Dr. Julian Smith

Residue Management In West

Problems peculiar to region provide a host of challenges to western conservation tillage growers.

Summary: *Western crop residue management matches the success of other regions in erosion control and water conservation, yet remains different in practical appli\cation due to crop rotations, climate and irrigation. This underscores the role of the site specific approach in modern fanning, particularly with the advent of watershed and ecosystem management concepts. Crop residue management practices, fur example, are an excellent companion to riparian filter strips; but what works in the eastern U.S. may have little practical relevance to the arid regions of the West, and vice versa. The key to reaping substantial economic and environmental benefits for growers and dealers has been by learning how to successfully implement crop residue management as an integrated system under the varied conditions of the West. Coupled with some excellent research and extension resources, ample opportunities remain for enterprising farmers and their dealers.*

According to the Conservation Technology Information Center, crop residue management is practiced on over 60 percent of the planted acres in the United States. Crop residue techniques include true conservation tillage (over 30 percent of soil surface covered by residue after planting) such as zone-till, no-till, ridge-till, and mulch-till. Other reduced tillage types that leave between 15 and 30 percent residue after planting also count as crop residue management. Residue management has steadily increased across U.S. farmland since the early 1980s. Though this trend includes western regions of the country, peculiarities of climate, cropping, and water management have presented a variety of crop residue management challenges for western growers and dealers.

Crop profile. True conservation tillage, notably no-till and ridge-till, predominates in the corn/bean cropping systems of the eastern and Midwestern U.S. In the western U.S., there is a transition to mulch-till and other reduced tillage forms of crop residue management, reflecting the predominance of small grains and row crops (such as potatoes and sugar beets) in western crop rotations. Western crop residue management, therefore, is different from that of the Corn Belt, yet it is effective.

Erosion. Crop residue management practices are extremely effective in reducing water erosion and runoff, and wind erosion of agricultural lands. In the drier regions of North America, improved moisture storage is an important additional benefit. The efficacy of western reduced tillage practices, however, is well documented by data of the Natural Resource Conservation Service (NRCS). According to area agronomist for the NRCS in Idaho, Carrie Smith, the state is on or ahead of schedule in executing conservation plans for Idaho's most erodible cropland. The NRCS estimates that when Idaho conservation plans are in place, erosion on highly erodible lands will be reduced by over two-thirds— from an estimated 18.1 tons/A prior to the Farm Bill to 5 tons/A annually. Clearly, growers are making tremendous progress in reducing soil erosion. As might be anticipated, gradual changes in farming practices have been minored by sound research and development in both public and private sectors.

Adaptability. That the western U.S. residue management programs are different from well documented Corn Belt systems is well demonstrated by dealer experience in Idaho. The famous potato crop predominates in the fertile, irrigated Snake River plain. At the eastern edge of the plain, dryland grain is the crop in the foothills of the western Rockies to altitudes of 6,000 feet. Brian Davis, unit manager for Simplot, services both dryland and irrigated producers in the area. He has noted a continual growth in crop residue management practices that started with dryland grain crops in the early l980s. Growers appear to be adapting dryland conservation practices to irrigated crops. Most problems, he explains, seem to be associated with the levels of residue under irrigation. Differences in residue from a 20- to 40-bu/A dryland grain

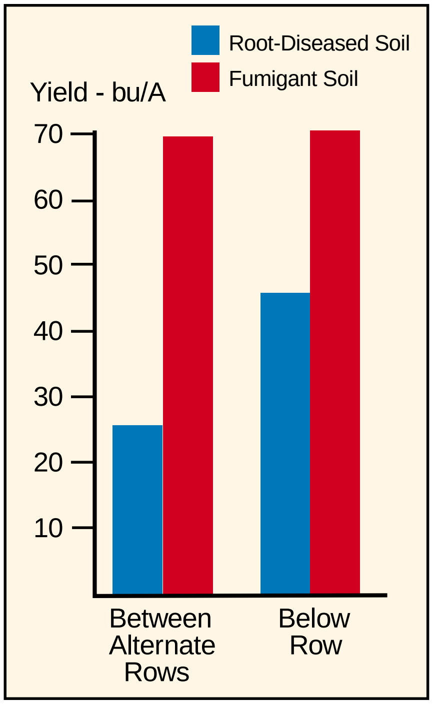

Figure 1. Effect of fumigated soil (vs. soil with root disease) on spring wheat yield, comparing two placement methods, Pullman, WA 1990.

crop and a 120-bu/A-plus irrigated crop are obvious. Davis sees the trend to residue management continuing.

Weed/disease management. As reported by Veseth, early control of volunteer grains and weeds between harvest and spring planting has been identified as another important component in crop health management strategies under no-till in the Pacific Northwest. Research has shown that roots of volunteer grain and weeds growing between harvest and planting of the spring crop can serve as a 'green bridge" host for root diseases to attack spring crops under conservation tillage, particularly with direct seeding. In the past, a common practice with seeding of spring cereals in conservation tillage in the Northwest has been to spray volunteer grain and weeds shortly before seeding with a non-selective herbicide such as glyphosate. The short interval served to increase the potential for some root diseases, particularly Rhizoctonia root rot, Pythium root rot, and take-all. Researchers are finding that earlier control of the "green bridge," beginning ideally in the fall after harvest and at least two to three weeks before spring seeding, sharply reduces root disease potential and commonly increases yields 20 to 50 percent, compared to letting the "green bridge" grow until shortly before planting. Continued R & D research in weed control needs to be coupled with an evaluation of the potential for disease levels and the subsequent design of control measures that are tailored to crop residue management systems.

The importance of controlling root pathogens, in conjunction with weed control, is amply demonstrated in Figure 1. Note how placement makes a big difference in spring wheat yield where there is root disease and virtually none where a soil fumigant is used to eliminate root pathogens.

Crop rotation. Reduced tillage acres serviced from Blackfoot have been mostly continuous grain. However, some progressive growers are evaluating reduced tillage options and residue management for other crops, including potatoes. Growers of row crops under irrigation have some interesting crop residue management hurdles to overcome. For example, Shane Boden, a Simplot unit manager who works the Rockford area, which has little or no dryland grain, finds that residue management for his customers is confounded by row crop rotations.

The nature of seedbed preparation and harvest of potatoes and sugar beets means that soil disturbance is inevitable and crop residues are reduced, compared with continuous grains.

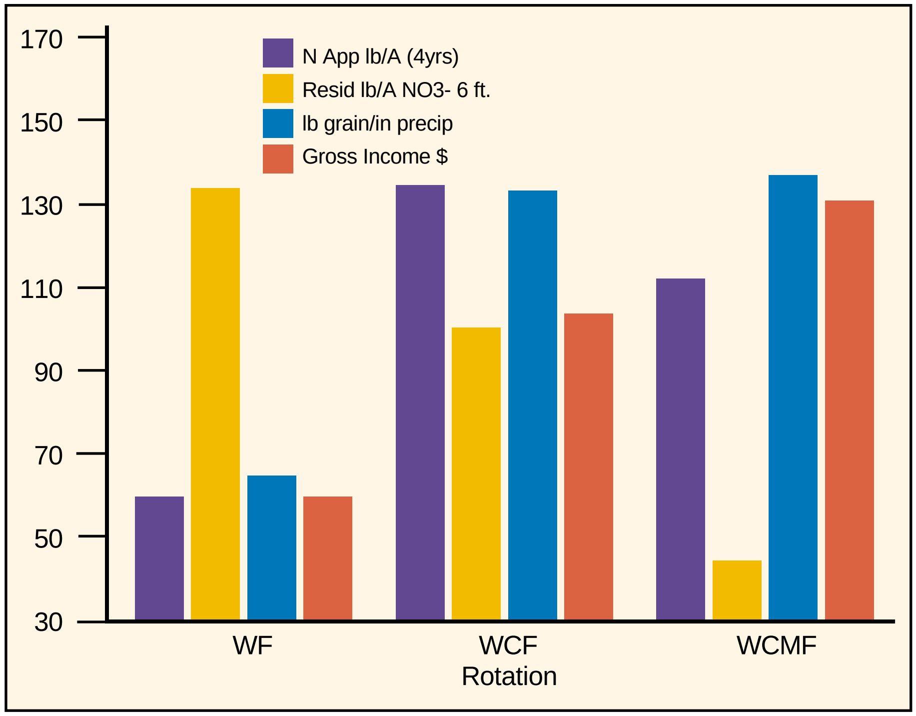

Figure 2. Influence of dryland rotation on income, water use efficiency, and residual N, Westfall, et al., 1991. WF = wheat-fallow; WCF = wheat-corn-fallow; WCMF = wheat-corn, milo, fallow.

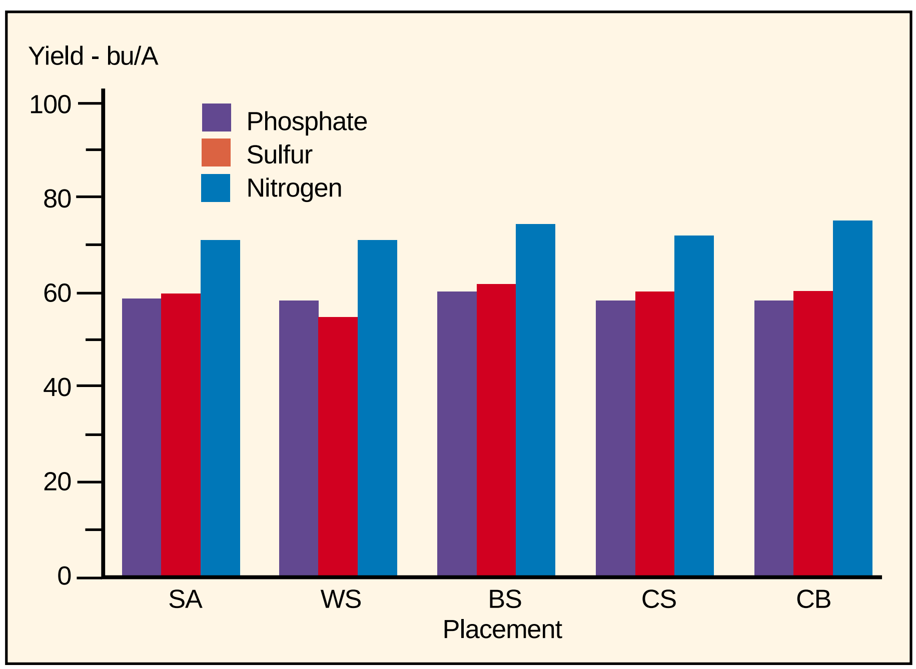

Figure 3. Winter wheat yield response to fertilizer placement averaged over N rates (1983-84) and P and S rates (1985-86) at three locations in northern Idaho. SA = surface-applied, WS = with seed, BS = below seed, CS = row centered-seed depth, CB = row centered-below seed.

An excellent example of the marriage of sustainable systems research and long-term agronomic ramifications is the dryland agroecosystem project of Colorado State University. In this study, no-till practices allow for up to 35 percent greater retention of moisture, such that 16 inches of rain can sustain a greater cropping intensity over the traditional wheat/fallow rotation. Fertilizer is an important tool in this system. Greater residue production and subsequent management through tillage improve the economics of the rotation, yet reduce potential for N loss (Figure 2). Data from this study will tell us a great deal about the long-term effects of intensive cropping in the arid western Great Plains region.

Veseth further notes that instead of trying to make one tillage and planting system work in all crops in annual rotations, most growers are typically rotating tillage systems along with the crop rotation. They are direct-seeding where they have the greatest chance of success, typically after low residue crops such as peas, lentils, canola, winter rape, and other spring crops. After high-residue crops, particularly winter wheat, growers are gradually beginning to switch from the traditional fall moldboard plow to fall chiseling and using other combination tillage implements in minimum or reduced tillage systems.

Environment. A Solutions to Environmental & Economic Problems (STEEP) study on no-till winter wheat seeded after spring peas or lentils in northern Idaho helps emphasize the fact that fertilizer placement can be overshadowed by soil, environmental or other factors. Five forms of application evaluated were: 1) surface, 2) with seed, 3) two inches below seed, 4) centered between 12-inch rows at seed depth, and 5) centered between 12-inch rows two inches below seed depth. The researchers found no advantage of applying fertilizer in one position over the other. The results were often site specific, varying between locations and years. Figure 3 summarizes the yield results of the four-year study averaged over all application rates. Compared to the other placement options, nitrogen centered between the rows and placed below the seed had a 3-to 4-bu/A advantage. Sulfur placed with the seed reduced yields by 5 to 7 bu/A when compared to other placements, probably because of dry conditions at two locations in the 1984-85 crop. Some general conclusions made were: I) fertilizer placed on the surface tended to stimulate weed production, 2) fertilizer with the seed tended to be associated with lower overall yield, 3) sulfur placed with the seed decreased emergence at two locations when soil water content was relatively low, 4) the first 20-lb/A increment of phosphorus produced virtually all the yield increase observed, 5) a split fall-spring nitrogen application generally resulted in highest yields.

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