Agronomy Tips

Conventional Tillage Not Required, but Crop Rotation Still Beneficial, for High Corn Yields in 2008 - (*Tony J. Vyn and Terry D. West*)

Introduction

Corn farmers in parts of Indiana (such as NC Indiana) that had little drought stress have been pleasantly surprised at their very high yields. Farmer reports of yields in the 220 to 260 bushel per acre range have been frequent for corn after soybean and even for fields where corn has followed corn. In many cases, 2008 corn yields on individual farms have broken previous yield records for those same fields. Many Indiana farmers experienced a year with low stress if they did not suffer from either too much rain in spring (which necessitated replanting on portions of numerous farms) or from too little rain in summer. Low corn plant stress in 2008 was primarily evident to our own frequent plot scouting this summer in the forms of low insect pressure, low incidence of silk clipping during pollination, low foliar disease pressure and, perhaps most importantly, moderate temperatures during pollination and much of the grain filling period. Low temperatures during the reproductive period contributed to delayed maturity and higher grain moisture contents than expected for a given hybrid maturity, but these were also beneficial to yield (as long as moisture wasn't limiting).

Our long-term tillage plots were no exception to the numerous on-farm trends for realizing exceptional yields; we also achieved record corn yields in multiple experimental locations in 2008. Was tillage beneficial in 2008? Our recent corn yield results can provide some perspectives on the latter question, and on the related question as to whether continuous corn yields could match those for corn after soybean in a high yield year.

Corn Yield Results in 2008

Corn yields at our long-term tillage plots on the dark prairie soil near West Lafayette have never been so high in our 34 year history at that site. Nevertheless, even then, the 2008 results presented in Table 1 confirmed that it is entirely possible to get yields above 250 bushels per acre in continuous no-till and that no-till corn yields after soybean were not significantly lower than those after conventional tillage (statistics not shown). Furthermore, it would have been challenging to economically justify either chisel or moldboard plowing following soybean for this location in 2008 (economics not shown). Tillage was only beneficial for continuous corn; in that case corn yields were from 12-20 bushels higher with these full-width primary tillage systems than after no-till.

Our short-term tillage experiment results provide further evidence of the small yield differences within a common planting date between no-till and either chisel or strip-till when corn follows soybean (Table 1). As in previous research, the sole yield benefit potentially associated with strip-till corn, compared to no-till corn following soybean, is if the strip-till provided an opportunity to gain yield because of enabling earlier planting.

At our northern Indiana location (Wanatah), corn yields in our 12-year tillage study were very similar in 2007 and 2008 so the results in Table 2 were averaged for those 2 years. Although no-till corn yields were slightly lower (11 bushels/acre) than those after chisel plowing in both continuous corn and corn-soybean systems, it is equally clear that strip-till corn yields were virtually identical to those after chisel plowing in both rotation scenarios. The latter is not new information; fall strip-till corn yields have equaled those after fall chisel plowing for the last 9 years at this site.

Furthermore, the crop rotation yield advantage associated with corn after soybean is still noticeable even when continuous corn yields are above 220 bushels per acre. The observed crop rotation advantages in 2008 were as low as 4% for the moldboard plow situation and as much as 10% for the continuous no-till system at West Lafayette (Table 1). Corn rotation yield advantages averaged about 7% at the Wanatah location (Table 2). We have observed that the rotation advantage is smaller with current hybrids and management than it was 20 or 30 years ago, and that the percent yield advantage for rotation corn is highly dependent on the tillage system chosen for the comparison.

Table 1. Effects of tillage (and crop rotation) on 2008 corn yields in long-term (1975-2008) and short-term experiments. Chalmers silty clay loam soil, West Lafayette, IN.

	Long-term (34 yr) Tillage Study at West Lafayette		Short-term Tillage Plots at West Lafayette	
Tillage Treatment	Corn After Soybean (bu/acre)	Continuous Corn (bu/acre)	Corn After Soybean Planted April 22 (bu/acre)	Corn After Soybean Planted May 27 (bu/acre)
Fall Moldboard	261	251	---	---
Fall Chisel	262	243	241	216
No-Till	256	231	235	209
Fall Strip-Till	---	---	241	218

Table 2. Effects of tillage and crop rotation on mean corn yields for 2007 and 2008. Sebawa loam soil, Wanatah, IN.

Tillage Treatment	Corn After Soybean (bu/acre)	Continuous Corn (bu/acre)
Fall Moldboard	239	225
Fall Chisel	238	221
No-Till	227	210
Fall Strip-Till	239	221

Our highest no-till corn yields this season (284 bushels/acre) were achieved in a 6-rep experiment investigating the interactions between hybrids and plant populations (Figure 1). In this experiment, no-till corn followed no-till soybean in 2007. These results illustrate the large effect of density on final yield in a year with ideal conditions for pollination (i.e. virtually no barren plants at any density). For hybrid A, maximum yields were obtained at 35,000 to 39,000 plants per acre. For hybrid B, maximum yields were achieved at a population of 30,000 plants per acre. Although the economically optimum density for this year and location/environment is dependent on seed costs as well as hybrid characteristics, it is interesting to observe how corn yields in 2008 increased by 30 bushels per acre, or in one case declined by 30 bushels, by a simple increase of 5,000 plants per acre in the final stand.

There is no reason to believe that optimum corn plant densities are any higher or lower in no-till than they are in tilled soils. In fact, final plant populations have been equal in no-till versus conventionally tilled plots for at least the past decade because of generally superior seed treatments and improved seed placement by modern planting equipment.

Conclusions

In summary, tillage system choice has less consequence for achieving high yields than other management factors. Hybrid selection and achieving optimum plant density and fertility levels are generally more important factors in the pursuit of high yield corn. Conventional tillage is not essential for achieving high corn yields. Even in situations (such as corn following corn) when no-till corn yields are somewhat lower, fall strip tillage is preferred over chisel plowing as the alternative to no-till because strip tillage usually yields equal to chisel while providing superior erosion protection. In addition, crop rotation still boosts corn yields and, if everything else (soil quality, drainage, management, etc.) is equal, yield-contest aspiring farmers should still avoid continuous corn.

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Figure 1. No-till corn yield response to hybrid and plant population in 2008. Chalmers silty clay loam soil, West Lafayette, IN.