Mosaic

MEY Maximum Economic Yield

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SECTION CONTENTS:

To sustain crop yields … To sustain farm profits…To sustain the environment

A Sustainable Crop Production System

Farmers are faced with many challenges. They must be efficient in order to remain in business and their production systems must be sensitive to environmental concerns. These requirements are in addition to the usual challenges of weather, pests and uncertain markets. A "Sustainable Crop Production System" is a term often used to describe a management philosophy that will be adopted by those farmers who are going to remain as the future producers of our food, feed and fiber. This philosophy includes the implementation of crop management strategies that provide:

Adequate, high quality food, feed, fuel and fiber supplies that are produced economically, and with the added responsibility to safeguard the environment.

It is this combination of productivity and responsibility that most accurately describes the term "Sustainable Crop Production Systems."

Sustainable systems start with the adoption of Best Management Practices (BMPs). Once in place, BMPs lead to Maximum Economic Yields (MEY) and together they lead to sustainability both economically and environmentally.

Best Management Practices (BMPs): A Basis for Sustainability

Consider two farmers on adjoining farms. Both have similar fixed costs, soils, and yield potential. Yet, it is not unusual for one farmer to consistently grow higher yields and enjoy greater profits. Most likely the more profitable farmer does a better job of selecting and managing inputs. He has developed a more successful management strategy for the controllable crop production practices.

All farmers have ready access to crop production information and latest technological advancements. Dealer contact, radio, television, computer networks, farm press, farmer meetings, university scientists, state and federal agencies, consultants, and neighbors are some common sources of information. Success is achieved by those farmers who can package this information into a high-yielding crop production system for the conditions specific for their locations.

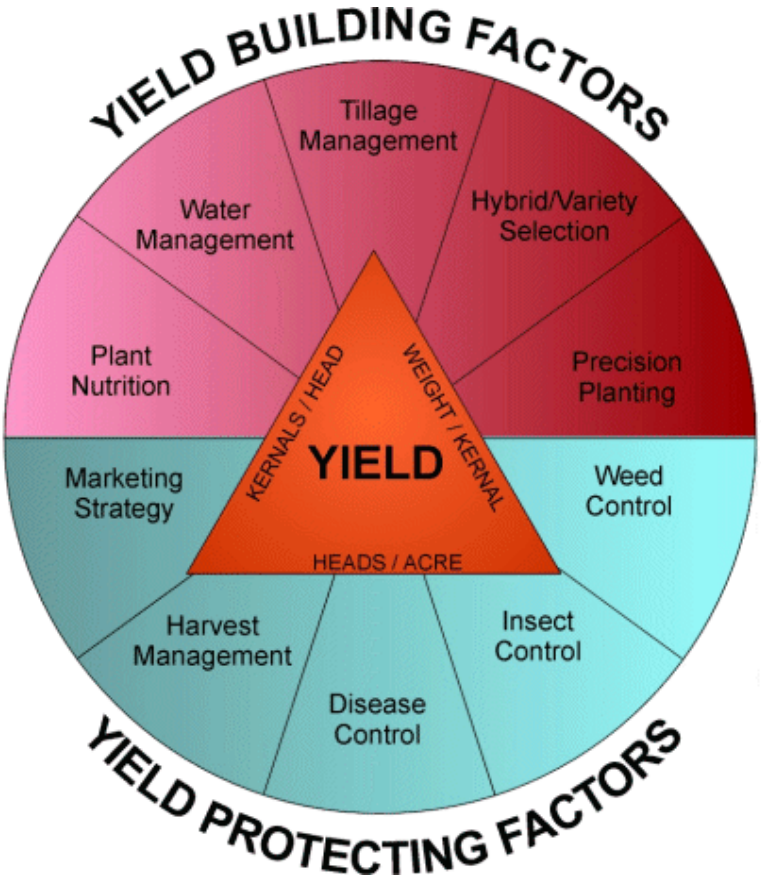
Like all high-yield cropping systems, there must be an integration and balance of the controllable practices. It is usually the improper management of several practices which explains why one farmer profits more than another---a single practice or input is seldom responsible. Best Management Practices (BMPs) is the term used to describe practices which have been proven to provide optimum production potential, input efficiency and environmental protection for a specific site. All BMPs, from seeding to harvest, must be considered and packaged into the cropping system. Success will be limited if just a few of the proven BMPs are adopted while average management is used on others. Only when all controllable factors are used at proven BMP levels will the optimum yield potential be achieved and the greatest economic and environmental benefits realized. Results from a BMP Club whose twenty members adopted a BMP wheat production package provide a good example.

Nitrogen Use Efficiency Comparison

Type System	Yield bu/acre	N Used lb/acre	N Efficiency bu/lb N	Soil N After Harvest lb/acre	Cost per acre
BMP	85	140	0.61	29	$2.43
Old	50	105	0.48	40	$3.19

Collectively, these farmers increased yields 35 bu/acre, used nitrogen (N) fertilizer much more efficiently, and lowered the cost of producing the wheat by $0.76/bu. The BMP Club strategy was for each farmer to use all the proven BMPs for intensively grown wheat, with each Club member given the freedom to alter parts of the package to satisfy his particular site-specific requirements.

Develop BMPs for each Crop Grown



The challenge of change is the most difficult management decision a farmer makes. It takes individual initiative to identify all crop production factors and to question himself, "Am I using the best management practice for that factor?" The key first step is to physically make a list of all controllable factors for each crop.

Graphic to the left shows major production categories encountered when growing grain crops. The list to be developed should identify numerous additional sub-factors associated with each of these major categories. Shown, for example, is a partial listing of controllable sub-factors that will need to be considered for Plant Nutrition and Precision Planting.

The next step is to identify BMPs that best fit yield locations, soils, yield goals and management levels. This requires education and a willingness to learn. Seek assistance from agribusiness dealers, farm advisors, university scientists, and others to help complete the list and to make sure the latest BMP practices have been identified for consideration. Once underway, it is important to annually review strategies and to be flexible---willing to change as yield goals increase, as new varieties/hybrids are released, or as research develops a new BMP.

Remember, you are putting individual BMPs into a cropping system package. Positive interactions will occur. That's what farmers are looking for and the reason yield potential increases. The table below illustrates this fact from a study on the interaction between applied fertilizer and plant population and their effect on corn yields.

Effects of Interactions between Fertilizers and Plant Population on Corn Yield

Interaction	Yield bu/acre	Response bu/acre
Average population x average fertility	118	--
BMP population x average fertility	164	46
Average population x BMP fertility	155	37
BMP population x BMP fertility	231	113

Many similar interactions occur between the various production factors. Some of the most responsive are those relating to the "Yield Building Factors" as seen in the figure, especially hybrids/varieties, plant nutrients, and the factors relating to precision planting.

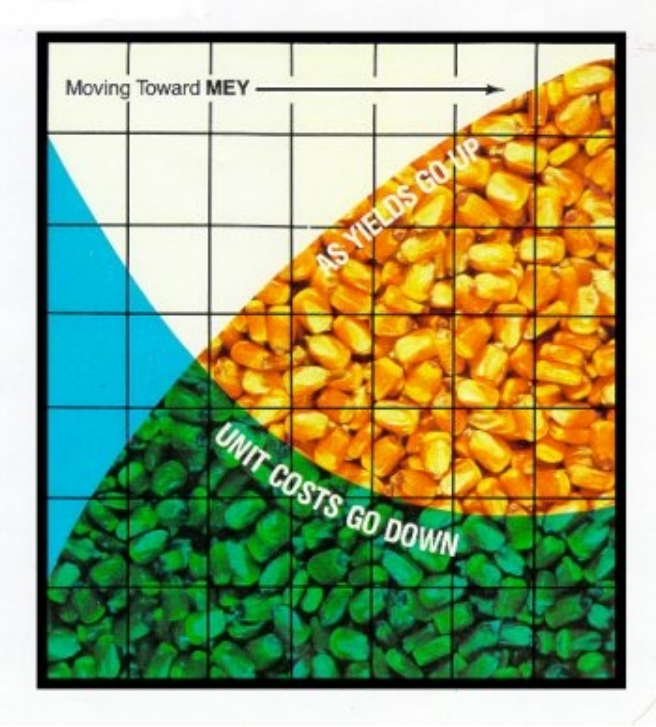
BMP Clubs Are a Success

Local dealers and farmer customers should consider forming a BMP Club. These clubs have proven very successful by allowing members, with similar interests, to exchange ideas and strive to meet challenging goals. Keep clubs small (no more than 20 members). Establish a formal agenda. Hold meetings on a regular basis with several of them out in the field during the growing season.

BMP Clubs help farmers make the transition from their previous system of farming to implementing a package of BMPs. Some important management steps to follow are:

1. **Start Small**: Set aside 10-20 acres as your BMP plot. Put the BMP package in place on these few acres. Expand as success is achieved.
2. **Apply the Total Package**: Utilize all of the BMPs that have been identified. Remember that variations of an identified BMP may be needed for site-specific conditions.
3. **Be Timely**: Timeliness of managing each step in producing a crop is a top priority. Timeliness costs nothing extra!

Adopting BMPs Provide the Potential to Achieve MEY



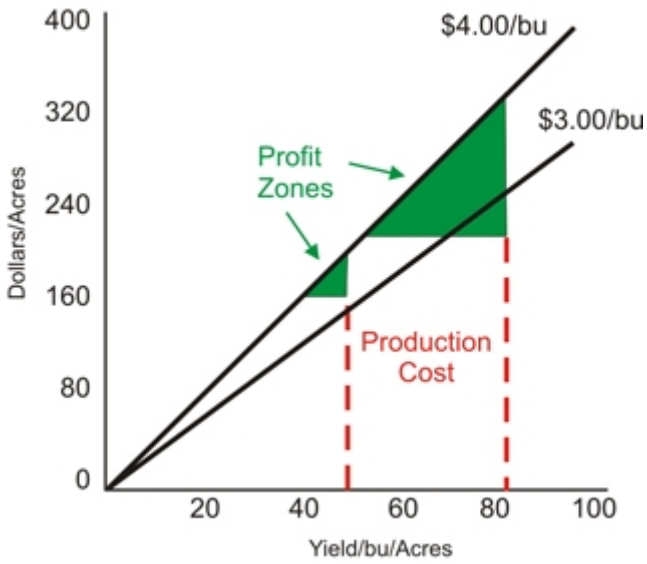
Moving toward MEY

Research, farmer clubs, and individual farmers have shown over and over again that yields increase when BMPs are integrated into a cropping system. Using BMP technology opens the door to achieving Maximum Economic Yields (MEY). MEY is that yield level which gives the highest profit. And that is the real purpose for being in the farming business...TO MAKE A PROFIT.

Profits increase with higher yields for a very simple reason: the unit cost of production declines as MEY is approached. MEY varies from year to year, and field to field. MEY is not a fixed target. However, farmers committed to adopting BMPs are on the right track to achieve their own MEY level.

Higher yields reduce unit costs because fixed expenses, such as those for land and machinery, do not change with yield and are spread over more bushels or tons of yields. Unit cost of production is a farmer's best single indicator of profit potential. As unit costs drop, there is a built-in protection factor against a fall in market price or when weather conditions may not allow an established yield goal to be achieved. A result from a BMP Wheat Club shows how this principle works. Yields were 85 bu/acre with a production cost of $207/acre for the BMP System compared to a yield of 50 bu/acre and $160/acre production cost for their previous management level.

For the BMP system and $4.00 wheat, yields could have dropped 33 bu/acre or market price decreased $1.56/bu before the farmer would have begun to lose money. The same wheat farmers using management practices with a 50 bu/acre yield potential, could only lose 10 bu/acre or suffer an $0.80/bu drop in market price before they would be at the breakeven level. With expected wheat prices at $3.00/bu, the BMP System still has a comfortable "profit zone" while the production system with a 50 bu/acre yield goal has no margin for profit. "Profit zones" expand as yields increase!



BMP wheat club data.

Use BMPs to Achieve MEY and Sustainability

A definition given earlier in this chapter contained three components that would need to be satisfied before a system would be considered sustainable. These three components were: (1) Adequate food, feed and fiber supplies; (2) A profitable system for the producer; and (3) Responsible safeguards for the environment.

BMPs do increase yield potential which is essential to meet the growing food, feed and fiber demands of the world's population. Fortunately, research continues to develop newer and better genetic material and other agronomic BMPs which will further increase yield potential as they are implemented into crop production systems. A concerted effort to utilize the latest BMP technology satisfies the number one component of sustainability---adequate production levels.

High yields and increased profit potential go hand-in-hand. A dedicated effort to use BMPs for all the controllable crop production factors helps assure that MEY can be achieved. Remember, MEY is that yield level which gives the highest profit — the second component of sustainability.

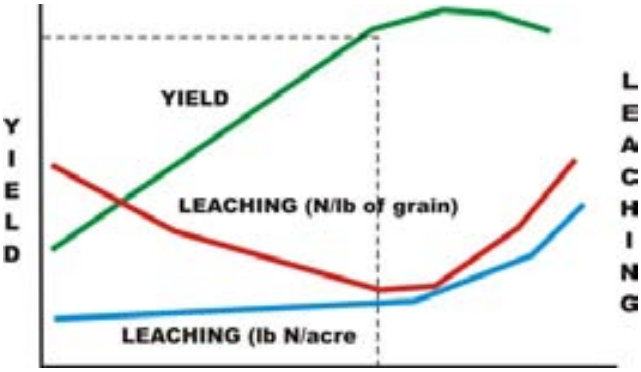
The implementation of new crop production technologies, soil management practices and other BMPs satisfy the third component of sustainability which is safeguarding the environment. The use of BMPs promotes a more vigorous, healthy and productive crop: A crop which develops greater root systems, more above-ground residue, reduced soil erosion, greater amounts of carbon assimilation, improved nutrient efficiency, build-up of organic matter, quicker ground cover, greater water use efficiency, and more resistance to crop stresses such as drought, pests, cold temperatures, or late planting. All these factors are associated with an improvement in environmental protection.

Higher yields through the use of BMPs means that fewer acres are required to produce our food, feed and fiber needs. This reduces the pressure to use the more fragile lands for agricultural production.

Harvested acres for 1991 in the U.S., for example, were 341 million. It would have required an additional 393 million acres to equal this production at the lower yield levels harvested in the 1950s.

Greater nutrient efficiency is an important environmental goal. Studies have shown that the amount of nitrate leached rises slowly compared with the increase in yield up to the fertilizer-N rate which corresponds very close to MEY. This is also the rate that gives the minimum amount of nitrate leached per unit of crop produced.

Leached N can increase markedly with excessive use of N above MEY. Where fertilizer-N is applied at rates that do not exceed MEY, its direct contribution to nitrate leaching is small. This chart illustrate how N efficiency corresponds very closely with MEY.



Relationship between MEY and nitrogen efficiency.

The BMP strategy is to establish the residual N available for the crop to be grown and add commercial N fertilizer rates sufficient to achieve the MEY goal. Crop residues and their management is an important environmental consideration. Crop residues increase with yield as can be seen from yield and crop residue production in 1973 versus 1992. Crop residues are decomposed through the action of soil microorganism with soil organic matter the end product. Crop residues are 45 percent carbon (C) which comes from the carbon dioxide (CO_2) captured during the process of photosynthesis. The level of organic matter in the soil increases as farmers implement more and more BMP conservation and agronomic strategies,

Crop Residues Produced by Various Crops

Crop	Yield 1973 bu/acre	Yield 1992 bu/acre	Residue for 1973 ton/acre	Residue for 1992 ton/acre
Corn	91	131	2.16	3.11
Wheat	32	39	1.22	1.55
Soybeans	28	38	1.09	1.48

Higher yields and the build-up of organic matter, as the result of BMPs, have several important environmental benefits. Among them are:

- Higher water holding capacity and water use efficiency.
- Higher nutrient holding capacity and nutrient efficiency.
- Reduction of atmospheric CO_2, a greenhouse gas with global warming implications.
- Increases in oxygen (O_2), a beneficial gas, released by the growing crop.

Using results from the 20-farmer BMP Wheat Club as an example, Table 4 shows some of the environmental advantages of implementing the BMP System.

Comparison of Environmental Advantage of BMP System with the Old Standard for Wheat Production

Components	BMP System	Old Std.	Environmental Advantage
Yield, bu/acre	85	50	—
Acres needed to produce 5,000 bu	59	100	41
N used, lb/acre	140	105	—
N Efficiency, bu/lb N	0.61	0.48	0.13
N Used to Produce 5,000 bushels, tons	4.13	5.25	1.12
N remaining in Ssoil after harvest, lb/A	29	40	11
Total CO_2 in crop, ton/acre	9.20	5.41	3.8
Total C in residue, ton/acre	1.51	0.89	0.62
Total O_2 released, ton/acre	6.69	3.94	2.75

The benefits are clear for those farmers who keep abreast of latest BMP technology and who introduce these BMPs into their site-specific cropping system. The reward is MEY crop production grown in an environmentally responsible and sustainable farming system.

LINKS TO OTHER EFU CHAPTERS			
• Appendices • Authors • Environment • Fertigation • Fluid Dry Fertilizers	• History of Fertilizer • MEY – Maximum Economic Yields • Micronutrients • Nitrogen • pH	• Phosphorus • Potassium • Soil Sampling • Secondary Nutrients • Site Specific Farming	• Soil Defined • Soil Testing • Tillage Systems