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By

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A New Concept: "Escaology" for Food Science Education

Summary

Japan is facing a food crisis involving issues of safety, quality, supply, and the general nutrition of the population; a major education campaign and food systems restructuring plan under the new concept of Escaology is proposed to bring this crisis back into balance.

Introduction

As indicated in a statement on the environment at a meeting at the Hokkaido Toyako Summit held in Japan from July 7th to 9th, 2008, there are three major environmental issues in the world; 1) global warming and the acidification of the oceans from rising concentrations of atmospheric carbon dioxide (1), 2) sustainable biofuel production, and 3) a global food crisis involving export regulations by food-producing countries. It is clear that science is indispensable in addressing these issues. As we solved the serious food crisis caused by rapid population increase during the 40 years from 1961 to 2002 by applying industrial and agricultural sciences, it is necessary to tackle the above issues by utilizing scientific knowledge and technologies based on sustainable science education.

Japan's Food Crisis

Recently, Japan has been hit by many food safety and false labeling scandals bringing into question the ethics of food producers/distributers and the role of the media who informs and reports on food and health issues. These events have been a wakeup call as to the fragility of Japan's food supply. The present food situation in Japan is unsustainable for the long term because: 1) the food self-sufficiency rate is low; in the fiscal year 2003 the

rate was 125% for the US and only 40% for Japan (39% in the fiscal year 2006); 2) the food miles value, a measurement of the energy costs of delivering food to a population (2) defined by Sustain in London, is about eight times higher in Japan than in the US; 3) the percent of arable land per capita is low. As noted by Dr. J. D. Watson:

> *Food production in Europe and the Unites States will come to be more expensive and less efficient than elsewhere in the world. Meanwhile, countries like China, which can ill afford to entertain illogical misgivings, will forge ahead. The Chinese attitude is entirely programmatic: With 23 % of the world population but only 7% of its arable land, China needs the increased yields and added nutritional value of GM (genetically modified) crops if it is to feed its populations (3).*

Applying the Dr. Watson's calculation to Japan with a population of approximately 130 million (2% of the world) the arable land area ratio is 0.7% of the world (see Table and Figure); the crisis factor in Japan is almost equal to that of China. Countries with a higher crisis factor are more responsible for threatening the stability of the world food supply. Inevitably, nearly 50% of vegetables in Japan are imported. In addition, Japan is dependant on the US for 75% of its soy beans, which are necessary for the production of many traditional Japanese foods such as *SOY SAUCE, TOFU, MISO* (soybean paste) and *NATTO* (fermented soybean with *Bacillus subtilis natto*). While the self-sufficiency rate of rice is almost 100%, that of wheat is only 10%. With any interruption of grain imports, there is the possibility of falling into a food crisis as indicated by the high crisis factor, if Japan does not consider genetically modified (GM) agriculture more seriously. Dr. Watson's statement seems especially appropriate when applied to food production and consumption in Japan. Taken together, it is obviously necessary to implement food science education program in Japan.

Proposal of New Concept

The above is only part of new and increasing problems with the food supply in Japan requiring the education of students, food professionals and consumers. These problems cannot be solved by applying fragments of existing concepts since they encompass

problems in many areas including politics, economics, energy use, international relationships, global ecology, and ethics/morality. In order to address the wide array of food related problems, education requires a scientific point of view. This is the major reason for proposing a new concept “Escaology” (“esca” meaning food in Latin), defined as “the study that proposes reasonable specific actions based on scientific, economic, psychological and ethical principles regarding all matters related to food." Through the study of Escaology, students/consumers will begin to understand how multiple factors must be considered in the discussion of food issues and policies.

Education program

The thrust of this paper is a proposal to establish comprehensive multidisciplinary food science education in both the public education system and within a university department, a “Division of Escaology.” In order to strengthen the weak link (5) between student’s/consumer’s interests and science education in Japan, education courses under the consolidated concept of Escaology are proposed to cover the following subjects/concepts:

1) Philosophy: A major area of study regarding Escaology is philosophy: the consideration and propagation of methods to provide safe, healthy and sufficient food for the people of Japan, in equilibrium with the production and consumption of foodstuffs throughout the world. Such consideration is based on scientific and ethical principals. Part of the study of philosophical Escaology will be educating the public concerning judicious choices for food consumption. Making proper food choices is a difficult task considering the seemingly endless amount of conflicting and unsubstantiated information the public receives. Providing accurate information to the public is essential so that proper food choices can be made. Students of Escaology will learn to consider the definitions, semantics and labeling of classes of foodstuffs. As an example, “natural” does not necessarily have to mean “healthful.” Precision in the semantics and definitions of classes of foods would do much to decrease public confusion. Herbs highlight this confusion. Historically, less common herbs present a particular problem in that they are natural but their effects are largely under-tested. In this unregulated environment, combining the human tendencies “if it is natural it is good” and “if a little is good, a lot is better” encourages the possibility of not only

consuming substances that could have unknown adverse effects, but also the potential for unintentional overdose of herbs that have a drug-like effect. Escaology would include this "psychological " aspect of food and as such investigate and publicly rate current popular beliefs about the efficacy of certain foods and their supposed effects, as well as assay current fears about new foods. This being done using scientific criteria is just one example of how a coordinated education effort would be beneficial.

2) Risk management: The Escaological approach to risk management should be performed on the understanding that the present food situation is not sustainable for the long term.

(i) Analysis technology --- The first step in establishing a safe and reliable food supply is to determine not only that it is not a threat to public health and safety, but also to ensure that food being purchased is of the quality that is expected. Students/consumers should learn current analytical technologies for agrochemicals, pathogenic bacteria etc. are involved in food safety. In addition, they should learn to use and apply analysis technology designed to test for the genetic and geographical authenticity.

(ii) Public health --- Students/consumers can learn that public health regarding food matters involves a variety of factors. For example, another serious issue affecting Japan is the increase of "unregulated health food." At present, there are two categories of *health food* on the market; one is food products regulated by the Ministry of Health, Labor and Welfare (MHLW), and the other is unregulated *health food* (4) which is intentionally not categorized by manufacturers as regulated *health food* because it cannot stand up to the rigors of regulation. The total market for *health food* in Japan is estimated to be about $21 billion, only one third of which accounts for the regulated health food. A large part of the remaining market is derived from unregulated health food some of which contains hazardous products. Although unregulated *health food* is not, by law, allowed to make health claims in their labeling, manufacturers/distributors lead the public to believe that these products are healthful through word of mouth, alluding to its effectiveness and safety because they are "naturally grown" products. Therefore, a supervisory organization and advisory staffs concerning food safety would be effective at the levels of import, manufacture, distribution, and retail. An effective way for this proposed organization to distribute information to food industry professionals and the public is the formation of a

web-based comprehensive information network.

3) Research and development: Research and development will be performed regarding the identification of functional components in food and in nutri-(epi)genomics to determine an individual's optimum food lifestyle. Education with respect to the meaning of this R&D, including up to date findings, should be clearly stated through the above mentioned network. Setting up a research laboratory in a single university department or non-profit organization will be expensive for this kind of education system, so an alliance management concept (6) will be employed to accelerate collaborative R&D. Internships with food safety analysis laboratories and industrial quality assurance laboratories will provide students with advanced training. One important factor of R&D activity will be to expand the understanding of genetically modified organisms (GMO) by identifying edible vaccines including transgenic rice (7). Through R&D, students will learn that GMO's have the potential to be a strong force in preventing food crises.

4) Manufacture: Students of Escaology will learn the about safe manufacturing procedures and standards including: Good Manufacturing Practice (GMP), Hazard Analysis and Critical Control Point (HACCP), the International Organization of Standardization (ISO), and the American Institute of Baking (AIB). Students will learn the software and hardware of these practices as well as quality control procedures, leading to the improvement of corporate social responsibility (CSR) instead of internal accusation. To establish the proper usage of agrochemicals and food additives throughout the food industry, necessity including the history of food additives should be explained for the consumer's as well as the manufacturer's benefit.

5) Globalization: The multiplicity of food issues including legislative complexity in Japan cannot be discussed without considering their interdependency on international markets. Regarding the global food crisis, food-producing countries such as China, Russia and Argentina no longer have sufficient surpluses and therefore will to export less. Increasing demand and decreasing international supply has caused dramatic increases in the prices of staple foods. In addition to feeding its own people, Japan has a social and ethical responsibility to not over-consume or waste food, thereby allowing more food resources to be allocated to the developing nations. Additionally, Japan, through the concept of

Escaology should use its technological resources to help alleviate the food crises in developing nations.

Because Japan's food issues are linked to the global food crisis, it is important for the international community of scientists to have knowledge of the unique circumstances in Japan. In conclusion, the concept of Escaology has the potential to unite the many disparate aspects involved in ensuring a safe and healthy food supply for not only Japan, but for the world. Creating an education program that embodies this multidisciplinary subject of study and integrating it into the existing education system is the next step along this path.

References

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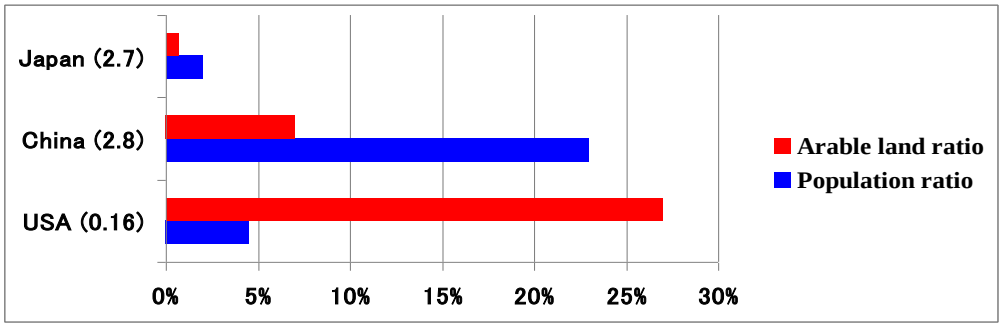
Table Population and world arable land ratios of countries on which Japan's food supply is largely dependent.

	Population in millions (population ratio)	Arable land multiplied by 10^{-5} km^2 (arable land ratio)	Crisis index (crisis factor)
World	6670 (100%)	670 (100%)	9.95 (1)
China	1300 (23%)	47 (7%)	27.7 (2.8)
USA	300 (4.5%)	183 (27%)	1.64 (0.16)
Japan	130 (2%)	4.8 (0.7%)	27.0 (2.7)

Numbers show 2006 data for population and those 2004 data for arable land in order to correlate with the number used by Watson (2). The crisis index is calculated from population (in millions) divided by arable land (in square km). Crisis factor is calculated with world crisis index = 1.

Diagram of relative ratios of arable land and population of Japan, China and the USA in relationship to the world



Ratios are shown in % of country/world. Numbers in parenthesis indicate the crisis factor calculated from the table.