NO-TILL IN THE NORTH CAROLINA BLACKLANDS: A CASE STUDY FOR FARMER-TO-FARMER EXCHANGE

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INTRODUCTION

Open Grounds Farm

Open Grounds Farm, Inc. encompasses approximately 35,000 acres in Carteret County North Carolina. This is in the Tidewater region of the state, generally described as low, flat, and wet. Average annual precipitation is 52.5 inches. Organic soils predominate, especially in shallow depressions or on broad flats with slow drainage (Goodwin, 1978; Lilly, 1981; Daniels et al., 1999).

Open Grounds Farm produces primarily corn and soybeans. In recent years, wheat and forage acreage has declined and cotton has been introduced. Although this farm is larger than other farms in the area, it is representative of much of northeastern North Carolina due to similar topography, soils, and land development. Regardless of overall farm size, the need for surface drainage results in fairly consistent field sizes, typically 320 feet wide (crowned to permit surface runoff to drainage ditches) by ½ to 1 mile long. At Open Grounds Farm, there are 69 blocks of land, each consisting of a series of such fields. Typical blocks are 1 square mile, bounded by main canals and roadways, and contain 16 narrow fields separated by smaller ditches.

Adopting No-Till Practices

No-till was first tried at Open Grounds in 1987 in an effort to reduce wind erosion and labor requirements. No-till production on highly erodible sloping lands had already become common throughout much of the rest of North Carolina during the 1980's. The first plantings included a small amount of corn, but were primarily double-cropped soybean into wheat stubble. The first no-till planters were purchased in 1991, and the farm established a goal of 50% of acreage to be planted no-till by 1996. Currently, half of the no-till planters operate with trash wheels, these are used to plant corn in fields with the heaviest residues. All of the cotton is planted using the trash wheels to enhance soil warming.

RESULTS AND DISCUSSION

Acreage and yield records

Acreage goals were met and exceeded for corn and soybeans (Figure 1). Relatively large increases in no-till acreage in 1995 were predominantly due to major land shaping efforts and to the direct conversion of pasture to no-till grain production. In 1999, it is expected that 99% of the corn, 82% of the soybean, and 100% of the cotton (5000 acres) will be planted no-till.

The main advantages with no-till perceived by the farm are increased yields (presumably due to moisture conservation) and a firmer soil surface for vehicle traffic. Farm records suggest that corn grain yield is generally a little higher with no-till (Figure 2). Initially, most no-till soybean was double-cropped and most conventional soybean was full-season, so it is difficult to assess the yield effect of tillage using these records.

Hurricanes and tropical storms frequently pass through this area in late summer and fall, and probably account for relatively low grain yields in 1996 and 1998 (Figure 2). Hurricanes still blow down no-till corn, but the firmer ground surface allows easier vehicle entry. Thus, corn can be harvested sooner after storms, which reduces grain deterioration and losses.

Soil preparation and labor issues

Switching to no-till production influences the timing of soil preparation work and the size of the total labor force required. Conventional tillage in this environment requires forming planting beds and cutting outlets (hoe drains) perpendicular to the crop rows to insure adequate drainage (Fig. 3a). With no-till, crops can be planted flat, which permits surface runoff without the need to excavate hoe drains (Fig. 3b). Nevertheless, the land must be carefully leveled to avoid ponding with no-till. Conventional tillage requires a much larger labor force during a few weeks at planting time (Table 1), especially considering that corn acreage has increased substantially (<12,500 to >15,000 acres) during the time the size of the planting crew has decreased (24 to 10 people). Labor savings are one of the main advantages of no-till on this farm.

Soil property changes

The firmer soil surface is another main advantage of no-

till in this region. No-till can help break a cycle in which cultivated soils are more susceptible to rutting, and deep ruts need to be smoothed out with tillage. Rutting will still occur with no-till if the soil is sufficiently wet, and the farm expects to continue to practice some conventional tillage.

Nutrient stratification has been characterized in several no-till systems, and were recently evaluated across North Carolina (Crozier et al., 1999). Soil samples from non-replicated representative fields (all Wasda mucks, Histic Humaquepts) with different tillage history at Open Grounds Farm demonstrate that pH and nutrient stratification do occur, but this is not always clearly explained by soil management (Fig. 4). The surface soil pH in undeveloped land in this region is very acidic, and all cropping systems maintain a thin layer of slightly higher pH at the soil surface (Fig. 4a). The practice known as maximum tillage (disking, land-leveling, liming, field cultivator) appears to result in more similarity between soil pH of the 0-4" and 4-8" depth layers than occurs with minimum tillage (1 pass with disk or field cultivator) or with no-till. Nevertheless, similar degrees of disparity occur between the pH of surface 0-4" and the underlying 4-8" with minimum tillage and no-till, and with established no-till which has not received lime in 5 years and established no-till limed 1 year prior to sampling. Soil phosphorus stratification was consistent, with levels declining with soil depth in all fields (Fig. 4b). Soil copper stratification was consistent for all fields, except for uniformly high levels in fields recently used as pastureland (Fig. 4c).

The impacts of agricultural runoff on water quality are increasingly under review. Drainage from much of Open Grounds Farm empties into the Neuse River and the Albemarle-Pamlico Estuarine System, which are sensitive to eutrophication due to poor tidal flushing. Although the impacts of no-till on runoff water quality are not well understood in this region, we expect sediment runoff to be greatly reduced with no-till. Ditch maintenance records show less frequent cleanout is needed with no-till, suggesting a reduction in sediment loss from fields.

Farmer-to-Farmer exchange

Since beginning his career as an extension agent, the farm manager has continually communicated with other producers about improving farming practices. As an active member of the Blackland Farm Manager's Association, he attends annual winter meetings and summer tours with a group of producers in the northeastern North Carolina organic soil region. As chair of the research committee of the North Carolina Soybean Producers Association, Inc., he is aware of innovations throughout the state. Open Grounds Farm has cooperated with university and corporate research and development programs involving variety testing, integrated pest management, pesticide efficacy trials, soil fertility, precision agriculture, and water quality.

Table 1. Size of the Labor Force Required to Plant Conventional till (Pre-1991) and No-till (Current) Corn Crops at Open Grounds Farm, Inc.

Prior to 1991		Present
# of people	Task	# of people
14	Disk, bed, hoe drains	0
8	Planting	8
2	Supply trucks	2
24	Total	10

Open Grounds Farm has been willing to describe its experiences and present farm records related to no-till at numerous producer and professional meetings. These include the Down East No-till Seminar (Greenville, NC, 1994), American Society of Agricultural Engineers Annual Meeting (Chicago, 1995), Southern Soybean Conference Annual Meetings (1996 and 1998), and the Monsanto Farm SMART conference (Raleigh, NC, 1998). In addition, Open Grounds Farm hosted the 1997 Blacklands Farm Manager's Tour, where much of the information in this paper was presented. These shared experiences are particularly valuable in this area, which differs greatly in topography, climate, and soils from demonstration sites located in the rest of the state or in other states.

Manager's Summary Advice

No-till production definitely has a place in these flat, wet soils. Careful land-leveling is needed to avoid ponding. For no-till to be successful, producers need to want to try it and be willing to work at it. Planting in heavy residue can be aggravating.

SUMMARY

Farm records are presented which describe no-till acreage and yields at Open Grounds Farm, Inc. in eastern North Carolina.

The soil types and management on this farm are representative of many grain and cotton farms in the Blackland region of northeastern North Carolina. This is not highly erodible land, but the farm expected no-till to reduce wind erosion as well as to reduce labor needs.

The farm exceeded its original goal of 50% of acreage

in no-till. Increased yield and a firmer soil surface for vehicle traffic are perceived by the farm as the most significant advantages with no-till. Farm records suggest corn yields are generally slightly higher with no-till. Since initially most no-till soybean was double-cropped and most conventional till was full season, it is difficult to assess the yield affect of tillage on soybean yield. The size of the labor force required to plant the corn crop has decreased from 24 (for less than 12,500 acres prior to 1991) to 10 (for more than 15,000 acres now). Stratification of soil pH and nutrients has been noted, but this does not appear to be a cause for immediate concern.

No-till has the potential to maintain, and perhaps slightly enhance yields while reducing labor costs in this flat, wet region. It is a locally appropriate model for many farms in northeastern North Carolina, since it involves organic soils and the typical land development and drainage networks of this area.

REFERENCES

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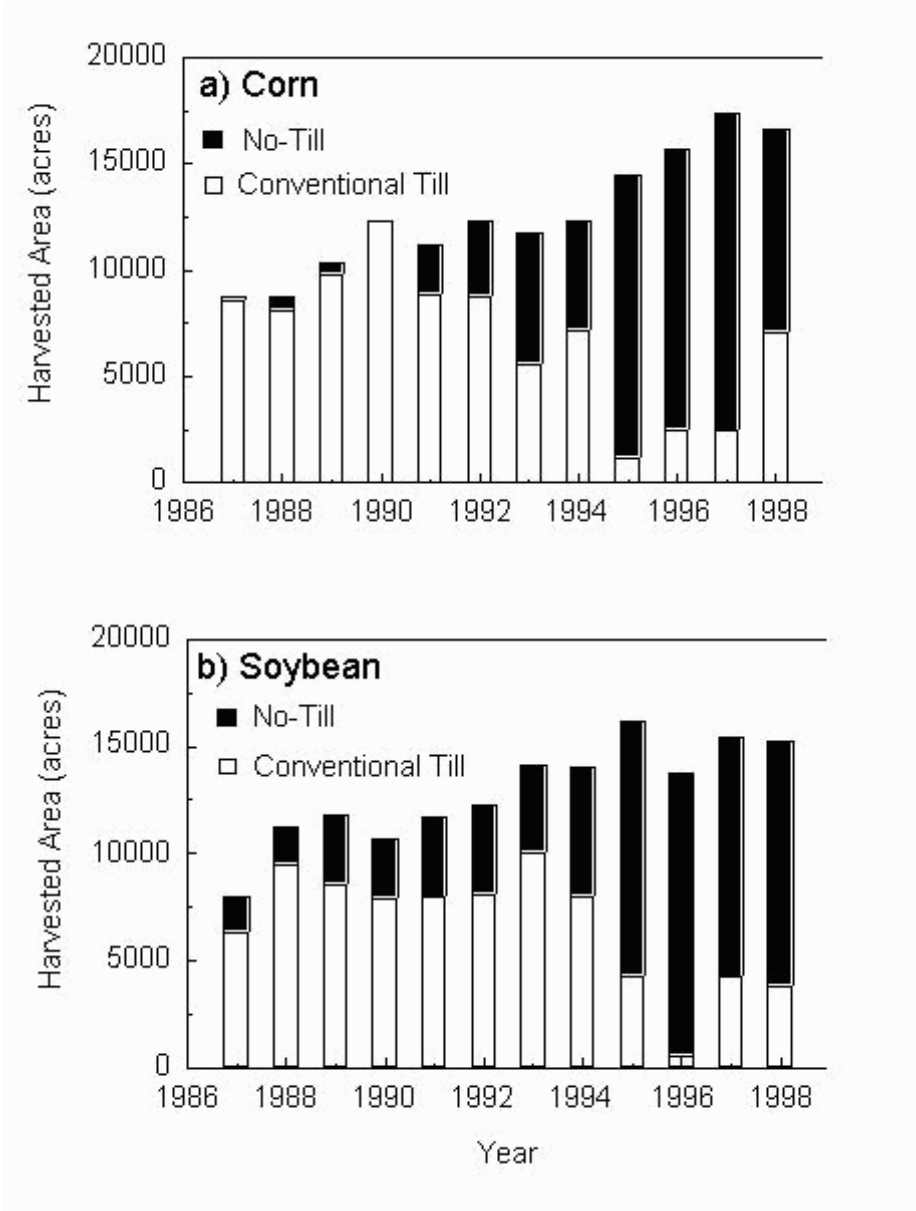

Figure 1. Harvested acreages of conventional and no-till planted corn (a) and soybean (b) at Open Grounds Farm, Inc.

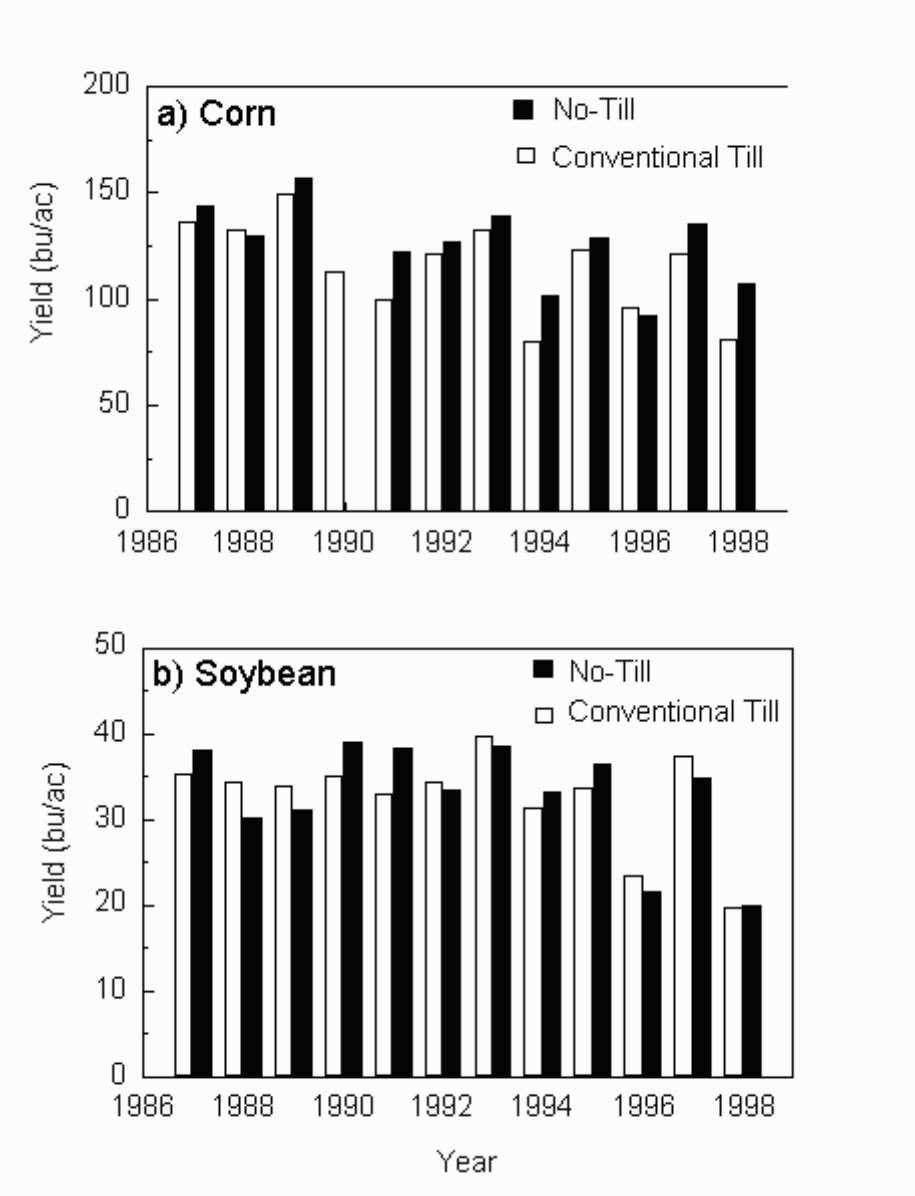

Figure 2. Average yields of conventional and no-till planted corn (a) and soybean (b) at Open Grounds Farm, Inc.

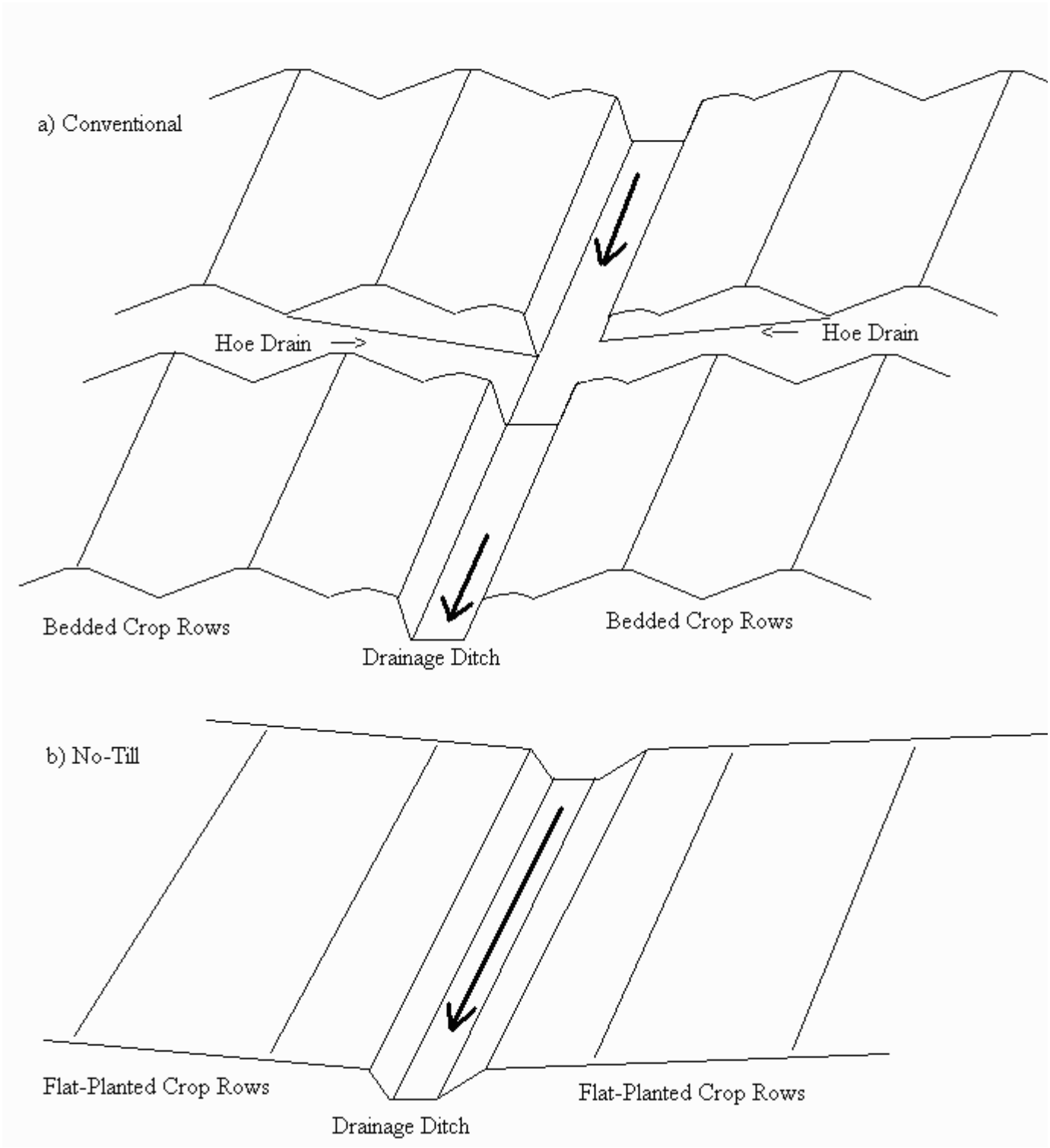

Figure 3. Typical land shaping for conventional (a) and no-till (b) planted corn and soybean at Open Grounds Farm, Inc.

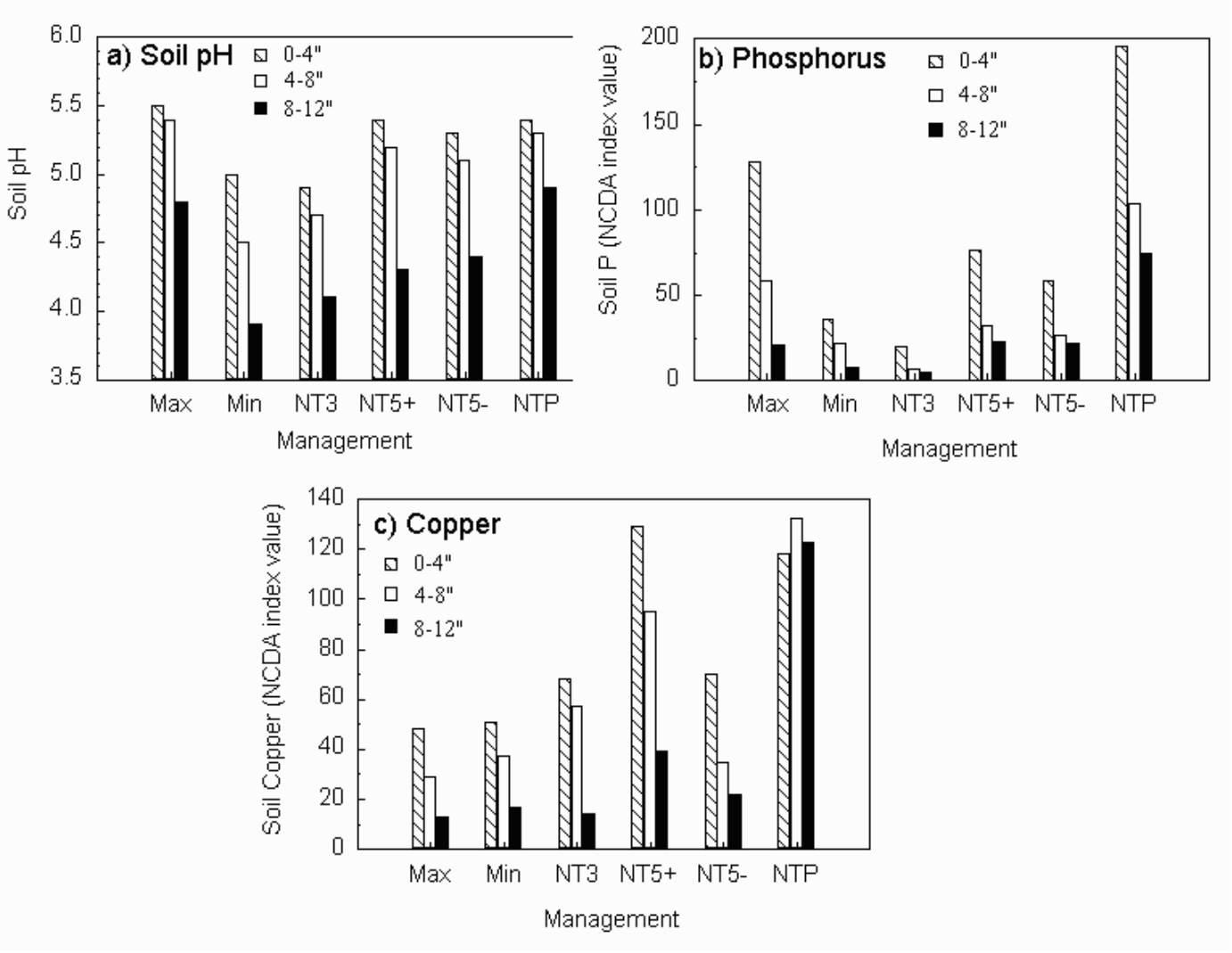

Figure 4. Soil test pH (a), phosphorus (b), and copper (c) levels measured from non-replicated fields with Wasda muck soil type. The management treatments sampled were: Max-Till (disking, land-leveling, liming, field cultivator); Min-Till (1 pass with disk or field cultivator), NT 3yr (3 years of continuous no-till), NT 5+ (5 years of continuous no-till with lime 1 year ago), NT 5 – (5 years of continuous no-till without any lime), and NT past (no-till following use of a herbicide to kill pasture).