International Conservation Agriculture

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5 Reasons to Re-think Your Opinion of Conservation Agriculture

December 8, 2014 in Uncategorized | Tags: agriculture, CA, climate change, conservation agriculture, ecosystem services, no-till, soil carbon, soil health, sustainability, zero-tillage | by cornellconservationagriculture | Leave a comment

Last month, the article, “Productivity limits and potentials of the principles of conservation agriculture,” published in Nature by Pittelkow, C. et al. generated great interest and controversy in the scientific and farming community alike. The study, which conducted a global meta-analysis using 5,463 paired yield observations from 610 studies compared no-till, one of the pillars of conservation agriculture, with conventional tillage practices across 48 crops and 63 countries, and found that no-till reduces yields. The article also revealed that combining no-till with the other two conservation agriculture principles of residue retention and crop rotation, minimized its negative impacts and in rainfed and dry climates crop productivity was significantly increased with no-till, suggesting that it may become an important climate-change adaptation strategy for ever-drier regions of the world. The full article can be found here.

The CA Cornell Group was contacted by several CA experts who were looking to find an outlet for their insight on the findings of the *Nature* article, and their viewpoints are featured here.

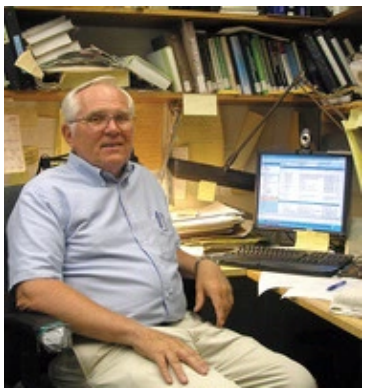


Photo credit: AgWeek

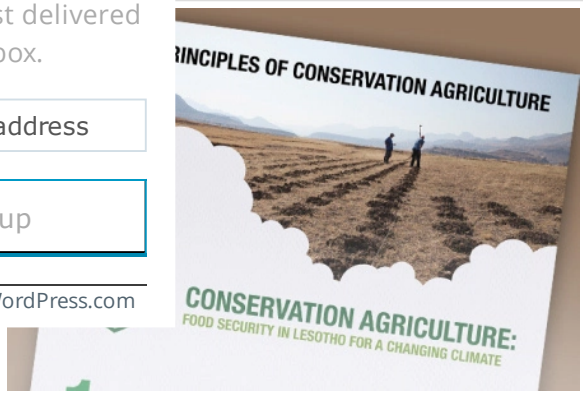
Don Reicosky is a soil scientist emeritus of the USDA Agriculture Research Station and has won international recognition for his ground-breaking work on tillage-induced carbon dioxide loss, carbon sequestration, and other related research.

Reicosky commends the thoroughness of the study. The paper did confirm and provided proof that no-till alone does not work well in all locations. Much of the research reported in the article provided the data, lessons and impetus to consider continuous crop residue cover and diverse crop rotations and/or cover crop mixes to provide a proper carbon balance in the CA system. The paper should serve as a “wake-up call” to the CA comm[illegible]oved definitions of methods used in CA research and better commu[illegible] environmental benefits to the broader commu[illegible]es with Pittelkow et al. (2014):

*1. **Too much emphasis on no-till: Is it ti***

The authors place undue emphasis on no-till[illegible] addressing all the principles of conservation agriculture will no-till be a succ[illegible]o-till as **the original and central**

concept of conservation agriculture, which i
years ago. More farmer experience has dis
continuous crop residue cover is more impo
soil disturbance. In fact, there are three fact
conservation agriculture that must be evalua
analysis: a) continuous crop residue cover; b
soil disturbance; and c) diverse crop rotatio
multiple species of cover crops for maximur
capture of carbon to nurture the living biological system.



FAO Bulletin: 3 Principles of Conservation Agriculture

2. ***Is it all the same? The tillage terminology dilemma***

One concern is related to the "tillage terminology dilemma".
Many research articles in the previous 40 years did not explicitly describe the amount of soil disturbance in the no-till system. To some, no-till simply means no plow. To others, the terms of minimum tillage, mulch tillage, reduced tillage, strip tillage, rotational tillage, vertical tillage, disc tillage, rotary tillage, ridge tillage, chisel tillage, conservation tillage, etc., can be lumped into the category of no-tillage. The definition of conservation tillage with a minimum of 30% residue cover is not the same as CA. As a result of this confusion, there was no way for the authors to differentiate between the studies that met the "minimum soil disturbance" criteria in CA.

Comparison of productivity: Maize cultivated under conventional vs. CA system. Picture credited to IFAD.

3. ***Wait for longer term benefits.***

Though the authors do separate their data based on the duration of no till, they do not discuss the relatively large number of research reports with only two or three years of data. However it has been shown that long-term benefits of **No-Till** take a minimum of two or three years to have tangible benefits. Part of this is learning to work with the complexities of nature and the time required for the biological system to adjust to the changes in management. Additionally, the study included few research reports with more than 10 years of data. The authors do acknowledge that the yields of no-till increase with greater than 10 years of No-Till. It is important to recognize the "publish or perish" pressure for promotion on scientists doing no-till research, which can reduce the number of years of study and bias experiments against longer term trials. Longer term trials are also mostly done on experiment stations and these don't always represent actual farmer situations.

4. ***Beyond yields: What about the sustainability benefits of CA?***

Unfortunately, the authors only focus on yield differences between the two different systems. Yes, yield is the primary output commodity from CA systems. However, we need to consider the long-term positive economic, environmental, social, cultural, and policy dimensions of the CA system as opposed to the corresponding negative attributes of conventional agriculture/inversion tillage. The authors chose to ignore all the other additional ecosystem services provided by the conservation agriculture system that are negatively affected and exacerbated by conventional tillage systems. We recognize that conventional tillage systems and the associated soil loss and degradation are not a sustainable system for future generations. Thus it becomes important that we understand all of the benefits of conservation agriculture, not just the yield impacts. Also what alternatives are there if the present system leads to soil degradation and a non-sustainable system?

*5. **Farm profit versus yield as an indicator of potential?***

CA info graphic from IFPRI.

Economics is not addressed. Yield is not absolute: profit is more important for farmers and for true sustainability. The authors place too much emphasis on yield differences and fail to mention anything about the economic differences between CA systems and conventional systems. They completely ignore the large fuel savings and lower carbon footprint associated with the CA system relative to the conventional system. While there may be some question about the quantitative impact of conservation agriculture on carbon sequestration, there are other ecosystem services that overshadow this one aspect. In addition, some scientists believe carbon cycling is more important than carbon sequestration in agricultural production systems. It is more important to recycle the carbon within agricultural systems to maintain food security than it is to sequester the carbon and make it unavailable to the soil biology so critical in maintaining nutrient availability and cycling. Unfortunately we do not have simple means to estimate the economic benefits of ecosystem services like minimizing soil erosion, improvement in water quality, and all the other ecosystem services enhanced by conservation agriculture.

More Research Needed

The paper also points to the need for more basic research to understand the interactions in this complex system. These include:

1. Why are the yields from large field, on-farm research studies as good as or better than inversion tillage agriculture on large fields, but not on small research plots?
2. What type and how much more detail do we in the scientific community need to accurately characterize CA research methods and materials to enable us to compare “apples to apples, not apples to oranges”?
3. What can we do to learn from and better understand the historical results of the last 40-50 years of research to continue the development and improvement of sustainable agriculture production systems?

Check out our Scoop-it Newsletter, where we have compiled a special issue of scientific articles relevant to this blogpost.

What do you think? Please feel free to comment or ask questions and CA experts Don Reicosky and Peter Hobbs will reply!

UNEP: Emerging Global Environmental Issues and Conservation Agriculture

October 27, 2014 in soil health | Tags: CA, climate change, conservation agriculture, ecosystem services, no-till, soil carbon, soil health, UN Environmental Programme, zero-tillage | by cornellconservationagriculture | Leave a comment

The UN Environment Programme just released the Year Book 2014 emerging issues update, a special e-book edition ten years after the first Year Book in the series. The 2014 Year Book presents ten environmental issues of the last