CROP AGRICULTURE

HISTORY

The “invention” of agriculture took place some 10000 years ago when humans, pushed by the challanges of shrinking game availability and growing population, were forced to turn to plants in search of sustenance. Foraging was known before, but cases of cultivation - use of wild plants - and domestification - selective breeding of of crops to develop desirable properties - were new and revolutionary.

CROPS AND PLACES

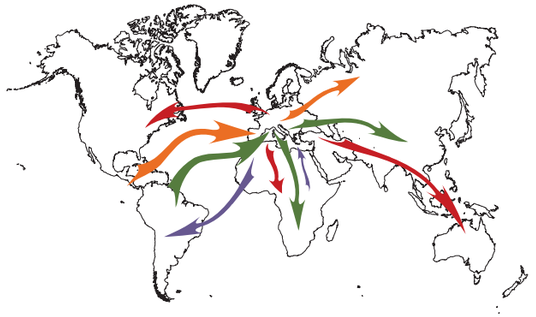
FERTILE CRESENT
flax
barley
lupine bean
vetch
emmer
einkorn
lentil
pea
chickpea

SUB-SAH. AFRICA
coffee
yam
millet
sorghum
kola nut
oil palm

SOUTH AMERICA
potato
manioc
guava
cotton
tobacco
peanut

ASIA
rice
soybeans
millet
mellon
barley

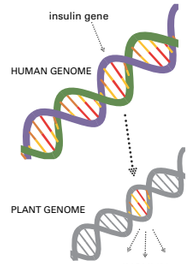
MESOAMERICA
maize
squash
avocado
pumpkin
pepper
beans



COLUMBIAN EXCHANGE

Plants, which were domesticated 8000 to 3000 years BCE, have largely retained their importance. With the exception of vetch (kind of bean, today grown only for cattle feed) and lupine (still grown for its flowers and as a snack) all of the original crops play and big role in todays agriculture. Columbian exchange was instrumental to the development of this situation. Indigenous people of America made great achievements in domestification of plants, which were exported to Europe with the beginnings of colonialism and became a crucial part of the diet there and in the rest of the world. The most significant exports were maize, potato and cassava (manioc), which became staple crops in Europe, Africa and Asia. Alongside these sunflower, tomato, pepper, pumpkin, cotton, sweet potato, yam, sisal and many others spread across the world.

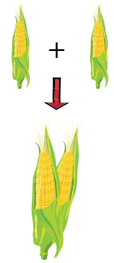
GM CROPS



A gene is a piece of DNA which contains chemically coded information that informs production of particular proteins in the cell. The chemical code is universal for all organisms. This means that one can take a gene for one protein and integrate it into the genome of another organism forcing it to generate that chemical, which is known as genetic manipulation.

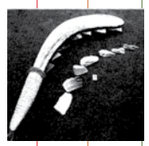
In one plant every cell carries all of the gene information for the whole, but a kontrolling mechanism determines which part of it is utilised in a particular organ. The smallest plant genome contains 30000 genes. This complexity means that until now we are able to manipulate only a handfull of genes.

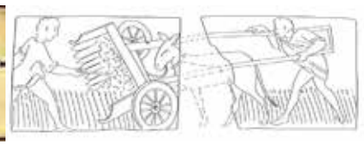
HYBRID MAIZE



Hybridizing is a process of crossing together varieties or similar species to produce offspring with desired qualities. Plants hybridise better then animals and the procedure was first used commercially to produce better maize yields. Crossing together two low-producing varieties gives a high-producing variety. Some hybrid offspring can reproduce e.g. modern breadwheat is a hybrid of three species. Others can’t, which is actively exploited by seed companies who thus force farmers to buy the seed every year as opposed to use their own.

SCIENCE AND TECHNOLOGY







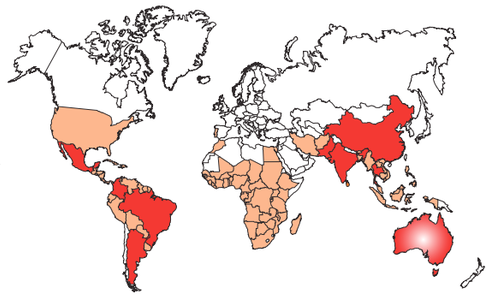

-800 000 HUMANS LEARNTO USE FIRE
-60 000 INVENTION OF BOW AND ARROW
-40 000 RISE OF CRO MAGNON IN EUROPE POPULATION OF AMERICA AND AUSTRALIA
-18 000 INVENTION OFTHE NEEDLE
-10 000 BEGINNING OF CULTIVATION
-8 000 HABITATION IN JERICHO
-7 000
-6 000
-5 000 SCRATCH PLOUGH
-4 000 IRRIGATION INDUS VALLEY
ORGANIC PESTICIDE
CITY OF UR AND URUK
-3 000 INVETION OF THE WHEEL
INVETION OFWRITING
-2 000 CITIES IN THE INDUS VALLEY
USE OF BRONZE
-1 000 ASSYRIAN EMPIRE
USE OF IRON
-500 FOUNDING OF ROME
IRON PLOUGHSHARE
-300 PERSIAN EMPIRE
-200 MACEDONIAN EMPIRE
-100 GREEK CITY-STATES
0 RISE OF THE ROMAN EMPIRE
400 DIVISION OF ROMAN EMPIRE
800 ARAB AGRIC. REVOLUTION
1000 SCYTHE BECOMES COMMON
1300
1400 BLACK DEATH IN EUROPE
ONE HUNDREDYEARS' WAR
GUTTENBERG BIBLE
1500 COLUMBUS DISCOVERS AMERICA
PLOUGH WITH INDIRECTTRACTION
MAIZE PLANTED WIDELY IN TURKEY
1600 FARMERS' WAR IN GERMANY
FIRST SEEDER PATENT
FIRSTTHRESHING MACHINE
1700 THIRTY YEARS' WAR
CROMWELL IN ENGLAND
ISAAC NEWTON
CARL LINNEAUS PLANT CLASSES
1800 FRENCH REVOLUTION
TULL'S SEEDER
WATT'S STEAM ENGINE
HAND MOWING MACHINE
1810 ABOLITION OF SLAVERY UK
DISCOVERY OF GUANO
HORTICULTURAL SOCIETY
1820 VIENNA CONGRESS
1830
1840 COMBINE HARVESTER
CHEMICAL FERTILISER
1850 FUTURES CONTRACTS
IRISH POTATO FAMINE
STEAM TRACTION ENGINE
STEAM PLOUGH PATENT
1860 WORLD EXHIBITION
DARWIN "THE ORIGIN OF SPECIES"
INTERNAL COMBUSTION ENGINE
1870 CIVIL WAR IN AMERICA
MENDEL'S PAPER, GENETICS
1880
1890 ELECTRIC AC ENGINE
CROSSBREEDING AND HYBRIDISING
PETROLTRACTOR DIESEL ENGINE
1900 WRIGHT BROTHERS
RECOGNITION OF GENETICS
THE WORD "TRACTOR"
HABER PROCESS
1910 FIRST WORLD WAR
TH MORGAN ON MUTATION
1920 THE GREAT DEPRESSION
DISCOVERY OF VITAMIN A
1930 AMERICAN DUSTBOWL
DICOVERY OF INSULIN
ODDA PROCESS
DISCOVERY OF PENICILLIN
1940 SECOND WORLD WAR
AIR TIRES FOR TRACTORS
1950 SECOND WORLD WAR ENDS
MODERN COMPUTERS
FIRST HERBICIDE 2,4-D STILL IN USE
KOREAN WAR
1960 VIETNAM WAR
DISCOVERY OF DNA STRUCTURE
USE OF DDT
FIRST SATELLITE "SPUTNIK"
TREATY OF ROME
1970 MAN ON THE MOON
GREEN REVOLUTION
ENERGY CRISIS
P. BERG AND GENETIC ENGINEERING
PLASTICULTURE
1980 FALL OF BERLIN WALL
MICROPROPAGATION
INDUSTRIAL AGRICULTURE
1990 SEPARATION OF THE USSR
GULF WAR
DIRECTED MUTATION HYPOTHESIS
2000 DRAFT OF THE HUMAN GENOME
WORLD WIDE WEB
DOLLY THE SHEEP
SYTHETIC LIFE

HISTORRICAL FACTS

MOST GROWN CROPS, WORLD BY QUANTITY (faostat 2009)

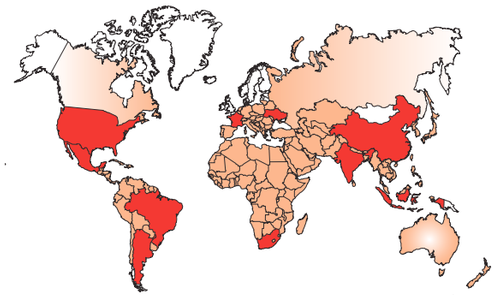
producing countries

top producers



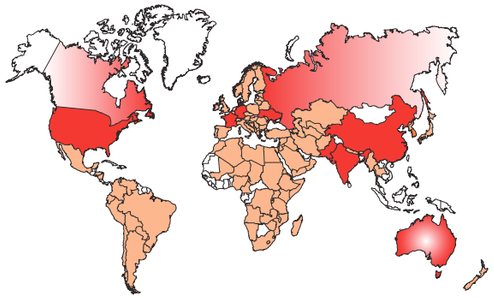
1 SUGAR CANE

Grows in tropical and subtropical regions on over 20 million hectares of land. Used for the production of sugar and increasingly bio-fuels. Some varieties capable of nitrogen fixation.



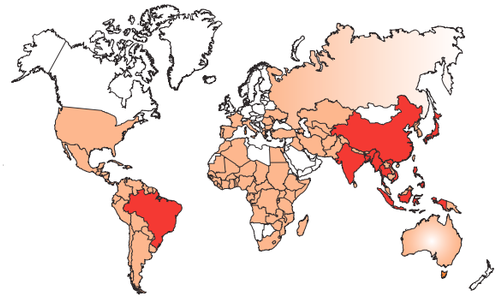
2 MAIZE

The most grown crop in the Americas, heavily subsidised, the first crop with commercial hybrid and later GM varieties. Wide range of applications in food, feed and other industries.



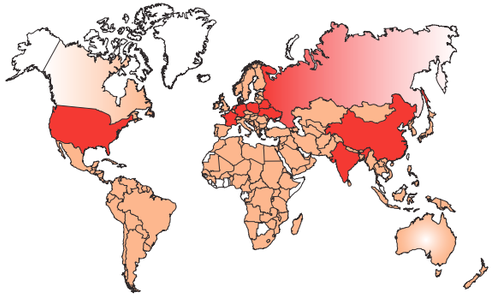
3 WHEAT

Leading source of vegetable protein in human food. Second most important cereal worldwide. Easily stored. Applications in food, construction and limited animal feed.



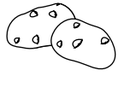
4 RICE PADDY

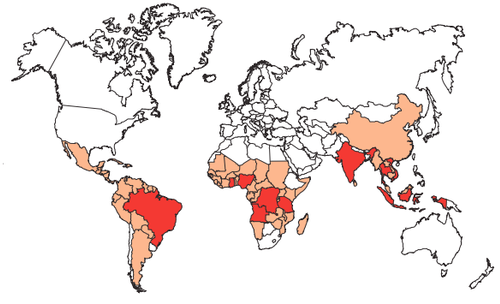
The most consumed cereal in human food. Cultivation is labour- and water-intensive. High in carbohydrate.



5 POTATO

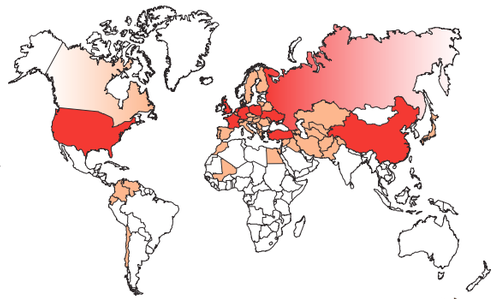
An average person globally consumes 33 kg of potatos per year. Central to European cuisine and gaining importance in China and India.





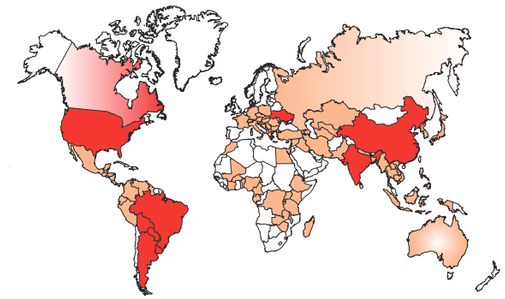
6 CASSAVA

Highest producer of carbohydrates of staple crops. Good back-up in case other crops fail. Equivalent of potato in tropical developing countries.



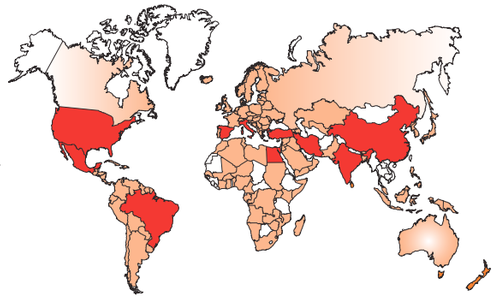
7 SUGAR BEET

Alternative source of raw sugar, unlike cane grows in temperate climates. Also used for production of bioethanol.



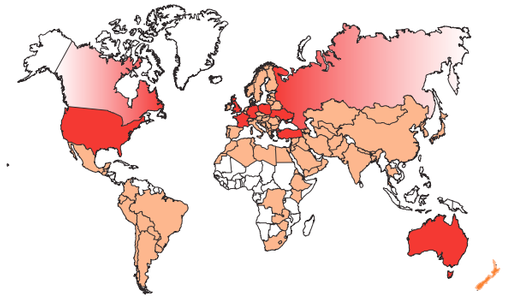
8 SOYBEANS

High in protein, important for production of meat and dairy substitutes and for animal feed. Beans must be prepared as they are toxic to monogastric animals when raw. Also produces oil. GM.



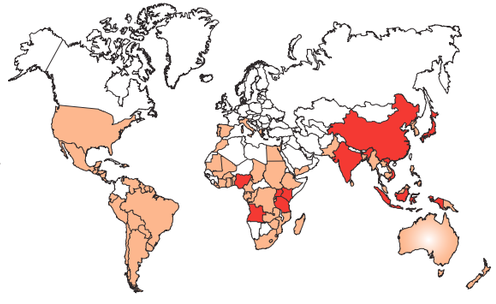
9 TOMATO

Important fruit grown solely for food outdoors or ingreenhouse culture in temperate climate. Requires pollination. No commercial GM.



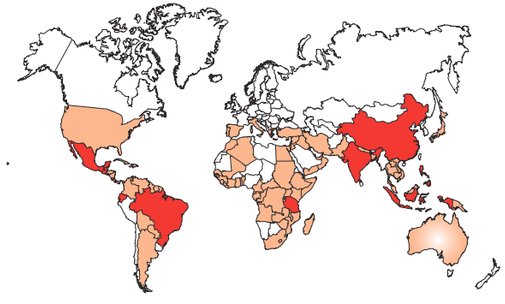
10 BARLEY

Major crop for animal feed. Used in production of alcoholic beverages, as ingridient in health foods and as a dish after milling and cooking.



11 SWEET POTATO

Human food with high nutricious value, used as animal fodder, for traditional dye and decoration. Research underway into bio-fuel varieties.

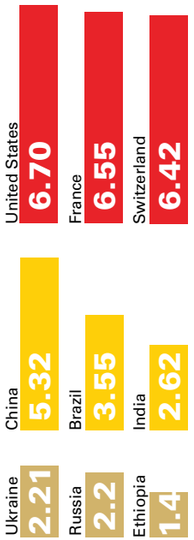


12 BANANA

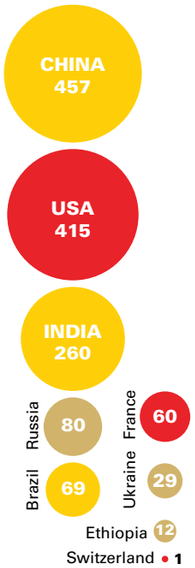
Grown primarily for food, it can also be used to make textiles and paper. Lacking in genetic variety and highly vulnerable to desease. Current widespread variety likely to decline.

AGRICULTURAL INPUTS

Yields of Cereals, t/ha, FAO 2007



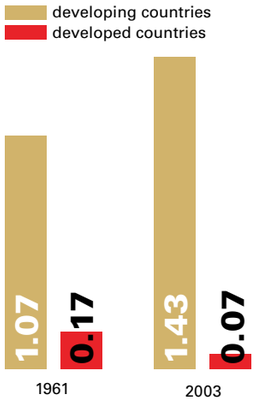
Total Cereal Crop 2007 Mio t, FAO



CEREALS

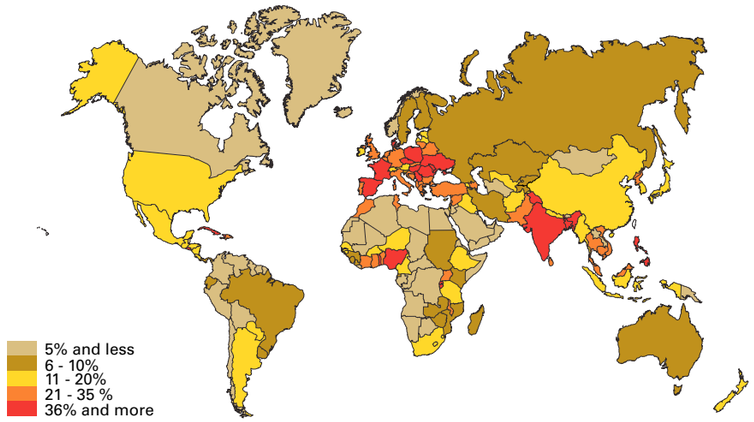
"Cereals include wheat, barley, maize, rye, oats, millet, sorghum, rice, buckwheat, alpiste/canary seed, fonio, quinoa, triticale, wheat flour, and the cereal component of blended foods. Cereal crops harvested for hay; harvested green for food, feed or silage; or used for grazing are excluded. Mixed grains and buckwheat are included."
WRI 2007

THE CEREAL HARVEST

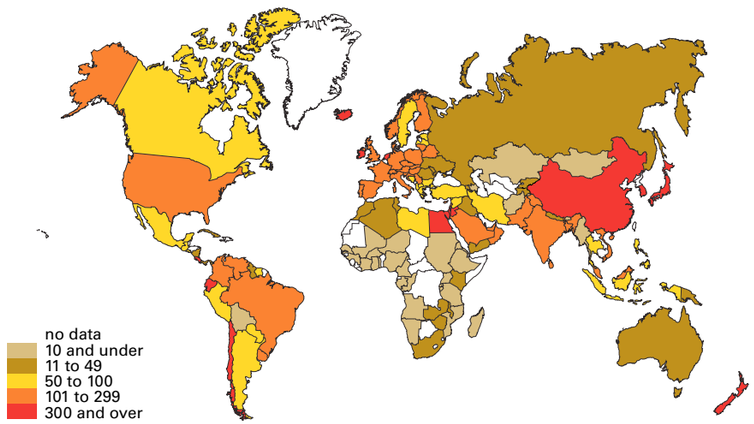


workers per hectare

LABOUR INTENSITY

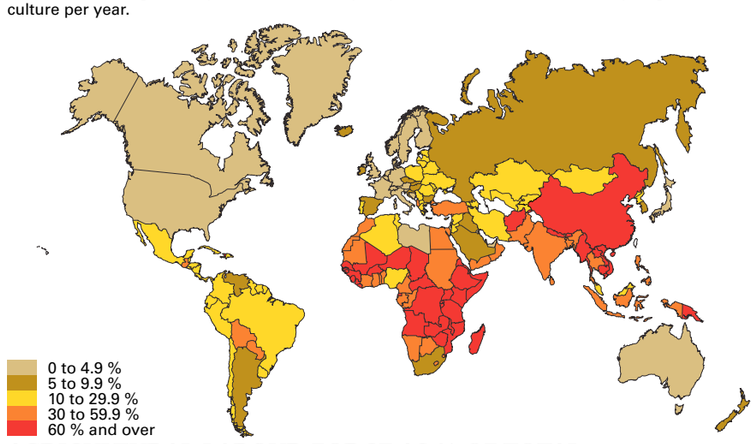


CROPLAND AS % OF AREA BY COUNTRY (WRI 2005)

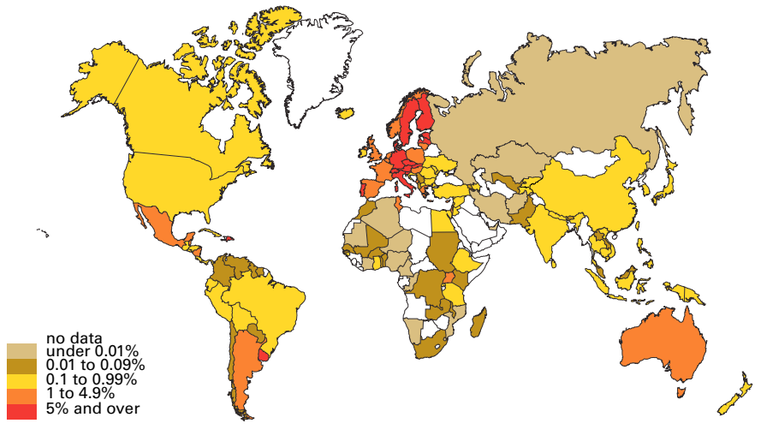


INTENSITY OF FERTILIZER USE KG/HA (WRI 2007)

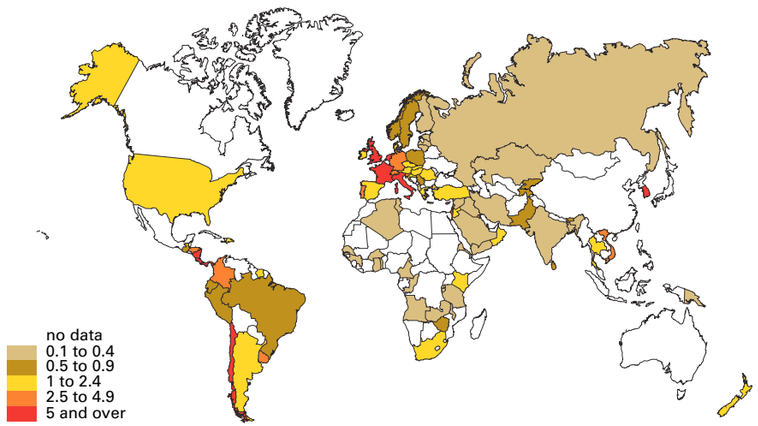
Amounts of nitrogen (N), potash (K2O), and phosphate (P2O5) used in a country's agriculture per year.



AGRICULTURAL LABOUR FORCE AS % OF TOTAL



ORGANIC FARMLAND AS % OF TOTAL FARMLAND (IFOAM 2006)



INTENSITY OF PESTICIDE USE KG/HA pa (WRI 1994-98)

"Organic agriculture is a holistic production management system which promotes and enhances agroecosystem health, including biodiversity, biological cycles, and soil biological activity....This is accomplished by using, where possible, cultural, biological and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system."
World Resources Institute

The use of synthetic fertilizers and pesticides as well as growth regulators, antibiotics and GMOs is strictly llimited in organic (bio-, eco-) farming. Organic as well as integrated agriculture moves away from monocultures and growing of plants without soil (e.g. tomatoes grown on miniral wool are not organic). That means that, rather than grow one kind of crop or animal, the farmer produces several in order to use local manure, crop rotation and own feed. The difference between integrated and organic is that in the latter the use of organic and mineral chemical substances is strictly limited.

In the German-speaking realm so-called bio-dynamic agriculture also exists. its principles are broadly similar to those of integrated farming, but they are attached to an Anthroposofic philosophy. A farm is understood as an organism and certain substances are permitted in accordance with the rythms of moon and sun. This movement exists since 1920s and can be understood in some aspects as a predecessor of the organic movement.

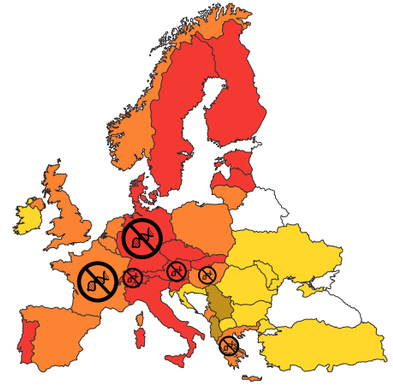
On a simplified level organic farming works on principles of farming as it was historically before introduction of artificial substances which strongly manipulated the growths environments to produce higher yields and many negative side effects. It was introduced in responce to growing concerns that the drive for higher productivity harms the environment and the people. Some of its effects are water pollution and soil erosion. These can take place even if natural fertilizers are used, so that organic farming is not just about use of traditional substances but also about carefull control to minimise negative effects on the environment.

Organic farming completely rejects GMO crops and animals.

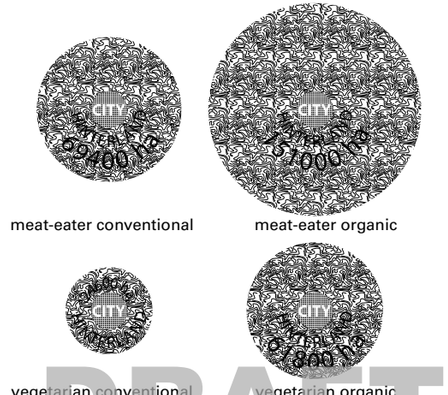
It is estimated that 80% of farmers of the developing world already use effectively organic methods. Projects for organic yield increases in Africa have been very successful (see biovision.ch), which throws doubt on the common conviction that organic agriculture cannot feed the world.

% of agricultural agea under organic farming

Despite Europe's apparent GM-unfriendliness a range of products have EU approval for use in feed and food. Most of them are commercially developed maize varieties as well as cotton and potato. All of these have been engineered for pest resistance and herbicide tolerance. Current move is towards relaxation of GM regulations.



ORGANIC FARMING AND GM CROPS IN EUROPE



FEEDING THE CITY OF BASEL