plot of each treatment on each slope. Four replicate plots of the tilled treatments were placed on a southeastern slope and four on a northwestern slope in 2001/2002; four tilled replicates were placed on a northwestern slope in 2002/2003. Similar treatments were established in the fall of 2003.

Data from the winters of 2001/2002 and 2002/2003 have been analyzed. In 2001/2002, a year with drifting snow, aspect of the stubble treatments had more effect than the treatment itself. North slopes had more snow and greater runoff, 10mm vs. 2mm, although there was large variation in the data. On the tilled plots, the northwest aspect plots had 23mm runoff and the southeast aspect only 8mm runoff. In 2002/2003, the stubble treatments were again placed on the north and south sides of two east-west ridges. There was less snow and aspect was not important in the results, with 0mm runoff from the north plots and 1mm runoff from the south plots. None of the stubble treatments had over 6mm runoff. The mean runoff from the four tilled plots was 28mm.

Runoff was greater from conventionally seeded treatments than from continuous direct stubble seeded treatments during the winter seasons of 2001/2002 and 2002/2003. In neither season was infiltration and runoff dominated by a deep freeze and rapid melt event.

*DRYLAND CROPPING SYSTEMS RESEARCH AT LIND

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Cropping systems research that compares intensive cropping using no-till vs. the traditional winter wheat – summer fallow rotation with tillage has been ongoing at the WSU Lind Dryland Research Station since 1998. Annual spring cropping was not economically competitive with winter wheat - summer fallow from 1998 to 2003. On average, soft white spring wheat grain yield was less than half of grain yield for soft white winter wheat after summer fallow (i.e., one crop every two years). Recrop winter wheat after two years of spring wheat has yielded significantly more grain than continuous annual spring wheat in 3 of 4 years. In addition, Russian thistle infestation in recrop winter wheat is minimal whereas Russian thistle infestation is generally severe in spring wheat. In 2003, winter wheat after summer fallow produced 32 bu/ac compared to 24 bu/ac for winter wheat after chemical fallow, 16 bu/ac for recrop winter wheat, and 8 bu/ac for continuous spring wheat.

ROTARY SUBSOILING TO REDUCE EROSION AND IMPROVE INFILTRATION IN NEWLY-PLANTED WINTER WHEAT AFTER SUMMER FALLOW

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Water erosion and runoff can be severe due to poor infiltration through frozen soil in the dryland wheat (Triticum aestivum L.) production region of the inland Pacific Northwest (PNW), USA. For more than 70 years, farmers and researchers have used various methods of subsoiling to reduce runoff and erosion and to improve infiltration and soil water storage. The practice and equipment have evolved from chiseling continuous open channels across hillslopes to the rotary subsoiler that pits the soil. Farmers often subsoil wheat stubble after harvest, but do not employ

DRYLAND CROPPING SYSTEMS RESEARCH AT LIND

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Abstract. Cropping systems research that compares intensive cropping using no-till vs. the traditional winter wheat – summer fallow rotation with tillage has been ongoing at the WSU Lind Dryland Research Station since 1998. Annual spring cropping was not economically competitive with winter wheat - summer fallow from 1998 to 2003. On average, soft white spring wheat grain yield was less than half of grain yield for soft white winter wheat after summer fallow (i.e., one crop every two years). Recrop winter wheat after two years of spring wheat has yielded significantly more grain than continuous annual spring wheat in 3 of 4 years. In addition, Russian thistle infestation in recrop winter wheat is minimal whereas Russian thistle infestation is generally severe in spring wheat. In 2003, winter wheat after summer fallow produced 32 bu/ac compared to 24 bu/ac for winter wheat after chemical fallow, 16 bu/ac for recrop winter wheat, and 8 bu/ac for continuous spring wheat (Table 1).

Phase II of the Study. A committee of 22 growers and researchers met at the Lind Station in February 2002 to discuss and design phase II of the long-term dryland cropping systems experiment. Results from phase I (1998-2001) have been presented previously. Based on recommendations of the committee, the following cropping systems are now in place:

1. Continuous annual soft white spring wheat.
2. Continuous annual hard red spring wheat.
4. Winter wheat - summer fallow (tillage).
5. Winter wheat - spring wheat - spring wheat.
6. Winter wheat - spring wheat - chemical summer fallow.
7. Winter wheat - spring wheat - summer fallow (tillage).

Each phase of all treatments appears every year. The experimental design is a randomized complete block with four replications, thus a total of 56 plots. Individual plots in the original experiment were 45 ft x 500 ft, whereas plot length in the second phase is 225 ft with a 50 ft alley in the middle. All no-till plots are 15-ft wide, and tillage plots are 30-ft wide. Thus, all seven of the new treatments fit within the area of the original experiment. Grain harvest is with a plot combine equipped with chaff spreader. The entire experiment area is then "blanket harvested" with a commercial-scale combine to uniformly spread straw and chaff. Tillage (in treatments 4 and 7 above) is conducted with a wide-blade undercutter sweep, both to control Russian thistle after harvest (if needed) and for primary spring tillage (aqua N is applied with the undercutter in one pass in the spring), followed by two rodweedings (i.e., minimum tillage). All other treatments are planted and fertilized in one pass into undisturbed standing stubble from the previous crop with a Cross-slot no-till drill. These crop rotations will continue at least until 2008 (i.e., six crop harvests).

Table 1. Grain yields in 2003 from phase II of the long-term dryland cropping systems study at Lind, WA. Phase I was from 1998-2001. The year 2002 was for establishing summer fallow (both chemical and tilled) while the remainder of the land was planted to spring wheat. The first grain yields from phase II were harvested in 2003.

Rotation	Grain yield (bu/ac) †
Continuous annual spring wheat	
1. Continuous soft white spring wheat ‡	9 e
2. Continuous hard red spring wheat	12 de
3. Continuous hard white spring wheat	15 cd
Two-year rotation	
4. Winter wheat – summer fallow (tillage) §	29 a
Three-year rotations	
5. Winter wheat	16 c
Spring wheat	10 e
Spring wheat	10 e
6. Winter wheat (after chemical summer fallow) ¶	24 b
Spring wheat	11 de
7. Winter wheat (after tillage summer fallow) §	32 a
Spring wheat	11 de

† Within-column wheat yields followed by the same letter are not significantly different at $P < 0.05$.
‡ All wheat is soft white except when mentioned otherwise (i.e., rotations 2 and 3).
§ Winter wheat was planted six inches deep into moisture on 3 Sept. 2002.
¶ Winter wheat was planted one-inch deep on 5 Nov. 2002 as seed-zone soil moisture was not sufficient for early planting.