

WHEAT PLANT DENSITY STUDIES IN THE WILLAMETTE VALLEY

by R.S. Karow¹

Soft white winter wheat yields in western Oregon have averaged over 75 bu/A for the past five years. The environment and available production technology favor high yields - better managers often obtain yields in excess of 100 bu/A. Even with yields at these levels, growers ask if they could achieve higher yields using more intensive management practices. The purpose of the trials reported here was to determine if increased plant densities would increase yields.

In the 1984-85 trial, three soft white winter wheat varieties and one hard red winter wheat experimental line were evaluated at four seeding rates – 8, 12, 16 and 32 seeds/ft². A seeding rate of 16 – 20 seeds/ft² is commonly used by growers. The fall was unseasonably rainy and seeding was done under adverse conditions the last day of October. Stands were poor. Final plant populations were less than twelve plants/ft² (Table 1). As might be expected with low plant densities, there was a significant yield response with higher populations; however, as yields were poor, conclusions on the effect of high plant densities cannot be drawn from this study.

In 1985, two plant density studies were planted under favorable conditions, one on Hyslop Farm and the other on the Department of Horticulture Vegetable Farm. Results of these trials are summarized in Tables 2 and 3.

On Hyslop Farm (Table 2) two soft white winter wheat varieties (Stephens and Hill 81) and two hard red winter wheats (Hatton and OR8511) were grown in 4 and 8 inch rows with seeding rates of 15, 30, and 45 seeds/ft². Stands were good and near the intended levels. Hatton, a dryland wheat variety, lodged severely in early June. All other materials were standing, with little lodging, until a July 3 windstorm leveled the trial. There was

EXT/CRS 67 11/86

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no statistically significant advantage to narrower rows though there was a trend toward higher yields. There was a significant yield reduction with higher seeding rates and plant populations. Plants in high density seeded plots showed little recovery in upright growth after the July 3 storm, unlike plots seeded at lower densities. Bushel weights, except for OR8511, also tended to decrease with higher plant densities.

On the Vegetable Farm (Table 3) disease incidence was minimal. Lodging was also minimal until the July 3 storm; however, lodging in these plots increased with plant densities indicating weaker stem structure with higher seeding rates. Yields were good. Neither row spacing nor seeding rate had a significant effect on yield.

In general, these studies confirm past Willamette Valley density studies which have shown that varieties currently grown in western Oregon are not responsive to increases in seeding rate beyond a level of 16 - 20 seeds/ft². All varieties tiller well and are able to compensate for thin stands. All varieties tend to have at least three kernels per spikelet and varieties such as Stephens and Malcolm have had as many as 26 spikelets per head in commercial fields.

Our recommendation to growers at this time is that they continue to use current seeding rates of 16 to 20 seeds/ft² if planting under good soil conditions in properly rotated fields. Higher seeding rates are recommended under unfavorable conditions and/or with late season plantings. We are also encouraging growers to think about seeding rates on a seeds/ft² basis rather than on a lbs/acre basis as there are great differences in seed size among varieties and in a variety from year to year.

Another plant density trial was planted in September, 1986. Row spacing, seeding rate, fertility and plant growth regulators will be evaluated in this study.

TREATMENT		OB	SERVATIONS				
VARIETY	SEEDS/ SQ FT	PLANTS SQ FT	HEIGHT (IN)	YIELD (B/A)	TEST WGT (LB/B)	KRNL WGT (MG)	PROTEIN (%)
Hill 81 Hill 81 Hill 81 Hill 81 Stephens Stephens Stephens Malcolm Malcolm Malcolm OR8313 OR8313 OR8313	8 12 16 32 8 12 16 32 8 12 16 32 8 12 16 32 8	6.2 6.9 9.1 10.8 5.2 5.9 8.6 11.8 4.4 7.0 9.2 10.9 8.0 7.3 8.8 12.2	32.8 34.2 35.0 35.2 30.8 31.5 31.8 32.2 31.5 33.2 33.5 33.2 33.5 33.2 34.5 35.2 35.0 36.5	58.4 56.2 70.6 76.2 53.6 53.0 62.8 69.9 46.2 67.2 69.3 74.8 56.2 60.6 67.3 76.6	60.4 60.6 60.5 60.2 58.4 58.6 58.9 59.1 60.2 60.3 60.1 60.3 61.4 61.9 61.6 61.9	42.3 43.2 42.8 41.0 58.2 56.5 56.2 56.8 54.0 54.8 54.0 54.8 54.6 53.4 46.9 49.0 47.6 47.1	11.0 11.0 10.7 10.2 10.8 10.3 10.5 9.9 10.7 10.4 9.7 9.8 12.1 11.6 11.6 11.3
AVE		8.3	33.5	63,7	60.3	50.3	10.7
PLSD (5%)	any w/in	3.1 2.2	2.9 1.6	21.1 11.2	0.5 0.4	2.8 2.2	NS NS
Hill 81 Stephens Malcolm OR8313		8.3 7.8 7.9 9.0	34.3 31.6 32.9 35.3	65.4 59.8 64.4 65.2	60.4 58.8 60.2 61.7	42.3 56.9 54.2 47.6	10.7 10.4 10.1 11.7
PLSD (5%)		NS	2.5	NS	0.4	2	0.4
8 12 16 32		6.0 6.8 8.9 11.4	32.4 33.6 33.8 34.3	53.6 59.3 67.5 74.4	60.1 60.3 60.3 60.4	50.4 50.8 50.3 49.6	11.1 10.8 10.6 10.3
PLSD (5%)		1.1	0.8	5.6	0.2	NS	0.3
Variety x S	eed Rate	NS	NS	NS	NS	NS	NS
CV		18,6	3,4	12.2	0.5	3,0	4,3

Table 1. 1984-85 Hyslop Farm Winter Wheat Seeding Rate Trial

Treatment Observations				ons	
Variety	Row Spacing	Seeds sq ft	Height (in)	Yield (bu/A)	Bu Wgt (1bs)
Hatton Hatton Hatton Hatton Hatton Hill 81 Hill 81 Hill 81 Hill 81 Hill 81 Hill 81 Hill 81 Hill 81 Hill 81 Hill 81 Stephens Stephens Stephens Stephens Stephens Stephens Stephens Stephens Stephens OR 8511 OR 8511 OR 8511 OR 8511 OR 8511	4 4 4 8 8 8 8 4 4 4 8 8 8 4 4 4 8 8 8 4 4 4 8	$\begin{array}{c} 15\\ 30\\ 45\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 45\\ 15\\ 30\\ 15\\ 15\\ 30\\ 15\\ 15\\ 15\\ 15\\ 15\\ 15\\ 15\\ 15\\ 15\\ 15$	$\begin{array}{c} 62\\ 61\\ 60\\ 62\\ 62\\ 60\\ 53\\ 53\\ 53\\ 54\\ 48\\ 49\\ 48\\ 49\\ 48\\ 49\\ 48\\ 49\\ 48\\ 51\\ 52\\ 52\\ 52\\ 52\\ 52\\ 52\\ 52\\ 52\\ 52\\ 52$	101.8 107.9 88.7 102.3 92.9 97.5 123.1 120.7 118.6 122.1 120.7 117.2 145.9 136.0 134.7 137.5 129.5 132.8 123.2 107.3 106.6 109.9 113.7 105.6	$\begin{array}{c} 63.4\\ 63.2\\ 62.3\\ 62.5\\ 62.5\\ 62.3\\ 60.1\\ 60.1\\ 59.2\\ 59.8\\ 58.2\\ 59.2\\ 60.0\\ 59.5\\ 59.3\\ 60.9\\ 57.8\\ 58.8\\ 60.7\\ 60.9\\ 57.8\\ 58.8\\ 60.7\\ 60.9\\ 61.5\\ 60.7\\ 61.2\\ 61.4\end{array}$
Ave.			54	116.5	60.7
PLSD (5%))		2	14.0	1.2
Hatton Hill 81 Stephens OR8511			61 53 48 52	98.5 120.4 136.1 111.0	62.9 59.4 59.4 61.1
PLSD (5%))		1	7.4	0.6
	4 8		54 54	117.9 115.1	60.8 60.5
PLSD (5%))		NS	NS	NS
		15 30 45	54 54 53	120.7 116.1 112.7	61.1 60.4 60.5
PLSD (5%)			NS	4.3	0.4
CV			2.9	8.2	1.3

Table 2. 1985-86 Wheat Plant Density Study on Hyslop Farm

	Table 3.	1985-86 WI	heat Plant	Density	Trial on	the \	Vegetable	Farm
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Variety	Row Spacing	Seeds/ sq ft	Plts /ft 2	Height (in)	Lodging 7-28-86	Yield (Bu/A)
OR 8511 OR 8511 OR 8511 OR 8511 OR 8511 OR 8511 OR 8511	4 4 8 8 8	15 30 45 15 30 45	19 33 46 15 30 36	46 47 47 47 49 48	25 66 80 34 79 88	135.2 130.3 134.0 135.8 127.1 138.5
AVE			30	47	62	133.5
PLSD (5%))		4	NS	33	NS
	4 8		33 27	47 48	57 67	133.2 133.8
PLSD (5%))		3	NS	NS	NS
		15 30 45	17 32 41	47 48 48	30 72 84	135.5 128.7 136.3
PLSD (5%))		2	NS	17	NS
CV			7.2	3.5	29.4	7.9

1. 1984-85 Hyslop Farm Wheat Seeding Rate Trial Investigator: Russ Karow Location: Hyslop Farm field 5-9, Corvallis, OR Field history: wheat-wheat Variety: As given Seeding date: October 31, 1984 Seeding rate: As given, 9" rows Plot size: 5 x 35' Herbicide: 1 lb/Karmex + 1/3 oz. Glean, March 28, 1985 Fertilizer: 180-40-44-17-150, N-P-K-S-Cl in split applications Fungicide: 1 1b/A Benlate, March 29, 1985 Plot design: RCBD split plot (rates in varieties), 4 replications Harvest: August 1, 1985, Hiege combined 2. 1985-86 Wheat Plant Density Study on Hyslop Farm Investigators: Russ Karow, Jim Habernicht Location: Hyslop Farm field 4-12, Corvallis, OR Field history: silage corn - fallow - fallow Variety: as given, winter wheats Seeding date: October 12, 1985 Seeding rate: as given 5 x 30[°] Plot size: Herbicide: 1.5 1b/A Karnex + 1.5 pt Racer, October 14, 1985; minor hand hoeing Fertilizer: 268-60-0-40-50, N-P-K-S-Cl in split applications a) 1 lb/A Benlate, March 21, 1986 Fungicide: b) 1/2 lb/A Benlate, April 24, 1986 c) 1/2 lb/A Benlate + 40 oz Manzate 200F, May 9, 1986 Plot design: RCBD split-split plot (rates in rows in varieties), 5 replications Harvest: July 31, 1986, Hiege combined 3. 1985-86 Wheat Density Trial on the Vegetable Farm Investigators: Russ Karow, Jim Habernicht Location: Horticulture Vegetable Farm, Corvallis, OR Field history: alfalfa - alfalfa Variety: OR8511 hard red winter wheat Seeding date: October 12, 1985 Seeding rate: as given Plot size: 5 x 30' Herbicide: 2 1b/a Karmex, November 26, 1985 Fertilizer: 228-60-0-24-50, N-P-K-S-Cl in split application Fungicide: .5 1b Benlate + 2 1b Dithane, Feekes 9 Plot design: RCBD, split plot (rates in rows)

Harvest: July 30, 1986, Hiege combined