by F. Ronald Mulford and Dr. William J. Kenworthy

Systems Approach Produces Yield Gains

Crop rotations, combined with enhanced fertility, supplemental water, and appropriate variety selection, produce significant yield gains.

Summary: *Using a systems approach friendly to the environment, a three-crop/two-year no-till system has shown significant yield increases in a three-year FEE-sponsored research project conducted at the Poplar Hill Research and Education Facility in Quantico, Maryland. In each case, corn, wheat, and double-cropped soybean yields exceeded average yields obtained by top farmers in Maryland's Delmarva Peninsula. Instrumental in producing these superior yields were enhanced fertility, supplemental water, and appropriate variety selection.*

A popular rotation in the mid-Atlantic states includes corn, wheat, and double-cropped soy-beans. The three-crop/two-year rotation is ideally suited to the soils and climate of the area. Heavy users of the three crops are large livestock and poultry industries in the region. Research into increasing production levels of these crops is deemed useful because all three must be imported into this grain-deficit region to meet feed needs.

We began studying ways to improve wheat production in 1980 and have been able to produce yields over 100 bu/A each year, regardless of weather patterns. Other maximum economic yield (MEY) studies on corn and soy-beans have proven successful. In our three-year study, we have found that these higher yields can be *profitably* produced in cropping systems that protect the environment.

Exceeding average

As can be seen in Figure 1, the crops grown using the systems approach significantly outyielded averages in the Delmarva Peninsula.

Corn. Although the three-year aver-age for corn yield did not reach our MEY goal of 250 bu/A, it was almost double the average of the Delmarva Peninsula and significantly greater than that produced by top farmers.

Wheat Again, wheat yield fell short of our MEY goal of 125 bu/A, but, like corn, almost doubled the average of the Delmarva Peninsula and was significantly greater than that produced by top farmers. Many farmers are adopting the intensive wheat management system. Record state average yields the past two years reflect this change.

Soybeans. The '91 field-size systems study produced a yield below our MEY goal of 65 bu/A but was substantially higher than the peninsula average and 5 bu/A better than that of top farmers. Farmer yields with double-cropped soybeans have been historically low because of the relatively short growing season, low moisture supplies, and low fertility. To maximize yields, double-cropped soybeans must be planted as soon as the wheat is harvested, usually during the first week in July.

Fine-tuning

In our study, variables were looked at for each crop and those practices proving best for each crop were incorporated.

Corn. Ten corn hybrids (five mid-season and five full-season) were planted on May 14 in 15- and 30-inch rows with a final population of 31,000 plants/A. As can be seen in Figure 2, row and hybrid selection made a significant difference in yield results. Only the top and bottom hybrids are shown in the figure. Eight of the ten hybrids averaged over 10 bu/A more when planted in 15-inch rows. The fertilization program used for corn is shown in Table 1. Soil test levels for P and K were high in the plot area. The goal here was to apply the right amounts of nutrients at the optimum time for the most efficient plant uptake.

Wheat Factors we've found important to consistently high yields are 1) selection of high-yielding/disease resistant varieties, 2) following planting recommendations, 3) bringing nutrient levels into high range via soil testing, 4) scouting to control weeds, insects and diseases, *5)* using a growth regulator in combination with split N applications when needed, and 6) strict N management, including rate, source, and timing.

Table 1. Corn fertilization program for a three-crop/two-year rotation system, Mulford/Kenworthy, Maryland.

Application time and method	N	P_2O_5	K_2O	S	B	Mn	Zn	Cu
	lbs/A							
Preplant broadcast	60	40	40	20		6	2	2
With herbicide-preemergence					1			
Sidedress-5-leaf	110	20	60	10				
Sidedress-row closer	70	20	60	10				

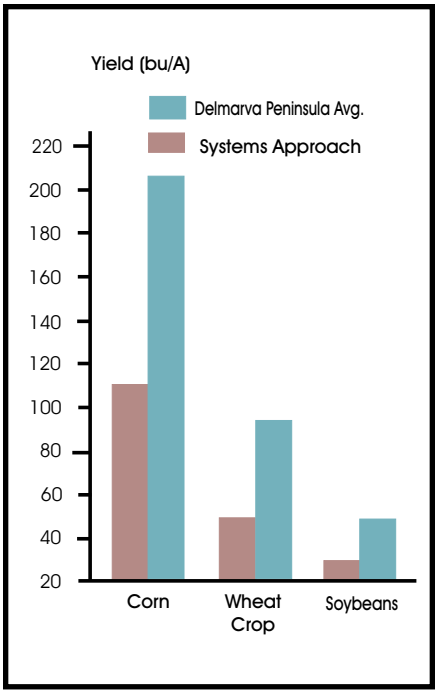

Figure 1. Yield comparisons, Delmarva Peninsula average versus three-crop/ two-year systems approach, Mulford/ Kenworthy, Maryland.

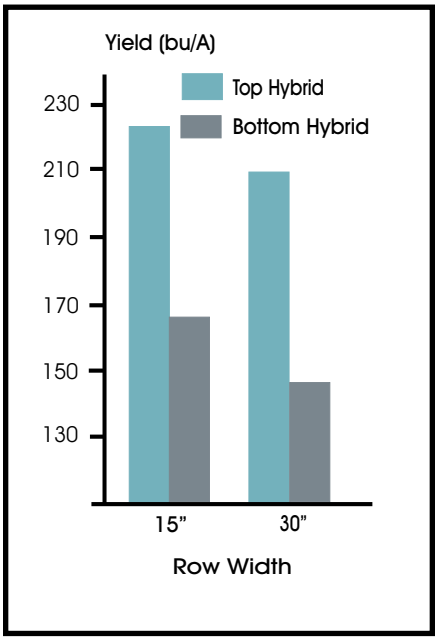

Figure 2. Yield response of corn hybrids to row spacing, three-crop/two-year systems approach study, Mulford/Kenworthy, Maryland.

Soybeans. The five varieties tested in the system were selected for their excellent yielding ability, but significant yield differences occurred. In 1991, five varieties averaged 56 bu/A with irrigation and 46 bu/A without. Similarly, MEY systems showed a significant yield increase over conventional systems. Our results showed that maturity was delayed about four days by irrigation, with a beneficial lengthening of the seed-filling period. Row spacing is another important cultural practice that has a significant effect on double-cropped soybean yields. We used spacing of 15 inches in our studies, with a seeding rate of six seeds/ft or about 209,000 seeds/A. Several fertility practices have been studied. One variable is direct fertilization of the soybeans. Results to date, where high soil test levels for P and K are maintained, show that farmers have the option of applying the total two-crop P and K requirement to wheat. We continue to experiment with N applications on soybeans.

Rotations

Rotation studies conducted at Poplar Hill to evaluate several cropping systems have shown that no-till corn planted into a wheat and double-cropped soybean stubble continuously produces the best yields. This includes yields of corn planted into a winter cover crop of hairy vetch. This is significant. No expense is involved for the wheat/soybean stubble, which provides a natural mulch following harvest of the two crops. Compare this to the cost for establishing a legume winter cover crop. Rotation also provides a wheat crop following corn, which takes up around 30 to 35 lbs of residual N not used by the corn.

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