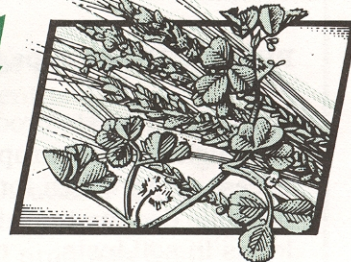


SUSTAINABLE FARMING

Quarterly



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A new generation of biological farm products: Proven 'miracles' scarce

By David Granatstein, project coordinator for the six-state Dryland Cereal/Legume Project.

Farmers have hundreds of decisions to make these days, and now they have even more choices to weigh when they purchase production inputs for their land, as non-traditional "biological" products flood the market.

Lack of research on most of these products to date makes it absolutely essential for producers to conduct field tests and to carefully monitor the use of these new products in their own agricultural operations.

In general, most of the biological products tested so far by the university system have shown

inconsistent yield benefits and doubtful cost-effectiveness. That's not to conclude that they aren't good. We just don't know enough about them to offer firm conclusions.

These biological products include mined materials (Sul-po-mag, humates), live microbes or their byproducts, seaweeds and fish oils, and materials of undisclosed nature. They represent specialty fertilizers, soil conditioners or amendments, and growth-promoting products, and often advertise their "non-caustic," "low-salt," or "natural" qualities.

This article will describe the difficulty in assessing biological products, report on two recent studies of their use on dryland cereal crops, and refer to sources for further information.

Some specialty products contain the same ingredients as commercial fertilizers, but at lower concentrations. Others are ground mineral products with low nutrient analysis fertilizers and a more varied mix of nutrients than high analysis fertilizers. This can help avoid potential minor nutrient deficiencies. However, farmers using these products need to monitor not only their yields, but also the effective cost per unit of nutrient.

Green manures get a second look in Montana

Edited by Sally K. Hilander, from a research update by Dr. Jim Sims, coordinator of a LISA project, "Low Input Legume/Cereal Rotations for the Northern Great Plains and Intermountain Region."

Montana researchers are revisiting the conclusions of a 1914-51 study on legume green manure crops. That study concluded that winter rye, field peas and sweet clover did not increase grain yields — but had a negative effect on dryland farming by reducing critical moisture to the grain crop that followed.

Yields did not increase with a green manure in the rotation because the soil had been cultivated for a short time and was not yet nitrogen deficient enough to respond to treatment, explained Dr. Jim Sims, cropping systems and specialty crops agronomist for Montana State University and the Montana Agricultural Experiment Station (MAES). "The soils couldn't demonstrate a nitrogen benefit until the mid-1960s," Sims said. "Most Montana soils had three to five percent organic matter when they were first

(More RESEARCH, page 6)

Inside the SFQ

- An interview with project director David Granatstein.
- Green manures may have been misjudged; researchers are urging another chance.
- Readership Survey: Is the Sustainable Farming Quarterly a success with you?
- Farmers learn by sharing in new farm improvement clubs.

(More PRODUCTS, page 2)

PRODUCTS, from page 1

With low analysis products and high-yielding crops, it is necessary to watch for a possible decline in nutrient levels in soil tests.

A given product may have an immediate and obvious benefit, a benefit only under certain environmental or management conditions, a benefit only apparent over a long period of time, a negative effect, or no effect at all. The effect on the growing crop may be subtle or indirect, involving decreased disease, improved grain quality, or more resistance to environmental stress.

Thus, manufacturers often challenge independent product tests by contending that the appropriate parameters are not being measured.

When the reported benefits are not supported by conventional understanding, even positive test results can be questioned by researchers. Yet some products such as growth-promoting microbes added to seed are similar in nature to organisms studied by universities and the U.S. Department of Agriculture.

University field tests of non-traditional soil amendments provide independent data on their effects. Testing of these products has not been comprehensive for several reasons. There are hundreds of these materials on the market. The names and/or composition of products are frequently changed. Many of the reported product benefits are qualitative, supported by farmer testimonial, and difficult to test through normal field trials or laboratory procedures. The products are often promoted

within the context of a whole management system, which can confound the effect of the product itself. These management systems are typically sound and could themselves account for the reported improvements.

Oregon State University researchers conducted field tests of several yield-enhancing agents on winter wheat, both at Corvallis and Moro. As Moro represents the dryland cereal region (wheat/fallow, 11" rainfall), only those results will be discussed. Six seed treat-

ment in a Bio-Mag seed treater unit; a recommended Vitavax treatment only; and a control of untreated seed. All seed except the untreated control received the recommended Vitavax treatment.

Stephens, Hill-81, and Malcolm winter wheat varieties were tested. Over the three-year period, none of the treatments positively or negatively affected wheat yields (See Figure 1). A companion lab study of seedling growth rate with the various treatments showed no effect from Car-

FIGURE 1**EFFECTS OF YIELD-ENHANCING AGENTS ON WINTER WHEAT YIELDS AT MORO, ORE.**

Treatment (Bushels per acre)	1986	1987	1988	Average
YEA! (+Vitavax)	38	43	60	47
Car-Dak (+ Vitavax)	37	47	59	48
Amplify-D (+ Vitavax)	38	49	60	49
Bio-Mag (+ Vitavax)	38	48	60	49
Vitavax only	37	47	58	47
Untreated control	40	44	59	48

Results: No significant differences among treatments.

Source: D.F. Grabe et al. 1989. Columbia Basin Agriculture Research, Special Report 840. Oregon State University, Corvallis, pg. 57-61.

ments, plus a control, were included in the study in 1986, 1987, and 1988, with four replications. These included YEA!, a crabshell derivative with chitosan; Amplify-D, containing adenosine monophosphate with sodium phosphate buffers; Car-Dak, a super-absorbent starch graft polymer with graphite; treat-

Dak, Amplify-D, or Bio-Mag, but a small, significant positive effect for YEA! Vitavax increased the seedling growth rate by 15 percent over the others.

Another three-year study conducted near Pullman, Wash., (annual cropping, 18"

More PRODUCTS, page 3

PRODUCTS, from page 2

precipitation) tested the effect of Seed Life, a seaweed-based product used to treat seeds. All seeds were treated with a normal fungicidal seed treatment, and then received either the recommended rate of Seed Life, twice the recommended rate, or none. The crops grown were winter wheat, spring wheat, winter barley, spring barley, and spring peas, with several rotations, and with four replications per treatment.

Yields were highly variable within the treatments. The double rate showed no consistently positive effect. The recommended rate of Seed Life showed a significant yield response (Wilcoxon sign-rank test, $p < 0.05$) for all crops except spring peas. Because the product costs only one cent per pound of treated seed, the yield increases generally more than recovered the cost of treatment. (See Figure 2.)

Given that university researchers don't have the financial resources to conduct the amount of independent testing necessary, it becomes crucial for farmers themselves to carefully test a product of interest in a simple, well-designed trial. Ideally, a replicated side-by-side test with and without the products should be used, with all other management practices kept the same. A test should be done over several years and on different soil types to look at the product's range of effectiveness. Statistical analysis is helpful in assessing the risk associated with a product or practices. Multiple tests on different farms can be useful if the work is coordinated and the results are compiled.

Growers and researchers often

assess product performance differently. Researchers use statistical analyses to determine whether the observed differences, if any, in an experiment are more likely due to chance, or a result of treatments imposed. If the probability of a chance difference is 5 percent or less, the difference is considered significant. For growers, this level of probability may be overly conservative if the consequences of there being no real difference are not serious.

product or practice, a realistic assessment is difficult to make.

Two publications present numerous test results on biological products from around the country. *A Practical Guide to Novel Soil Amendments*, by Janet McAllister, summarizes test results under the following categories: Soil-wetting agents; humates; microbial fertilizers and activators; growth regulators; and specialty fertilizers and micro-

FIGURE 2

**EFFECT OF SEED LIFE TREATMENT
ON CROP YIELDS NEAR PULLMAN, WASH.**

Crop	1987		1988		1989		Average	
	-	+	-	+	-	+	-	+
Winter Wheat	86	90	80	90	92	95	86	92
Spring wheat	48	49	51	53	57	59	53	55
Winter barley	4420	4905	---	---	4932	5226	4676	5066
Spring barley	4915	5175	4094	4315	4460	4717	4489	4735
Spring peas	---	---	2467	2548	---	---	2467	2548

Wheat yields in bushel/acre, barley and pea yields in pounds/acre.

- means no Seed Life

+ means recommended rate Seed Life.

Many growers are skeptical of statistics and prefer to use their observation skills and experience to determine the value of a product. If a product or practice pays its way 50 to 60 percent of the time, a grower may consider it acceptable, especially if downside risk is small. But in the absence of an actual side-by-side comparison with and without a

nutrient products. The report was written in 1982 and is available from Rodale Press, 222 Main St., Emmaus, PA 18049.

A much larger report from the north central states is the *Compendium of Research Reports on Use of Non-Traditional*

More PRODUCTS, page 4

Project leader has diverse ag background

David Granatstein grew up in upstate New York, a fertile region of dairy farms, orchards, and forests. "New York was once the food basket for the nation — a much smaller nation," he commented in a recent interview with the SFQ.

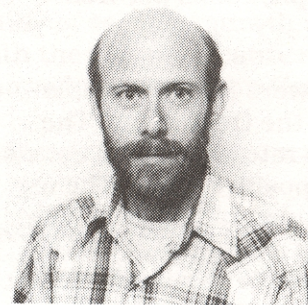
In the mid-1960s, Granatstein spent a summer in the West, hiking, mountain climbing, and river rafting — experiences that steered him toward his work in natural resources and lured him to Washington state in the early 1970s. He spent eight years managing a small farm on the east slope of the North Cascades.

Granatstein began his formal education in natural resources management at Cornell University, where he earned a bachelor's degree and also worked in soil conservation and forest planning. "Resource management, both on forest and farm lands, is ultimately a people issue," says Granatstein, who seeks opportunities to broaden people's understanding of conflicting viewpoints. For example, he helped sponsor

several workshops that brought urban residents to a farm on the border of a national forest where they could experience first-hand the issues involved in managing natural resources.

involved with on-farm testing of legume crops. He decided to further his technical understanding of soils, and went on to complete a master's degree at WSU in soil science.

David Granatstein is project coordinator for a six-state effort examining production alternatives for dryland grain growers, based at Washington State University in Pullman. The project supports publication of the Sustainable Farming Quarterly.



Granatstein directed a study of future farming and timber options for Okanogan County, Wash., in 1982, and helped produce the publication, "Land and People: Options for Okanogan Agriculture." Through this effort, he met a number of people from Washington State University and became in-

In 1985, Granatstein joined a WSU farming systems project at Lesotho in southern Africa, where he spent a year conducting on-station and on-farm research on maize management, legume intercropping, and acid-tolerant forages.

More BIOGRAPHY, page 5

PRODUCTS, from page 3

Materials for Crop Production, produced by the NCR-103 Committee. Results are reported under biological inoculants and activators, growth stimulants and regulators, mineral nutrient sources, soil conditioners, and wetting agents. Research results on more than 70 products are reported. It is updated periodically with new results. This publication is available from Extension Publications, Iowa

State University, Ames, IA 50011.

Again, yield benefits appear to be inconsistent and cost effectiveness questionable. Some products advertise benefits from microbial inoculants, trace elements, or special growth-promoting compounds. With the advent of sulfonylurea herbicides, which are extremely active at rates measured in ounces/acre, it is

apparent that small amounts of product can give dramatic results. The mode of action of microbial products may be well-documented, but may not give a response in the field at the low rate recommended by the manufacturer.

Nonetheless, it is as improper to dismiss all these materials as useless without documentation as it is to claim their benefits without the same. **SFQ**

BIOGRAPHY, from page 4

This experience in a developing country, he said, helped clarify in his mind the relative meaning of terms such as "sustainable" and "low input."

In 1987, Granatstein became on-farm research director for the Land Stewardship Project, a private, non-profit group in Minnesota. He worked in an area of severe groundwater contamination caused by nitrates and herbicides from agriculture. He worked closely with 25 farmers to identify and test production options that would reduce pollution potential, and at the same time improve profitability.

The farmers were successful at reducing nitrogen rates and herbicide use, and experimented with different rotations, new crops, and rotational grazing. "This area still has quite a bit of livestock integrated into the farms, and conditions are excellent for developing more sustainable systems," Granatstein commented. "It's a totally different situation out here in the dry farming area."

Granatstein produced a book, *Reshaping the Bottom Line: On-farm Strategies for a Sustainable Agriculture*, while he was in Minnesota, and it has been well-received as a practical guide to promising production alternatives.

He left his work in the Midwest to return to Washington and work with the more challenging dryland systems as coordinator of the LISA Dryland Cereal/Legume project in January 1989. He's well aware that Midwest solutions often won't fit here — but he has met many innovative growers seeking new ap-

Sustainable Agriculture Act of 1990 would promote program flexibility

*By David Granatstein,
project coordinator for the
six-state Dryland Cereal/
Legume Project*

The two hottest issues for 1990 federal farm legislation as they pertain to "sustainable agriculture" are environmental protection and more planting flexibility within commodity programs, says House Rep. Jim Jontz, D-Indiana, author of one of three farm bills pending before Congress.

Jontz, who serves on the House Agriculture Committee, was the keynote speaker at the February "Farming for Profit and Stewardship" conference in Lewiston, Idaho, attended by about 250 producers.

At the SFQ's press time, Jontz' Sustainable Agriculture Act of 1990 was being considered as the basis for increased program flexibility. It will likely be incorporated into the conservation title of the the new farm bill.

The Act would remove the economic barriers for using

soil improving practices and give the producer an option to use a crop rotation with environmental as well as market objectives. Participation would be strictly voluntary.

Farmers generally support the concept of more flexibility in farm legislation, Jontz said, but it could present problems in areas with few crop choices, such as the drylands of the Northwest. Flexibility provisions, therefore, must be written so that an alternate crop in one area does not undercut the market where the crop is primary. "Everyone is for flexibility if they are not the ones being flexed upon," Jontz remarked.

Jontz believes that "stewardship farming is smarter farming". He recognizes the danger of burdening producers with too many plans and prescriptions, and favors farm policies that create an environment in which the creative abilities of American farmers are unlocked so that they may maintain production while protecting the environment.

proaches that can be economically sound and environmentally beneficial.

"Such people resources are the most valuable asset we have in addressing the problems at hand," Granatstein said. His goal is for the LISA Project to get the experience of growers

into the information system so that other growers and researchers can learn from them.

Granatstein can be reached through Washington State University at (503) 335-3491.

SFQ

Research, from page 1

broken out of virgin prairie," Sims noted, "but after alternating crop/fallow cultivation for however long it was farmed, most Montana soils now have two percent or less organic matter." Once the nitrogen was depleted, he said, the benefits of green manure in the rotation became apparent.

The data that gave dryland and legumes a bad name for 40 years came from an unreplicated, cooperative study involving U.S. Department of Agriculture and MAES scientists at Moccasin, Huntley, and Havre. (See *Agronomy Journal*, Army and Hide, 1959, Vol. 51, pages 196-198, available in the LISA project database at Washington State University, Pullman).

The early scientists interpreted the data to mean that winter rye, field peas and sweet clover green manures had either no effect or a depressing effect on small grain yields — compared to fallow, according to Sims.

Treatments were part of a rotation study, winter and spring wheat, spring barley, oats and corn in 42 various rotations that didn't involve legumes. The main effect of green manures, according to the authors, Army and Hide, was to reduce the water available to the grain crop that followed.

Perhaps the results would have been more positive with better management, Sims said. The report states that when the green manures were not successfully established, there were good crops of Russian thistle to plow down.

MAES scientists searched the files at the Moccasin and Huntley Ag Research Centers

and located the original raw data. The last 10 years of data from the 37-year-long study are being analyzed separately by Sims and his colleagues.

Preliminary results show that grain yields from the green manure plots exceeded those following fallow at least eight out of the 10 years. By this time, organic matter had declined enough in Montana soils to show a measurable response to the addition of

Farmers in the inland Northwest who have had experience with the use of green manure crops include the following:

Joann and Dewey Forsness
Wolf Point, MT
(406) 695-2492

David Oien, Conrad, MT
(406) 278-3384

Merlan L. Huling, Newport, WA
(509) 447-3785

Pat T. Rathbone, Marsing, ID
(208) 896-4478.

Dozens more are listed in the Alternative Energy Resources Organization "Guide to Sustainable Agriculture in the Northern Rockies and Plains." Send \$7 to AERO, 44 N. Last Chance Gulch, Helena, MT

nitrogen. In addition, newer dwarf varieties of wheat are more tolerant to dry conditions, and so react less to loss of soil moisture following a green manure crop.

But Sims stressed that the "key question" in dryland farming is still moisture, "so understanding the moisture relations is important."

Perhaps the greatest value of green manure crops is their positive effect on soil organic matter and erosion control, both of which help maintain or improve the moisture-holding capacity of the soil. In addition, legume green manures provide nitrogen for crop use, which may or may not be economical when compared with commercial fertilizers.

A second and perhaps more useful publication included in the database is *The History of Summer Fallow in Montana*, published in 1975 as MAES Bulletin 704 by G. L. Ford and J. L. Krall. This is a comprehensive review of the development of dryland cropping systems in the northern Great Plains, including the Canadian prairies.

It discusses the advantages and disadvantages of various rotations involving small grains, primarily wheat and barley and occasionally oats. Disadvantages are the development of saline seep and other natural-resource impacts — organic matter decline, and wind and water erosion. SFQ

Bulletin 675 available

An Oregon State University Bulletin that illustrates the long-term implications of various cropping and tillage practices on soils and crop yield is still available. The full title is "Long Term Management Effects on Soil Productivity and Crop Yield in Semi-Arid Regions of Eastern Oregon."

Ask for Bulletin 675 at the Printing Department Mailing Services Building, IND B-226, Oregon State University, Corvallis, OR 97331. SFQ

CALENDAR

June 13: Pendleton, Ore. Pendleton Research Station field day. Discussion of winter barley varieties, frozen-soil management, downy brome research, and other topics. Contact Don Wysocki at (503) 276-5721.

June 28: Pullman, Wash. Palouse Conservation Station field day, Pullman, Wash. 8:30 a.m. to noon. Topics include nitrogen fertility management; biological control of grass weeds; managing for cereal disease control and fungicide resistance; and strategies for returning grass/CRP fields back to cropping. Contact Carl Engle at WSU, (206) 335-2811.

June 30: University of California, Santa Cruz. "Symposium on Sustainable Agriculture: Balancing Social, Environmental and Economic Concerns." 8 a.m. to 6 p.m. Topics include strengths and weaknesses of current concepts of sustainability; identifying and closing research gaps; and making policy. No charge. Pre-registration preferred by June 15. Contact Barbara Laurence, Agroecology Program, University of California, Santa Cruz, CA 95064. (408) 459-3240.

June 22-July 13: Montana. Tours of three farms cooperating in the "Low Input Legume/Cereal Rotations for the Northern Great Plains and Intermountain Region" Project. For details, call AERO at (406) 443-7272. Dates, farmers, locations and topics are: June 22, Gene McKeever, Fort Benton, Austrian winter peas grown as a green manure crop; June 25, Floyd Dahlmann, Forsyth, field trials of Sirius field peas; and July 13, Gordon Matheson, Conrad, demonstration fields of Indianhead lentils and black medic.

July 10-19: Montana. Cereal/legume research will be featured at Montana Agricultural Experiment Stations in Conrad, Havre, Moccasin, Huntley, Sidney, and Kalispell. All six have state-wide legume adaptation trials, and Conrad, Havre, Moccasin, and Kalispell also have cereal/legume research trials. Field days are July 10 in Conrad; July 11 in Havre; July 12 in Moccasin; July 13 in Huntley; July 17 in Sidney; and July 19 in Kalispell. For more information call (406) 994-5132 or 994-5136.

July 15 and 17: Ulm, Mont. Tours of the Greg Gould farm. (See related story at right).

July 29-Aug. 1: Salt Lake City, Utah. "Water Futures," the 45th annual meeting of the Soil and Water Conservation Society (SWCS). For information, write SWCS, 7515 NE Alkeny Road, Alkeny, Iowa 50021.

Aug. 15-18: Lincoln, Neb. National Sustainable Agriculture Conference. Sponsors include Extension, SCS, USDA, EPA, Nebraska Sustainable Agriculture Society, Soil and Water Conservation Society, and

several land grant universities. Topics include challenge of designing a sustainable agriculture policy; innovative programs; public-private collaboration; and information systems. \$300 registration fee. Contact Jim Bushnell, University of Nebraska, Lincoln, NE 68583. (402) 472-2966.

Oct. 12: Moiese, Mont. Day-long workshop on cover crops and green manures. Speakers and agenda to be announced in the next issue of SFQ. For more information, call AERO at (406) 443-7272.

Dec. 7-8: Bozeman, Mont. "Using Alternative Practices in Maintaining Livestock Health and Nutrition," Holiday Inn. Conference topics include alternative forms of disease and illness treatment; preventive care and nutrition of food-producing animals; labeling standards; and market development. Keynote speaker is Dr. Frank Baker of Winrock International Institute for Agricultural Development, Little Rock, Ark. For more information, call AERO at (406) 443-7272.

Montana farm tours showcase Gould's successful sustainable techniques

The Alternative Energy Resources Organization is conducting tours of the Gould Ranch at Ulm, Mont., south of Great Falls, July 15 and 17.

Gregory Gould and his partners run a mixed cow/calf, hay and grain operation. In an 11-inch rainfall area, they raise dryland wheat, barley and oats continuously cropped in rotation with green manure and hay crops.

They have largely eliminated the need for purchased agri-chemicals, and summer fallow. Interseeding plays a big role in their cropping system, with the small grain crops no-till seeded into young stands of alfalfa, or seeded in paired rows alternated with legumes and native grass.

Weed control in wheat is accomplished with post-emergent harrowing and/or grazing. Trap crops, resistant varieties, and crop rotations control insects.

Protection of erodible land is a primary consideration in the management scheme, which is kept very flexible through crop diversity and livestock production. For travel information, contact AERO in Helena at (406) 443-7272.

Farm improvement clubs promote grassroots networking

Thirty-four farm and ranch families in Montana are beginning cooperative research this spring to develop improved cropping systems that reduce loss of soil, water and nutrients, and increase crop diversity.

Organized into six local farm improvement clubs, these producers will conduct joint on-farm research with the help of local Extension and conservation district offices, and the Montana Agricultural Experiment Station, sharing the results of their progress with the other clubs.

"This program will facilitate farmer-to-farmer networking, and foster local efforts to develop and adopt environmentally-sound, sustainable production methods," said Nancy Matheson, coordinator of the farm improvement club program for the Alternative Energy Resources Organization (AERO).

- Seven farmers in the Valier-Conrad-Shelby area northwest of Great Falls will examine the potential of different legume and legume-grass mixtures interseeded with grain for fixing

nitrogen, controlling weeds, and producing profitable hay and grain yields on dryland and irrigated acres.

- A second group of seven farmers and ranchers in the Stanford area of central Montana will experiment with black medic, a legume, in grain/forage systems, to discover whether it can reduce fertilizer requirements for grain, offer adequate weed control as ground cover, and provide forage for cattle in the alternating years when small grains aren't planted.

- Four north-central Montana farmers who have second-year sweet clover this year will manage it to conserve adequate moisture for a following grain crop. Sweet clover is a common green manure crop, but uses so much moisture that a season of summer fallow is often required prior to planting grain. This project will determine if mowing schedules can reduce the moisture requirement of sweet clover, thereby eliminating the need for summer fallow.

- Eight or more farm families in the lower Flathead Valley

north of Missoula will examine the effect of different soil-building amendments on pasture and hay, strawberries, melons, legumes, including alfalfa, and fruit trees.

- A Farm Improvement Club in northern Toole County will experiment with black medic or other green manure crops grown in conjunction with small grains for preventing saline seep. The green manure crops will be grown in a flexible cropping system designed to reduce summer fallow and keep ground cover on potential seep recharge areas.

- Four diversified farms in the Bitterroot Valley in western Montana will share common production and marketing problems and solutions, including soil fertility, insect pest control, and equipment related issues. Emphasis will be placed on organic marketing.

AERO's Farm Improvement program is supported in part by grants for the Jessie Smith Noyes Foundation and the Presbyterian Hunger Fund.

AERO
Sustainable Farming Quarterly
44 North Last Chance Gulch
Helena, MT 59601
(406) 443-7272

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