

PLANT & MEAT: PROTEIN IN HARMONY

By Henk Hoogenkamp

Part 2

No Self Reliance

Increasing meat consumption has manifested itself in China, losing its near self-sufficiency in soybeans. Chinese soybeans imports have steadily increased and now represent about 85 percent of consumption. Similarly, corn imports are now also at the beginning of the soy-trajectory as compared to the past when China was self-sufficient.

Chinese adult consumers took in about 1860 calories per day in 1971, rising to 2800 calories by 2011. In 2016, this number rose to about 3100 calories daily. For the same years, in 1971, the average Chinese consumer's animal protein intake was only 125 calories daily, increasing to almost 700 calories daily in 2011, which is expected to rise to 760 calories in 2018.

The Chinese consumption of plant foods has risen by approximately 30 percent since 1955, while meat and dairy consumption has increased by about 45 percent over the same period. It is clear that Chinese food consumption is being transformed rapidly into a typical American diet. Most likely, the conclusion is that the Chinese demand for meat and dairy will remain very strong in the years ahead.

Physically Growing

A country in rapid transition, such as China, is usually confronted with opposite medical observations. Improved nutrition has made Chinese people markedly taller on average since 2000, with women having grown more than men. The average height of fully-grown Chinese men increased

4mm to reach 167.1 cm while women grew by an average of 7mm to 155.8 cm.

These are significant growth numbers and mostly the result of increased intake of animal protein, such as meat and dairy. However, with more prosperity also come signs that China is shifting to typical Western chronic diseases. Smoking, excessive alcohol use, insufficient physical exercise, as well as high sodium and increased fat consumption are the main causes. About 30 percent of Chinese adults are overweight, and more than one in ten are obese, a number that is quickly reaching Western standards. In plain numbers, China has the largest number of obese people in the world: 46.2 million men and 49.4 million women (2018).

As Chinese citizens generate more disposable income allowing to buy more meat and processed foods, there still lingers a lack of nutritional education. Subsequently, relatively few Chinese know about the importance of a balanced diet and the importance of regular physical activity.

Sustainable Livestock Farming

There is no question that the sustainable production and consumption of animal-origin foods is the biggest environmental challenge. The Western world, spoiled with high levels of meat availability at relatively low prices, cannot point fingers at developing countries since they also increase consumption of these premium high-impact animal protein-based foods and meat products. After all, many developing countries have always been deprived of eating quality meat and enjoying dairy foods. With the economic standard

in developing countries improving, it is very likely that the consumption of animal origin foods will rise exponentially through to at least 2050. In fact, it is projected that the world's meat and dairy consumption will increase by at least 50 percent as compared to the 2018 numbers.

Needless to say that the sharp increase in demand for dairy and meat products has raised environmental and ecological concerns. The UN estimates that livestock production is



responsible for about 15 percent of global greenhouse emissions. It is clear that meat is a relatively ineffective source of protein, and it would be smarter to convert crops directly into food, instead of feeding and raising animals first. However, animals should be part of a sustainable and ecologically balanced agricultural infrastructure, since its products contribute to a nutritionally sound and good-tasting healthy diet.

Although food production accounts for about 8 percent of greenhouse gas emissions, in general terms, animal-based foods are responsible for more greenhouse gas emissions than plant-based foods. For example,

while beef accounts for only 4 percent of the weight of available food, it contributes 36 percent of the associated greenhouse gasses. Cattle -which has a long outgrow cycle- does not efficiently convert plant-based feed into muscle meat and milk. Growing feed often involves the use of fertilizers and other substances through energy-intensive processing methods.

Cows, in particular, are not very efficient at converting feed to muscle protein for human consumption. Only one of every 25 calories a cow ingests becomes edible beef: a very inefficient feed-to-yield ratio. Compared to other farmed and harvested animals like hogs, poultry and fish, beef produces

five times more heat-trapping gasses per calorie, takes 11 times more water for irrigation, and uses 28 times the land. Also, cows burp major amounts of methane, a greenhouse gas that is significantly more potent than carbon dioxide (Journal Proceedings of the National Academy of Sciences, July 21, 2014). Methane is the greenhouse gas most often associated with the depletion of the ozone layer.

Pork, poultry, dairy and eggs all have comparable environmental footprints. US government data calculate air and water emissions and how much water and land are used in the lifetime production of the harvested animals: beef, pork, poultry, dairy, and eggs. This calculation gives a rather accurate environmental cost profile of different meats and other types of animal proteins.

Water Diversions

Erratic weather patterns can quickly wreak havoc on harvest yields. It does not take much to create an imbalance when projected crop yields of wheat, corn, soy, rice and potatoes do not meet the needs of the world population. The pressure on resources is intensifying, not only due to soaring populations but also because of desertification, droughts, floods, land grabbing, and lack of GM progress.

Prolonged spells of drought, like those happening in California 2010-2015 -or Cape Town, South Africa in the beginning of 2018- ultimately require mandatory regulation to reduce water use. By denying irrigation water, farmers are forced to leave agricultural land unplanted. Farmers who don't have access to surface water may decide to increase the amount of water pumped from limited groundwater supplies, though this option can only go so far until dead zones start to occur. Limited fresh water supply



is a wake-up call and may require drastic action in order to curb water use for landscaping, lush lawns, golf courses, shower, car wash, industry, and food production. The pressure on food security is further compounded by the availability of suitable agricultural farmland, biofuels, climate change, clean energy, and manpower.

Precision Farming

It is estimated that the world's supply of vegetables and fruits falls 22 percent short of global nutritional needs, and the shortfall is expected to worsen. Massive indoor farms, such as hydroponically, or aquaponically-grown crops, to cultivate greens and some types of fruit might be the answer to the global nutrition gap as an alternative novel method to conventional farming. Indoor vertical farming, as developed by Plenty's botanists, presents a compelling solution to a series of connected problems like the scarcity of arable land, clean water shortages, and a farming population that is aging, as fewer young people are attracted to this industry. In addition, indoor farming systems can be set up close to the large mega-cities, so there is no need

for ultra-long transportation routes to get produce to the supermarket shelves. Shortening the length of the supply chain is a real advantage in freshness, taste and economics.

The Dutch have pioneered much of the indoor growing or greenhouse technologies and have created systems for lettuce and other leafy greens, as well as fruits that yield as much as 10 outdoor harvests and cut the need for chemicals by some 95 percent.

"Precision farming" is the answer to sustainable agriculture using fully automated and uniquely engineered drones, tractors and equipment to provide detailed readings on water content, soil condition, nutrient needs and growth progress of the individual plant. As an example: the use of chemical pesticides has almost been eliminated and the dependence on fresh water for crops reduced by a staggering 90 percent, compared to conventional outdoor farming. Climate-controlled farms managed by a new generation of computer savvy and visionary farmer entrepreneurs have propelled the Netherlands as a world authority on science driven plant pathology, which is able to deliver

massive amounts of nutritious, tasty and freshly-harvested fruits and vegetables.

Food Depression

The dynamic change of basic food prices cannot only stress economies all over the world but may also exacerbate hunger and spark political unrest in poorer countries. Food costs must be taken into perspective: The cost of growing food accounts for only 15 percent of the final consumer price. The balance goes to processing, packaging, marketing, transportation, and profit.

How much longer can political inaction continue, if even highly affluent countries like the US, Germany and the UK have millions of people living off food stamps and receiving emergency food supplies from food banks? Another 2 billion+ people will populate Earth by 2050. Every single day, 210,000 more mouths need to be fed. The challenges ahead to manage food security are immense and very complex.

Food and Land Waste

Food waste is an environmental, economic and ethical problem of huge proportion. It is difficult to comprehend that large parts of the globe still is suffering from food shortage, while in the affluent societies food often is considered an afterthought.

Consumers in the developed countries are by far the largest component that dumps food, even if it is still in good condition for consumption. Fruits and vegetables are the most wasted category, particularly within households, though it is true that lots of (imperfect) fruit and vegetables don't even get past the farm gate. Consumers need to be made aware that improving food management will not only benefit the environment, climate, and human health, but also reduce municipal waste in terms of



increased use of biodegradable and renewable packaging.

However, first and foremost, the mindset of consumers in developed countries should be reprogrammed in which unsold food products remain available for safe redistribution. For example, manufacturers and supermarkets now frequently donate food to local charity through organized programs.

US Government data estimate that nearly a third of food available for consumption in the US goes uneaten. Probably, similar numbers are true for many EU countries. Consumers don't understand the impact of food waste and most of them underestimate how much food is thrown away. Although consumers are now more attuned than ever to the purity of ingredients, organic, natural and locally grown, most consumers unfortunately don't care (yet) about the environmental impacts of food waste.

It is estimated that in affluent societies, food waste makes up more than 20 percent of what's in landfills, which is a significant source of methane gas as it rots (US Environmental Protection Agency/2015). Methane is a potent greenhouse gas that contributes to global warming. The wasted food accounts for about 2 percent of greenhouse gas emissions, not to mention huge freshwater losses, cropland and fertilizer inefficiencies (John Hopkins -Public Health, PLOS Journal). A possible future solution could be the development of technologies to convert methane in biodegradable plastic.

It is indeed true that a very large amount of food is wasted between harvest and consumption. Bad-harvest, poor storage, hoarding, political maneuverings, processing, the point of sale inefficiencies, and consumer waste are all guilty parameters as to why food does not reach actual consumption. It can, therefore, be

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stated that the greater the affluence of society, the higher the food waste. For example, on a worldwide basis, it is estimated that nearly 25 percent of bread and cereal products waste occurs in high-income countries. Of 263 million tons of meat produced globally (2017), more than 20 percent is lost or wasted, of which about 8 percent

on average in most regions happens during processing and distribution. (FAO, September 2017).

Seen from a different angle, American consumers waste food that equals roughly 30 percent of the average daily calories. This amounts to about 150.000 tons of food daily or some



430 grams per person each day. These staggering food waste numbers correspond with the use of 12 million hectares of total US cropland, and 15.9 trillion liters of irrigation water each year.

It seems that if consumers, who opt for a healthy diet by choosing more fruit and vegetables, are inclined to waste more food. Yet, these healthy fruit and vegetable diets typically use less cropland than lower-quality diets, though higher in irrigation water waste and higher use of pesticides.

Plant-based Solutions

A new approach is needed to determine how food is grown and shared, while assuring affordability and ecological sustainability. Apparently, one can still argue that the world is capable of growing sufficient food for future generations, and that inequality is not a matter of sufficient food but rather of shameful waste and unequal sharing.

Feeding valuable plant protein to animals with the objective of converting into animal protein - meat, milk and eggs - can be considered waste to a certain extent. To sustain healthy diets

for current and future generations, it is essential to capture the abundant nutritional value of plant protein ingredients -such as rice bran- that remains largely wasted.

All these variables make it imperative to put more emphasis on the use of plant protein ingredient solutions, such as to formulate sustainable and healthy foods like "plant meat" as well as hybrid meat products. The world can ill-afford to continue business as usual, knowing that about 83 million more people will live on Earth every single year with no decline in sight.

To conclude: plant-based nutrition is more sustainable with less greenhouse gas emissions, less use of clean water, selective elimination of animal sourcing, and increased land utilization. Slowly but surely, plant-based foods will achieve considerable consumer popularity and wellness status. No doubt, the protein paradigm will shift to increased plant protein formulated foods. Do not however, make the mistake of ruling out meat. Meat is not only a valuable source of high-quality protein but also a universal favorite across most societal cultures

and will continue to dominate meal solutions for many years to come.

Although meat and dairy consumption in developing countries will skyrocket, plant protein is the new normal. For the sake of health and eco-sustainability, the developed and affluent world has no other choice but to embrace these changes.

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