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NF95-243 Soil Compaction Tips

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Soil Compaction Tips

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Generalities

1. In a single year, nearly 90% of a field is compacted by normal field operations using a conventional tillage system.
2. Compaction can reduce yields up to 60% depending upon the depth of compaction and its severity.
3. Compaction has been shown to persist up to 9 years when it is very severe and deep in the soil profile; persistence for three to four years is common.
4. Research shows that 80% of soil compaction from wheel traffic occurs on the first pass of a tire.
5. In a Nebraska survey from the late 1980s, about 40% of fields had some compaction; only about 10% of the fields had compaction severe enough to cause yield reductions.

Machinery and Operational Practices

6. Improperly adjusted packer wheels can compact soil around the seed restricting much of the root growth to the top 4 inches of soil; this is especially true with wet soil conditions.
7. In-row ripping during the growing season tear crop roots and increase water evaporation from soils; this usually results in significant yield reductions.
8. Heavy axle loads can create compaction to depths of 3 feet.
9. Country roads often have axle load limits of 10 ton while large combines or grain carts, when fully loaded, can have axle loads up to 40 ton.
10. Confining wheel traffic to specific traffic lanes in a field is an excellent way to manage compaction.
11. Adding dual tires, fluid to tires, and wheel or front weights increase axle load and the potential for compaction.
12. Deep compaction is primarily controlled by axle load whereas surface compaction is controlled by tire-soil contact pressure.
13. Dual, as compared to single, tires reduce tire-soil contact pressure but increase the total area of soil being compacted.
14. Tillage implements, as well as wheel traffic, can cause compaction.
15. Small amounts of compaction can improve traction and reduce slip.

16. Harvest equipment is heavier than tillage, planting, and most fertilizing equipment; thus, it can compact soil the most.
17. Subsoiling soils when they are at or above field capacity may create more compaction rather than eliminate it.
18. Subsoiling followed by the "usual" field operations can easily recompact soil to the same or greater pre-subsoiling levels of bulk density and soil strength.
19. Costs of subsoiling are typically $10 or $15/acre.
20. Deep tillage of a severely compacted soil can require 40 to 60 PTO hp/shank to adequately breakup a compacted zone.
21. Deep tillage should be 50% deeper than the bottom of a compacted zone.
22. No-till is a good option for minimizing compaction because it eliminates many field operations and allows more flexibility in required field operations, thus avoiding wheel traffic on wet soils.
23. To minimize compaction at harvest, unload grain from the combine at the end of the field or at a traffic lane established across the field, rather than on-the-go.

Soil Environment and Water Availability

24. The ability of a soil to compact depends on soil texture, bulk density, soil water status and the weight of the compactive force — machinery, people, animals.
25. Medium textured soils having a blend of sand, silt and clay particles are more likely to compact than are soils that are almost pure sand, silt or clay.
26. Soils are most prone to compaction when the soil water status is near field capacity.
27. Repeated cycles of freezing and thawing over the winter can be very effective in eliminating surface compaction found in the top 4 inches of soil.
28. Grazing livestock on dry or frozen soil will not create compaction.
29. Maintaining crop residue on or near the soil surface will help "absorb" some of the compactive forces from wheel traffic.
30. Cracks which develop when soil is dry serve as channels for root growth and water movement to deeper depths in compacted soil.
31. Tensiometers used in irrigation scheduling often give false readings because roots are not present at the tensiometer depth to extract water; thus, tensiometers indicate adequate water while plants are stressed.
32. Compaction is measured in terms of bulk density and soil strength. Soil strength measurements are influenced by soil water content but bulk density measurements are not.
33. Dry soils can be hard but this does not necessarily indicate that the soil is compacted.
34. Soils that naturally have a high bulk density cannot be improved much by subsoiling.
35. Compaction of the tilled zone can accelerate water runoff and soil erosion on steep land.
36. Sandy soil may benefit from a small amount of compaction because drainage will be slowed.
37. Crusting is one type of compaction; it tends to be worse in fields where residue is not maintained on the soil surface.
38. Water will not likely get to the end of the run, at least in the first irrigation, when furrow irrigation is applied to a field that has been deep tilled.
39. Root and earthworm channels are not disrupted in no-till systems so channels can serve as paths for new root growth, and water and nutrient movement through compacted soil zones.

Plant Response and Management Strategies

40. Compaction can influence plant nutrition, pest problems and control as well as plant growth.
41. Many management alternatives are available to reduce or eliminate soil compaction — crop rotation, reduced tillage, controlled wheel traffic, increase soil organic matter content, stay off wet

soils, and deep tillage/subsoiling.

42. Winter wheat is a good crop to grow before subsoiling because a long period of dry weather and dry soil is usually available to perform the operation.
43. Penetrometers are used to evaluate soil strength; there is no specific numerical soil strength value that identifies compaction as root or yield limiting.
44. There are many visual symptoms of soil compaction that can be observed in the field — dark soil streaks, ponded water, accelerated runoff, increased power requirements, excess soil moisture, delayed crop emergence and poor crop growth, crop color, abnormal root development, and early plant water stress.
45. Crop yield increases after subsoiling depend on precipitation and/or irrigation; the greater the water availability the smaller the increase in yield due to subsoiling.
46. Soil compaction can be identified by washing crop roots, digging holes in the field and near the fence row, and using a penetrometer or soil probe.
47. Slight and moderate compaction will not typically affect yield; however, management practices should be changed to minimize the development of further compaction.
48. CRP fields should have no compaction because of the lack of wheel traffic and tillage over a 10-year period.
49. To determine if soil compaction is really a problem, holes must be dug in the field to visually inspect the growth patterns of crop roots; the crop is the ultimate integrator of the soil environment.
50. Ask for help in assessing soil compaction before making a costly decision by your action or inaction.

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