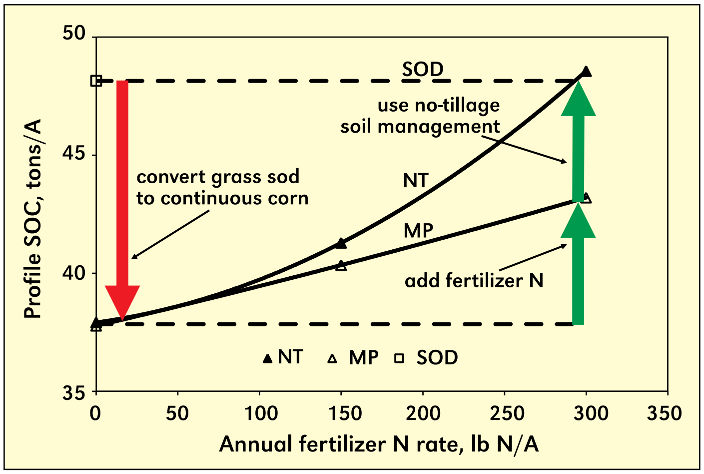

Figure 5. The impact of fertilizer N on total profile SOC levels found after 39 years of cropping to continuous corn with a winter cereal cover crop.

in the upper 12 in. of soil. Fertilizer N rate influenced profile SOC to a depth of 20 to 24 in., probably because of greater root growth with N fertilization **(Figure 4)**. The surface 4 to 8 in. of soil exhibited the greatest SOC response to fertilizer N rate. The unfertilized sod exhibited the greatest SOC, primarily because of the large amount (16 tons/A) found in the surface 4 in. of soil.

Interpretation/Conclusion

Figure 5 summarizes our findings. Profile SOC was as low as 38 tons/A, where corn has been grown without N fertilization, and regardless of tillage system. Profile SOC was as high as 48 tons/A, under the unfertilized grass sod and also where NT corn was grown with an agronomically excessive annual N fertilization rate of 300 lb N/A/year. Without N fertilizer, conversion of grass sod to continuous corn, with a winter cereal cover crop, has resulted in about 20% less SOC. At 150 lb N/A/year, the corn soils contain about 15% less SOC than the sod. Plow tillage has an increasing impact on SOC with greater fertilizer N rate, resulting in 10% less SOC at 300 lb N/A/year.

The agronomic evidence indicates that fertilizer N is needed for adequate yield and that the need for supplemental N nutrition has become greater with time and tillage. The greater need for added N is due to reduced soil N release from the SOM reservoir, itself diminished by both time and tillage.

There was no evidence that fertilizer N caused SOM loss. With NT and a winter cereal cover crop, 150 lb N/A/year appears to sustain corn yield, but it appears that more fertilizer N will be needed to sustain MP corn yield. Tillage-caused losses of SOM are outpacing N derived gains, at 150 lb N/A/year. The loss of SOC was more associated with agroecosystem change, than with tillage. The gain/maintenance of SOC was most associated with N fertilization, which presumably increased crop and winter cover crop dry matter formation, and with no-tillage, which conserves that carbon-laden material.

Well-informed soil management should cause, as much as is practical, SOM to be maintained/replaced. Soil management science should acknowledge, rather than confuse/confound, the roles of different practices, acting over different time frames. The oxidative practices (drainage, tillage, and fallow), the reductive practices (photosynthesis, immobilization, and denitrification), and the mass transfer practices (additions of compost, manure, etc.; removal of grain, stover, etc.) all contribute to the SOM we have today.

On this soil, crop productivity and C sequestration are intimately linked agroecosystem services – services fostered by management practices appropriate to this soil – no-tillage and fertilizer N application. BC

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