LAND LEVELING AND CROP PRODUCTIVITY

Precision land leveling to facilitate surface drainage and uniform distribution of irrigation water in the Delta results in severe soil disturbance. Alteration of soil physical, chemical, and biological properties can be associated with even shallow land leveling activities.

Short-term crop yields following land leveling generally decrease. However, over the long term the practice will increase crop yields, presumably because of more efficient drainage and water management.

Either rice or soybeans are typically planted in fields following land leveling. It is generally accepted that rice is preferred in the first year because the flooded soil environment used in its culture should enhance nutrient distribution and availability to its fibrous root system. However, soybeans may be grown immediately following land leveling to maintain a crop rotation. Soybeans are known to be sensitive to prolonged wet-soil conditions and are perceived to be more sensitive than rice to disturbed soils with altered soil fertility.

Studies conducted in Mississippi and Arkansas have shed light on how land leveling affects soil properties and crop productivity immediately following land leveling. All of the studies were conducted on Delta alluvial soils that are commonly used for rice and irrigated soybean production.

On Alligator and Sharkey soils in Mississippi (Walker et al., Agron. J., 2003), rice yields were lower from cut areas than from filled areas in five of seven on-farm trials. The percentage of yield loss from the cut areas compared to the filled areas was directly proportional to the volume of soil moved per acre during the land-leveling process.

Average values for measured soil chemical properties in the cut and filled areas were deemed sufficient for rice production. Therefore, yield reductions in the cut areas were not related to soil nutrient deficiencies resulting from land leveling. Evidently something other than soil nutrient levels caused the difference in yields between cut and filled areas.

In another Mississippi study conducted on Sharkey soil (Walker et al., Crop Management, 2007), rice nitrogen fertility recommendations that are based on clay soils that have not been disturbed by land leveling were found to be sufficient for the cut areas of land-leveled fields. Thus, cut areas of fields with clay soils can be fertilized with the same nitrogen rates recommended for rice grown on non-cut areas.

In Arkansas studies (Brye et al., Plant and Soil, 2004; Brye et al., Crop Management, 2004; Brye, Crop Management, 2006), land leveling did not cause enough surface compaction to result in a positive soybean yield response to deep tillage in the first year. Also, the addition of fresh poultry litter did not produce a short-term soybean yield response on clay soil. In the second year after leveling, neither deep tillage nor poultry litter positively affected rice yields.

Crop growth and productivity following land-leveling could not be predicted from post-leveling soil properties. This is similar to Walker's findings in Mississippi. Brye and colleagues also concluded that crop response to leveling of clay soils that are uniform with depth is different from the response on silt loam soils that have more stratified subsoil properties.

Post-leveling, preplant soil properties were not significantly related to first-year soybean productivity or second-year rice productivity

following land leveling. Thus, assessment of soil properties following land leveling cannot be used to reliably predict crop performance in land-leveled fields.

In summary, soybean and rice productivity immediately following land leveling generally will be reduced. These yield reductions seem to be directly related to the volume of soil moved from cut areas.

Yield reductions resulting from land leveling cannot reliably be predicted from changes in soil chemical and physical properties. Also, an increase in bulk density (a measure of soil compaction) on land-leveled clay soils apparently is not enough to justify remediation by tillage.

These results from the cited studies lead to the following conclusions.

- Severe soil disturbance by land-leveling may negatively affect short-term productivity of both rice and soybeans. Contrary to popular opinion, there does not appear to be an advantage from planting one crop vs. the other following the operation.
- Visual evidence suggests that the soil surface following land leveling should be tilled and land-planed to get rid of small depressions which will adversely affect surface drainage. This is especially important when soybeans will be the first crop planted.
- Soil fertility recommendations for rice grown on non-disturbed fields seem to be appropriate for leveled fields.
- When soybeans follow land leveling, seed should be inoculated with nitrogen-fixing bacteria, and irrigation should be applied as needed to reduce the possible negative effect from leveling.

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