



Use of Plant Growth Regulators to Prevent Winter Wheat Lodging in Tulelake

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Introduction: Tulelake’s climate and soils are very favorable for irrigated barley and wheat production, and growers consistently obtain some of the highest barley and wheat yields reported in California. Growers also frequently have a problem with lodging, the bending over of the stems near the ground level. Lodging is caused by several factors including nitrogen, soil moisture, and weather. Plant breeding efforts reduced the incidence of lodging over the years by developing shorter varieties with stiff straw, but some varieties still tend to lodge. One solution to lodging is to apply a plant growth regulator (PGR) that shortens the internodes and strengthens the stem through inhibition of cell elongation. This study tested the effectiveness of PGRs applied at different timings and rates for reducing winter wheat lodging. The study also documented the yield and quality benefit from using PGRs compared to leaving wheat untreated.

Methods: The study site was established at IREC in fall 2017 using two soft white winter wheat varieties, Tubbs and Duet. The study was set up as a RCB design with four replications. Treatments included an Eastman PGR (Test PGR) with the active ingredient chlormequat chloride, and a Sygenta PGR (Palisade) applied alone and in combination with the fungicide Quilt. PGR treatments were applied at two application times, early stem elongation (30-32) and flag leaf emergence (37-39). The trial included an untreated control. Evaluations included plant height, lodging incidence and severity, grain yield, and grain quality.

Results: Several PGR treatments reduced plant height for both varieties. Palisade applied at the late application timing was the only treatment to reduce lodging across varieties (Tables 1 & 2). Reduced lodging from Palisade at the late application timing increased grain yield for Duet (Table 2). PGR treatments applied at the early application timing provided little benefit regarding lodging and grain yield.

Table 1. 2018 PGR Results from Tulelake, CA- Tubbs winter soft white wheat

Trt #	Treatment Name	Application Timing	Rate per Acre	Unit	Crop Injury Rating - 5/16/18 Injury (0-10, 10 worse)	Stem width anthesis 6/26/18 (mm)	Heading date	Maturity date	Plant height anthesis 6/26/18 (cm)	Lodging Rating		Plant Height at Harvest 9/6/18 cm	head/stem per 3' of 1 row 9/6/18 #	Plant stem width 9/6/18 mm	Grain yield 9/6/18 lbs/acre	Bushel wt. lbs 9/6/18	Grain protein 9/16/18 %	Grain moisture 9/16/18 %	1000 Kernel Wt. 9/16/18 grams	Kernels per 10 heads 9/16/18 #
										7/12/18	8/23/18									
										Soft Dough Maturity 1-9, 1=flat										
1	Control (Standard Fertility)	N/A			0	3.95	6/22/18	8/16/18	106ab	4bc	5.5ab	101.6a	116.3	3.4	8478	57.68ab	11.07	9.3	40.9ab	432
2	Control (High Fertility)	N/A			0	3.87	6/22/18	8/16/18	108a	2.3c	3.8b	99.8ab	115.8	3.3	7977	58.15ab	11.25	9.3	41.9ab	481
3	Test PGR (HF)	1	25	fl oz	0.4*	3.79	6/22/18	8/16/18	101bcde	4.5abc	5.5ab	97.4abc	111.3	2.9	7854	57.15ab	11.25	9.3	39.1abc	507
4	Test PGR (HF)	2	25	fl oz	0	3.79	6/22/18	8/16/18	101cde	4.5abc	5.3ab	96.4bc	120.3	2.8	8120	57.43ab	11.36	9.4	39.8abc	439
5	Test PGR (HF)	1	14	fl oz	0	3.88	6/22/18	8/16/18	99e	4.5abc	5ab	94.9c	104	3.1	8187	56.8ab	11.6	9.3	38.4abc	446
6	Test PGR (HF)	1	25	fl oz	0	3.72	6/22/18	8/16/18	99de	4bc	5ab	96.1bc	106.5	3.4	8151	56.75ab	11.33	9.3	38.1abc	482
7	Quilt Fungicide	1	14	fl oz	0	3.85	6/22/18	8/16/18	98e	4.3bc	4.5b	94.3c	110.8	3	7749	55.88b	11.63	9.2	35.9c	488
8	Palisade EC	1	14	fl oz	0	3.86	6/22/18	8/16/18	99e	4.3bc	5ab	94.2c	110.3	3.1	7611	56.1ab	11.8	9.3	37.2bc	438
9	Test PGR (HF)	2	11	fl oz	0	3.89	6/22/18	8/16/18	99e	6ab	5.3ab	94.6c	127.8	3.1	8635	57.5ab	11.33	9.4	38.7abc	467
10	Palisade EC	1	14	fl oz	0	3.93	6/22/18	8/16/18	105abc	3.3bc	4b	98.6abc	115.5	3	8187	57.8ab	11.38	9.4	40.2abc	417
11	Test PGR (HF)	2	25	fl oz	0	3.98	6/22/18	8/16/18	101cde	7.8a	7.5a	96.5bc	115.3	3	8654	58.55a	11.35	9.4	42.2a	447
12	Palisade EC (HF)	1	14	fl oz	0	3.83	6/22/18	8/16/18	104abcd	2.5c	3.8b	98.4abc	106.3	3	7808	57.42ab	11.65	9.3	38.32	445
	Quilt Fungicide	1	14	fl oz	0	3.83	6/22/18	8/16/18	104abcd	2.5c	3.8b	98.4abc	106.3	3	7808	57.42ab	11.65	9.3	38.32	445

NIS was added to all treatments at 0.25% v/v

1= Gstage 30-32

2= Gstage 37-39

Table 2. 2018 Results from Tulelake, CA- Duet winter soft white wheat

Trt #	Treatment Name	Application Timing	Trt Rate per Acre	Unit	Crop Injury Rating - Leaf Burn 5/16/18	Stem width anthesis 6/26/18	Injury (0-10, 10 worse)	Heading date	Maturity date	Plant height anthesis 6/26/18 (cm)	Lodging Rating		Plant Height at Harvest 9/6/18 (cm)	head/stem per 3' of 1 row 9/6/18 (#)	Plant stem width 9/6/18 (mm)	Grain yield 9/6/18 (lbs/acre)	Bushel wt. lbs 9/6/18	Grain protein 9/16/18 (%)	Grain moisture 9/16/18 (%)	1000 kernel wt. 9/16/18 (grams)	Kernels per 10 heads 9/16/18 (#)
											7/12/18 Soft Dough	8/23/18 maturity									
											1-9, 1=flat										
1	Control (Standard Fertility)	N/A			0	3.75		6/22/18	8/16/18	110.5a	5.5bcd	6ab	104.5a	122	2.76	8739abcde	60.54a	11.57b	9.5	43.4a	490
2	Control (High Fertility)	N/A			0	3.66		6/22/18	8/16/18	111.2a	3.75d	4.25b	105.1a	131	2.79	8033de	59.98ab	11.92ab	9.5	42.3ab	473
3	Test PGR (HF)	1	25	fl oz	1*	3.82		6/22/18	8/18/18	99.4c	5bcd	4.5b	99.8bc	123	3.06	8199cde	59.19b	11.92ab	9.5	40.4ab	479
4	Test PGR (HF)	2	25	fl oz	0	3.51		6/22/18	8/16/18	101.9c	4.25bcd	4.5b	99.2bc	127	3.11	8478abcde	59.25b	12.12a	9.5	39.9ab	423
5	Test PGR (HF)	1	14	fl oz	0	3.79		6/22/18	8/17/18	98.3c	7.5ab	6ab	97.3c	129	2.97	9194abc	59.42ab	12.02ab	9.5	39.5b	447
6	Test PGR (HF)	2	11	fl oz	0	3.79		6/22/18	8/17/18	98.3c	7.5ab	6ab	97.3c	129	2.97	9194abc	59.42ab	12.02ab	9.5	39.5b	447
6	Test PGR (HF)	1	25	fl oz	0.125	3.88		6/22/18	8/17/18	102.4bc	7abcd	6.5ab	99.6bc	112	3.16	8356bcde	59.61ab	12.05ab	9.4	40ab	449
7	Quilt Fungicide	1	14	fl oz	0	3.85		6/22/18	8/18/18	97.7c	7.5ab	7.25ab	98.2c	105	2.73	8612abcde	59.42ab	11.87ab	9.4	40.4ab	445
7	Test PGR (HF)	2	11	fl oz	0	3.85		6/22/18	8/18/18	97.7c	7.5ab	7.25ab	98.2c	105	2.73	8612abcde	59.42ab	11.87ab	9.4	40.4ab	445
7	Quilt Fungicide	1	14	fl oz	0	3.85		6/22/18	8/18/18	97.7c	7.5ab	7.25ab	98.2c	105	2.73	8612abcde	59.42ab	11.87ab	9.4	40.4ab	445
8	Palisade EC	1	14	fl oz	0	3.72		6/22/18	8/17/18	98.1c	7.25abc	5.75ab	97.8c	115	2.99	9023abcd	59.73ab	12.17a	9.4	39.9ab	471
8	Test PGR (HF)	2	11	fl oz	0	3.72		6/22/18	8/17/18	98.1c	7.25abc	5.75ab	97.8c	115	2.99	9023abcd	59.73ab	12.17a	9.4	39.9ab	471
9	Palisade EC	1	14	fl oz	0	3.62		6/22/18	8/17/18	100.7c	7.25abc	6.5ab	98.5c	113	2.44	9317ab	59.24b	12.12a	9.5	39.5b	451
9	Test PGR (HF)	2	25	fl oz	0	3.62		6/22/18	8/17/18	100.7c	7.25abc	6.5ab	98.5c	113	2.44	9317ab	59.24b	12.12a	9.5	39.5b	451
10	Palisade EC (HF)	1	14	fl oz	0	3.82		6/22/18	8/17/18	107.2ab	4.75bcd	5.25ab	102.3ab	125	2.93	8727abcde	59.55ab	12.17a	9.5	40ab	462
11	Palisade EC (HF)	2	14	fl oz	0	3.77		6/22/18	8/16/18	100.8c	9a	8.5a	98c	110	2.77	9457a	59.93ab	12.05ab	9.5	42.1ab	465
12	Palisade EC (HF)	1	14	fl oz	0	3.71		6/22/18	8/18/18	106.9ab	4cd	5ab	100.8bc	128	3.02	7759e	59.59ab	12.12a	9.6	40.5ab	413
12	Quilt Fungicide	1	14	fl oz	0	3.71		6/22/18	8/18/18	106.9ab	4cd	5ab	100.8bc	128	3.02	7759e	59.59ab	12.12a	9.6	40.5ab	413

NIS added to all treatments at 0.25% v/v

1= Gstage 30-32

2= Gstage 37-39