Planting Durum on Lettuce Beds
Arizona Grain Research and Promotion Council
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Final Report

Overview and Rationale: In 2005, over 36,000 acres were planted to wheat in Yuma County, all of which following either a lettuce or cole (cabbage, broccoli or cauliflower) crop. For wheat grown in the region, the conventional tillage sequence prior to planting can be tied to as many as 7 field operations (Table 1) which consumes valuable time, labor and resources. In this study, our aim was to determine the effectiveness of reducing the number tillage (minimum till) operations in fields immediately following lettuce harvest. This effort is designed to demonstrate alternative tillage systems to Arizona wheat producers and suggest a means for conserving time, fuel and resources.

Protocol: Three 20-acre trials were conducted on commercial farms within the vicinity of Yuma, Arizona during the spring, 2007. Durum following lettuce was planted conventionally on flat ground or on beds which were either ring rolled to crush unharvested lettuce heads only or in combination of a ring roller and field cultivator. Previous work in 2006 has shown that a step which severs the stem portion of the lettuce plant prevents lettuce grow back and reduces the chance of a lettuce weed outbreak and also flattens the bed for greater seeding efficiency within the furrow. Prior to seeding, the conventional tillage practice included disking, ripping with a short shank, and a land leveling operation.

Conventional 12-foot grain drills were used to plant both conventional and raised bed trials at a seeding rate of 150 pounds/acre (variety Kofa), seeding occurred between February 26 and March 9. Durum grown conventionally was solid seeded and for bed planting, 3 to 4 rows were planted on the bed surface, furrows were not be intentionally seeded. All locations included Durum following either head lettuce or romaine hearts planted on 42-inch beds and all treatments used sprinkler irrigation for germination. It was determined that planting density was not significantly different when sunlight penetration through the crop canopy was measured at the soil level under conventional and minimum tillage conditions (Table 2).

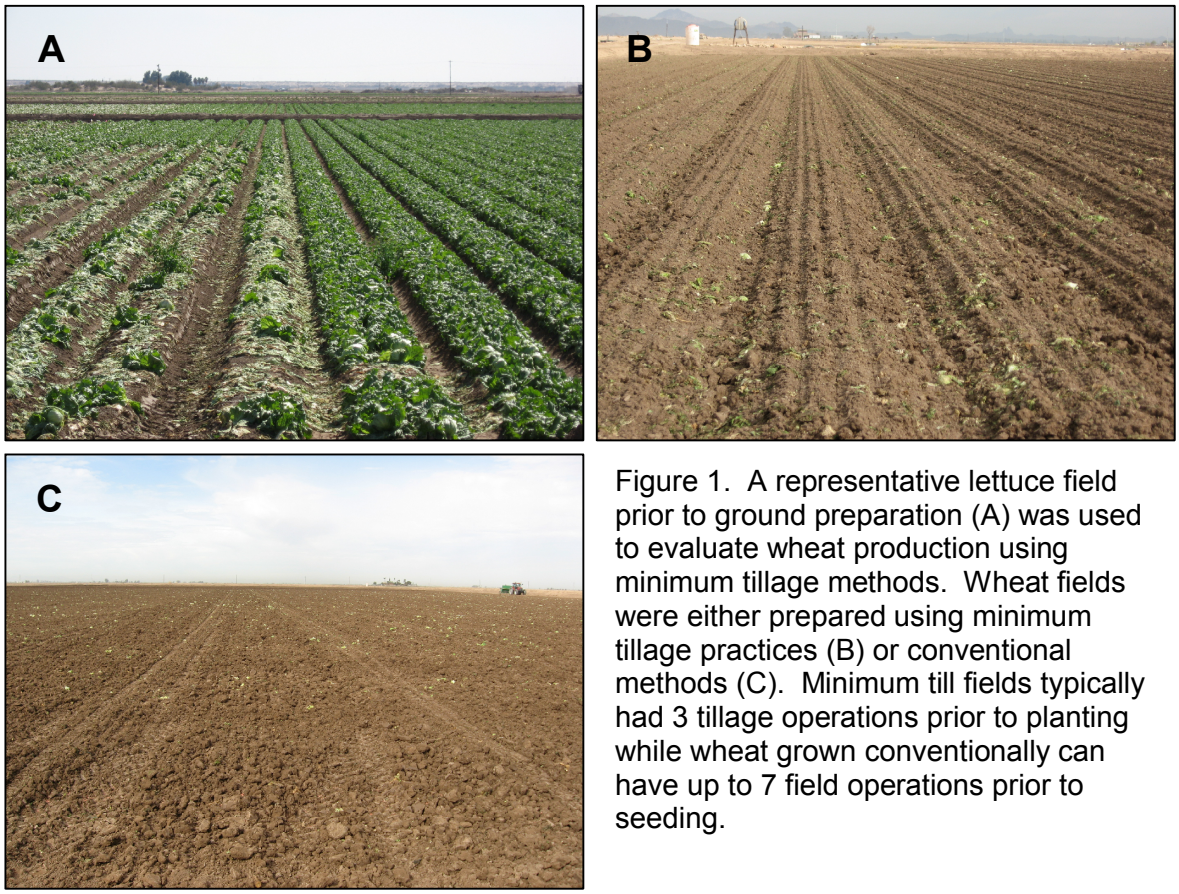

Figure 1. A representative lettuce field prior to ground preparation (A) was used to evaluate wheat production using minimum tillage methods. Wheat fields were either prepared using minimum tillage practices (B) or conventional methods (C). Minimum till fields typically had 3 tillage operations prior to planting while wheat grown conventionally can have up to 7 field operations prior to seeding.

Of Significant Interest: A chief area of concern related to this effort was the grow-back of previously harvested lettuce and later becoming a weed issue. This matter became problematic with a particular grower/cooperator during this study (Fig. 2). During germination and growth of wheat on beds, the cooperator had the opinion that the regrowth of the previous lettuce crop would threaten the future management of the lettuce diseases, *Fusarium* and *Schlerotinia*. As a result, it was decided to remove this trial location from the study and add a 3 acre trial at the Yuma Ag Center.

However, it seems clear that when producing wheat following vegetables on raised beds, specific and careful control of lettuce regrowth is required. Thus, elimination of the previous lettuce crop by either herbicide application or cultivation prior to cultivation is imperative.

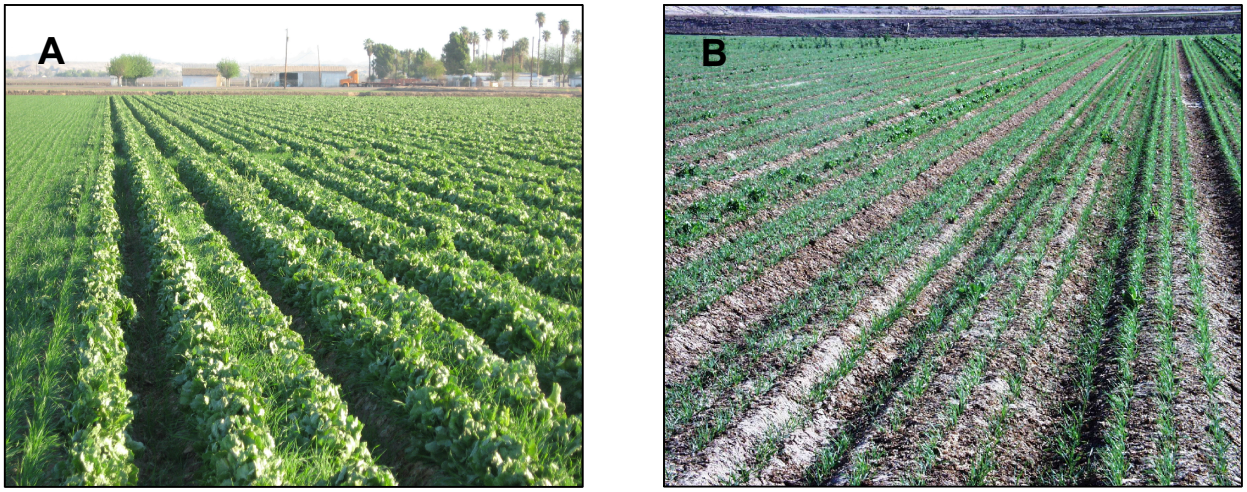

Figure 2. (A) Significant regrowth of lettuce during wheat establishment can be problematic during stand establishment if not controlled adequately. The control of lettuce regrowth (B) by the use of a broadleaf herbicide (ie. Prowl®) or light cultivation prior to seeding can significantly assist in stand establishment.

Conclusions:

- Growing wheat on lettuce beds immediately following lettuce harvest did not significantly reduce grain yield or quality (Table 3).
- Wheat growth, measured as either plant height at heading or days to heading (data not shown), was determined to be similar when wheat grown conventionally was compared to Durum grown on beds.
- Grain moisture content and grain test weights of Durum grown conventionally or using minimum tillage practices was also found to be statistically similar (Table 3).
- The regrowth of the previous crop can have significant implications for Durum grown with minimum tillage if not managed effectively.
- Lodging was not a significant factor in this study as the degree of lodging was similar in both growing systems. Lodging within the furrow in the raised bed system did not statistically affect grain yield.
- Plant stand, as measured by the penetration of sunlight through the crop canopy, did not appear to be different among the trials evaluated in this study.
- The significant savings in fuel, labor and time, with no apparent reduction in Durum yield or quality, may be a significant benefit to wheat producers who incorporate minimum tillage practices following a lettuce crop (Table 1).

Table 1. Ground preparation and estimated fuel usage prior to planting at locations used in this study.

Location	Tillage Method	Tillage Operations (No.)	Tillage Sequence	Typical Fuel Consumption (gal/acre)*
Somerton	Conventional	7	1. Ring roll unharvested lettuce 2. Disk 3. Short Shank Chisel (direction 1) 4. Short Shank Chisel (direction 2) 5. Disk 6. Float 7. Grain drill	0.30 0.95 0.65 0.65 0.95 0.40 0.35
Somerton	Minimum Till	3	1. Ring roll unharvested lettuce 2. Cultivate beds 3. Grain drill	0.30 0.65 0.35
Yuma Ag Center	Conventional	6	1. Ring roll unharvested lettuce 2. Disk 3. Chisel (single pass) 4. Disk 5. Float 6. Grain drill	0.30 0.95 0.65 0.95 0.40 0.35
Yuma Ag Center	Minimum Till	2	1. Ring roll unharvested lettuce 2. Grain drill	0.30 0.35
Winterhaven, CA	Conventional	7	1. Ring roll unharvested lettuce 2. Disc 3. Short Shank Chisel (direction 1) 4. Short Shank Chisel (direction 2) 5. Disc 6. Land plane 7. Grain drill	0.30 0.95 0.65 0.65 0.95 0.40 0.35
Winterhaven, CA	Minimum Till	3	1. Ring roll unharvested lettuce 2. Cultivate beds 3. Grain drill	0.30 0.65 0.35
Summary	Conventional	6.7	Ring roll, disc, chisel, float, plant	~4.2 gal/a
	Minimum Till	2.7	Ring roll, cultivate, plant	~1.3 gal/a

* Frisby, J. 1999. Fuel Requirement Estimates for Selected Field Operations. University of Missouri, Extension Publication No. G1208.

Table 2. Plant density measured as a function of photosynthetically active radiation (PAR) penetration through crop canopy. Overall data or data within a location that share the same letter were not different at P=0.05.

Location	Tillage Method	PAR, Bed	PAR, Furrow	PAR, Conventional
Somerton	Conventional			149.0 a
Somerton	Minimum Till	134.8 a	178.2 a	
Yuma Ag Center	Conventional			147.9 a
Yuma Ag Center	Minimum Till	212.1 a	177.9 a	
Winterhaven, CA	Conventional			279.3 a
Winterhaven, CA	Minimum Till	291.0 a	305.8 a	
Summary	Conventional			185.86 a
	Minimum Till	212.57 a	214.57 a	

Table 3. Wheat yield and quality parameters as influenced by tillage practice. Overall data or data within a location that share the same letter were not different at P=0.05.

Location	Tillage Method	Moisture (%)	Test Weight (lb/bu)	Yield (tons/acre)
Somerton	Conventional	9.15 a	61.25 a	3.64 a
Somerton	Minimum Till	8.80 a	61.50 a	3.78 a
Yuma Ag Center	Conventional	9.07 a	61.00 a	3.35 a
Yuma Ag Center	Minimum Till	8.70 a	62.00 a	2.98 a
Winterhaven, CA	Conventional	10.10 a	61.50 a	2.57 a
Winterhaven, CA	Minimum Till	11.20 a	61.25 a	2.21 a
Summary	Conventional	9.39 a	61.25 a	3.21 a
	Minimum Till	9.43 a	61.58 a	2.94 a