

Sustainable farmer uses humanure to close loop between food production and sanitation

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LIBERTAD, Misamis Oriental—Can organic farmers address the issue of food security, sanitation, nutrition, the environment and others confronting modern humans? For a rural farmer in this 5th class municipality, 38.5 kilometers west of Cagayan de Oro City, the answer is a simple but resounding yes.

“We can positively address all these issues confronting us today through a system called ecological sanitation or EcoSan,” said Elmer Sayre, in-house adviser to the internationally-awarded and recognized Water, Agroforestry, Nutrition and Development (WAND) Foundation.

Sayre, a sustainable agriculture through organic farming advocate, uses humanure (human feces and urine) to do just that — fertilizes land to grow highly nutritious organic vegetables, improved sanitation and at the same time improve the quality of life of marginalized households.

He said that EcoSan provides a solution to such issues as food production and poor sanitation while helping curbed the spread of diseases, help solve water scarcity and improve biodiversity.

EcoSan, which “provides a hygienically safe, economical and closed-loop system to convert human wastes into nutrients to be returned to the soil,” effectively closes the loop between food production and sanitation because EcoSan practitioners see and use human wastes as resources and opportunities, Sayre said, as he explained that the three main objectives of EcoSan is to reduce health risks related to sanitation, prevent pollution of surface and ground water, and reuse the nutrients or energy in the wastes for food production.

WAND Foundation is now on the process of producing high-grade organic fertilizer from the “terra-preta” EcoSan toilets. The humanure is added to other compost

materials like goat dung, chicken manure and biochar, and biodegraded using lactic acid bacteria in order to produce high-grade organic fertilizer with a carbon nitrogen ratio in the vicinity of 30:1.

“The scientific basis for using urine and feces in agriculture is that urine contains nitrogen which is one of the major elements needed by plants. Feces contain phosphorus and much organic matter useful in improving soil properties,” he said.

He also pointed out that using humanure in agriculture helps protect the environment because farmers will no longer use commercial synthetic laboratory-made fertilizers that “take high fossil fuel energy to produce.”

“Our study with urine in vegetable gardens and feces application in coconut and fruit trees shows that yield is comparable to those fertilized with commercial fertilizer. Given the scarcity and high cost of commercial fertilizers nowadays, our idea will be a fresh take at an old problem of lack of sanitation coupled with low farm productivity, malnourishment, biodiversity loss and poverty among the bottom poor by using human excreta in small-scale agriculture and tree farming while at the same time solving the issue of lack of sanitation and groundwater contamination in poor rural and urban areas,” he stressed.

Improves Food Security:

Human excreta is rich in nitrogen, phosphorous and potassium (NPK)—key nutrients plant needs. Human urine contains 80 percent nitrogen and potassium and 67 percent phosphorus; while feces contain 80 percent carbon. Fecal matter is also rich in humus-building organic matter and could be used as a soil conditioner.

The average nutrient content in Philippine excreta is estimated at around 2.8 kg/person/year for nitrogen, 0.4 kg/person/year for phosphorus, and 1.2 kg/person/year for potassium, according to the Xavier University-published *Urine as Liquid Fertilizer in Agricultural Production in the Philippines, A Practical Field Guide* written by Robert Gensch, Analiza Miso and Gina Itchon. And the World Health Organization (WHO) said that each average adult person produces 500 liters (kgs.) of urine per year. Multiply that with 7 billion people and you get an ocean of urine. No wonder then that Sally Magnusson wrote in *Life of Pee* that “our urine footprint is just as indelible as our carbon one.”

According to The Ecologist, a member of the Guardian Environment Network, “fresh human urine is sterile and so free from bacteria. In fact it is so sterile that it can be drunk when fresh; it’s only when it is older than 24 hours that the urea turns into ammonia, which is what causes the ‘wee’ smell.”

Studies show that an adult’s urine contains enough nutrients to fertilize 50 to 100 percent of the crops needed to feed one adult. “And it’s very cheap. So cheap, in

fact, that we just throw it all away,” said Analiza Miso, director of Xavier University’s Sustainable Sanitation (XU-SUSAN) Center.

Urine is also a very quick-acting organic fertilizer, said William Repolo, communal garden manager at the Xavier EcoVille, the 5-hectare permanent relocation site of the survivors of Tropical Storm Washi (Sendong) in Barangay Lumbia, Cagayan de Oro City. XU-SUSAN is helping EcoVille residents the rudiments of organic agriculture using recycled humanure.

Repolo said that a farmer can immediately see result to his crops 3 days to one week after applying urine. This is fast-tracked if the soil is conditioned with feces, he added.

“Urine is a quick-acting fertilizer that can be used for any crops which require the macro-nutrients nitrogen, phosphorus and potassium. The fertilizing effects of these nutrients in urine are the same as those of artificial mineral fertilizer if the same calculated amount of nutrients is applied,” Sayre said.

In his farm in Initao, Misamis Oriental, Sayre’s average harvest of organic eggplant is 8.2 kilograms, comparable to the 8.4 kgs using synthetic fertilizer. For Chinese cabbage, his harvest using urine is 2.6 kgs compared to 2.8 kgs using synthetic fertilizer. For water spinach, its 2.7 kgs compared to 3.1 kgs. While for green mustard, he usually harvests 1.6 kgs compared to 2.2 kgs. “The results show increase in harvest as urine treatment is increased, proving that urine is an excellent fertilizer. Compared to synthetic fertilizer, the difference is small,” he said.

Using combination of urine and composted feces mixed with organic fertilizer on his rice paddy in Dipolog City, his harvest of organic *palay* is just .045 kgs. shy of his *palay* harvest using synthetic fertilizer. “Results show that rice responds well to urine and composted feces-mixed fertilizer. Even though harvest for rice using commercial fertilizer is higher, the difference is very small, providing us with evidence that human waste-based fertilizer is comparable in effect with synthetic fertilizer,” he added.

With data culled from his own farms, Sayre is confident that given proper support and funding, EcoSan practitioners like him will be able to help Agriculture Secretary Proceso Alcala’s dream of making the Philippines a major exporter of vegetables by 2016. “Yes, we can help in achieving this target primarily because supply of humanure is high; one needs only to process it,” he said.

Sayre said that using humanure is best for small farm settings because “small farm holders are at the heart of the battle against hunger and poverty.”

“To the extent that most food is locally produced and consumed, small farm holders are at the heart of the food security challenge. The majority of the extremely poor and about half of the undernourished people in the world live in a total of 500

million farms in developing countries (almost 90 percent of farms worldwide), each comprising less than two hectares of land,” according to the International Food Policy Research Institute.

The UN’s *World Economic and Social Survey 2011* said that “small farm holders dominate agriculture in developing countries. With small-scale farms likely to dominate the agricultural landscape in the foreseeable future, addressing the particular challenges they face is vital to combating poverty and hunger.”

Scholars believed that food insecurity is one of the threats that modern society must face especially since global population has grown exponentially. As of mid-2011, estimates put the world population at 7,021,836,029 and are expected to rise to 9.3 billion in 2050. Scholars also postulated that the world’s population will double in the next 50 years if the current growth rate of 1.3 percent continues. Food production, however, has continually declined. According to the Food and Agriculture Organization (FAO) of the United Nations (UN), per capita food production declined in 51 developing countries, while rising in only 43 between 1979 and 1987. And this is blamed mostly on global warming, urban sprawl, and land degradation—which is blamed on loss of topsoil from water erosion and fertility decline.

Chapter 3 of the UN’s *World Economic and Social Survey 2011* pointed out the need to increase food production between 70 and 100 percent by 2050 to feed a growing population. However, it said that “with current agricultural technology, practices and land-use patterns, this cannot be achieved without further contributing to greenhouse gas emissions, water pollution and land degradation. The consequent environmental damage will undermine food productivity growth.” What is needed to address food insecurity, the *Survey* said, is “a radical change in existing policies—a change that would result in a strengthening of currently fragmented systems of innovation and an increase in resources for agricultural development and sustainable resource management.” And recycling humanure for agricultural use, as espoused by EcoSan philosophy, is one of this “systems of innovation” and “sustainable resource management,” Sayre claimed.

“In using humanure, we bring back the fertility of the soil to produce highly nutritious organic food which can help combat hunger and malnutrition. Because this food is produced cheaply, it will help it mitigating food price volatility. At the same time, we help protect the environment,” he said.

Keeps Human Nutrient Cycle Intact:

For EcoSan practitioners, humanure is not waste at all but an organic resource material rich in soil nutrients. Humanure originated from the soil and must be returned to the soil after converting it to humus through composting to help fertilize the soil the natural way and thus help protect the environment.

Sayre said that the use of nutrient-rich humanure in food production has a high potential to provide a continuous fertilizer source that is freely and immediately available. It frees farmers from the shackles of expensive synthetic fertilizer manufacturers and has a considerable impact on the mitigation of poverty, malnutrition and food insecurity.

In the natural system, everything is recycled, thereby eliminating waste. One organism's excrement is another's food. Humans, however, create waste because humans ignore the natural systems upon which life depends. Yet, human's long-term survival requires that humans learn to live in harmony with the earth. This means human's must understand the natural cycles and eliminate waste altogether, including human excreta which most of the people on earth treat as waste.

EcoSan practitioners believed that recycling organic residues from crops must be returned to the soil for agricultural purposes. This is very fundamental for a truly sustainable agriculture, which EcoSan advocates. In this way, recycling humanure keeps the human nutrient cycle intact.

The human nutrient cycle is referred as (a) people grow food; (b) people eat it; (c) people collect and process the organic residues such as feces, urine, food scraps and agricultural materials; and (d) people then return the processed organic material back to the soil, thereby enriching the soil and enabling more food to be grown.

"This cycle can be repeated, endlessly. This is a process that mimics the cycles of nature and enhances our ability to survive on this planet. When our food refuse materials are instead discarded as waste, the natural human nutrient cycle is broken, creating problems such as pollution, loss of soil fertility and abuse of our water resources," according to *The Humanure Handbook, Chapter 2: Waste Not, Want Not*.

"The Human Nutrient Cycle is an endless natural cycle. In order to keep the cycle intact, food for humans must be grown on soil that is enriched by the continuous addition of organic materials recycled by humans, such as humanure, food scraps and agricultural residues. By respecting this cycle of nature, humans can maintain the fertility of their agricultural soils indefinitely, instead of depleting them of nutrients, as is common today," it added.

And this is the exact philosophy that Sayre and others like him espoused. He said that unlike other so-called sustainable agriculture systems, "EcoSan addresses sanitation issues in a sustainable manner by using dry or waterless toilets and recycling and reusing nutrients in human wastes (feces and urine) in a hygienic way rather than disposing them where they can contaminate groundwater aquifers, rivers and seas."

Addresses sanitation issues:

In 2009, after two years of field testing his EcoSan philosophy, Sayre founded the Water, Agroforestry, Nutrition and Development (WAND) Foundation, a local NGO that promotes social development through ecological sanitation. WAND also aims to close the gap in the country's Millennium Development Goals (MDGs), particularly in the proportion of the population using an improved sanitation facility. "EcoSan promotes the safe reuse of human urine and feces as fertilizer, a key feature in sustainable sanitation. If distributed widely and used adequately, it can greatly advance our efforts in trying to meet our MDG target for sanitation by 2015," he said.

For Sayre, the present sanitation systems based on the flush-pour toilet operate on the premise that human wastes are better off disposed. But it is not effective in areas where there is no water or where septage is difficult to build as in slums or flooded zones. "Try to imagine any village in the Philippines, or even an urban slum. One hundred percent you will soon find out that the disposal of human excreta is a major problem. For so long we are trained that the only toilet in the world is something that you can flush – one uses it, one pushes a button, or in most cases pours water from a pail, then that is it – your excreta is out of sight, out of mind! My problem with this scheme of things is that in any village or in any urban slums in the Philippines water is a growing issue. Or if not, space is an issue as in the case of urban slums or coastal villages where one's neighbor is just an *amakan* (bamboo slats) wall away and having a toilet is clearly a luxury," he stressed.

The United States Agency for International Development's (USAID) 2007 publication *Philippine Environmental Governance 2 Project, Septage Management in the Philippines: Current Practices and Lessons Learned* pointed out that "more than 90 percent of the sewage generated in the Philippines is not disposed or treated in an environmentally acceptable manner. The indiscriminate disposal of domestic wastewater is the main reason for degradation of water quality in urban areas, with negative impacts on health, the economy, and the environment." Department of Health (DOH) data also showed that approximately 18 people die each day from water-borne diseases, which accounted for 31 percent of all reported illnesses from 1996-2000.

Dan Lapid, president and executive director of the Center for Advanced Philippine Studies (CAPS) well as secretary general of the Philippine Ecosan Network (PEN), said: "There are more than 20 million Filipinos suffering the indignities and health hazards of not having access to proper sanitation."

UNICEF data showed that there are as many as 2.6 billion people on earth who have no access to safe and affordable sanitation while more than 1.2 million children under the age of five die of diarrhea each year. And contact with human feces is the main cause. "To address the needs of the 2.6 billion people who don't have access to safe sanitation, we not only must reinvent the toilet, we also must find safe, affordable and sustainable ways to capture, treat, and recycle human waste," said

Sylvia Mathews Burwell, president of the Global Development Program at the Bill & Melinda Gates Foundation, one of the world's leading institutional proponent of the EcoSan philosophy.

And for Sayre, EcoSan starts with urine diverting and dehydration toilets, which WAND Foundation tailor-made for its beneficiaries in the provinces of Misamis Oriental, Lanao del Norte, and Zamboanga del Norte.

“The use of human waste in agriculture via urine diverting and dehydration (UDD) toilets closes the loop between food production and sanitation. The advantages of ecological sanitation is that containing human waste prevent the spread of diseases, conserve water, minimize pollution and conserve valuable fertilizer for the plants, namely nitrogen and phosphate. It is a needed ingredient in improving small farming systems, improving livelihood and incomes and improving biodiversity. It is a new holistic paradigm in sanitation, which is based on an overall view of material flows as part of an ecologically and economically sustainable wastewater management system tailored to the needs of the users and to the respective local conditions. It does not favor a specific sanitation technology, but is rather a new philosophy in handling substances that have so far been seen simply as wastewater and water-carried waste for disposal,” he explained.

The use of humanure is so effective in addressing sanitation that XU-SUSAN Center has implemented it at the EcoVille, the permanent relocation site of the survivors of Tropical Storm Washi (Sendong). William Repolo, garden manager at EcoVille, said that they are applying humanure in the communal garden not only to help maintain healthy lifestyle of the residents but most importantly help maintain the sanitation of the 5-hectare community in Barangay Lumbia, Cagayan de Oro City.

Acceptability Issue:

Sayre narrated that when he first presented the idea of recycling human excreta for agricultural purposes, he was met with incredulous looks and reaction. Some of his friends even vehemently opposed him when he vouched the idea after learning EcoSan from Peter Wychodil, project officer of the German Doctors for Developing Countries in 2007, who showed him a piece of paper with some diagrams of a double vault urine diverting dehydration toilet (UDDT). He also said that while delivering a paper at a conference of water and sanitation in Kuala Lumpur in 2009, a lady from Indonesia insisted that the hormones in ones' feces will contaminate the food and kill people. “After my paper, she came to me to give me her address so that we can continue the debate in a long distance manner. “

Despite this, Sayre trudged on and pushed through his EcoSan philosophy especially since in his countless meetings with rural folks, he is not met with incredulity and negativism. “If we adopt it, how do we do it?,” were often the questions rural folks ask him at the end of his presentation of the benefits of ecological sanitation. He

learned later that for the poor there was no question of grossness in recycling humanure for agriculture because, without proper sanitation, the poor simply do not have any choice.

Since 2007, Sayre and WAND Foundation's "converts" to the EcoSan philosophy now number more than 3,000 people in 7 municipalities across three provinces in Mindanao—Misamis Oriental (the municipalities of Libertad, Initao and Manticao), Lanao del Norte (the municipality of Balo-i, and Barangay Bansarvil in the Municipality of Kapatagan, and Barangay Ma. Cristina in Iligan City), and Zamboanga del Norte (Municipality of Katipunan, and Barangays Barra and Sta. Isabel in Dipolog City).

"Social and cultural acceptability are high. Local beneficiaries were able to use, manage and take good care of the pilot units with no problem at all. All of the beneficiaries are poor farmers and fishermen. Most of the materials used in the designs of the EcoSan toilets were locally sourced such as bamboo, coconut palm fronds, wooden poles, gmelina wood and rattan baskets. Recycled drums, containers, black plastic sheets and heavy-duty Manila hemp sacks were sourced from a junk store in Cagayan de Oro. The special EcoSan bowl is produced by our local masons. The result is a much-reduced cost of an EcoSan toilet," he said.

In urban areas, however, Sayre depends on the success of the XU-SUSAN's EcoSan program at EcoVille because urban thinking and mindset still need to be finetuned to the EcoSan philosophy of recycling human excreta for food production. "Yes, acceptability is a major challenge in urban areas. But in order to overcome the stigma, one only has to practice it," he said.

In five years of practicing and propagating the EcoSan philosophy, Sayre was able to (a) prevent open defecation of poor families thereby reduced infestation of intestinal parasites and water/feces- borne diseases; (b) enabled rural households to have continuous supply of water by installing recycled drums for grey-water and rainwater harvesting; (c) enabled poor households to have their own vegetable garden that helped improved their nutrition and lessened malnutrition; (d) helped in small reforestation projects that helped improved the integrity of the watershed areas; (e) helped rural households increase their income from the sale of the organic vegetables; and (f) created functional clusters that are actively participating in the life of the community.

As proof of the effectiveness of his EcoSan initiatives, WAND Foundation was declared the National Development Marketplace winner in 2004 and 2005 given by the World Bank (WB). In 2006, WB also declared WAND Foundation a finalist in the International Development Marketplace Awards in Washington, D.C.

The Raanan Weitz International Competition on Integrated Development Projects of the Weitz Center for Development Studies in Rehovot, Israel also declared

WAND Foundation as winner in 2006 and 2011 in its international competition on integrated rural development.

The Ateneo de Manila University (ADMU) and the International Development Research Center declared WAND Foundation as winner in 2009 for its work on The Base of the Pyramid in Asia (iBoP-Asia). And in 2010, The Asia Foundation declared WAND Foundation a human rights winner for its land co-management initiative.

Last year (2011), the Bill and Melinda Gates Foundation declared WAND Foundation winner in its Grand Challenge on Global Health Grant for Sayre's research project "Ecological Sanitation for the Base of the Pyramid."

WAND Foundation was also one of the three Tech Awards winner from over 600 nominees worldwide in 2011 by The Tech Museum in California. Last year also, WAND Foundation was a finalist in the Asia Public Intellectual Competition of the Japan Foundation.

And this year (2012), the United Nations Convention to Combat Dessertification (UNCCD) has cited the WAND Foundation as finalist in its Land for Life Award.

"Today, we are on the brink of another 'sanitation revolution', in which we must broaden our horizons about the way we manage excreta in order to keep our cities running and to feed the world's population. In addition to maintaining a sanitary environment to live, sustainable sanitation systems will need to promote water, nutrient and energy reuse, as the shortage of finite resources becomes more apparent and the prices for water, fertiliser and energy continue to rise," wrote the authors in *Sustainable Sanitation in Cities*, published last year by the Sustainable Sanitation Alliance (SuSanA) and International Forum on Urbanism.

And for EcoSan and Sayre, recycling humanure for agricultural purposes is at the forefront of this so-called 'sanitation revolution.' (**Bong D. Fabe**)

Photos:



ECOSAN TOILET BOWLS. Elmer Sayre inspects EcoSan toilet bowls the WAND Foundation locally produced for their beneficiaries in the 7 municipalities across 3 provinces. *(Photos by BONG D. FABE)*



ECOSAN GARDEN. A mother, one of WAND Foundation's beneficiaries in Initao, Misamis Oriental, harvests vegetables from her organic vegetable garden fertilized by recycled humanure from her own EcoSan toilet. *(Photo by BONG D. FABE)*



ECOSAN GARDENING. Sendong survivors at the XU EcoVille in Barangay Lumbia, Cagayan de Oro City, tending to their EcoSan communal garden. *(Photo by BONG D. FABE)*



HEALTHY CHILDREN. Healthy children of some Sendong survivors at the XU EcoVille who were tending their small EcoSan vegetable garden when chanced upon immediately stood up and pose for my camera. *(Photo by BONG D. FABE)*



DESIGNER COMPOST. A WAND Foundation worker pours human urine into a compost heap materials of human feces, biochar, lacto-bacilli, sawdust, river sand and other organic matter from the foundation's farm in Libertad, Misamis Oriental to make a 'designer compost.' The biochar improves the carbon:nitrogen ratio and improves soil in general, the lacto-bacilli degrades humanure quickly, the sawdust improves the carbon ratio as well as traps urine, which improves the overall N-P-K level of the compost. *(Photo by BONG D. FABE)*



DEMO ECOSAN GARDEN. The 1,500 square-meter demo ecological sanitation 'garden' of WAND Foundation in Libertad, Misamis Oriental, that is fully-powered by humanure, taken from the EcoSan toilet seen in the background. The garden is 100 percent organic and the crops are mixed to minimize disease and pest infestation. Products from this garden supply WAND's small restaurant in Initao, Misamis Oriental. Surplus products are sold to neighbors and in the local market and the proceeds help in sending the foundation's working students to college. *(Photo by BONG D. FABE)*



"BLACK SOIL." Elmer Sayre (left) oversee WAND Foundation workers in loading *Terra Preta do Indio* (anthropogenic black soil) into a multicab. Black soil was used by ancient cultures to fertilize their land for agricultural purposes. WAND's black soil is made of humanure that was composted using lacto-bacilli, biochar, african night crawler (vermi worms), and other organic matters found in the farm. *(Photo by BONG D. FABE)*



YOUTH EMPOWERMENT. Elmer Sayre (in stripe shirt) discusses the importance of the UDD toilet in improving urban and rural sanitation and agricultural productivity, among others, to a group of young urban professionals who visited the WAND Foundation for a tree planting program. *(Photo by BONG D. FABE)*