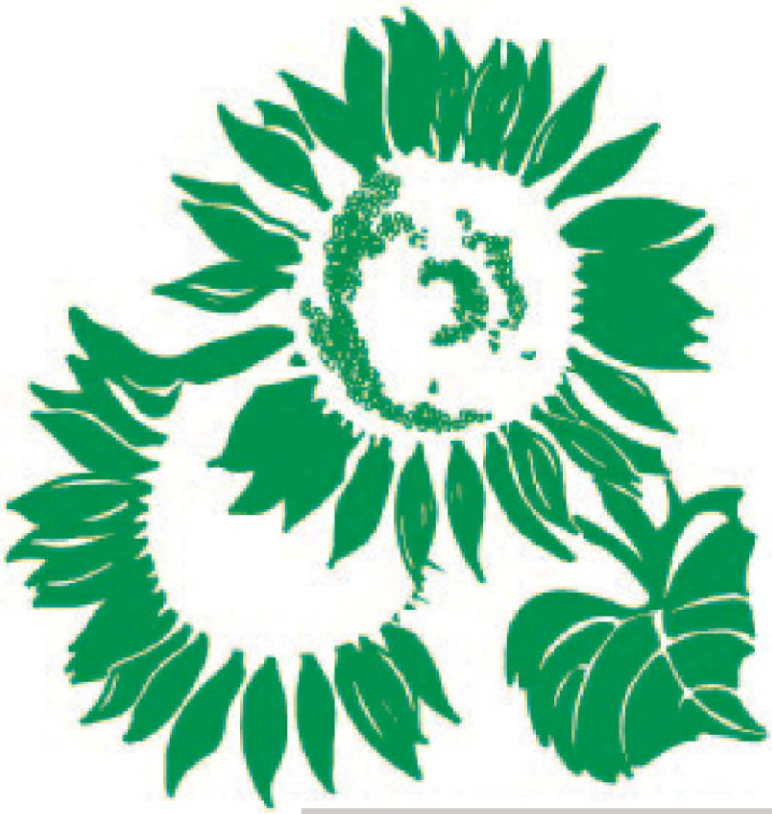
Technical Report TR07-03 February 2007

Agricultural Experiment Station

Colorado State University

College of Agricultural Sciences | Department of Soil and Crop Sciences | Western Colorado Research Center | Extension



MAKING BETTER DECISIONS

2006 Colorado Sunflower Variety Performance Trials

Acknowledgments

The authors express their gratitude to the Colorado farmers who generously contributed the use of their land, equipment, and time to conduct these trials for the good of all Colorado sunflower producers:

- Burlington - Randy Wilks
- Haxtun - Dave and Dan Anderson
- Idalia - Dennis Towns
- Akron - Central Great Plains Field Station

We gratefully acknowledge the Colorado Sunflower Administrative Committee for funding the sunflower trials and to Triumph Seed Co., Inc. for sunflower oil analyses and Red River Commodities, Inc. for sunflowers seed-sizing analyses.

Research conducted by Colorado State University Crops Testing Program
Department of Soil and Crop Sciences
Crops Testing Program
Western Colorado Research Center
Colorado State University Extension

http://www.csucrops.com

Table of Contents

AUTHORS and INFORMATION RESOURCES

Dr. Jerry Johnson - Research Scientist/Extension Specialist/Crop Production, Colorado State University, Department of Soil and Crop Sciences, C11 Plant Science Building, Fort Collins, CO 80523-1170; telephone 970-491-1454; fax 970-491-2758; e-mail jerry.johnson@colostate.edu.

Alicia Davisson - Research Associate/Crops Testing Program, Colorado State University, Department of Soil and Crop Sciences, C03 Plant Science Building, Fort Collins, CO 80523-1170; telephone 970-491-1914; fax 970-491-2758; e-mail cas_csucroptesting@mail.colostate.edu.

Jim Hain - Research Associate/Crops Testing Program, Colorado State University, Department of Soil and Crop Sciences, Central Great Plains Research Station, 40335 County Road GG, Akron, CO 80720; telephone 970-554-0980; fax 970-345-2088.

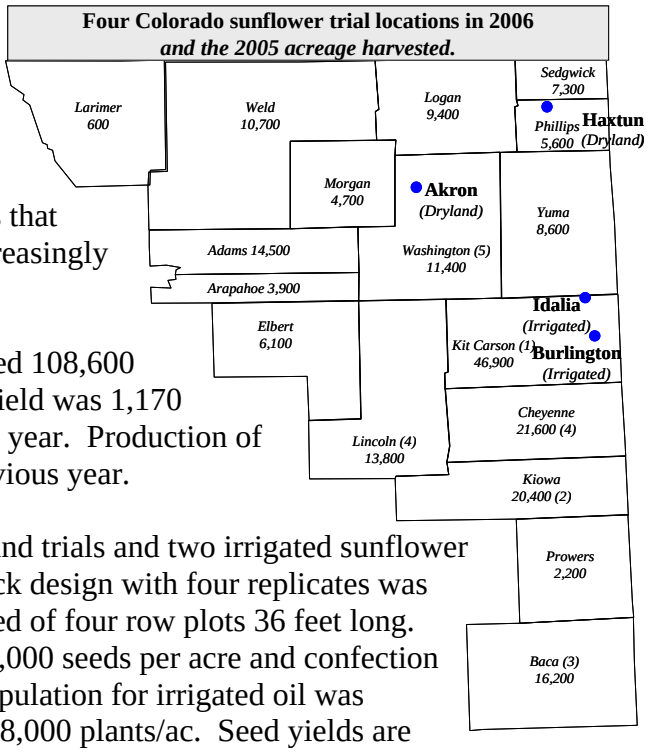
Dr. Calvin Pearson - Professor/Extension Specialist/New & Alternative Crops, Colorado State University, Western Colorado Research Center, 1910 L Road, Fruita, CO 81521; telephone 970-858-3629; fax 970-858-0461; e-mail calvin.pearson@colostate.edu.

Ron Meyer - Golden Plains Area Extension Agronomist, Kit Carson County, 251 16th Street, Suite 101, Burlington, CO 80807-1674; telephone 719-346-5571; fax 719-346-5660; e-mail ronald.meyer@colostate.edu.

2006 COLORADO SUNFLOWER HYBRID PERFORMANCE TRIALS

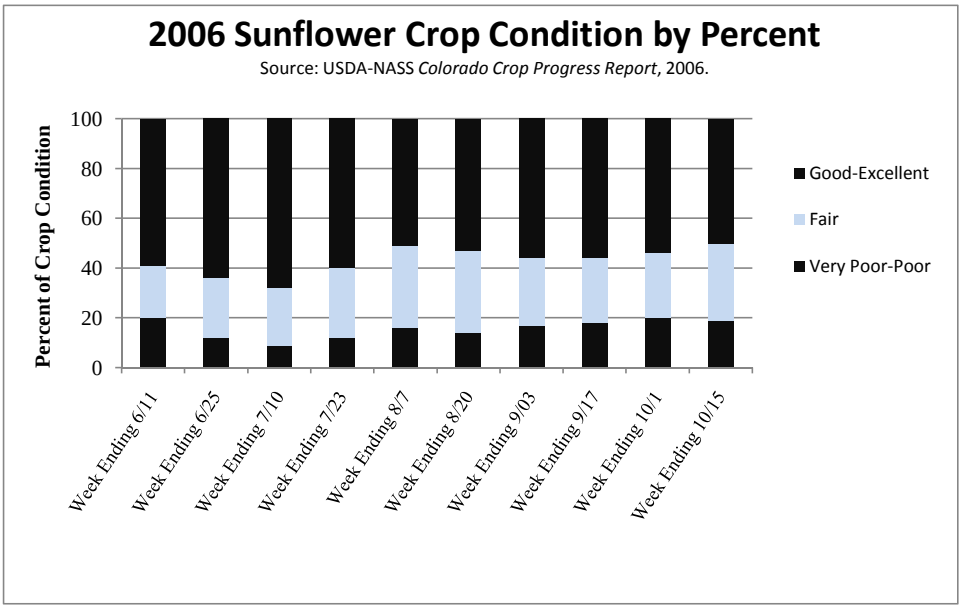
Introduction

CSU's Crops Testing personnel assists Colorado sunflower producers to make the best possible hybrid sunflower seed selection by providing unbiased and reliable yield trial results from oil and confection sunflower performance trials. Variable climatic conditions, innovations from biotechnology, acquisitions and mergers of seed companies, and rapid evolution of new hybrid lines means that unbiased crop performance information is increasingly important to Colorado sunflower producers.



In 2006, sunflower production harvested 108,600 million pounds from 93,000 acres. Average yield was 1,170 pounds per acre, down from 1,280 pounds last year. Production of sunflowers decreased 41 percent from the previous year.

For the two traditional small-plot dryland trials and two irrigated sunflower performance trial, a randomized complete block design with four replicates was used. All trials, dryland and irrigated, consisted of four row plots 36 feet long. Target plant population for dryland oil was 18,000 seeds per acre and confection hybrids was 15,000 plants/ac. Target plant population for irrigated oil was 22,000 plants/ac and confection hybrids was 18,000 plants/ac. Seed yields are reported in lbs/ac and are adjusted to 10% moisture content. Oil content is reported as % oil at 10% seed moisture content.



The chart above shows the sunflower crop condition by percent every two weeks during the 2006 growing season. There are three categories used for rating the crop condition, very poor to poor, fair and good to excellent.

Insect pressure in eastern Colorado for 2006

Sunflower insects: Below average

Table 1. Irrigated oil sunflower variety performance at Idalia[1].

Hybrid	Yield	Moisture	Test Weight	Plant Height	Density	Lodging	Oil
	lb/ac	%	lb/bu	in	plants/ac	%	%
Cropland Genetics 356NS	2988	7.1	30.9	61	14425	1.6	40.7
Dekalb DKF37-31NS	2868	7.8	30.0	53	11189	1.6	40.5
Mycogen 8H350 DM	2774	6.8	30.5	61	11805	3.6	42.7
Mycogen 8N520 DM	2730	6.7	30.8	61	13241	1.6	40.8
Fontanelle IS 5880	2698	6.4	30.1	60	11922	3.8	42.2
Dekalb DKF38-45NS	2690	5.8	30.6	60	14361	2.0	44.2
Triumph 845HO	2652	7.5	28.2	72	15282	3.9	41.7
Triumph 847HO	2652	9.2	30.4	71	12757	0.0	42.8
Mycogen 8N462 DM	2649	7.1	33.4	65	13694	0.0	45.3
Mycogen 8N453 DM	2633	8.6	33.4	63	13120	2.8	44.1
Triumph TRXs5423	2610	6.4	30.4	45	15794	4.1	43.2
Fontanelle HySun 424	2609	6.5	29.7	61	13139	1.3	39.2
Monsanto MH5436	2607	6.6	30.4	56	14092	1.0	40.7
Mycogen 8N352	2590	7.8	32.1	59	15554	1.3	44.8
Triumph s678	2587	8.2	32.4	57	15150	1.9	42.3
Mycogen 8N510	2573	7.3	30.9	57	15092	1.4	40.1
Garst 4665 HO	2568	7.4	31.6	59	14622	6.1	39.4
Croplan Genetics 378 DMR HO	2562	6.9	30.5	66	15291	0.9	41.7
Pioneer brand 63M91	2561	8.1	32.8	65	15792	0.5	41.7
Garst 4668 NS/CL	2544	9.5	31.0	66	17002	2.5	40.0
Pioneer brand 63M80	2543	6.6	31.4	59	14572	2.8	42.5
Croplan Genetics 343 DMR HO	2537	7.5	30.3	61	13824	2.5	37.9
Dekalb DKF38-30 NS	2503	7.3	31.9	65	15293	0.8	39.6
Monsanto MH4436	2495	6.2	30.6	61	15118	3.8	43.7
Advanta Pacific AP534 NS/CL	2480	7.6	30.1	65	16511	2.2	38.9
Producers Hybrids 7104	2467	7.1	31.6	48	15738	0.9	39.6
Triumph 660CL	2462	7.8	30.9	69	16862	0.5	40.8
Triumph TRX4240	2448	7.0	31.1	66	14085	2.9	40.9
Advanta Pacific AP533NS	2447	8.0	29.7	52	15481	1.7	42.0
Triumph 658	2443	7.4	28.7	66	13791	5.2	44.1
Trial Check 2*	2419	6.6	29.2	67	17494	3.8	44.5
Advanta Pacific F51321	2408	6.8	30.6	55	14457	3.7	38.8
Seeds 2000 Blazer	2405	6.4	31.0	54	13066	1.2	41.9
Mycogen 8N386 CL	2394	8.4	29.9	59	14032	0.6	39.1
Trial Check 1*	2390	6.8	31.5	42	14663	5.4	42.3
Triumph 665	2380	7.8	30.6	63	14407	2.4	43.0
Producers Hybrids 7203	2365	6.8	30.1	66	14280	1.1	38.8
Advanta Pacific F41273	2342	6.5	30.1	62	14498	3.1	41.1
Garst 4420 NS	2326	7.4	31.5	66	14530	3.5	40.0
Dekalb DKF35-10	2279	8.0	30.3	62	14344	0.9	38.1
Mycogen 8H419 CL	2245	7.1	29.6	59	14575	1.4	40.5
Monsanto MH5434	2207	6.5	30.2	62	13669	1.8	42.8
Fontanelle 902NS	2159	7.4	29.5	71	14441	4.0	44.6
Monsanto MH4438CL	2114	6.5	29.4	58	13971	6.7	40.2
Advanta Pacific AP561 NS	1892	7.6	31.0	64	15574	1.4	39.5
Fontanelle HyOleic 120	1688	7.8	29.7	68	13991	2.2	38.0
Average	**2478**	**7.3**	**30.7**	**61**	**14491**	**2.4**	**41.3**
$LSD_{(0.05)}$	478						
$LSD_{(0.30)}$	252						

[1]Trial conducted on the Dennis Towns farm; seeded 6/2 and harvested 10/23.

*Trial Check 1 was Triumph s672 & Check 2 was Triumph 645.

**Dry soil at planting time caused reduced germination.

Site Information
Plot Size: 5' x 31' with 30" row spacing; ridge till
Experimental Design: randomized complete block; 4 replications
Seeding Rate: approximately 22,000 seeds/acre
Previous Crop: corn
Irrigation: furrow
Soil Type: Kuma-Kieth silt loam
Fertilization: 88 lbs N $acre^{-1}$; 37 lbs P_2O_5 $acre^{-1}$
Herbicide: Sonalan HFT, Prowl H_2O

Table 2. 2-yr average irrigated oil sunflower performance at Idalia, 2005-06.

Hybrid	Yield	Moisture	Test Weight
	lb/ac	%	lb/bu
Mycogen 8N352	2918	8.5	31.5
Seeds 2000 Blazer	2879	7.1	31.4
Mycogen 8N510	2845	8.0	30.7
Triumph s678	2735	10.0	30.6
DEKALB DKF38-30 NS	2723	7.6	31.7
Producers Hybrids 7203	2711	7.6	30.3
Pioneer brand 63M80	2676	7.2	31.5
Croplan Genetics 378 DMR HO	2638	9.1	29.4
Mycogen 8H350 DM	2637	7.8	30.3
Triumph TRX4240	2625	7.7	31.8
Pioneer brand 63M91	2581	8.9	31.7
Fontanelle 902NS	2572	8.7	29.2
Triumph s672	2567	8.1	30.6
Triumph 665	2560	8.4	30.6
Mycogen 8H419 CL	2517	8.4	29.2
Triumph 660CL	2512	8.8	30.0
Triumph 658	2489	8.7	28.6
Advanta Pacific AP534 NS/CL	2485	9.7	29.5
Triumph 645	2481	7.6	29.3
Mycogen 8N386 CL	2431	8.9	29.5
Advanta Pacific AP561 NS	2259	8.8	30.6
Average	**2611**	**8.4**	**30.4**

Table 3. Irrigated confection sunflower variety performance at Idalia[1] with the percent of seed by screen size.

Hybrid	Yield	Moisture	Test Weight	Plant Height	Density	Lodging	Seed Size		
							Percent below 20/64	Percent above 20/64	Jumbo Percent above 22/64
	lb/ac	%	lb/bu	in	plants/ac	%			
Mycogen 8C482	2092	7.7	21.7	77	7377	3.7	17.5	18.7	63.8
Triumph 777C	2074	8.7	20.8	73	9344	1.5	17.2	23.4	59.4
Red River RRC 7015	1903	7.4	21.8	66	6885	4.3	9.2	16.4	74.4
Croplan Genetics 137	1890	8.2	17.7	61	7869	2.4	5.1	12.6	82.3
Mycogen 8C481	1855	5.7	20.8	75	9625	5.8	11.6	22.2	66.2
Dahlgren 9541	1828	8.9	20.5	75	9274	1.3	4.8	18.6	76.6
CHS Sunflowers RH112	1738	6.7	21.0	67	10679	2.4	9.6	16.5	73.9
Triumph 765C	1706	9.8	22.5	64	7518	0.0	20.8	30.4	48.8
Sigco Sun Goliath RT	1667	7.0	22.5	64	5902	0.0	29.9	16.7	53.4
Red River RRC 2216	1658	8.0	22.0	67	6675	2.0	11.3	26.7	62.0
Triumph 767C	1647	9.2	21.6	69	7658	3.5	33.7	21.2	45.1
CHS Sunflowers RH1122	1634	5.1	19.5	69	7658	10.7	5.5	15.2	79.3
Red River RRC 2215	1562	7.4	22.8	66	7728	1.9	15.4	23.5	61.1
Croplan Genetics 142	1515	5.0	16.7	61	6112	6.8	4.5	13.1	82.4
CHS Sunflowers RH316	1476	8.4	21.3	61	7588	0.0	7.7	15.2	77.1
Dahlgren 9569	1464	9.5	22.0	68	4567	0.0	18.4	16	65.6
Seeds 2000 X3967	1463	6.3	22.6	65	9977	2.4	4.1	10.7	85.2
Dahlgren 9530	1429	7.0	22.5	64	5199	1.3	14.9	17.1	68.0
Seeds 2000 X3938	1413	8.6	20.4	59	7799	0.0	5.2	8.3	86.5
Croplan Genetics 135	1347	5.6	18.8	63	9555	12.1	15.3	13.6	71.1
Triumph TRX2354CLS	719	5.1	21.3	59	4005	15.0	8.9	27.2	63.9
Average	**1623**	**7.4**	**21.0**	**66**	**7571**	**3.7**			
$LSD_{(0.05)}$	545								
$LSD_{(0.30)}$	285								

[1]Trial conducted on the Dennis Towns farm; seeded 6/2 and harvested 10/25 & 10/30.
*Dry soil at planting time caused reduced germination.

Site Information
Plot Size: 5' x 31' with 30" row spacing; ridge till
Experimental Design: randomized complete block; 4 replications
Seeding Rate: approximately 18,000 seeds/acre
Previous Crop: corn
Irrigation: furrow
Soil Type: Kuma-Kieth silt loam
Fertilization: 88 lbs N $acre^{-1}$; 37 lbs P_2O_5 $acre^{-1}$
Herbicide: Sonalan HFT, Prowl H_2O

Table 4. 2-yr average irrigated confection sunflower performance at Idalia, 2005-06.

Hybrid	Yield	Moisture	Test Weight	Plant Height	Density	Lodging	Seed Size		
							Percent below 20/64	Percent above 20/64	Jumbo Percent above 22/64
	lb/ac	%	lb/bu	in	plants/ac	%			
Red River RRC 7015	2214	7.2	21.6	66	9512	5.5	47.5	13.3	39.2
Triumph 777C	2158	8.6	21.1	72	11261	6.4	56.7	13.3	30.0
Red River RRC 2215	2055	7.5	22.8	65	10140	2.7	53.6	14.9	31.5
Mycogen 8C481	2045	6.9	21.2	73	11030	5.5	49.0	16.8	34.2
Sigco Sun Goliath RT	1965	7.5	22.7	62	8446	1.6	58.4	13.1	28.5
Red River RRC 2216	1925	7.7	22.3	67	9437	3.1	51.6	16.6	31.8
Triumph 767C	1808	8.4	22.1	67	11121	7.6	61.4	15.1	23.5
Croplan Genetics 135	1772	6.5	19.6	61	11711	7.5	53.6	9.9	36.6
Average	**1993**	**7.6**	**21.7**	**67**	**10332**	**5.0**			

Table 5. Dryland oil sunflower variety performance at Akron[1].

Hybrid	Yield	Moisture	Test Weight	Plant Height	Density	Lodging	Oil
	lb/ac	%	lb/bu	in	plants/ac	%	%
Advanta Pacific AP534 NS/CL	1042	9.4	31.6	46	14567	16.8	40.0
Triumph s678	961	10.0	31.8	35	15457	2.9	40.1
Trial Check 2*	947	9.7	30.6	47	13715	12.7	42.5
Garst 4651 NS	924	9.8	30.8	46	10590	25.4	42.0
Mycogen 8N352	854	9.2	32.4	36	14373	18.3	42.8
Trial Check 1*	853	9.8	32.1	30	13369	6.7	40.3
Dekalb DKF37-31NS	836	8.7	32.8	41	11093	33.1	40.9
Triumph 660CL	794	10.0	31.2	36	13789	13.8	41.8
Mycogen 8N453 DM	785	9.7	31.2	41	13333	16.1	41.4
Dekalb DKF38-30 NS	686	8.9	32.0	42	15740	15.7	42.3
Advanta Pacific F41273	633	8.6	31.7	41	13217	16.1	41.1
Triumph 658	618	9.0	31.5	39	13269	28.8	42.3
Pioneer brand 63M91	618	7.9	31.0	39	12227	15.0	40.1
Dekalb DKF35-10	579	8.8	33.5	40	14899	14.7	40.5
Garst 4420 NS	577	8.7	32.4	39	15057	9.7	40.6
Garst 4668 NS/CL	573	8.9	32.0	36	15707	20.4	39.4
Mycogen 8N386 CL	572	9.2	31.9	41	13748	7.8	42.2
Mycogen 8H419 CL	548	8.2	32.4	42	12824	8.1	41.2
Mycogen 8N462 DM	547	9.2	32.6	39	14023	11.7	43.4
Mycogen 8H350 DM	541	9.7	32.5	43	14569	35.3	41.7
Advanta Pacific F51321	518	8.7	32.4	37	15370	21.6	41.2
Advanta Pacific AP561 NS	500	9.7	32.5	37	15546	10.4	40.7
Pioneer brand 63M80	481	8.5	32.4	36	14576	32.8	43.0
Advanta Pacific AP533NS	467	9.8	32.7	37	12445	10.4	42.1
Mycogen 8N510	459	9.1	31.8	37	14654	18.9	40.7
Monsanto MH5436	446	8.3	32.3	36	10128	17.6	40.4
Monsanto MH5434	418	8.9	30.9	37	14246	18.8	40.3
Garst 4665 HO	416	10.0	31.7	40	12261	41.7	40.0
Mycogen 8N520 DM	411	9.1	31.6	38	12940	32.1	40.3
Monsanto MH4438CL	361	9.7	31.5	39	10571	42.2	40.2
Dekalb DKF38-45NS	358	8.9	31.9	34	12324	26.4	41.8
Monsanto MH4436	178	8.8	31.0	37	12642	57.1	40.3
Average	**609**	**9.2**	**31.9**	**39**	**13540**	**20.6**	**41.2**

[1]Trial conducted at the Central Great Plains Research Station; seeded 6/14 and harvested 10/27.
*Trial Check 1 was Triumph s672 & Check 2 was Triumph 645.
**Note that dry soil at planting time caused extremely poor germination. Drought and daily high temperatures continued throughout July and part of August. Due to very high variation in yield from plot to plot, no statistical interpretation was possible and yield results can only be considered as yield trends.

Site Information
Plot Size: 5' x 31' with 30' row spacing; no-till
Experimental Design: randomized complete block, 4 replications
Seeding Rate: approximately 18,000 seeds/acre
Previous Crop: canola/juncea
Precipitation: May 4 - September 30, 11.69 inches, 84 % of normal
Soil Type: Weld silt loam
Fertilization: none
Herbicide: Round up

Table 6. 2-yr average dryland oil sunflower performance at Akron, 2005-06.

Hybrid	Yield	Moisture	Test Weight
	lb/ac	%	lb/bu
Triumph 660CL	1069	7.8	29.6
Triumph 645	1014	7.6	29.6
Mycogen 8N352	986	7.4	30.9
Triumph s678	904	7.7	30.6
Mycogen 8N386 CL	859	7.4	30.4
Pioneer brand 63M91	855	6.7	30.4
Mycogen 8H419 CL	823	6.9	30.6
Triumph s672	804	7.6	30.9
Pioneer brand 63M80	754	6.9	30.8
Mycogen 8N510	706	7.3	30.8
Mycogen 8H350 DM	637	7.6	31.0
Average	**855**	**7.4**	**30.5**

Table 7. Dryland confection sunflower variety performance at Akron[1] with the percent of seed by screen size.

							Seed Size		
Hybrid	Yield	Moisture	Test Weight	Plant Height	Density	Lodging	Percent below 20/64	Percent above 20/64	Jumbo Percent above 22/64
	lb/ac	%	lb/bu	in	plants/ac	%			
Triumph 777C	714	11.2	21.6	48	3724	19.7	13.4	12.7	73.9
Triumph 767C	707	7.6	22.2	45	4286	17.1	18.9	17.0	64.1
Average	**710**	**9.4**	**21.9**	**46**	**4005**	**18.4**			

[1]Trial conducted at the Central Great Plains Research Station; seeded 6/14 and harvested 10/27.
*Note that dry soil at planting time caused extremely poor germination. Drought and daily high temperatures continued throughout July and part of August. Due to very high variation in yield from plot to plot, no statistical interpretation was possible and yield results can only be considered as yield trends.

Site Information
Plot Size: 5' x 31' with 30' row spacing; no-till
Experimental Design: randomized complete block, 4 replications
Seeding Rate: approximately 15,000 seeds/acre
Previous Crop: canola/juncea
Precipitation: May 4 - September 30, 11.69 inches, 84 % of normal
Soil Type: Weld silt loam
Fertilization: none
Herbicide: Round up

Table 8. 2-yr average dryland confection sunflower performance at Akron, 2005-06.

							Seed Size		
Hybrid	Yield	Moisture	Test Weight	Plant Height	Density	Lodging	Percent below 20/64	Percent above 20/64	Jumbo Percent above 22/64
	lb/ac	%	lb/bu	in	plants/ac	%			
Triumph 777C	710	8.6	20.9	40	7512	10.7	46.0	14.7	39.4
Triumph 767C	647	6.7	21.0	38	6972	9.8	52.2	14.3	33.5
Average	**679**	**7.7**	**21.0**	**39**	**7242**	**10.3**			

Table 9. Dryland oil sunflower variety performance at Haxtun[1].

Hybrid	Yield	Moisture	Test Weight	Density	Lodging	Oil
	lb/ac	%	lb/bu	plants/ac	%	%
Triumph 658	1133	5.1	27.3	8853	0.0	35.9
Garst 4651 NS	998	5.3	28.2	9696	0.6	34.7
Advanta Pacific F41273	924	5.3	29.6	14052	0.4	37.4
Mycogen 8N520 DM	857	5.4	29.1	12084	0.6	36.9
Triumph s678	834	5.5	31.1	10609	3.3	37.4
Garst 4420 NS	793	5.1	29.2	13560	2.8	37.0
Croplan Genetics 378 DMR HO	777	5.2	29.2	10468	0.0	35.5
Mycogen 8N510	724	5.4	30.0	14684	1.5	35.9
Advanta Pacific AP561 NS	718	5.2	30.2	14824	0.0	36.7
Fontanelle HySun 424	717	5.3	30.0	10820	0.0	36.7
Mycogen 8N453 DM	701	5.5	29.8	9555	0.0	36.4
Seeds 2000 Blazer	701	5.5	28.9	9836	0.0	36.3
Croplan Genetics 343 DMR HO	666	5.2	30.0	11382	0.0	36.9
Mycogen 8H350 DM	657	5.5	29.6	8923	0.0	36.3
Fontanelle HyOleic 120	649	5.5	30.6	10820	0.0	37.4
Fontanelle 902NS	648	5.6	28.5	7377	1.4	36.4
Mycogen 8H419 CL	636	5.2	29.9	12155	0.0	36.6
Mycogen 8N352	628	5.3	30.9	12084	0.0	37.3
Advanta Pacific AP533NS	575	5.5	29.6	8782	0.0	36.2
Pioneer brand 63M91	569	5.4	30.8	10187	0.6	37.0
Mycogen 8N462 DM	562	5.3	30.4	10679	0.0	36.6
Pioneer brand 63M80	561	5.4	29.7	7588	0.0	36.8
Mycogen 8N386 CL	560	5.6	28.7	7447	0.0	35.5
Trial Check 2*	555	5.2	29.5	12084	0.6	36.7
Cropland Genetics 356NS	517	5.3	30.1	9625	0.0	35.8
Advanta Pacific F51321	501	5.6	29.0	10117	0.0	35.3
Trial Check 1*	481	5.3	30.1	13490	0.0	37.2
Advanta Pacific AP534 NS/CL	480	5.4	29.8	12576	0.0	36.1
Fontanelle IS 5880	466	5.2	30.6	7799	0.0	36.6
Average	**675**	**5.4**	**29.7**	**10764**	**0.4**	**36.5**

[1]Trial conducted on the Dave and Dan Anderson farm; seeded 6/26 and harvested 11/9.
*Trial Check 1 was Triumph s672 & Check 2 was Triumph 645.
**Note that due to very high variation, no statistical interpretation was possible of this trial. Trial results should be considered yield trends. Trial was planted in late June into relatively good soil moisture, voles dug up seed from significant parts of many plots resulting in highly variable plant populations. Drought and high temperatures characterized most of the growing season which further increased yield variation. The confection type sunflower variety trial was even more affected by erratic and poor stands and could not be harvested.

Site Information
Plot Size: 5' x 31' with 30' row spacing
Experimental Design: randomized complete block, 4 replications
Seeding Rate: approximately 18,000 seeds/acre
Previous Crop: wheat
Precipitation: May 4 - September 30, 10.9 inches, 90 % of normal.
Soil Type: Iliff loam
Fertilization: 20 lbs N $acre^{-1}$; 15 lbs P_2O_5 $acre^{-1}$
Herbicide: Spartan, Round up

Table 10. 2-yr average dryland oil sunflower performance at Haxtun, 2005-06.

Hybrid	Yield	Moisture	Test Weight
	lb/ac	%	lb/bu
Croplan Genetics 378 DMR HO	1039	6.7	26.5
Mycogen 8N510	972	6.2	27.6
Triumph s678	957	6.2	28.8
Mycogen 8H350 DM	938	6.0	27.7
Mycogen 8H419 CL	920	5.9	27.2
Pioneer brand 63M80	912	6.0	27.3
Triumph 645	911	6.3	27.3
Croplan Genetics 343 DMR HO	885	6.2	27.7
Pioneer brand 63M91	885	6.1	28.4
Mycogen 8N352	883	5.8	28.4
Triumph s672	798	5.9	28.2
Mycogen 8N386 CL	796	6.0	26.8
Dyna-Gro 93C05	748	6.2	27.0
Average	**896**	**6.1**	**27.6**

*Refer to comments from the 2006 trial results.

Seed Company Entrants in the 2006 Colorado Sunflower Performance Trials

Entrant	Brand/Hybrid	Address	Telephone
Advanta Pacific, L.L.C.	Advanta Pacific	6109 53rd Avenue, SW, Fargo, ND 58104	701-282-2952
CHS Sunflowers	CHS	220 Clement Avenue, Grandin, ND 58038	701-484-5128
Croplan Genetics	Croplan	P.O. Box 1291, Minot, ND 58702	701-852-3556
Dahlgren Company	Dahlgren	1220 Sunflower Street, Crookston, MN 56716	218-281-4945
Fontanelle Hybrid, Inc	Fontanelle	10981 8th Street, Fontanelle, NE 68044	402-721-1410
Garst Seed Co.	Garst	162 Alyssum Drive, Brighton, CO 80601	303-519-7016
Dekalb/Monsanto	DEKALB/Monsanto	304 Center Street, West Fargo, ND 58078	800-437-4120
Mycogen Seeds	Mycogen	9330 Zionsville Road, Indianapolis, IN 46268	317-337-4662
Pioneer Hi-Bred Int'l, Inc	Pioneer brand	1616 S. Kentucky St., Ste. C350, Amarillo, TX 79102	806-356-9221
Producers Hybrids	Producers Hybrids	26 Chantilly Street, Grand Island, NE 68803	308-750-4245
Red River Commodities, Inc	Red River	212 NE Loop 289, Lubbock, TX 79403	806-763-9747
SEEDS 2000	SEEDS 2000	115 North 3rd Street, Breckenridge, MN 56520	218-643-2410
SunOpta		P.O. Box 331, 90 N. 8th St., Breckenridge, MN 56520	218-643-8467
Triumph Seed Co, Inc	Triumph	P.O. Box 1050, Ralls, TX 79357	800-530-4789

Producing Oilseed Sunflower under Irrigation in Western Colorado

Calvin H. Pearson[1]

Summary

The high cost of petroleum diesel has increased interest in alternative fuels such as biodiesel. There are a number of biodiesel production facilities currently under construction and many of the existing facilities are undergoing expansion. The potential of agriculture to produce vegetable oil to use as feedstocks to operate biodiesel manufacturing facilities in the United States appears promising. An oilseed sunflower cultivar performance test was conducted at the Western Colorado Research Center at Fruita, Colorado during 2006 to evaluate thirty-two sunflower varieties for seed and oil yield and related agronomic characteristics to assess the potential for commercial production of sunflower under irrigation in western Colorado. Seed yields averaged 2420 lbs/acre and ranged from a high of 3500 lbs/acre for HySun 454 to a low of 701 lbs/acre for Croplan Genetics 3080 DMR. Seed oil content averaged 44.3%, which is typical for many sunflower varieties. Oil contents ranged from a high of 47.0% to a low of 42.0%. Oil yield averaged 1072 lbs/acre. Oil yields among the sunflower varieties ranged from a high of 1530 lbs/acre to a low of 310 lbs/acre. The variety with the highest seed yield did not have the highest oil yield. Additional years of field research will be needed to determine the long-term potential for producing sunflower for vegetable oil under irrigation in western Colorado.

Introduction

In the Rocky Mountain region of the United States the price of petroleum diesel during January 2007 was approximately $2.55 per gallon (U.S. Dept. of Energy, 2007). The price of diesel fuel reached record highs during October-November 2005 at more than $3.00 per gallon.

Biodiesel has recently become popular primarily because of the high cost of petroleum diesel but also because of its performance characteristics and environmental benefits. Comparison characteristics of biodiesel with petroleum diesel have been summarized previously (Pearson, 2006). Ma et al. (1999) presented detailed information on direct use, blending, and the manufacturing chemistry for biodiesel.

The high cost of petroleum diesel has prompted the construction of numerous biodiesel production facilities in the United States. Currently, there are 87 biodiesel production facilities around the country with another 65 under construction along with thirteen of the existing biodiesel facilities

[1] Contact information: Colorado State University Agricultural Experiment Station, Western Colorado Research Center – Fruita, 1910 L Road, Fruita, CO 81521. Ph. 970-858-3629; Fax 970-858-0461; email: calvin.pearson@colostate.edu

From: Colorado State University, Agricultural Experiment Station Technical Report 07-08 pgs. 34-39

undergoing expansion (National Biodiesel Board, 2007a; National Biodiesel Board, 2007b).

Feedstocks for biodiesel production facilities are tri-glyceride seed oils, found in crop plants such as canola, mustards, sunflower, cotton, safflower, soybean, corn, and also used cooking oils, fats, and tallows (Eidman, 2005). Many of the biodiesel facilities use multiple feedstocks while some facilities use a sole source such as soybean oil.

The potential of agriculture to produce vegetable oil as a feedstock to operate biodiesel manufacturing facilities in the United States appears promising (Tickell, 2003). Using vegetable oils for a diversity of applications, particularly in the energy industry, will require large quantities of feedstocks and will likely increase commodity prices in the short and long-term (Eidman, 2005).

With a yield of 3000 lbs/acre and a seed oil content of 44%, an acre of sunflower will produce 1320 lbs of oil. Sunflower oil weighs 7.5 pounds per gallon, and a gallon of vegetable oil will produce about 1 gallon of biodiesel (Hofman, 2003). Under these conditions, an acre of sunflower will produce approximately 176 gallons of biodiesel.

Currently, a biodiesel production facility in southwest Colorado is proposed for construction by the San Juan Biodiesel Cooperative in mid-2007. The main crops targeted for use in this facility are sunflower and canola. Production of biodiesel in western Colorado will open the possibility of growing alternative crops such as sunflower in western Colorado to supply vegetable oil for the biodiesel facility.

The objective of this research was to evaluate thirty-two sunflower varieties for seed and oil yield and other agronomic characteristics to determine the potential for commercial production of sunflower under irrigation in western Colorado.

Materials and Methods

An oilseed sunflower cultivar performance test was conducted at the Western Colorado Research Center at Fruita, Colorado during 2006. The experiment was a randomized, complete block with four replications. Thirty-two oilseed sunflower cultivars were included in the trial. Plot size was 10-feet wide by 50-feet long (4, 30-inch rows). The previous crop was oats.

Prowl herbicide was applied just prior to planting at a rate of 2.5 pts at 25 psi in 20 gals water per acre and incorporated twice with a roller harrow on 11 May 2006. Planting occurred on 15 May 2006 with a White air planter modified for plot research.

Fertilizer was applied broadcast during seedbed preparation (22 lbs N/acre and 104 lbs P_2O_5/acre) on May 10, 2006. Nitrogen fertilizer was side-dressed (80 lbs N/acre as 32-0-0 in a split application of 40 lbs N/acre on each side of the plant row) on 15 June 2006.

The experiment was furrow-irrigated using gated pipe. A germination irrigation was applied on 16 May 2006 in a 24-hour irrigation set. Sunflower was irrigated four times during the 2006 growing season and averaged 18 hours per irrigation.

The two middle rows of the four-row plot were harvested 1 Nov. 2006 using a International 1440 commercial combine and a portable electronic weighing system positioned in the grain tank. Data were collected for plant population, flowering date, plant height, plant lodging, seed

moisture at harvest, test weight, and seed yield. Seed moisture and test weight were obtained using a Dickey-John GAC2100b seed moisture tester.

Results and Discussion

The 2006 cropping season in western Colorado was mild. In 2006, there were 14 days during the summer when temperatures reached 100°F. The average growing season for Fruita is 181 days. The 2006 growing season was 184 days.

Adequate irrigation water was available during the growing season for crop production and water was not a limiting factor for sunflower production.

Seed moisture content averaged across all entries was 6.1% (Table 1). Seed moisture ranged from a high of 6.4% for 'Croplan Genetics 343 DMR' to a low of 5.8% for Croplan Genetics 308 NS. Twenty-four of the thirty-two varieties had seed moisture contents higher than 6.0%, and eight varieties had moisture contents below 6.0%.

Seed yield for the sunflower varieties averaged 2420 lbs/acre (Table 1). There were significant and a wide range of differences among entries for seed yield. Seed yields ranged from a high of 3500 lbs/acre for HySun 454 to a low of 701 lbs/acre for Croplan Genetics 3080 DMR. Three of the thirty-two sunflower varieties (HySun 454, Producers Hybrids 7203, Garst 454) were high yielding and two varieties (Croplan Genetics 308 NS and Croplan Genetics 3080 DMR) had particularly low yields.

Seed oil content averaged 44.3%, which is typical for many sunflower varieties. Oil contents ranged from a high of 47.0% for Mycogen 8N453DM to a low of 42.0% for Dyna-Gro 93N05 #2.

Oil yield averaged 1072 lbs/acre. Oil yields among the sunflower varieties ranged from a high of 1530 lbs/acre for Mycogen 8N462DM to a low of 310 lbs/acre of Croplan Genetics 3080 DMR. The variety with the highest seed yield did not have the highest oil yield.

The standard test weight value for sunflower is 24 lbs/bu. The average test weight for the varieties evaluated in this trial was 33.6 lbs/bu (Table 2). The four varieties with the highest test weights were Pioneer brand 63M91 (34.7 lbs/bu), Mycogen 8N462DM (34.9 lbs/bu), Mycogen 8N453DM (35.5 lbs.bu), and Seeds 2000 Blazer (35.2 lbs/bu). Seven varieties had test weights that were lower than 33.0 lbs/bu., however, the lowest test weight value for all varieties was still substantially greater than the standard test weight value of 25 lbs/bu.

Plant height of sunflower varieties averaged 78.1 inches and the tallest ones were '7203' (88.5 inches), 8N453DM (86.4 inches), and Croplan Genetics 378 DMR (86.0 inches) (Table 2). The shortest variety, as expected, was a dwarf sunflower variety, Triumph s672, with a plant height of 57.8 inches.

Plant population, averaged across all varieties, was 31,364 plants/acre (Table 2). Plant populations ranged from a high of 35,504 plants/acre for Triumph 645 to a low of 26,930 plants/acre for Croplan Genetics 356. Plant populations among the sunflower varieties differed significantly. Eleven

varieties had plant populations greater than other varieties exceeding 33,000 plants/acre and eight varieties had plant populations lower than other varieties, which were less than 29,500 plants/acre.

The average number of days to flowering was 63 days from planting (Table 2). Seven sunflower varieties were the first to flower in 60 to 62 days from planting. Three varieties (Triumph s678, Triumph s672, Sierra) took the most time to reach the flowering stage at 66.5 to 68 days. Other sunflower varieties were intermediate in the number of days they needed to reach flowering.

Plant lodging among sunflower varieties varied significantly and there was a wide range in the response of sunflower varieties to lodging (Table 2). The two sunflower varieties with the most lodging were Croplan Genetics 3080 DMR and Croplan Genetics 308 NS. The low seed yields of these two varieties were likely affected by the high amount of lodging they experienced. Three varieties had less than 1% lodging. They were Mycogen 8N453DM, Producers Hybrids 7203, and Dyna-Gro 93N05 #2.

In summary, most sunflower varieties established well and exhibited good growth during the growing season. Many sunflower varieties produced good seed yields, had low seed moisture contents at harvest, and had good seed oil contents and thus oil yields. We experienced considerable rain during the fall that delayed harvest. This provided birds with more time to forage in the sunflower field. Our seed yields, while good, would likely have been somewhat higher if we could have harvested the plots sooner and reduced seed loss due to bird damage.

Oilseed sunflower production in western Colorado appears promising based on one year of agronomic data obtained at Fruita in 2006. Weed control in the sunflower field was excellent.

Additional years of field research are needed to determine the long-term potential for producing sunflower for vegetable oil under irrigation in western Colorado.

Acknowledgments

Thanks to Fred Judson (WCRC staff), Chip Brazelton (WCRC staff), and Daniel Dawson (part-time hourly employee) who assisted with this research. Thanks also to Triumph Seed Co., Inc. for determining the oil content of the sunflower varieties.

References

Eidman, V.R. 2005. Agriculture as a producer of energy. P. 30-67. *In* J.L. Outlaw, K.J. Collins, J.A. Duffield (eds.). Agriculture as a producer and consumer of energy. CABI Publishing. Cambridge, MA.

Hofman, V. 2003. Biodiesel fuel. North Dakota State University Extension Service Bulletin AE-1240. North Dakota State University, Fargo, ND.

Ma, F. and M.A. Hanna. 1999. Biodiesel production: a review. Bioresource Tech. 70:1-15.

National Biodiesel Board. 2007a. Biodiesel production plants under construction or expansion (September 12, 2006) [Online]. Available at http://www.biodiesel.org. Assessed 30 Jan. 2007.

National Biodiesel Board. 2007b. Commercial biodiesel production plants (September 14, 2006) [Online]. Available at http://www.biodiesel.org. Assessed 30 Jan. 2007.

Pearson, C.H. 2006. Agronomic performance of canola at Fruita, Colorado 2005. p. 29-33. *In*: Western Colorado Research Center 2005 Research Report. Colorado State University, Agricultural Experiment Station and Cooperative Extension, Technical Report TR06-06. Fort Collins, Colorado.

Tickell, J. 2003. From the fryer to the fuel tank: the complete guide to using vegetable oil as an alternative fuel. (3rd ed.). Joshua Tickell Media Productions. New Orleans, LA.

U.S. Dept of Energy, Energy Information Administration. 2007. Gasoline and diesel fuel update [Online]. Available at http://tonto.eia.doe.gov/oog/info/gdu/gasdiesel.asp. Assess 30 Jan. 2007.

Table 1. Seed moisture, seed yield, oil content, and oil yield of thirty-two sunflower varieties evaluated in the Grand Valley of western Colorado at the Western Colorado Research Center at Fruita during 2006.[1]

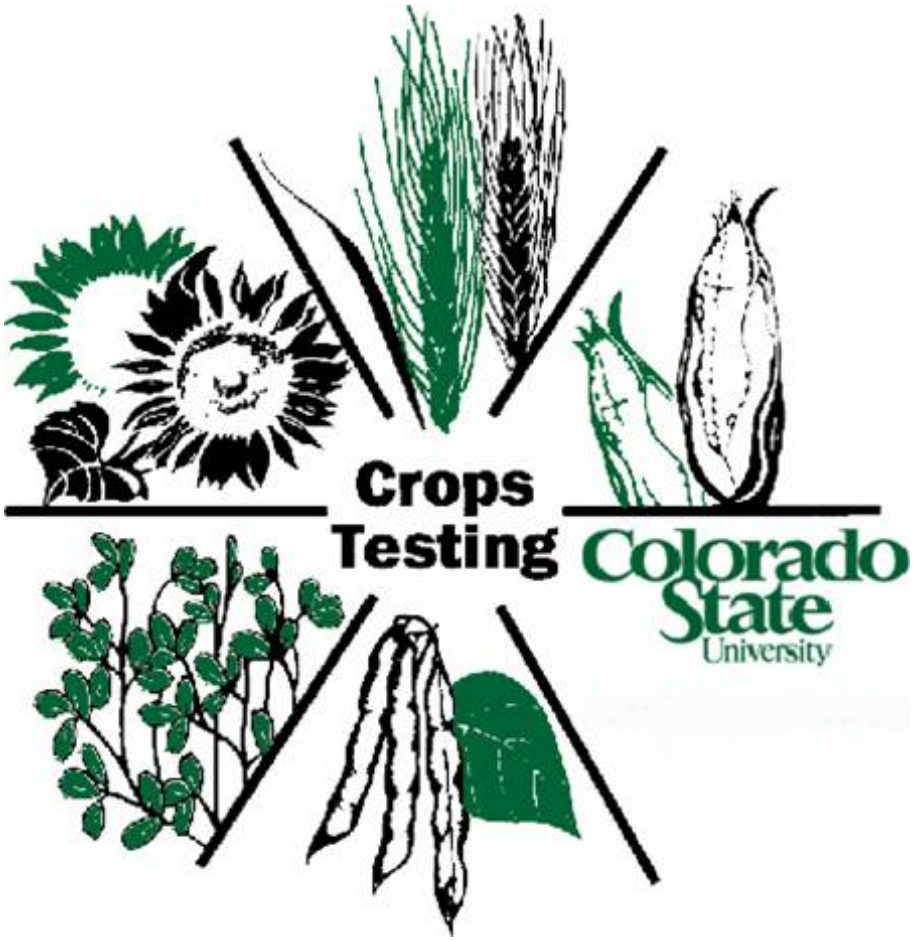
Cultivar	Source	Seed moisture	Seed yield	Oil content	Oil yield
		%	lb/ac	%	lbs/acre
HySun 454	HySun	6.3	3500	43.1	1509
7203	Producers Hybrids	6.0	3388	44.1	1494
Garst 454	Garst	6.3	3377	43.6	1472
8N462DM	Mycogen	6.0	3269	46.8	1530
8N453DM	Mycogen	6.1	3166	47.0	1488
8N386CL	Mycogen	6.1	3120	42.4	1323
DKF 37-31NS	DEKALB	6.1	3046	45.7	1392
8H419CL	Mycogen	6.1	3024	43.1	1303
63M91	Pioneer brand	6.2	2996	46.2	1384
Croplan Genetics 378 DMR	Croplan Genetics	6.2	2898	44.3	1284
Croplan Genetics 356	Croplan Genetics	6.1	2756	46.2	1273
63M80	Pioneer brand	6.1	2756	46.1	1271
Triumph 645	Triumph	6.0	2736	43.8	1198
8N520DM	Mycogen	5.9	2642	45.0	1189
Sierra	Seeds 2000	6.2	2632	43.8	1153
Blazer	Seeds 2000	6.0	2374	45.5	1080
Croplan Genetics 343 DMR	Croplan Genetics	6.4	2363	41.6	983
Garst 450	Garst	6.2	2342	45.1	1056
7303	Producers Hybrids	6.0	2298	44.5	1023
Garst 4668 ns/cl	Garst	6.1	2249	42.8	963
HySun 450	HySun	6.1	2248	44.8	1007
DKF 35-10 NS	DEKALB	6.2	2126	43.4	923
Garst 521	Garst	6.1	2079	42.6	886
Croplan Genetics 305 DMR	Croplan Genetics	6.0	2010	43.0	864
SF7105NS	Producers Hybrids	6.1	1983	44.0	873
Triumph s672	Triumph	5.9	1963	42.7	838
93N05 #2	Dyna-Gro	6.0	1743	42.0	732
Triumph 820 HO	Triumph	5.9	1697	45.3	769
93C05 #4	Dyna-Gro	6.0	1645	44.1	725
Triumph s678	Triumph	6.2	1401	44.6	625
Croplan Genetics 308 NS	Croplan Genetics	5.8	899	45.8	412
Croplan Genetics 3080 DMR	Croplan Genetics	6.1	701	44.2	310
Ave.		6.1	2420	44.3	1072
LSD (0.05)		0.4	610		

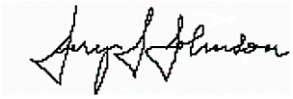
[1] Table is arranged by decreasing seed yield.

Table 2. Test weight, plant height, plant population, flowering, and lodging of thirty-two sunflower varieties evaluated in the Grand Valley of western Colorado at the Western Colorado Research Center at Fruita during 2006.

Cultivar	Source	Test weight.	Plant height	Plant population	Flower	Lodging
		lb/bu	in.	Plants/ac	days	%
HySun 454	HySun	33.6	83.7	30869	63	3.2
7203	Producers Hybrids	33.4	88.5	33326	65	0.7
Garst 454	Garst	33.6	82.8	30406	64	4.3
8N462DM	Mycogen	34.9	83.7	29294	64	5.5
8N453DM	Mycogen	35.5	86.4	32167	64	0.8
8N386CL	Mycogen	32.2	83.7	30359	64	2.3
DKF 37-31NS	DEKALB	33.8	75.3	28459	63	8.2
8H419CL	Mycogen	32.8	84.0	32862	65	3.4
63M91	Pioneer brand	34.7	80.8	32352	62	1.7
Croplan Genetics 378 DMR	Croplan Genetics	33.9	86.0	30545	64	2.1
Croplan Genetics 356	Croplan Genetics	34.0	71.7	26930	63	4.9
63M80	Pioneer brand	34.1	74.5	33511	62	3.8
Triumph 645	Triumph	32.4	83.7	35504	63	7.9
8N520DM	Mycogen	33.3	80.0	33233	65	16.6
Sierra	Seeds 2000	32.0	83.6	32353	67	16.4
Blazer	Seeds 2000	35.2	71.5	27810	63	32.3
Croplan Genetics 343 DMR	Croplan Genetics	32.9	81.5	30128	63	2.6
Garst 450	Garst	32.8	79.1	28459	65	9.1
7303	Producers Hybrids	33.1	76.6	29803	65	9.1
Garst 4668 ns/cl	Garst	32.8	82.8	33789	64	14.9
HySun 450	HySun	33.6	81.1	31796	65	14.1
DKF 35-10 NS	DEKALB	33.2	79.7	31240	62	3.2
Garst 521	Garst	33.4	72.5	34021	60	4.3
Croplan Genetics 305 DMR	Croplan Genetics	34.1	77.1	33326	64	4.2
SF7105NS	Producers Hybrids	34.0	74.2	34160	61	5.8
Triumph s672	Triumph	33.7	57.8	35087	67	16.9
93N05 #2	Dyna-Gro	32.7	69.9	27903	61	0.6
Triumph 820 HO	Triumph	33.8	74.6	34438	60	10.1
93C05 #4	Dyna-Gro	34.0	81.1	30776	66	6.2
Triumph s678	Triumph	34.4	66.3	27161	68	6.2
Croplan Genetics 308 NS	Croplan Genetics	34.0	70.8	28505	62	58.6
Croplan Genetics 3080 DMR	Croplan Genetics	33.0	73.0	33094	60	57.6
Ave.		33.6	78.1	31364	63	10.5

LSD (0.05)	1.0	4.2	2595	1.9	12.4





Jerry Johnson, Extension Specialist Crop Production

Colorado State University

Department of Soil and Crop Sciences
1170 Campus Delivery
Fort Collins, Colorado 80523-1170

Extension

From: Colorado State University, Agricultural Experiment Station Technical Report 07-08 pgs. 34-39