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Opinion

A Geneticist's Perspective of "Non-GMO" and "Organic" Foods: A Lesson in Discrimination

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Opinion

A quick walk around your local grocery store with your labelling lens fully operational would bring some very surprising finds. The numbers of food items that have not only the "organic label" but also the label "NON-GMO" in large capital letters have been on the exponential increase in most free-market countries around the world. The types of products with the "organic" labels used to be limited to those in the produce section, however this has spread across almost every aisle with raw food or processed products with exorbitant prices. Curiously, this trend seems to have lately affected the "NON-GMO" labeled items as well, with even still, spring water being bottled and labelled as "Non-GMO". While the intent may not have been to mislead the public, this is the reality of these marketing strategies.

What does a non-GMO label mean? Supposedly the "non-GMO" product does not contain any genetically modified organisms (GMOs). The word GMO is a misnomer however, as "genetically engineered" or GE product would be best used to describe those developed from recombinant DNA techniques versus conventional or selection-based breeding practices. This is especially true since GMOs could be said to have begun production when the first animals and plants were domesticated, and therefore selectively bred out of the native phenotype about 10,000 years ago in Mesopotamia, with the advent of cultivation of plants and rearing animals for human use. Domesticating plants marked a major turning point for humans with wheat and goats being the first species being selected and bred. Agriculture therefore allowed for permanent settlements and established waterways to spawn large civilizations. Humans no longer had to wander to hunt animals and gather plants for their food supplies. The appearance of Agriculture historically, allowed fewer people to provide more food. The stability that came with regular, predictable food production led to increased population density and societal growth.

Advances in science and agriculture have included breeding and selection programs to create and mass-produce food products that grew exponentially, requiring chemical interventions and physical infrastructure to be able to meet demands. With this, as with most human interventions, came misuse and misappropriation within the agricultural and food production related industries. This has mistrust and consumer outrage as the drivers of policy and regulations versus sound, proven research with little "clap back" from the scientific community. The media has also been complaisant in the scaremongers' tactics with an almost sycophantic regurgitation of the latest soapbox tirade. This has created a movement to reject more recent advancements in the science of agriculture towards products that can prove their "organic-ness". This has also the boomerang effect of rejection of novel food products derived from genetic engineering, biotechnology or chemical intervention solely on hearsay. The size and complexity of organic trade has grown over time with many growers, processors, and handlers working in multi-business supply chains, often across borders to supply increasing worldwide demand. This translates to big bucks as the recent statistics according to USDA reports for 2017, the number of certified organic operations increased domestically by seven percent and globally by 11 percent. Industry estimates show that organic sales in the United States reached almost $47 billion in 2016, reflecting an increase of almost $3.7 billion since 2015 [1]. The global organic control system includes strict production standards; accreditation

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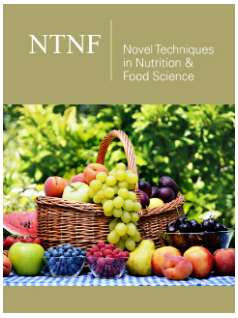

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of certifiers; certification of farmers, processors and handlers; and enforcement. Also, the application of "Organic" labels seems to be quite contrived dependent on the country of origin and "degree" of "organic-ness" which is arbitrarily decided upon by the certifying body or other parties. The cost attached to these labels are quite substantive as well, with producers, packagers and third-party distributors justifying a premium price and increasing market share by the certification costs of marketing these "premium" products, a billion-dollar industry.

The USDA organic regulations include organic system plan requirements, recordkeeping requirements, comprehensive process audits, and inspections that trace organic product from market to farm. The USDA National Organic Program claims the Organic Seal can only be used for products where organic and non-organic foods are kept separated, approved pest-control materials are used and no toxic/synthetic fertilizers, GMOs, antibiotics, synthetic growth hormones, artificial preservatives or flavors are utilized. The certified organic USDA seal has been applied to products from food, wine, cotton and even makeup. The USDA has even gone so far as to have different degrees of organic in their labelling strategy with products being labelled either "100% Organic", "Organic", "Made with Organic" or just simply "Organic Ingredients", the last of which are stated to "may even contain GMOs".

The British are also very active in the organic labelling market. The UK Department for Agriculture and Rural Affairs (DEFRA) states that: 'Organic food is the product of a farming system which avoids the use of man-made fertilizers, pesticides; growth regulators and livestock feed additives. Irradiation and the use of genetically modified organisms (GMOs) or products produced from or by GMOs are generally prohibited by organic legislation" [2]. In the UK there are 7 approved UK organic control bodies who must be used when labelling certified organic products, however the rules much vaguer and differs from certifier to certifier. In addition, many of the government links such as the "Organic farming: how to get certification and apply for funding" have not even been updated for more than three years. This is particularly interesting since the UK have led much of the early rage in the 1990's against the use of GMOs, stressing the importance of "heirloom" varieties of crops with an emphasis on organic production.

We can look at the US agricultural crop output to see the effects of consumer outrage and antagonism against GMOs driving decisions at the highest levels of government. There are examples of success stories for GMOs as corn, soybeans since its introduction in 1996, with exponential usage of GMO crops. Currently, over 90 percent of US corn, upland cotton, soybeans, canola, and sugar beets are produced using genetically engineered (GE) varieties. This has allowed for lower prices for consumers, higher productivity per land usage, reduction in their use of chemical insecticides and shift to less toxic herbicides to control weeds. However over 15% of wheat exports are sent from the U.S. to Europe and Japan, who have been the most resistant against GMO crops and derived products which has been the impetus to now embrace GMO wheat in the U.S. market despite fantastic biotechnologies with private companies developing GE wheat that are resistance to pests, disease, frost and drought. Golden rice that was supposed to alleviate poverty in India was put on a back burner due to negative press, inaction by policy makers and lack of visible support by local scientists.

There are over 32 links to fact sheets on organic products on the USDA website yet only a handful on other biosecurity issues some of which are real threats to consumers. When it comes to livestock in the U.S., the National Organic Program (NOP), part of USDA's Agricultural Marketing Service (AMS), develops and oversees the USDA organic standards, including standards for organic livestock production. Yet very few livestock-derived products suffer from the disparaging onslaught of negativity that plague industry and debase GMOs world-wide with the vehemence that seems to be reserved for GMOs in crop production.

There are very few GE products on the market, fewer than I can count on one hand, with transgenic salmon being the latest produced through introduction of a Growth hormone gene that does not change any aspect of the nutritional quality of its derived food products. The first GE product to enter into the market was rBST milk, produced since the late 1980's having over 40 years of research and product analysis, yet this recombinant growth hormone derived from the bovine genome has been vilified for generations, becoming a poster-child for anti-GMO policy worldwide. Would it then make more sense to label actual genetically engineered foods than doing the opposite? It would be much cheaper!

What is the advantage in "organic" and "non-GMO" labelling? Does it change the nutritional status of foods? Research says not really. Flavor/taste? Anecdotally, but taste tests have not shown any marked difference in either. In fact, there is a decrease in shelf-life and palatability in some products that are not enhanced either through recombinant-DNA or chemical additives. Yet, the regulatory bodies and industry food safety activists are advocating, supporting and actively soliciting funds from an already cash-strapped industry to justify labeling thousands of products as "non-GMO" or "organic" with little or no effect on consumer's quality of product. The producers and processors then must pass on costs to the consumers or in some cases will inflate pricing to claim "premium" product status. So, which are the true "Franken-foods"? One can argue, that by increasing the price point absorbed by the gullible consumer just with application of a label, with no change to the product, is false advertising.

Can we scientifically justify a monitoring, or a regulatory system based solely on the process by which new organisms are developed (i.e. recombinant DNA technology) rather than by their potential for harm to the consumer? Are the additional costs to the consumer justified? Is the reluctance to embrace new products with the potential to alleviate poverty, address food shortage from drought or flood or increase nutritional value and potentially arm us with the tools to feed our ever-expanding population justified? On today's world population counter, we stand at 7.7 billion people. Every day approximately another 200,000 are added. We need to encourage

biotechnologies, expand genetic engineering, use our technological ingenuity to provide food in an environment with decreasing water supplies, exponential population growth, increasing societies that are war-torn and plagued with famine. It is our responsibility as scientists to speak in truths, as loudly as possible and to object to erroneous policies against these biotechnologies, to end the discrimination against real solutions to our world's problems. Most importing nations, with little or no domestic production, would also support any technologies to access a better, cheaper food product. Policymakers must hear the truths, listen to the real science and act responsibly to attain food security for all.

References

1. USDA (2017) Organic Regulations. United state department of Agriculture.
2. DEFRA (2019) Department for Environment Food & Rural Affairs.