

Vision

Population Explosion
Global Dimension
World Nutrition 2020
New Technologies

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EXPO 2000 PROJECT Securing Food for the World *Position and Perspectives*



Registriertes Projekt
der Weltausstellung



The Hunger in the World

There is no simple explanation for the causes of hunger and food scarcity in a global context. The search for the optimum solution involves skilful science, unorthodox politics and dedicated practical agriculture.

The subject of the challenge is food security, and this demands world-wide efforts to create a sustainable way to over-

come under-nutrition in the developing lands. With hunger, that desperately unfair crippler of future potential, the decisive links are missing in the chain between talent and education, between labour productivity and economic development, between scientific discovery and bio-technological progress. Hunger makes labour unproductive and hinders the participation in economic life. Where hunger rules, the spiral of life seldom winds upwards, hunger means stagnation.

Warlike conflicts, social injustice, exploitation, unsuccessful economical politics, shortage of natural resources, ill-functioning marketing infrastructures, the underdeveloped state of practical farming, regularly occurring catastrophes - floods, droughts and epidemics, for instance - are only a few examples taken from a long list of causes. To these can be added poor education and health care, large numbers of children, religious conviction, values and morals, as well as unequal opportunities for women in society. Where the minimum requirements are missing for the functioning of the elements supporting welfare, a population is unlikely to be able to free itself from the strangling grip of want and hunger. Fighting hunger is the politics of peace but, at the same time, the overcoming of hunger requires survival in a destructive war. Global nutritional politics and security politics therefore complement one another.

Hunger obstructs the participation in social life. Hunger produces nothing else but more hunger, and this is why the vicious circle cannot be broken without help towards self-help. A indispensable requirement for this is improved education and training, above all for women on the land. They procure the food for their families and they give birth to, and then nurse, their children. Training courses in the preparation of food and in family planning are elementary contributions towards the fight against want. Rural nutrition programmes are the kick-start for economic life in the countryside and with that, the emergence of buying-power and demand.

The production of food is not the only thing to be aimed for, the food must be available for the whole population. There is not much to be gained by curing the symptoms, therefore no matter how many effective charity and state food programmes are introduced, they only represent a

drop in the ocean when the emergency aid is not followed-up with a sustainable and workable strategy.

Hunger is often supposed to be “only” a distribution problem. This hypothesis gives the impression that the distribution is easy to carry out, if the will is there. Distribution programmes do not solve

A problem with no easy answer

the problem and, anyway, there's not the cash available to purchase the goods in the first place. Hunger is the absence of the right amount of food in the right place. And the number of urgently required portions will grow from day to day. If every human being should have a daily intake of 2,700 kilocalories, as the World Food Summit of the U.N. targeted in 1996, then the amount of food required in the next generation will be double that of today. The amount of food required for such a supply is known. Experts have calculated that agricultural productivity must be increased year for year by 2.3 percent if this promise is to be kept. However, the problem will not be solved alone by simply increasing the amount of food available.

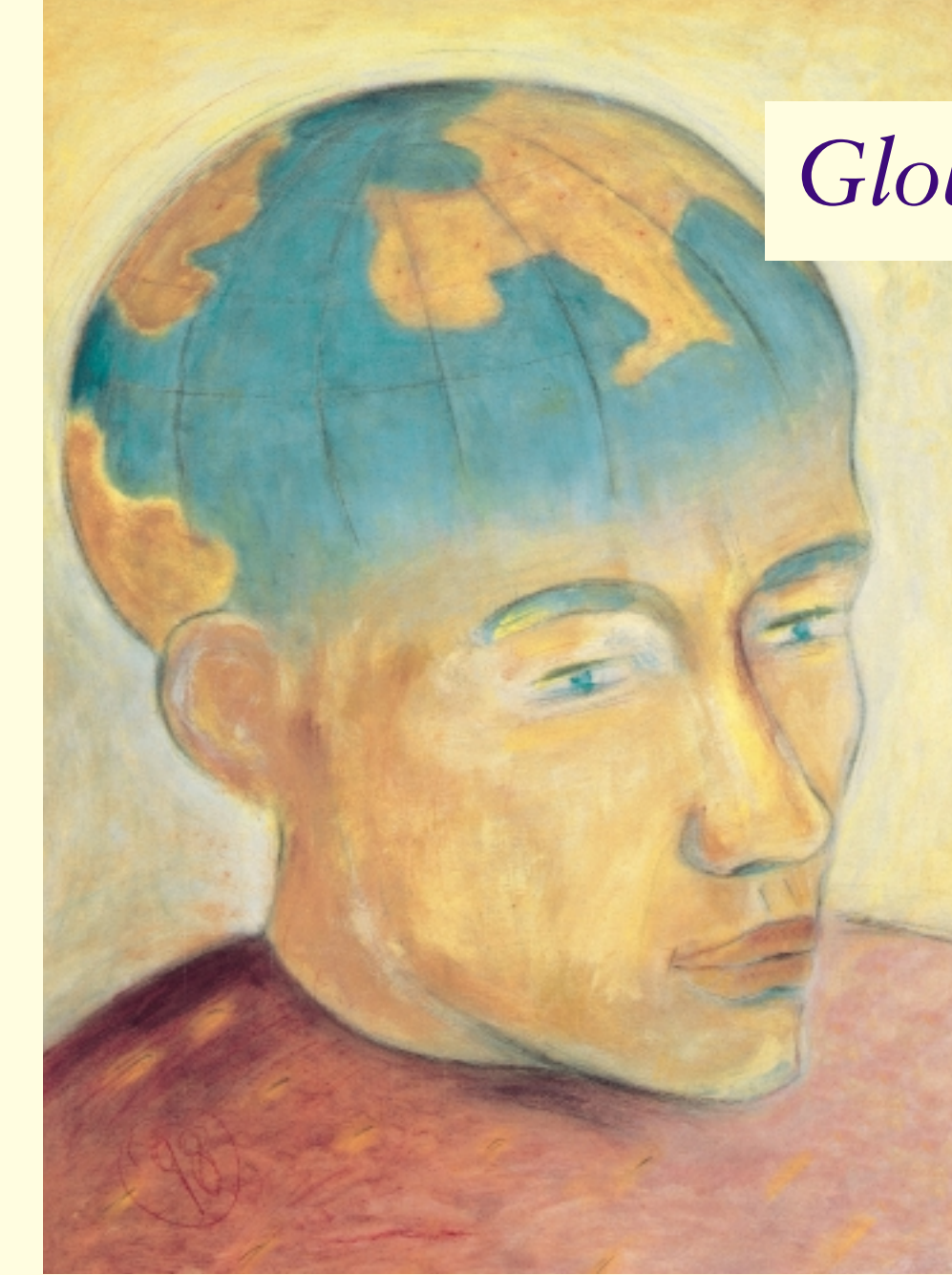
It is high time that a massive blow for freedom should be made in the battle against hunger. To the nucleus of such a “big bang” belongs increased support for agricultural research aimed at increasing yields in the afflicted regions. Simply transferring our own production techniques into such areas would not be much help. Rather, the solution lies in efforts towards step-by-step improvement with scientific support of production methods appropriate to local conditions. The store of agri-scientific knowledge is open to everyone; nowadays available world-wide through Internet. The motor for a positive and significant trend change is always created by agriculture. The new technologies should be used. These include new procedures in crop and livestock production, in agricultural technology, but also the utilisation of gene technology for yield improvement, rise in quality, increase of resistance against insect pests and plant diseases, as well as drought and frost resistance.

Even with this, it's true that a world without poverty and hunger is still a long way off. But this blueprint is a vision which repays and rewards every possible effort and every intelligent input. It is obvious that the technological possibilities - over which especially the highly-developed countries of the northern hemisphere have access - are a long way from being exhausted. And it should no longer be an argument that the third world countries cannot afford such technology.

The good news for every hopefully waiting land is this: When success in the healing of poverty can be celebrated, then the process will be substantially self-supporting until, in the end, no one more will need aid from the outside.

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Global thinking

We have to work together so that all Mankind has enough to eat. Mother Earth has room and food enough for all, but we have to revise our attitudes and recognise our responsibly for the common good.

Are we nearing the limits?

When Christ was born, only 200 million people lived on Earth. By 1900, population had risen to a thousand million. Today, over 6,000 million people live on this planet and by the year 2020 the population will be 8,300 million. The multiplication of the human race sprints towards a veritable population explosion.

However, not all live under humane conditions and that's why matters cannot be allowed to continue as they have done, with the people in the industrial lands living in plenty while some of the others exist in the bitterest poverty and hunger.

*In parts of the world,
over-population leads to need,
hunger and living conditions
below acceptable
human standards.*

The other side of success

The scientific and technological successes of the human race have always had social repercussions too. With industrialisation and the direct result that an increasing number of people received wages and bread, the population curve rose steeply. Advances in medicine have led to decreases in child mortality and the successful combating of epidemics has meant longer life expectancy. In many parts of the world, however, the production of food and the standard of living have not been able to keep up with the speed of beneficial development.



*The enormous increase
in world population
is the result
of improved living
conditions for Man.*

Tradition and custom

With some races, having many children is regarded as wealth in its own right and is seen as a security for old age. On the other hand, the control of population meets with great resistance in many areas on philosophical and on political grounds.

Learning and reconsidering

We must learn to work together to put right the challenges on our planet. Rethinking and re-learning has to be gone through in order to bring a positive change in relationships. When we fail to face up to our responsibility for the globe today and do not get down to doing something about it, then things are going to get very difficult on the planet Earth.

Everyone wants to eat well

More and more people want a better life. Each year world population increases by 80 million, the number of people now living in Germany. Even now, 800 million people world-wide go hungry. A much large number survive on poor and imbalanced diets. All these people must be supplied with enough food of the right kind: a gigantic task.

The world population grows faster than the production of food

For we affluent Europeans this challenge of getting enough food is easy to overcome: for those with money or those with high earnings it is no problem to eat well. But for more than 1,300 million people - representing around a fifth of the world population - getting food is a daily battle for survival.

In a vicious circle

Eating until full is a question of money. The poor of this world have access to less than a single dollar per day and person. This situation not only leads to an increase in social unrest, the environment also suffers. The infertile soil, despite decreasing harvests, is continually cropped and drained of nutrients, forests are chopped down for fuel or further farmland - a vicious circle that is very hard to break.

A breakthrough is urgently needed

Eating well is also, however, a question of accessibility as well as price. Because only where food is plentifully produced can it be offered for sale at attractive prices. In this context, farming everywhere has a duty. Not all fields are equally fertile, and not everywhere do the same crops flourish. But in nearly all locations the cultivation techniques can be improved and better harvests achieved. At the same time, one can take more care of the environment.

With agriculture's increased production potential, it might be possible to close the currently yawning chasm between too many births and too little bread. But in many cases it is impossible for the developing lands to close this gap with their own efforts. They are dependent on our advisory and active help.

It is 5 minutes past 12: 180 million people, one third of all pre-school children in developing countries, suffer from chronic undernourishment



We need a yield explosion to match the population explosion

If everyone is to have enough to eat in 25 years' time, then the food production of today will have to be doubled. This will require massive efforts on every continent. Demanded above all else are efficient processes for the environmentally-friendly production of much more food.

The doubling of the harvest yield is a very ambitious aim when one considers that there are tremendous differences between cultivation areas. Optimum area yields therefore differ completely according to the region. The way that these yields are achieved is also different overall. This is indicated right away by a glance at the different social, economical and cultivation-technology considerations, as well as the different training and know-how standards of the farmers.



Reachable goals

The cultivation conditions in the southern countries are not, for instance, so easy to oversee and to estimate. A variation in the climate down in the tropics can lead to a harvest catastrophe followed by disastrous food supply shortages. Even then, the yield potentials are not fully exploited and there's lots of room for improvements.

A key role for cereals

Cereals are critical for the securing of food for the world. Husbandry advances have led to the harvest increasing annually by 1.5 %. But in order to keep up with the rapid expansion of the population, the yearly yield increase would have to reach 2.3 %. Only when this gap is closed can we win the race against hunger.

Reliable and safe harvesting

An explosion in yields must not, however, be bought at the expense of soil fertility depletion. Tried and tested methods must be used - methods which also protect the environment. The high yield regions of this world show how this can be done. In such areas, the environment can be proved to be less under stress than in regions of the world which have poor harvests.

On average 2.6 tonnes of wheat per hectare are harvested world-wide, in top regions such as Schleswig-Holstein yield can be 10 tonnes per hectare and more.

The world's fields and pastures are limited

Farmland on this planet is rather like a roof garden - there are absolute limits to its expansion! Only about 10 % of the Earth's surface is used for cropping and livestock production. But this total includes nearly all our reserves, and we cannot afford to take land for food production out of ecologically-important areas.

Total land on the Earth surface covers about 13,000 million hectares. Of this, 4,300 million hectares comprise infertile desert, glaciers and mountains, 3,800 million hectares are forest and steppe, 3,400 million hectares comprise permanent pasture, rough grazings and prairie. Only 1,500 million hectares are covered by cultivated crops and long-term plantations such as orchards and vineyards.

Putting a price on biotope protection

To extend this fertile area representing slightly more than 10 % of land on this planet, water areas would have to be polderised, barren stretches of land made fertile or forests felled and put to the plough. The huge technical efforts demanded for such actions could never, however, be represented as cost-effective - quite apart from the facts that all these different biotopes must be kept as they are in the interests of the human race, and that the "green lungs" of the forests are critical for the survival of life.

Reserves can be exhausted

This is why every effort is being concentrated on the cultivation areas already in use, areas which in future must feed even more human beings that they do at present. The industrialised countries in the northern hemisphere have shown how this can be done. There, with husbandry methods developed to suit the prevailing growing conditions, yields have been continuously increased - with perhaps the process even overdone in some places.

Thus the way ahead for countries suffering from food shortage is demonstrated. These lands, too, have a huge yield potential to exploit. With increased production methods suited to the local conditions, improved harvests can be targeted. These are achievable only through the transfer of our know-how into the deprived regions.

Only 10 % of the Earth's surface is available for plant production. Expansion of cultivation areas threatens the ecological balance.



Our planet is vulnerable

Food for everyone must not be produced at the cost of irreversible ecological damage. The natural biosphere with its wide variety of living species must be protected. Only a sustainable agriculture and considerate treatment of the environment can secure a worthwhile existence for us in the future.

Out of the massive production-plus in food growing over the past 50 years, only 8 % has been due to extending the growing areas and 92 % through increasing productivity per hectare.

Agriculture and Nature are not irreconcilable opposites. Over thousands of years, Man has learned to improve the cultivation of the fields. Agriculture in previous centuries was partly a culture of exploitation and resource-exhausting. The forest delivered livestock feed and litter. The organic manure thus produced supported a basic fertility in the fields. More exactly, its application only slowed-down the depletion of nutrients.

Reconcilable opposites

Sustainable agriculture goes much further. The flora and fauna of the area is considered, the soil becomes more fertile and - when all is done correctly - the variety of living organisms is retained. In this way, agriculture has become an inexhaustible source for our nutrition, nor is it a coincidence that, parallel to this form of food production a cared-for and neatly-tended countryside has evolved.

No copy-cat cropping

In no way is improved agricultural production achieved through following the same cultivation procedure everywhere. The recipe for successful increased output here in this country cannot be transferred directly onto the development countries.

To put land that is too wet, too arid, too unsheltered, too saline or that is frozen for months at a time, under the plough for intensive cultivation is a risk that is often paid-for by extensive environmental damage. In such areas, cultivation methods are required that are in harmony with Nature, complementing and protecting the local environment.



Everywhere, where intensive agriculture has led to damage, cultivation intensity must be reduced to the optimum level.



The new dimension

We must increase the yields on the land that we have available. Up until now, this increase proceeded

gradually through the modernisation of agriculture. The world

shortage of food and the rapid rise in population demand a new dimension of efforts now.

Only through a technological change of completely new dimensions can the problems that have grown with the steep rise in world population be overcome.

The world today appears completely different from that of 25 years ago and so, too, will the living arrangements of our children and grandchildren a quarter century from now. Technology will have more influence in their lives. Great challenges demand equally large efforts, and because of this the bio-technological revolution, in agriculture as elsewhere, must not slow down. For people in all sectors of agricultural, improved education and sound knowledge build the foundations for tackling the challenges of tomorrow's world.

In order to achieve security of food supply in the world, it is important now to reinforce and coordinate agricultural research in all disciplines. Germany is regarded as the motherland of agricultural research and it is appropriate that this tradition should be continued on a higher level. Science must help agriculture to be in a position to take full advantage of, with the aid of electronics and the new agri-technologies such as biotechnology and gene technology, the huge potential offered by soil, plants and animals. The end result must be the raising of living standards globally.

Progress depends now on the further evolution, according to the local conditions, of traditional cropping and animal husbandry in the developing lands through the transfer of know-how. This must take place hand-in-hand with the protection of Nature and soil fertility. With improved cultivation methods, the developing countries will increasingly be in a position to feed themselves - and achieving this goal to a large extent would be the best of all results. But the countries with over-production of agricultural products also have a task before them. Because it is to everyone's advantage that food should be produced in areas of the northern hemisphere where growth is best and also where the greatest amount of know-how, and the most modern technology, are available. The responsibility for world-wide balancing of supplies lies with trade.

Half-portions all round?

Nowadays, an area of 3,000 m² is required to produce enough food for one person. By 2020, the same area will have to produce enough to satisfy two people: yields will have to be doubled.

The human race can only survive from the yields that it harvests from the available fields. This applies to cropping as well as to livestock output, because before domestic animals can produce eggs, milk and meat, they must feed on plants.

Simple sums?

The calculation seems simple, but working out the answer is going to keep us very busy in the next decades. In 1950, more than 5,000 square metres of agricultural land was available for each person's food needs whilst today that area is 3,000 square metres. In two decades, it is estimated that this figure will be down to 1,500 square metres.

Half helpings?

In any case, food production up until now cannot continue the way it has, and such a complicated calculation as the one before us has never been solved without some sort of determined action. One thing is sure though, whatever the future brings, in the highly developed industrial countries it will be unlikely that we suffer from food supply emergencies.

It is the starving peoples in Africa, Asia and Latin America that find themselves in the centre of the problem. In order to defeat chronic under-nutrition in these lands too, diets which are more substantial and varied will have to be devised.

Steep increase in productivity

The 1996 World Food Summit of the UN looked, at that time, far into the future and came up with some impressive figures: Africa must improve its supply of vegetable foods by 25 % up to 2020, and Asia must improve its output by 21 %.

And don't forget that these targets must be achieved by the developing countries in a situation where farmland area is decreasing. On their own, it's hardly possible for them to meet these targets and this is why these countries urgently need our help.



In 1950, more than 5,000 m² of food production land was available per person. Today, this has shrunk to 3,000 m² and by 2020 it will only be 1,500 m².

The bare facts are even more frightening when quality, and not quantity, is the criterium. When the shopping basket has to be filled according to priorities other than bulk, then the world-wide food requirements are altered substantially.

Basic rights and nutrition

Nowadays in Germany we have no experience of hunger. But in other parts of the world people are still undernourished. This situation led the 1996 World Food Summit of the U.N. to declare a "Basic Right to Enough Food". The conference also formulated the target of achieving a daily minimum of 2,700 kilocalories available per person by 2020.

In Africa, one third of the population suffers from undernourishment, in southeast Asia this figure is 15% and in Latin America 10%. Many people feel threatened by fear of a hopeless outcome in the race between the cradle and the plough.

The limits of affluence

Globally, there is 18% more food per head compared with 30 years ago although the world population has increased in that time by 60%. On a world average basis, the kilocalorie supply per head each day has risen in that time from 2,300 to 2,700. However, the growth in affluence is unevenly spread throughout the world. Whilst the average daily kilocalorie supply in western Europe is 3,500, and 3,600 and more in North America, inhabitants of many African countries get only from 1,500 to 2,000 kilocalories in their food bowls daily.

A duty to share responsibility in the securing of world food supply applies especially to the affluent countries – this means Germany too.



The commitment

At the World Food Summit conference the heads of government of most countries throughout the world pledged to fight against hunger and for the security of world food supply. This commitment included not only the defeat of current undernourishment but also the tackling of the whole problem right at its roots:

Using tried and tested sustainable agricultural systems, food supply right around the world must be built on more reliable foundations. The basic aim is an increase in productivity with consideration for the environment; action which will protect the diversity of life for future generations and, at the same time, even improve the fertility of the soil.

The vicious circle of poverty is continuously fuelled by social inequality, poor education and the oppression of women. This makes it even more urgent to introduce stimulating elements such as training, and modern farming systems related to prevailing growing conditions, into the villages of the affected countries.

Stopping hunger throughout the world cannot be achieved through charity alone. The problem of undernourishment demands completely different efforts.

Mankind needs more than bread

It's not only the bare quantity of food that counts. Healthy food must be interesting, diversified and nutritionally balanced. As well as staple plant foods, a certain amount of meat belongs in the diet along with milk products, fruit and vegetables.

While it's true that illnesses are caused by eating too much and by diets which are imbalanced, this is more a problem among the spoiled affluent minority on our planet.

Fighting for diversity

It's not only lack of nutrition that leads to illness. One-sided diets also end in damaged health. Those who eat only vegetables tend to suffer first from deficiencies and fall easier prey to disease. Children who grow up with deficient supplies of proteins, vitamins and minerals fall behind in their development.

In third world countries where the economies are improving, giving higher purchasing power in the population, the trend-change towards improved diets is already noticeable. There, the shopping list is enriched by meat, fish, fruit and vegetables.

All-round agriculture

Too often, discussions leave out the fact that agriculture delivers not only food, but also the basic materials for clothing, raw material for industry, space for leisure and sport, and on top of this helps ensure clean water and fresh air.

Under the title "renewable source raw material" it is expected, for instance, that farming in the future supplies substitutes for the diminishing supplies of finite fuel, delivers building materials and helps the chemical industry change to a completely new basis. Thus the German term for food which translates as "the material of life" gains an extra dimension in association with agriculture.

Farmers increasingly join the decisive planners influencing our future. The choice of food and raw materials at affordable prices, the consideration of the environment with soil protection, care of the groundwater, maintenance of wildlife variety and of the biosphere for plants and animals: these are all aspects that Mankind requires for its existence just as urgently as its daily bread.



Everyone is strongly dependant on animal protein for healthy development. Milk products are important for the development of the skeleton and for the maintenance of bone stability in old age.

Agriculture produces not only food, but also other "materials for life" that Mankind requires just as urgently as it does daily bread.



If we are to overcome the challenges of the next decades, we have to search for new tools and new

We need new strategies

strategies. On their own, the methods we've used up until now are not enough.

The human race has never before been faced with such a task. New challenges demand new solutions, therefore the first thing required is intensive thought.

Innovations presuppose more knowledge and ability, more education and advice, more consideration and environment protection. There's no doubt that agricultural research up until now can claim great successes, achievements creating, within a single century, the foundations which have resulted in five-fold increases in wheat yields and the seven-times increase of milk output per cow. However, the traditional

methods have now lost a lot of their potential and the creative spirit of science is once again called-for to increase yields further.

Research has indeed achieved a considerable step in this direction, especially with molecular-biological discoveries and gene technology methods. These have opened-up whole new fields of business opportunities as well as making possible even higher performances from crops and livestock. In particular the combination of biotechnology and plant protection will bring performance increases in crop output which up until now would have been hard to envisage. Micro electronics and communications technology deliver new tools for an agriculture with even more performance potential.

The biology researcher learns to improve his understanding of Nature, and how to unlock its secrets. Thus, the biological processes within the plant are discovered step-by-step and through this, defence mechanisms revealed which can be copied in order to achieve ways of plant protection which can be gentle with the environment. Additionally, crop plant pests are held in check through biological lures, alarm substances and those capable of restricting pest development. Another new way is through the release of natural predator populations which can control crop pests.

The aim is to use this entire arsenal of ultra-modern research results to ensure that the world population gets enough to eat. There is no other way open to us.

Are all possibilities exhausted ?

Even with today's techniques, there are still large reserves of yield potential to be tapped. There are natural limits, however, including those of weather, water shortages and lack of soil fertility. Despite such barriers, the current world wheat yield average of 2.5 tonnes per hectare is too small in any context. In the best regions, such as Schleswig-Holstein, three and a half times this yield is achieved - and more.

The race between harvest yields and consumption will become increasingly more critical. Nowadays, less than 15 % of annual consumption is in storage as reserve.

Good news: the long-term trend in rising levels of grain production continues world-wide. Not so good: grain consumption increases even faster.

The alpha and omega of nutrition security

Currently, around 2,000 million tonnes of grain, including rice, are harvested in the world. The world grain reserves, however, sink year by year. This, according to FAO*, represents a great risk to world food security. This is why higher yields are the alpha and omega of all strategies for improving world nutrition. Bigger harvests are especially urgently required in the countries where there are great shortages of food. In such areas, the difference between the yield achieved by the best growers and that by less successful farmers is especially high. Even a national internal levelling of yields can be a big step forward. In such countries, agriculture is very often the backbone of the total national economy. When farming receives a boost, it means not only that more and cheaper food appears on the country's markets, more work places and earning possibilities are also created.

The role of agricultural research

National and international agricultural research has a real responsibility here. Innovations will offer advances in progress which future generations can profit from. New tools are thus put into the hands of farmers through advances in the technologies of electronics, genetic engineering, biology and communications. With their help, problems can in the future be solved more efficiently and more quickly.

New discoveries in agricultural science, and their uses in agricultural practice, fill the harvest wagon and the bread basket. They prevent the exhaustion of soil fertility, and soil fertility is the real capital of the farmer.



Agricultural research has set high targets for itself in world food security: stable growth in yields and higher livestock performances whilst protecting animal health and soil fertility.

* FAO = Food and Agricultural Organization of the United Nations (UN)

Plants require nutrition and protection

For strong plant growth and good performance, nutrition must be balanced. Through fertilising according to yield potential, harvests in many areas may be considerably increased. Every year, the total world harvest is reduced by about 40 % by pests, diseases and weeds. Improved plant protection lessens this risk and therefore increases the amount of food available.

Every harvest takes nutrients out of the soil and these must be returned again in order to maintain fertility.

The explosion-like world population growth must in future be fed from a world-wide total of 1,500 million hectares farmland, with hardly any expansion possibilities.

Integrated crop production is the basis

This approach means nothing other than achieving higher yields by intensifying the use of farmland by regionally-suitable and environmentally-friendly production methods. The best road to success follows integrated cultivation methods which achieve a balanced and sustainable production whilst meeting all ecological and economical requirements. In this way, the natural on-site and cultivation factors are taken account of whilst, at the same time, bio-technological advances are utilised. Thus, over the longer term, a contribution to world nutrition, as well as to business success for the farmer, can be secured.

Fertilisation brings food and maintains soil fertility

Plants require a balanced supply of mineral nutrients for growth. With every harvest, nutrients are withdrawn from the soil, and these must be returned. Only in this way can fertility be retained, or even increased. Globally, this process cannot be achieved with organic fertilisers - slurry or farm yard manure - alone. These must be supplemented by mineral fertilisers. Nowadays, around 50 % of the human race owe their daily bread to this latter development. Modern fertiliser management means matching fertiliser applications and timing to the requirements of the plants.

Integrated plant protection reduces risk

Crop plants are open to a multitude of dangers through animal pests, disease pathogens and weeds. Insufficient plant protection leads to yield and harvest quality penalties. Unnecessary applications of plant protection material can cause environmental damage. The concept of integrated plant protection means achieving the optimum economic output goal through applying the minimum therapeutic treatment needed to maintain crop health.

Integrated crop production methods mean harvest yields can be increased in a sustainable way with full consideration to environmental protection.



More help from less material

Agricultural technology is being steadily refined in order to mobilise yield potential. Plant protection is being improved through innovative chemistry: where 2,000 grams active ingredient per hectare was required to control plant disease a few decades ago, the same effect is achieved nowadays with as little as 2 grams per hectare.

Supplying the human race with enough nutrition of sufficient quality is, along with the concerns of environmental protection, the motor for new developments in agricultural research and practical farming. More disease resistant livestock need less medicines. Hardier plants require fewer plant protection substances.

In recent times, methods have been developed that allow precision fertilisation with smaller amounts of manure.



Precision fertilising

An idea of the kind of developments we can expect in the future is given by a machine studded with electronics which, whilst travelling across the field, applies nitrogen accurately to the growing crop. It does this after assessing precise plant requirements through on-the-spot optical analyses of the foliage colour. Another procedure features the accurate application of fertiliser at different rates for separate areas of the field with equipment controlled from satellite in outer space according to appropriate soil analysis and harvest yield field maps.

Plant protection with micro-chemistry

Active ingredients have been discovered by the agro-chemical industry which achieve plant protection at very low doses and are harmless for humans and the environment. This is achieved through the substances attacking specific metabolic processes in the pest organism - processes which do not apply to humans, animals or other kinds of plant. Science has found ways of hitting pathogens at their most vulnerable stage so that the amount of plant protection substance can be minimized. Instead of spraying the fields, seed can be encased with a substance which, for example, protects beet against aphid attack. The amount of active ingredient required is thus reduced to 0.6 percent of that which would be needed if the whole field had to be sprayed.

“Induced resistance” is the name of another “gentle” plant protection method and this works along the same lines as vaccination in the case of humans. In this way, plants are able to increase their natural resistance against disease.

Modern methods by which only 0.6 percent of a total crop area comes into contact with plant protection material, reduce environmental risks.

Impressive breeding successes

Breeders have developed our present efficient high-yield crop plants, and livestock with high performance potential, through methods including selection and crossing. Traditional breeding is a long-term exercise. It resembles an exhausting journey through a labyrinth. Using the methods of gene technology, the target can be reached much faster.

Gene technology is the key technology of our times, bringing advantages to both plant and animal breeding.

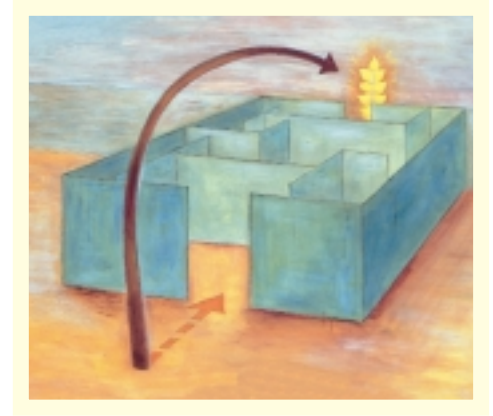
How does gene technology work?

Genes are the carriers of hereditary traits. They are to be found in the form of a double helix within the cell nuclei DNA of every living creature. Just as letters in a particular order make up a word with a specific meaning, so can hereditary traits be understood from the order of the DNA* building blocks. Research scientists can analyse the genome of crop plants and livestock. Simply put, this means they try to find out in which position, which hereditary trait for which property is situated. When the correct gene is found, it can then be transferred into another organism, giving the latter properties which it did not have before. In this way, plants and animals can be bred that are more resistant to disease, are capable of more performance or produce new, or larger amounts of, raw materials.

Gene technology allows faster breeding with less risks

In traditional cross breeding all hereditary traits of the parents are re-mixed in the offspring, with properties distributed by chance. This makes conventional breeding an unreliable, as well as a lengthy, procedure. With precise transfer of genes, however, a desired new property can be added whilst all other properties are retained unaltered.

Gene technology not only allows properties to be transferred within a single species such as from one wheat sort to another. A trait from a completely different life form can also be transferred. This can, for instance, feature the anti-freeze gene in a cruciferous plant being transferred into a vine. Result: new vines can survive in areas of the world where, up until now, grapes have never been able to ripen. Breeding through gene technology is not only faster and more efficient, it can allow completely new breeding targets to be aimed for. All this does not in the least mean that classic breeding is redundant. Still available for this method is the immeasurably huge gene potential of all living organisms on the Earth.



Breeding targets can be achieved more quickly through gene technology.

Gene technology makes it easier to breed plants more resistant against disease and even against insects and nematodes.

* DNA = deoxyribonucleic acid

More protein for the world

Meat, eggs and dairy products contain protein: the most important building block of life. The aim of the livestock breeder is, therefore, to improve the health, longevity, fertility and the performance capability of our farm animals, so that a continually increasing share of mankind can afford balanced and healthy nutrition.

Humans, especially children and older people, require a protein-rich diet which must include dairy products and meat.

Some meat pots are not so full as others

The plentiful meals of the normal consumer in Germany consist of up to 30% animal products, whilst the meagre diet of a poor African from Burundi contains less than 3%. This is not only appallingly unfair; even worse is the fact that the development of children from such regions remains physically and mentally retarded compared with their well-fed opposite numbers in the north.

The demand rises

The consumption of animal products increases along with the rise in affluence. This is plain to see nowadays in countries where the economy is expanding. Other continents will soon be following this road. Up to the year 2020, the world demand for meat will have increased by 25 percent. Especially poultry, sheep and pig meat consumption will increase in this period - each by from 27 to 30 percent whilst demand for beef will rise by 17 percent.

The world demand for meat will increase 25 percent by 2020.

Humans depend on animal protein because it contains certain essential nutrients that cannot be metabolized through the consumption of vegetable material.

Agriculture must produce more in answer to this growing demand so that milk, meat and eggs are also affordable for those with poor incomes. The way to this target is through breeding improvements of the hereditary traits for milk and protein output and for animal health - as well as through welfare-oriented husbandry methods and optimum feeding.

Research with livestock also includes intensive study of hereditary traits through genome analysis. Researchers are preparing a gene map for cattle with the genes for health, fertility and milk production identified. Breeding target is the healthy, consistently-performing cow capable of producing a lot of protein over a long productive life.



Are farm animals our competitors for food?

Quite the opposite! Animals are important suppliers of nutrients. They process grass and hay into meat and milk. Their performance potential must be increased further through animal breeding because people in developing countries desire to eat animal-source food more often instead of surviving on rice or bread alone.

There's an oft-heard opinion which runs along the following lines: "We shouldn't be eating meat because we are thus squandering valuable calories which starving people desperately need".

Our farm animals process biomass unsuitable for human diets into valuable food for our consumption.



Primary calories and dietary calories

The line of argument appears to be logical and clear: in order to produce a kilogramme of meat, a chicken eats 2 kilogrammes of nutrient-rich feed, the pig 3 and the steer as much as from 6 to 9 kilogrammes. This means that we, with our daily dietary intake of 3,300 kilocalories are actually consuming many times this in vegetable primary calories. Are we and our livestock therefore direct competitors of starving peoples in the southern hemisphere?

This point of view is too one-sided: most of the material eaten by livestock is not suitable for the human diet. This applies especially to green feed from pastures and meadows, and hay and silage produced from grass and other forage crops. Animal feed can also comprise the many by-products from the food industry that are in this way usefully converted to meat or milk.

For many peoples, livestock represent the basis of existence

Ruminants cannot be ignored in any schemes towards securing enough food for the world. All nomad peoples exist with their cattle and sheep from the grazing of poor pastures. There isn't a better use for such infertile ground.

The opening quote of this passage has little real logic to it and cannot be used as a reason against meat consumption: doing without meat in our diet still doesn't mean more calories are available elsewhere. Giving is the way to help, not only doing without. Thus can our support for improved husbandry for livestock represent a useful aid to development.

In many developing countries, the inhabitants live through grazing their animals on land unsuitable for growing crops.

By doing without meat we are not helping people in other parts of the world. Instead, it is more helpful to encourage the welfare-oriented husbandry of consistently-performing and healthy livestock.



The count-down is on

This “new dimension” in food production will not be achieved by

conventional methods alone. It needs new strategies, new instruments. But in this way, the apparently unassailable wall of obstacles will be transformed into a challenge. Mankind which has managed, after all, to fly to the moon surely must have access to the technologies for feeding itself.

The world has never been faced with such a task - a task in comparison with which the flight to the moon fades into simple technical routine. It requires much more effort to achieve a world-wide balance between excess in affluence and the bitterest poverty. And once this task is overcome, no one will be able to say that it is was only “a small step”. There’s

a lot that has to be done before all countries can feed themselves. The new dimension demands a fundamental rethink in the interests of all; it needs new instruments and revised strategies. Only through working together will we succeed in bringing knowledge and material right on-target to the places where they are most urgently needed.

Poverty and hunger are complementary. In addition to the apparently unbreakable vicious circle of degrading living conditions in the Third World come disease, poor education and lack of employment. We have to start somewhere, and the most important point is, after all, having enough to eat.

The step by step development of the economy in the developing countries, and particularly that of agriculture, is the best way ahead. This creates jobs, purchasing power, demand, and gives the whole economy momentum and energy. Every country, every region - in fact, every single farming enterprise - will have to find its own way ahead, because nothing can be achieved by simply adopting our successful methods.

But in many parts of the world, agriculture can spring over entire phases of development and seek the short way to success. Helping towards such a course will be biotechnological developments, gene technology and integrated agriculture. Agricultural research also expects much from the great possibilities of communications technology. Taking all this into account makes it possible today for optimum cropping according to prevailing conditions to produce increased and, most importantly, dependable, harvests.

Technology transfer by the farmer

Progressive developments only help when translated into practice. Nowadays, the qualified farmer plans and controls production on his farm helped by the most modern technology, just like a pilot in his cockpit. This gives him more time to personally attend to livestock and crops.

Nowadays, a German farmer fills more than 100 hungry mouths and the total will be much higher in the future.

The profession of the future is farmer. Who else bears full responsibility for his own existence? Who else has the possibility of changing things in this world so sustainably for the better - provided that the infrastructure for this is also in place?

Progressive-thinker

Every single farmer on this planet will be fully challenged. Very little - apart from the tradition and task of sustaining food supplies - will remain in common between the farmer of the past and the agricultural business man of the future. The progressive-thinker is encouraged everywhere.

The basis for success in this profession will be a very comprehensive training in natural sciences and economics - as well as the application of highly developed technology. The committed younger generation in the industrial countries has shown the way ahead.

In order to achieve large harvest yields, the farmer no longer needs to work himself to exhaustion. The factors that raise productivity nowadays are high investment in technology, environmentally-friendly use of machinery and implements, cultivations according to local conditions, welfare-oriented livestock husbandry and skilled agricultural management. But all this is only possible when the farmer can conduct business under fair global trading conditions.

The end of existence farming

The change towards an improvement in the world means that a farmer, even those in the up-until-now deprived regions of the world, produces not only for his own family but also for many other hungry people. The developing countries will find their own way ahead. However, the target must be the same as in Germany. Today, a German farmer supplies more than 100 people with food - and this will be much more in future.

Nowadays, a German farmer fills more than 100 hungry mouths and the total will be much higher in the future.



The farmer with a future is an all-rounder that gets top results with production-technological, marketing and biological skills.

Hi-tech: the all-round helper

Modern satellite and communication technology enables surveillance of crop nutrition and health, growth development and other data such as ripeness. It can also set in motion corrective action when necessary. This is hi-tech, the all-round helper for the qualified farmer, already accepted practice in top performance regions.

Hi-tech has taken over a part of the management in agriculture with satellite, computer and communications technology opening the doors to a new era.

Satellites: the orbiting agricultural assistants

Nothing escapes their piercing gaze from space. This identifies every furrow and plant. Such geographical information systems allow individual management, according to soil potential, of separate areas within large fields. At the touch of a keyboard, the farmer can pull a particular piece of land right onto the computer screen in his office. Yield mapping helps him adjust fertiliser applications according to the precise needs of the different crop areas, and also to introduce optimum plant protection measures. Satellite-controlled land management improves efficiency through precision-control of each production stage. At the same time, environment protection remains the decisive criterium for this form of "technical farming".

Spies in the sky

Help is also available from aerial-photography which can interpret crop growth and nutrition-availability, water-supply, chlorophyll level, and ripeness stage too. Also possible is identification of crop disease outbreaks. "False colour" prints, achieved through the manipulation of different wavelengths while photographing, can give detailed information on crop condition and warning of any necessary action to be taken.

The Internet is also at the service of the farmer, offering a broad spectrum of information. This oft-referred-to "artificial intelligence" helps him to improve the performance of his farming business.

A decisive factor in the development of systems for separate management of field areas was the protection of the environment.



Geographical information systems identify crop condition and assist decisions on necessary treatments such as added fertiliser or plant protection measures.

All-round care for cattle

Animal husbandry aims for a high level of livestock performance. To achieve this, one requires healthy animals, looked after and housed according to welfare-oriented principles and also continually watched-over. Nowadays, the traditional “stockman’s eye” cannot watch over everything, so electronics are an important aid in livestock husbandry.

An animal cannot be regarded as merely food on the hoof or a supplier of hide or pelts. Cows cannot simply be looked upon as producers of milk, nor hens as only egg suppliers. Every animal is, first of all, a living creature that has needs and even, increasingly, rights, and requires to be treated according to welfare principles.

Top performance requires human input

Livestock can only bring highest performances when optimum living conditions are open to them. Animal protection is therefore not only a demand from society but also, and above all, in the interests of the livestock farmer.

Taking the example of the all-round care of cattle, it is clear that the farmer must be there for his animals on every day of the year, including all holidays - and also during the night if he has to help with births. This sort of schedule goes way over the work, free time and holidays conception which would be accepted as normal by an employee in any town.

Hi-tech helps Mankind and animals

It is therefore little wonder that engineers and scientists are always concerned with applying advanced technology in improving livestock husbandry and making the work involved easier. They have developed, for instance, automatic ventilation control for optimising the atmosphere in animal houses, and improved feeding technology. This has been advanced so far that every single cow can now be individually served with the ration it requires and then, when she feels the need, milked by robot.

The crux of management in such herds is performance recording, with accurate assimilation of milk yield and fat and protein content, as well as the milk's hygienic standard and the health of the animal. This data then forms the basis for herd management and breeding programmes. The information allows decisions to be made as to whether the offspring of the cows have the potential to further improve the average performance of a herd.

Considerable technological advances have been made in livestock farming: In welfare-oriented husbandry, in the optimising of in-house temperature/air supply and in the development of suitable feeding and milking technologies.



Animal protection is not only expected by society as a whole, it lies directly in the interests of the livestock farmer too.

Keeping up with the human race

Our crop plants and farm livestock form the basis for supplying the coming generations with enough food. The new techniques in biotechnology and gene technology offer us the possibilities of further improving this supply, of increasing production potential and helping the plants and animals to create their own resistance against disease and to produce well in new locations.

In our part of the world, many people have criticised the involvement of gene technology or other new technologies in food production.

Mixed-up world

For one who has to give out only a comparatively small portion of personal income for food and who is well-fed, the position of others can only be imagined with difficulty. In the affluent regions of this world food is seldom used to simply satisfy hunger nowadays. Instead, it is often enough a question of merely titillating the palate and of extravagant consumption.

The crux of securing enough nutrition for the world lies in the amount, quality and sustainability of food production world-wide.

The hard reality

The point of view of the well-fed on this planet is, however, not the only one that counts. Far away from us there are a hundred million human beings that cannot even find enough food for basic dietary requirements. Putting it more plainly, it is irresponsible and egoistic not even to take into consideration the desperation and fears of others in this world.

Many millions, for whom each day is a fight for mere survival, stand with empty food bowls right before our doors, however. And these people are increasing in numbers every day. It's in their interest that we should revise the entire production concept of breeding, cultivation, harvest and processing of crop plants and the breeding and husbandry of livestock. Wherever the newly-developed technologies offer

the chance for improvement of harvest quantity, quality and dependability, these people are determined to take full advantage.

Admittedly, there has to be careful consideration of the values of the new technologies at the beginning of such strategies, along with the realisation that the challenge facing us must be overcome.



In the developing countries millions of human beings are starving. They are waiting for us to show that we are competent to cope with our task.



Traditional and new methods must complement one another so that we can get near the goal. A single answer to all the problems is not possible. Only the intelligent utilisation of all accepted methods, as well as the new innovative ones, can create the driving force that will establish the basic right of food for all Mankind.

The whole is more than the sum of the parts

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