M.S. Swaminathan
Chair
HLPE
07 Dec 2011

Dear Dr M.S. Swaminathan,

The International Federation of Organic Agricultural Movements (IFOAM) and the Latin American Scientific Society of Agroecology (SOCLA) wish to raise their concerns about the misuse of the principles of agroecology and the scientifically incorrect reference to the use of nitrogen in organic farming systems as stated in Appendix 1 of the document on Land Tenure and International Investment in Agriculture.

The use of agroecology in this appendix is not consistent with the use in the Price Volatility document and this contradiction and inconsistency erodes the scientific credibility of documents produced by the HLPE.

The agroecology definitions and the references to organic agriculture and nitrogen in Appendix 1 are not consistent with the science and published peer reviewed literature in these areas.

Firstly: on Agroecology

The majority of experts in this area agree that the key concepts of agroecology as both a science and a set of practices have been developed by agricultural scientists whose work have been published extensively in the peer reviewed literature and in the form of classical textbooks (i.e. Altieri, M.A. 1995. *Agroecology: the science of sustainable agriculture.* Boulder CO: Westview Press and Gliessman, S.R. 1998. *Agroecology: ecological process in sustainable agriculture*. Ann Arbor, MI: Ann Arbor Press.) where they have clearly defined and developed the concepts and practices of agroecology as followed today by hundreds of researchers and thousands of farmers around the world

The Agroecology Research Group at University of California, Santa Cruz states that the definition of agroecology is: *'The application of ecology to the design and management of sustainable agroecosystems. A whole-systems approach to agriculture and food systems development based on traditional knowledge, alternative agriculture, and local food system experiences. Linking ecology, culture, economics, and society to sustain agricultural production, healthy environments, and viable food and farming communities.' (*http://www.agroecology.org/)

The Laboratory of Agroecology at the University of California, Berkeley offers the following definition *'Agroecology is both a science and a set of practices. As a science, agroecology consists of the application of ecological science to the study, design and management of sustainable agroecosystems'* (Altieri 2002). *'This implies the diversification of farms in order to promote beneficial biological interactions and synergies among the components of the agroecosystem so that these may allow for the regeneration of soil fertility, and maintain productivity and crop protection'* (Altieri 2002). *'The core principles of agroecology include recycling nutrients and energy on the farm, rather than introducing external inputs; enhancing soil organic matter and soil biological activity; diversifying plant species and genetic resources in agroecosystems over time and space; integrating crops and livestock and optimizing interactions and productivity of the total farming system, rather than the yields of individual species'* (Gliessman 1998). *'Sustainability and resilience are achieved by enhancing diversity and complexity of farming systems via polycultures, rotations, agroforestry, use of native seeds and local breeds of livestock, encouraging natural enemies of pests, and using composts and* *green manure to enhance soil organic matter thus improving soil biological activity and water retention capacity'* (Altieri 2011).

These key fundamental concepts of agroecology are not articulated in the text of Appendix 1 of the document on Land Tenure and International Investment in Agriculture. Instead the text is a classic 101 on the basic agronomy of conventional farming that clearly does not follow the principles of diversity, synergy, efficiency and resiliency emphasized by the science agroecology. Agroecology does not support monoculture farming systems that are dependent on the main input systems that define industrial/conventional agriculture – synthetic fertilizers (including synthetic nitrogen fertilizers that are derived from the energy intensive Haber-Bosh process.), pesticides and genetically modified seeds. In fact a key idea of agroecology is to go beyond alternative farming practices and to develop agroecosystems with minimal dependence on high agrochemical and energy inputs. Agroecological systems differ in fundamental ways from industrial agriculture. Conventional agrosystems are highly dependent on petroleum whereas agroecologically based systems make effective use of local resources and ecosystem services provided by biodiversity nurtured by diversified farming systems. Industrial/conventional agriculture use fertilizers for crop nutrition (to feed the plants) versus plant- and animal-derived organic matter used in agroecology to feed the soil (Altieri 2011).

Therefore the statements published in the peer reviewed literature clearly contradict the arguments put forward in Appendix 1 which constitute a grave misuse and misinterpretation of the scientific principles of agroecology.

Secondly: The application of synthetic nitrogen and organic agriculture in Appendix 1

This statement is not correct and disregards the peer reviewed science on good practice organic production systems.

Organic farming is not a system of neglect. It negates the need for synthetic pesticides and fertilizers by improving soil fertility and activation soil biology by using composts, natural minerals, cover crops and by recycling organic materials. Cultural and ecological management systems are used as the primary methods to prevent rather than control insect pests, weeds and diseases, with a limited use of biocides of mineral, plant or biological origin as the tools of last resort.

Organic production systems have numerous methods to ensure that adequate bioactive nitrogen is available for optimum crop growth. These include green manures, composts, legumes and free living nitrogen fixing organisms such as azobacters and cyanobacterias. Using these methods obviates the need for synthetic nitrogen fertilizers produced by the Haber–Bosch process which cause emissions of nitrous oxides, eutrophication of major water bodies and contaminate aquifers.

Badgley and colleagues demonstrated that there are more than enough organic sources of nitrogen to grow enough food to feed the world (Badgley et al 2007).

Published studies in Africa show that the application of good practice organic methods including elements of traditional farming systems can result in significant increases. The report by the United National Conference on Trade and Development (UNCTAD) and the United Nations Environment Programme (UNEP) found that organic agriculture increases yields in Africa*. '…the average crop yield was … 116 per cent increase for all analyzed African projects and 128 per cent increase for the projects in East Africa.'*

'The evidence presented in this study supports the argument that organic agriculture can be more conducive to food security in Africa than most conventional production systems, and that it is more likely to be sustainable in the long term.' Supachai Panitchpakdi, Secretary general of UNCTAD and Achim Steiner, Executive Director of UNEP stated (Unep-Unctad 2008).

The majority of African farmers (many of them are women) are smallholders, with two-thirds of all farms below 2 hectares and 90% of farms below 10 hectares. Most small farmers practice "low-resource" agriculture which is based primarily on the use of local resources, but which may make modest use of external inputs. Low-resource agriculture produces the majority of grains, almost all root, tuber and plantain crops, and the majority of legumes. Most basic food crops are grown by small farmers with virtually no or little use of fertilizers and improved seed.

The advantages of these organic systems over those dependent on synthetic nitrogen fertilizers are that they are low cost and readily available from numerous local sources, whereas synthetic nitrogen fertilizers are high cost and usually have to be imported, increasing their cost and making farmers dependent on external inputs.

Furthermore peer reviewed research shows that these natural nitrogen sources do not pollute the atmosphere with greenhouse gases or water sources with excess nitrates. Research studies from North America and Europe show that organic systems are more efficient in using nitrogen than conventional farming systems. Significantly, because of this efficiency, very little nitrogen leaves the farms as greenhouse gases or as nitrate that pollutes aquatic systems (Drinkwater et al 1998, Mader et al 2002).

Peer reviewed scientific literature on organic systems show that the emphasis on recycling organic residues to build up soil organic matter allows for increased infiltration and storage of rainfall, increasing the resilience of farms to both droughts and heavy rainfall events. Research shows that organic systems use water more efficiently due to better soil structure and higher levels of humus (Lotter 2003, Pimentel 2005). *'Soil water held in the crop root zone was measured and shown to be consistently higher by a statistically significant margin in the organic plots than the conventional plots, due to the higher organic matter content in the organic treated soils'* (Lotter 2003).

'Data collected over the past 10 years of the FST [Farming Systems Trial at the Rodale Institute] experiment show that the MNR [organic manure system] and LEG [organic legume system] treatments improve the soils' water-holding capacity, infiltration rate and water capture efficiency. LEG maize soils averaged a 13% higher water content than CNV [conventional system] soils at the same crop stage, and 7% higher than CNV soils in soybean plots…'(Lotter 2003).

The open structure and tilth allows rain water to quickly penetrate the soil, resulting in less water loss from run off. *'The exceptional water capture capability of the organic treatments stood out during the torrential downpours during hurricane Floyd in September of 1999. The organic systems captured about twice as much water as the CNV* [conventional] *treatment during that two day event'* (Lotter 2003). Humus stores around 20 times it weight in water so that rain and irrigation water is not lost through leaching or evaporation (Handrek 1990, Stevenson 1998, Handrek and Black 2002). It is stored in the soil for later use by the plants.

One consistent piece of information coming from many studies is that organic agriculture performs better than conventional agriculture in adverse weather events, such as droughts (Drinkwater, L. E., Wagoner, P. & Sarrantonio, M. 1998, Welsh R. 1999, Lotter 2003, Pimentel 2005). This means that these systems are more resilient and provide the basis for the design for future agroecosystems to be deployed in an area of increasing climate extremes.

Peer reviewed studies show that synthetic nitrogen fertilizers are one of the major reasons for the decline in soil organic matter, which reduces the ability for the soil to capture and retain water and to store nutrients, leading to a greater dependency on irrigation water, poor drought resilience and a greater need for artificial fertilizers (Khan et al 2007, Mulvaney et al 2009).

One of the main reasons for the differences in soil carbon between organic and conventional systems is that the synthetic nitrogen fertilizers degrade soil carbon. Research shows a direct link between the application of synthetic nitrogenous fertilizers and the decline in soil carbon. According to La Salle and Hepperly, '*The application of soluble nitrogen fertilizers…stimulates more rapid and complete decay of organic matter, sending carbon into the atmosphere instead of retaining it in the soil as the organic systems do*' (La Salle and Hepperly 2008).

Scientists from the University of Illinois analyzed the results of a 50-year agricultural trial and found that synthetic nitrogen fertilizer resulted in all the carbon residues from the crop disappearing as well as an average loss of around 10,000 kg of soil carbon per hectare. This is around 36,700 kg of carbon dioxide per hectare on top of the many thousands of kilograms of crop residue that is converted into CO_2 every year (Khan et al 2007, Mulvaney et al 2009).

The researchers found that the higher the application of synthetic nitrogen fertilizer the greater the amount of soil carbon lost as CO_2. This is one of the major reasons why conventional agricultural systems have a decline in soil carbon while organic systems increase soil carbon.

The United Nations Millennium Assessment Report and other research on the environment found that loss of soil fertility is resulting in yield decline around the world. In fact major modern cropping systems have reached the point of diminishing returns. Farmers need to dramatically increase the amounts of synthetic fertilizers and pesticides to maintain yields and this is causing major environmental problems (MA Report 2005, Tilman et al 2001).

'Since 1960, flows of reactive nitrogen in terrestrial ecosystems have doubled, and flows of phosphorus have tripled. More than half of all the synthetic nitrogen fertilizer… ever used on the planet has been used since 1985.' Soluble fertilizers from conventional farming systems are causing the eutrophication of freshwater and coastal marine ecosystems and acidification of freshwater and terrestrial ecosystems. These are regularly creating harmful algal blooms and leading to the formation

of oxygen-depleted zones that kill animal and plant life. The dead zones in the Gulf of Mexico and parts of the Mediterranean are caused by this (MA Report 2005).

Scientists have shown that tropical and subtropical oceans are acutely vulnerable to nitrogen pollution stating that *'Our findings highlight the present and future vulnerability of these ecosystems to agricultural runoff'* (Bemani 2005).

In Australia this is already occurring in the Great Barrier Reef with the run off of nutrients from farms causing harm. This increase in nitrogen and phosphorous is causing algal growths that cover the corals, preventing them from accessing nutrients and sunlight for photosynthesis, causing deaths and declines. This is particularly true with the coastal fringing reefs. Nearly all of the coral fringing reefs that are adjacent to farming regions in Queensland died in the 20th century (Bell 1992, Bell 1995). As a result the government of Queensland has regulated to decrease amount of synthetic nitrogen that can be used in the farming areas adjacent to the Great Barrier Reef.

Farming in Europe is resulting in significant nitrogen contamination of water catchments (MA Report 2005). According the researchers *'Nitrogen contamination of ground and surface water in the Seine, Somme and Scheldt watersheds, as well as in the receiving coastal marine zones, results in severe ecological problems'* (Thieu et al 2010).

The researchers looked at a range of strategies in catchments off the Southern Bight of the North Sea to reduce N runoff based on several scenarios to improve Good Agricultural Practice (GAP). *'Previous modelling results showed that the implementation of classical management measures involving improvement of wastewater purification and "good agricultural practices" are not sufficient to obviate these problems'* (Thieu et al 2010).

GAP systems originated in Europe are designed to ensure that conventional agriculture does not damage the environment or cause health problems to people who consume its food. They are held up as examples of best practice even though they are labelled as 'good' practice.

Researchers in Europe have found that despite adopting better practices than those prescribed under GAP systems, the reductions in pollution were too small to make a significant change to the damage caused by nitrogen fertilizers. *'However, only an overall 14–23% reduction in N could be achieved at the outlet of the three basins, by combining improved wastewater treatment and land use with management measures aimed at regulating agricultural practices. Nonetheless, in spite of these efforts, N will still be exported in large excess with respect to the equilibrium defined by the Redfield ratios, even in the most optimistic hypothesis describing the long-term response of groundwater nitrate concentrations*' (Thieu et al 2009).

In a follow up study the researchers found that adopting organic management systems would significantly reduce the problems of aquatic eutrophication. *'It leads to a significant reduction of agricultural production that finally brings the three basins closer to autotrophy/heterotrophy equilibrium. Nitrate concentrations in most of the drainage network would drop below the threshold of 2.25 mg N/l in the most optimistic hypothesis. The excess of nitrogen over silica (with respect to the requirements of marine diatoms) delivered into the coastal zones would be decreased by a factor from 2 to 5, thus strongly reducing, but not entirely eliminating the potential for marine eutrophication'* (Thieu et al 2010).

These recent studies confirm the results of earlier research studies from North America and Europe showing that organic systems are more efficient in using nitrogen than conventional farming systems. Significantly, because of this efficiency, very little nitrogen leaves the farms as greenhouse gases or as nitrate that pollutes aquatic systems (Drinkwater et al 1998, Mader et al 2002).

The governments of Germany and France have encouraged conversion to organic farming to improve water quality, particularly in relation to its nitrogen and pesticide content (FAO 2000).

Synthetic Fertilisers and Climate Change

Synthetic chemical fertilizers are significant contributors to climate change in terms of the energy used to manufacture them and their contribution to nitrous oxide (N_2O) and methane (NH_4).

One of the most significant of the greenhouse gases emitted by agriculture is nitrous oxide (N_2O). One N_2O molecule is equivalent to 310 CO_2 molecules in its greenhouse effect in the atmosphere. It has a mean residence time in the atmosphere of 120-150 years and also contributes to the depletion of the Ozone Layer in the atmosphere.

The biggest contributor to human-produced (anthropogenic) N_2O pollution is the use of synthetic nitrogen fertilizers such as urea and ammonium nitrate in conventional agriculture. This does not include all the CO_2 and N_2O that is emitted in the production of these energy-intensive fertilizers.

Most governments do not factor the CO_2e emissions that result from the production of these synthetic fertilizers into the greenhouse gas levels caused by agriculture. These emissions are usually factored into the emissions of the manufacturing sector, even though the primary reason for manufacturing them is agriculture.

N_2O Causes More Damage to the Ozone Layer

N_2O is expected to become an even greater issue since a paper published in the journal Science reveals that the increasing levels of this gas causes more damage to the ozone layer than the more commonly known chlorofluorocarbons (CFCs). The researchers showed that nitrous oxide is the single most important ozone-depleting substance (Ravishankara 2009).

The Need for Clear Definitions

We ask that the HLPE resolve these inconsistencies in the use of agroecology by commissioning an authoritative paper that clearly defines the scientific principles and the practice of agro-ecology as applied to the design and management of farming systems. This is very important considering that the world agroecology is now appearing in numerous publications including those from the HLPE and FAO.

This paper should be informed by people with a long scientific trajectory on agroecology and that commands the major published peer reviewed literature, so that the definition and intent is consistent with the extensive body of agroecological literature.

This will ensure that there is clarity and consistency in meaning when the word agroecology is used in texts, rather than as a generic term to replace the much overused term of sustainable agriculture. A list of references that can be used for this purpose has been provided.

We would also ask that for the sake of clarity that other related terms need to be clearly defined so that they can be used accurately rather than as generic replacements for sustainable agriculture. An example of this is the term Ecological Agriculture. This term was put forward by Charles Waters, the editor of Acres USA in the 1980s and 90s. It has been used in a more generic way to describe sustainable agriculture systems that do not use synthetic pesticides and fertilizers.

Of particular importance to IFOAM is that HLPE corrects the inaccuracy about the use of nitrogen in organic systems. A list of references that can be used for this purpose has been provided. These credible published papers will help the HLPE to be adequately informed on this issue.

IFOAM and SOCLA believe that the HLPE should ensure that the information in its publications is correct to ensure that it is seen as a credible authority.

Yours Faithfully,

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Agroecology References

Altieri, M.A. 1995. Agroecology: the science of sustainable agriculture. Boulder CO: Westview Press.

Altieri, M.A. 1999. Applying agroecology to enhance productivity of peasant farming systems in Latin America. Environment, Development and Sustainability, 1, 197–217.

Altieri, M.A. 2002. Agroecology: the science of natural resource management for poor farmers in marginal environments. Agriculture, Ecosystems and Environment, 93, 1–24.

Altieri, M.A. 2004. Linking ecologists and traditional farmers in the search for sustainable agriculture. Frontiers in Ecology and the Environment, 2, 35–42.

Altieri, M.A. 2009. Agroecology, small farms and food sovereignty. Monthly Review, 61(3), 102–11.

Altieri, M.A. and Toledo,V.M. 2011. The agroecological revolution in Latin America: rescuing nature, ensuring food sovereignty and empowering peasants, Journal of Peasant Studies, 38: 567-612

Gliessman, S.R. 1998. Agroecology: ecological process in sustainable agriculture. Ann Arbor, MI: Ann Arbor Press.

Organic References

Badgley et al, (2007), Organic agriculture and the global food supply, Renewable Agriculture and Food Systems (2007), 22: 86-108 Cambridge University Press doi:10.1017/S1742170507001640.

Bell, P, 1992, Eutrophication and coral reefs: some examples in the Great Barrier Reef lagoon, Water Research, 26: 553-568.

Bell, P, Elmetri I, (1995) Ecological Indicators of Large-scale Eutrophication in the Great Barrier Reef Lagoon, Ambio (1995) Volume: 24, Issue: 4, Pages: 208-215.

Bemani J.M. et al, (2005), Agricultural runoff fuels large phytoplankton blooms in vulnerable areas of the ocean, Nature 434, 211 - 214 (10 March 2005); doi:10.1038/nature03370.

Drinkwater, L. E., Wagoner, P. & Sarrantonio, M. (1998), Legume-based cropping systems have reduced carbon and nitrogen losses. Nature 396, 262 - 265 (1998).

FAO (2000) Twenty Second FAO Regional Conference for Europe, Porto, Portugal, 24-28 July 2000 Agenda Item 10.1, Food Safety and Quality as Affected by Organic Farming.

Handrek, K. (1990), Organic Matter and Soils, CSIRO, Australia, 1979, reprinted 1990.

Handrek, K. and Black, N. (2002) Growing Media for Ornamental Plants and Turf, UNSW Press, Sydney 2002.

Khan, S. A., Mulvaney, R. L., Ellsworth, T. R., and Boast (2007), C. W. The Myth of Nitrogen Fertilization for Soil Carbon Sequestration. Journal of Environmental Quality. 2007 Oct 24; 36(6):1821-1832.

LaSalle, T. and Hepperly, P. (2008), Regenerative Organic Farming: A Solution to Global Warming, The Rodale Institute 611 Siegfriedale Road Kutztown, PA 19530-9320 USA.

Lotter, D.W., R. Seidel, and W. Liebhart. (2003). The performance of organic and conventional cropping systems in an extreme climate year. American Journal of Alternative Agriculture 18(3):146–154.

Mader, P., Fliessbach, A., Dubois, D., Gunst, L., Fried, P. and Niggli, U. 2002. Soil fertility and biodiversity in Organic Farming. Science 296, 1694-1697.

MA Report (2005), Millennium Ecosystem Assessment Synthesis Report, The United Nations Environment Programme March 2005.

Mulvaney R. L., Khan S. A. and Ellsworth T. R., (2009), Synthetic Nitrogen Fertilizers Deplete Soil Nitrogen: A Global Dilemma for Sustainable Cereal Production, Journal of Environmental Quality 38:2295-2314 (2009) DOI: 10.2134/jeq2008.0527, American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America 677 S. Segoe Rd., Madison, WI 53711 USA.

Pimentel D et al (2005), Environmental, Energetic and Economic Comparisons of Organic and Conventional Farming Systems, Bioscience (Vol. 55:7), July 2005.

Ravishankara, A. R.; Daniel, J. S.; Portmann, R. W. (2009). "Nitrous Oxide (N2O): The Dominant Ozone-Depleting Substance Emitted in the 21st Century". Science 326 (5949).

Stevenson J (1998), Humus Chemistry in Soil Chemistry p148 Wiley Pub. NY 1998.

Thieu V, Billen G, Garnier J, Benoıˆt Marc, (2010) Nitrogen cycling in a hypothetical scenario of generalised organic agriculture in the Seine, Somme and Scheldt watersheds. Reg Environ Change (2011) 11:359–370 DOI 10.1007/s10113-010-0142-4, Published online: August 2010 This article is published with open access at Springerlink.com

Thieu V, Billen G, Garnier J, (2009) Assessing the effect of nutrient mitigation measures in the watersheds of the Southern Bight of the North Sea, Science of the Total Environment, Published online: Jan 2010, This article is published with open access at Springerlink.com

Tilman D., Fargione F, Wolff B, D'Antonio C, Dobson A, Howarth R, Schindler D, Schlesinger W, Simberloff D, and Swackhamer D. (2001), Forecasting Agriculturally Driven Global Environmental Change, Science 13 April 2001 292: 281-284 [DOI: 10.1126/science.1057544]

Unep-Unctad (2008), Organic Agriculture and Food Security in Africa, Sept 2008. http://www.unep-unctad.org/cbtf/index.htm

Welsh R. (1999), Henry A. Wallace Institute, The Economics of Organic Grain and Soybean Production in the Midwestern United States, Policy Studies Report No. 13, May 1999.