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Tillage implement design and its effect on soil

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Tillage implement design and its effect on soil

Abstract

The weather is gradually improving and most Iowa producers are getting closer to working in the field. Some have already started fieldwork. However, there is still time to finalize preparation of tillage implements for spring fieldwork. Producers are encouraged to check and evaluate the design of soil-engaging components of their tillage implements, assess the potential for soil erosion, and think about their chances for a successful crop.

Keywords

Agronomy, Agricultural and Biosystems Engineering

Disciplines

Agricultural Science | Agriculture | Agronomy and Crop Sciences | Bioresource and Agricultural Engineering

INTEGRATED CROP MANAGEMENT

A photograph of a person in a field, overlaid with large, stylized text. The text 'INTEGRATED CROP' is in green and 'MANAGEMENT' is in white. The background shows a person in a field with tall grasses.

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However, there is still time to finalize preparation of tillage implements for spring fieldwork. Producers are encouraged to check and evaluate the design of soil-engaging components of their tillage implements, assess the potential for soil erosion, and think about their chances for a successful crop.

Why adjusted tillage implements improve crop performance

No matter what the goal for spring tillage -- spreading residue evenly, preparing the seed bed, incorporating herbicides, or preparing for the next crop in rotation --, a properly adjusted and properly used tillage implement will result in fewer trips to the field, better management of the quality and performance of the crop, and hopefully lower potential erosion.

Tips: Primary tillage

Straight, narrow teeth or shanks (2 inches wide) on a chisel plow allow for deep penetration into the soil, with the least turning of soil and burying of residue of any primary tillage implement. Changing to twisted shanks increases soil mixing, buries more residues, and leaves the soil exposed to erosion.

There have been a lot of discussion and research lately, regarding the benefits of deep rippers. If deep ripping is used for treating real soil compaction, the use of a ripper in dry soil conditions is recommended. However, because best results occur in dry soils, this operation may be best suited as a fall practice rather than a spring tillage investment. With very narrow blades or shanks that penetrate the soil from 12 to 14 inches, deep rippers loosen the soil in fractured planes running diagonally from the tip of the tool to the soil surface, break the compacted soil layer, and allow for the development of dense root systems. Heavily rooted plants gain greater access to subsoil moisture and nutrients throughout the soil profile.

But remember, primary tillage is focused on soil fracturing and, while loosening the soil, it will destroy soil structure and bury a great deal of crop residue--particularly those fragile ones such as soybean residue--, leaving the soil exposed to erosion. Primary tillage operations should be the last choice when improving soil productivity.

Tips: Secondary tillage

When it comes to secondary tillage -- preparing the soil seed-bed for planting -- most farmers use a field cultivator. Field cultivators come equipped with a variety of soil-engaging points, from narrow tines to wider shovels and sweeps.

Tines, shovels, and sweeps come in many shapes and sizes. The shape determines what the soil-engaging points do in the soil: narrow tines tend to fracture the soil, wider sweeps tend to lift and mix surface soil and residue, and are commonly used for chemical incorporation. Setting a blade at a sharper angle (or 'pitch') usually means that more soil will be disturbed. Implement weight is supported by the underlying soil. Therefore, wet and nearly-saturated soil can be compacted underneath the secondary tillage.

Other issues

Shank spacing on the implement, as well as operating speed and operational depth, all influence how much residue will be buried by any tillage implement. Increased depth and to some extent faster speeds translate into more soil being thrown over the crop residue.

Consistency in maintaining the soil-engaging points on tillage equipment is also important. Proper adjustment of only half of the blades on any implement means that the implement will be only 50 percent effective in each tillage pass. Therefore, proper maintenance and adjustment are keys to achieving the desired results. It is well worth the time it takes to properly set up, test and adjust the equipment, and check it daily, rather than just rolling hard and fast through the season, trusting to luck.

Conclusion

Knowing your tillage implements and their settings can go a long way in establishing a good seed bed, sufficient seed-to-soil contact, and hardier and more profitable crops. These techniques require fewer trips through the field, lower the levels of waste of fertilizers, and leave the soil better prepared to withstand erosion.

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