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Organic Agricultural Production in the United States: An Old Wheel Being Reinvented

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ABSTRACT

Organic production is not a new concept that has been developed in the United States during the last part of the 20th century as an alternative to conventional agriculture. It can better be described as a resurgence of old ideas that have been combined with modern technology. The problems faced by practitioners of organic agriculture are the same as those faced by practitioners of conventional agriculture, i.e., establishment, maintenance, and harvesting of a crop or animal enterprise. What is different between the systems is the methodology by which the goal is attained. The road to the present state of organic agriculture in the US began before European colonization; the concept was influenced by the Industrial Revolution, and organic agriculture was almost dismissed by changes in demographics and the upsurge of technology that was applied to agriculture after World War 2. Concerns about the effects conventional agriculture was having on the environment, and the perception that organic food is healthier, has increased demand for organic products. The opportunities for expansion of organic production are present, but the demand is outstripping supply. The future for research includes finding answers about how to: control pests, pathogens, and especially weeds; development of a better understanding of the interaction of soil, water, microorganisms, plants and nutrients; and reduce costs of organic production. Participants in these endeavors include the organic farmer and state and federal research and regulatory organizations.

Keywords: agriculture, conventional, organic, production
Abbreviations: ARS, Agricultural Research Service; **ERS,** Economic Research Service; **FAS**, Foreign Agricultural Service; **NOP**, National Organic Program; **USDA**, United States Department of Agriculture, **USEPA**, United States Environmental Protection Agency

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INTRODUCTION

To consider where organic agriculture in the US is headed it is necessary to look back on where it has been. J. I. Rodale coined the word "organic" in the US in 1940, and based his concept of agriculture on previous work by others in Europe and the US (ASAP 2006). To propose that organic agriculture, or the shorthand term organics, was a viable form of production in the US would, in the not too distant past, have elicited a response near to derision. The image of the practitioners of organics would have been those not in the mainstream of society.

When man settled in communities and began to farm the land forces were unleashed that changed the terrestrial ecosystem, and these effects are still being felt (Cavalli-Sforza and Cavalli-Sforza 1995; Smil 2000). As a result of human agriculture there has been a loss of soil organic carbon that can affect air and soil quality (Lal 2006a). Alternatives to commercial agriculture, including organic production methods, may be able to restore carbon levels in the soil (Lal 2004, 2006b).

Organics is not a new concept. It is as old as agriculture. The basic idea is to take what is available from nature and apply it to the production of food. The Industrial Revolution in the United States allowed for fewer hands to work the land. Conversely, the materials used to provide nutrition for crops were not different from when horse or oxen power provided the muscle to prepare the soil and maintain the crops.

A series of books, first published in 1928, contained the most up-to-date information at the time on agricultural production in the United States (Vick 1935). Much of what is cited in the books was the result of work done by the USDA, ARS. What was described then is very much like what is termed organics now. When printed, the population of the US was 120 million, with 30% living on farms and about 60% living in rural areas. Rural communities, and to some degree, urban centers as well, were isolated since the national road system was not as well developed as it is now. Production areas were either located near urban areas to provide food to city dwellers, or distributed throughout the remainder of country to serve local markets. The possibility of shipping fresh produce from, for example, California to a New York market without spoilage was virtually impossible.

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Invited Mini-Review

As agriculture advanced, use of organics lessened as the world adjusted to another revolution that occurred in conjunction with the mechanization that was an outcome of World War 2. In western countries, including the US, organic agriculture came to be considered to be "old-fashioned" and "antiquated". Along with mechanization and the increased use of petroleum-based fuels to power engines, the widespread use of synthetic chemicals also changed the concept of how farming was done as well as how life was lived day-to-day. Accompanying changes in methods of agricultural production was a move of people from rural areas to cities. The on-farm population in the US has steadily declined to about 2% of the total population. Agricultural production, even as farm population decreased, increased to levels where much of the world's food is produced within the boundaries of the US. A concept developed that modern agriculture could not be accomplished without the use of synthetic fertilizers and pesticides, and more recently without the use of genetically modified organisms.

While the metamorphosis from organic-based production to synthetic-based production was taking place, there was still a group of producers who had a different vision on how to produce the food, fiber, and fuel from agricultural products that are demanded by consumers. An underlying premise was that organic production had changed from a necessity based on the availability of materials to a philosophy of production. Organic and conventional producers have much the same values regarding stewardship and production (Sullivan *et al*. 1996). It was also reported that the methods of achieving the goals differ, and organic producers reported experiencing less psychological stress than practitioners of conventional production (Sullivan *et al*. 1996). The latter may be due to the necessity of dealing with problems as they arise in conventional production. Organic producers start with the philosophy of building toward an integrated production system where problems are expected, and the method of dealing with them is more long-term and holistic as opposed to prescription-based as in conventional agriculture. This attitude seems to be reflected in the factors reported to affect decision-making for organic producers that include: diversity, challenge, change, business-like approach, no formal agricultural education, love of the land, anti-"radical-environmentalist", and various obstacles (Duram 1999).

It is generally stated that the practice of commercial organic production began in the US in the 1930's. It is probably more accurate to state that there was a group of producers that continued with the type of agriculture that would have generally been practiced if the mechanization and synthetic chemical revolution had not taken place. These producers continued with a type of agriculture that developed into a mix of process and philosophy. As the 20th century neared the end, The Natural Resource Council (1989) presented a report that explained the benefits of alternative types of agriculture, but the report was not met with universal acceptance (Hileman 1990).

The misconceptions about organics during the late 20th century could be exemplified by a report of Williams and Wise (1997) that documented concepts that existed among a group of secondary education students and their teachers. For that group, the question might have been for the teachers: would it be better to learn more about what was accepted practice or would it be better to learn a different way of accomplishing objectives? This latter concept might be exemplified by the state of Washington that made available a manual on the methods of organic production (Taylor and Zenz 1999). A more wide-spread acceptance of organics is probably going to grow since major seed companies are providing organic seed, major retailers are providing organic products, and industry publications and newspapers are constantly running articles on organics.

HOW DO CONVENTIONAL AGRICULTURE AND ORGANICS DIFFER?

Organic production does not rely on "prescription intervention" to address problems, but rather on a holistic approach that integrates interactions between components of production (Kropff *et al*. 2001). The prevailing understanding is that conventional and organic production methods are on diametrically opposite ends of the spectrum of agriculture. The concept of conventional agriculture is that it relies on synthetic fertilizers and pesticides, with the emphasis on providing the plant with an immediate response if changes in nutrition are needed or if plants are under stress from abiotic and biotic sources. The concept of organics is to effect long-term changes in the soil which lead to a healthier plant that is better able to adjust to environmental change, or respond to stress without chemical enhancement. As the population of the planet edges toward 10 billion persons, it is necessary that the soil be managed so that sustainable production can be maintained (Lal 2006a). In the US all plant and animal operations in organics must conform to the NOP requirements (USDA, AMS 2000).

The NOP describes the processes and materials that can and can not be used. For instance, and these are not the only requirements, plant residue can not be burned, or a mold-board plow used to turn the soil. These are prohibited because burning volatilizes nutrients away from the soil, and a mold-board plow turns the soil in such a way that the soil equilibrium is drastically disturbed by the process. Organic production has been reported to be more energy efficient than conventional production, even if yields are sometimes higher under conventional production (Gristina *et al*. 1995). Costs in organics are considered to be higher than in conventional agriculture. A possible cure for the higher input costs in organic agriculture could be the production of biofuels which could be helpful to all types of agriculture. The use of alternative energy can be through the on-farm production of biofuels which may also be accomplished using organic methods. During a past period in the history of the US, farmers put aside a portion of the land to grow the grain necessary to feed the animals that provided the power to operate the equipment used to grow a crop. It might become the norm that a version of this activity is undertaken, and land will be set aside to grow the crops that can be converted to biofuels to power the engines necessary for modern agriculture.

The lines between organic and conventional production may be blurring. For example the use of over-wintering cover crops was, in the past, generally not practiced in conventional agriculture. However, use of various cover crops has come to be more accepted among conventional producers. Conversely, in organic production in parts of California, cover crops may not be used since growing seasons are longer, land costs are high, and the maturation of cover crops does not fit within the growing cycles and the crops being grown. As a result, land is left fallow for short periods between plantings of different crops. In both methods, rotations are used; they are required in organic production and commonly used in conventional production. One similarity that both production methods share is the possibility of contamination of food products. Reports of contaminated food that lead to disease have occurred in the US. Often the source of the outbreak may not be identified.

Acceptance of organic production begins with understanding the concept of organics. This appears to be becoming clearer to a larger number of people. Merrill (1983) described the derivation of the philosophy that underlies organics. Practitioners of organics contend that there should be an emphasis on an ecological approach to production agriculture in which the soil is an important component of the production system. The methodology of organic production rejects use of synthetic pesticides or fertilizers. It does include use of alternative materials for improvement of growing conditions and the quantity and quality of yield. This is a different direction than for conventional agriculture,

in which the use of chemicals is the norm before, during, and after the growing season. Practitioners of organics do not reject mechanization; they do not contend that all that is new is bad. Modern agriculture, at the levels that would continue to deliver products to consumers, can not be practiced without mechanization; there are not enough people in the US that want to work on a farm. Those who practice organics would likely agree that the engineering of today can be mixed with the production knowledge of the past. If materials used for organic production were able to be formulated, packaged, and delivered in a way that is familiar to conventional producers, then there might be a more ready acceptance by conventional producers.

The application of organics provides additional benefits to improving land, water and the community, and once established, organic farmers are less vulnerable to market fluctuations due to crop diversification (Cacek and Langner 1986). When 26 crop and animal systems in different countries dating to the 1930's were examined, organic production systems compared favorably in terms of economics and/or yield to conventional agriculture (Stanhill 1990). However, as the 20th century entered its last decade, there was no consensus as to whether organic agriculture was profitable (Crosson and Ostrov 1990). It needs to be ascertained if organic agriculture is comparable to conventional agriculture in terms of yield. This is determined by replicated agricultural research designed to provide information of direct value to growers and stakeholders. Many researchers consider that organic agriculture should be conducted in an explicitly organic setting (Lipson 1997; Sooby 2001, 2003; Yandoc *et al*. 2004). At this point in the on-going process, it may still be necessary to do research that compares organics to conventional production (Russo and Taylor 2006).

IMPACT OF ORGANICS

The demand for organic products in California was projected to be $500 million as the 20th century entered its last decade (Karst 1989). In 2000, the combined value of sales of organic fresh fruits and vegetables, nondairy beverages, breads and grains, packaged foods, and dairy products in the US was about $2.5 billion (Dimitri and Greene 2002). In 2006, the consensus estimate is that the value of organics in the US is closer to $15 billion.

Organic agriculture represents the fastest growing agricultural sector in the United States, with retail sales increasing at least 20% per year over the preceding decade (Dimitri and Green 2002). In 2005, there was certified organic land in all 50 states in the US (Dimitri and Oberholtzer 2006a). From 1997 to 2003 organic crop and pasture acreage increased 1.7- and 1.5-fold to 587,250 and 301,725 ha, respectively (Dimitri and Oberholtzer 2006b). The change in area under organic cultivation, and numbers of animals grown using organic practices, has increased dramatically over a relatively short time (**Table 1**). However, even with this increase in organic acreage, the demand for organic agricultural products has outgrown the ability of US producers to satisfy the need. No organization in the US government differentiates between trade in organic and non-organic products. In 2000, the potential value of selected imported products was $126 million (**Table 2**). It has been estimated that in 2005 the US exported organic products were valued between $125 to $250 million but imported organic products were valued between $1 and $1.5 billion (USDA, FAS, 2005). According to the NOP it is necessary that importing countries conform to US regulation if the term organic is used on the product. However, only 20% of US respondents felt that fresh produce grown outside of the US was as safe as that grown in the US (FAO 2006). To qualify to export organic products to the US foreign growers must meet the standards described by NOP, and must be inspected by USDA personnel, or personnel trained in the NOP specifications to make sure that is the case (USDA, ERS, 2007). Consumers in the US should have a high degree of confidence that foreign products entering the US organic market conform to US regulations. However, even as conventional products imported into the US are checked to determine if they conform to regulations regarding health and pesticide residues it will remain necessary that products coming into the US under an organic label be checked to make sure they conform to current or future US organic regulations.

Table 1 Changes in certified pasture/rangeland or cropland acres, or numbers of certified animals produced with organic practices in the US from 1992 to 2005. (Adapted from USDA, ERS, 2006)

Certified component	1992	2005	% change
Land type	(acres) [1]	(acres)	
Pasture/rangeland	532,050	2,331,158	438
Cropland	403,400	1,723,271	427
Total	935,450	4,054,429	
Animals	(number)	(number)	
Beef cows	6,796	36,113	531
Milk cows	2,265	87,082	3,845
Hogs and pigs	1,365	10,018	734
Sheep and lambs	1,221	4,471	366
Layer hens	43,981	2,415,056	5,491
Broilers	17,382	10,405,879	59,866
Turkeys	0	144,086	144,086
Total	73,010	13,104,710	

[1] to convert to metric (ha) multiply by 0.405

Table 2 Potential value of selected organic products imported into the US. (Adapted from FAO, 2004)

Product	Value (US$1,000's)
Vegetables	61,425
Fruit	35,484
Nuts	29,487

RESEARCH IN ORGANICS

In order to support organic producers, who are partners in innovation, it is necessary to have institutional agricultural research. For the research to be meaningful, it is necessary that researchers be in close contact with the recipients of the research, the producer. Also, it is necessary to determine if results of research done in one part of the country are relevant to results in other parts of the country.

Federal and State research institutions in the US are joining in cooperative agreements with non-governmental organizations and organic producers (Sooby 2001, 2003). One hundred and fifty-six US colleges and universities offer courses, programs or entire curricula devoted to sustainable and/or organic agriculture (USDA, ARS, NAL 2006). The USDA/ARS has programs whose mission can contribute to the advancement of knowledge of organic production. The USDA has 11 projects that have the terms "organic" and "production" in the title. These projects are located, in alphabetical order, in Beltsville, MD, Lane, OK, Salinas, CA, Wenatchee, WA, and Weslaco, TX. There are at least 60 scientists involved in aspects of organic agriculture at these and other locations within the USDA.

In-depth reviews of the role of USDA in organics have been presented by Bull (2006a, 2006b). Some salient points of those contributions follow. Organics have not always been embraced by the USDA (Lipson 1997; Duram and Larson 2001; Jawson and Bull 2002; Paar 2003; Bull 2006a). About 27 years ago, a white paper entitled "Report and Recommendations on Organic Farming" was developed by a USDA Study Team on Organic Farming (USDA 1980), and was a collaboration among federal and state agencies and stakeholders. However, even though the report was well received, the term organic was subsequently dropped from the USDA lexicon. As the 20th century was coming to a close, there was another move by stakeholders for ARS to conduct organic research. However, with the beginning of the new century there was still no officially recognized organic re-

search conducted by the USDA/ARS. In the ensuing years, interest in organic research at the USDA/ARS level has increased. Prior to being recognized as being organic, the research was likely called sustainable or alternative agriculture, but organic concepts were being tested in replicated trials in the greenhouse and field. There have been two meetings of ARS personnel designed to codify the place of organics in the ARS. The first occurred in 2005 as an USDA/ARS Workshop on Organic Agriculture. From that meeting, an action plan determined that a position in the USDA/ARS should be reestablished to coordinate organic agriculture research in the USDA/ARS. In 2006, ARS scientists and administrators again met with organic stakeholders. These meetings between researchers and industry will likely increase interactions between organic stakeholders and ARS personnel as US government involvement in organic agricultural research expands.

It is necessary to determine if organic agriculture is economically feasible so that potential producers will have bench marks on which to base decisions (Taylor *et al*. 2006). Economic analysis of organic production indicates that the transition period represents the greatest economic risk (Dabbert and Madden 1986; Russo and Taylor 2006). For those converting from conventional production, or if the soil can not be immediately certified as organic qualified, there is a mandated three-year transition period before the producer will be able to use the USDA organic logo on products. During this period, no synthetic materials can be employed in production, and other requirements of the NOP must be followed. Once organic certification is awarded, there are annual inspections, and deviation from NOP regulations can result in revocation of the USDA organic certification.

During the transition period, costs of production are higher, but increasing costs of synthetic materials could make cost of production under the organic and conventional systems comparable (Smolik and Dobbs 1991; Houghton 2006). Yields of crops during the transition period can be lower than those from conventional production (Sellen *et al*. 1995), but toward the end of the three year period can be as good as, or better than, yields from conventional agriculture (Russo and Taylor 2006). During this time, monetary returns to organic producers are not as high as levels that can be obtained in 'mature' organic systems (USDA 1980; Lockeretz *et al*. 1981; Liebhardt *et al*. 1989; MacRae *et al*. 1990; Temple *et al*. 1994; Russo and Taylor 2006). This response has been termed the 'transition effect' (Scow *et al*. 1994; Drinkwater *et al*. 1995; Martini *et al*. 2004).

The land used during the transition period may, or may not, be the best for production, and responses on this class of land may underestimate potential returns of production on better land. The response is not restricted to the agricultural functions of the equation. The people involved in transitioning to organic agriculture undergo a learning phase, and are variables in the process. Martini *et al*. (2004) asked whether increased yields are effects of better husbandry, or whether they are effects of continued learning. An understanding of the social and economic content of the learning process is required, and these should be included in the experimental approach (Rzewnicki *et al*. 1988; Holling 1997; Riley and Alexander 1997; Niggli 1999; Alrøe and Kristensen 2002; Drinkwater 2002; Dabbert 2006; du Puis 2006).

OBSTACLES TO ACCEPTANCE AND PRACTICE OF ORGANICS

Whether organics represents a doctrinal change in American agriculture is still not clear. There is always room for improvement in methods used in organic production. There are problems associated with agriculture beyond the day-to-day problems of planting, maintaining, protecting and harvesting a crop. Among the most persistent problem is labor. Farming is hard, dangerous, work in an enterprise that could culminate in total failure. This is true whether organic or conventional agriculture is practiced. The problem of mechanization has to some degree reduced the problem of labor, but it has contributed to making agriculture more dangerous and expensive. The activities on, and near, land undergoing organic production can affect the organic certification of the soil and the producer. A certification can be revoked if materials from adjacent conventional production land contaminate the organic land (Watson and Atkinson 2002). Differences in geography and climate can affect yields. Unique mixes of crops and practices must be developed for regions, and their applicability to other regions established. The availability of institutional organic certified land is still small, but is increasing. It is also necessary to conduct research on commercial organic farms (Lockeretz 1987; Rzewnicki *et al*. 1988; Vogl *et al*. 2004; Yandoc *et al*. 2004). There are problems associated with this type of activity, since priorities of the land owner change, and research that was important in the previous year may not seem as important in the current year. However, it is important, and necessary, to maintain these connections so that integrity of the research and the relevancy of the interaction is maintained (Duram and Larson 2001; Walz 2004).

In order to grow food and fiber in sufficient quantities, it is necessary that systems for economic and efficient production be developed. These systems are likely not able to be transferred without adjustment between all regions in the US. Region-specific systems need to be developed. Diverse strategies, which incorporate knowledge of the various components of systems for production and interactions among these components, are needed to support organic research.

Nutrition is a part of production that often overshadows other components. The use of animal manure is perceived as an important underpinning of organic production, and a substitute for synthetic fertilizer. The benefits from using manure are that nutrients are released over time, soil tilth is improved, and microorganisms are introduced into the soil, or numbers of microorganisms increase. The most economical use of animal manure is in areas where there is chicken, cow or swine production. The US has regions in which large areas of commercial animal production occur, and vast amounts of waste products are produced. However, even in those areas it is expensive to transport bulky manure over distances exceeding about 160 km. Although the animal waste represents a resource there needs to be research into ways to make the transport of the material more economical. The cost of transport of other energy resources, i.e., coal, oil, gasoline, occurs over long distances and is absorbed by the end user. It may become necessary for the cost of animal waste transport to become another cost of doing the business of agriculture.

It is necessary to determine application timing, rates, and effects of animal manure on various crops (Pang and Letey 2000). Application of chicken litter increased yields of cotton, pearl millet, wheat and canola, increased lodging in canola, and reduced yield and increased limb rot in peanut (Gascho *et al*. 2001). In addition, yearly application of chicken manure will raise phosphorus in the soil to prohibitive levels (Roberts *et al*. 1999a, 1999b, 2004). Levels of manure, including animal waste lagoon effluent (Kurunç 2004), timing of application, and incorporation methods need to be better understood.

Weeds are always considered to be among the most important problems confronted by organic producers (Rasmussen and Ascard 1995). Several strategies have been described to control weeds without the use of synthetic chemicals. These include: tillage, including tillage at night (Scopel *et al*. 1994; Clements *et al*. 1996), weed eating birds (Clark *et al*. 1995), non-synthetic herbicides (Liu *et al*. 1994; Bingaman and Christians 1995; McDade and Christians 2000; Tworkoski 2002), mulching (Crutchfield *et al*. 1985), use of allelopathic crops (Putnam *et al*. 1983), crop competition (Boydston and Hang 1995; Lyon and Baltensperger 1995), use of rotations (Teasdale *et al*. 2004), and flame cultivation (Seifert and Snipes 1996). Collateral results of flaming are effects on beneficial and pest insects. All of these practices

are generally non-specific methods of weed control and have to be used with care and generally before most annual crops are sown or transplanted. Physical removal with handheld implements remains an effective, but expensive method of weed control. Methods of more precise and selective weed control need to be developed.

The recycling of materials from on- and off-farm sources can also be used to improve soil condition and provide nutrients (Friend 2004; Loecke *et al*. 2004). Use of composting, as it is applied to the problem of waste stream management, will reduce pollution of water sources and reduce land from being used for landfills. Amounts and types of available compost will likely vary in different parts of the US. The amounts of compost, how often to apply compost, and the types of materials used for compost need to be determined for a wide range of crops and locations. Costs involved in production and delivery of compost to end-users likely need to be reduced to make the materials available, and economically accessible, to all producers. Biosolids, i.e., sewage sludge, is a controversial material that can also be used to amend soil. One concern is the heavy metal load that is associated with, and accumulated in, biosolids (USEPA 1992). In a production system for row crops Granato *et al*. (2004) determined that heavy metal accumulation in plants was below that estimated by the USEPA (1992). It remains to be determined if the USEPA estimates are applicable for various crops and various locations in the US.

It is necessary to determine how nutrition of organically produced foods compare to conventionally produced foods (Brandt and Mølgaard 2001). Some surveys consider organic foods to be more healthful and better tasting than those produced conventionally (Jolly *et al*. 1989; Bourn and Prescot 2002). However, there is a difference among public perceptions, taste and nutritional content of crops. Occasionally, reports will indicate that there are differences between chemical contents of organically and conventionally produced food (Magkos *et al*. 2003; Wszelaki *et al*. 2005). However, the majority of reports do not present definitive evidence for superiority of quality of organically or conventionally produced food. The question that should be asked is if it is necessary that organic foods be better than, or simply as good as, conventionally produced food?

HAS THE WHEEL BEEN REINVENTED?

Organic production in the US is generally considered to have grown at 20% per year for the last decade, and is found in all parts of the US (**Table 3**). The amount of crop and pastureland in the western part of the US almost equals the area in the rest of the US. Alaska and Hawaii should be considered separately due to differences in climate and distance from the US mainland. The amount of crop and pastureland in Alaska is greater than for the West Coast, and there is a relatively small amount of land under organic production in Hawaii. The numbers of animals grown on either coast with organic techniques almost equals the numbers of animals found in the interior of the country. No animals are grown with organic practices in Alaska and Hawaii.

Growers who choose organic production methods to produce the food and fiber needed by consumers still face challenges and opportunities. Organics is not yet used by the majority of producers in the US, and organic producers have had to justify the type of agriculture they practice. Conventional producers have to comply with rules, regulations, and laws in the practice of agriculture. Those in organics have to comply with these same rules, regulations and laws, and also with the NOP, an additional layer of laws that define and codify organic production at the federal level in the US. In addition, it is frequently asked if yields and/or quality of organic products are equal to conventional production; but should that question even be asked? If the assumption is that responses of consumers to organics are similar to conventional agriculture, is that reason enough to pursue a doctrinal change from conventional to organics? If consumer responses to organics are at least as good as conventional agriculture, then it should be determined if there are other benefits beyond yield and quality that can be realized by an expanded adoption of organics. Those benefits can include reductions in energy and amounts of petroleum-based products in the production of synthetic materials for use in agriculture, a lessening of pollution of water associated with runoff of some materials used in agriculture, the incorporation of waste stream materials through composting into products that can be used in production, the possible reduction in on-farm energy requirements, and an improvement of the condition of the soil. The last is of utmost importance since the major production areas of the world, including the US, are going to be called on to support the growing population of the world. Countries in which populations are increasing dramatically may not have the ability to support their populations and run the risk of degradation of the soil in an effort to feed their people (Lal 2006a).

The scope of the methods employed in the latest iteration of organics is different from the organic methods employed before the change to conventional agriculture in the US in the middle of the 20th century. The materials used in organics, or the packaging of familiar materials, may be different than those previously used. However, some materials, and the way they are used, would be immediately recognizable to those who would have been conventional producers in the early portion of the 20th century. The motivation of those involved in organics can be described as being the expression, in part, of a philosophy on how agriculture should be practiced. How much more acceptance there will be of organics in the US and the rate by which the conversion to organics will occur remains to be seen. How changes concerning organics in the US are coming about should receive additional scrutiny; are the changes being pushed by producers, or pulled by the consumers? If a starting point for organics is established in the US in the 1930's; there has been an on-going push from producers for acceptance of organics as the norm for agriculture for at least 75 years. That represents a long time to push. The time when acceptance of organics began is not easily established, but it is both recent and on-going. The time of pulling of acceptance by consumers across US society is certainly not as long as the push of producers. However, this pull that is affecting organics appears to be a result of a change of societal understanding of how the process of agriculture is undertaken. As a result of this interaction of push and pull, there seems to be a trend toward a fundamental change in the practice of agriculture in the US.

Table 3 Distribution of certified crop/pastureland and animals in regions of the US in 2005. (Adapted from USDA, ERS 2006)

Region	Total crop and pastureland (acres) [1]	Total animals (number)
Alaska	1,460,205	0
Hawaii	5,204	0
East	198,992	4,929,040
Midwest	480,680	2,250,889
Great Plains	775,030	2,491,888
West	1,134,198	4,085,408

[1] to convert to metric (ha) multiply by 0.405

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