POTENTIAL FOR USING NO-TILL TO INCREASE FORAGE AND GRAIN YIELDS OF WINTER WHEAT

Deena L. Bushong[1] and Thomas F. Peeper[1]

Oklahoma State University, Stillwater, OK 74078
Corresponding author's e-mail address: bdeena@okstate.edu

ABSTRACT

In Oklahoma, more than half of the hard red winter wheat (*Triticum aestivum* L.) produced is grown as a dual-purpose crop (forage plus grain). The objective of this study is to agronomically compare no-till and conventional tillage production systems in continuous wheat grown with five production objective ranging from forage only to grain only. Experiments were initiated at three sites in north central Oklahoma by cutting wheat for hay in May 2002 or grain in June 2002. After wheat hay was cut, foxtail millet (*Setaria itlalicahay* (L.) Beauv) was seeded in appropriate plots and harvested in late August each year. Ok101 hard red winter wheat was seeded in the fall at the dates appropriate for each production objective. In the first year of production, when averaged across locations, the millet produced 4880 pounds of dry matter/ acre in the no-till, which was 630 pounds more than with conventional tillage. During the second year, millet in conventional tilled produced 700 pounds of dry matter per acre more than no-till millet. Wheat forage yields was affected by planting date, tillage, and insertion of a summer foxtail millet crop. Wheat grain yields were reduced with no-till by 5 to 7 bushels/ acre when averaged across locations.

INTRODUCTION

Hard red winter wheat is the primary crop grown in Oklahoma. More than half of the wheat produced in Oklahoma is used as a dual-purpose crop, which means that wheat is produced for grain and forage in the same growing season (Krenzer 2000). In a dual-purpose system, the income from forage often equals the income from grain and increasing either forage or grain should increase net returns.

Seeding date has an effect on the grain yield and the amount of forage that is available for grazing in the fall. Krenzer (1995) recommended planting wheat in the first three weeks of October to maximize grain production in northern Oklahoma. For forage production in Oklahoma, wheat should be seeded as early as late August but no later than early September. Depending on variety, an early planting date can cause poor germination due to warm soils and lack of water required for early seeded wheat (Krenzer 2000). One possible solution to maximize forage production is the use of no-till to conserve soil moisture and cool the soils.

Over the last few years, no-till acreage has increase across the United States (USDA Statistics 2003). Some of the major problems with no-till wheat in the past were: poor seeding equipment, inadequate herbicides to control grass weeds in wheat, and high cost of herbicides. Now, the seeding equipment that is available has been improved, there are more herbicides on the market that grass control in winter wheat and the cost of glyphosate is less.

Epplin et al. (1994) reported the results of a ten-year study that compared the economics of six tillage systems (5 tillage practices and one no-till) in a continuous wheat system. The no-till system produced lower wheat grain yields than conventional systems. Net returns were higher in conventional tillage systems primarily because of the high cost of herbicides used in the no-till treatments. A similar study by Epplin et al. (1983) concluded that no-till did lower fuel and labor cost but the cost of herbicide to control the weeds was greater than the money saved on fuel and labor. In a more recent study, wheat grain yield was consistent for no-till, minimum till and delayed minimum till, but the net return for minimum till and no-till were equal and both slightly more profitable than delayed minimum tillage (Janosy et al. 2002).

Although a number of experiments have been conducted on no-till wheat grain production systems, little research has been conducted on the effects of no-till on dual-purpose wheat. The objective of this study is to compare optional no-till and conventional tillage wheat production systems to determine which is more productive when both forage and grain productions are considered.

MATERIALS AND METHODS

Field experiments are being conducted at three on-site farm locations in north central Oklahoma, to evaluate forage and grain production with various production objectives using conventional tillage and no-till. This three-year study was initiated in 2002 by either cutting existing wheat for hay in May or harvesting the wheat for grain in June.

The experimental design is a complete randomized block with a factorial arrangement. Treatments are replicated four times. The factors are tillage practices (no-till and conventional tillage) and five production objectives. The production objectives are: (1) Maximize fall wheat forage and harvest wheat for hay in the spring; (2) Maximize fall wheat forage, harvest wheat for hay in the spring, and produce a doublecrop forage crop (foxtail millet hay); (3) Maximize fall forage and harvest wheat for grain production; (4) Traditional balance of fall wheat forage and grain production; and (5) No forage, maximize grain production.

For the first two production objectives, wheat was planted in early September, grazed by stocker cattle from fall to March and mechanically cut for wheat forage in late April or early May. After forage removal in May, German foxtail millet was planted and harvested for hay at heading. Approximately two weeks later, Roundup Ultra was applied at 1.5 pints/acre to the no-till treatments to control wheat re-growth. The conventional treatments (CT) were chiseled and then disked. Foxtail millet was then planted at 17 pounds/acre using a no-till drill. In the first year, 110 pounds of nitrogen/acre was applied to millet plots, and 84 pounds of nitrogen/acre in the second year.

For the third production objective, wheat was seeded in early September, grazed from fall to March and harvested for grain in June.

The fourth production objective was considered the traditional balance between forage and grain. Wheat was planted September 20-24, grazed until early March, and harvested for grain in June.

Wheat forage was estimated by clipping quadrats in November at that time cattle were released onto the fields. A 10- by 30-foot portion of each plot was fenced to prevent grazing to determine grazing effects on wheat grain yield. Grazed portions of each plot were topdressed with 60 pounds of nitrogen per acre. Cattle were removed from the plots in March. These experiments are continuing through the 2003-2004 growing season.

The final production objective was to grow wheat for grain only. The wheat was seeded in the middle of October and harvested for grain in June. Cattle were excluded from these plots by a hot wire fence around each plot.

Wheat was seeded using a conventional single disk opener drill for CT treatments and a double disk no-till drill for no-till treatments. Ok101 hard red winter wheat was selected based because of its adaptation to early-planted dual-purpose management systems and also because of its ability to produce abundant wheat forage. The wheat was seeded at 90 pounds per acre for all treatments and 80 to 90 pounds of nitrogen was applied at or before planting (Krenzer, 2001).

In June 2002 following grain harvest all no-till treatments except ones planted to millet received Roundup Ultra at 1.5 pints/acre (for the first year at Hunter, no herbicide was applied because no weeds were present). In August 2002 following millet harvest RT Master was applied at 1 quart/acre to all no-till treatments. June 2003 RT Master at 1 quart/acre was applied to all no-till treatments except those with foxtail millet. Roundup Ultra at 14 oz/acre was applied one week prior to seeding wheat.

Various tillage methods were used to control weeds in the CT treatments grown for grain. June 2002, CT treatments harvested for grain were moldboard plowed and then disked. In August 2002 and 2003, all CT treatments were disked. For fall 2002 and 2003, treatments were disked and tilled with a light cultivator with double rolling baskets at time of planting for each appropriate planting date.

RESULTS AND DISCUSSION

With production objective 1, no-till increased forage production. Averaged across locations, the no-till forage sampled in November ’02 and ’03 yielded 760 and 420 pounds of dry matter/acre more than the CT. Wheat hay produced in no-till was 5930 pounds of dry matter/ acre, which exceeded CT by 910 pounds (Table 1).

Within production objective 2 the foxtail millet yields were good in the summer of 2002. Averaged across locations, the no-till millet forage yielded 4880 pounds of dry matter/ acre, which was 630 more pounds of dry matter than the CT. The results from the summer of 2003 were different. The CT millet produced 3690 pounds of dry matter/ acre, which was 600 pounds more than the no-till. We believe that the difference in years is due to fertilizer placement. For the second year, the conventional plots were tilled prior to seeding to incorporate the fertilizer into the soil and the no-till needed water to wash the nitrogen to the root zone, which it did not receive. Wheat forage production was greater in the no-till in November 2003. The no-till wheat forage yielded 1940 pounds of dry matter/acre averaged across three locations, which was 365 pound more than CT. Wheat hay yields were 150 pounds less in the no-till.

In production objective 3, the early September planted wheat that was grown for fall forage production and grain yield had higher forage yields in the no-till for both years. When averaged across three locations, no-till yielded 2830 pounds of dry matter/acre in 2002 and 2140 pounds/acre in 2003, which are 540 and 370 pounds more than CT, respectively. Grain yields were reduced 7 to 9 bushels/acre with no-till and grazing reduced yields by 5.5 bushels/acre when averaged across locations. Official test weight was reduced with no-till, which decreased official grade.

The late September planting used for forage and grain had lower forage yields than the earlier planted wheat. In 2003 no-till forage production was greater than the previous years. Wheat grain production was reduced with no-till by 7 to 8 bushels/acre. Wheat quality was the same for CT and no-till.

For the objective with grain production only, CT produced 43 bushels/acre, which was 8 bushels more than the no-till. However official test weight and grade were the same for CT and no-till.

In the first year's observations, the no-till millet forage yields were as good if not better than the CT forage yields. As for the second year, millet yields were reduced with no-till. Fertilizer placement in no-till maybe an issue. Compared to other treatments, the treatments with millet grown for forage reduced the amount of wheat forage produced but the total amount of forage produced averaged over locations, was 14230 for no-till and 14380 for CT treatments. No-till reduced grain yield and slightly lowered wheat quality.

Our future plans are to complete this year's data collection and meet with cooperators to determine plans for the 2004-2005 growing season.

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Table 1: Effect of production objective tillage practice on forage and grain production and grain quality.
Average of three locations (Cherokee, Loyal, and Hunter, OK)

Planting dates and Production objective	**Tillage Practice**	**Millet** Forage* Lbs/A	**Wheat** Forage** Lbs/A	**Wheat** Hay Lbs/A	**Wheat** Yield*** Bu/A	**Wheat** Official Test Wt.	**Wheat** Official Grade	**Wheat** Protein %
1. Wheat planted Sept. 4-6 Winter Graze + Wheat hay	Conventional Tillage		1610 ('02) 1720 ('03)	5020				
	No-till		2370 ('02) 2140 ('03)	5930				
2. Millet planted May 14-22 Wheat planted Sept. 4-6 Winter Graze + Wheat hay + Millet hay	Conventional Tillage	4250 (2002) 3690 (2003)	1300 ('02) 1575 ('03)	5040				
	No-till	4880 (2002) 3090 (2003)	1370 ('02) 1940 ('03)	4890				
3. Wheat planted Sept. 4-6 Winter Graze + Grain	Conventional Tillage		2290 ('02) 1770 ('03)		46.1 (G) 52.6 (U)	58.7	2.0	11.7
	No-till		2830 ('02) 2140 ('03)		38.4 (G) 43.6 (U)	57.1	2.8	11.7
4.Wheat planted Sept. 20-24 Winter Graze + Grain	Conventional Tillage		1025 ('02) 725 ('03)		51.0 (G) 55.9 (U)	58.9	1.9	12.3
	No-till		970 ('02) 900 ('03)		43.5 (G) 47.2 (U)	58.2	2.5	12
5. Wheat planted Oct. 11-15 Grain only	Conventional Tillage				43.0	58.2	2.3	11.7
	No-till				35.0	58.4	2.1	12

* Pounds of dry matter
** Wheat forage present when stockers were turned onto the field
***G= Yield from grazed part of each plot and U = Yield from ungrazed part of each plot.