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On-Farm Research of Biologicals, 1986 - 1994
Practical Farmers of Iowa

February 7, 1995

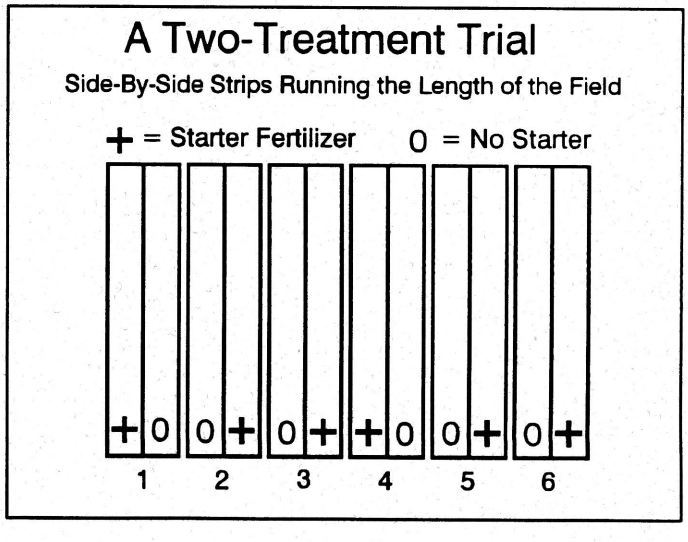
The term "biologicals" covers a range of products, from trace elements, to live cultures of microbes. If there is a common thread, it may be that these materials are intended to utilize natural processes and interrelationships in the agroecosystem. That is a goal of many farmers who are working to make their farms more sustainable. The question is: "Will biologicals help you get there?"

That is what this on-farm research is about. These were well-designed experiments carried out by farmers to see if biological products would pay off. Maybe someone was trying to sell them a particular item, or maybe they were following up on a biological because the promotional material sounded plausible to them. In some way, they probably all hoped these products would work. But they started with a test on a few acres. Often they asked the salesperson or company consultant how best to use the biological in the trial.

The results that appear here imply neither endorsement nor condemnation of any particular product. In most of the trials reported here, biologicals did not increase yields. However, producers are encouraged to carry out their own trials to find what works in *their* operations. PFI members have carried out close to 400 experiments on farms, and we have some good methods worked out if you are interested in doing your own testing. In reports of trials that involve proprietary products, we include brand names solely for purposes of information. The following explains how to interpret the table and describes the way these field trials were done.

Reading the Numbers, Knowing the Terms

Valid and reliable farmer-generated information is a cornerstone of Practical Farmers of Iowa. Consequently, PFI has worked to develop practical methods that safeguard the accuracy and credibility of that information. PFI members use methods that allow statistical analysis of their on-farm trials. Chief among these are: 1) "replication," and 2) "randomization." (See figure below, a typical PFI trial layout.) They have repeated, or "replicated," the farming practices compared in a trial at least six times across the field. So trial results do not depend on a single comparison only, but on six or more. The order of the practices, or "treatments," in each pair is chosen with a flip of the coin. This "randomization" is necessary to avoid unintentional bias. PFI on-farm trials have been recognized for their statistical reliability, which increases confidence in arriving at an unbiased conclusion. So, while PFI members don't have all the answers, they do have a tool for working toward those answers.



When you see the outcome of a PFI trial, you also see a statistical indication of how seriously to take those results. The following information should help you to understand the reports of the trials. The symbol "*" shows that there was a "statistically significant" difference between treatments; that is, one that probably did not occur just by chance. We require ourselves to be 95% sure before we declare a significant difference. If, instead of a "*," there is an "N.S.," you know the difference was "not significant," that is, the yields are not different.

Average statewide yearly prices for inputs were assumed in calculating the economics of these trials. For uniformity, average fixed and variable costs and time requirements were also used. These can vary greatly from farm to farm, of course. Labor was charged at $6.00 per hour until 1993, when $7.00 was charged. We costed labor at $8.00 per hour in 1994.

Dollar amounts shown in parentheses ( ) are *negative* numbers. A treatment "benefit" that is a negative number indicates a relative *loss*.

Researching Biologicals, Researching Systems

The farmers who carried out these trials have no way of knowing if the products were increasing the soil life or doing other things not visible to the naked eye. They were usually only measuring crop yield and, indirectly, profitability. Some people say you can't test biologicals in strip plots because the "good bugs" swim across strips to wherever they are needed. The strips in these experiments were generally eight to sixteen rows wide. The reader will have to judge whether these were valid trials.

Another criticism is that biologicals must be tested as part of a whole farming system. In some of these trials, farmers did maintain the experiment for several years, looking for cumulative effects. The systems question goes both ways. Systems with diverse crop rotations, manure, cover crops, and residue management are systems with plenty of native soil biological activity. The amount of additional microbes that can be added as a product is very small compared to what is already there. And added microbes face fierce competition from the native "bugs." That could be why biologicals had little measurable effect on the farms reported here. On the other hand, if the farming system itself does not create the conditions that encourage soil biological activity, any added microbes will face a harsh environment in that soil, too. The best success with soil inoculants has been with *symbiotic* microbes - those that find a safe home in another organism. The common example is the *Rhizobia* bacteria added to the seed of soybeans, alfalfa, and other legumes.

Again, producers are encouraged to do their own testing to find out what works in their farming system. PFI has written a brief guide to setting up a replicated on-farm trial. For a copy of the guide, or to discuss trial results, contact:

Richard Thompson, 2035 190th St., Boone, IA 50036, 515-432-1560; or
Rick Exner, 2104 Agronomy Hall, ISU, Ames, IA 50011, 515-294-1923.

On-Farm Trials of Biological Products, 1986-1994 -- Practical Farmers of Iowa										
Year	Cooperator/ Member	Biological Product or Program	Product Class or Purpose	Biological Yield (bu/acre)		Control Yield (bu/acre)		Statistical Signifi-cance	Biological Benefit $/acre	Comments
				Corn	Soybean	Corn	Soybean			
1991	Leazer	15-9-2-17S+ micronutrients		101.8		102.2		N.S.	($38.50)	
1991	Mays	15-9-2-17S+ micronutrients		132.4		131.3		N.S.	($38.50)	
1991	Lubben	ACA	zinc acetate	146.2		147.9		N.S.	($4.56)	Entire field received 60 lbs preplant N.
1994	Lubben	ACA	zinc acetate		62.7		62.8	N.S.	($4.14)	ACA applied with the herbicide.
1993	Stonecypher	Achieve®	microbial seed treatment	60.6		62.9		N.S.	($10.00)	Seed treatment applied with the starter fertilizer.
1994	Stock	Achieve® + Remedy® (Farm for Profit, Inc.)	microbial nutrient and inoculant.	159.5		160.5		N.S.	($13.85)	
1994	Stock	Achieve® + Remedy® (Farm for Profit, Inc.)	microbial nutrient and inoculant.		54.0		53.0	N.S.	($13.85)	
1990	Leazer	Ag Spectrum + Grozyme®		108.6		116.6		*	($46.86)	A third treatment with 7-21-7 starter yielded 112.5 bu.

Year	Cooperator/ Member	Biological Product or Program	Product Class or Purpose	Biological Yield (bu/acre)		Control Yield (bu/acre)		Statistical Signifi-cance	Biological Benefit ($/acre)	Comments
				Corn	Soybean	Corn	Soybean			
1990	Hermanson	Agrienergy, Inc.	biological fertilizers	111.6		109.8		N.S.	($26.35)	Control treatment received conventional fertilizer (28% N).
1991	Hermanson	Agrienergy, Inc.	biological fertilizers		48.8		47.8	N.S.	($18.67)	
1992	Hermanson	Agrienergy, Inc.	biological fertilizers	198.0		198.8		N.S.	($34.88)	Entire field received turkey compost, micronutrients, and starter.
1991	Wurpts	Agrienergy, Inc.	biological fertilizers	135.7		144.7		*	($38.27)	Poor weed control in Agrienergy strips. Excluded from average.
1991	Wurpts	Agrienergy, Inc.	biological fertilizers		31.7		31.3	N.S.	($28.97)	Control was ISU recommendation (no fertilizer).
1992	Wurpts	Agrienergy, Inc.	biological fertilizers	180.6		177.6		N.S.	($34.89)	Control was ISU recommendation (N fertilizer only).
1992	Wurpts	Agrienergy, Inc.	biological fertilizers		47.9		48.3	N.S.	($41.69)	Control was ISU recommendation (no fertilizer).
1993	Wurpts	Agrienergy, Inc.	biological fertilizers	101.3		100.4		N.S.	($27.01)	Control was ISU recommendation (N fertilizer only).
1993	Wurpts	Agrienergy, Inc.	biological fertilizers		30.9		31.1	N.S.	($15.91)	Control was ISU recommendation (no fertilizer).

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				Corn	Soybean	Corn	Soybean			
1994	Wurpts	Agrienergy, Inc.	biological fertilizers	184.7		187.3		N.S.	($10.11)	Control was ISU recommendation (N, P, & K).
1994	Wurpts	Agrienergy, Inc.	biological fertilizers		60.6		60.3	N.S.	($8.75)	Control was ISU recommendation (no fertilizer).
1986	Thompson	AgriGrow		121.1		116.1		*	$7.11	
1986	Thompson	AgriGrow		138.4		137.2		N.S.	($9.50)	
1986	Thompson	AgriGrow			51.1		50.3	N.S.	($6.50)	
1986	Thompson	AgriGrow			46.0		46.6	N.S.	($6.50)	
1991	Carlson	Arouse®	microbial seed treatment	93.5		91.2		N.S.	($13.65)	
1990	Reicherts	Bio Soil, Inc.	soil inoculant	158.1		156.7		N.S.	($25.58)	
1991	Lubben	Biomix® + Pepzyme®		132.8		135.2		N.S.	($10.00)	1 lb Biomix, 6 oz. Pepzyme. Manufactured by Tainio Technique and Technology
1991	Lubben	Biomix® + Pepzyme®			51.7		50.0	*	($1.81)	1 lb Biomix, 8 oz. Pepzyme. Manufactured by Tainio Technique and Technology
1991	Leazer	Bioroot Plus®	root stimulant	107.4		106.6		N.S.	($14.40)	Treatment with Counter yielded 114.2 bu. and netted $19.97 more than Bioroot.
1992	Leazer	Bioroot Plus®	root stimulant	140.6		137.4		N.S.	($8.90)	Treatment with Counter yielded 147.8 bu and netted $15.32 more than Bioroot.

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				Corn	Soybean	Corn	Soybean			
1991	Mays	Bioroot Plus®	root stimulant		54.8		56.3	N.S.	($7.20)	
1989	Lubben	Grozyme®		151.4		149.9		N.S	($8.00)	12 oz./acre preplant incorporated. Both treatments received 28% N.
1990	Lubben	Grozyme®			53.5		53.2	N.S	($8.00)	12 oz./acre preplant incorporated.
1994	Olson	Grozyme® + Agri-SC® (Ag Spectrum, Inc.)	nutrient release, soil conditioner		63.9		65.0	N.S.	($10.76)	Added to banded herbicide.
1994	Olson	Grozyme® + Agri-SC® (Ag Spectrum, Inc.)	nutrient release, soil conditioner	165.2		164.0		N.S.	($10.76)	Added to banded herbicide.
1990	Carlson	micronutrients		131.8		130.5		N.S.	($5.50)	

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				Corn	Soybean	Corn	Soybean			
1989	Carlson	Molasses		123.0		132.2		*	($22.70)	
1989	Lubben	Molasses		137.5		138.0		N.S.	($1.60)	3 gal./acre preplant incorporated. Both treatments received 28% N.
1990	Lubben	Molasses			53.5		53.9	N.S.	($4.00)	3 gal./acre preplant incorporated. Both treatments received 28% N.
1988	Broders	P_3K® (Petrik Labs., Inc)		99.6		97.4		N.S.	($18.00)	
1988	Broders	P_3K® (Petrik Labs., Inc)		79.6		82.6		N.S.	($18.00)	
1990	Lubben	Trans-National AGronomy	micronutrients and natural fertilizer	157.6		166.2		*	($56.04)	TNA compared to farmer's customary fertilizer
1991	Lubben	Trans-National AGronomy	micronutrients and natural fertilizer		47.6		50.9	*	($30.92)	starter and foliar
1990	Bumgarner	Triple Noctin-L®	seed treatment		39.0		44.2	*	($13.95)	hail damage
* indicates a statistically significant yield difference (less than a 5% probability this great a difference would occur by chance).			Average Corn:	131.7		132.2			($19.27)	Numbers in parentheses ($) show a negative benefit, or loss.
			Average Soybeans:		49.9		50.3		($13.85)	