International Animal Health News

A Publication of Christian Veterinary Mission

Autumn 2009 Volume 32, Issue 2

Inside this issue:

Improving Human and Animal Health by Restoring Fertility to Depleted Soils

compiled by Dr. D.E. Goodman, Editor

Over the past several years, increasing attention in both the press and publications of humanitarian, charitable, missionary, and governmental organizations is focusing on problems associated with rapid depletion of soil fertility. The problems are worsened by lack of restoration activity and lack of new homesteading land availability. These factors are ample reason for widespread concern among knowledgeable people, who feel that unless finding a solution to rapid depletion of soil fertility is given higher priority, the health consequences for people and their animals in developing areas will soon become very serious.

The world may be on the verge of a second Green Revolution, says Dr.Ratten Lal, an Ohio State University soil scientist. But while the original movement pulled people from the brink of starvation using genetics, he believes the success of the current movement will be rooted in careful management of Earth's natural resources.

Dr. Rattan Lal is an internationally recognized agronomist who has spent much time working in developing countries, and is a current researcher at the Ohio Agricultural and Research Center. According to him, seed germplasm to improve crop production will not be useful if soil, water, and climate aren't carefully managed and conserved. He states:

> This second green revolution has to be different than what was done in the 1960s. It must be resource-based, not seed-based. It means restoring degraded soils and conserving water resources, while providing seed genetics that support changes in climate. There are 5 billion acres of agricultural land worldwide that were once productive but are now degraded. It's important to save that land, as well as preserve the land that is still fertile. Modern technology can play an important role in that resource-based strategy but the implementation of resource management techniques and technological developments is a slow process, and whatever immediate solution is proposed for the global food crisis is just a band-aid. Improving soil quality and conserving water resources takes time. Any improvements implemented today take years for results. But they have the potential to solve our food deficit problem. Global leaders just need to recognize that new paradigm shift.
> *(Quote taken from Ag Answers, a publication of the Ohio State Extension Service and Purdue Extension Partnership, April 2008)*

Our extensive research led us to two major sources of the information for the series. In the first issue, we concentrated on the overall problem and the short term solutions. One basic method of replenishing fertility to depleted soils and reducing the loss of fertility is composting. Most of the information in the first issue came from ECHO (Ecumenical Council of Hunger Organizations) and was used with their permission. For a copy of the first issue, you may access it, and more past issues, on our website at www.cvmusa.org/IAHN.

In this second issue, our focus is on long term solutions, many of which are contained in the book Soils and Men, The 1938 Yearbook of Agriculture, published by the United States Department of Agriculture and ATTRA-National Sustainable Agriculture Information Service operated by the National Center for Appropriate Technology. The basic method identified here is the use of cover crops and green manures to replenish and reduce the loss of fertility to depleted soils.

AN OVERVIEW OF COVER CROPS AND GREEN MANURES

by Preston Sullivan
NCAT Agricultural Bulletin published 2003
ATTRA Publication #IP024

ABSTRACT

Cover crops could be considered the backbone of any annual cropping system that seeks to be sustainable. This publication summarizes the principal benefits of cover crops, summer green manures, living mulches, catch crops, and some forage crops. To impart a sense of the importance of these practices in sustainable farming, we summarized the effect of cover crops and green manures on organic matter and soil structure, nitrogen production, soil microbial activity, nutrient enhancement, rooting action, weed suppression and soil and water conservation. Issues addressed include vegetation management, limitations of cover crops, use of crop rotations, and use in pest management.

Principal Uses Of Cover Crops And Green Manures:
"Green manuring" involves the soil incorporation of any field or forage crop while green or soon after flowering, for the purpose of soil improvement. A cover crop is any crop grown to provide soil cover regardless of whether it is later incorporated. Cover crops and green manures can be annual, biennial, or perennial herbaceous plants grown in a pure or mixed stand during all or part of the year. In addition to providing ground cover and in the case of a legume, fixing nitrogen, they also help suppress weeds and reduce insect pests and diseases. When cover crops are planted to reduce nutrient leaching following a main crop, they are often called 'catch crops.'

Summer Green Manure Crop:
A summer green manure occupies the land for a portion of the summer growing season. These warm season cover crops can be used to fill a niche in crop rotations to improve the conditions of poor soils, or to prepare land for a perennial crop. Legumes such as cowpeas, soybeans, annual sweet clover, sesbania, guar, non-poisonous varieties of crotalaria, velvet beans, and others adapted to local conditions may be grown as summer green manure crops to add nitrogen along with organic matter to the soil.

Living Mulch:
Living mulch is a cover crop that is inter-planted with an annual or perennial cash crop. Living mulches suppress weeds, reduce soil erosion, enhance soil fertility and improve water filtration. Examples of living mulches in annual cropping systems include inter-planting legumes at the last cultivation, no till planting of vegetables, and annual ryegrass broadcast into vegetables. Living mulches in perennial cropping systems are the grasses or legumes planted in the alleyways between rows in orchards and vineyards.

[Editor's note: The editor grew up in a near semitropical area of the southeastern USA on a farm with small fields, relatively poor soils with limited topsoil and moderately heavy rainfall. It had been farmed continually for 150 years growing crops that were known to remove much of the nutrients from the soil. It was farmed under somewhat primitive conditions using most of the methods mentioned in this article and the results were very satisfactory. Edible legumes as peas and others were inter-planted between maize plants at the last cultivation and in the space between rows.]

Catch Crop:
A catch crop is a cover crop established after harvesting the main crop and is used primarily to reduce nutrient leaching from the soil. For example, planting cereal rye following corn harvest helps to scavenge residual nitrogen, thus reducing the possibility of groundwater contamination. In this instance, the rye catch crop also functions as a winter cover crop. Short-term cover crops that fill a niche within a crop rotation are also known as 'catch' crops.

Benefits Of Cover Crops And Green Manures:
A major benefit obtained from green manures is the addition of organic matter to the soil. During the breakdown of organic matter by microorganisms, compounds are formed that are resistant to decomposition – such as gums, waxes and resins. The compounds – and the mycelia, mucus and slime produced by the microorganisms - help bind together the soil particles as granules or aggregates. A well aggregated soil tills easily, is well aerated, and has a high water infiltration rate. Increased levels of organic matter also influence soil humus. Humus, the substance that results as the end product of the decay of plant and animal materials in the soil, provides a wide range of benefits to crop production.
(End of Abstract)

SOILS AND MEN, YEARBOOK OF AGRICULTURE 1938 *by the United States Department of Agriculture*

The Yearbook Of Agriculture 1938, compiled by a committee of the most broadly knowledgeable scientists in the land at the time and containing contributions by over 100 specialists with experience in research, teaching, and field experience, is by far the most comprehensive and useful treatise on the subject of restoring fertility to depleted soils. It covers each subject in depth, but basic and practical enough to be applicable to the small, subsistence farmers and their advisors. It discusses the problems of impaired soil fertility and suggested solutions for restoring and, in many cases, increasing the fertility beyond its original state.

The diversity in soil and weather conditions in the United States made compiling this book, undertaken in 1938 near the end of The Great Depression, an effort of major proportions. Developed over sixty years after the major western movement and homesteading stage in the United States' history, the book identifies agriculture practices and problems similar to those found in present day developing areas of the world. Earlier in the United States, little was known about preserving the soil fertility. Many of the same mistakes being made in developing areas of the world today had been experienced in the United States; consequently, most concerns about soil infertility are thoroughly addressed, including reasons and solutions for the problems.

The following excerpts are from the Yearbook of Agriculture 1938:

Some Relationships of Soil to Plant and Animal Nutrition, The Major Elements *by C. A. Brown*

The plant is the great intermediary by which certain elements of the rocks, after their conversion to soil, were assimilated and made available for the vital processes of man and animals. The simple inorganic constituents of the atmosphere and soil are selected and built up by the plant into protein, sugar, starch, fat, organic salts, and other substances of marvelous complexity. The substances thus synthesized by the plant are subsequently elaborated, with additional selections and removals of elementary components, by the vital processes of the animal and human body into flesh, blood, bones and other structural materials. To investigate the progressive steps of these changes of matter by plant and animal life and to make them conform so far as possible to man's special requirements are the chief aims of agricultural science.

Loss Of Soil Organic Matter And Its Restoration
by William A. Albrecht

Centuries before there was any science that acquainted people with the intricacies of plant nutrition, decaying organic matter in manure or other forms, was recognized as an effective agent in the nourishment of plants. The high productivity of most virgin soils has always been associated with their high content of organic matter, and the decrease in the supply of organic matter with cultivation has generally been followed by a corresponding decrease in productivity.

The decaying remains of plant generations resolved by bacterial wrecking crews into simpler varied nutrients for rebuilding into new generations must still be the most effective basis for crop production. Soil organic matter is one of our most important resources; its unwise exploitation has been devastating; and it must be given its proper rank in plans for increasing yields in the future. The stock of organic matter in the virgin soils was a heritage from an extensive past and continued long enough to ripen the residues into compounds that were ready to be used quickly by growing plants.

The loss of organic matter represents soil compaction which hampers the circulation of air and water and hinders tillage at the same time that that functions of the soil in plant nutrition is disturbed. This study showed that under ideal conditions, in a fairly short period of time, much of the organic matter representing many centuries of accumulation can be lost or destroyed and the efficiency of the soil for crop production greatly reduced.

[Editor's Note: The above mentioned study which covered 60 years was in an area with a moderate climate and rainfall. This would represent almost an ideal situation for slowing the rate of degeneration of soil organic matter under tillage. One would expect that the rate of degradation of organic matter would be much greater in tropical and semitropical areas. The point being emphasized here is that if the problem develops and continues under the best conditions, it must occur much more quickly in less than ideal conditions.]

The depletion of organic matter by cultivation is well known. A study was done in the U.S. in undisturbed virgin prairie soil compared to an adjoining field cropped to corn, wheat, and oats without addition of manure or fertilizer. No erosion had taken place, yet much of the organic matter represented by the virgin soil had been lost because of cultivation; consequently, the soil structure was modified greatly.

With the removal of water through furrows and ditches, and the aeration of the soil by cultivation, farmers increased the fires of acidification and preservation into a blaze of bacterial oxidation and more complete combustion. The combustion of the accumulated organic matter began to take place at a rate far greater than its annual accumulation. Along with the increased rate of destruction of the ancient supply, the removal of crops lessened the change for annual additions. The age old process was reversed and the supply of organic matter in the soil began to decrease instead of accumulating.

[Editor's Note: Long time friends and correspondents, Delano and Linda Meyer, are agricultural-humanitarian missionaries, working with projects in many countries in West Africa with LCMS World Mission. They have graciously shared their experiences in soil fertility below:]

Soil Fertility *by Delano and Linda Meyer*
Most agriculturalists feel that improved fallow using soil improving legumes is an important second step to improving soil and thus producing better crops. The first step is to stop burning off crop lands as a way to clear or prepare the field for planting.

Successes were reported in improved rice crops after not burning the old crop residue, grasses and weeds, but instead tilling this all into the soil. Burning swamp rice straw was stopped and the straw and weeds were incorporated into the soil with a hoe about a month before planting time. When the area began to grow weeds again, the soil was cultivated again with a hoe and then rice was planted. The good crop grew in an area that had not been producing good rice crops in the past. Farmers showed a willingness to work hard hoeing twice as opposed to burning once. They showed good judgment realizing the rice would not do well competing with already emerged weeds. That is why they hoed again giving the rice an excellent seed bed and greatly encouraging microbial decomposition which made nutrients from the decayed straw available for the new crop.

During discussions about better ways to improve soil, I had encouraged them to use methods called "improved fallow" which uses legumes to improve the soil instead of just abandoning a farm for 7-15 years and expecting the soil to regenerate by itself. Tropical legumes are a gift from God to hold soil from erosion and add important nutrients, including nitrogen, to the soil. They suppress other weeds and form a thick soft mat of vegetation that enhances microbial growth and helps absorb rainfall. Reports say one year of improved fallow equals 15-20 years of forest fallow. We were encouraged to hear a lady say that near her village where pueraria (tropical kudzu) grows, they get a very good harvest of rice. What a blessing to get positive responses from folks with whom we have worked.

Excerpt from Delano and Linda Meyers' September 2009 Newsletter:

Dr. Lebede, an agriculturalist working with the South Central Ethiopian Synod of EECMY, gave us many helpful insights on why areas of Ethiopia are struggling with decreasing soil fertility. Fields and pastures are grazed very short year after year, straw and stalks are used for animal feed and no crop residue is returned to the soil. Often even the animal manure is burned for fuel so there is no replenishment of nutrients to the soil.

We appreciated hearing from Fred Van Gorkom, DVM of Christian Veterinary Mission, a 25 year veteran of service in Ethiopia, who also shared with us that Ethiopia has not had normal rains in the past years. When the grasslands cannot regain their growth, the result is desertification; when the grasslands degenerate toward becoming a desert rather than regain their cover of grasses. Dr. Van Gorkom went on to say, "I know that we taught about overgrazing and deforestation and erosion control and rotating grazing lands…but this is even harder for pastoralists on common grazing areas."

To correspond with the Meyers:
Delano and Linda Meyer, c/o Travis Torblaa,
LCMS World Mission
1333 S. Kirkwood Road
St. Louis, MO 63122-7295 U.S.A.

Resources Used in this Issue

1. "Solution to Global Food Crisis in Managing Natural Resources" by Dr. Rattan Lal in *Ag Answers*, a publication of the Ohio State Extension Service and Purdue Extension Partnership, issue dated April 24, 2008. Dr. Lal is an internationally recognized agronomist who has spent much time working in developing countries. He is currently a researcher at the Ohio Agricultural and Research Center.

2. "An Overview of Cover Crops and Green Manures" by Preston Sullivan, NCAT Agricultural, published 2003, ATTRA Publication #IP024. The information for this article came from ATTRA-National Sustainable Agriculture Information Service operated by the National Center for Appropriate Technology through a grant from the Rural Business-Cooperative Service, U.S. Dept. of Agriculture. NCAT has offices in Fayetteville, Arkansas (PO Box 3657, Fayetteville, AR 72702 U.S.A.), Butte, Montana and Davis California. Their website is www.attra.ncat.org

3. Candace Pollock, Media Relations Coordinator/ Technical Editor, Communications and Technology, The Ohio State University, 216 Kottman Hall, 2021 Coffey Road, Columbus, Ohio 43210-1044 U.S.A., Phone: (614) 292-3799, Fax: (614) 292-2270.

WEBSITES & INFORMATION SOURCES

http://commtech.ag.ohio-state.edu
http://www.aganswers.net
http://vegnet.osu.edu
http://agcrops.osu.edu
http://oardc.osu.edu/offer/
http://southcenters.osu.edu
http://www.hcs.ohio-state.edu/bygl/
http://sustainableag.osu.edu/

RESOURCES

LPES Small Farms Fact Sheets

Manure on Your Farm by Craig Cogger, Soil Scientist, Washington State University. Can be reached by phone at 253 445-4512 or by e-mail at cogger@wsu.edu .

Educational Resources

Fertilizing with Manure. (PNW 533).WSU Extension Bulletin Office, Washington State University, Box 645912, Pullman WA 99164-5912 U.S.A Phone: 1-800-723-1763

Managing Cover Crops Properly. Sustainable Agriculture Network. Phone: 1-802-656-0484 or online: www.sare.org/publications/covercrops/covercrops.pdf.

On-Farm Composting Handbook. NRAES-54, Northeast Regional Agricultural Engineering Service. Online: www.nraes.org or phone: 1-800-562-3618

For FREE copies of ATTRA publications, call toll-free: 1-800-346-9140 or online: www.attra.ncat.org . ATTRA is a project of the National Center for Appropriate Technology NCAT.

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Let's Restore Our Land

Available from ECHO, Let's Restore Our Land, edited by Dan Fountain, describes how church and community leaders came to realize that the soil that produces our food is becoming weak, and the forests that provide us with many resources are disappearing. They recognized that God has given us the responsibility to care for the protect these natural resources that he has created and allows us to use. Under the leadership of Pastor Simon, the people in the community of Katindi made changes that increased the fertility and production of their soil and began restoring the trees and forest that had almost disappeared. The increased prosperity of the people of Katindi encouraged people in other communities to make similar changes. Restoring their land and forest improved their lives and their nutrition. *(description from ECHO's website)*

This book is available for $5 U.S. at www.echobooks.org. Click here to link directly to this book.

Note: This book is currently being translated into Creole by one of CVM's fieldworkers for use in Haiti.

UPDATES

Response to our Readers Questions:
Issue: Vaccination of Farm Animals

1.Should we vaccinate sick animals when vaccinating a herd?

It is not a good idea to vaccinate sick animals as they do not respond well to the vaccine and in some cases the vaccine may make the sickness worse.

2. What should we do with the sick animal?

Upon close observation, one will often notice that the thin or weak or anemic animals are suffering from parasitism, unless they have been treated fairly recently. In almost all cases, it is a good idea to postpone vaccination until animals have been treated for parasites, both internal and external, and have had a few weeks to recover to get the best results from the vaccination. A possible exception is vaccination in the face of a major disease outbreak.

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