also, the income and the labor requirements are spread through the year instead of being seasonal in nature, as in the case of a single crop, such as wheat. Some phases of a well – ordered crop rotation program are apt to succeed, even if others fail. It is not necessary for all parts of the program to show a financial profit; it is the overall result that counts. A soil – improving crop, for example, may not be economically profitable at the time it is grown, but its benefits may be clearly realized in future years.

Land use is a continuous operation. Farmers normally do not put their land aside while they are restoring their soils; they repair and improve them while the land is in use. The ways that soils are used, the length of time they remain productive, and the harvests they yield depend to a marked degree upon the care they receive.

Time makes little change in virgin soils. But when soils are used for crops or pasture, the balance that nature has given them is upset in various ways and to varying degrees. Changes in the nature of soils cannot be avoided as they are put to diverse uses. These changes may result in improvement in productivity. Frequently, however, soil use results in soil damage and decreased yields. Thus careful treatment of soils in ways that will keep them productive through continuous use is the aim of every good agricultural program.

Under careful and proper use soils may continue indefinitely to produce good yields. It is improper use and lack of care that harm soils. Thus good care is of vital importance in prolonging the useful life of soils.

Improper use may result in the deterioration of soil structure; several things may contribute to this deterioration, including: plowing when soil is too wet; failure to return organic matter; unwise use or lack of lime; neglecting to rotate crops. An even more serious and widespread kind of soil damage is the loss of essential plant nutrients. This may result from continuous growing of the same crop and from failing to fertilize it properly. Still another serious cause of depletion in most soils is known to be the loss of organic matter.

Most kinds of soil damage are related to each other in many ways. For example, organic deficiency is definitely a factor in soil erosion and in structural breakdown as well as in the deficiency of plant nutrients. Consequently, understanding these relationships and properly evaluating them in a balanced farming program make modern agriculture truly a scientific undertaking.

Microbiology is the study of *microorganisms*, which are unicellular or cell-cluster microscopic organisms. This includes eukaryotes such as fungi and protists, and prokaryotes such as bacteria and certain algaes. Viruses, though not strictly classed as living organisms, are also studied. People that study the field of microbiology are known as *microbiologists*.

Although much is now known in the field of microbiology, advances are being made regularly. The most common estimates suggest that we have studied only about 1% of all of the microbes in any given environment. Thus, despite the fact that over three hundred years have passed since the discovery of microbes, the field of microbiology is clearly in its infancy relative to other biological disciplines such as zoology, botany and entomology.

History

Bacteria were first observed by Anton van Leeuwenhoek in 1676 using a single-lens microscope of his own design. The name "bacterium" was introduced much later, by Ehrenberg in 1828, derived from the Greek word βακτηριον meaning "small stick". While Antony van Leeuwenhoek is often cited as the first microbiologist, the first recorded microbiological observation, that of the fruiting bodies of molds, was made earlier in 1665 by Robert Hooke.

The field of **bacteriology** (later a subdiscipline of microbiology) is generally considered to have been founded by Ferdinand Cohn (1828-1898), a botanist whose studies on algae and photosynthetic bacteria led him to describe several bacteria including *Bacillus* and *Beggiatoa*. Ferdinand Cohn was also the first to formulate a scheme for the taxonomic classification of bacteria.

Louis Pasteur (1822-1895) and Robert Koch (1843-1910) were contemporaries of Cohn's and are often considered to be the founders of **medical microbiology**. Pasteur is most famous for his series of experiments designed to disprove the then widely held theory of spontaneous generation, thereby solidifying microbiology's identity as a biological science. Pasteur also designed methods for food preservation (pasteurization) and vaccines against several diseases such as anthrax, fowl cholera and rabies. Robert Koch is best known for his contributions to the germ theory of disease, proving that specific diseases were caused by specific pathogenic microorganisms. He developed a series of criteria that have become known as the Koch's postulates. Koch was one of the first scientists to focus on the isolation of bacteria in pure culture resulting in his description of several novel bacteria including *Mycobacterium tuberculosis*, the causative agent of tuberculosis.

While Louis Pasteur and Robert Koch are often considered the founders of microbiology, their work did not accurately reflect the true diversity of the microbial world because of their exclusive focus on microorganisms having medical relevance. It was not until the work of Martinus Beijerinck (1851-1931) and Sergei Winogradsky (1856-1953), the founders of **general microbiology** (an older term encompassing aspects of microbial physiology, diversity and ecology), that the true breadth of microbiology was revealed. Martinus Beijerinck made two major contributions to microbiology: the discovery of viruses and the development of enrichment culture techniques. While his work on the Tobacco Mosaic Virus established the basic principles of virology, it was his development of enrichment culturing that had the most immediate impact on microbiology by allowing for the cultivation of a wide range of microbes with wildly different physiologies. Sergei Winogradsky was the first to develop the concept of chemolithotrophy and to thereby reveal the essential role played by microorganisms in geochemical processes. He was responsible for the first isolation and description of both nitrifying and nitrogen-fixing bacteria.

Types of microbiology

The field of microbiology can be generally divided into several subdisciplines:

- **Microbial physiology**: The study of how the microbial cell functions biochemically. Includes the study of microbial growth, microbial metabolism and microbial cell structure.
- **Microbial genetics**: The study of how genes are organised and regulated in microbes in relation to their cellular functions. Closely related to the field of molecular biology.

- **Medical microbiology**: The study of the role of microbes in human illness. Includes the study of microbial pathogenesis and epidemiology and is related to the study of disease pathology and immunology.
- **Veterinary microbiology**: The study of the role in microbes in veterinary medicine.
- **Environmental microbiology**: The study of the function and diversity of microbes in their natural environments. Includes the study of microbial ecology, microbially-mediated nutrient cycling, geomicrobiology, microbial diversity and bioremediation. Characterisation of key bacterial habitats such as the rhizosphere and phyllosphere.
- **Evolutionary microbiology**: The study of the evolution of microbes. Includes the study of bacterial systematics and taxonomy.
- **Industrial microbiology**: The exploitation of microbes for use in industrial processes. Examples include industrial fermentation and wastewater treatment. Closely linked to the biotechnology industry. This field also includes brewing, an important application of microbiology.
- **Aeromicrobiology**: The study of airborne microorganisms.
- **Food Microbiology**: The study of microorganisms causing food spoilage.
- **Pharmaceutical microbiology**: the study of microorganisms causing pharmaceutical contamination and spoillage.

Benefits of microbiology

While microbes are often viewed negatively due to their association with many human illnesses, microbes are also responsible for many beneficial processes such as industrial fermentation (e.g. the production of alcohol and dairy products), antibiotic production and as vehicles for cloning in higher organsisms such as plants. Scientists have also exploited their knowledge of microbes to produce biotechnologically important enzymes such as Taq polymerase, reporter genes for use in other genetic systems and novel molecular biology techniques such as the yeast two-hybrid system.

Mashqlar

I. Tekstdan quyidagi so‘z va so‘z birikmalarini antominlarini toping.

To succeed, economic loss, to raise, poor user, damage, to deplete the soil, the latter.

II. Quyidagi atamalarning ma’nosini aniqlang.

Crop rotation, diversification.

Lug‘at-minimum

fertilizer – o‘g‘it
damage – zarar
nevertheless – shunga qaramasdan
rotation – hosilni ayirboshlash
adjusting – standartlashtirish, moslashish
imply – ma’noni anglatmoq
legumes – dukkakli o‘simlik
clover – beda
nitrogen – azot
involving – jalb etmoq
risks – havf
diversification – qishloq xo‘jalik mevalarini almashlab ekish
reduce – kamaytirmoq, pasaytirmoq

ROTATIONS

A rotation is a succession of crops usually fixed in a certain definite order. Nowadays rotations are not so fixed as before. To meet the changing conditions and the needs of the market, new crops can be introduced into rotations changes made when and where needed.

The opposite of rotation is to grow one crop year after year. This is known as monoculture and can lead to troubles, particularly disease. The one crop which can be grown this way is grass; permanent grass, if farmed properly, can be productive for a long time.

I. "Uses and Care of Soils" tekstni o'qib chiqib, quyidagi gaplarni tartib bilan qo'yib chiqing.

1. The economic value of crop rotation. 2. Properties determining the agricultural quality of soils. 3. Crop rotation. 4. The results of improper soil use. 5. The importance of proper care of the soil.

II. "Uses and Care of Soils" tekstiga annotatsiya yozing.

Lug'at-minimum

rotation – ekinlarning almashinuvi
crop – qishloq xo'jalik ekinlari
monoculture – almashtiril-maydigan ekin
disease – kasallik
grass – o't
for a long time – uzoq vaqt mobaynida

FERTILIZATION

Fertilizers (British English **fertilisers**) are compounds given to plants to promote growth; they are usually applied either via the soil, for uptake by plant roots, or by foliar feeding, for uptake through leaves. Fertilizers can be organic (composed of organic matter, i.e. carbon based), or inorganic (containing simple, inorganic chemicals). They can be naturally-occurring compounds such as peat or mineral deposits, or manufactured through natural processes (such as composting) or chemical processes (such as the Haber process).

Fertilizers typically provide, in varying proportions, the three major plant nutrients (nitrogen, phosphorus, and potassium), the secondary plant nutrients (calcium, sulfur, magnesium), and sometimes trace elements (or micronutrients) with a role in plant nutrition: boron, chlorine, manganese, iron, zinc, copper and molybdenum.

Inorganic fertilizers (Mineral Fertilizer)

- Examples of naturally-occurring inorganic fertilizers include Chilean sodium nitrate, mined "rock phosphate" and limestone (a calcium source, but mostly used to reduce soil acidity).

Examples of manufactured or chemically-synthesized inorganic fertilizers include ammonium nitrate, potassium sulfate, and superphosphate, or triple superphosphate.

Macronutrients and micronutrients

FERTILIZERS can be divided into macronutrients or micronutrients based on their concentations in plant dry matter. There are six macronutrients: nitrogen, potassium, and phosphorus, often termed 'primary macronutrients' because their availability is often managed with NPK fertilizers, and the 'secondary macronutrient', and calcium, magnesium, and sulfur, which are required in similar quantities but whose availability is often managed as part of liming and manuring practices rather than fertilizers. The macronutrients are consumed in larger quantities and normally present as whole number or tenths of percentages in plant tissues. There are many micronutrients, and their importance and occurrence differ somewhat from plant to plant. In general, most present from 5 to 100 parts per million (ppm) by mass. Examples of micronutrients are as follows: iron (Fe), manganese (Mn), boron (B), copper (Cu), molybdenum (Mo), and zinc (Zn).

Macronutrient fertilizers

Synthesized materials are also called **artificial** , and may be described as **straight**, where the product predominantly contains the three primary ingredients of nitrogen (N), phosphorus (P) and potassium (K), which are known as **N-P-K fertilizers** or **compound fertilizers** when elements are mixed intentionally. They are named or labeled according to the content of these three elements, which are macronutrients. The mass fraction (percent) nitrogen is reported directly. However, phosphorus is reported as phosphorus pentoxide (P_2O_5), the anhydride of phosphoric acid, and potassium is reported as potash or potassium oxide (K_2O), which is the anhydride of potassium hydroxide. Fertilizer composition is expressed in this fashion for historical reasons in the way it was analyzed (conversion to ash for P and K); this practice dates back to Justus von Liebig (see more below). Consequently, an 18-51-20 fertilizer would have 18% nitrogen as N, 51% phosphorus as P_2O_5, and 20% potassium as K_2O, The other 11%is known as **ballast** and has no value to the plants.Although analyses are no longer carried out by ashing first, the naming convention remains. If nitrogen is the main element, they are often described as **nitrogen fertilizers**.

In general, the mass fraction (percentage) of elemental phosphorus, $[P] = 0.436 \times [P_2O_5]$

and the mass fraction (percentage) of elemental potassium, $[K] = 0.83 \times [K_2O]$

(These conversion factors are mandatory under the UK fertiliser-labelling regulations if elemental values are declared in addition to the N-P-K declaration.[1])

An 18−51−20 fertiliser therefore contains, by weight, 18% elemental nitrogen (N), 22% elemental phosphorus (P) and 16% elemental potassium (K).

Agricultural versus Horticultural Fertilizers

In general, agricultural fertilizers contain only one or two macronutrients. Agricultural fertilizers are intended to be applied infrequently and normally prior to or along side seeding. Examples of agricultural fertilizers are granular triple superphosphate, potassium chloride, urea, and anhydrous ammonia. The commodity nature of fertilizer, combined with the high cost of shipping, leads to use of locally available materials or those from the closest/cheapest source, which may vary with factors affecting transportation by rail, ship, or truck. In other words, a particular nitrogen source may be very popular in one part of the country while another is very popular in another geographic region only due to factors unrelated to agronomic concerns.

Horticultural or specialty fertilizers, on the other hand, are formulated from many of the same compounds and some others to produce well-balanced fertilizers that also contain micronutrients. Some materials, such as ammonium nitrate, are used minimally in large scale production farming. The 18-51-20 example above is a horticultural fertilizer formulated with high phosphorus to promote bloom development in ornamental flowers. Horticultural fertilizers may be water-soluble (instant release) or relatively insoluble (controlled release). Controlled release fertilizers are also referred to as sustained release or timed release. Many controlled release fertilizers are intended to be applied approximately every 3-6 months, depending on watering, growth rates, and other conditions, whereas water-soluble fertilizers must be applied at least every 1-2 weeks and can be applied as often as every watering if sufficiently dilute. Unlike agricultural fertilizers, horticultural fertilizers are marketed directly to consumers and become part of retail product distribution lines.

Justus von Liebig

Chemist Justus von Liebig (in the 19th century) contributed greatly to understanding the role of inorganic compounds in plant nutrition and devised the concept of Liebig's barrel to illustrate the significance of inadequate concentrations of essential nutrients. At the same time he deemphasized the role of humus. This theory was influential in the great expansion in use of artificial fertilizers in the 20th century.

Nitrogen fertilizer is often synthesized using the Haber-Bosch process, which produces ammonia. This ammonia is applied directly to the soil or used to produce other compounds, notably ammonium nitrate, a dry, concentrated product. It can also be used in the Odda Process to produce compound fertilizers such as 15-15-15.

Inorganic fertilizers sometimes do not replace trace mineral elements in the soil which become gradually depleted by crops grown there. This has been linked to studies which have shown a marked fall (up to 75%) in the quantities of such minerals present in fruit and vegetables.[2] One exception to this is in Western Australia where deficiencies of zinc, copper, manganese, iron and molybdenum were identified as limiting the growth of crops and pastures in the 1940's and 1950's. Soils in Western Australia are very old, highly weathered and deficient in many of the major nutrients and trace elements. Since this time these trace elements are routinely added to inorganic fertilizers used in Agriculture in this state.

In many countries there is the public perception that inorganic fertilizers "poison the soil" and result in "low quality" produce. However, there is very little (if any) scientific evidence to support these views. When used appropriately, inorganic fertilizers enhance plant growth, the accumulation of organic matter and the biological activity of the soil, while reducing the risk of water run-off, overgrazing and soil erosion. The nutritional value of plants for human and animal consumption is typically improved when inorganic fertilizers are used appropriately.

Organic fertilizers

- Examples of naturally occurring organic fertilizers include manure, slurry, worm castings, peat, seaweed and guano. Green manure crops are also grown to add nutrients to the soil. Naturally occurring minerals such as mine rock phosphate, sulfate of potash and limestone are also considered Organic Fertilizers.
- Examples of manufactured organic fertilizers include compost, bloodmeal, bone meal and seaweed extracts. Other examples are natural enzyme digested proteins, fish meal, and feather meal.

The decomposing crop residue from prior years is another source of fertility. Though not strictly considered "fertilizer", the distinction seems more a matter of words than reality.

Some ambiguity in the usage of the term 'organic' exists because some of synthetic fertilizers, such as urea and urea formaldehyde, are fully organic in the sense of organic chemistry. In fact, it would be difficult to chemically distinguish between urea of biological origin and that produced synthetically. On the other hand, some fertilizer materials commonly approved for organic agriculture, such as powdered limestone, mined "rock phosphate" and Chilean saltpeter, are inorganic in the use of the term by chemistry.

Although the density of nutrients in organic material is comparatively modest, they have some advantages. For one thing organic growers typically produce some or all of their fertilizer on-site, thus lowering operating costs considerably. Then there is the matter of how effective they are at promoting plant growth, chemical soil test results aside. The answers are encouraging. Since the majority of nitrogen supplying organic fertilizers contain insoluble nitrogen and are slow release fertilizers their effectiveness can be greater than conventional nitrogen fertilzers.

Implicit in modern theories of organic agriculture is the idea that the pendulum has swung the other way to some extent in thinking about plant nutrition. While admitting the obvious success of Leibig's theory, they stress that there are serious limitations to the current methods of implementing it via chemical fertilization. They re-emphasize the role of humus and other organic components of soil, which are believed to play several important roles:

- Mobilizing existing soil nutrients, so that good growth is achieved with lower nutrient densities while wasting less
- Releasing nutrients at a slower, more consistent rate, helping to avoid a boom-and-bust pattern
- Helping to retain soil moisture, reducing the stress due to temporary moisture stress
- Improving the soil structure

Organics also have the advantage of avoiding certain long-term problems associated with the regular heavy use of artificial fertilizers:

- the possibility of "burning" plants with the concentrated chemicals (i.e. an over supply of some nutrients)
- the progressive decrease of real or perceived "soil health", apparent in loss of structure, reduced ability to absorb precipitation, lightening of soil color, etc.
- the necessity of reapplying artificial fertilizers regularly (and perhaps in increasing quantities) to maintain fertility
- the cost (substantial and rising in recent years) and resulting lack of independence

Organic fertilizers also have their disadvantages:

- As acknowledged above, they are typically a dilute source of nutrients compared to inorganic fertilizers, and where significant amounts of nutrients are required for profitable yields, very large amounts of organic fertilizers must be applied. This results in prohibitive transportation and application costs, especially where the agriculture is practiced a long distance from the source of the organic fertilizer.
- The composition of organic fertilizers tends to be highly variable, so that accurate application of nutrients to match plant production is difficult. Hence, large-scale agriculture tends to rely on inorganic fertilizers while organic fertilizers are cost-effective on small-scale horticultural or domestic gardens.

In practice a compromise between the use of artificial and organic fertilizers is common, typically by using inorganic fertilizers supplemented with the application of organics that are readily available such as the return of crop residues or the application of manure.

It is important to differentiate between what we mean by organic fertilizers and fertilizers approved for use in organic farming and organic gardening by organizations and authorities who provide organic certification services. Some approved fertilizers may be inorganic, naturally occurring chemical compounds, e.g. minerals...

Environmental effects of fertilizer use

Over-application of chemical fertilizers, or application of chemical fertilizers at a time when the ground is waterlogged or the crop is not able to use the chemicals, can lead to surface runoff (particularly phosphorus) or leaching into groundwater (particularly nitrates). One of the adverse effects of excess fertilizer in lacustrine systems are algal blooms, which can lead to excessive mortality rates for fish and other aquatic organisms. When prolonged algae blooms occur over many years, the effect is a process called eutrophication. Worldwide the issues of nutrient fate are analyzed using hydrology transport models.

Excessive nitrogen fertilizer applications can lead to pest problems by increasing the birth rate, longevity and overall fitness of certain pests (Jahn 2004; Jahn et al. 2001a,b, 2005; Preap et al. 2002, 2001).

It is also possible to over-apply organic fertilizers. However: their nutrient content, their solubility, and their release rates are typically much lower than chemical fertilizers, partially because by their nature, most organic fertilizers also provide increased physical and biological storage mechanisms to soils.

The problem of over-fertilization is primarily associated with the use of artificial fertilizers, because of the massive quantities applied and the destructive nature of chemical fertilizers on soil nutrient holding structures. The high solubilities of chemical fertilizers also exacerbate their tendency to degrade ecosystems.

Storage and application of some fertilizers in some weather or soil conditions can cause emissions of the greenhouse gas nitrous oxide (N_2O). Ammonia gas (NH_3) may be emitted following application of inorganic fertilizers, or manure or slurry. Besides supplying nitrogen, ammonia can also increase soil acidity (lower pH, or "souring").

For these reasons, it is recommended that knowledge of the nutrient content of the soil and nutrient requirements of the crop are carefully balanced with application of nutrients in inorganic fertiliser especially. This process is called nutrient budgeting. By careful monitoring of soil conditions, farmers can avoid wasting expensive fertilizers, and also avoid the potential costs of cleaning up any pollution created as a byproduct of their farming.

The concentration of up to 100 mg/kg of Cadmium in phosphate minerals (for example Nauru and the Christmas islands) increases the contamination of soil with Cadmium, for example in New Zealand. Uranium is another example for impurities of fertilizers

Mashqlar

I. Tekstda ajratilgan so‘z va so‘z birikmalarning sinonimlarini toping.

to check erosion, decrease in yields deep high fertility, to break down, to add, especially, the following crop.

Lug‘at-minimum

synthetic fertilizers – sun’iy, sintetik o‘g‘it
crop yields – hosildorlik
inherent – hos bo‘lgan
manure – organik o‘g‘it, go‘ng
compost – kompost, chirindi
maintenance – saqlab turish
soil – tuproq
toxic – zaharli modda
a positive interaction – ijobiy o‘zaro aloqadorlik
erosion – eroziya
potassium – kaliy
aeration – aeratsiya
drainage – quritish
amenable – ta’sirchan
point of view – nuqtayi nazar

WHEAT

Wheat – growing was extensively practiced throughout Europe in prehistoric times and this cereal was of great importance in the ancient civilizations of Persia, Greece and Egypt. It spread to all the temperate countries where it now plays a major part in the food supply of many nations and it is also widely cultivated in tropical and subtropical areas.

Cultivation. It is often said that winter wheat does best on a well-formed seed-bed. Ploughing should be done as early as possible and the normal depth would be in the region of 6 inches. The type of seed-bed required for winter wheat can be described as one with a reasonable tilth in the top 2-3 inches, with a surface containing a high proportion of clods the largest of these being about the size of a man's hand. This is to prevent capping, a condition which can easily arise with heavy rain, when the soil surface runs together forming a crust

Manu ring. With all crops it is essential to ensure that adequate supplies of phosphate and potash are available during the first few weeks of growth. Once observed it is not possible to correct properly any deficiency and both of these major elements are required either in advance of drilling or they may be combine-drilled with the seed. Combine-drilling is the most economical way of applying these fertilizers, but with winter wheat time of sowing being of prime importance, the faster method of application using fertilizer spinners is more often preferred. For average conditions 30 units (one unit is equal to 1.12 1b and is the same as 1% on analysis) each phosphate and potash will be sufficient. It the soil is rich in nitrogen, then 30 units/acre of fertilizer nitrogen would suffice, but under average conditions levels up to 60 units are considered economic rising to 80 units in the low rainfall areas. Previous cropping, local environment and to some extent cultural techniques can also influence the optimum level of this nutrient. When the soil is likely to supply some nitrogen for early growth of a winter crop, tit is unlikely that any autumn fertilizer nitrogen would be required.

The short, stiff-strawed varieties of wheat can stand high levels of fertilizer nitrogen whereas the taller one used to produce quality straw will only tolerate moderate amounts.

Mashqlar

I. Tekstdan quyidagi so‘z va so‘z birikmalarining sinonimlarini toping.

Widely, area, to grow best, important, to see, rightly, enough, fertilization, to be high in, before, local conditions, to withstand, to use (fertilizers), as to, to differ, stand, yield, to ripen, to show.

II. Quyidagi so‘zlarni lug‘atsiz tarjima qiling va ma’nosini tushuntirib bering.

1) extent, extensive, extensively, to extend; 2) to supply, the supply, supplying, supplied, supplier; 3) content, to contain, containing, container; 4) to form, the form, forming, formed, formation, formless; 5) deficient, deficiency; 6) dry, dryly, to dry out, dryer, dryness.

III. Tekstdan foydalanib tushurilib qoldirilgan so‘zlarni toping.

The time and method of … the land for wheat depends principally on the … that is followed by it. Unless the rainfall is high it is desirable to have the land prepared … of seeding to permit settling of the … and accumulation of … When the land is to be plowed after a small grain there should be a month … plowing and seeding.

Lug‘at-minimum

in prehistoric times – oldingi asrlarda

cereal – boshoqli o‘simliklar

food supply – oziqaviy ta’minlash

to be cultivated – haydalmoq ekilmoq

the optimum level – muqobil, optimal daraja

the size of a man’s hand – odam qo‘li bilan barobar

crust – qobiq, po‘stloq, qatlam

a winter crop – qishki ekin

ploughing – yer haydash, shudgor qilish

low rainfall areas – yog‘ingar-chilik past bo‘lgan hududlar

Rice

Rice is two species of grass (***Oryza sativa*** and ***Oryza glaberrima***) native to tropical and subtropical southern & southeastern Asia and in Africa, which together provide more than one fifth of the calories consumed by humans in their global diets[1]. (The term "wild rice" can refer to wild species of *Oryza*, but conventionally refers to species of the related genus *Zizania*, both wild and domesticated.) Rice is a monocarpic annual plant, growing to 1–1.8 m tall, occasionally more depending on the variety and soil fetility, with long slender leaves 50–100 cm long and 2–2.5 cm broad. The small wind-pollinated flowers are produced in a branched arching to pendulous inflorescence 30–50 cm long. The seed is a grain (caryopsis) 5–12 mm long and 2–3 mm thick.

Rice is a staple for a large part of the world's human population, especially in East and Southeast Asia, making it the most consumed cereal grain. Rice is the world's third largest crop, behind maize ("corn") and wheat. Rice cultivation is well suited to countries and regions with low labour costs and high rainfall, as it is very labour-intensive to cultivate and requires plenty of water for irrigation, much like the licorice crops found in Eastern Europe. However, it can be grown practically anywhere, even on steep hillsides. Although its species are native to South Asia and certain parts of Africa, centuries of trade and exportation have made it commonplace in many cultures.

Rice is often grown in paddies. The shallow puddles take advantage of the rice plant's tolerance to water: the water in the paddies prevents weeds from outgrowing the crop. Once the rice has established dominance of the field, the water can be drained in preparation for harvest. Paddies increase productivity, although rice can also be grown on dry land (including on terraced hillsides) with the help of chemical weed controls.

In some instances, a deepwater strain of rice often called *floating rice* is grown. This can develop elongated stems capable of coping with water depths exceeding 2 meters (6 feet).

Rice paddies are an important habitat for birds such as herons and warblers, and a wide range of amphibians and snakes. They perform a useful function in controlling insect pests by providing useful habitats for those who prey on them.

Whether it is grown in paddies or on dry land, rice requires a great amount of water compared to other food crops. Rice growing is a controversial practice in some areas, particularly in the United States and Australia, where some individuals claim it produces little GDP for the large amounts of water used to produce rice. However, in nations that have a periodical rain season and typhoons, rice paddies serve to keep the water supply steady and prevent floods from reaching a dangerous level.

Rice blast, caused by the fungus *Magnaporthe grisea* is the most significant disease affecting rice cultivation.

Preparation as food

The seeds of the rice plant are first milled using a rice huller to remove a chaff (the outer husks of the grain); this creates brown rice. This process may be continued, removing the germ and the rest of the husk, called bran at this point, creating white rice. The white rice may then be buffed with glucose or talc powder (often called *polished rice,* though the term may also refer to white rice in general), parboiled, or processed into flour. The white rice may also be enriched by adding nutrients, especially those lost during the milling process. While the cheapest method of enriching involves adding a powdered blend of nutrients that will easily wash off (in the United States, rice which has been so treated requires a label warning against rinsing), more sophisticated methods apply nutrients directly to the grain, coating the grain with a water insoluble substance which is resistant to washing.

While washing is counterproductive for the powder enriched rice, it is absolutely necessary when talc-coated rice is used, not least because of concerns about the negative health effects of talc consumption and possibility of asbestos accompanying the talc. Despite the hypothetical health risks of talc (such as stomach cancer), talc-coated rice remains the norm in some countries due to its attractive shiny appearance, but it has been banned in some or is no longer widely used in others such as the United States. Even where talc is not used, glucose, starch, or other coatings may be used to improve the appearance of the grains; for this reason, many rice lovers still recommend washing all rice in order to create a better tasting and better consistency rice, despite the recommendation of suppliers.

Rice bran, called *nuka* in Japan, is a valuable commodity in Asia and is used for many daily needs. It is a moist inner oily layer that is heated to produce a very healthful oil. Another use is to make a kind of pickled vegetable.

The raw rice may be ground into flour for many uses as well, including making many kinds of beverages such as amazake, horchata, rice milk, and sake. Rice flour is generally safe for people on a gluten-free diet. {{selfref|See Category:Rice dishes and Wikibooks' Rice Recipes for information on food preparation usi Latin America, simplify the process of cooking rice.

Rice may also be made into rice porridge by adding more water than usual, so that the cooked rice is saturated with water to the point that it becomes very soft, expanded, and fluffy. Rice porridge is very easy to digest, so it is especially suitable for the sick.

Rice may be soaked prior to cooking. Soaked rice cooks faster. For some varieties, soaking improves the texture of the cooked rice by increasing expansion of the grains.

In some culinary traditions, especially those of Latin America and Italy, dry rice grains are fried in oil before cooking in water.

When preparing brown rice, a nutritionally superior method of preparation known as **GABA Rice** or GBR (Germinated Brown Rice)[2] may be used. This involves soaking washed brown rice for 20 hours in warm water (38 °C or 100 °F) prior to cooking it. This process stimulates germination, which activates various enzymes in the rice. By this method, a result of the United Nations Year of Rice, it is possible to obtain a more complete amino acid profile, including GABA.

History

Etymology

According to *Microsoft Encarta Dictionary* (2004) and to *Chambers Dictionary of Etymology* (1988), the word *rice* has an Indo-Iranian origin. It came to English from Greek *óryza*, via Latin *oriza*, Italian *riso* and finally Old French *ris* (the same as present day French *riz*). The same Indo-Iranian origin produced the Arabic *ar-ruzz*, from which the Portuguese and Spanish word *arroz* originated. It is widely accepted that the term Rice comes from the Tamil word for rice *Arisi* but some scholars like Edmund Leach have argued that the Tamil term was derived from Sanskrit *vrihi*, and not vice versa

Genetic History

Rice cultivation is considered to have begun simultaneously in many countries over 6500 years ago. Two species of rice were domesticated, Asian rice (*Oryza sativa*) and African rice (*Oryza glaberrima*).

Genetic studies suggest that common wild rice, *Oryza rufipogon*, was the wild ancestor of Asian rice [4].

According to Londo and Chiang, *O. sativa* appears to have originated around the foothills of the Himalayas, with *O. sativa* var. *indica* on the Indian side and *O. sativa* var. *japonica* on the Chinese and Japanese side

East Asia

The origins of rice cultivation is the object of research of specialized branch of archaeology called palaeoethnobotany. Research in China is active, well reported, and there are a number of differing perspectives on when rice was domesticated and when domesticated rice was first cultivated. Zhao, a Chinese palaeoethnobotanist, hypothesizes that people of the Late Pleistocene began to collect wild rice. Zhao explains that the collection of wild rice from an early date eventually led to its domestication and then the exclusive use of domesticated rice strains by circa 6400 B.C. at the latest (Zhao 1998). Evidence from the Yunchanyan site (circa) in Hunan province suggests the possibility that Early Neolithic groups cultivated rice as early as circa 9000 B.C. (Crawford and Shen 1998:862). Crawford and Shen point out that calibrated radiocarbon dates show that direct evidence of the earliest cultivated rice is no older than 7000 B.C. (Crawford and Shen 1998:862). Jared Diamond, a biologist and popular science author, summarizes some of the work done by professional archaeologists mentioned above and estimates that the earliest attested domestication of rice took place in China by 7500 B.C.[6]

Most radiocarbon evidence of the Neolithic sites in China that have confirmed finds of charred rice date to 5000 B.C. or later (Crawford and Shen 1998). This evidence leads most archaeologists to say that large-scale dry-land rice farming began between 5000 and 4500 BC in the area of Yangtze Delta (for example Hemudu culture, discovered in 1970s), and the wet-rice cultivation began at approximately 2500 BC in the same area (Liangzhu culture). It is now it is commonly thought that some areas such as plains in Shaoxing and Ningbo in Zhejiang province are the cradlelands of East Asian rice cultivation. Finally, ancient textual evidence of the cultivation of rice in China dates to 3000 years ago.

Interestingly, archaeologists have recently discovered much older burnt grains (domesticated rice) in Sorori, Korea, potentially challenging this view of Chinese origin.[7] Unfortunately, the media reports of the Soro-ri charred grains are brief and lack sufficient detail for us to properly evaluate the true meaning of this very unusual find.

Reliable, mainstream archaeological evidence derived from palaeoethnobotanical investigations indicate that dry-land rice was introduced to Japan and Korea some time between 3500 and 1200 BC. Later wet-paddy intensive rice agriculture was introduced into Korea during the Middle Mumun pottery period (c. 850-550 BC) and reached Japan by the Yayoi circa 300 BC (Crawford and Lee 2003; Crawford and Shen 1998).

South Asia

It is generally assumed that the Rigveda does not know rice. There is however mention of ApUpa, Puro-das and Odana (rice-gruel) in the Rig Veda, terms that, at least in later texts, refer to rice dishes,[8] The rigvedic commentator Sayana refers to "tandula" when commenting on RV 1.16.2., which usually means rice. [9] It was also speculated that the rigvedic term dhana (dhanaa, dhanya) could possibly refer to rice.[10] Both Charaka and Sushruta mention rice in some detail.[11] The Arthasastra discusses some aspects of rice cultivation.[12] The Kashyapiyakrishisukti by Kashyapa is the most detailed ancient Sanskrit text on rice cultivation.

Africa

African rice has been cultivated for 3500 years. Between 1500 and 800 BC, *O. glaberrima* propagated from its original center, the Niger River delta, and extended to Senegal. However, it never developed far from its original region. Its cultivation even declined in favor of the Asian species, possibly brought to the African continent by Arabs coming from the east coast between the 7th and 11th centuries CE

Near East and Europe

O. sativa was adapted to farming in the Middle East and Mediterranean Europe around 800 BC. The Moors brought it to the Iberian Peninsula when they conquered it in 711 AD. After the middle of the 15th century, rice spread throughout Italy and then France, later propagating to all the continents during the great age of European exploration.

The Americas

In 1694, rice arrived in South Carolina, probably originating from Madagascar. The Spanish brought rice to South America at the beginning of the 18th century.

In the United States, colonial South Carolina and Georgia grew and amassed great wealth from the slave labour obtained from the Senegambia area of West Africa. At the port of Charleston, through which 40% of all American slave imports passed, slaves from this region of Africa brought the highest prices, in recognition of their prior knowledge of rice culture, which was put to use on the many rice plantations around Georgetown, Charleston, and Savannah. From the slaves, plantation owners learned how to dike the marshes and periodically flood the fields. At first the rice was milled by hand with wooden paddles, then winnowed in sweetgrass baskets (the making of which was another skill brought by the slaves). The invention of the rice mill increased profitability of the crop, and the addition of water power for the mills in 1787 by millwright Jonathan Lucas was another step forward. Rice culture in the southeastern U.S. became less profitable with the loss of slave labour after the American Civil War, and it finally died out just after the turn of the 20th century. The predominant strain of rice in the Carolinas was from Africa and was known as "Carolina Gold." The cultivar has been preserved and there are current attempts to reintroduce it as a commercially grown crop

World production and trade

World production of rice [14] has risen steadily from about 200 million tons of paddy rice in 1960 to 600 million tons in 2004. Milled rice is about 68% of paddy rice by weight. In the year 2004, the top three producers were China (31% of world production), India (20%), and Indonesia (9%).

World trade figures are very different, as only about 5-6% of rice produced is traded internationally. The largest three exporting countries are Thailand (26% of world exports), Vietnam (15%), and the United States (11%), while the largest three importers are Indonesia (14%), Bangladesh (4%), and Brazil (3%).

Rice is the most important crop in Asia. In Cambodia, for example, 90% of the total agriculutral area is used for rice production (see "The Burning of the Rice" by Don Puckridge for the story of rice production in Cambodia

Rice Pests

Rice pests are any organisms or microbes with the potential to reduce the yield or value of the rice crop (or of rice seeds) (Jahn et al. 2000). Rice pests include weeds, pathogens, insects, rodents, and birds. A variety of factors can contribute to pest outbreaks, including the overuse of pesticides and high rates of nitrogen fertilizer application (e.g. Jahn et al. 2005)[7]. Weather conditions also contribute to pest outbreaks. For example, rice gall midge and army worm outbreaks tend to follow high rainfall early in the wet season, while thrips outbreaks are associated with drought (Douangboupha et al. 2006).

Rice pests are managed by cultural techniques, pest-resistant rice varieties, and pesticides (which include insecticide). Increasingly, there is evidence that farmers' pesticide applications are often unnecessary (Jahn et al. 2004a) [8][9][10]. By reducing the populations of natural enemies of rice pests (Jahn 1992), misuse of insecticides can actually lead to pest outbreaks (Cohen et al. 1994). Among rice cultivars there are differences in the responses to, and recovery from, pest damage

(Jahn et al. 2004b, Khiev et al. 2000). Therefore, particular cultivars are recommended for areas prone to certain pest problems. Major rice pests include the brown planthopper (Preap et al. 2006), the rice gall midge (Jahn and Khiev 2004), the rice bug (Jahn et al. 2004b), rats (Leung et al 2002), and the weed *Echinochloa crus-gali* (Pheng et al. 2001).

Cultivars

The largest collection of rice cultivars is at the International Rice Research Institute (IRRI), with over 100,000 rice accessions [11] held in the International Rice Genebank [12]. Rice cultivars are often classified by their grain shapes and texture. For example, Thai Jasmine rice is long-grain and relatively less sticky, as long-grain rice contains less amylopectin than short-grain cultivars. Chinese restaurants usually serve long-grain as plain unseasoned steamed rice. Japanese mochi rice and Chinese sticky rice are short-grain. Chinese people use sticky rice which is properly known as "glutinous rice" (note: glutinous refer to the glue-like characteristic of rice; does not refer to "gluten") to make zongzi. The Japanese table rice is a sticky, short-grain rice. Japanese sake rice is another kind as well.

Indian rice cultivars include long-grained and aromatic Basmati (grown in the North), long and medium-grained Patna rice and short-grained Masoori. In South India the most prized cultivar is 'ponni' which is primarily grown in the delta regions of Kaveri River. Kaveri is also referred to as ponni in the South and the name reflects the geographic region where it is grown. Rice in East India and South India, is usually prepared by boiling the rice in large pans immediately after harvesting and before removing the husk; this is referred to in English as *parboiled rice*. It is then dried, and the husk removed later. It often displays small red speckles, and has a smoky flavour from the fires. Usually coarser rice is used for this procedure. It helps to retain the natural vitamins and kill any fungi or other contaminants, but leads to an odour which some find peculiar. This rice is easier on the stomach to digest. In South India, it is also used to make idlis

Aromatic rices have definite aromas and flavours; the most noted cultivars are the aforementioned basmati, Patna rice, and a hybrid cultivar from America sold under the trade name, Texmati. It is a cross between Basmati and American long-grained rice that is creating great controversy. Both Basmati and Texmati have a mild popcorn-like aroma and flavour. In Indonesia there are also *red* and *black* cultivars.

High-yield cultivars of rice suitable for cultivation in Africa and other dry ecosystems called the new rice for Africa (NERICA) cultivars have been developed. It is hoped that their cultivation will improve food security in West Africa.

Scientists are working on so-called *golden rice* which is genetically modified to produce beta carotene, the precursor to vitamin A.

Draft genomes for the two most common rice cultivars, *indica* and *japonica*, were published in April 2002. Rice was chosen as a model organism for the biology of grasses because of its relatively small genome (~430 megabase pairs). Rice was the first crop with a complete genome sequence.[15] Basmati rice is the oldest, common progenitor for most types

MAIZE

Types of Maize. Several thousand varieties of maize are now grown throughout the world and most of these can be allocated to one of the seven most important groups: dent maize, pod maize.

Soil Requirements. Successful maize cultivation is more frequently and more easily achieved on soils which are of medium texture. As the soils become lighter the greater is the chanced of their "drying out" in midsummer and although there is really nothing else against them, the very light sandy soils should be avoided.

Having suggested light to medium textured soils for maize, is must also be stressed that organic status and fertility should be high.

The maize land should be free draining in order that as much of the heat as possible is employed in raising soil temperatures and not removing excess of soil moisture. The soil should be naturally free draining to enable a full rooting system to develop in a plentiful supply of oxygen.

Maximum yields are believed to be obtained between pH 4 and 9. Some scientists believe maize to be successfully cultivated on the moderately acid soils (pH 6-7 as optimal). Others say that maize growing can be successful under alkaline conditions provided there are no serious deficiencies the micro-nutrients.

Application of Fertilizers it has been suggested that phosphate and potash should be applied to the land well in advance of drilling and the nitrogen incorporated into the seedbed just prior to drilling otherwise much of it would be lost by leaching.

One should remember that germination is much retarded by fertilizers in contact with the seed.

Cultivation. With a more extensive and deeper rooting system than the other cereals, maize will require deeper ploughing, cultivations and seed-beds to obtain maximum growth. Autumn ploughing is advisable on stronger soils and it may be left early spring when textures are light. Cultivations which follow should be to a depth of 4-5 inches. They kill the weeds after germination; inter-row cultivation can follow crop emergence to obtain further weed control. Chemical means are often preferred.

Seed-beds should be uniform and fin e to obtain a quick germination and to assist the action of herbicides in their control of weeds.

Seeding. Minimum temperatures for growth of maize are around 50 F (10 °C) and thus early spring sowings are of little value except when the soils are warmer than usual. Under cool conditions seeds rot.

When the average **t** is over 50 F the emergence of maize will take approximately two weeks. Late spring frosts can also damaging to seedling maize although with the cold tolerant varieties being introduced there is every chance that this crop may now survive the first few degrees of frost.

Sunshine and Solar Energy. Little is said and written about sunshine and solar energy requirements with this cereal. It is, however, assumed that for satisfactory growth and ripening of the crop high levels of bright sunshine are required.

Maize is quite unique in its mode of growth and extent and duration of its leaves. They grow in a manner which facilitates efficient use of radiant energy by trapping most of the sun's rays and since the duration of full leaf extends almost to grain maturity, the sun's energy can be transferred to grain yield throughout the whole life of the plant. A point close to optimum leaf area is obtained early and maintained almost to grain maturity thus making maize one of the most efficient utilizers and converters of solar energy into plant energy particularly when the whole plant is considered as the economic yield.

Mashqlar

I. Tekstdan foydalanib, tushirilib qoldirilgan so'zlarni toping.

1. When there is not enough potassium in the soil, we say the soil is … in potassium. 2. … is the process which removes excess of soil moisture. 3. Best yields of maize are achieved on soils of medium … and high … . 4. Nitrogen fertilizer should be … into the soil, otherwise much of it will be lost by … . 5. Cultivations and … help to control … . 6. The average temperature for the … of maize is over fifty degrees F.

Lug‘at-minimum

maize – makkajo‘xori
throughout the world – butun jahonda

texture – tuzilish, tekstura
in midsummer – yozning o‘rtasida
sandy soils – qumli tuproq
excess of soil moisture – tuproq namligini ko‘pligi
solar energy – quyosh energiyasi
acid – kislota
to be applied to the land – yerga ishlov bermoq
alkaline – ishqoriy
fertility – yuqori hosildorlik
sunshine – quyosh nuri
germination – urug‘larning unib chiqishi

OATS

Soil. The cultivation of oats may take place on a wide range of soil types with a reasonable degree of success. Oats can be found on all the light to medium soils in the higher rainfall areas and will give high yielding crops of good quality. They can also produce good crops of the heavier soils, clay and silts, in the drier areas of Britain where there are significant moisture reserves in the soil which can be drawn upon during a particularly dry time.

It is that oats will grow well where barley will fail completely and wheat produces only moderate crops but extreme acidity even oats cannot be tolerated.

Climate. The oat crop is particularly suited to the cooler more humid climate of the western and northern regions of Britain where growth is relatively slow and as a result the grains have plenty of time to fill out to produce good plump samples.

Oat crops which do not suffer through lack of moisture will produce high grain yields of good quality and on the average the straw will weigh slightly more than the grain. Most of the world’s oats are supposed to be produced at elevations below 2,000 feet and probably half below 1,000 feet.

Seed-bed Preparation. Oats are said to be the best cereal to follow the ploughing up of grassland but this is only true if the grass is turned in timely and well, the furrow slice being properly inverted and no large air pockets left which tend to accentuate drying out.

Ploughing depths should be 6 inches except where grass or surface trash need to be buried deeper and then 8-9 inches plough depths may be required. Were early ploughing has been carried out it is often only necessary to give the land a light-medium harrowing to obtain the desired tilth in the top 3 inches of the soil.

Drilling. Optimum drilling depth with oats lies in region of 1.5-2 inches. When seed-beds have an irregular surface tilth, drilling depth becomes uneven and in order to ensure that all the seed is covered, it will often go in well below the optimum in many areas and this will be responsible for patchy stands.

Harvest. It has been pointed out that for straw to have additional feeding value the crop should be cut early and this will mean bindering one or two weeks before full ripeness. Very tall crops may be cut earlier than usual to make the harvesting easier and to avoid risks of late lodging and this will also apply to crops which have been undersown.

Windrow Harvesting. Oats has been said to shatter more easily, high winds (when the crop is ripe) resulting in extensive loss of grain. In some parts of the United States and in parts of Canada a high proportion of the oat crop grown specifically for grain is windrowed to avoid these losses due to shattering.

Combine harvesting. The proportion of the oat crop harvested by combine has risen markedly over the past few years. The advantages of combining the crop li firstly in the speed at which the operation can be carried out, secondly grain losses can be kept to a minimum and thirdly it is possible to save lodged crops which would be extremely difficult by any other means.

The grain should be left to dry out as far as possible in the field to reduce artificial drying costs, but not at the expense of grain losses.

Mashqlar

I. Chap tomondagi so‘zlar o‘ng tomondagi qaysi so‘zlar bilan mos keladi.

Climate	cool, humid, slow, high, dry
Growth	good, slow, heavy, rank, plump
Land	grass, well, slice, best,

	plowed
Harrowing	desired, medium, light, rough, combine
Variety	spring, early-maturing, ripe, hardy, even

Lug‘at-minimum

oats – suli
lack of moisture – namlik yetish-masligi
barley – arpa
to tolerate – chidash bermoq
grains – don
clay – loy
at elevation – balandlikda
on the average – o‘rtacha

BARLEY

1. The first requirement in the production of any crop is to see that soil conditions are as close to the optimum as possible. Barley prefers well-drained soils, light to medium in texture with a high pH. When fertility is high and weather conditions high yielding crops of good quality are obtained. When pH values are recorded below 6.0, it would be wise to lime specifically for this crop and it should be worked into the topsoil in advance of sowing. Since the grain yield with barley is likely to be higher than with oats and due to its better feeding value, it has replaced the traditional oat crop on many dairy farms in Britain. As long as the pH is over 6 and the soil is in reasonable conditions, there is no reason why this crop cannot be grown on most soils in Britain, one notable exception being the wet soils associated with upland conditions.

2. When barley is grown in the wetter areas of Britain, it does best when the rainfall is below normal and when sunshine are higher than usual. Kramer reviewed the effect of climate on this crop through data Zealand. Their results suggest that low rainfall in April and early May and cool weather in May, is required for high yields. High rainfall in the previous winter appeared detrimental and warm dry weather was required during ripening.

3. Winter barley is often sown after easily harvested sugar beet on the lighter soils, since seed – beds can often be easily and quickly prepared for sowing in October and November. With large acreage of arable land in cereals, many crops of winter barley will go in after spring cereals, but it would be unwise to grow winter barley following winter barley due to the increased disease risks involved. Spring barley may follow almost any other crop provided the land is not in too high a state of fertility otherwise wide – spread lodging can result.

Mashqlar

I. Tekstdan quyidagi so'zlarni sinonimini toping.

1. to influence, thanks to, preceding, to reach, to keep up, most, lack, appearance, clear, implements.

II. Tekstdan foydalanib, tushirilib qoldirilgan so‘zlarni qo‘ying.

1. Good weather is … for high yields. 2. When … values are below 6.0, it is necessary to lime. 3. The yield of barley is easily … by application of fertilizers. 4. Most nitrogen is applied as … . 5. The … from the previous crop should be turned under. 6. Barley on soils of high fertility may … .

III. Tekstni o‘qing va quyidagi savollarga javob bering.

The best rate of seeding for any particular field is determined by the amount of moisture likely to be available (especially during critical periods in the development of the crop) by the fertility of the soil and by the size of the seed used. The average rate of seeding barley is l to 2 bushels per acre. A lower rate should be employed on rich soils well supplied with moisture than on poorer upland fields, because there will be less trouble from lodging on the poorer lands.

Reductions in rate of seeding will lead to the development of stronger straw that is better able to support the weight.

IV. Tekstni lug‘atsiz tarjima qiling.

The fertilizer requirements for barley ate about the same as those of oats and wheat. Barley will generally respond to an application of nitrogen, phosphorus, and potash – especially on soil of lower fertility. On the lighter – textured soils, top – dressing of the crop with nitrogen will increase yields. However, the addition of too much nitrogen will increase the danger of lodging. It may also increase the protein content of the grain, which may be undesirable in the production of malting.

V. Quyidagi tekstni lug‘at yordamida 10 daqiqa ichida tarjima qiling.

Lug‘at-minimum

barley – arpa
topsoil – tuproqning ustki qatlamlari

dairy farms – sut fermalari
upland conditions – tog‘ sharoitlarida

sunshine hours – quyosh qizitadigan soatlar

detrimental – zararli
ripening – yetilishi, pishishi
cool weather – salqin havo
arable land – ekiladigan yer
seed-beds – ekish uchun tayyorlangan tuproq
spring cereals – bahorgi boshoqli o‘simliklar

Flax

Flax (also known as **Common Flax** or **Linseed**) is a member of the genus *Linum* in the family Linaceae. The **New Zealand flax** is unrelated. Flax originated in India and was first domesticated in the Fertile Crescent.[1]

It is an erect annual plant growing to 120 cm tall, with slender stems. The leaves are glaucous green, slender lanceolate, 2-4 cm long and 3 mm broad. The flowers are pure pale blue, 1.5-2.5 cm diameter, with five petals. The fruit is a round, dry capsule 5-9 mm diameter, containing several glossy brown seeds shaped like an apple pip, 4-7 mm long.

In addition to the plant itself, flax may refer to the unspun fibres of the flax plant.

Flax is grown both for seed and for its fibers. Various parts of the plant have been used to make fabric, dye, paper, medicines, fishing nets and soap. It is also grown as an ornamental plant in gardens, as flax is one of the few plant species that is capable of producing truly blue flowers (most "blue" flowers are really shades of purple), although not all flax varieties produce blue flowers.

Flax seed

The seeds produce a vegetable oil known as linseed oil or flaxseed oil. It is one of the oldest commercial oils and solvent-processed flax seed oil has been used for centuries as a drying oil in painting and varnishing. Flax seeds come in two basic varieties; brown and yellow (also referred to as golden). Although brown flax can be consumed and has been for thousands of years, it is better known as an ingredient in paints, fibre and cattle feed. Brown and yellow flax have similar nutritional values and equal amounts of short-chain omega-3 fatty acids. The exception is a type of yellow flax called solin which is very low in omega-3 and has a completely different oil profile. A number of studies have shown that people have a very hard time absorbing the Omega-3 from flaxseed oil compared to oily fish (see Fish and plants as a source of Omega-3 for more).

A North Dakota State University research project led to the creation of a new variety of the yellow flax seed called "Omega"[2]. This new variety was created primarily as a food source and has a more pleasant nutty-buttery flavour than the brown variety and retains a comparable level of the beneficial Omega-3 oil.

One tablespoon of ground flax seeds and three tablespoons of water may serve as a replacement for one egg in baking by binding the other ingredients together, and ground flax seeds can also be mixed in with oatmeal, yogurt, water (similar to Metamucil), or any other food item where a nutty flavour is appropriate. [*citation needed*] Flaxseed oil is most commonly consumed with salads or in capsules. Flax seed owes its nutritional benefits to lignans and omega-3 essential fatty acids. Omega-3s, often in short supply in populations with low-fish diets, promote heart health by reducing cholesterol, blood pressure and plaque formation in arteries. In addition, flaxseed oil is often recommended as a galactagogue. Lignans benefit the heart and possess anti-cancer properties: A series of research studies by Lilian U. Thompson and her colleagues at the Department of Nutritional Science of the University of Toronto have reported that flaxseed can have a beneficial effect in reducing tumour growth in mice, particularly the kind of tumour found in human post-menopausal breast cancer. The effects are thought to be due to the lignans in flaxseed, and are additive with those of tamoxifen, the currently standard drug treatment for these cancers. Initial studies suggest that flaxseed taken in the diet have similar beneficial effects in human cancer patients. Reports that flaxseed is beneficial in other cancers, e.g. prostate cancer, are less numerous but promising.

Flax seed sprouts are edible, with a slightly spicy flavour.

Flax fibre

Flax fibres are amongst the oldest fibre crops in the world. The use of flax for the production of linen goes back 5000 years. Pictures on tombs and temple walls at Thebes depict flowering flax plants. The use of flax fibre in the manufacturing of cloth in northern Europe dates back to pre-Roman times. In North America, flax was introduced by the Pilgrim fathers. Currently most flax produced in the USA and

Canada are seed flax types for the production of linseed oil or flaxseeds for human nutrition.

Flax fibre is extracted from the bast or skin of the stem of flax plant. Flax fibre is soft, lustrous and flexible. It is stronger than cotton fibre but less elastic. The best grades are used for linen fabrics such as damasks, lace and sheeting. Coarser grades are used for the manufacturing of twine and rope. Flax fibre is also a raw material for the high-quality paper industry for the use of printed banknotes and rolling paper for cigarettes.

Cultivation

The major fibre flax-producing countries are the former USSR, Poland, France, Belgium, Ireland, and the Czech Republic.

The soils most suitable for flax, besides the alluvial kind, are deep friable loams, and containing a large proportion of organic matter. Heavy clays are unsuitable, as are soils of a gravelly or dry sandy nature. [*citation needed*]

Flax is harvested for fibre production when still green, before seed maturation as the fibre starts to degrade later; it is pulled up with the roots (not cut), so as to maximise the fibre length. Immediately after harvesting, it is put in water to soak (retting) to rot off the non-fibrous material in the stems. Retting takes 7-12 days, depending on temperature.

Flax grown for seed is allowed to mature until the seed capsules are yellow and just starting to split; it is then harvested by combine harvester and dried to extract the seed.

Threshing flax

The process is divided into two parts: the first part is intended for the farmer, or flax-grower, to bring the flax into a fit state for general or common purposes. This is performed by three machines: one for threshing out the seed, one for breaking and separating the wood from the fibre, and one for further separating the broken wood and matter from the fibre. In some cases the farmers will perhaps thrash out the seed in their own mill and therefore, in such cases, the first machine will be, of course, unnecessary.

The second part of the process is intended for the manufacturer to bring the flax into a state for the very finest purposes, such as lace, cambric, damask, and very fine linen. This second part is performed by the refining machine only.

The threshing process would be conducted as follows:

- Take the flax in small bundles, as it comes from the field or stack, and holding it in the left hand, put the seed end between the threshing machine and the bed or block against which the machine is to strike; then take the handle of the machine in the right hand, and move the machine backward and forward, to strike on the flax, until the seed is all threshed out.
- Take the flax in small handfuls in the left hand, spread it flat between the third and little finger, with the seed end downwards, and the root-end above, as near the hand as possible.
- Put the handful between the beater of the breaking machine, and beat it gently till the three or four inches, which have been under the operation of the machine, appear to be soft.
- Remove the flax a little higher in the hand, so as to let the soft part of the flax rest upon the little finger, and continue to beat it till all is soft, and the wood is separated from the fibre, keeping the left hand close to the block and the flax as flat upon the block as possible. [*citation needed*]
- The other end of the flax is then to be turned, and the end which has been beaten is to be wrapped round the little finger, the root end flat, and beaten in the machine till the wood is separated, exactly in the same way as the other end was beaten.

Sugar beet

Sugar beet (*Beta vulgaris* L.), a member of the *Chenopodiaceae* subfamily and the *Amaranthaceae* family, is a plant whose root contains a high concentration of sucrose. It is grown commercially for sugar.

The sugar beet is directly related to the beetroot, chard and fodder beet, all descended by cultivation from the sea beet.

The European Union, the United States, and Russia are the world's three largest sugar beet producers,[1] although only Europe and Ukraine are significant exporters of sugar from beet. Beet sugar accounts for 30% of the world's sugar production.

Culture

Sugar beet is a hardy biennial plant that can be grown commercially in a wide variety of temperate climates. During its first growing season, it produces a large (1–2 kg) storage root whose dry mass is 15–20% sucrose by weight. If not harvested, during its second growing season, the nutrients in this root are consumed to produce the plant's flowers and seeds. In commercial beet production, the root is harvested after the first growing season, when the root is at its maximum size.

In most temperate climates, beets are planted in the spring and harvested in the autumn. At the northern end of its range, growing seasons as short as 100 days can produce commercially viable sugarbeet crops. In warmer climates, such as in California's Imperial Valley, sugarbeets are a winter crop, being planted in the autumn and harvested in the spring. Beets are planted from a small seed; 1 kg of beet seed comprises 100,000 seeds and will plant over a hectare of ground (1 lb will plant about an acre).

Up until the latter half of the 20th century, sugarbeet production was highly labor-intensive, as weed control was managed by densely planting the crop, which then had to be manually thinned with a hoe two or even three times during the growing season. Harvesting also required many workers. Although the roots could be lifted by a plough-like device which could be pulled by a horse team, the rest of the preparation was by hand. One laborer grabbed the beets by their leaves, knocked them together to shake free loose soil, and then laid them in a row, root to one side, greens to the other. A second worker equipped with a beet hook (a short handled tool something between a billhook and a sickle) followed behind, and would lift the beet and swiftly chop the crown and leaves from the root with a single action. Working this way he would leave a row of beet that could then be forked into the back of a cart.

Today, mechanical sowing, herbicide application for weed control and mechanical harvesting has removed this reliance on workers.

Harvesting is now entirely mechanical. The beet harvester chops the leaf and crown (which is high in non-sugar impurities) from the root, lifts the root, and removes excess soil from the root in a single pass over the field. A modern harvester is typically able to cover 6 rows at the same time. The beet is left in piles at the side of the field and then conveyed into a trailer for delivery to the factory. The conveyor removes more soil -a farmer would be penalised at the factory for excess soil in his load.

If beet is to be left for later delivery, it is formed into "clamps". Straw bales are used to shield the beet from the weather. Provided the clamp is well built with the right amount of ventilation, the beet does not significantly deteriorate. Beet that is frozen and then defrosts, produce complex carbohydrates that cause severe production problems in the factory. In the UK, loads may be hand examined at the factory gate before being accepted.

In the US, the fall harvest begins with the first hard frost, which arrests photosynthesis and the further growth of the root. Depending on the local climate, it may be carried out in few weeks or be prolonged throughout the winter months. The harvest and processing of the beet is referred to as "the campaign", reflecting the organization required to deliver crop at a steady rate to processing factories that run 24 hours a day for the duration of the harvest and processing (for the UK the campaign lasts approx 5 months). In the Netherlands this period is known as "*de bietencampagne*", a time to be careful when driving local roads in the area the beets are grown. The reason for this is the naturally high clay content of the soil, causing slippery roads when soil falls from the trailers during transport.

Processing

Reception

After harvesting the beet are hauled to the factory. Delivery in the UK is by hauler or, for local farmers, by tractor and trailer. Railways and boats were once used in the UK, but no longer. Some beet was carried by rail in the Republic of Ireland, until the 2006 shutdown of sugar beet production in the country due to the end of subsidies.

Each load entering is weighed and sampled before tipping onto the reception area, typically a "flat pad" of concrete, where it is moved into large heaps. The beet sample is checked for

- soil tare - the amount of non beet delivered
- crown tare - the amount of low sugar beet delivered
- sugar content ("pol") - amount of sucrose in the crop
- nitrogen content - for recommending future fertilizer use to the farmer.

From these the actual sugar content of the load is calculated and the grower's payment determined.

The beet is moved from the heaps into a central channel or gulley where it is washed towards the processing plant.

Diffusion

After reception at the processing plant the beet roots are washed, mechanically sliced into thin strips called ***cossettes***, and passed to a machine called a diffuser to extract their sugar content into a water solution.

Diffusers are long (many metres) vessels in which the beet slices go in one direction while hot water goes in the opposite direction. The movement may either be by a rotating screw or the whole unit rotates and the water and cossettes move through internal chambers. There are three common designs of diffuser, the horizontal rotating 'RT' (from "*Raffinière Tirlemontoise*", the manufacturer), inclined screw 'DDS' (*Det Danske Sukkerfabrik*)), or vertical screw "Tower". A less common design uses a moving belt of cossettes and water is pumped onto the top of the belt and pours through. In all cases the flow rates of cossettes and water are in the ratio one to two. Typically cossettes take about 90 minutes to pass through the diffuser, the water only 45 minutes. These are all countercurrent exchange methods that extract more sugar from the cossettes using less water than if they merely sat in a hot water tank. The liquid exiting the diffuser is called ***raw juice***. The colour of raw juice varies from black to a dark red depending on the amount of oxidation which is itself dependent on diffuser design.

The used cossettes, or ***pulp***, exits the diffuser at about 95% moisture but low sucrose content. Using screw presses, the wet pulp is then pressed down to 75% moisture. This recovers additional sucrose in the liquid pressed out of the pulp, and reduces the energy needed to dry the pulp. The pressed pulp is dried and sold as animal feed, while the liquid pressed out of the pulp is combined with the raw juice or more often introduced into the diffuser at the appropriate point in the countercurrent process.

During diffusion there is a degree of breakdown of the sucrose into invert sugars and these can undergo further breakdown into acids. These breakdown products are not only losses of sucrose but also have knock-on effects reducing the final output of processed sugar from the factory. To limit (thermophilic) bacterial action the feed water may be dosed with formaldehyde and control of the feed water pH is also practised. There have been attempts at operating diffusion under alkaline conditions but the process has proven problematic - the improved sucrose extraction in the diffuser offset by processing problems in the next stages.

Carbonatation

The raw juice contains many impurities that must be removed before crystallisation. This is accomplished via carbonatation. First, the juice is mixed with hot milk of lime (a suspension of calcium hydroxide in water). This treatment precipitates a number of impurities, including multivalent anions such as sulfate, phosphate, citrate and oxalate, which precipitate as their calcium salts and large organic molecules such as proteins, saponins and pectins, which aggregate in the presence of multivalent cations. In addition, the alkaline conditions convert the simple sugars, glucose and fructose, along with the amino acid glutamine, to chemically stable carboxylic acids. Left untreated, these sugars and amines would eventually frustrate crystallization of the sucrose.

Next, carbon dioxide is bubbled through the alkaline sugar solution, precipitating the lime as calcium carbonate (chalk). The chalk particles entrap some impurities and adsorb others. A recycling process builds up the size of chalk particles and a natural flocculation occurs where the heavy particles settle out in tanks (clarifiers). A final addition of more carbon dioxide precipitates more calcium from solution; this is filtered off, leaving a cleaner golden light brown sugar solution called ***thin juice***.

Before entering the next stage the thin juice may receive soda ash to modify the pH and sulphitation with a sulphur-based compound to reduce colour formation due to decomposition of monosaccharides under heat.

Evaporation

The thin juice, is concentrated via multiple-effect evaporation to make a ***thick juice***, roughly 60% sucrose by weight and similar in appearance to pancake syrup. Thick juice can be stored in tanks for later processing reducing load on the crystallization plant.

Crystallization

The thick Juice is fed to the crystallisers, recycled sugar is dissolved into it and the resulting syrup is called "mother liquor". This is concentrated further by boiling under vacuum in large vessels and seeded with fine sugar crystals. These crystals grow, as sugar from the mother liquor forms around them. The resulting sugar crystal and syrup mix is called a *massecuite* (from French "cooked mass"). The massecuite is passed to a centrifuge where the liquid is removed from the sugar crystals. Remaining syrup is rinsed off with water and the crystals dried in a granulator using warm air. The remaining syrup is fed to another crystalliser from which a second batch of sugar is produced. This sugar ("raw") is of lower quality with a lot of colour and impurities and is the main source of the sugar that is re-dissolved into the mother liquor. The syrup from the raw is also sent to a crystalliser. From this a very low quality sugar crystal is produced (known in some systems as "AP sugar") that is also redissolved. The syrup separated is molasses; still containing sugar but with too much impurity to be economically processed further.

There are variations on the above system, with different recycling and crystallisation paths.

FEEDING BARLEY

Barley is one of the best of the small grains for feed. Ground barley is an excellent feed for dairy cows. Studies conducted have shown that, ton for ton, ground barley is equal corn in feeding valve for dairy cows when used as 40 to 60 per cent of the concentrate of "grain" mixture. Ground barley is rated as being somewhat better than ground oats for milk production.

Because barley ripens early in summer, long before corn does, it fits in well with swine production where high carbohydrate crops are needed during summer months. Hogs can be fed on barley in late summer, finished off, and put on the market early. Barley also used as feed beef cattle, where corn cannot be grown or is too expensive.

Transgenic plants are plants that possess a gene or genes that have been transferred from a different species. Such modification may be performed through ordinary hybridization through cross-pollination of plants, but the term today refers to plants produced in a laboratory using recombinant DNA technology in order to create plants with specific characteristics by artificial insertion of genes from other species, and sometimes entirely different kingdoms. *See also* Genetics, List of genetic engineering topics.

Prior to the current era of molecular genetics starting around 1975, transgenic plants including cereal crops were (since the mid 1930s) part of conventional plant breeding.

Transgenic varieties are frequently created by classical breeders who deliberately force hybridization between distinct plant species when carrying out interspecific or intergeneric *wide crosses* with the intention of developing disease resistant crop varieties. Classical plant breeder may use use of a number of *in vitro* techniques such as protoplast fusion, embryo rescue or mutagenisis to generate diversity and produce plants that would not exist in nature (*see also Plant breeding, Heterosis, New Rice for Africa*).

Such traditional techniques (used since about 1930 on) have never been controversial, or been given wide publicity except among professional biologists, and have allowed crop breeders to develop varieties of basic food crop, wheat in particular, which resist devastating plant diseases such as rusts. *Hope* is one such transgenic wheat variety bred by E. S. McFadden with a transgene from a wild grass. *Hope* saved American wheat growers from devastating stem rust outbreaks in the 1930s.

Methods used in traditional breeding that generate transgenic plants by non-recombinant methods are widely familiar to professional plant scientists, and serve important roles in securing a sustainable future for agriculture by protecting crops from pest and helping land and water to be used more efficiently. (*see also* Food security, International Fund for Agricultural Development, International development)

Natural movements of genes between species.

Natural movement of genes between species, often called horizontal gene transfer or lateral gene transfer, can also because of gene transfer mediated by natural agents such as microrganisms, viruses, or mites. Such transfers occur at a frequency that is low compared with the hybridization that occurs during natural pollination, but can be frequent enough to be a significant factor in genetic change of a chromosome on evolutionary time scales (Syvanen, M. and Kado, C. I. Horizontal Gene Transfer. Second Edition. Academic Press 2002).

This natural gene movement between species has been widely detected during genetic investigation of various natural Mobile genetic elements, such as transposons, and retrotransposons that naturally transfer to new locations in a genome, and often move to new species host over an evolutionary time scale. There are many types of natural mobile DNAs, and they have been detected abundantly in food crops such as rice DNA-binding specificity of rice mariner-like transposases and interactions with Stowaway MITEs.

These various mobile genes play a major role in dynamic changes to chromosomes during evolution [1], [2], and have often been given whimsical names, such as Mariner, Hobo, Trans-Siberian Express (Transib), Osmar, Helitron, Sleeping Princess, MITE and MULE, to emphasize their mobile and transient behavior.

Such genetically mobile DNA contitutute a major fraction of the DNA of many plants, and the natural dynamic changes to crop plant chromosomes caused by this natural transgenic DNA mimics many of the features of plant genetic engineering currently pursued in the laboratory, such as using transposons as a genetic tool, and molecular cloning. *See also* transposon, retrotransposon, integron, provirus, endogenous retrovirus, heterosis, Gene duplication and exon shuffling by helitron-like transposons generate intraspecies diversity in maize.

There is large and growing scientific literature about natural transgenic events in plants, such as the creation of shibra millet in Africa, and movement of natural mobile DNAs called MULEs between rice and millet [3].

It is becoming clear that natural rearrangments of DNA and generation of transgenes play a pervasive role in natural evolution. Importantly many, if not most, flowering plants evolved by transgenesis - that is, the creation of natural interspecies hybrids in which chromosome sets from different plant species were added together. There is also the long and rich history of transgenic varieties in traditional breeding.

Deliberate creation of transgenic plants during breeding

Production of transgenic plants in wide-crosses by plant breeders has been a vital aspect of conventional plant breeding for a century or so. Without it, security of our food supply against losses caused by crop pests such as rusts and mildews would be severely compromised. The first historically recorded interpecies transgenic cereal hybrid was actually between wheat and rye (Wilson, 1876).

Last century, the introduction of alien germplasm into common foods was repeatedly achieved by traditional crop breeders by artificially overcoming fertility barriers. Novel genetic rearrangements of plant chromosomes, such as insertion of large blocks of rye (Secale) genes into wheat chromosomes ('translocations'), has also been exploited widely for many decades [4].

By the late 1930s with the introduction of colchicine, perennial grasses were being hybridized with wheat with the aim of transferring disease resistance and perenniality into annual crops, and large-scale practical use of hybrids was well established, leading on to development of Triticosecale and other new transgenic cereal crops. In 1985 Plant Genetic Systems (Ghent, Belgium), founded by Marc Van Montagu and Jeff Schell, was the first company to develop genetically engineered (tobacco) plants with insect tolerance by expressing genes encoding for insecticidal proteins from Bacillus thuringiensis (Bt). [1]

Important transgenic pathogen and parasite resistance traits in current bread wheat varieties (gene, eg "Lr9" followed by the source species) are:

Disease resistance to Leaf rust

- Lr9 (from *Aegilops umbellulata*)
- Lr18 *Triticum timopheevi*
- Lr19 *Thinopyrum*

- Lr23 *T. turgidum*
- Lr24 *Ag. elongatum*
- Lr25 *Secale cereale*
- Lr29 *Ag. elongatum*
- Lr32 *T. tauschii*

Disease resistance to Stem rust

- Sr2 *T. turgidum* ("Hope") McFadden, E. S. (1930) J. Am. Soc. Agron. 22, 1020-1031 .
- Sr22 *Triticum monococcum*
- Sr36 *Triticum timopheevii*

Stripe rust

- Yr15 *Triticum dicoccoides*

Powdery mildew

- Pm12 *Aegilops speltoides*
- Pm21 *Haynaldia villosa*
- Pm25 *T. monococcum*

Wheat streak mosaic virus

- Wsm1 *Ag. elongatum*

Pest resistance

- **Hessian fly**
    - H21 *S. cereale* H23,
    - H24 *T. tauschii*
    - H27 *Aegilops ventricosa*
- **Cereal cyst nematode**
    - Cre3 (Ccn-D1) *T. tauschii*
- **Lepidoptera**
    - Bt *Bacillus thuringiensis*

The intentional creation of transgenic plants by laboratory based recombinant DNA methods is more recent (from the mid-80s on) and has been a controversial development opposed vigorously by many NGOs, and several governments, particularly within the European Community. These transgenic recombinant plants (= biotech crops, modern transgenics) are transforming agriculture in those regions that have allowed farmers to adopt them, and the area sown to these crops has continued to grow globally in each of the ten years since their first introduction in 1996.

Transgenic recombinant plants are now generally produced in a laboratory by adding one or more genes to a plant's genome,and the techniques frequently called transformation. Transformation is usually achieved using gold particle bombardment or a soil bacterium (*Agrobacterium tumefaciens*) carrying an engineered plasmid vector, or carrier of selected extra genes.

Transgenic recombinant plants are identified as a class of genetically modified organism(GMO); usually only transgenic plants created by direct DNA manipulation are given much attention in public discussions.

Transgenic plants have been deliberately developed for a variety of reasons: longer shelf life, disease resistance, herbicide resistance, pest resistance, non-biological stress resistances, such as to drought or nitrogen starvation, and nutritional improvement (*see Golden rice*). The first modern transgenic crop approved for sale in the US, in 1994, was the FlavrSavr tomato, which was intended to have a longer shelf life. The first conventional transgenic cereal created by scientific breeders was actually a hybrid between wheat and rye in 1876 (Wilson, 1876). The first transgenic cereal may have been wheat itself, which is a natural transgenic plant derived from at least three different parenteral species.

Commercial factors, especially high regulatory and research costs, have so far restricted modern transgenic criop varieties to major traded commodity crops, but recently R&D projects to enhance crops that are locally important in developing counties are being pursued, such as insect protected cow-pea for Africa [5], and insect protected Brinjal eggplant for India

Regulation of transgenic plants

In the United States the Coordinated Framework for Regulation of Biotechnology governs the regulation of transgenic organisms, including plants. The three agencies involved are:

- USDA Animal and Plant Health Inspection Service - who state that

The Biotechnology Regulatory Services (BRS) program of the U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) is responsible for regulating the introduction (importation, interstate movement, and field release) of genetically engineered (GE) organisms that may pose a plant pest risk. BRS exercises this authority through APHIS regulations in Title 7, Code of Federal Regulations, Part 340 under the Plant Protection Act of 2000. APHIS protects agriculture and the environment by ensuring that biotechnology is developed and used in a safe manner. Through a strong regulatory framework, BRS ensures the safe and confined introduction of new GE plants with significant safeguards to prevent the accidental release of any GE material. APHIS has regulated the biotechnology industry since 1987 and has authorized more than 10,000 field tests of GE organisms. In order to emphasize the importance of the program, APHIS established BRS in August 2002 by combining units within the agency that dealt with the regulation of biotechnology. Biotechnology, Federal Regulation, and the U.S. Department of Agriculture, February 2006, USDA-APHIS Fact Sheet

- EPA - evaluates potential environmental impacts, especially for genes which encode for pesticide production

DHHS, Food and Drug Administration (FDA) - evaluates human health risk if the plant is intended for human consumption

Ecological risks

The potential impact on nearby ecosystems is one of the greatest concerns associated with transgenic plants but most domesticated plants mate with wild relative a some location where they are grown, and gene flow from domesticated crops (whether they are transgenic or non-transgenic) can then have potentially harmful consequences of 1. evolution of increased weediness; 2. increased likelihood of extinction of wild-relatives. Weediness of hybrids created with domesticated crops is quite common. For instance in California, cultivated rye hybridises with the wild *Secale montanum* to produce a weed, and this has led many Californian farmers to abandon rye as a crop. [7]

Transgenes (and traits present in domesticated crop created by conventional breeding) have the potential for significant ecological impact if the plants can increase in frequency and persist in natural populations. This can occur:

- if transgenic plants "escape" from cultivated to uncultivated areas.
- if transgenic plants mate with similar wild plants, the transgene could be incorporated into the offspring.
- if these new transgene plants become weedy or invasive, which could make control more difficult
- if the transgenic crop trait confers a selective advantage in natural environments

Gene flow may affect biodiversity and can impact entire ecosystems.

Pollen flow from conventional crop plants to native species also poses gene-flow derived ecological risks, as crop plants are not selected to have optimal selective advantages in natural environments, and farm fields are different to natural ecosystems. Conventional varieties also posses new traits such as pest resistance that have been deliberately transferred into the crop variety from other species.

There are at least three possible avenues of hybridization leading to escape of a transgene:

1. Hybridization with non-transgenic crop plants of the same species and variety.
2. Hybridization with wild plants of the same species.
3. Hybridization with wild plants of closely related species, usually of the same genus.

However, there are a number of factors which must be present for hybrids to be created.

- The transgenic plants must be close enough to the wild species for the pollen to reach the wild plants.
- The wild and transgenic plants must flower at the same time.
- The wild and transgenic plants must be genetically compatible.

In order to persist, these hybrid offspring:

- Must be viable, and fertile.

- Must carry the transgene.

Studies suggest that a possible escape route for transgenic plants will be through hybridization with wild plants of related species.

1. It is known that some crop plants have been found to hybridize with wild counterparts.
2. It is understood, as a basic part of population genetics, that the spread of a transgene in a wild population will be directly related to the fitness effects of the gene in addition to the rate of influx of the gene to the population. Advantageous genes will spread rapidly, neutral genes will spread with genetic drift, and disadvantageous genes will only spread if there is a constant influx.
3. The ecological effects of transgenes are not known, but it is generally accepted that only genes which improve fitness in relation to abiotic factors would give hybrid plants sufficient advantages to become weedy or invasive. Abiotic factors are parts of the ecosystem which are not alive, such as climate, salt and mineral content, and temperature. Genes improving fitness in relation to biotic factors could disturb the (sometimes fragile) balance of an ecosystem. For instance, a wild plant receiving a pest resistance gene from a transgenic plant might become resistant to one of its natural pests, say, a beetle. This could allow the plant to increase in frequency, while at the same time animals higher up in the food chain, which are at least partly dependent on that beetle as food source, might decrease in abundance. However, the exact consequences of a transgene with a selective advantage in the natural environment are almost impossible to predict reliably.

It is also important to refer to the demanding actions that government of developing countries had been building up among the last decades.

FEEDING AND MANAGEMENT OF DAIRY STOCK

In farming practice the majority of calves are born to dairy cows kept for the production of milk for sale. Therefore, in order to rear calves it is frequently necessary to deprive them of their natural feeding and environment and to rear them in some artificial way.

As soon as the calf removed from its mother, it is important that there is a dry bedding of straw for the calf lie on and for it to be well away from draughts.

The first, milk, or colostrums, produced by the cow after to the needs of the young calf.

In the calf is left with mother, it will start to suckle almost as soon as can stand. With calves being removed from their mothers, the first milk must be provided regularly for at least the first 3 or 4 days.

The first 6 months or in the life of a calf, whether it be ultimately for beef or dairy, is mot important time in the rearing programmed. Good feeding and management at this stage are the best means of ensuring the calf grow quickly for production and profit.

Here is one example of s method of feeding giving good results with calves from such breeds the Ayrshire, Friesian and Shorthorn, or cross-bred calves from these breeds. The calves are removed from their dams within 12 hours of birth and fed colostrums from a bucket. After a few days the colostrums is changed to milk, and whole-milk feeding is continued until the end of the second week, that is to 14 days of age. During the third week the feed is half milk and half milk substitute mixed with 0.5 gal of warm water and fed twice a day .By about the beginning of the fourth week the change-over to milk substitute will be completed. A little good hay and concentrates should be offered from about 3 weeks of age.

The calf born in autumn will get most of its food from good nutritious grazing during the first summer. The calves certainly grow faster with some grain, and are also better able to resist disease and parasitic troubles. Up to about 2 1b (0.9 kg) of a mainly cereal mixture per head per day is quite adequate. At the same time, a mineral supplement can conveniently be added to the concentrates. A clean water supply is most important.

It is very common for a heifer to be bred at the age of about 2 years.

The gestation period of the cow is 280 days. Normally, the cow will calve at 12-monthly intervals.

A liberal diet is given to the cow in calf for the last 6 or weeks before she is to calve. It is best to prepare the cow slowly so that she has time to build up body reserves. High feeding months as it is during the last 2 to 3 months of pregnancy that the unborn calf makes its most growth.

It is well-known that the sire is half of the herd. That is why, the herd bull must be kept in good breeding condition, especially at the time of service. It is also well-known that the ability to produce milk and butterfat can be transmitted to the offspring through the male as through the female.

Summer Feeding. Almost universally, grazing of grassland, whether it be permanent or temporary pastures, is the staple summer food of the dairy cow.

In early spring grass is of high feeding value, and particularly rich in amino acids and proteins. It is laxative and has so little fibre at this time that it becomes necessary to give the cow some fibrous material such as hay or good-quality oat or barley straw. As the summer progresses the grass becomes more mature, more fibre is then available for the proper functioning of the rumen.

Concentrates are usually fed in some small degree to dairy herds in the summer-time. They may be absolutely necessary to supplement poor or inadequate grazing, and they may be necessary in the ration of the cow that is in peak production high digestibility. High -… .cows are allowed to eat high-… hay to appetite. They will eat 30 to 40 pounds and produce three and more gallons of … without receiving concentrates.

Lug‘at-minimum

in farming practice – fermerlik amaliyotida
calf – buzoq
the rearing program – ko‘paytirish dasturi
artificial way – sun’iy yo‘l

the production of milk for sale –sutni iste'molga ishlab chiqish
therefore – binobarin
to rear calves – buzoqlarni koʻpaytirish
draught – afzal, homut
to rear – boqib koʻpaytirmoq
colostrums – ogʻiz suti
to suckle – emizmoq
to deprive of – mahrum boʻlmoq

SHEEP

Sheep are best adapted to the land that is high and dry, though they may be successfully raised on almost any land that is not too wet. Sheep raising is usually not practiced in regions that are too hot and too wet.

Sheep are mainly bred for their wool and meat (mutton). With some breeds, as Merino, for instance, wool is the principal product, while other breeds are largely kept for mutton.

According to the characteristics of the wool sheep are subdivided into fine – wool, semi – fine – wool and long – wool breeds. The best sheep are fine – wool.

The annual clip of wool, that is, the quantity of wool sheared is a major factor in the economy of sheep raising countries.

Lugʻat-minimum

sheep – qoʻy
breed – zot
wool – jun
meat – goʻsht

PIC BREEDING

The most common rearing system is to leave the piglets with the sow until they are 6 to 8 weeks old. The sow and her litter can be housed in a rearing hut and run on a concrete yard, or reared completely indoors in a pen, or moved out into a clean field and given a rearing hut when the piglets are 10 to 14 days old.

For the first 3 weeks of its life the piglet is almost entirely dependent on its mother's milk. That is why she should be well fed at this time. Infrared lamps are a great aid in the successful rearing of young pigs. A good milking sow will rear ten piglets, each weighing approximately 12 lb (kg) at 3 weeks old. One would expect the average weight of piglets in smaller – size litters than this to be heavier. The weight of piglets at 3 weeks is an indication of the mothering and milking ability of the mothering and milking ability of the sow.

In order to achieve good weaning weights most farmers give piglets creep food in addition to the sow's milk. Food is first offered in clean, low metal troughs in the creep when the piglets are between 2 and 3 weeks of age. Initially, scattering a little food on the floor near the troughs will encourage the piglets to stating eating. The food provided must be fresh and palatable, and is usually fed dry. Water must be provided in a clean trough close to the food.

At about 6 weeks of age the piglets should be eating at least I (0.45 kg) of creep food each per day, and once their consumption reaches this level many farmers consider that weaning should take place.

Mashqlar

I. Belgilangan, o'ng ustundagi qaysi so'zlar lug'aviy chap ustundan xizmat qiladi.

food	nutritious, fresh, digestible, palatable, laxative, dry, sufficient, rapid, prolific, supplementary, succulent
gain	rapid, fast, slow, fibrous, poor, normal, average, sufficient, liberal, artificial
litter	vigorous, small, large, healthy, additional, suitable,
animal	mature, young, poor, fat, valuable, useful, healthy, pregnant, lean, prolific, fresh, vigorous, lengthy, heavy, cold
grass	rich, short, old, woody, fast, natural, free, laxative, common, young, green, leafy, mature, valuable

II. Quyidagi tekstdan shunday so‘zlarni toping-ki, bu so‘zlar lug‘aviy ma’noga mos kelsin.

1. All little piglets of one sow. 2. The removal of pigs. 3. The place where young stock is fed but mature animals are not allowed. 4. The increase in weight. 5. The house where piglets are kept. 6. Change of air in the piggery or any other building for animals. 7. The flesh of a pig. 8. The male pig. 9. The female pig.

Lug‘at-minimum

pig – cho‘chqa	**to provided** – ta’minlamoq
to achieve – erishmoq	**creep** – ohur

POTATO PLANTERS

Potato-seed pieces are entirely different in character from other seeds and the seed – selection mechanisms differ accordingly. Because of the irregularity of the size and shape of cut seed, conventional type is not successful. One type of selector arm has cam-actuated jaws which close to grasp a seed piece while passing up through the well and then release it into the boot on the opposite side. Another type of selector arm has cam-actuated picker points which are projected through the picker arm face as it passes up through the seed well, thus spearing a seed piece and carrying it over to the opposite side, where the points are withdrawn, allowing the seed to drop in the furrow made by the opener. Seed flows sideways from the hopper into the seed well, the rate being regulated by the operator.

Potatoes are planted deep, and a wide V-opener is required to open a deep enough furrow for the seed. Disk coverers without press wheels are most common.

Large amounts of fertilizer are often used with potatoes, and to avoid damage the fertilizer should be placed in bands at each side and slightly below the seed. A pair of disks open furrows for the fertilizer bands. The seed opener then splits the soil between the bands, thus covering the fertilizer and preventing contact with the seed. Fertilizer hoppers have belt-type or horizontal plate feeds capable of applying up to 3,000 1b per acre.

Potato planters are made as two-wheel trail-type implements only, since the weight and bulk of the seed and fertilizer required make tractor mounting impractical. One and two-row machines are available. An operator is required on the planter to see that the seed flows into the well properly, and he is also relied upon to lift and adjust the furrow opener and to actuate the feed clutch and in some cases the row maker.

The weight carried and the draft make it necessary for the frame, axle, and wheels to be sturdy and well designed. Seed and fertilizer hoppers should be placed as low as possible to ease the labour of filling hoppers.

Mashqlar

I. Quyidagi bir o‘zakli so‘zlarning internatsional so‘zlarga o‘xshashlik jihatini aniqlang.

character, selection, irregularity, opposite, to regulate, operator, pair, to prevent, contact, acre, impractical.

II. Otlarning har xil ma’nosini –er (-or) yasovchi qo‘shimcha yordamida aniqlang.

selector, picker, opener, operator, hopper, coverer, fertilizer, feeder, planter, tractor, maker, designer, labourer.

Lug‘at-minimum

seed – urug‘
shape – shakl
selector – saralovchi
jaw – jag‘
picker – o‘rim mashinkasi
boot – o‘rama
deep – chuqur

Veterinary medicine

Veterinary medicine is the application of medical, diagnostic, and therapeutic principles to companion, domestic, exotic, wildlife, and production animals. **Veterinary Science** is vital to the study and protection of animal production practices, herd health and monitoring the spread of disease. It requires the acquisition and application of scientific knowledge in multiple disciplines and uses technical skills directed at disease prevention in both domestic and wild animals.

Veterinary science helps safeguard human health through the careful monitoring of livestock, companion animal and wildlife health. Emerging zoonotic diseases around the globe require capabilities in epidemiology and infectious disease control that are particularly well-suited to veterinary science's "herd health" approach.

Veterinary medicine is informally as old as the human/animal bond but in recent years has expanded exponentially because of the availability of advanced diagnostic and therapeutic techniques for most species. Animals nowadays often receive advanced medical, dental, and surgical care including insulin injections, root canals, hip replacements, cataract extractions, and pacemakers.

Veterinary specialization has become more common in recent years. Currently 20 veterinary specialties are recognized by the American Veterinary Medical Association (AVMA), including anesthesiology, behavior, dermatology, emergency and critical care, internal medicine, cardiology, oncology, neurology, radiology and surgery. In order to become a specialist, a veterinarian must complete additional training after graduation from veterinary school in the form of an internship and residency and then pass a rigorous examination.

Veterinarians assist in ensuring the quality, quantity, and security of food supplies by working to maintain the health of livestock and inspecting the meat itself. Veterinary scientists occupy important positions in biological, chemical, agricultural and pharmaceutical research.

In many countries, equine veterinary medicine is also a specialized field. Clinical work with horses involves mainly locomotor and orthopaedic problems, digestive tract disorders (including equine colic, which is a major cause of death among domesticated horses), and respiratory tract infections and disease.

Zoologic medicine, which encompasses the healthcare of zoo and wild animal populations, is another veterinary specialty that has grown in importance and sophistication in recent years as wildlife conservation has become more urgent.

As in the human health field, veterinary medicine (in practice) requires a diverse group of individuals to meet the needs of patients. Veterinarians must complete four years of study in a veterinary school following 3-4 years of undergraduate pre-veterinary work. They then must sit for examination in those states in which they wish to become licensed practitioners. It is widely believed that veterinary school is the hardest to gain acceptance into among the various medical professions. In fact, among medical practitioners, veterinarians are routinely ranked the most intelligent and trustworthy. They are expected to diagnose and treat disease in a variety of different species without benefit of verbal communication with their patients. In addition to veterinarians, many veterinary hospitals utilize a team of veterinary nurses and veterinary assistants to provide care for sick as well as healthy animals. Veterinary nurses are generally registered as "veterinary technicians" in most states. They are graduates of two or four year college-level programs and are legally qualified to assist veterinarians in many medical procedures. Veterinary assistants are not licensed by most states, but can be well-trained through programs offered in a variety of technical schools.

WHAT A FOREST IS

1. Do you know what forest is? It certainly is not just multitude of trees neither is it a combination is not just multitude of trees neither is it a combination of several tree species, because both conditions can be found present or orchard, yet they do not make forest.

2. To understand what forest is let us watch its birth … Now, imagine that onto an abandoned or fire-destructed land which is covered with cinders and ashes winds have brought multitude of dark-brown, light, winged pine seeds.

About three million seeds have fallen on an area of one hectare. There are both large and small seeds here, both strong and weak ones. Some have fallen into small nice cosy holes, others onto hummocks. Some are strong and germinate easily, others are weak and can hardly spring up from the ground.

Not all of them can germinate, of course; yet one third part is sure to come to life.

3. So, one million offspring's have made their appearance. And again some are stronger, others weaker, these have got right into warm sunlight; those are in deep shadow; the stems of these are thick and strong, the stems of those thin.

All the roots have come to work now. They try hard to get a better fix. Some offspring's prosper; others fail to get rooted.

4. The little ones who have survived come now to fight enemies. The winds brought grass seeds; the grasses sprang up quickly and are now taller and stronger than the baby pines.

Field mice come to look for pine seeds, they try their teeth on young roots, the maybug larvae do their best to live on offspring's.

Before pine trees are five years of age, they have suffered cold autumn rains, heavy snow-falls, rapid spring flows and summer droughts. Lots of them could not survive the fight and perished.

Out of one million only five (or maybe ten) thousand are left on the hectare area.

5. Up to the age of ten each pine of these five thousand has been fighting all alone, all by itself. Now that the trees are meeting their eleventh spring, they all keep

together, their crowns have joined, their roots interlaced under the earth, they can withstand now many troubles, they stand now together and are now influencing the environment, they dominate it, because they have become forest!

A new life, a forest life has begun. Under the canopy (a very low canopy so far) of a young forest fight is still going on because the forest trees do not live under equal conditions. Individual trees in the forest die but the forest prospers.

Mashqlar

I. Rus tilidagi bir o‘zakli o‘xshashlik jihatidan so‘zlarning ma’nosini aniqlang.

combination, park, area, hectare, ground, fix, dominate, individual, interesting, active, activity, astronomical, bacteria, army, human, illustrate, cone, start *v*, equilibrium, control *v*, attack *n*, bore *v*, crown *n*.

II. Quyidagi murakkab so‘z va so‘z birikmalarini ma’nosini aniqlang.

tree species, hectare area, grass seeds, pine seeds, field mice, pine-trees, human being, bark beetle, snow-fall, sunlight, sunset, wildlife, undergrowth, fire-destructed.

III. Quyidagi so‘zlar qaysi so‘z turkumiga mansubligini aniqlang va ularni o‘zbek tiliga tarjima qiling.

condition, germinate, literally, appearance, itself, eleventh, environment, dominate, individual, maturity, growth, coexistence, miraculous, visible, unthinkable, numerous, active, activity, harmful, astronomic, prominent, illustrate.

IV. Qudagi so‘zlarning sinonimini toping.

garden, to live, to leave, to observe, a great amount, a trunk, to struggle, to connect, to die, different, to construct, to force, forest floor, to show, connection, work.

Lug‘at-minimum

forest – o‘rmon
orchard – mevali bog‘
to cover – qoplamoq
cinder – kul; yonib kul bo‘lmoq
ash – kul
hectare – gektar
hummock – tepalik
germinate – o‘smoq

Weed control

Weed control, a botanical component of pest control, stops weeds from reaching a mature stage of growth when they could be harmful to domesticated plants, sometimes livestocks, by using manual techniques including soil cultivation, mulching and herbicides. Prevention of weeds from growing is desirable, but often difficult to achieve, due to the resilient fertilization and growth patterns of weeds.

The term *weeding* is also used metaphorically to describe any act of removing unwanted items of any kind.

The effects of weeds on other plants

Luther Burbank has been quoted as the source of the saying, "A weed is any plant growing in the wrong place". Yet with a small shift in perspective we can often change our definition to *a plant whose virtues have not yet been discovered*. Those plants that we call weeds can often have many useful functions- many are edible, medicinal, attract wildlife, increase biodiversity, provide valuable information about the condition of our land (eg, nettles (*Urtica diocia*) indicate a fertile soil, whilst the presence of horsetail (*Equisetum arvensis*) suggests poor soil and waterlogging) or can act as 'dynamic accumulators', bringing up and making available deficient nutrients from the subsoil with their roots. As A.W. Hadfield states; *"We could never for long be free of them, and we would be the poorer without them"* (from the introduction to *How To Enjoy Your Weeds*, Muller Press, 1969). However, weeds can also compete with our productive crops, and given half a chance will quickly return cultivated land to a wilderness state.

By their very nature, and the fact that these are the plants that are naturally adapted to local conditions, weeds tend to thrive at the expense of our more refined edible or ornamental crops. They provide competition for space, nutrients, water and light, although how seriously they will affect a crop depends on a number of factors. Some crops have greater resistance than others- smaller, slower growing seedlings are more likely to be overwhelmed than those that are larger and more vigorous. Onions are one of the crops most susceptible to competition, for they are slow to germinate and produce slender, upright stems. Quick growing, broad leafed weeds therefore have a distinct advantage, and if not removed, the crop is likely to be lost. Broad beans however produce large seedlings, and will suffer far less profound effects of weed competition other than during periods of water shortage at the crucial time when the pods are filling out. Transplanted crops raised in sterile seed or potting compost will have a head start over germinating weed seeds.

Weeds also differ in their competitive abilities, and can vary according to conditions and the time of year. Tall growing vigorous weeds such as fat hen (*Chenopodium album*) can have the most pronounced effects on adjacent crops, although seedlings of fat hen that appear in late summer will only produce small plants. Chickweed (*Stellaria media*), a low growing plant, can happily co-exist with a tall crop during the summer, but plants that have overwintered will grow rapidly in early spring and may swamp crops such as onions or spring greens.

The presence of weeds does not necessarily mean that they are competing with a crop, especially during the early stages of growth when each plant can find the resources it requires without interfering with the others. However as the seedlings' size increases, their root systems will spread as they each begin to require greater amounts of water and nutrients. Estimates suggest that weed and crop can co-exist harmoniously for around three weeks, therefore it is important that weeds are removed early on in order to prevent competition occurring. Weed competition can have quite dramatic effects on crop growth. Harold A Roberts cites research carried out with onions wherin *"Weeds were carefully removed from separate plots at different times during the growth of the crop and the plots were then kept clean. It was found that after competition had started, the final yield of bulbs was being reduced at a rate equivalent to almost 4 % per day. So that by delaying weeding for another fortnight, the yield was cut to less than half that produced on ground kept clean all the time."* (*The Complete Know And Grow Vegetables*, Bleasdale, Salter and others, OUP 1991). He goes on to record that *"by early June, the weight of weeds per unit area was twenty times that of the crop, and the weeds had already taken from the soil about half of the nitrogen and a third of the potash which had been applied"*.

Perennial weeds with bulbils, such as lesser celandine and oxalis, or with persistent underground stems such as couch grass (*Agropyron repens*) or creeping buttercup (*Ranunculus repens*) are able to store reserves of food, and are thus able to grow faster and with more vigour than their annual counterparts. There is also evidence that the roots of some perennials such as couch grass exude allelopathic chemicals which inhibit the growth of other nearby plants.

Weeds can also host pests and diseases that can spread to cultivated crops. Charlock and Shepherd’s purse may carry clubroot, eelworm can be harboured by chickweed, fat hen and shepherd’s purse, while the cucumber mosaic virus, which can devastate the cucurbit family, is carried by a range of different weeds including chickweed and groundsel.

However, at times the role of weeds in this respect can be over-rated. As far as insect pests are concerned, often the species that live on weeds are not the same as those that attack vegetable crops; *"Tests with the common cruciferous weeds such as shepherds purse have shown that they do not act as hosts for the larvae of the cabbage root fly. One exception was found to be the wild radish, but this is not usually a weed of established vegetable gardens"* (Roberts, *The Complete Know And Grow Vegetables*). However pests such as cutworms may first attack weeds then move on to cultivated crops.

While charlock, a common weed in southeastern USA, may be considered a weed by row crop growers, it is highly valued by beekeepers, who seek out places where it blooms all winter, thus providing pollen for honeybees and other pollinators. Its bloom is resistant to all but a very hard freeze, and even that will only kill it back briefly. By feeding an array of pollinators during a seasonal dearth, it can redound to the farmer's advantage. Many weeds are likewise highly beneficial to pollinators.

Methods

Knowing how weeds reproduce, spread and survive adverse conditions can help in developing effective control and management strategies. Weeds have a range of techniques that enable them to thrive;

Annual and biennial weeds such as chickweed, annual meadow grass, shepherd's purse, groundsel, fat hen, cleaver, speedwell and hairy bittercress propagate themselves by seeding. Many produce huge numbers of seed several times a season, some all year round. Groundsel can produce 1000 seed, and can continue right through a mild winter, whilst scentless mayweed produces over 30,000 seeds per plant. Not all of these will germinate at once, but over several seasons, lying dormant in the soil sometimes for years until exposed to light. Poppy seed can survive 80-100 years, dock 50 or more. There can be many thousands of seeds in a square foot or square metre of ground, thus and soil disturbance will produce a flush of fresh weed seedlings.

See also Bradley Method of Bush Regeneration, which uses ecological processes to do much of the work.

"Stale seed bed" technique

One technique employed by growers is the 'stale seed bed', which involves cultivating the soil, then leaving it for a week or so. When the initial flush of weeds has germinated, the grower will lightly hoe off before the desired crop is planted. However, even a freshly cleared bed will be susceptible to airborne seed from elsewhere, as well as seed brought in by passing animals which can carry them on their fur, or from freshly imported manure. The organic solution to the problem of spreading annual weeds lies in regular, properly timed weeding, preferably just before flowering (fortuitously, this is also the time at which they will be of the most value in the compost heap). This technique is also quite often used by farmers who let weeds germinate then return the soil before crop sowing.

Perennial weeds also propagate by seeding; the airborne seed of the dandelion and the rose-bay willow herb are parachuted far and wide. But they also have an additional range of vegetative means of spreading that gives them their pernicious reputation. Dandelion and dock put down deep tap roots, which, although they do not spread underground, are able to regrow from any remaining piece left in the ground. Removal of the complete tap root is the only sure remedy.

The most persistent of the perennials are those that spread by underground creeping rhizomes that can regrow from the tiniest fragment. These include couch grass, bindweed, ground elder, nettles, rosebay willow herb, Japanese knotweed, horsetail and bracken, as well as creeping thistle, whose tap roots can put out lateral roots. Other perennials put out runners that spread along the soil surface. As they creep along they set down roots, enabling them to colonise bare ground with great rapidity. These include creeping buttercup and ground ivy. Yet another group of perennials propagate by stolons- stems that arch back into the ground to reroot. Most familiar of these is the bramble.

All of the above weeds can be very difficult to eradicate- thick black plastic mulches can be effective to a degree, although will probably need to be left in place for at least two seasons. In addition, hoeing off weed leaves and stems as soon as they appear can eventually weaken and kill the plants, although this will require persistence in the case of plants such as bindweed. Nettle infestations can be tackled by cutting back at least three times a year, repeated over a three year period. Bramble can be dealt with in a similar way. Some plants are said to produce root exudates that suppress herbaceous weeds. *Tagetes minuta* is claimed to be effective against couch and ground elder, whilst a border of comfrey is also said to act as a barrier against the invasion of some weeds including couch.

Use of herbicides

The above described methods of weed control avoid using chemicals. They are often used by farmers. However, these methods may damage a fragile soil by destructuring it, hence are not always used. They are those preferred by the organic gardener or organic farmer.

However weed control can also be achieved by the use of herbicides. Selective herbicides kill certain targets while leaving the desired crop relatively unharmed. Some of these act by interfering with the growth of the weed and are often based on plant hormones. Herbicides are generally classified as follows;

- **Contact** herbicides destroy only that plant tissue in contact with the chemical spray. Generally, these are the fastest acting herbicides. They are ineffective on perennial plants that are able to re-grow from roots or tubers.
- **Systemic** herbicides are foliar-applied and are translocated through the plant and destroy a greater amount of the plant tissue.
- **Soil-borne** herbicides are applied to the soil and are taken up by the roots of the target plant.
- **Pre-emergent** herbicides are applied to the soil and prevent germination or early growth of weed seeds.

In agriculture large scale and systematic weeding is usually required, often by machines, such as liquid herbicide sprayers, or even by helicopter (such as in the USA), to eliminate the massive amount of weeds present on farming lands.

However there are a number of techniques that the organic farmer can employ such as mulching and carefully timed cutting of weeds before they are able to set seed.

(See also section below on UK legislation regarding the control of certain weeds)

Wood

Besides those kinds of weeds which are of an herbaceous nature, there are others which are woody, and grow to a very considerable size; such as broom, furze and thorns. The first may be destroyed by frequent ploughing and harrowing, in the same manner as other perennial weeds are. Another method of destroying broom is by pasturing the field where it grows with grazers.

The best method of extirpating furze is to set fire to it in frosty weather, for frost has the effect of withering and making them burn readily. The stumps must then be cut over with a hatchet, and when the ground is well softened by rain it may be ploughed up, and the roots taken out by a harrow adapted to that purpose. If the field is soon laid down to grass, they will again spring up; in this case, pasturing with grazers is an effectual remedy. The thorn, or bramble, can only be extirpated by ploughing up the ground and collecting the roots.

In June, weeds are in their most succulent state, and in this condition, after they have lain a few hours to wither, cattle will eat almost every species. There is scarcely a hedge, border, or a nook, but what at that season is valuable.

Legislation concerning weeds

The *Weeds Act, 1959* is described as *"Preventing the spread of harmful or injurous weeds"*, and is mainly relevant to farmers and other rural settings rather than the allotment or garden scale grower. There are five 'injurious' (that is, likely to be harmful to agricultural production) weeds covered by the provisions of the Weeds Act. These are:

- Spear thistle (*Cirsium vulgare*)
- Creeping or field thistle (*Cirsium arvense*)
- Curled Dock (*Rumex crispus*)
- Broad leaved dock (*Rumex obtusifolius*)
- Common ragwort (*Senecio jacobaea*) (nb, this weed is poisonous to livestock. Livestock should not be allowed to graze where ragwort has grown until it is eradicated, and any traces have disintegrated. Ragwort should not be allowed to be harvested in hay or silage for feed).

DEFRA provide guidance for the treatment removal of these weeds from infested land. Much of this is oriented towards the use of herbicides, the majority of which may not be acceptable to the organic producer (apart from non-synthetic substances like sulphur, which in some circumstances are accepted within Soil Association standards) but in most cases there are manual techniques that can be used such as digging out the roots, mulching out or carefully timed cutting before seeds are able to spread.

Primary responsibility for weeds control rests with the occupier of the land on which the weeds are growing, therefore it is important to be alert to potential weed problems and to take prompt action. However it should be remembered that most common farmland weeds are not "injurious" within the meaning of the Weeds Act, and many such plant species have conservation and environmental value. When dealing with complaints under the Weeds Act, DEFRA has a duty in law to try and achieve a reasonable balance between different interests. These include agriculture, countryside conservation and the public in general. Constructive discussion about problems caused by weeds can often result in effective solutions and avoid the need for DEFRA to take official action. In addition to those weeds covered by the 1959 act, under section 14 of the *Wildlife and Countryside Act 1981*, it can be an offence to plant or grow certain specified plants in the wild (see Schedule 9 of the Wildlife and Countryside Act 1981), including Giant Hogweed and Japanese Knotweed. Problems involving these plants can be referred to the local authority for the area where those weeds are growing as some local authorities have bye-laws controlling these plants. There is no statutory requirement for landowners to remove these plants from their property.

Pesticide

The U.S Environmental Protection Agency (EPA) defines a **pesticide** as "any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest".[1]

A pesticide may be a chemical substance or biological agent (such as a virus or bacteria) used against pests including insects, plant pathogens, weeds, mollusks, birds, mammals, fish, nematodes (roundworms) and microbes that compete with humans for food, destroy property, spread disease or are a nuisance. Many pesticides are poisonous to humans.

Types of Pesticides

- Bactericides for the control of bacteria
- Herbicides for the control of weeds
- Fungicides for the control of fungi
- Insecticides for the control of insects - these can be Ovicides, Larvicides or Adulticides
- Miticides for the control of mites
- Nematicides for the control of nematodes
- Rodenticides for the control of rodents
- Virucides for the control of viruses

Pesticides can also be classed as synthetic pesticides or biological pesticides, although the distinction can sometimes blur.

A systemic pesticide moves inside a plant following absorption by the plant. This movement is usually upward (through the xylem) and outward. Increased efficacy may be a result. Systemic insecticides which poison pollen and nectar in the flowers may kill needed pollinators.

History

Since before 500 BC, humans have used pesticides to prevent damage to their crops. The first known pesticide was elemental sulfur dusting used in Sumeria about 4,500 years ago. By the 15th century, toxic chemicals such as arsenic, mercury and lead were being applied to crops to kill pests. In the 17th century, nicotine sulfate was extracted from tobacco leaves for use as an insecticide. The 19th century saw the introduction of two more natural pesticides, pyrethrum which is derived from chrysanthemums, and rotenone which is derived from the roots of tropical vegetables.[citation needed]

In 1939, Paul Müller discovered that DDT was a very effective insecticide. It quickly became the most widely-used pesticide in the world. However, in the 1960s, it was discovered that DDT was preventing many fish-eating birds from reproducing which was a huge threat to biodiversity. Rachel Carson wrote the best-selling book "Silent Spring" about biological magnification. DDT is now banned in at least 86 countries, but it is still used in some developing nations to prevent malaria and other tropical diseases by killing mosquitoes and other disease-carrying insects.

Pesticide use has increased 50-fold since 1950, and 2.5 million tons of industrial pesticides are now used each year.

Regulation

In most countries, in order to sell or use a pesticide, it must be approved by a government agency. For example, in the United States, the EPA does so. Complex and costly studies must be conducted to indicate whether the material is effective against the intended pest and safe to use. During the registration process, a label is created which contains directions for the proper use of the material. Based on acute toxicity, pesticides are assigned to a Toxicity Class. Pesticide misuse is illegal in most countries.

Some pesticides are considered too hazardous for sale to the general public and are designated restricted use pesticides. Only certified applicators, who have passed an exam, may purchase or supervise the application of restricted use pesticides. Records of sales and use are required to be maintained and may be audited by government agencies charged with the enforcement of pesticide regulations.

"Read and follow label directions" is a phrase often quoted by extension agents, garden columnists and others teaching about pesticides. This is not merely good advice; it is the law, at least in the U.S. Similar laws exist in limited parts of the rest of the world. The Federal Insecticide, Fungicide, and Rodenticide Act of 1972

(FIFRA) set up the current system of pesticide regulations. It was amended somewhat by the Food Quality Protection Act of 1996. Its purpose is to make pesticide manufacture, distribution and use as safe as possible. The most important points for users to understand are these: it is a violation to apply any pesticide in a manner not in accordance with the label for that pesticide, and it is a crime to do so intentionally.

Effects of pesticide use

On the environment

Pesticides have been found to pollute virtually every lake, river and stream in the United States, according to the US Geological Survey. Pesticide runoff has been found to be highly lethal to amphibians, according to a recent study by the University of Pittsburgh. Pesticide impacts on aquatic systems are often studied using a hydrology transport model to study movement and fate of chemicals in rivers and streams.

The use of pesticides also decreases biodiversity in the soil. Not using them results in higher soil quality[2] with the additional effect that more life in the soil allows for higher water retention. This helps increase yields for farms in drought years where there is less rain. For example, during drought years, organic farms have been found to have yields 20-40% higher than conventional farms

On farmers

There have been many studies of farmers with the goal of determining the health effects of pesticide exposure.[4] Research in Bangldesh suggests that many farmers' do not need to apply pesticide to their rice fields, but continue to do so only because the pesticide is paid for by the government. [1] Organophosphate pesticides have increased in use, because they are less damaging to the environment and they are less persistent than organochlorine pesticides.[5] These are associated with acute health problems such as abdominal pain, dizziness, headaches, nausea, vomiting, as well as skin and eye problems.[6] Additionally, many studies have indicated that pesticide exposure is associated with long-term health problems such as respiratory problems, memory disorders, dermatologic conditions,[7][8] cancer,[9] depression, neurologic deficits,[10][11] miscarriages, and birth defects.[12] Summaries of peer-reviewed research have examined the link between pesticide exposure and neurologic outcomes and cancer, perhaps the two most significant things resulting in organophosphate-exposed workers

On consumers

A study published by the United States National Research Council in 1993 determined that for infants and children, the major source of exposure to pesticides is through diet.[15] A recent study in 2006 measured the levels of organophosphorus pesticide exposure in 23 school children before and after replacing their diet with organic food (food grown without synthetic pesticides). In this study it was found that levels of organophosphorus pesticide exposure dropped dramatically and immediately when the children switched to an organic diet

Pesticide residues in food

The Pesticide Data Program, a program started by the United States Department of Agriculture is the largest tester of pesticide residues on food sold in the United States. It began in 1990, and has since tested over 60 different types of food for over 400 different types of pesticides - with samples collected close to the point of consumption. Their most recent summary results are from the year 2004:

- Pesticide Data Program (Feb 2006). "*Annual Summary Calendar Year 2004*" (pdf). USDA. Retrieved on 2006-07-24.

For example, on page 30 is comprehensive data on pesticides on fruits. Some example data:

Fresh Fruit and Vegetables	Number of Samples Analyzed	Samples with Residues Detected	Percent of Samples with Detections	Different Pesticides Detected	Different Residues Detected	Total Residue Detections
Apples	774	727	98	33	41	2,619
Lettuce	743	657	88	47	57	1,985
Pears	741	643	87	31	35	1,309
Orange Juice	186	93	50	3	3	94

They were also able to test for multiple pesticides within a single sample and found that:

> *These data indicate that 29.5 percent of all samples tested contained no detectable pesticides [parent*
> *compound and metabolite(s) combined], 30 percent contained 1 pesticide, and slightly over 40 percent*
> *contained more than 1 pesticide.* - page 34.

The Environmental Working Group used the results of nearly 43,000 tests for pesticides on produce collected by the USDA and the U.S. FDA between 2000 and 2004, to produce a ranking of 43 commonly eaten fruits & vegetables

Pesticides can present danger to consumers, bystanders, or workers during manufacture, transport, or during and after use[citation needed]. There is concern that pesticides used to control pests on food crops are dangerous to the consumer. These concerns are one reason for the organic food movement. Many food crops, including fruits and vegetables, contain pesticide residues after being washed or peeled (see Pesticide residues in food, above). Residues, permitted by US government safety standards, are limited to tolerance levels that are considered safe, based on average daily consumption of these foods by adults and children.

Tolerance levels are obtained using scientific risk assessments that pesticide manufacturers are required to produce by conducting toxicological studies, exposure modelling and residue studies before a particular pesticide can be registered, however, the effects are tested for single pesticides, and there is no information on possible synergistic effects of exposure to multiple pesticide traces in the air, food and water[citation needed].

The remaining exposure routes, in particular pesticide drift, are potentially significant to the general public[citation needed]. Risk of exposure to pesticide applicators, or other workers in the field after pesticide application, may also be significant and is regulated as part of the pesticide registration process.

Children have been found to be especially susceptible to the harmful effects of pesticides. A number of research studies have found higher instances of brain cancer, leukemia and birth defects in children with early exposure to pesticides, according to the National Resources Defense Council.

Peer-reviewed studies now suggest neurotoxic effects on developing animals from organophosphate pesticides at legally-tolerable levels, including fewer nerve cells, smaller birth weights, and lower cognitive scores. The EPA finished a 10 year review of the organophosphate pesticides following the 1996 Food Quality Protection Act, but did little to account for developmental neurotoxic effects, drawing strong criticism from within the agency and from outside researchers. Environmental Health Perspectives

Besides human health risks, pesticides also pose dangers to the environment[*citation needed*]. Non-target organisms can be severely impacted. In some cases, where a pest insect has some controls from a beneficial predator or parasite, an insecticide application can kill both pest and beneficial populations. The beneficial organism almost always takes longer to recover than the pest. Pesticides sprays in an effort to control adult mosquitoes, may temporarily depress mosquito populations, however they may result in a larger population in the long run by damaging the natural controlling factors[*citation needed*].

Pesticides inflict extremely widespread damage to biota, and many countries have acted to discourage pesticide usage through their Biodiversity Action Plans. Misuse of pesticides can also cause pollinator decline, which can adversely affect food crops.

An early discovery relating to pesticide use, is that pests may eventually evolve to become resistant to chemicals. When sprayed with pesticides, many pests will initially be very susceptible. However, not all pests are killed, and some with slight variations in their genetic make-up are resistant and therefore survive. Through natural selection, the pests may eventually become very resistant to the pesticide. Farmers may resort to increased use of pesticides, exacerbating the problem[*citation needed*].

‘'Persistent Organic Pollutants’' (POPs) are one of the lesser-known environmental issues raised as result of using pesticides. POPs may continue to poison non-target organisms in the environment and increase risk to humans[citation needed] by disruption in the endocrine system, cancer, infertility and mutagenic effects, although very little is currently known about these 'chronic effects'. Many of the chemicals used in pesticides are persistent soil contaminants, whose impact may endure for decades, and adversely affect soil conservation[citation needed].

A new study conducted by the Harvard School of Public Health in Boston, has discovered a 70% increase in the risk of developing Parkinson's disease for people exposed to even low levels of pesticides

Managing pest resistance

Pest resistance to a pesticide is commonly managed through pesticide rotation or tankmixing with other pesticides[citation needed].

Rotation involves alternating among pesticide classes with different modes of action to delay the onset of or mitigate existing pest resistance. Different pesticide classes may be active on different pest sites of action. The U.S. Environmental Agency (EPA or USEPA) designates different classes of fungicides, herbicides and insecticides. Pesticide manufacturers may, on product labeling, require that no more than a specified number of consecutive applications of a pesticide class be made before alternating to a different pesticide class. This manufacturer requirement is intended to extend the useful life of a product.

Tankmixing pesticides is the combination of two or more pesticides with different modes of action. This practice may improve individual pesticide application results in addition to the benefit of delaying the onset of or mitigating existing pest resistance

Continuing development of pesticides

Pesticides are often very cost-effective for farmers. Pesticide safety education and pesticide applicator regulation are designed to protect the public from pesticide misuse, but do not eliminate all misuse. Reducing the use of pesticides and replacing high risk pesticides is the ultimate solution to reducing risks placed on our society from pesticide use. For over 30 years, there has been a trend in the United States and in many other parts of the world to use pesticides in combination with alternative pest controls. This use of integrated pest management (IPM) is now commonplace in US agriculture. With pesticide regulations that now put a higher priority on reducing the risks of pesticides in our food supply and emphasize environmental protection, old pesticides are being phased out in favor of new reduced risk pesticides. Many of these reduced risk pesticides include biological and botanical derivatives and alternatives. As a result, older, more hazardous, pesticides are being phased out and replaced with pest controls that reduce these health and environmental risks. Chemical engineers continually develop new pesticides to produce enhancements over previous generations of products. In addition, applicators are being encouraged to consider alternative controls and adopt methods that reduce the use of chemical pesticides. This process is on-going and is not an immediate solution to the risks of pesticide use.

In 2006, the World Health Organization suggested the resumption of the limited use of DDT to fight malaria. They called for the use of DDT to coat the inside walls of houses in areas where mosquitoes are prevalent. Dr. Arata Kochi, WHO's malaria chief, said ,"One of the best tools we have against malaria is indoor residual house spraying. Of the dozen insecticides WHO has approved as safe for house spraying, the most effective is DDT

Fungicide

A **Fungicide** is one of three main methods of pest control- chemical control of fungi in this case. **Fungicides** are chemical compounds used to prevent the spread of fungi in gardens and crops, which can cause serious damage to the plants. Fungicides are also used to fight fungal infections.

Fungicides can either be contact or systemic. A contact fungicide kills fungi when sprayed on its surface. A systemic fungicide has to be absorbed by the fungus before the fungus dies. One example is the QoI.

It is used in agriculture to avoid fungus growth because this can harm profits. In contexts other than agriculture, the term antifungal is often used for similar compounds.

Fungicides can also indirectly be harmful to human health as the cultivated crop is consumed[citation needed] and it can cause irritation as well as many symptoms such as headaches, diarrehea, damaged organs as well as severe disorders and maladies related to the nervous system[citation needed]. It is also a hazard to ecosystems as it can run off and can contaminate water bodies and as it bioaccumulates it can be increasingly toxic to living organisms in the ecosystem

Insecticide

An **insecticide** is a pesticide used against insects in all developmental forms. They include ovicides and larvicides used against the eggs and larvae of insects. Insecticides are used in agriculture, medicine, industry and the household. The use of insecticides is believed to be one of the major factors behind the increase in agricultural productivity in the 20th century. Nearly all insecticides have the potential to significantly alter ecosystems; many are toxic to humans; and others are concentrated in the food chain. It is necessary to balance agricultural needs with environmental and health issues when using them.

Classes of agricultural insecticides

The classification of insecticides is done in several different ways:

- *Systemic* insecticides are incorporated by treated plants. Insects ingest the insecticide while feeding on the plants.
- *Contact* insecticides are toxic to insects brought into direct contact. They most often applied through aerosol distribution.
- *Natural* insecticides, such as nicotine and pyrethrum, are made by plants as defences against insects.
- *Inorganic* insecticides are manufactured with metals and include arsenates copper- and fluorine compounds, which are now seldom used, and sulfur, which is commonly used.
- *Organic* insecticides are synthetic chemicals which comprise the largest numbers of pesticides available for use today.
- *Mode of action* -- how the pesticide kills or inactivates a pest -- is another way of classifying insecticides. Mode of action is important in predicting whether

an insecticide will be toxic to unrelated species such as fish, birds and mammals.

Classes of insecticides, a short history

A series of classes of insecticides have existed, as time progressed one class has largely replaced the one before it. These trends in the classes of compounds in some ways has mirrored the development of chemical warfare agents.

Heavy metals, eg lead, mercury, arsenic and plant toxins such as nicotine have been used for many years. Various plants have been used as folk insectides for centuries, including tobacco and pyrethrum.

Chlorine based agents, with the rise of the modern chemical industry it was possible for form organochlorides. The substances used in chemical warfare tend to be more potent electrophiles than those used as insecticides. For instance mustard gas (sulfur mustard, HD) is a potent alklating agent which uses neighbouring group participation of the sulfur to make the alkyl chloride a stronger electrophile. An organochlorine insecticide such as DDT or lindane does not directly kill the insect. It is likely that the chlorine is used to tune the lipophilicity of the compound, and to alter the shape and electrostatic effects involved in the interactions of the insecticide and the biomolecules in the target organism. For instance DDT works by opening the sodium channels in the nerve cells of the insect.

The next large class was the organophosphates, both the insecticides and the chemical warfare agents (such as sarin, tabun, soman and VX) work in the same way. All these compounds bind to the neurotransmitter acetylcholinesterase and other cholinesterases. This results in disruption of nervous impulses, killing the insect or interfering with its ability to carry on normal functions. Carbamate insecticides have similar toxic mechanisms but have a much shorter duration of action and are somewhat less toxic on that basis.

To mimic the insecticidal activity of the natural compound pyrethrum another class of pesticides, pyrethroid pesticides, have been developed. These are nonpersistent and much less acutely toxic than organophosphates and carbamates.

Recent efforts to reduce broad spectrum toxins added to the environment have brought biological insecticides back into vogue. An example is the development and increase in use of *Bacillus thuringiensis*, a bacterial disease of Lepidopterans and some other insects. It is used as a larvicide against a wide variety of caterpillars. Because it has little effect on other organisms, it is considered more environmentally friendly than synthetic pesticides. The toxin from Bacillus thuringiensis (Bt toxin) has been incorporated directly into plants through the use of genetic engineering.

Environmental effects

One of the bigger drivers in the development of new insecticides has been the desire to replace toxic and irksome insecticides. The notorious DDT was introduced as a safer alternative to the lead and arsenic compounds which had been used before. It is the case that when used under the correct conditions that almost any chemical substance is 'safe', but when used under the wrong conditions most insecticides can be a threat to health and/or the environment.

Some insecticides have been banned due to the fact that they are persistent toxins which have adverse effects on animals and/or humans. A classic example which is often quoted is that DDT is an example of a widely used (and maybe misused) pesticide. One of the better known impacts of DDT is to reduce the thickness of the egg shells on predatory birds. The shells sometimes become too thin to be viable, causing reductions in bird populations. This occurs with DDT and a number of related compounds due to the process of bioaccumulation, wherein the chemical, due to its stability and fat solubility, accumulates in organisms fat. Also, DDT may biomagnify which causes progressively higher concentrations in the body fat of animals farther up the food chain. The near-worldwide ban on agricultural use of DDT and related chemicals has allowed some of these birds--such as the peregrine falcon--to recover in recent years. A number of the organochlorine pesticides have been banned from most uses worldwide and globally they are controlled via the Stockholm Convention on Persistent Organic Pollutants. These include: aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex and toxaphene.

While the overuse of DDT lead to a reduction in its use, opponents of traditional environmentalism often cite it as an example of environmentalism going too far and interfering with malaria eradication, going so far as to estimate the cost of human lives resulting from the DDT ban; for instance the novelist Michael Crichton states in his bestselling book, *State of Fear*:

> "Since the ban, two million people a year have died unnecessarily from malaria, mostly children. The ban has caused more than fifty million needless deaths. Banning DDT killed more people than Hitler."

This accusation, while sensational, is erroneous, as no ban exists on the use of DDT for eradication of malaria or any other mosquito borne disease.[1] Groups fighting malaria have praised the ban on agricultural use of DDT, since it reduces the rate with which mosquitoes become resistant to DDT, which is the main reason it is not used more often to fight malaria:

> "The outcome of the treaty is arguably better than the status quo going into the negotiations over two years ago. For the first time, there is now an insecticide which is restricted to vector control only, meaning that the selection of resistant mosquitoes will be slower than before." [2].

In fact, according to *Agricultural production and malaria resurgence in Central America and India*, Chapin, Georgeanne & Robert Wasserstrom, *Nature*, Vol. 293, 1981, page 183), the lives actually saved due to banning agricultural use of DDT can be estimated:

> "Correlating the use of DDT in El Salvador with renewed malaria transmission, it can be estimated that at current rates each kilo of insecticide added to the environment will generate 105 new cases of malaria."

Alternative insecticides have had to be used as an alternative to DDT because the population of insects have become resistant to DDT. Most of the newer insecticides are more specific in their actions and are designed to break down into non-toxic components within a few days of application. Nonetheless, misuse of insecticides remains an environmental and economic issue. For example, in

Bangladesh most of the insecticide applications by rice farmers are apparently unnecessary

Application methods for household insecticides

Integrated pest management or IPM in the home begins with restricting the availability to insects of three vital commodities: shelter, water and food. If insects become a problem despite such measures then it is wise to control them using the safest possible methods, targeting the approach that is used to the pest that is present in the household environment[1].

Insect repellent, commonly referred to as "bug spray", comes in a plastic bottle or aerosol can. Applied to clothing, arms, legs, and other extremities, the use of these products will tend to ward off nearby insects. This is not an insecticide.

Insecticide used for killing pests—most often insects, and arachnids—primarily comes in an aerosol can, and is sprayed into the air or a nest as a means of killing the animal. Fly sprays will kill house flies, blowflies, ants, cockroaches and other insects and also spiders. Other preparations are granules or liquids that are formulated with bait that is eaten by insects. For many household pests bait traps are available that contain the pesticide and either pheromone or food baits. Crack and crevice sprays are applied into and around openings in houses such as baseboards and plumbing. Pesticides to control termites are often injected into and around the foundations of homes.

Active ingredients of many household insecticides include permethrin and tetramethrin, which act on the nervous system of insects and arachnids.

Bug sprays should be used in well ventilated areas only, as the chemicals contained in the aerosol and most insecticides can be harmful or deadly to humans and companion animals. All insecticide products including solids, baits and bait traps should be applied such that they are out of reach of wildlife, companion animals and children.

SYSTEMS OF BREEDING

The systems of breeding can be summarized as follows. Mating of animals of different breeds – cross – breeding: unrelated – out crossing; related (very closely) – in crossing; (not closely) – line breeding.

Cross-breeding cross-breeding is the system of mating animals of different breeds. To be successful it must be planned and the parents must be care fully chosen. When there is no planning or control, the results are usually unsuccessful.

Good cross-breeding can give very good results and is used widely in the breeding of nearly every class of stock.

There are two main reasons for cross-breeding. The first is to combine the desirable characteristics of two or more breeds and the second is second is to get some degree of heterocyst or hybrid vigor. No breed is perfect in every way. Some are well-known for one character, some for another. If good characters of one breed can be combined with the good characters of another breed, it may be possible to produce an animal which is better suited than its parents to a particular market or particular conditions.

The offspring from cross-breeding are usually referred to as half – brads or crosses.

The sheep industry in Great Britain is one of the best examples of planned and efficient cross-breeding. The mountain breeds such as very good mothers but they are rather small, not very prolific and their lambs are not suitable for the fat lamb production. Therefore they are crossed with a long – wood ram such as the Border Leicester, Hex ham Leicester, Wesleyan or Tees water that are noted for size and prolificacy.

Cross-breeding can produce new breeds. This type of breeding is usually carried out by research stations. It takes many years to produce a new breed.

Recent examples are the Colored breed of sheep. The development of this breed has taken ten years.

Breeds are also interchanged between countries. The Lincoln Long – wool was interchanged from Britain to Australia and crossed with the Merino breed. This combination has resulted in a new breed, the Correlate which is better suited to Australian conditions and wool production.

Hetaerists is the second important reason for cross-breeding. The term is used to explain the fact that hybrids or cross-breeds are usually better or more vigorous than their parents. For example, a recent analysis of 34, 000 recorded litters of pigs showed that mating pure – bred sows to a boar of a different breed resulted in 2 per cent more pigs at birth, 5 per cent more pigs at weaning, 10 per cent greater litter weight at weaning compared with pure – bred sows to boars of the same breed. Cross-bred sows gave even better results. In other words, there were more pigs born, more of them survived and they grew and thrived better than the pure – brads. The characters of prolificacy, hardiness and early growth rate are the characters included in the "hybrid vigor".

Mating of Animals of the Same Breed. There are many breeds in all classes of stock, same being more being more popular than others. The more popular breeds usually possess one or more valuable characteristics in some high degree. Developing that character within the breed will greatly improve it.

There are two main possibilities to improve the stock by mating them to animals of the same breed. They are using animals that are known to be related or animals that are either not related or very distantly related.

Out crossing. Out crossing is the term used in practice of mating stock that are unrelated.

Lug'at-minimum

mating – ko'paytirish, chatishtirish

unrelated – begona, yot, qarindosh bo'lmagan

related – qarindosh

out crossing – chatishtirish

stock – chorva, mol, poda

THE SUPPLY OF WATER

The total amount of water contained in our Planet is constant and invariable and can neither be increased nor diminished. It assumes a variety of forms, such as oceans, moissaliniti, and ice. As most of this water is locked away in the oceans, in snow fields, ice caps and glaciers, only a small proportion is available in a form readily usable by man. Moreover, a great deal of the water in and on the land is polluted by minerals or by industrial waste and so frequently rendered unusable. Of the water contained in the oceans, a very small proportion daily changes its form and composition and is moved to the land, where it returns to the oceans. This process, which has no beginning and no end, is known as the hydrologic cycle. It comprises a gigantic system operating in and on the earth and in the atmosphere surrounding it. It is estimated that something like 80,000 cubic miles of water are evaporated each year from the oceans, together with approximately 15,000 cubic miles of the continents. This total global evaporation is exactly balanced by the total precipitation, of which approximately 24,000 cubic miles in the form of waterfall on the land surfaces and the rest on the oceans. This cyclical movement of water is divisible into three main stages. Firstly, solar radiation, acting upon the surface of the oceans, heats the surface layers and causes evaporation and the diffusion of water vapor upwards into the atmosphere. There water vapor, which at this stage is pure, is then transported great distances by the winds. During its movement across the oceans and over the land, it may become polluted in a variety of ways: by atmospheric dust, by particles of radioactive material or by industrial and domestic smoke and soot.

In the second stage of the cycle, the air masses containing the water vapor are suddenly cooled. This cooling, which may occur for a number of reasons, though primarily as a result of the air masses being forced to rise over high ground, causes condensation to be usable. The third and final stage is that in which it came. Of the water which falls upon the long, some flows over the surface, some sinks into the soil, and some is taken up by the roots of vegetation to be used by plants and subsequently released into the atmosphere by transpiration. If, for example, an average of thirty inches of rainfall reaches the land surface each year, approximately twenty-one inches will evaporate directly or be transpired by vegetation. Of the remaining nine inches, most will run directly to the oceans as surface to form underground water and, at a later stage, indirectly reach the oceans. Water which began in the oceans sooner or later returns to them. The only stage in the cycle at which man can, at present, intervene and make use of the water on a large scale is the third, and only then if the water is comparatively pure.

Mashqlar

I. Ajratib ko‘rsatilgan so‘zlarning o‘zbek tilidagi ma’nosini aniqlang.

the total amount; minerals of our planet; hydrological cycle; solar radiation; diffusion of water; radio- active material; industrial smoke; the stages of the cycle; atmospheric dust; global evaporation; final stage; gigantic system; to balance condensation; the ocean of air.

II. Quyidagi so‘zlarning so‘z yasovchi suffikslarini aniqlang.

1) to use, the use, used, usable; 2) to divide, division, divide, division, divided, divisible; 3) to vary, variation, variable, invariable; 4) to move, movement, moved, movable; 5) to compare, comparison, compared, comparable; 6) to permeate, permeability, permeable; 7) to measure, measurement, measured, measurable.

Lug‘at-minimum

water – suv
vapour – bug‘, par
salinity – sho‘r, tuzli
ice caps – muz qoplash
glaciers – ustki qatlam
operate – boshqarish, ishlatish
solar radiation – quyosh nuri radiatsiyasi
approximately – taxminan
divisible – bo‘lim, qism
diffusion – diffuziya
stage – stadiya; davr; etap
soot – chirindi; chang qoldig‘i
gigantic – gigant, ulkan

Water resources

Water resources are sources of water that are useful or potentially useful to humans. It is important because it is needed for life to exist. Many uses of water include agricultural, industrial, household, recreational and environmental activities. Virtually all of these human uses require fresh water. Only 2.5% of water on the Earth is fresh water, and over two thirds of this is frozen in glaciers and polar ice caps. Water demand already exceeds supply in many parts of the world, and many more areas are expected to experience this imbalance in the near future. The framework for allocating water resources to water users (where such a framework exists) is known as water rights.

Water and conflict

Throughout history, water resources have occasionally been the source of conflict. Examples include:

- Well poisoning
- Privatization and Water Pricing in India [1],
- Privatization and Water Pricing protests in Cochabamba, Bolivia in 2000

Nevertheless, some claim that the issue does not get the attention it deserves, in particular with regard to security.

Sources of fresh water

Surface water is water in a river, lake or fresh water wetland. Surface water is naturally replenished by precipitation and naturally lost through discharge to the oceans, evaporation and sub-surface seepage.

Although the only natural input to any surface water system is precipitation within its watershed, the total quantity of water in that system at any given time is also dependent on many other factors. These factors include storage capacity in lakes, wetlands and artificial reservoirs, the permeability of the soil beneath these storage bodies, the runoff characteristics of the land in the watershed, the timing of the precipitation and local evaporation rates. All of these factors also affect the proportions of water lost through discharge to the oceans, evaporation and sub-surface seepage.

Human activities can have a large impact on these factors. Humans often increase storage capacity by constructing reservoirs and decrease it by draining wetlands. Humans often increase runoff quantities and velocities by paving areas and channelizing stream flow.

The total quantity of water available at any given time is an important consideration. Some human water users have an intermittent need for water. For example, many farms require large quantities of water in the spring, and no water at all in the winter. To supply such a farm with water, a surface water system may require a large storage capacity to collect water throughout the year and release it in a short period of time. Other users have a continuous need for water, such as a power plant that requires water for cooling. To supply such a power plant with water, a surface water system only needs enough storage capacity to fill in when average stream flow is below the power plant's need.

Nevertheless, over the long term the average rate of precipitation within a watershed is the upper bound for average consumption of natural surface water from that watershed.

Natural surface water can be augmented by importing surface water from another watershed through a canal or pipeline. It can also be artificially augmented from any of the other sources listed here, however in practice the quantities are negligible. Humans can also cause surface water to be "lost" (i.e. become unusable) through pollution.

Sub-Surface water, or groundwater, is fresh water located in the pore space of soil and rocks. It is also water that is flowing within aquifers below the water table. Sometimes it is useful to make a distinction between sub-surface water that is closely associated with surface water and deep sub-surface water in an aquifer (sometimes called "fossil water").

Sub-surface water can be thought of in the same terms as surface water: inputs, outputs and storage. The critical difference is that for sub-surface water, storage is generally much larger compared to inputs than it is for surface water. This difference makes it easy for humans to use sub-surface water unsustainably for a long time without severe consequences. Nevertheless, over the long term the average rate of seepage above a sub-surface water source is the upper bound for average consumption of water from that source.

The natural input to sub-surface water is seepage from surface water. The natural outputs from sub-surface water are springs and seepage to the oceans.

If the surface water source is also subject to substantial evaporation, a sub-surface water source may become saline. This situation can occur naturally under endorheic bodies of water, or artificially under irrigated farmland. In coastal areas, human use of a sub-surface water source may cause the direction of seepage to ocean to reverse which can also cause salinization. Humans can also cause sub-surface water to be "lost" (i.e. become unusable) through pollution. Humans can increase the input to a sub-surface water source by building reservoirs or detention ponds.

Water in the ground are in sections called aquifers. Rain rolls down and comes into these. Normally an aquifer is near to the equilibrium in its water content. The water content of an aquifier normally depends on the grain sizes. This means that the rate of extraction may be limited by poor permeability.

Desalination

Desalination is an artificial process by which saline water (generally ocean water) is converted to fresh water. The most common desalinization processes are distillation and reverse osmosis. Desalinization is currently very expensive compared to most alternative sources of water, and only a very small fraction of total human use is satisfied by desalination. It is only economically practical for high-valued uses (such as household and industrial uses) in arid areas. The most extensive use is in the Persian Gulf.

Threats to fresh water

There are many things that are a threat to the Earths fresh water supply. Here are a few of them.

Climate change

Climate change will have significant impacts on water resources around the world because of the close connections between the climate and hydrologic cycle.

Rising temperatures will increase evaporation and lead to increases in precipitation, though there will be regional variations in rainfall. Overall, the global supply of freshwater will increase. Both droughts and floods may become more frequent in different regions at different times, and dramatic changes in snowfall and snowmelt are expected in mountainous areas. Higher temperatures will also affect water quality in ways that are not well understood. Possible impacts include increased eutrophication. Climate change could also mean an increase in demand for farm irrigation, garden sprinklers, and perhaps even swimming pools.

Depletion of aquifers

Due to the expanding human population competition for water is growing such that many of the worlds major aquifers are becoming depleted. This is due both for direct human consumption as well as agriculatural irrigation by groundwater. Millions of small pumps of all sizes are currently extracting groundwater throughout the world. Irrigation in dry areas such as northern China and India is supplied by groundwater, and is being extracted at an unsustainable rate.

Pollution and water protection

Water pollution is one of the many concerns of the world today. World governments have strived to find solutions to reduce this problem. Many pollutants threaten water supplies, but the most widespread, especially in underdeveloped countries, is the discharge of raw sewage into natural waters; this method of sewage disposal is the most common method in underdeveloped countries, but also is prevalent in quasi-developed countries such as China, India and Iran

Uses of fresh water

Uses of fresh water can be categorized as consumptive and non-consumptive (sometimes called "renewable"). A use of water is consumptive if that water is not immediately available for another use. Losses to sub-surface seepage and evaporation are considered consumptive, as is water incorporated into a product (such as farm produce). Water that can be treated and returned as surface water, such as sewage, is generally considered non-consumptive if that water can be put to additional use.

Agricultural

It is estimated that 70% of world-wide water use is for irrigation. In some areas of the world irrigation is necessary to grow any crop at all, in other areas it permits more profitable crops to be grown or enhances crop yield. Various irrigation methods involve different trade-offs between crop yield, water consumption and capital cost of equipment and structures. Irrigation methods such as most furrow and overhead sprinkler irrigation are usually less expensive but also less efficient, because much of the water evaporates or runs off. More efficient irrigation methods include drip or trickle irrigation, surge irrigation, and some types of sprinkler systems where the sprinklers are operated near ground level. These types of systems, while more expensive, can minimize runoff and evaporation. Any system that is improperly managed can be wasteful. Another trade-off that is often insufficiently considered is salinization of sub-surface water.

Aquaculture is a small but growing agricultural use of water. Freshwater commercial fisheries may also be considered as agricultural uses of water, but have generally been assigned a lower priority than irrigation (see Aral Sea and Pyramid Lake).

As global populations grow, and as demand for food increases in a world with a fixed water supply, there are efforts underway to learn how to produce more food with less water, through improvements in irrigation methods and technologies, agricultural water management, crop types, and water monitoring.

Industrial

It is estimated that 15% of world-wide water use is industrial. Major industrial users include power plants, which use water for cooling or as a power source (i.e. hydroelectric plants), ore and oil refineries, which use water in chemical processes, and manufacturing plants, which use water as a solvent.

The portion of industrial water usage that is consumptive varies widely, but as a whole is lower than agricultural use.

Household

It is estimated that 15% of world-wide water use is for household purposes. These include drinking water, bathing, cooking, sanitation, and gardening. Basic household water requirements [2] have been estimated by Peter Gleick at around 50 liters per person per day, excluding water for gardens.

Most household water is treated and returned to surface water systems, with the exception of water used for landscapes. Household water use is therefore less consumptive than agricultural or industrial uses.

Recreation

Water has a lot of recreational value.

Recreational water use is a very small but growing percentage of total water use. Recreational water use is mostly tied to reservoirs. If a reservoir is kept fuller than it would otherwise be for recreation, then the water retained could be categorized as recreational usage. Release of water from a few reservoirs is also timed to enhance whitewater boating, which also could be considered a recreational usage. Other examples are anglers, water skiers, nature enthusiasts and swimmers.

Recreational usage is non-consumptive. However it may reduce the availability of water for other users at specific times and places. For example, water retained in a reservoir to allow boating in the late summer is not available to farmers during the spring planting season. Water released for whitewater rafting may not be available for hydroelectric generation during the time of peak electrical demand

Environmental

Explicit environmental water use is also a very small but growing percentage of total water use. Environmental water usage includes artificial wetlands, artificial lakes intended to create wildlife habitat, fish ladders around dams, and water releases from reservoirs timed to help fish spawn.

Like recreational usage, environmental usage is non-consumptive but may reduce the availability of water for other users at specific times and places. For example, water release from a reservoir to help fish spawn may not be available to farms upstream

World water supply and distribution

Food and water are two basic human needs. As the picture shows, in 2025, water shortages will be more prevalent among poorer countries where resources are limited and population growth is rapid, such as the Middle East, Africa, and parts of Asia. By 2025, large urban and peri-urban areas will require new infrastructure to provide safe water and adequate sanitation. This suggests growing conflicts with agricultural water users, who currently consume the majority of the water used by humans.

Generally speaking the more developed countries of North America, Europe and Russia will not see a serious threat to water supply by the year 2025, not only because of their relative wealth, but more importantly their populations will be better aligned with available water resources. North Africa, the Middle East, South Africa and northern China will face very severe water shortages due to physical scarcity and a condition of overpopulation relative to their carrying capacity with respect to water supply. Most of South America, Sub-Saharan Africa, Southern China and India will face water supply shortages by 2025; for these latter regions the causes of scarcity will be economic constraints to developing safe drinking water, as well as excessive population growth

Lugʻat-minimum

surface – havza

ground – 1) yer, tuproq;
2) yer uchastkasi

pure – toza, sof

lack – kamchilik

artificially – sun’iy

permeable – singish

saturation – singish, oʻta singuvchan

rocks – togʻli tuproq

pressure – bosim

subterranean – yer osti

STORAGE AND DISTRIBUTION OF WATER FOR IRRIGATION

The regime of most great rivers is irregular. Frequently, they carry their greatest volumes of water in spring and in late autumn and winter, they may be reduced to mere trickles of water. To control these rivers and to regularize their regimes by storing water in the dry seasons, dams and reservoirs are constructed.

Dams, known also as barrages and weirs, and barriers built across rivers or streams to control the flow of water. Today most dams have several functions, which may include the storage and diversion of water for irrigation, the raising of water for generating hydroelectricity, and the provision of flood control. Dams have been constructed for thousands of years, at first of earth and of stone.

Sometimes, the source of water may be lower than the area to be irrigated, especially if the river runs in a canyon, and the water itself often has to be transported considerable distances from the river to the fields. In such cases, complex systems of pumping stations and canals may be necessary to lift and move the water from the reservoir to the fields.

A large – scale system of irrigation requires a complex network of dams, pumping stations and canals. In addition to lift and move the water from the fields.

A large – scale system of irrigation requires a complex network of dams, pumping stations and canals. In addition to the main dam, whose is the main storage unit, smaller diversion dams are needed to direct the water into an intricate canal system. The water is led from the dams into broad canals by gravity, and where these major canals, because of local physical conditions, are unable to receive their required water by gravity, pumping stations may be installed. These plants frequently receive their power from energy generated from power stations at the main storage dam.

From the main canals, water is diverted into a system which will distribute it throughout the farm. The most common means by which this is done is with open ditches or laterals, and the flow of water into them is controlled by head gates or regulators. They are frequently earth ditches, which may suffer from excessive losses owing to seepage, and evaporation, especially in arid regions or in to areas, of porous, sandy or gravelly soils. To eliminate such wastage, the use of tubing in place of open ditches to carry water from the canal to the land has land otherwise used ditches.

Lug‘at-minimum

regime – rejim
river – daryo
frequently – tez-tez
volume – ovoz, tovush
trickles – tomchilar
dams – suv ombori
reservoirs – rezervuar, suv ombori
barrages – suv ko‘tarilishi havzasi
weirs – kam naporli suv
how – oqim

Irrigation

Irrigation is the replacement or supplementation of rainfall with water from another source in order to grow crops or plants. In contrast, agriculture that relies only on direct rainfall is sometimes referred to as dryland farming.

Overview

The water source for irrigation may be a nearby or distant body of lake or frozen water such as a river, spring, lake, aquifer, well, or snowpack. Depending on the distance of the source and the seasonality of rainfall, the water may be channelled directly to the agricultural fields or stored in reservoirs or cisterns for later use. In addition, the "harvesting" of local rain that falls on the roofs of buildings or on nearby unfarmed hills and its use to supplement the rain that falls directly on farmed fields also involves irrigation.

Various types of irrigation techniques differ in how the water obtained from the source is distributed within the field. In general, the goal is to supply the entire field uniformly with water, so that each plant has the amount of water it needs, neither too much nor too little.

Overhead (sprinkler) irrigation

In overhead or sprinkler irrigation, water is piped to one or more central locations within the field and distributed by overhead high-pressure sprinklers or guns or by lower-pressure sprays. A system utilizing sprinklers, sprays, or guns mounted overhead on permanently installed risers is often referred to as a *solid-set* irrigation system. Some sprinklers can also be hidden below ground level, if aesthetics is a concern, and pop up in response to increased water pressure. This type of system is commonly used in lawns, golf courses, cemeteries, parks, and other turf areas. Sprinklers that spray in a fixed pattern are generally called *sprays* or *spray heads*. Sprays are not usually designed to operate at pressures above 30 lbf/in^2 (200 kPa), due to misting problems that may develop. Higher pressure sprinklers that rotate are called *rotors* and are driven by a ball drive, gear drive, or impact mechanism. Rotors can be designed to rotate in a full or partial circle. Guns are similar to rotors, except that they generally operate at very high pressures of 40 to

130 lbf/in² (275 to 900 kPa) and flows of 50 to 1200 US gal/min (3 to 76 L/s), usually with nozzle diameters in the range of 0.5 to 1.9 inches (10 to 50 mm). Guns are used not only for irrigation, but also for industrial applications such as dust suppression and logging.

Sprinklers may also be mounted on moving platforms connected to the water source by a hose. Automatically moving wheeled systems known as *traveling sprinklers* may irrigate areas such as small farms, sports fields, parks, pastures, and cemeteries unattended. Most of these utilize a length of polyethylene tubing wound on a steel drum. As the tubing is wound on the drum powered by the irrigation water or a small gas engine, the sprinkler is pulled across the field. When the sprinkler arrives back at the reel the system shuts off. This type of system is known to most people as a "waterreel" traveling irrigation sprinkler and they are used extensively for dust suppression, irrigation, and land application of waste water.

Other travelers use a flat rubber hose that is dragged along behind while the sprinkler platform is pulled by a cable. These cable-type travelers are definitely old technology and their use is limited in todays modern irrigation projects.

Overhead irrigation is generally the best solution for most irrigation projects although drip irrigation is efficient in limited applications, which is mostly trees or produce. (See also center pivot irrigation.)

Manually assembled systems of piping that are broken down to permit tillage and harvesting are sometimes called "hand set" or "hand move pipe". These are also commonly used where permanently installed sprinklers or outlets are not desired or where low initial costs are a factor.

Center pivot irrigation

Center pivot irrigation is a form of overhead irrigation consisting of several segments of pipe (usually galvanized steel or aluminum) joined together and supported by trusses, mounted on wheeled towers with sprinklers positioned along its length. The system moves in a circular pattern and is fed with water from the pivot point at the center of the arc. These systems are common in parts of the United States where terrain is flat.

Most center pivot systems now have drops hanging from a u-shaped pipe called a *gooseneck* attached at the top of the pipe with sprinkler heads that are positioned a few feet (at most) above the crop, thus limiting evaporative losses. Drops can also be used with drag hoses or bubblers that deposit the water directly on the ground between crops. The crops are planted in a circle to conform to the center pivot. This type of system is known as LEPA (Low Energy Precision Application). Originally, most center pivots were water powered. These were replaced by hydraulic systems (*T-L Irrigation*) and electric motor driven systems (*Lindsay*, *Reinke*, *Valley*, *Zimmatic*). Most systems today are driven by an electric motor mounted low on each span. This drives a reduction gearbox and transverse driveshafts transmit power to another reduction gearbox mounted behind each wheel.

Center pivot equipment can also be configured to move in a straight line, where the water is pulled from a central ditch. In this scenario, the system is called a *linear move* irrigation system.

Lateral move (Side roll, Wheel line) irrigation

A series of pipes, each with a wheel of about 1.5 m diameter permanently affixed to its midpoint and sprinklers along its length, are coupled together at one edge of a field. Water is supplied at one end using a large hose. After sufficient water has been applied, the hose is removed and the remaining assembly rotated either by hand or with a purpose-built mechanism, so that the sprinklers move 10m across the field. The hose is reconnected. The process is repeated until the opposite edge of the field is reached. This system is less expensive to install than a center pivot, but much more labor intensive to operate, and it is limited in the amount of water it can carry. Most systems utilize 4 or 5 inch diameter aluminum pipe. One feature of a lateral move system is that it consists of sections that can be easily disconnected. They are most often used for small or oddly-shaped fields, such as those found in hilly or mountainous regions, or in regions where labor is inexpensive.

Drip, or trickle irrigation

Water is delivered at or near the root zone of plants, drop by drop. This type of system can be the most water-efficient method of irrigation, if managed properly, since evaporation and runoff are minimized. In modern agriculture, drip irrigation is often combined with plastic mulch, further reducing evaporation, and is also the means of delivery of fertilizer. The process is known as *fertigation*. Deep percolation, where water moves below the root zone, can occur if a drip system is operated for too long of a duration or if the delivery rate is too high. Drip irrigation methods range from very high-tech and computerized to low-tech and relatively labor-intensive. Lower water pressures are usually needed than for most other types of systems, with the exception of low energy center pivot systems and surface irrigation systems, and the system can be designed for uniformity throughout a field or for precise water delivery to individual plants in a landscape containing a mix of plant species. Although it is difficult to regulate pressure on steep slopes, pressure compensating emitters are available, so the field does not have to be level. High-tech solutions involve precisely calibrated emitters located along lines of tubing that extend from a computerized set of valves. Both pressure regulation and filtration to remove particles are important. The tubes are usually black (or buried under soil or mulch) to prevent the growth of algae and to protect the polyethylene from degradation due to ultraviolet light. But drip irrigation can also be as low-tech as a porous clay vessel sunk into the soil and occasionally filled from a hose or bucket. Subsurface drip irrigation has been used successfully on lawns, but it is more expensive than a more traditional sprinkler system. Surface drip systems are not cost-effective (or aesthetically pleasing) for lawns and golf courses. Jain Irrigation Systems, Chapin Watermatics are major manufaturer of Drip Irrigation Systems.

Subirrigation

Subirrigation also sometimes called *seepage irrigation* has been used for many years in field crops in areas with high water tables. It is a method of artificially raising the water table to allow the soil to be moistened from below the plants' root zone.

Subirrigation is also used in commercial greenhouse production, usually for potted plants. Water is delivered from below, absorbed upwards, and the excess collected for recycling. Typically, a solution of water and nutrients floods a container or flows through a trough for a short period of time, 10-20 minutes, and is then pumped back into a holding tank for reuse. Subirrigation in greenhouses requires fairly sophisticated, expensive equipment and management. Advantages are water and nutrient conservation, and labor-saving through lowered system maintenance and automation. It is similar in principle and action to subsurface drip irrigation.

How an in-ground irrigation system works

Most commercial and residential irrigation systems are "in ground" systems, which means that everything is buried in the ground. With the pipes, sprinklers, and irrigation valves being hidden, it makes for a cleaner, more presentable landscape without garden hoses or other items having to be moved around manually.

Water source and piping

The beginning of a sprinkler system is the water source. This is usually a tap into an existing (city) water line or a pump that pulls water out of a well or a pond. The water travels through pipes from the water source through the valves to the sprinklers. The pipes from the water source up to the irrigation valves are called "mainlines", and the lines from the valves to the sprinklers are called "lateral lines". Most piping used in irrigation systems today is PVC or PEX plastic due to its ease of installation and resistance to corrosion. After the water source, the water usually travels through a backflow prevention device. This prevents water in the irrigation lines from being pulled back into and contaminating the clean water supply.

Controllers, zones, and valves

Most Irrigation systems are divided into zones. A zone is a single Irrigation Valve and one or a group of sprinklers that are connected by pipes. Irrigation Systems are divided into zones because there is usually not enough pressure and available flow to run sprinklers for an entire yard or sports field at once. Each zone valve has a solenoid on it that is controlled via wire by an Irrigation Controller. The Irrigation Controller is either a mechanical or electrical device that signals a zone to turn on at a specific time and keeps it on for a specified amount of time. "Smart Controller" is a recent term used to describe a controller that is capable of adjusting the watering time by itself in response to current environmental conditions. The smart controller determines current conditions by means of historic weather data for the local area, a moisture sensor, weather station, or a combination of these.

Sprinklers

When a zone comes on, the water flows through the lateral lines and ultimately ends up at the irrigation Sprinkler heads. Most sprinklers have pipe thread inlets on the bottom of them which allows a fitting and the pipe to be attached to them. The sprinklers are usually installed with the top of the head flush with the ground surface. When the water is pressurized, the head will pop up out of the ground and water the desired area until the valve closes and shuts off that zone. Once there is no more water pressure in the lateral line, the sprinkler head will retract back into the ground.

History of irrigation

Evidence exists of irrigation in Mesopotamia and Egypt as far back as the 6th millennium BC.

There is also evidence of ancient Egyptian pharaohs in the twelfth dynasty using the natural lake of the Fayûm as a reservoir to store surpluses of water for use during the dry seasons, as the lake swelled annually as caused by the annual flooding of the Nile. Ancient visitors reported the appearance of "an artificial excavation, as reported by classic geographers and travelers" (*CATHOLIC ENCYCLOPEDIA: Egypt: I. GENERAL DESCRIPTION: Flora and Agriculture*).

Developed in ancient Persia the Qanat is among the oldest known irrigation methods developed and still used today. 'Qanats are constructed as a series of well-like vertical shafts, connected by gently sloping tunnels.' meaning that the receiving populus was always lower than the source, the source being higher and connected to these Qanats which had many exit points for the water (vertical shafts)at villages and pastures.

Irrigation Works of Ancient Sri Lanka were one of the most complex irrigation systems of the ancient world, the sinhalese managed to build major irrigation schemes to support the agriculture which thrived at the time. The sinhalese civilization is responsible for the invention of the valve pit which remains unchanged to-date. Highly complex use of trigonometry and other engineering aspects such as soil mechanics, built environment had been used for the construction of these schemes.King Parakrama Bahu (1153–1186 AD) had been responsible for the construction or the restoration of 165 dams, 3910 canals, 163 major tanks (reservoirs) and 2376 minor tanks, all in a reign of 33 years.

In the Zana Valley of the Andes Mountains in Peru, archaeologists found remains of 3 irrigation canals radiocarbon dated from the 4th millennium BC, the 3rd millennium BC and the 9th century. These canals are the earliest record of irrigation in the New World. Traces of a canal possibly dating from the 5th millennium BC were found under the 4th millennium canal.(Dillehay, *et al.*, 2005)

The Indus Valley Civilization in Pakistan and North India (from circa 2600 BC) also had an early canal irrigation system. [1]

In ancient China the Dujiangyan Irrigation System was built in 250 BC which irrigated a large area and it still supplies with water nowadays.

By the middle of the 20th century, the advent of diesel and electric motors led for the first time to systems that could pump groundwater out of major aquifers faster than it was recharged. This can lead to permanent loss of aquifer capacity, decreased water quality, ground subsidence, and other problems. The future of food production in such areas as the North China Plain, the Punjab, and the Great Plains of the US is threatened.

Drainage

Drainage is the natural or artificial removal of surface and sub-surface water from a given area. Many agricultural soils need drainage to improve production or to manage water supplies

Early history

The earliest archaeological record of an advanced system of drainage comes from the Indus Valley Civilization from around 3100 BC in what is now Pakistan and North India. The ancient Indus systems of sewerage and drainage that were developed and used in cities throughout the civilization were far more advanced than any found in contemporary urban sites in the Middle East and even more efficient than those in some areas of modern Pakistan and India today. All houses in the major cities of Harappa and Mohenjo-daro had access to water and drainage facilities. Waste water was directed to covered drains, which lined the major streets.

Reasons for artificial drainage

Wetland soils may need drainage to be used for agriculture. In the northern USA and Europe, glaciation created numerous small lakes which gradually filled with humus to make marshes. Some of these were drained using open ditches and trenches to make mucklands, which are primarily used for high value crops such as vegetables.

The largest project of this type in the world has been in process for centuries in the Netherlands. The area between Amsterdam, Haarlem and Leiden was, in prehistoric times swampland and small lakes. Turf cutting (Peat mining), subsidence and shoreline erosion gradually caused the formation of one large lake, the Haarlemmermeer, or lake of Haarlem. The invention of wind powered pumping engines in the 15th century permitted drainage of some of the marginal land, but the final drainage of the lake had to await the design of large, steam powered pumps and agreements between regional authorities. The elimination of the lake occurred between 1849 and 1852, creating thousands of km^2 of new land.

Coastal plains and river deltas may have seasonally or permanently high water tables and must have drainage improvements if they are to be used for agriculture. An example is the flatwoods citrus-growing region of Florida. After periods of high rainfall, drainage pumps are employed to prevent damage to the citrus groves from overly wet soils. Rice production requires complete control of water, as fields need to be flooded or drained at different stages of the crop cycle. The Netherlands has also led the way in this type of drainage, not only to drain lowland along the shore, but actually pushing back the sea until the original nation has been greatly enlarged.

In moist climates, soils may be adequate for cropping with the exception that they become waterlogged for brief periods each year, from snow melt or from heavy rains. Soils that are predominantly clay will pass water very slowly downward, meanwhile plant roots suffocate because the excessive water around the roots eliminates air movement through the soil.
Other soils may have an impervious layer of mineralized soil, called a hardpan or relatively impervious rock layers may underlie shallow soils. Drainage is especially important in tree fruit production. Soils that are otherwise excellent may be waterlogged for a week of the year, which is sufficient to kill fruit trees and cost the productivity of the land until replacements can be established. In each of these cases appropriate drainage is used to carry off temporary flushes of water to prevent damage to annual or perennial crops.

In farming drier areas, irrigation is often used, and one would not consider drainage necessary. However, irrigation water always contains minerals and salts, and these can be concentrated to toxic levels by evapotranspiration. Irrigated land may need periodic flushes with excessive irrigation water and drainage to remove these toxic minerals.

Drainage in the 19th century

This operation is always best performed in spring or summer, when the ground is dry. Main drains ought to be made in every part of the field where a cross-cut or open drain was formerly wanted; they ought to be cut four feet (1.2 m) deep, upon an average. This completely secures them from the possibility of being damaged by the treading of horses or cattle, and being so far below the small drains, clears the water finely out of them. In every situation, pipe-turfs for the main drains, if they can be had, are preferable. If good stiff clay, a single row of pipe-turf; if sandy, a double row. When pipe-turf cannot be got conveniently, a good wedge drain may answer well, when the subsoil is a strong, stiff clay; but if the subsoil be only moderately so, a thorn drain, with couples below, will do still better; and if the subsoil is very sandy, except pipes can be had, it is in vain to attempt under-draining the field by any other method. It may be necessary to mention here that the size of the main drains ought to be regulated according to the length and declivity of the run, and the quantity of water to be carried off by them. It is always safe, however, to have the main drains large, and plenty of them; for economy here seldom turns out well.

Having finished the main drains, proceed next to make a small drain in every furrow of the field if the ridges formerly have not been less than fifteen feet (5 m) wide. But if that should be the case, first level the ridges, and make the drains in the best direction, and at such a distance from each other as may be thought necessary. If the water rises well in the bottom of the drains, they ought to be cut three feet (1 m) deep, and in this ease would dry the field sufficiently well, although they were from twenty-five to thirty feet (8 to 10 m) asunder; but if the water does not draw well to the bottom of the drains, two feet (0.6 m) will be a sufficient deepness for the pipe-drain, and two and a half feet (1 m) for the wedge drain. In no case ought they to be shallower where the field has been previously leveled. In this instance, however, as the surface water is carried off chiefly by the water sinking immediately into the top of the drains, it will be necessary to have the drains much nearer each other--say from fifteen to twenty feet (5 to 6 m). If the ridges are more than fifteen feet (5 m) wide, however broad and irregular they may be, follow invariably the line of the old furrows, as the best direction for the drains; and, where they are high-gathered ridges, from twenty to twenty-four inches will be a sufficient depth for the pipe-drain, and from twenty-four to thirty inches for the wedge-drain. Particular care should be taken in connecting the small and main drains together, so that the water may have a gentle declivity, with free access into the main drains.

When the drains are finished, the ridges are cleaved down upon the drains by the plough; and where they had been very high formerly, a second clearing may be given; but it is better not to level the ridges too much, for by allowing them to retain a little of their former shape, the ground being lowest immediately where the drains are, the surface water collects upon the top of the drains; and, by shrinking into them, gets freely away. After the field is thus finished, run the new ridges across the small drains, making them about ten feet (3 m) broad, and continue afterwards to plough the field in the same manner as dry land.

It is evident from the above method of draining that the expense will vary very much, according to the quantity of main drains necessary for the field, the distance of the small drains from each other, and the distance the turf is to be carried.

The advantage resulting from under-draining, is very great, for besides a considerable saving annually of water furrowing, cross cutting, etc., the land can often be ploughed and sown to advantage, both in the spring and in the fall of the year, when otherwise it would be found quite impracticable; every species of drilled crops, such as beans, potatoes, turnips, etc., can be cultivated successfully; and every species, both of green and white crops, is less apt to fail in wet and untoward seasons.

Wherever a burst of water appears in any particular spot, the sure and certain way of getting quit of such an evil is to dig hollow drains to such a depth below the surface as is required by the fall or level that can be gained, and by the quantity of water expected to proceed from the burst or spring. Having ascertained the extent of water to be carried off, taken the necessary levels, and cleared a mouth or loading passage for the water, begin the drain at the extremity next to that leader, and go on with the work till the top of the spring is touched, which probably will accomplish the intended object. But if it should not be completely accomplished, run off from the main drain with such a number of branches as may be required to intercept the water, and in this way disappointment will hardly be experienced. Drains, to be substantially useful, should seldom be less than three feet (1 m) in depth, twenty or twenty four inches thereof to be close packed with stones or wood, according to circumstances. The former are the best materials, but in many places are not to be got in sufficient quantities; recourse therefore, must often be made to the latter, though not so effectual or durable.

It is of vast importance to fill up drains as fast as they are dug out; because, if left open for any length of time, the earth is not only apt to fall in but the sides get into a broken, irregular state, which cannot afterwards be completely rectified. A proper covering of straw or sod should be put upon the top of the materials, to keep the surface earth from mixing with them; and where wood is the material used for filling up, a double degree of attention is necessary, otherwise the proposed improvement may be effectually frustrated.

The pit method of draining is a very effectual one, if executed with judgment. When it is sufficiently ascertained where the bed of water is deposited, which can easily be done by boring with an auger, sink a pit into the place of a size which will allow a man freely to work within its bounds. Dig this pit of such a depth as to reach the bed of the water meant to be carried off; and when this depth is attained, which is easily discerned by the rising of the water, fill up the pit with great land-stones and carry off the water by a stout drain to some adjoining ditch or mouth, whence it may proceed to the nearest river.

Current practices

Modern drainage systems incorporate geotextile filters that retain and prevent fine grains of soil from passing into and clogging the drain. Geotextiles are synthetic textile fabrics specially manufactured for civil and environmental engineering applications. Geotextiles are designed to retain fine soil particles while allowing water to pass through. In a typical drainage system they would be laid along a trench which would then be filled with coarse granular material: gravel, sea shells, stone or rock. The geotextile is then folded over the top of the stone and the trench is then covered by soil. Groundwater seeps through the geotextile and flows within the stone to an outfall. In high groundwater conditions a perforated plastic (PVC or PE) pipe is laid along the base of the drain to increase the volume of water transported in the drain.

Alternatively prefabricated plastic drainage systems, often incorporating geotextile, coco fiber or rag filters can be considered. The use of these materials has become increasingly more common due to their ease of use which eliminates the need for transporting and laying stone drainage aggregate which is invariably more expensive than a synthetic drain.

Over the past 30 years geotextile and PVC filters have become the most commonly used soil filter media. They are cheap to produce and easy to lay, with factory controlled properties that ensure long term filtration performance even in fine silty soil conditions.

Drainage in Construction

The civil engineer or site engineer is responsible for drainage in construction projects. They set out from the plans all the roads, drainage, culverts and sewers involved in construction operations. During the construction of the work on site he/she will set out all the necessary levels for each of the previously mentioned factors.

Site engineers work alongside architects and construction managers, supervisors, planners, quantity surveyors, the general workforce, as well as subcontractors.

Agricultural machinery

Agricultural machinery is one of the most revolutionary and impactful applications of modern technology. Given the truly elemental human need for food, agriculture has been an essential human activity almost from the beginning, and it has often driven the development of technology and machines. Over the last 250 years, advances in farm equipment have dramatically changed the way people are employed and produce their food worldwide.

History

Doubtless, the first man to turn from the hunting and gathering lifestyle to farming did so by using his bare hands, and perhaps some sticks or stones. Tools such as knives, scythes, and wooden plows were eventually developed, and dominated agriculture for thousands of years. During this time, almost everyone worked in agriculture, because each family could barely raise enough food for themselves with the limited technology of the day.

With the coming of the Industrial Revolution and the development of more complicated machines, farming methods took a great leap forward. Instead of harvesting grain by hand with a sharp blade, wheeled machines cut a continuous swath. Instead of threshing the grain by beating it with sticks, threshing machines separated the seeds from the heads and stalks.

These machines required a lot of power, which was originally supplied by horses or other domesticated animals. With the invention of steam power came the steam-powered tractor, a multipurpose, mobile energy source that was the ground-crawling cousin to the steam locomotive. Agricultural steam engines took over the heavy pulling work of horses, and were also equipped with a pulley that could power stationary machines via the use of a long belt. The steam-powered behemoths could provide a tremendous amount of power, both because of their size and their low gear ratios. Their slow speed led farmers to comment that tractors had two speeds: "slow, and damn slow."

Gasoline, and later diesel engines became the main source of power for the next generation of tractors. These engines also contributed to the development of the selfpropelled, combined harvester and thresher, or combine for short. Instead of cutting the grain stalks and transporting them to a stationary threshing machine, these combines cut, threshed, and separated the grain while moving continuously through the field.

Types

Combines may have taken the harvesting job away from tractors, but tractors still do the majority of work on a modern farm. They are used to pull implements—machines that till the ground, plant seed, or perform a number of other tasks.

Tillage implements prepare the soil for planting by loosening the soil and killing weeds or competing plants. The best-known is the plow, the ancient implement that was upgraded in 1838 by a man named John Deere. Plows are actually used less frequently in the U.S. today, with offset disks used instead to turn over the soil and chisels used to gain the depth needed to retain moisture.

The most common type of seeder is called a planter and spaces seeds out equally in long rows, which are usually 2 to 3 feet apart. Some crops are planted by drills, which put out much more seed in rows less than a foot apart, blanketing the field with crops. Transplanters fully or partially automate the task of transplanting seedlings to the field. With the widespread use of plastic mulch, plastic mulch layers, transplanters, and seeders lay down long rows of plastic, and plant through them automatically.

After planting, other implements can be used to cultivate weeds from between rows, or to spread fertilizer and pesticides. Hay balers can be used to tightly package grass or alfalfa into a storable form for the winter months.

Modern irrigation also relies on a great deal of machinery. A variety of engines, pumps and other specialized gear is used to provide water quickly and in high volumes to large areas of land. Similar types of equipment can be used to deliver fertilizers and pesticides.

And, besides the tractor, a variety of vehicles have been adapted for use in various aspects of farming, including trucks, airplanes, and helicopters, for everything from transporting crops and making equipment mobile, to aerial spraying and livestock herd management.

New technology and the future

The basic technology of agricultural machines has changed little in the last century. Though modern harvesters and planters may do a better job or be slightly tweaked from their predecessors, the US$250,000 combine of today still cuts, threshes, and separates grain in essentially the same way it has always been done. However, technology is changing the way that humans operate the machines, as computer monitoring systems, GPS locators, and self-steer programs allow the most advanced tractors and implements to be more precise and less wasteful in the use of fuel, seed, or fertilizer. In the foreseeable future, some agricultural machines will be capable of driving themselves, using GPS maps and electronic sensors. Even more esoteric are the new areas of nanotechnology and genetic engineering, where submicroscopic devices and biological processes, respectively, are being used as machines to perform agricultural tasks in unusual new ways.

Agriculture may be one of the oldest professions, but the development and use of machinery has made the job title of *farmer* a rarity. Instead of every person having to work to provide food for themselves, less than 2% of the U.S. population today works in agriculture, yet that 2% provides considerably more food than the other 98% can eat. It is estimated that at the turn of the 20th century, one farmer in the U.S. could feed 25 people, where today, that ratio is 1:130 (in a modern grain farm, a single farmer can produce cereal to feed over a thousand people). With continuing advances in agricultural machinery, the role of the farmer will become increasingly specialized and rare.

Standardization

Standardization or **standardisation**, in the context related to technologies and industries, is the process of establishing a technical standard among competing entities in a market, where this will bring benefits without hurting competition. It can also be viewed as a mechanism for optimising economic use of scarce resources such as forests, which are threatened by paper manufacture. As an example, all of Europe now uses 230 volt 50 Hz AC mains grids and GSM cell phones, and (at least officially) measures lengths in metres.

Common use of the word standard implies that it is a universally agreed upon set of guidelines for interoperability. However, the plurality of standards-issuing organizations means that in many cases, a document purporting to be a "standard" doesn't necessarily have the support of many parties. As Grace Hopper said, "The wonderful thing about standards is that there are so many of them to choose from".

In the context of social criticism and social sciences, standardization often means the process of establishing standards of various kinds, and improving efficiency to handle people, their interactions, cases, and so forth. Examples include formalization of judicial procedure in court, and establishing uniform criteria for diagnosing mental disease. Standardization in this sense is often discussed along with (or synonymously to) such large-scale social changes as modernization, bureaucratization, homogenization, and centralization of society.

In the context of business information exchanges, standardization refers to the process of developing data exchange standards for specific business processes using specific syntaxes. These standards are usually developed in voluntary consensus standards bodies such as the United Nations Center for Trade Facilitation and Electronic Business (UN/CEFACT), the World Wide Web Consortium W3C, and the Organization for the Advancement of Structured Information Standards (OASIS).

Standards can be de facto, which means they are followed for convenience, or de jure, which means they are used because of (more or less) legally binding contracts and documents. Government agencies often have to follow standards issued by official standardization organizations. Following such standards can also be a prerequisite for doing business on certain markets, with certain companies, or within certain consortia.

A standard can be open or proprietary.

There are many worldwide standards and drafts (for example, for the standardization of powercords) developed and maintained by the ISO, the IEC, or the ITU.

Regional standards bodies also exist such as CEN, CENELEC, ETSI, and the IRMM in Europe, the Pan American Standards Commission (COPANT), the Pacific Area Standards Congress (PASC), the African Organization for Standardization (ARSO), the Arab Industrial Development and Mining Organization (AIDMO), and others.

Sub-regional standards organizations also exist such as the MERCOSUR Standardization Association (AMN),the CARICOM Regional Organisation for Standards and Quality (CROSQ), and the ASEAN Consultative Committee for Standards and Quality (ACCSQ).

In general, each country or economy has a single recognized National Standards Body (NSB). Examples include ABNT, ANSI, BSI, DGN, DIN, IRAM, JISC, KATS, SABS, SAC, SCC, SIS, SNZ. An NSB is likely the sole member from that economy in ISO.

NSBs may be either public or private sector organizations, or combinations of the two. For example, the three NSBs of Canada, Mexico and the United States are respectively the Standards Council of Canada (SCC), the General Bureau of Standards (Dirección General de Normas, DGN), and the American National Standards Institute (ANSI). SCC is a Canadian Crown Corporation, DGN is a governmental agency within the Mexican Ministry of Economy, and ANSI is a 501(c)(3) non-profit organization with members from both the private and public sectors. The determinates of whether an NSB for a particular economy is a public or private sector body may include the historical and traditional roles that the private sector fills in public affairs in that economy or the development stage of that economy.

Many specifications that govern the operation and interaction of devices and software on the Internet are de facto standards. To preserve the word "standard" as the domain of relatively disinterested bodies such as ISO, the W3C, for example, publishes "Recommendations", and the IETF publishes "Requests for Comments" (RFCs). These publications are often informally referred to as being standards.

In a military context, **standardization** is defined as: *The development and implementation of concepts, doctrines, procedures and designs to achieve and maintain the required levels of compatibility, interchangeability or commonality in the operational, procedural, materiel, technical and administrative fields to attain interoperability.*

In statistics, standardization refers to conversion to standard scores.

In test theory, standardization refers to measurements or assessments conducted under exact, specified, and repeatable conditions.

In supply chain management, standardization refers to approaches for increasing commonality of either part, process, product or procurement. Such change will enable delayed making of manufacturing or procurement decisions, thus reducing variability found in having many non-standard components.

From a modern economics point of view, *standardization process* starts with a social problem knowed as "coordenation dilema". *Standards*, as "voluntary norms", serve to falicitate the resolution of coordination dilemmas and realize mutual gains; then *standard* refer also to a kind of social dilemma solution

International Organization for Standardization

The **International Organization for Standardization** (**ISO**) is an international standard-setting body composed of representatives from national standards bodies. Founded on February 23, 1947, the organization produces world-wide industrial and commercial standards, the so-called ISO standards.

While the ISO defines itself as a non-governmental organization (NGO), its ability to set standards which often become law through treaties or national standards makes it more powerful than most NGOs, and in practice it acts as a consortium with strong links to governments. Participants include several major corporations and at least one standards body from each member country.

ISO cooperates closely with the International Electrotechnical Commission (IEC), which is responsible for standardization of electrical equipment.

The name

The organization is usually referred to simply as "**ISO**" (IPA pronunciation in English: [ˈaɪsəʊ]). It is a common misconception that ISO stands for "International Standards Organization", or something similar. ISO is not an acronym; it comes from the Greek word *ίσος* (*isos*), meaning "equal". In English, the organization's long-form name is "International Organization for Standardization", while in French it is called "Organisation internationale de normalisation." These initials would result in different acronyms in ISO's two official languages, English (IOS) and French (OIN), thus the founders of the organization chose "ISO" as the universal short form of its name

Standards and technical reports

ISO standards are numbered, and have a format that contains *"ISO[/IEC] [IS] nnnnn[:yyyy]: Title"* where *"nnnnn"* is the standard number, *"yyyy"* is the year published, and *"Title"* describes the subject. IEC will only be included if the standard results from work of JTC1. The date and IS will always be left off an incomplete or unpublished standard, and may (under certain circumstances) be left off the title of the published work.

Aside from standards, ISO also creates Technical Reports for documents that cannot or should not become International Standards such as references, explanations, etc. The naming conventions for these are the same as for standards with the exception of having TR prepended in the place of IS in the standard's name. Examples:

- ISO/IEC TR 17799:2000 Code of Practice for Information Security Management
- ISO TR 15443-1/3 Information Technology - Security Techniques - A Framework for IT Security Assurance parts 1-3

Finally, ISO will on rare occasions issue a Technical Corrigendum. These are amendments to existing standards because of minor technical flaws, improvements to usability or to extend applicability in a limited way. Generally, these are issued with the expectation that the affected standard will be updated or withdrawn at its next scheduled review.

ISO documents

ISO documents are copyrighted and ISO charges for copies of most. ISO does not, however, charge for most draft copies of documents in electronic format. Although useful, care must be taken using these drafts as there is the possibility of substantial change before it becomes finalized as a standard. Some ISO standards are made freely available. For examples, see Freely Available Standards and Free Standards2

ISO has three membership categories. There are *member bodies* that are national bodies that are considered to be the most representative standards body in each country. These are the only members of ISO that have voting rights. For countries that don't have standards organizations on their own there is a membership category called *correspondent members*. These are informed about the work going on in ISO but are not allowed to take part in the actual standardization work. Finally there are *subscriber members* for countries with small economies. These have reduced membership fees but can follow the development of new standards.

Products named after ISO

Still, the fact that many of the ISO-created standards are ubiquitous has led, on occasion, to common usage of "ISO" to describe the actual product that conforms to a standard. Some examples of this are:

- CD images end in the file extension "ISO" to signify that they are using the ISO 9660 standard filesystem as opposed to another file system - hence CD images are commonly referred to as "ISOs". Virtually all computers with CD-ROM drives can read CDs that use this standard. Some DVD-ROMs also use ISO 9660 filesystems.

Photographic film's sensitivity to light, its "film speed," is described by ISO 5800:1987. Hence, the film's speed is often referred to as its "ISO number.

Mashqlar

I. Quyidagi ajratib ko‘rsatilgan so‘z va so‘z birikmalarining o‘zbek tilidagi ma’nosini aniqlang.

Ideal conditions; individual features; economical use; a popular from; normal technique of cultivation; a special combination; capillary action; natural condition; in theory; parallel to the water – table; to sink vertically; to distribute water radially; in the centre

II. Tekstdan foydalanib, qaysi gapda sug‘orish usuli lug‘aviy ma’noga to‘g‘ri keladi.

1) watering of plants by applying the water below the ground surface; 2) a method of irrigation in which water under adequate pressure is sprinkled over the land; 3) a method of irrigation in which water is made to cover the surface of the land to a considerable depth for a considerable depth for a considerable depth for a considerable period after which it is drawn off; normally one such flooding is enough for the whole growing period; 4) a method of surface irrigation in which water is run in furrows between crops.

Lug‘at-minimum

absorb – singish
flooding – sug‘orish
furrows – egat
stream – oqim, irmoq
predermine – oldindan aniqlash
wet – nam
row – qator
thrown – uloqtirmoq, tashlamoq
ridges – tog‘li yer
germinate – o‘smoq
anyhow – har ehtimolga qarshi
revolving – aylantirish
shallow – mayda

Mashqlar

I. Quyidagi so‘zlarning lug‘aviy izohini aniqlang.

mechanical, electric control *n*, individual, function *v*, system *n*, role, ideal *a*, production, energy, conveyor *n*, centre *n*, coordinate *n*, material *n*, plan *n*.

II. Quyidagi so‘zlarning qaysi so‘z turkumiga tegishli ekanligini aniqlang.

formerly, storage, availability, supplement, gravity, convenience, attention, blender, manual, distributor, grinder, laborer, perfectly, numerous, location.

III. Tekstdan quyidagi so‘zlarning sinonimini aniqlang.

efficient, outside, high-cost, dry, attainable, input.

Lug‘at-minimum

livestock, farming – chorvachilik
convenience – qulaylik
power – kuch, quvvat
human – insoniyat
cringers – tegirmon, qirg‘ich
blenders – blender
conveyors – konveyr

FEED AND WATER SPACE
FOR NOGS AND CATTLE

In planning the means of distribution, one must give careful consideration to the problem of feed and water space for the animals. At the present time, most mechanical feeding systems use the king of self – feeders in which the feed is actually held in the main bins or silos until it is prepared and conveyed to the feeder. For mechanical apply as for older forms of self – feeding per hog and six inches per steer. If frequent limited feeding is planned, there must be enough space for all the animals to eat one time; the requirements are one foot for hogs and two feet for steers.

Using these figures one may determine the space needs of any number of feeding animals. A 10-door feeder with foot per door is satisfactory for 60 hogs on food of feeder space per pig is necessary. Cattle of 500 pounds or larger each require two feet of space at the feed bunk when fed on a limited feeding basis. A 100- foot bunk accessible from both sides has room for 100 head if they are all to eat one time. However, cattle have been brought to full grain feed by staring them on silage full feed, and then, over a period several weeks, adding increasing quantities of grain while decreasing the silage mechanically. When this kind of self – feeder is used, six inches of space per steer is sufficient and a 25 – foot – long feed bunk will feed 100 head (such feed bunks must be at least 58 inches wide and 10 inches deep)

A two – door hog water, located so as to be accessible from all sides, is satisfactory for 75 weight animals. Two hundred cattle can be accommodated with a two – door waterier which should be located the open so that there is no crowding at any time against a fence or shed.

Tekstga izoh

1. in the open – ochiq havoda

Mashqlar

I. Quyidagi bir o‘zakli so‘zlarning o‘zbek tilidagi ma’nosini aniqlang.

limit *v*, actually, silos, practice *v*, state *v*, period, mechanically.

II. Quyidagi so‘zlarning qay biri qanday so‘z turkumiga tegishligini aniqlang va o‘zbek tiliga tarjima qiling.

careful, consideration, actually, constantly, accessible, silage, sufficient, winterer.

III. Tekstdagi quyidagi so‘zlarning antonimlarini toping.

careless; in the past years; newer forms; rare unlimited feeding; increasing; narrow; indoors.

IV. Ajratib ko‘rsatilgan so‘zlarni tarjima qiling.

a) hog, cattle, steer, calf, sheep, cow; b) space, room, shed, fence.

Lug‘at-minimum

hog – bir yoshgacha bo‘lgan uy hayvoni
cattle – qoramol, sog‘in sigir
bins – yem-hashak saqlanadigan joy
steer – buzoqcha (olti oygacha bo‘lgan)
silage – silos (mol uchun yemish)

SOIL MANAGEMENT CAN REDUCE SOIL COMPACTION

Research can only identify and evaluate the importance of those factors which result from soil compaction. It then, however, falls upon others to use the facts appropriately. In the case of the disk harrow, it has been shown that a large force is applied to the soil over a small contact area. These forces are of sufficient magnitude that they may cause soil damage in the form of harrow soles. The disk harrow must then be used with caution to minimize any damage which would result from its use. This can only be done at the time of disking by the operator.

Soil Compaction Can Be Corrected. In view of the fact that soil compaction by traffic is increasing and since it already exists in many locations, certain things can be done to remove or minimize the ill effects of soil compaction: (a) Avoid travel on the soil under those conditions which are conducive to soil compaction. If it is absolutely essential that an operation be conducted, one should attempt to remove as much of the compaction by tillage, i.e. with tiles which follow the offending wheels to loosen the compacted wheel paths. (b) Eliminate unnecessary tillage or traffic from the soil. It is import and to realize that excessive tillage, which is not only expensive, may also be damaging to the soil. Obviously, the elimination of traffic must be balanced against other management considerations. (c) The use of new and improved equipment which is designed with a specific aim of reducing soil compaction will assist in reducing future soil, which includes deep tillage to remove compacted layers in the soil and the use of deep rooted crops to help improve soil structure, is quite effective in overcoming some types of soil compaction. This type of management is generally as effective on dense soils which have been formed by traffic as it is to those dense soil which are formed genetically.

Mashqlar

I. Quyidagi so'zlarning internatsional so'zlarga o'xshash tomonini aniqlang.

dick *n*, form *n*, correct *v*, absolutely. Balance, specific, assist, effective *a*.

II. Quyidagi so‘zlarning qaysi turkumiga tegishli ekanligini aniqlang.

to mange, management, manager: to identify, identity identification, identical: to exist, existence; to conduct, conductive, conductor; to realize, realization, realizable; to improvement, improvable, improver; to from, formation.

III. Tekstdan foydalanib, quyidagi so‘zlarning sinonimlarini aniqlang.

significance, adequate, quantity, to be the reason soil injury, the harmful effects, dear, purpose, modernized.

IV. Tekstdan foydalanib, quyidagi so‘zlarni antonimlarini aniqlang.

in spite of the; to compact; necessary; cheap; insufficient; favourable; will prevent reducing.

Lug‘at-minimum

evaluate – anglamoq, bahosini aniqlamoq
location – joylashish
harrow – yer tekislash
appropriately – ma’lumki bir maqsadda aniq bahosini ko‘rsatish
avoid – o‘zini olib qochish
compaction – tekislash

FORESTS OF ENGLISH – SPEAKING COUNTRIES

A. BRITAIN'S FORESTS

In prehistoric times, Britain was well – covered with tress. But as the population changed and grew, the forest areas gradually disappeared. The grazing of and sheep prevented much natural regeneration of trees. However, some woodland areas enjoyed a royal protection because of the facilities they offered for game, hunting. Similar control was exorcized by landowners. Some of these woodland areas as New Forest, Forest of Dean and Epping Forest, still exist with many of the old customs and laws still surviving.

Some landowners managed their estates well and responded to emergency calls, such as that made by John Evelyn in the 17^{th} century and it is thanks to tem that we have trees we do possess, and were able to face up to some of the demands for timber during the two great world wars.

So much hove – grown timber was used in the First World War, that it was quite obvious that the growing of trees should no longer be left to individuals. There had to be a national policy. Accordingly, the Forestry Commission was set up 1919. The Second World War once again made great demand for timber reserves because the effective blockade of the ports made the import of this bulky item a great problem.

But in spite of the two wars Forestry Commission has now planted 1.5 million acres tees in the 500 forests of the country. The annual programmer in recent years has been 100 million new trees planted each year. Of these, 90 per cent are conifer trees because they are quick growing. The softwood they provide represents practically 90 per cent of our timber needs. The Forestry Commission, with their scientific and financial resources them 2.5 million of forest schools which train the men who look after Britain's forests. A number of universities have specialist courses which provide a steady flow of men who will occupy various positions both in State and private woodlands.

The target in the 1970^s was to have 5 million acres of trees providing about one third of a national need of timber.

Lugʻat-minimum

graze – molxona, otxona
prevent – saqlamoq, ogohlantirmoq
regeneration – qayta tiklash
landowner – yer egasi
respond – javob bermoq
obvious – guvoh
ports – port
bulky – massa

THE NATURE OF PAPER

The word “paper” is used to describe a felted sheet of fibers formed by introducing a water suspension of the fibers onto a fine screen. The water drains through the screen, leaving a wet sheet of paper which is removed and dried. Additives of one or several kinds are usually introduced properties to the paper. There is not a sharp line of demarcation between paper and paperboard. Generally, paperboard is thicker, heavier, and less flexible than paper.

The invention of paper has been credited to Ts’ai Lun in China in 105 A. D. However, paper sheets appear to have been in use before the Christian era and the art of papermaking is certainly a very old one.

The craft spread to Korea and Japan and found its way westward by the routes of the camel caravans, reaching the Arabs about 750 A. D. Papermaking was introduced into Spain in the twelfth century, into Italy in the thirteenth century, into France and Germany in the fourteenth century, and into England in the fifteenth century. The first American peppermill was established in 1690. Before the invention of the paper machine about 1800, paper was made by a tedious hand process. Fibrous materials such as cotton or linen fags and hemp were stamped or pounded in the presence of water until they reached the condition desired for papermaking. The fibers were then made into a thin slurry with water in a large tank or vat. The water drained through the screen while the papermaker shook the mold sidewise to ensure even formation of the fibers into sheet. The wet sheet was removed from the screen by pressing a felt or blotter against it, and a stack of felts with the paper sheets was compacted in a screw press to flatten the sheets and to remove additional water. The sheets of paper were then removed and allowed to dry in the air. The surface of paper designed for writing was sized with animal glue or starch to prevent feathering of inks. With the introduction of the paper machine, the laborious hand process declined in importance.

In 1798 the Fourdrinier machine was invented by Nicolas Louis Robert in France and soon extensively developed by the Fourdrinier brothers in England. The paper machine forms, presses, the sheet in a continuous web. With the greater production now made possible, attention was directed to ward other sources are the chief material used in the making of paper. The major part of present – day production is based on wood – pulp. Other papermaking fibres are derived from bats fibers (hemp, jute, flax), grasses (straw, reeds, bamboo, bagasse), leaf fibres, and cotton.

Pulps for use in the manufacture of paper are produced by chemical or mechanical means from any of the sources of fibrous raw material. They are classified according to origin (e.g., wood, cotton straw, etc.) and to process of manufacture (mechanical, semi chemical).

Lug‘at-minimum

paper – qog‘oz
sheet – qog‘oz varaqlari
suspension – suspenziya eritma
screen – elak
additives – to‘ldiruvchi qo‘shimcha
contribute – jamg‘armoq, sarflamoq

DOMESTICATION OF ANIMALS

Domestication of animals is more than taming. Their habitat is restricted, protection assured, food supply maintained, and most important, breeding farm animals is done under human management and control.

In general animals have been domesticated for the following three purposes: as a source of food, clothing, etc, as assistants used in various human activities, or as pets.

The usefulness of animals domesticated may vary. For instance, European and many other peoples breed cows for obtaining milk and beef, but the Chinese do not milk cows, and Hindus do not eat beef.

The origin of domestication is unknown. The dog is likely to be most widely distributed and variably used domesticated animal. It assists hunting, draws sledges in Northern parts of the Soviet Union and America, a hairless type is bred for producing food in Mexico and elsewhere, while the specialized purposes for which dogs have been used are too numerous to mention.

Cattle are the most important of the animals domesticated by man and, next to the dog, the most ancient. Domesticated cattle belong to the family Bovidae, which also includes the buffalo, the bison, yak, zebu and some others. Domestication of cattle has had varying degrees of success, from half wild buffaloes to the tame British Jersey. Cattle were at first used and developed as draft animals and as suppliers of milk and were usually used for food only when no longer useful for the purposes mentioned. Only in very recent times have cattle been raised to be eaten.

The tractor has now replaced the cattle that supplied most of the farm draft power until after the turn of the century. Draft cows have practically disappeared except in a few back-ward and remote areas. The last representative of the wild cattle in Europe died at the beginning of the seventeenth century.

The horse was perhaps domesticated in Central Asia, where Przewalski's horse is still found wild today, and from there is spread rapidly all around the world.

In addition to the animals mentioned above there are some other animals that have been successfully domesticated by man. They are fowls, camels, bees and others.

Great physical changes have taken place in animals domesticated. Now they differ considerably in colour, form, size, etc from their related wild forms. Great experience has been gained in improving stocks by the scientists, using selection, crossbreeding and inbreeding.

Some possibilities for domestication may still exist. Perhaps fur-bearing animals, such as mink and foxes are now being domesticated in the same slow way as cattle and sheep were many thousand years ago.

Tekstga izoh

1. the Chinese – xitoyliklar; 2. draft animals – qo‘sh tortadigan ho‘kiz; 3. fur-bearing animals – mo‘ynali hayvonlar.

Mashqlar

I. Tekstdan foydalanib, nuqtalar o‘rnini to‘ldiring.

1. It is … when the domestication of animals began. 2. The dog was perhaps domesticated many thousand … … . 3. With the domestication of animals, their habitat is … . 4. The animals that are bred by man are known as … animals. 5. The … for which domestic animals are used … in different countries. 6. The degree of success of domesticating different ones.7. Only in very few countries of the world cattle are used as … animals. 8. Among the animals domesticated there are many that are highly … for man, the horse being one of them. 9. One can use different methods of … farm animals.

Lug‘at-minimum

domestication – xonakilashtirish
domesticate – xonakilashtirishmoq, qo‘lga o‘rgatmoq
restrict – chegaralamoq
restriction – chegara
assure – kafolat bermoq
supply – ta’minlash
maintain – tasdiqlamoq
general – oddiy, umumiy
sallow – suyanmoq, tayanmoq
assist – yordam bermoq
add – qo‘shimcha qilmoq, qo‘shmoq
obtain – olmoq
origin – kelib chiqish
numerous – ko‘p sonli
degree – daraja
representative – vakil
spread – yoymoq
assistance – yordamchi

Theoretical production ecology

Theoretical production ecology tries to quantatively study the growth of crops. The plant is treated as a kind of biological factory, which processes light, carbon dioxide, water and nutrients into harvestable parts. Main parameters kept into consideration are temperature, sunlight, standing crop biomass, plant production distribution, nutrient and water supply.

Modelling

Modelling is essential in theoretical production ecology. Unit of modelling usually is the crop, the assembly of plants per standard surface unit. Analysis results for an individual plant are generalised to the standard surface, e.g. the Leaf Area Index is the generalised surface of all crop leafs per surface unit.

Processes

The usual system of describing plant production divides the plant production process into at least five separate processes, which are influenced by several external parameters.

Two cycles of biochemical reactions constitute the basis of plant production, the light reaction and the dark reaction.

- In the light reaction, sunlight photons are trapped in chloroplasts which split water into an electron, proton and oxygen radical which is recombined with another radical and released as molecular oxygen. The recombination of the electron with the proton yields the energy carriers NADH and ATP. The rate of this reaction depends on sunlight intensity, leaf area index, leaf configuration and amount of chloroplasts per leaf surface unit. The maximum theoretical gross production rate under optimum growth conditions is approximately 250 kg per hectare per day.

- The dark reaction or **Calvin cycle** ties atmospherical carbon dioxide and uses NADH and ATP to convert it into glucose. The available NADH and ATP, as well as temperature and carbon dioxide levels determine the rate of this reaction. This cycles of plant production must complement each other in order to achieve optimum plant production. Together those two reactions are termed photosynthesis. The rate of this reaction depends on temperature and availability of NADH, ATP and carbon dioxide.
- The produced glucose is transported to other plant parts, such as storage organs and converted into secondary products, such as amino acids, lipids, cellulose and other chemicals needed by the plant or used for respiration. Lipids, sugars, cellulose and starch can be produced without extra elements. The conversion of glucose into amino acids and nucleic acids requires nitrogen, phosphorus and sulphur. Chlorophyll production requires magnesium, while several enzymes and coenzymes require trace elements. This means, nutrient supply influences this part of the production chain. Water supply is essential for transport, hence limits this too.
- The production centers, i.e. the leafs, are sources, the storage organs, growth tips or other destinations for the photosynthetic production are sinks. The lack of sinks can be a limiting factor for production too, as happens e.g. in apple orchards where insects or night frost have destroyed the blossoms and the produced assimilates cannot be converted into apples. Biannual and perennial plants employ the stored starch and fats in their storage organs to produce new leafs and shoots the next year.
- The amount of crop biomass and the relative distribution of biomass over leafs, stems, roots and storage organs determines the respiration rate. The amount of

biomass in leafs determines the leaf area index, which is important in calculating the gross photosynthetic production.

- extensions to this basic model can include insect and pest damage, intercropping, climatical changes, etc.

Parameters

Important parameters in theoretical production models thus are:

Climate

- **Temperature** - The temperature determines the speed of respiration and the dark reaction. A high temperature combined with a low intensity of sunlight means a high loss by respiration. A low temperature combined with a high intensity of sunlight means that NADH and ATP heap up but cannot be converted into glucose because the dark reaction cannot process them swiftly enough.
- **Light** - Light, also called photosynthetic Active Radiation (PAR) is the energy source for green plant growth. PAR powers the light reaction, which converts carbon dioxide and water into glucose and molecular oxygen. When temperature, moisture, carbon dioxide and nutrient levels are optimal, light intensity determines maximum production level.
- **Carbon dioxide levels** - Atmospherical carbon dioxide is the sole carbon source for plants. About half of all proteins in green leaves have the sole purpose of capturing carbon dioxide.
  Although CO_2 levels are constant under natural circumstances, CO_2 fertilization is common in greenhouses and is known to increase yields by on average 24% [1].
  C4 plants like maize and sorghum can achieve a higher yield at high solar radiation intensities, because they prevent the leaking of captured carbon dioxide due of the spatial separation of carbon dioxide capture and carbon dioxide use in the dark reaction. This means that their photorespiration is almost zero. This advantage is often offset by a higher maintenance respiration

level. In most models for natural crops, carbon dioxide levels are assumed to be constant.

Crop

- **Standing crop biomass** - Unlimited growth is an exponential process, which means that the amount of biomass determines the production. Because an increased biomass implies higher respiration per surface unit and a limited increase in intercepted light, crop growth is a sigmoid function of crop biomass.
- **Plant production distribution** - Usually only a fraction of the total plant biomass consists of useful products, e.g. the seeds in pulses and cereals, the tubers in potato and cassava, the leafs in sisal and spinach etc. The yield of usable plant portions will increase when the plant allocates more nutrients to this parts, e.g. the high yielding varieties of wheat and rice allocate 40% of their biomass into wheat and rice grains, while the traditional varieties achieve only 20%, thus doubling the effective yield.
  Different plant organs have a different respiration rate, e.g. a young leaf has a much higher respiration rate than roots, storage tissues or stems do.
  Sinks, such as developing fruits, need to be present. They are usually represented by a discrete switch, which is turned on after a certain condition, e.g. critical daylength has been met.

Care

- **Water supply** - Because plants use passive transport to transfer water and nutrients from their roots to the leafs, water supply is essential to growth, even so that water effiency rates are known for different crops, e.g. 5000 for sugar cane, meaning that each kilogram of produced sugar requires up to 5000 liters of water.
- **Nutrient supply** - Nutrient supply has a twofold effect on plant growth. A limitation in nutrient supply will limit biomass production as per Liebig's Law of the Minimum. With some crops, several nutrients influence the distribution of plant products in the plants. A nitrogen gift is known to stimulate leaf

growth and therefore can work adversely on the yield of crops which are accumulating photosynthesis products in storage organs, such as ripening cereals or fruit-bearing fruit trees.

Phases in crop growth

Theoretical production ecology assumes that the growth of common agricultural crops, such as cereals and tubers, usually consists of four (or five) phases:

- **Germination** - Agronomical research has indicated a temperature dependence of germination time (GT, in days). Each crop has a unique critical temperature (CT, dimension temperature) and temperature sum (dimensions temperature times time), which are related as follows.

$$GT = TS / \sum_{k=1}^{N} (T - T_{crit})$$

  When a crop has a temperature sum of e.g. 150 °C·d and a critical temperature of 10 °C, it will germinate in 15 days when temperature is 20 °C, but in 10 days when temperature is 25 °C. When the temperature sum exceeds the threshold value, the germination process is complete.
- **Initial spread** - In this phase, the crop does not cover the field yet. The growth of the crop is linearly dependent on leaf area index, which in its turn is linearly dependent on crop biomass. As a result, crop growth in this phase is exponential.
- **Total coverage of field** - in this phase, growth is assumed to be linearly dependent on incident light and respiration rate, as nearly 100% of all incident light is intercepted. Typically, LAI is above two to three in this phase. This phase of vegetative growth ends when the plant gets a certain environmental or internal signal and starts generative growth (as in cereals and pulses) or the storage phase (as in tubers).
- **Allocation to storage organs** - in this phase, up to 100% of all production is directed to the storage organs. Generally, the leafs are still intact and as a result, gross primary production stays the same. Prolonging this phase, e.g. by

careful fertilization, water and pest management results directly in a higher harvest.

- **Ripening** - in this phase, leafs and other production structures slowly die off. Their carbohydrates and proteins are transported to the storage organs. As a result, the LAI and, hence, the primary production decreases.

Existing plant production models

Plant production models exist in varying levels of scope (cell, physiological, individual plant, crop, geographical region, global) and of generality: the model can be crop-specific or be more generally applicable. In this section the emphasis will be on crop-level based models as the crop is the main area of interest from an agronomical point of view.

As of 2005, several crop production models are in use. The crop growth model **SUCROS** has been developed during more than 20 years and is based on earlier models. Its latest revision known dates from 1997. The IRRI and Wageningen University more recently developed the rice growth model **ORYZA2000**. This model is used for modeling rice growth. Both crop growth models are open source. Other more crop-specific plant growth models exist as well.

SUCROS

SUCROS is programmed in the Fortran computer programming language. The model can and has been applied to a variety of weather regimes and crops. Because the source code of Sucros is open source, the model is open to modifications of users with FORTRAN programming experience. The official maintained version of SUCROS comes into two flavours: SUCROS I, which has non-inhibited unlimited crop growth (which means that only solar radiation and temperature determine growth) and SUCROS II, in which crop growth is limited only by water shortage.

ORYZA2000

The ORYZA2000 rice growth model has been developed at the IRRI in cooperation with Wageningen University. This model, too, is programmed in

FORTRAN. The scope of this model is limited to rice, which is the main food crop for Asia.

Other models

The United States Department of Agriculture has sponsored a number of applicable crop growth models for various major US crops, such as cotton, soy bean, wheat and rice. [2] Other widely-used models are the precursor of SUCROS (**SWATR**), **CERES**, several incarnations of **PLANTGRO**, **SUBSTOR**, the FAO-sponsored **CROPWAT**, **AGWATER** and the erosion-specific model **EPIC**

Mashqlar

I. Quyidagi gaplarni o'zbek tiliga tarjima qiling.

1. I should give you a lot of examples without any difficulty.2. The engineer demanded that the new tractor should be tested.3. Provided your sister sees the picture ask her to describe it. 4. The student will not be able to translate this text unless he gets a good dictionary.5. I.V. Michurin grew different kinds of fruit so that he might provide the people with such food as had never existed before. 6. Without the Sun there would be no light, no heat, no energy of any kind. 7. If there had been oxygen in the atmosphere when life began, the sun's rays would not have prevented life from developing on land.8. Without decomposers chemical substances would not be able to return to the physical environment.9. If the amount of energy at the end of a food chain did not depend on the length of the chain each plant would provide a large amount of energy. 10. Without respiration of all living things carbon dioxide would not be returned to the air. 11. If ecosystems did not change all the time plants and animals would not be able to adapt to changes in the physical environment.

Lug'at-minimum

major – asosiy, bosh
substance – narsa
manufacture – ishlab chiqarish
primary – ilk
nitrogen – azot
carbon – uglerod
oxygen – kislorod
consequently – natija

feed – oziqlamoq
break – sinmoq
return – qaytib kelmoq
chain – zanjir
travel – sayohat qilmoq
proper – to‘g‘ri
fire – olov
destroy – yo‘q qilmoq
insect – qurt-qumursqa
bird – qush
expand – yoyilmoq, cho‘zilmoq
layer – qatlam

UTILIZATION OF NATURAL RESOURCES

The problem of rational utilization of natural resources is of greatest importance all over the world today. There are two main aspects of the problem: first – all natural resources are to be used more economically as they are not unlimited ,and second – measures are to be taken to prevent harmful effect of waste products of industrial enterprises on the environment.

Now, in the period of most intensive development of industry and agriculture, the programmed of nature conservation is of special importance. According to this programmed, practical measures on rational and economic utilization of natural resources in different spheres of economy are planned. One of the means to solve both aspects of the problem is to build complex enterprises. It means that the production process in the complex must be organized so that waste products of one enterprise could be utilized and processed by another. On the one hand, it will have great economic effect and on the other hand, will protect air and water from pollution.

Though complex enterprises will require rather big capital investments, it is better both from economic and ecological point of view to prevent pollution of the atmosphere than to liquidate its effect. For example, it has been shown that under the influence of air pollution the yield of wheat decreases by 40-60%.

When we use natural resources we should be careful not to destroy the balance of the biosphere in order to preserve nature not only for people living now, but also for those who will live many thousand years after. To realize measures to be taken for nature conservation, to fulfill the program e on rational use and reproduction of natural resources, co-operation of specialists in different spheres of science and practical activities is wanted. To solve ecological problems biologists, economists, physicists, biochemists mathematicians geologists, agronomists, forests, engineers are co-ordination their work. That is why some basic information on ecology is to be part of professional education of specialists in different spheres of science.

Tekstga izoh

1. all over the world – butun dunyoda. 2. part and parcel – ajralmas qism. 3. pollution of the environment – atrof muhitning ifloslanishi. 4. as a whole – bir butunligicha. 5. on the one hand – bir tomondan. 6. on the other hand – ikkinchi tomondan. 7. from… point of view – nuqtaiy nazar. 8. that is why – shuning uchun.

Mashqlar

I. Tekstdan foydalanib, quyidagi so‘zlarning sinonimlarini aniqlang.

Species, management, contaminate, secure, modify, lose, sufficient, encourage, pest, supply, poverty, loud, pour, earning, vivid, vital, escape, liver, observation, markedly, create, onion, excessive, pork, cucumber, mirror, liquor.

ROBOTS IN AGRICULTURE

The existing agricultural machines are not always good to perform necessary production operations. For example, the present-day tractor could have been working much faster if it were not for its driver who cannot withstand stepped- up speeds. The machinery currently in use makes secessionists adjust plant and even animals to suit its characteristics. But this is not easy: e.g., all milk-producing animals are to exhibit identical productivity and to yield milk within prescribed time limits. In other words, livestock breeding if put on an industrial basis, necessitates stereotyped herds.

Multiple problems also arise in plant breeding. Thus, for machine harvesting, tomatoes should ripen simultaneously and be equal in size. To “suit” the machines, man has had to develop, for example, dwarf-size trees and corn trees in which cobs all ripen to one height. However, such violence over heredity not seldom results in reduced productivity.

For reasons specified above, intensive work has been started on the development of robots designed specially for agriculture. It is worth noting that agricultural robots should be even more mobile, their “bionics” in the form of artificial sensitive organs should be more logical. Such model of a mobile autonomous robot (MAR-1) has been already developed. It has two hands enjoying eight levels of freedom.

Its body is capable of rotating any side. The hydraulic “muscles” of each hand can lift up to 75 kg. Special measuring devices are designed to measure the force of compression or impact, the temperature and the humidity. The built in watch gives a command to start the work.

The robot memory stores data concerning the floor space, e.g. that of a swine house, all its corridors, entrance, exits and feedlots. On coming to its workplace, the robot connects itself to the mains, a poser source, a control panel, or a computer. It takes a required working tool to place it bask when the work is completed.

Tekstga izoh

1. to withstand stepped-up speeds – katta tekstni ushlab turmoq. 2. dwarf-size trees – daraxtlarni pakana navi. 3. for reasons above – yuqorida qayd etilgan sabablarni ko‘rsating. 4. it is worth noting – qayd etish. 5. enjoying eight levels of freedom – sakkiz daraja ozodlikka ega bo‘lish. 6. the built-in watch – soatda belgilangan. 7. the floor space – maydon. 8. the robot’s hands manipulate like trunks – robotning qo‘llari belkurakdek harakatlanmoq.

ENGLISH-UZBEK DICTIONARY

aback – orqaga, orqasidan, orqasi bilan
abandonment – qarovsiz qoldirib ketish
abdomen – qorin, qorin bo‘shlig‘i
absorb – so‘rmoq, shimmoq, namni tortib olmoq
acclimatation – iqlimga moslashtirish
achieve – erishmoq, yetishmoq
acid – nordon, kislota
adapt – moslashmoq, o‘zlashtirmoq
add – qo‘shimcha qilmoq, qo‘shmoq, orttirmoq
additive – to‘ldiruvchi qo‘shimcha
adjusting – standartlashtirish, sozlaydigan
aeration – aeratsiya
alkaline – ishqoriy
amenable – javobgar, ta’sirchan
anyhow – qanday qilib bo‘lmasin
appropriately – taxmin
approximately – taxminan, taqriban
arable – yer haydash
arrangement – tartibga keltirish
artificial – sun’iy, yasama
ash – kul, kul sepmoq
assist – yordam bermoq
assistance – yordam, yordam berish
assure – ishontirmoq, kafolat bermoq
avoid – o‘zini chetga olmoq
barley – arpa
barrages – suv ko‘tarilishi havzasi
bins – yem-hashak saqlanadigan joy
bird – qush
blenders – blender
boot – o‘rama
break – sinmoq
breed – zot
bulky – massa
calf – buzoq
carbon – uglerod
cattle – qoramol, sog‘in sigir
cereal – boshoqli o‘simliklar
chain – zanjir
cinder – kul; yonib kul bo‘lmoq
clay – loy
clover – beda
colostrums – og‘iz suti
compaction – tekislash
complex – kompleks, murakkab tajriba
compost – kompost, chirindi
comprise – saqlab turmoq
consequently – natija
contribute – jamg‘armoq, sarflamoq
convenience – qulaylik
conveyors – konveyr
cool weather – salqin havo
cover – qoplamoq
creep – ohur
cringers – tegirmon, qirg‘ich
crop – qishloq xo‘jalik ekinlari
crop yields – hosildorlik
crust – qobiq, po‘stloq, qatlam
dairy farms – sut fermalari
damage – zarar
dams – suv ombori
deep – chuqur
degree – daraja
deprive of – mahrum bo‘lmoq
destroy – yo‘q qilmoq
determine – aniqlamoq, o‘rnatmoq
detrimental – zararli
diffusion – diffuziya
disease – kasallik
diversification – qishloq xo‘jalik mevalarini almashlab ekish
divisible – bo‘lim, qism
domesticate – xonakilashtirishmoq, qo‘lga o‘rgatmoq
domestication – xonakilashtirish
drainage – drenaj, quritish uskunasi
draught – afzal, homut
erosion – eroziya

evaluate – anglamoq, bahosini aniqlamoq
excess of soil moisture – tuproq namligini ko‘pligi
excessive – haddan tashqari
expand – yoyilmoq, cho‘zilmoq
feed – oziqlamoq
fertility – yuqori hosildorlik
fertilizer – o‘g‘it
fire – olov
flooding – sug‘orish
food supply – oziqaviy ta’minlash
for a long time – uzoq vaqt mobaynida
forest – o‘rmon
frequently – tez-tez
furrows – egat
general – oddiy, umumiy
germinate – o‘smoq
germination – urug‘larning unib chiqishi
gigantic – gigant, ulkan
glaciers – ustki qatlam
grains – don
grass – o‘t
graze – molxona, otxona
ground – 1) yer, tuproq; 2) yer uchastkasi
harrow – yer tekislash
hectare – gektar
hog – bir yoshgacha bo‘lgan uy hayvoni
how – oqim
human – insoniyat
hummock – tepalik
ice caps – muz qoplash
imply – ma’noni anglatmoq
in farming practice – fermerlik amaliyotida
in midsummer – yozning o‘rtasida
in prehistoric times – oldingi asrlarda
influence – ta’sir etish, ta’sir etadi
inherent – hos bo‘lgan
insect – qurt-qumursqa
involving – jalb etmoq
jaw – jag‘
lack – kamchilik
lack of moisture – namlik yetish-masligi
landowner – yer egasi
layer – qatlam
legumes – dukkakli o‘simlik
livestock, farming – chorvachilik
location – joylashish
low rainfall areas – yog‘ingar-chilik past bo‘lgan hududlar
maintain – tasdiqlamoq
maintenance – saqlab turish
maize – makkajo‘xori
major – asosiy, bosh
manufacture – ishlab chiqarish
manure – organik o‘g‘it, go‘ng
mating – ko‘paytirish, chatishtirish
meat – go‘sht
moisture – namlik
monoculture – almashtiril-maydigan ekin
nevertheless – shunga qaramasdan
nitrogen – azot
numerous – ko‘p sonli
nutrients – foydali ozuqa, vitaminlar
oats – suli
obtain – olmoq
obvious – guvoh
on the average – o‘rtacha
operate – boshqarish, ishlatish
orchard – mevali bog‘
origin – kelib chiqish
out crossing – chatishtirish
oxygen – kislorod
paper – qog‘oz
percolation – singish
permeable – singish
picker – o‘rim mashinkasi
pig – cho‘chqa
ploughing – yer haydash, shudgor qilish
podzols – qumloq tuproq
point of view – nuqtayi nazar
ports – port
potassium – kaliy
power – kuch, quvvat
predermine – oldindan aniqlash

pressure – bosim
prevent – saqlamoq, ogohlantirmoq
primary – ilk
proper – to‘g‘ri
property – sifat, belgi, mulk, yer uchastkasi
provided – ta’minlamoq
pure – toza, sof
rear – boqib ko‘paytirmoq
rear calves – buzoqlarni ko‘paytirish
reduce – kamaytirmoq, pasaytirmoq
regeneration – qayta tiklash
regime – rejim
related – qarindosh
representative – vakil
reservoirs – rezervuar, suv ombori
respond – javob bermoq
restrict – chegaralamoq
restriction – chegara
retentive – ushlab turuvchi
return – qaytib kelmoq
revolving – aylantirish
ridges – tog‘li yer
ripening – yetilishi, pishishi
risks – havf
river – daryo
rock – tog‘ jinsi, tog‘li hudud tuprog‘i
root – ildiz
rotation – ekinlarning almashinuvi, hosilni ayirboshlash
row – qator
salinity – sho‘r, tuzli
sallow – suyanmoq, tayanmoq
sand – qum
sandy soils – qumli tuproq
saturation – singish, o‘ta singuvchan
screen – elak
seed – urug‘
seed-beds – ekish uchun tayyorlangan tuproq
selector – saralovchi
shallow – mayda
shape – shakl
sheep – qo‘y
sheet – qog‘oz varaqlari
silage – silos (mol uchun yemish)
silt –tuproq qoldig‘i, tuproq changi
slope – o‘rib olingan ozuqa
soil – tuproq
solar energy – quyosh energiyasi
solar radiation – quyosh nuri radiatsiyasi
soot – chirindi; chang qoldig‘i
spread – yoymoq
spring cereals – bahorgi boshoqli o‘simliklar
stage – stadiya; davr; etap
steer – buzoqcha (olti oygacha bo‘lgan)
stock – chorva, mol, poda
stream – oqim, irmoq
substance – narsa
subterranean – yer osti
suckle – emizmoq
sunshine – quyosh nuri
sunshine hours – quyosh qizitadigan soatlar
supply – oziqlanmoq, ta’minlash
supports – tayanch, qo‘llab-quvvatlash
surface – havza
suspended – o‘lchangan holatda bo‘lmoq
suspension – suspenziya eritma
synthetic fertilizers – sun’iy, sintetik o‘g‘it
texture – strukturasi, tuzilishi (tuproq) tarkibi
the optimum level – muqobil, optimal daraja
the production of milk for sale –sutni iste’molga ishlab chiqish
the rearing program – ko‘paytirish dasturi
the size of a man’s hand – odam qo‘li bilan barobar
therefore – binobarin
throughout the world – butun jahonda
thrown – uloqtirmoq, tashlamoq
to be applied to the land – yerga ishlov bermoq
to be cultivated – haydalmoq ekilmoq

tolerate – chidash bermoq
topsoil – tuproqning ustki qatlamlari
toxic – zaharli modda
travel – sayohat qilmoq
trickles – tomchilar
undesirable – mos kelmaydigan
unrelated – begona, yot, qarindosh bo‘lmagan
upland conditions – tog‘ sharoitlarida
utility – foydaliligi, afzalligi
vapour – bug‘, par
vegetable – sabzavot
vital – hayotiy
volume – ovoz, tovush
water – suv
weirs – kam naporli suv
wet – nam
wool – jun

CONTENT

Mazkur qo'llanma Axmedov Shuhrat tomonidan nashrga tayyorlandi.