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OPPORTUNITIES FOR CROP ROTATIONS WHEN WATER IS LIMITING

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The potential benefits of crop rotations are well recognized around the world. In most environments rotations benefit all components of the cropping system from both agronomic and economic perspectives. However, in water-limited environments where cotton is the primary crop, rotations with other crops should be carefully evaluated. For example, in West Texas where nearly 5 million acres of cotton are grown annually and rainfall ranges from 26 inches on the east side of the Rolling Plains to 16 inches on the west side of the High Plains region, efficient and profitable use of this limited resource is the major concern. Under dryland conditions, one must critically evaluate the ability of the rotational crop to use the rain effectively and profitably and to result in a significant benefit to the subsequent cotton crop. Rotational crops currently used in this environment include winter wheat and grain sorghum. In the Rolling Plains, winter wheat can provide grazing opportunities for stocker cattle with the opportunity to go to grain if the spring rains allow. The wheat stubble would be summer-fallowed allowing soil water to accumulate for the cotton crop next year. If spring rains don't occur in early March, the wheat crop can be chemically terminated and cotton planted in May-June. Summer rain averages 14 inches and can make a reasonable dryland cotton yield. The central and southern Rolling Plains has a problem with Cotton Root Rot (*Phymatotrichum omnivorum*). However, continuous grain crop production for three consecutive years followed by cotton is required to appreciably reduce the incidence of this disease in these areas, and this is not an economically viable option. Evaluation of tillage and rotation crops in the Rolling Plains reveals that reduced tillage results in higher cotton yields, but no significant impact of rotation crop on cotton yields existed. Continuous cotton using reduced tillage produced the greatest yields and profit. On the Southern High Plains, winter wheat is not a viable option due to very low precipitation probabilities in the winter months. Grain sorghum fits the rainfall pattern much better. A large percentage of the dryland acreage on the Southern High Plains is designated as highly erodible land (HEL) and by law must have a high residue crop on a certain percentage of the total area in order to continue participation in USDA farm program benefits. The dryland cotton acreage is largely planted in a 2x1 skip-row pattern. By planting solid, one can use the 33% of the land area, currently in the blank row, for grain sorghum and benefit from both agronomic- economic and legal perspectives compared with continuous skip-row cotton. This concept has been evaluated for the past 10 years. The solid-planted cotton-sorghum system produced 90% of the cotton yield as the continuous skip-row cotton, produced additional income from grain production and allowed for conservation compliance for highly erodible land. The bottom line for the cotton-sorghum system was just slightly greater than for the continuous skip-row cotton system. The only real benefit was compliance with HEL requirements and continued participation in the Farm Program.

Under irrigated conditions, we sell irrigation water through our commodities. Therefore, economic water use efficiency plays a major role in use of crop rotations in irrigated production systems. Irrigation water supplies across much of the Southern High Plains are usually not adequate to meet the crop water use demands of summer grain crops such as corn or sorghum which require almost twice the total irrigation water to produce maximum yields as cotton. Grain crops also require more water per day during peak demand periods than cotton. Irrigated corn and sorghum acreage has greatly diminished the past 10 years in this region. More importantly, the economic return per dollar spent irrigating a summer grain crop is not comparable to that for cotton. Some winter wheat is grown for grazing, then terminated, and cotton planted into it. However, the wheat crop seldom gets started early enough in the fall, following cotton harvest, to provide much grazing until late in the spring. Soil water depletion by the wheat crop and its effect on the subsequent cotton crop are major concerns. Peanuts are grown in rotation with cotton on the sandy soils in the Southern High Plains and Northern Rolling Plains and provide both agronomic and economic advantages to cotton producers. Peanuts produce about 250 pounds of nuts per inch of water returning about $50/inch. However, the peanut acreage is limited to less than 200,000 acres due to both water requirements and cost of production concerns.

In summary, in water-limited environments the use of rotational crops are very limited in choice when compared with continuous cotton. Regulatory requirements for highly-erodible land is the major factor causing use of grain crops in rotation under dryland conditions. With modern, highly efficient water application systems, continuous irrigated cotton uses this limited resource with the greatest efficiency and is the most profitable production system available.