

RESEARCH PROGRESS REPORT – FINAL

RESEARCH PROJECT TITLE: Evaluation of Wheat and Pea Varieties Under Direct and Conventional Seeding in Washington, Idaho and Oregon.

INVESTIGATORS:

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COOPERATORS:

Russ Zenner

PROJECT OBJECTIVES:

1. Identify pea varieties with superior performance under direct seeding.
2. Compare performance of pea varieties in direct vs. conventional seeding.
3. Determine if the performance ranking of pea varieties under direct seeding is different from that under conventional seeding.

KEYWORDS: *Pisum sativum*, tillage, yield, no-till

STATEMENT OF PROBLEM:

Conventional tillage practices commonly used in the highly erosive Palouse region of eastern Washington, northern Idaho and northeastern Oregon threaten the sustainability of agricultural production. Reduced tillage and direct seeding into standing stubble provide greater crop residue to protect the soil surface from erosive forces such as spring rain and runoff from snow melt. Significant information is available on the performance of wheat and pea varieties in conventional tillage conditions, however, relatively little information is available on production under reduced tillage and direct seeding. Results of this study will provide needed information on the adaptability of pea varieties to these conditions.

ZONE OF INTEREST: Palouse region of Idaho, Washington and Oregon

ABSTRACT:

Conventional tillage practices are a tradition in the Palouse region of the Pacific Northwest; however, the impact on the soil is threatening the sustainability of crop production. Reduced tillage and direct seeding into previous crop stubble (no-till) offers significant environmental benefits for crop production. All pea varieties currently available to growers have been developed under conventional tillage conditions and with little understanding of their response to no-till conditions. Fifteen to twenty pea varieties were compared in conventional tillage and no-till conditions in Idaho and Washington between 2000 and 2002. Seed yield was lower under no-till in all trials with few individual varieties producing greater seed yield under no-till conditions. Several factors contribute to the reduced yield including cold and

wet soil conditions, poor stand establishment and slow crop growth. Lifter and Karita were the highest yielding green pea varieties while Badminton and Swing were the highest yielding yellow pea varieties. In general, varieties with the tendrilled leaf type and short vine length were the most upright and easiest to harvest. Direct comparison between conventional and no-till conditions indicated significant variety by tillage system interaction, however, no variety produced greater seed yield on average in no-till compared to conventional tillage conditions. Overall, pea varieties well adapted and high yielding under conventional tillage are also well adapted and high yielding under no-till conditions. Further investigation into the effect of the no-till environment on individual varieties will aid in establishing specific breeding objectives and allow final conclusions to be drawn regarding variety adaptation to no-till conditions.

RESULTS AND INTERPRETATION:

Idaho Trials

Dry pea variety evaluations were conducted at three locations in northern Idaho in 2002. No-till (NT) trials were planted at the Parker Plant Science Farm near Moscow and southeast of Genesee in cooperation with Russ Zenner. Trials at Genesee and Moscow were sown on 23 April 2002 following spring wheat and barley, respectively, using a five-row flexi-coil plot drill with Anderson openers. Stands establishment was excellent at both locations. Twenty pea varieties, including green, yellow and marrowfat were evaluated. A third site compared fifteen pea varieties in a replicated trial comparing conventional tillage (CT) and NT at the Kambitsch farm north of Genesee. This trial was sown on 22 April 2002 following barley using a Great Plains drill equipped with turbo-coulters and double disc openers.

Conventional tillage was established using a chisel plow. Weed control for all sites was accomplished using pre-plant applications of Roundup followed by Pursuit. Leaf weevil was controlled by an Asana application on all pea plots. Seed weevil and aphids were controlled by an application of Capture at mid-bloom.

Seed yield and seed size as well as vine length and canopy height were recorded for all varieties included in the Moscow and Genesee no-till trials (Table 1). 'Bluebird' (1570 lb/a) was the highest yielding green-seeded variety at Genesee followed by CEB 1171 and PRO 98106. 'Athos' (1580 lb/a) was the highest yielding yellow-seeded variety followed by 'Shawnee' and 'Fallon'. 'Toledo' (1990 lb/a) was highest yielding green variety at Moscow followed by Bluebird and CEB 1171. 'Swing' (2270 lb/a) was the highest yielding yellow-seeded variety followed by Shawnee and 'Badminton'. Bluebird was, on average, the highest yielding green-seeded variety and Swing was the highest yielding yellow-seeded variety (Table 1). Bluebird, CEB 1171 and Toledo were above average for seed weight, but Swing, Shawnee, and Badminton were below average. 'Supra', a marrowfat type green pea produced the largest seed among the green-seeded types followed by Karita and Toledo. Rex produced the largest seed among the yellow-seeded varieties.

A measure of lodging resistance and erect plant habit can be determined by comparison of vine length and canopy height. All varieties remained upright through harvest with the exception of 'Shawnee', 'Joel' and 'Columbian' which were prone to lodge due to their long vine length (Table 1). The highest yielding varieties, Bluebird, CEB 1171, Athos and

Badminton, have a semi-dwarf plant type with vine length averaging 18 inches. Shorter vine length coupled with stem strength result in the upright growth habit necessary for harvest ease.

Table 2 summarizes yield data and seed weight for those varieties included in all three years of the study (2000, 2001 and 2002). Complete data is available for past years in the 2000 and 2001 STEEP progress reports. Averaged across the three years, 'Lifter', Karita, and Toledo were the highest yielding green-seeded varieties, but of these varieties, only Karita was above average in each year. Swing, Badminton, and 'Rex' produced the greatest seed yield on averaged among the yellow-seeded varieties.

Direct comparison of CT and NT treatments at the Kambitsch farm resulted in a yield reduction of 280 lb/a for the NT treatment compared to the CT treatment (Table 3). Bluebird was the highest yielding variety in CT (2780 lb/a); however, it was the only variety that produced significantly less under NT (2080 lb/a). Badminton was significantly higher yielding than all other varieties in the NT treatment. Stand establishment was not significantly different between tillage treatments and averaged 9.2 plants/ft² in CT and 9.7 plants/ft² in NT. However, stand establishment for individual varieties ranged from 5.4 to 11.6 plants/ft² in CT and from 6.0 to 13.1 plants/ft² in NT. Seed weight averaged 21.9 g/100 seed in both CT and NT and only Rex showed a significant difference between treatments, 26.7 g/100 seed in NT and 23.8 g/100 seed in CT. Vine length was reduced 3 inches on average between CT and NT, but reductions for individual varieties was only significant for 'Cruiser' and Rex. Canopy height did not differ significantly between tillage treatments.

Seed yield for ten varieties common in all three years of the study are summarized in Table 4. Additional data from 2000 and 2001 experiments are available in previous STEEP reports. Seed yield was lowest in 2000 at 1300 lb/a in CT and 1000 lb/a in NT. Trials in 2001 produced the greatest yield at 2660 lb/a in CT and 2410 lb/a in NT. Averaged across the three years and ten varieties, yields were 2010 lb/a in CT and 1750 lb/a in NT. When compared within varieties, individual variety response to tillage treatments was different between years. For example, yield reduction for Badminton in the NT treatment compared to CT was only 90 and 170 lb/a in 2000 and 2002, respectively, but was 650 lb/a in 2001. The marrowfat variety 'Supra' appears to be the least influenced by tillage treatments and averaged across years only 50 lb/a less in NT. All varieties with the exception of Supra and Swing in 2001 suffered yield reduction under NT conditions. The significantly lower yield potential of Supra likely contributes to its yield stability between tillage treatments. On average, Karita and Badminton were the highest yielding varieties of the two respective seed types in both tillage treatments. Overall, pea varieties well adapted and with high yield potential under CT will also be well adapted and high yielding in NT. Continued improvement in the NT cropping system is likely to improve the response of pea varieties under those conditions making NT more competitive with CT.

Washington Trials

Twenty pea varieties were evaluated in a single trial at the USDA-ARS Soil Conservation Farm near Albion, WA. The trial was sown into spring barley stubble on May, 2001 using the Crop and Soil Sciences Department cross-slot no-till drill. Soil and residue conditions

allowed optimum seed placement resulting in excellent stand establishment. Weed control was accomplished using a pre-plant application of Roundup and Pursuit and a post emergent application of Assure II. Ineffective control of aphid and feeding pressure from deer significantly impaired plant growth and seed set forcing the trial to be abandoned. Data from 2000 is presented in Table 5.

Note: Wheat evaluations were not conducted due to a reduced level of funding from that originally proposed. Also, Dr. Stephen Dofing and Dr. Bill Payne have accepted new positions elsewhere, therefore, Kevin McPhee has taken the lead for the Washington trials.

INTERACTION (COOPERATION) WITH OTHER SCIENTISTS CONDUCTING RELATED ACTIVITY: None

PUBLICATIONS:

Guy, S.O. and D.B. Cox. 2002. Reduced tillage increases residue groundcover in subsequent dry pea and winter wheat crops in the Palouse region of Idaho. *Soil and Tillage Res.* 66:69-77.

Cook, J.R., E. Adams, S. Guy, D Huggins, A. Kennedy, D. Ruark, R. Smiley, D. Thill, R. Veseth, D. Wilkins, D. Wysocki, E. Zakarison, and R. Zenner. 2002. Retooling Agriculture: A report on direct-seed cropping systems research in the Pacific Northwest. PNW 553. WSU, OSU, UI, USDA-ARS, and PNWDSA. Pullman, WA.

Guy, S., K. Stewart-Williams, and Y. Wu. 2002. 2002 Idaho certified seed selection guide for some varieties of peas, Austrian winter peas, lentils, and chickpeas. Univ. of Idaho, College of Ag. Progress Report no. 318, Moscow, ID.

Guy, S.O., N.A. Bosque-Perez, S.D. Eigenbrode, J. Johnson-Maynard, and L.M. Dandurand. 2002. Assessing the impact of no-till and conventional-till on crop, variety, soil, insect, and disease responses. p. 36-49. *In* STEEP 2001 annual report. Spokane, WA, 16-18 Jan., Univ. of Idaho, Oregon St. Univ., Wash. St. Univ., USDA-ARS, and NRCS.

Guy, S.O., K. McPhee, and D. Huggins. 2002. Evaluation of wheat and pea varieties under direct and conventional seeding in Washington, Idaho, and Oregon. p. 28-35. *In* STEEP 2001 annual report. Spokane, WA, 16-18 Jan., Univ. of Idaho, Oregon St. Univ., Wash. St. Univ., USDA-ARS, and NRCS.

Guy, S.O. and Y. Wu. 2002. No-till and conventional till comparisons of wheat, barley, and pea varieties. *In* 2002 Agronomy Abstracts. ASA, Madison, WI.

Smith, L.J., S.O. Guy, Y. Wu, and K.N. Hart. 2002. North-Central Idaho Cooperative Extension Crop Management Trials 2001. Progress Report 358. Univ. of Idaho Coop. Ext., Moscow, ID.

Guy, S.O. and Y. Wu. 2002. Northern Idaho Extension Small Grain and Legume Variety Performance Trials 2000-2001. Progress Report 355. Univ. of Idaho Coop. Ext., Moscow, ID.

Guy, S.O. 2002. Performance Shown. Article by S. Allen. *In* Agri-Times Northwest. 1 February, 2002.

PRESENTATIONS:

Guy, S.O.. 5 Nov., 2001. 2001 North Idaho Extension Variety Cereal and Legume Studies. NezPerce Co. Crop Advisory Comm. Lewiston, ID. 14 attended.

Guy, S.O., 6 Dec., 2001. 2001 N. Idaho Legume Variety Trials. USA Dry Pea and Lentil Assoc. Annual Grower's Meeting. Moscow, ID. 105 attended.

Guy, S.O., 8 Jan., 2002. Pea, Wheat and Barley Variety Response to Tillage. Clearwater Direct Seeders, Lewiston, ID. 30 attended.

Guy, S.O. and Y. Wu. 16 Jan., 2002. Variety Performance of Dry Pea, Spring Wheat, and Barley in a No-till and Conventional Till Comparison. Poster. 2002 PNW Direct Seed Conference. Spokane, WA. 850 attended.

Veseth, R., D. Wysocki, S. Guy, B. Schillinger, J. Yenish, G. Schwab, J. Burns, D. Tonks, and L. Robertson. 16 Jan., 2002. Pacific Northwest Research for Successful Conservation Tillage Systems. Poster. 2002 PNW Direct Seed Conference. Spokane, WA. 850 attended.

Guy, S.O. 5 Feb., 2002. Variety Performance in Northern Idaho and Variety Response to Tillage. Idaho Co. Crop School. Greencreek, ID. 75 attended.

Guy, S.O. 6 Feb., 2002. Variety Performance in Northern Idaho and Variety Response to Tillage. Latah Co. Crop School. Moscow, ID. 40 attended.

Guy, S.O. 7 Feb., 2002. Variety Performance in Northern Idaho and Variety Response to Tillage. NezPerce Co. Crop School. Lewiston, ID. 63 attended.

Guy, S.O. 21 Feb., 2002. Variety Performance in Northern Idaho and Variety Response to Tillage. Boundary Co. Crop School. Bonners Ferry, ID. 24 attended.

Guy, S.O. 22 May, 2002. Six Years of Crop Production Research and Extension Work. UI/PSES Promotion Meeting. Moscow, ID. 45 attended.

Guy, S.O. 8 July, 2002. Pea and Lentil Variety Performance at Nez Perce. Lewis Co. Crop Tour. Nez Perce, ID. 24 attended.

Guy, S.O. 10 July, 2002. Pea No-Till Variety Performance and Chickpea Seed Treatment in No-Till. NezPerce Co. Rimrock Crop Tour. Genesee, ID. 58 attended.

Table 1. Combined no-till spring pea performance data at Genesee and Moscow, 2002.

Variety	Seed Yield			Seed Weight			Vine	Canopy
	Genesee	Moscow	Average	Genesee	Moscow	Average	Length	Height
	-----lb/acre-----			-----g/100-----			----inches----	
Ariel	1350	1500	1420	15.8	18.4	17.1	23	23
Bluebird	1570	1890	1730	21.8	23.8	22.8	19	19
Columbian	1350	1810	1580	18.7	19.6	19.2	33	24
Cruiser	1290	1280	1280	17.9	20.5	19.2	22	22
Hero	830	970	900	20.2	22.9	21.6	18	18
Joel	1340	1690	1530	19.4	18.2	18.8	32	19
Karita	1300	1420	1360	22.7	24.3	23.5	22	22
Lifter	1310	1520	1420	18.1	21.6	19.9	24	20
Supra	930	1470	1200	33.5	34.5	34.0	20	20
Toledo	1240	1990	1610	21.3	24.7	23.0	25	25
Pro 98106	1390	1530	1460	18.0	18.4	18.2	18	18
PS 610152	1190	1030	1110	16.5	20.3	18.4	20	19
CEB 1171	1530	1870	1700	24.0	24.9	24.5	19	19
Athos	1580	1100	1340	23.6	26.9	25.3	17	17
Badminton	1450	1590	1520	19.9	23.5	21.7	18	18
Fallon	1500	1230	1370	21.0	21.2	21.1	21	21
Jasmin	1190	1460	1320	23.4	24.3	23.9	25	25
Rex	1440	1550	1490	23.9	24.8	24.4	27	24
Shawnee	1510	1800	1660	18.8	20.5	19.7	32	18
Swing	1280	2270	1780	18.6	22.1	20.4	26	26
Average	1330	1550	1440	20.9	22.8	21.8	23	21
LSD (0.10)	150	270	150	2.1	1.0	1.6	3	2
CV (%)	9	14	--	8.6	3.6	--	--	--

Table 2. Seed yield and seed weight for NT spring pea tested for three years in northern Idaho*.

Variety	Seed Yield				Seed Weight			
	2000	2001	2002	Average	2000	2001	2002	Average
	-----lb/acre-----				-----g/100-----			
Ariel	700	2480	1420	1530	14.3	20.2	17.1	17.2
Columbian	790	2230	1580	1540	16.2	20.8	19.2	18.7
Cruiser	400	2310	1280	1330	15.4	21.7	19.2	18.8
Hero	1000	2080	900	1330	17.3	23.8	21.6	20.9
Joel	620	2400	1520	1510	15.4	22.5	18.8	18.9
Karita	910	2530	1360	1600	19.6	27.0	23.5	23.4
Lifter	1270	2280	1420	1660	16.3	22.3	19.9	19.5
Supra	490	2000	1200	1230	26.6	33.8	34.0	31.5
Toledo	480	2620	1610	1570	19.2	26.3	23.0	22.8
Badminton	980	2650	1520	1720	17.2	25.1	21.7	21.3
Fallon	670	2640	1370	1560	16.8	25.5	21.1	21.1
Jasmin	690	2690	1320	1570	19.3	26.2	23.9	23.1
Rex	600	2720	1490	1610	19.9	26.5	24.4	23.6
Shawnee	880	2210	1660	1580	17.2	22.8	19.7	19.9
Swing	820	2700	1780	1770	16.8	24.1	20.4	20.4
Average	750	2440	1430	1540	17.8	24.6	21.8	21.4
LSD (0.10)	210	180	150	100	1.4	0.8	1.6	0.8

*2001 and 2002 data are for Genesee and Moscow and 2000 data are for Moscow only.

Table 3. Performance of Pea Varieties Under Replicated Conventional-Tillage and No-Till Management at the Kambitsch farm near Genesee, ID, 2002.

Variety	Seed Yield		Seed Weight		Plant Stand		Vine Length		Canopy Ht.	
	Conv-Till	No-Till	Conv-Till	No-Till	Conv-Till	No-Till	Conv-Till	No-Till	Conv-Till	No-Till
Green Pea	----lbs/acre----		-----g/100-----		---no./sq.ft.--		----inches----		----inches---	
Columbian	1900	1650	19.1	18.5	11.4	10.9	43	37	15	18
Cruiser	2250	1860	18.8	19.0	8.7	7.1	33	21*	25	21
Joel	1810	1710	20.9	19.4	11.6	12.2	41	42	19	17
Karita	2110	1970	24.0	21.6	7.1	8.3	23	22	23	22
Bluebird	2780	2080*	22.0	21.6	11.6	13.1	22	18	22	18
Lifter	2020	1760	20.0	20.6	10.6	12.7	30	27	17	18
Hero	2020	1580	21.1	22.9	10.3	9.6	19	23	19	16
Ariel	2210	1900	16.5	17.4	8.5	10.2	25	22	24	22
Supra (MF)	1720	1560	32.3	32.5	9.0	10.1	20	21	20	21
Average	2090	1790	21.6	21.5	9.9	10.5	28	26	20	19
Yellow Pea										
Badminton	2560	2390	21.5	21.3	9.5	9.8	22	18	22	18
Fallon	2270	1920	22.6	22.7	7.4	8.6	25	19	24	19
Jasmine	1830	1790	25.8	24.1	6.6	6.3	26	21	26	21
Rex	1960	1800	23.8	26.7*	5.4	6.0	27	31	22	19
Shawnee	2050	1800	19.8	19.6	9.9	10.1	45	31*	16	18
Swing	2460	1940	19.7	21.3	10.5	9.7	28	24	28	23
Average	2190	1940	22.2	22.6	8.2	8.4	29	24	23	20
Overall Average	2130	1850	21.9	21.9	9.2	9.7	28	25*	21	19
LSD (0.10)	280	280	2.4	2.4	2.9	2.9	7	7	4	4
CV	10	10	8	8	22	22	18	18	14	14

*No-Till values followed by an asterisk are significantly different than the conventional till value.

Table 4. Combined Performance of Pea Varieties Under Replicated Conventional-Tillage and No-Till Management at the Kambitsch farm near Genesee, ID, 2000, 2001, and 2002.

Variety	2000 Seed Yield		2001 Seed Yield		2002 Seed Yield		2000-2002 Avg. Seed Yield	
	Conv- Till	No- Till	Conv- Till	No- Till	Conv- Till	No- Till	Conv- Till	No- Till
Green Pea	----lbs/acre----		----lbs/acre----		----lbs/acre----		----lbs/acre----	
Columbian	1120	840	2170	2000	1900	1650	1730	1500
Joel	1530	1260	2340	2180	1810	1710	1890	1720
Karita	1410	1290	3180	2780	2110	1900	2230	1990
Supra (MF)	590	590	2420	2450	1720	1560	1580	1530
Average	1160	1000	2530	2350	1890	1710	1860	1690
Yellow Pea								
Badminton	1400	1310	3050	2400*	2560	2390	2340	2030
Fallon	1720	1100*	2620	2490	2270	1920	2200	1840
Jasmine	1210	780*	2850	2520	1830	1790	1960	1700
Rex	1190	700*	2830	2420	1960	1800	1990	1640
Shawnee	1580	1200	2590	2140	2050	1800	2070	1710
Swing	1270	910	2500	2760	2460	1940	2080	1870
Average	1400	1000	2740	2460	2190	1940	2110	1800
Overall Average	1300	1000*	2660	2410	2070	1850	2010	1750
LSD (0.10)	300	300	380	380	280	280	190	190
CV	10	10	11	11	10	10	--	--

*No-Till values followed by an asterisk are significantly different than the conventional till value.

Table 5. Plant morphology and seed yield of twenty pea varieties under no-till conditions at the USDA-ARS Soil Conservation Farm near Albion, WA in 2000.

Variety	Leaf Type	Vine Type	Seed Yield		Mean Yield
			Trial 1	Trial 2	
			lb/a	lb/a	lb/a
Green Pea					
PRO8612-2G	SL	SD	624	773	698
Karita	SL	SD	592	635	613
NZ-4L25	SL	SD	790	430	610
Joel	N	LV	547	578	562
Majoret	SL	SD	573	546	559
Toledo	SL	SD	524	517	521
Franklin	N	SD	523	418	471
Scuba	SL	SD	361	368	364
Supra	SL	SD	325	326	325
Lifter	N	SD	334	162	248
Average			519	475	497
Yellow Pea					
Shawnee	N	LV	831	869	850
Fallon	SL	SD	695	585	640
Rex	N	SD	552	707	629
Jasmin	SL	SD	584	642	613
Delta	SL	SD	573	611	592
Swing	SL	SD	675	505	590
Athos	SL	SD	401	631	516
Integra	SL	SD	498	498	498
Cruiser	SL	SD	516	392	454
Badminton	SL	SD	498	393	445
Average			582	583	583
Experiment average			549	530	539
LSD(0.05)			171	140	128
C.V.			23.1	24.8	25.4

SL = Semi-leafless

N = Normal leaflets

SD = Semi dwarf/short vine

LV = Long vine

Trial 1 was part of a 2-year rotation and Trial 2 was part of a 3-year rotation