Wide Row Spacing for Deep-Furrow Planting of Winter Wheat

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Introduction

A tillage-based winter wheat (*Triticum aestivum* L.)-summer fallow rotation is practiced on 3.5 million cropland acres in regions of the Pacific Northwest of the United States that receive less than 12 inches annual precipitation. Deep-furrow drills used to plant wheat have a row spacing of 16 to 18 inches. Conservation tillage methods have been developed that allow growers to preserve ample residue during fallow, but existing drills cannot pass through heavy residue.

Research

Since 2009 we have worked to design and test improved deep-furrow drill prototypes for successful planting into tilled summer fallow with high quantities of surface residue (Fig. 1). As part of this effort, we conducted a 3-year experiment at three sites (total = 8 site years) to determine if row spacing can be widened from that currently used to facilitate residue clearance without detrimental effects on grain yield. Row spacing treatments in the study were 16, 18, 20, 22, 24, and 32 inches (Fig. 2). Experimental design was a randomized complete block with four replications and individual plot size was 100 x 16 ft.

During the first two years, all row-spacing treatments had the same number of seeds per row; thus, the 50 lb/acre planting rate for the 16-inch spacing treatment was diluted to 25 lb/acre planting rate for the 32-inch spacing. In the third year, we procured a specialized seed metering devise to plant an additional study with the same number of seeds per acre for all treatments. Grain yield components (spikes per unit area, kernels per spike, and kernel weight) as well as straw production were determined by clipping 3-ft-long samples at ground level in each treatment at plant maturity. Grain yield was determined with a plot combine (Fig. 3).

Fig. 1. Concurrent with the row spacing experiment, new deep-furrow drill prototypes are being developed that can pass through heavy residue with excellent seed placement in tilled summer fallow. This high-frame-clearance prototype has 17-inch row spacing with shovel-type openers on two ranks and had no plugging problems in three years of testing.

Fig. 2. A 32-inch row spacing was the widest in the experiment.

Fig. 3. Harvesting the row spacing experiment with a plot combine near Ritzville, WA.

Results

Same number of seeds per row. With the same number of seeds per row, there were never any within-year grain yield differences between the 16 and 18-inch row spacing and a decline in yield with 20-inch spacing occurred only in one of the eight years (Table 1). Grain yield slowly and progressively declined during most years with 22, 24, and 32-inch row spacing. When averaged over the eight site years, the 16 and 18-inch treatments had the highest yields, with small but statistically significant ($P<0.05$) declines in yield as row spacing widened (Table 1). The average grain yield from narrowest to widest row spacing over the eight sites years was 60 to 50 bu/acre. Gradual grain yield decline with widening row spacing was due to fewer spikes per unit area, despite a tendency for more kernels per spike with wider rows (Figs. 4, 5, and 6). Kernel weight was never a factor. Straw production declined with wider rows, especially with the 32-inch row spacing (Figs. 4, 5, and 6).

Same number of seeds per acre. With more seeds per unit length of row with the wider spacing treatments (i.e., same number of seeds per acre), there were no grain yield differences among treatments at Lind or Pendleton and, at Ritzville, there were no differences in yield until row spacing reached 24 inches (Table 2). When averaged across the three sites, there was no difference in grain yield among the 16, 18, 20, and 22-inch spacing treatments, and with a narrow range of only 49 to 45 bu/acre from the 16-inch to 32-inch treatments, respectively (Table 2). Averaged over the three sites, there were no differences in any of the three grain yield components or in straw production (Fig. 7).

Table 1. Winter wheat grain yield at three locations (8 site years) as affected by 16, 18, 20, 22, 24, and 32-inch row spacing with the same number of seeds per row (i.e., declining seeding rate per acre as row spacing widened).

	Spacing (inches)					
	16	18	20	22	24	32
	Grain yield (bu/acre)					
Lind, WA						
2011	35	35	29	29	28	32
2013	43	46	39	40	40	40
2-yr avg.	39 ab	40 a	34 b	35 b	34 b	36 ab
Ritzville, WA						
2011	75 a	76 a	68 b	65 bc	61 c	63 bc
2012	81 a	81 a	79 a	73 b	69 bc	66 c
2013	78 a	72 abc	77 ab	77 ab	70 bc	69 c
3-yr avg.	78 a	76 a	75 a	70 b	67 bc	66 c
Pendleton, OR						
2011	73 a	73 a	73 a	70 a	70 a	62 b
2012	60 a	58 ab	57 b	53 c	53 c	43 d
2013	30	30	30	30	29	29
3-yr avg.	55 a	53 ab	53 abc	51 bc	51 c	45 d
8-site-year avg.	60 a	59 a	56 b	54 c	53 c	50 d

Table 2. Winter wheat grain yield at three locations (3 site years) as affected by 16, 18, 20, 22, 24, and 32-inch row spacing with the same number of seeds per acre (i.e., number of seeds per unit length of row increased as row spacing widened).

	Spacing (inches)					
	16	18	20	22	24	32
	Grain yield (bu/acre)					
Lind, WA	41	41	39	40	39	38
Ritzville, WA	78 a	75 ab	77 a	74 ab	71 bc	68 c
Pendleton, OR	29	30	30	29	29	29
3-site avg.	49 a	49 a	49 a	47 abc	46 bc	45 c

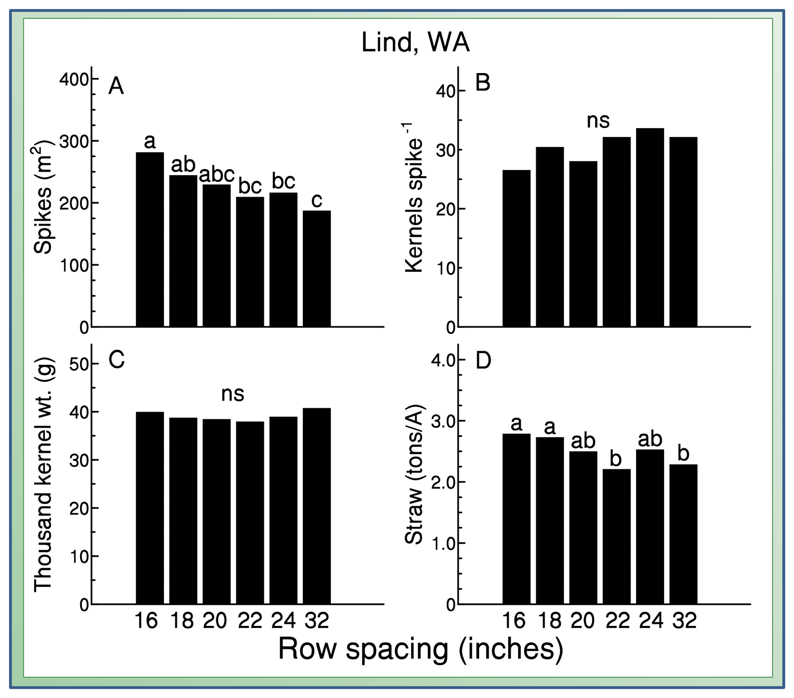

Fig. 4. Grain yield components and straw production of six row spacing treatments with the same number of seeds per row averaged over two years near Lind, WA.

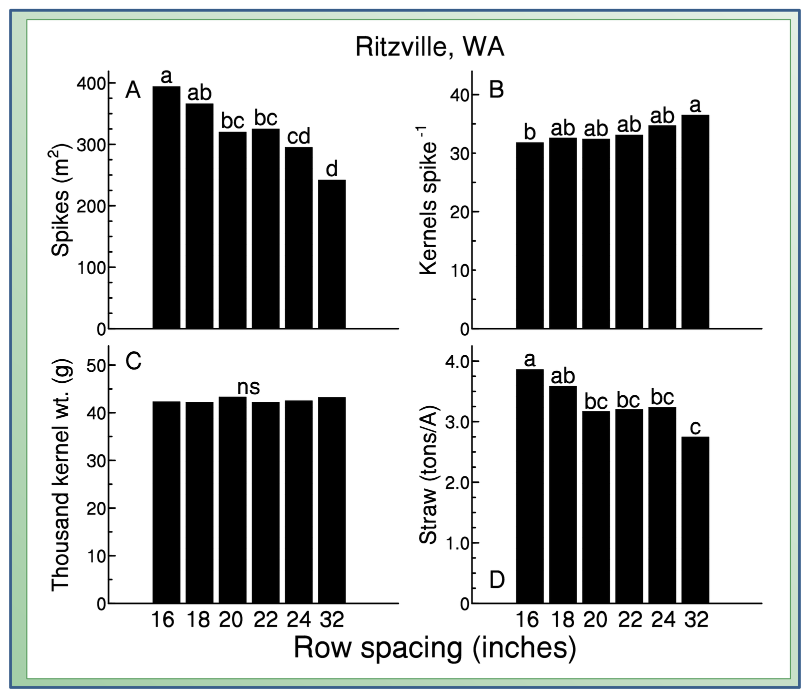

Fig. 5. Grain yield components and straw production of six row spacing treatments with the same number of seeds per row averaged over three years near Ritzville, WA.

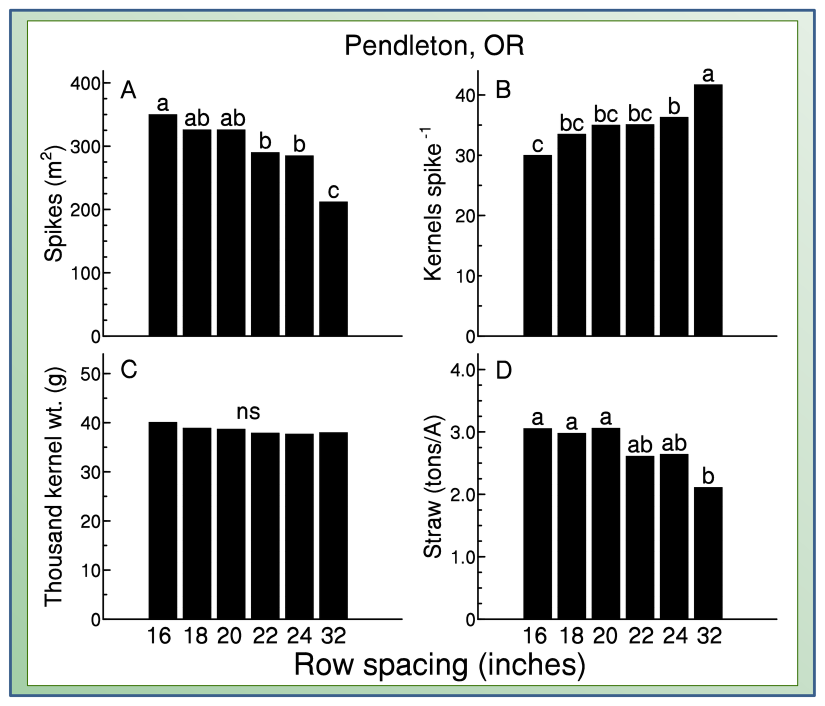

Fig. 6. Grain yield components and straw production of six row spacing treatment with the same number of seeds per row averaged over three years near Pendleton, OR.

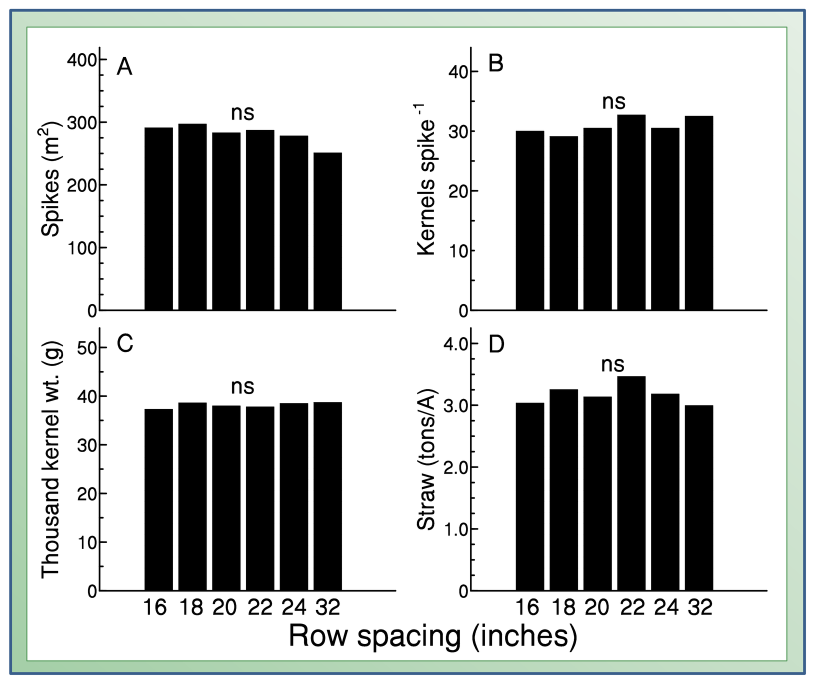

Fig. 7. Grain yield components and straw production of six row spacing treatments with the same number of seeds per acre (i.e., number of seeds per unit length of row increased as row spacing widened) averaged over the Lind, Ritzville, and Pendleton locations in the final year of the experiment (i.e., three site years).

Conclusions

Wheat growers in the dry wheat-fallow region of the Pacific Northwest are reluctant to retain high quantities of surface residue in fallow fields due to concerns about plugging their deep-furrow drills during planting. Drills with wider row spacing will enhance residue clearance. Data from our study suggest that row spacing can be widened to 20 and possibly 22 inches with little to no decline in grain yield compared to the 16 and 18-inch row spacing of drills currently used by growers.