

› Ethics and horticulture

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Ethics refers to moral considerations on a human level. It includes standards of what is considered inherently “right or wrong” in terms of rights, obligations, and benefits to individuals and to society. Furthermore, ethical considerations involve the precepts of specific virtues such as honesty and fairness, and impose obligations on conduct, including the obligation to avoid harm to others and to abstain from misrepresentation or selectively using known information. The relevance of ethics in the context of horticulture (the growth, management, and use of plants such as fruits, vegetables, ornamentals, culinary spices, and medicinal plants) is explored across a number of subjects including employment, supply chain management, plant breeding and the release of improved cultivars, genetically modified organisms, invasive species, pesticide use, product claims, and the responsibilities of scientists. Two overriding guidelines are offered: “do no harm” and “do good” for producers, workers, consumers, and the environment.

Introduction

Ethics refers to moral considerations on a human level. It includes standards of what is considered inherently “right or wrong” in terms of rights, obligations, and benefits to individuals and to society. Furthermore, ethical considerations involve the precepts of specific virtues such as honesty and fairness, and impose obligations on conduct, including the obligation to avoid harm to others and to abstain from misrepresentation or selectively using known information. Most professional organizations, in medicine for example, have developed standards of ethics for their practitioners. What may not be widely known is that similar standards are imposed within the plant sciences as well. The object of this essay is to consider ethical standards for the activity we know as horticulture, i.e., the growth, management, and use of plants such as fruits, vegetables, ornamentals, culinary spices, and medicinal plants (Aitken et al., 2012). We offer two overriding guidelines: “do no harm” and “do good” for producers, workers, consumers, and the environment. We realize that many people are directly or indirectly involved with horticultural activities along the entire supply chain and we acknowledge that a balance must be maintained between conflicting and competing issues and beliefs. Many different elements comprise horticulture. They can be considered to be the components of a supply chain and it is these that we examine individually below. However, given the integration that occurs in the pathway from producer to consumer, the responsibilities at one level will *ipso facto* transfer to those at all other levels within that chain.

Producers

Since many horticultural activities involve growers of plants who are selling either a product or service as a means of livelihood, a fair return or profit is necessary for the efforts and investments that they expend. Ethical producers – whether single individuals or corporations – do not exploit workers and must respect and reward their contributions in a fair and equitable manner. Producers must certainly not exploit children and must avoid all forms of discrimination in the workforce. Too often, the margins of return available to producers, even in the developed world, are so small that workers employed in the production and processing sectors are usually paid only at, or even below, the minimum wage specified by society. Any exploitive employment practices that deviate from the norms expected by society should be regarded as being unethical, if not illegal (Wasley, 2011). Unfortunately, employment in many horticultural industries is now highly unattractive. Therefore, producers increasingly shift to labor-reducing methods such as mechanization and rely on migrant labor. In California, for example, all tomatoes for processing are machine harvested (Rasmussen, 1968; Huffman, 2010) and most fruits and vegetables that are hand harvested use migrant labor. Labor cost is a contentious and sensitive issue and whole industries have disappeared as a result of producers seeking to reduce expenses. One such example is the pineapple processing industry of Hawaii, once the major world producer. The industry moved to Southeast Asia where wage structures were lower (Bartholomew et al., 2012). In this case, Hawaii’s loss was The Philippines’ gain. Thus there is a paradox in these examples. Some have argued

that the use of mechanization, or the relocation of industries, are in their very actions unethical, as these changes have deprived those who were previously employed of an income and created major disruptions to local economies (Schmitz and Seckler, 1970). However, most societies expect technologies, such as mechanical harvesting, to be developed and progressed as a normal activity. Equally, the globalization of food production has resulted in monumental shifts in sources of supply as consumers expect year-round supply of affordable fruits, vegetables and ornamental plants. Consequently, movements of horticultural industries cannot be regarded as being unethical *per se*, unless it can be demonstrated that the shift in locations involves exploitative practices. Unfortunately this is often the case. We realize that this is a conundrum and the problem is certainly not unique to horticulture, but is a common issue when industries get globalized and become increasingly controlled by multinational corporations. Many such corporations have developed codes of behavior in order to demonstrate to consumers that they are behaving responsibly (see http://corporate.marksandspencer.com/documents/policy-documents/2_code-of-ethics.pdf; accessed 25 March 2015). The product, often but not always a food, must be assured to “produce no harm.” The product must be safe. This involves efforts to eliminate any contamination from poor sanitation, freedom from known and excessive harmful residues, both natural and chemical, and avoidance of misrepresentation of any kind. To ensure product safety, the producer and consumer need to be linked. Thus methods to preserve the chain of identity of products, including the marketplace, are to be applauded. Increasingly, producers around the world must conform to the use of good agricultural practices (GAP) where many of these issues of concern are addressed in a systematic way and can be subjected to close scrutiny through independent audits (FAO, 2003). Modern horticultural producers are themselves consumers of inputs required for the production of various fruits, vegetables and ornamentals. Access to germplasm (improved seeds and clones) is one such input that can lead to various ethical considerations. For example, newly bred elite cultivars of fruit trees in modern production systems can be legally protected for a limited period, usually about 20 years. For example, clonal plants in

the United States can be protected under Plant Patent Law. Seed-propagated plants are protected by Plant Variety Protection. In the European Union and other countries, Plant Breeder's Rights allow the breeder to recover a royalty through their unique intellectual contribution in developing that particular cultivar. During this period of protection, it is unethical to propagate plants or plant parts without paying royalties based either on tree number or, if the license requires, on the amount of product produced. To propagate such material without a license (i.e. without permission), or where production is subject to royalties, to grow the product without declaring the amount produced, is both an unethical and often illegal practice. In emerging economies where farmers are often poor, there is much controversy regarding plant variety rights but it should be noted that there is usually an exemption for farmer-saved seed. Nonetheless, commercial seed companies often protect their cultivars of many vegetables such as eggplant and onion by producing F_1 hybrids. In addition to providing hybrid vigor and uniformity, the off-spring do not grow true-to-type and thus the grower must continually purchase seed. Producers must make the decision to assess the return on the extra cost of the seed through the enhanced performance and uniformity of product. We do not consider the production of F_1 hybrids unethical since the producer can make a decision on whether or not to purchase such seed.

In some instances, the risks with a product are not always readily apparent. For example, producers in the nursery sector need to consider the production of potentially harmful products such as ornamental capsicum peppers. These pose a risk to children because of eye injury from the highly potent oils that are produced by the attractive fruits. Clearly, such products should not be sold if such risks can be identified and are serious, but balance is also needed. Roses, many cacti, and a number of other plants have thorns that can cause injury and others, such as cassava or peanut, contain toxin or allergens. In Europe, 5% of the population is allergic to apples! Most societies have regarded these as acceptable risks, and consequently, the production and sale of such plant material has not been regarded as unethical. In such examples, it is reasonable to expect that consumers will take the necessary measures to avoid any injury or harm.

Marketers

Those who market and handle horticultural products must strive to avoid misrepresenta-

tion including cultivar identity, source and origin of product, treatments imposed on the product, and sanitary handling. Unfortunately, except for apples, pears, and some ornamentals such as roses, most horticultural products on the market do not have cultivar labeling and this vital piece of identification is lost. Some marketers such as Driscoll Strawberry Associates, marketers of berry fruits, use a brand name to ensure and represent quality where the specific clone or cultivar that changes with the season, is not mentioned. We suggest that, in many cases, inclusion of cultivar names would be valuable both to consumers and to breeders as a means of discerning quality and avoiding unethical misrepresentation.

Modern breeding is highly sophisticated and expensive and the cultivars that emerge from such programs can be superior in terms of size, flavor, or appearance, as well as having improved traits such as disease resistance. Accordingly, they usually command a premium. Nonetheless, to a consumer, there is often little visual difference between an improved cultivar and a "standard" one, leading some producers and marketers to unethically misrepresent or obscure cultivar designation.

Farmers' markets in temperate urban areas, which often purport to be the champions of "grow local" campaigns, are frequently observed to unethically offer produce that is not locally grown and sometimes even include imported tropical fruits such as bananas and pineapples amongst their range of products. Consumers who purchase food at such local markets should know where the food that they are purchasing is produced. Many urban farmers' markets now have local rules that forbid the practice of selling food not produced by the seller. In many countries, imported food must be so labeled.

The issue of fresh product labeling is contentious but extremely important. For example, because of health concerns it is essential that all horticultural products need to be traceable back to the original producer. Failure to do this imposes a threat to all producers of that product. Disease outbreaks due to contamination from *Escherichia coli* or *Salmonella* soon become national news and quickly impose a tremendous threat to all producers of that specific crop (see http://en.wikipedia.org/wiki/2011_Germany_E_coli_O104:H4_outbreak; accessed 25 March 2015). Rapid isolation of the source of the problem becomes vital. To knowingly avoid the compulsion of such labeling requirements can be regarded as being unethical and, in many instances, illegal.

The treatment of fresh fruit and vegetables with ionizing radiation, such as gamma-rays (see http://www.epa.gov/radiation/sources/food_irrad.html; accessed 25 March 2015), is a controversial issue that has ethical implications. There is consumer resistance to such practices because of concerns of the chemical changes that might occur with such treatments. The fear that the foods could become radioactive is completely unwarranted. The practice is widely used in imported dried spices yet labeling is usually not required. The irradiation of fruits may be necessary because of import restrictions in certain countries that prohibit the presence of specific invasive insects such as spotted winged fruit fly (*Drosophila suzukii*), marmorated stink bug (*Halyomorpha halys*), and the Asian citrus psyllid (*Diaphorina citri*) that is responsible for spreading citrus yellows (Huanglongbing) caused by the bacterium (*Candidatus Liberibacter asiaticus*). Whether irradiation should be declared on the product is part of a wider issue of what is necessary or appropriate on food labeling and who decides on the detail that should be declared. There are many who would consider avoidance of labeling irradiated food as unethical, but the case can be made that if this practice is proven to be a safe and necessary practice, then labeling imposes an undue imposition on marketers.

Many consumers believe that organic products are completely pesticide free. However, production of many organic products can involve sprays with copper hydroxide, copper sulphate, and a number of other pesticides (usually "natural" products), yet there is no insistence that these products be so labeled. The labeling of genetically modified foods is equally contentious. This problem would be solved with the requirement that clonal genetically modified cultivars be identified (discussed further below).

The market chain has become a strong force in horticulture and, in many industries, the marketers have had a dominant voice in pricing and control over producers. As an example, one corporate marketer has arranged contracts where the producer of bedding plants is not paid until the item is sold in-store, thus eliminating the marketer's risk when the lack of sales may have been due to poor handling by the retail outlet. Such practice should be regarded as unethical since in-store management and not the producer has corrupted the product.

Processors

Many horticultural products are preserved or processed in various ways (canned, frozen,

dried) and many are only components of other processed products, such as composite fruit juices or sauces. Many processed horticulture products are extensively altered and “refined” such as in a number of tomato-based products. Processors have an ethical obligation to truthfully represent the treatments that have been imposed, and to precisely state the amount of each component that is in a processed product. This requirement falls within the jurisdiction of product labeling, which is fraught with controversy. Many consumer advocate organizations are demanding more complete information on the product label. Such requirements are strictly regulated in developed countries and are the responsibility of government supported food authorities (such as Food Standards Australia New Zealand, www.foodstandards.govt.nz/; accessed 25 March 2015 and the Food and Drug Administration (FDA) of the United States).

Labeling of processed food is a tremendously challenging issue that involves serious ethical considerations. In the United States, the FDA regulates food labeling and their guidelines are often followed worldwide (especially where producers and processors wish to export to the USA). What should be on labels of food products must balance two issues: the consumer’s right to know vs. the issue of where to draw the line on what information is essential. For example, although the FDA has taken the position that there is no evidence that genetically modified food is unsafe, labeling defining such modification is required. Consequently, the food processing industry and the biotechnology companies involved in producing these products are vehemently opposed to this requirement of labeling. Furthermore, many ordinary foods are involved indirectly through other steps in processing that might involve the use of genetically modified products. For example, practically all cheeses use a genetically engineered substitute for rennet. Labeling of processed products that contain genetically modified organisms has become an issue because many consumers have an unwarranted fear of such products. Almost all processed products in the United States contain small amounts of soybean or maize products, which in the United States are practically all genetically modified. This creates a special problem for the processing industry, which fears consumer boycott of their products if this fact is emphasized. However, despite the complexity of the problem and our agreement with the vast body of scientific research that has found no evidence of danger from transgenic food, we acknowledge that a great number of people feel that they have the right to know if a genetically

modified component is included in the product. Interestingly, it is neither illegal nor unethical to exclude such a provision in many instances given the inability to trace such components in the end-product or due to the very small amounts that may be present. This issue is solved in a number of countries by the production and marketing of a class of processed products using the designation as “GMO free” to satisfy those customers who demand this assurance. This is similar to products identified for vegans who require assurance that the processed product contains no meat products, or observant Jews, Moslems, or Hindus who want assurance that the processed product contains no ritually-unacceptable ingredients.

Processors should avoid health claims or insinuations that are misleading. This is an increasingly contentious area and the food industry is often perceived as misleading the public in their advertising campaigns. This issue extends to some sectors in the fresh fruit and vegetable industries that claim specific health benefits that are often unproven. Such health claims are prohibited under current food regulations, for example, in the European Union (see <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32006R1924>; accessed 25 March 2015). Companies like Zespri Ltd, the main kiwifruit marketing company in New Zealand, have invested heavily in defining many of the beneficial health characteristics of kiwifruit but are required to represent such information circumspectly (see <http://www.zespri.com/nutritious>; accessed 25 March 2015).

Many processors have been at best “creative” in extolling the benefits of some of their products and at worst misleading. For example, promoting some “health” drinks as a way for children to get their vegetables (without the “vegetably” taste!!) by promising two servings of vegetables based on the presence of small amounts of tomato and potato juice, is an example of a “creative” practice. Bakery products with pictures of blueberries that do not contain the actual fruit are simply fraudulent. Similarly, processed fruit and vegetable products with high additions of salt and refined sugars are considered to be unhealthy and their promotion as healthy foods on that basis is clearly unethical.

The environment and sustainability

In order for horticulture to be sustainable in the long term, there must be respect for the environment. In the early 20th century, the unrestricted use of arsenic damaged many soils, given the persistent nature of that element in the environment (Smith et

al., 1998). Currently, any excessive and persistent use of copper sprays in organic production is also dangerous to the environment (see http://www.epa.gov/oppsrrd1/REDS/factsheets/copper_red_fs.pdf; accessed 25 March 2015) and, consequently, their use must be very carefully managed. Application of pesticides or herbicides whose residues damage the soil or the air must be considered as being unethical practice. The use of products such as plastics or pesticides must also take into consideration their disposal as well as these long-term effects.

Exploitation of natural germplasm must be handled in a responsible manner. Wild species that have horticultural value, orchids for example, must not be extracted in a manner that causes extinction in the natural habitat. The ownership of such natural vegetation is a very controversial issue. Some would maintain that it is a right of national ownership similar to that for oil or minerals, while others suggest that the earth’s biological bounty is a heritage for all of humankind. The reality is that most of our present horticultural plants originate from other locations around the world. They are currently grown very widely, and often have been for millennia, without consideration being given to their place of origin. We suggest that access to genetic resources is a general right for humanity, and we agree with recent conventions that this germplasm should be a part of equitable international exchange and conservation (see Gepts (2004) for an overview of this topic; and <http://www.cbd.int/convention/text/> (accessed 25 March 2015) for the actual convention).

Intellectual property

Much of horticultural activity includes intellectual activity. Products and outcomes can now be protected by patents and royalties on fair use where these are demanded, but only for a limited time (Staub et al., 1996; Ryder, 2005). This concept is based on the premise that innovation must be encouraged. In exchange for the discovery or invention, the inventors or developers can profit from their discoveries by being granted a monopoly over a stated interval of time, usually 20 years, for the protection of a cultivar. The concept is that this will encourage future innovation. We concur that this concept has validity. This concept should work for utility patents, plant patents, and copyrights. In many cases, copyrights have been extended for excessive periods of time, while 20 years may be too brief for some plant patents because, as in tree fruits, it often takes 7 or 8 years for commercial development and for economic yields to be realized.

Plant breeding

The genetic improvement of plants would appear to be non-controversial since improved performance of plants has benefited humanity in terms of increased production of food, feed, fiber, and medicines for many decades. It can also lead, for example, to marked reductions in pesticide use through the selection of pest-resistant cultivars (Volk et al., 2013). However, plant breeders face serious ethical decisions in various areas including the acquisition and transfer of plant genetic resources, which are the raw materials for plant breeding, because the priorities and goals seem to favor international seed companies over producers. The use of biotechnology has been controversial, particularly in some parts of the world, and it is fair to say that this practice involves ethical considerations that have not been resolved to everyone's satisfaction (Fowler and Lower, 2005; Janick and Muresan, 2010; Dias and Ortiz, 2012). Currently, transgenic plants such as in soybean, maize, cotton, and canola are now planted in 28 countries worldwide on over 170 million hectares involving 17 million farmers (James, 2012). The production of genetically modified horticultural crops is minor by comparison. The best example in horticulture is the incorporation of transgenic virus resistance in two cultivars of papaya (Manshardt, 2012). Societies in the Americas, China, and Australia, have approved and accepted the production of these crops but they cannot be imported into most of Europe. This reveals the differences in acceptance across these major regions of the world.

An interesting dilemma is deciding the best method to improve the nutritional value of foods. This can be accomplished by gene technology solutions (Dwivedi et al., 2012), or in the case of many vegetable crops, by improving quality, flavor, appearance, and yield by conventional approaches that would reduce the cost of healthy foods and thereby increase consumption. Clearly, these two approaches are not mutually exclusive.

Healthful and harmful plants

While we admire and love many plants, particularly ornamentals and delicious fruits, we must not lose sight that many plants can have harmful effects on humans. The production, sales, and distribution of many injurious plant products have important ethical considerations. Thus, while a species of *Nicotiana* has been used as an ornamental, the harmful effects of smoking tobacco cannot be ignored. Similarly, the opium poppy, a species with valuable medicinal uses (morphine), is also a source of addictive opium

and heroin (Finetto, 2008). It is reasonable that the production and supply of products of plants such as coca (*Erythroxylum* spp.), opium poppy (*Papaver somniferum*), hemp (*Cannabis sativa*), and khat (*Catha edulis*) be regulated. Regulation of marijuana production has become an issue as the recreational use of this product has already become decriminalized in some states of the United States, while various medical effects have been claimed. At present, the production of cannabinoid-resistant hemp as a textile crop has been curtailed by this ban in the United States but not in Europe.

A number of plant introductions, especially landscape ornamentals, have turned out to be invasive and have become a serious danger to the environment in various locations. Thus, introduction of exotic plant species involves a serious ethical situation for the ornamentals industry (Niemi and Phillips, 2006). Kudzu vine (*Pueraria lobata*), introduced from Japan to the United States in 1876 as a potential forage crop and for erosion control, is a well-known example of an invasive species that became a serious noxious weed in the southern United States. Other examples include *Rosa multiflora*, Japanese barberry (*Berberis thunbergii*), and *Melaleuca* spp. in various regions of the United States, and cactus, which infested millions of hectares in Queensland and New South Wales, Australia, in the 1920s and still remains a problem.

Do plants have rights?

There are some who would suggest that plants as living creatures have rights that must be respected. At various times such practices as pruning, grafting, and micro-propagation have been felt by some to be unnatural and thus unethical. In our opinion, these claims are specious. Plants are non-sentient and granting them human feelings is anthropomorphic. However, we do consider that for the long term survival of humans, plant life must be protected in an environmental and conservation sense. The wanton destruction of plants, and particularly driving a species to extinction, is unethical.

Horticultural researchers and scientists

In many of the areas covered above, the matter of ethics within various sectors of the community involved with horticulture has been outlined and discussed. Almost without exception, each of the areas covered includes elements of scientific and technical research and the behavior and influence of individual scientists and communities of scholars. Horticultural scientists, working either individu-

ally or collectively, are subjected to formally promulgated ethical principles and regulations. In academia, there are important ethical guidelines (codes of ethics) for research, including the appropriate use of human and animal subjects, intellectual honesty, falsification of experiments and results, and especially plagiarism, the appropriation without attribution of another scholar's language, thoughts, and ideas in the preparation of publications. Plagiarism, however, can often be a complex and contentious area since all scientists appropriate and build on the ideas and language of others. Modern software packages are now frequently used in academia and by scientific journals to detect incidences of plagiarism in a range of outputs including students' assignments and scholarly contributions.

Scientific ethics typically originate within professional societies (see, for example, the statement by the Australian Society for Horticultural Science at <http://www.aushs.org.au>; accessed 25 March 2015), academic organizations, and government departments or ministries. Within universities and governmental organizations, staff members are often bound by formal ethical standards that recognize the expectations of society and the laws and regulations that exist within the country concerned. For example, Massey University in New Zealand, a country that currently does not allow the field release of genetically-modified organisms, does allow research on such organisms in containment; all such research is overseen by a Genetic Technology Committee that must approve all experiments before they are allowed to commence (see <http://www.massey.ac.nz/massey/research/research-ethics/genetic-technology/code-ethicalconduct.cfm>; accessed 25 March 2015). This committee is comprised of technical specialists, academics, and community representatives.

Conclusions

The many examples and controversies over ethical issues discussed above suggest that ethics is not an absolute concept but rather a balancing act of many points of view and issues. We concede that there are many different interpretations and many different sides of the many issues that divide the horticultural community and the solutions must be equitable to all as far as possible. It is not always clear as to what is "right" or what is "wrong" in areas that are highly complex, either because of the nature of the technology or because of the extent of a supply chain. The horticultural industry and the community of scholars together must strive to do what is right for the greater good,

with special attention to both ordinary workers and the consumers of products, to local, national, and international economies, and to both the local landscape and the world environment. Since we increasingly live in a global community, horticulture must strive to reach consensus and strive to develop more uniform definitions that make sense across national boundaries. However, our overriding concern still remains to “do good” and “do no harm.”

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