NORTHARVEST BeanGrower

SPECIAL EDITION

2016 Dry Bean Directory

Northarvest Research Report

2015 Dry Bean Variety Trials

NORTHARVEST BeanGrower

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VOLUME 22 ISSUE 2

Research Updates

Market prices go up and down, and the weather is never totally predictable, but one thing seems to be consistent: the serious interest among dry bean growers in this industry. That was most evident again at Bean Day in Fargo. I am always impressed with how growers come to learn and do their homework on production, marketing and promotional aspects of this industry.

It was exciting to get the update on both the slow darkening pinto breeding, and the water logging tolerance projects from Dr. Juan Osorno, the dry bean breeder at NDSU. Updates on other Northarvest-funded research included Dr. Sam Markell's disease update, and Area Extension Agronomist Greg Endres' research on plant establishment.

This Special Edition of the *BeanGrower* includes updates from Osorno and Endres, as well as plant pathologist Dr. Michael Wunsch's work on improving sclerotinia management, and reports on the development of soybean cyst nematode-resistant dry bean breeding material, and dry bean tolerance to dicamba. Of course, NDSU Extension agronomist Dr. Hans Kandel's variety trial results are also included in this issue.

The Northarvest Bean Growers Association was founded back in the mid-1970s because of the need for research to aid in the production of dry beans. That remains a priority! Your Board of Directors approved the investment of over $317,500 in 2015-16, an increase of 15 percent over the previous year, and accounting for 24 percent of our total Northarvest budget. As always, the Northarvest research committee welcomes your input as we plan for future projects.

This has been a rather typical El Nino winter, which not too many of us in Northarvest can complain about. Spring is approaching and before long we'll get a chance to smell that rich, productive soil as it springs back to life. On behalf of the Northarvest Bean Growers Association, I wish you a productive, and profitable 2016!

Sincerely,

Norm Krause
Chairman
Research Committee
Northarvest Bean Growers Association

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2016 Northarvest Resource Directory

Seed Bean Suppliers & Commercial Buyers

Company Name	Address	Ph/Fax/Email/Website	Beans
ADM Edible Bean Specialties, Inc.	P.O. Box 124 550 W Christenson Ave Appleton, MN 56208	Ph: 320-289-2430 Fax: 320-289-2008 Email: bob.kieffer@adm.com	Navy
ADM Edible Bean Specialties, Inc.	P.O. Box 249 1804 Front St. Casselton, ND 58012	Ph:701-347-5321 Fax: 701-347-5552 Email: thomas.stadler@adm.com	Pinto, Navy
ADM Edible Bean Specialties, Inc.	9451 Hwy. 18 P.O. Box 676 Cavalier, ND 58220	Ph: 701-265-8385 Fax: 701-265-4804 Email: richard.dinger@adm.com	Pinto, Navy
ADM Edible Bean Specialities, Inc	PO Box 98 108 MN Ave. W. Galesburg, ND 58035	Ph: 701-488-2214 Fax: 701-488-2538 Email: larry.erickson@adm.com	Pinto, Navy
ADM Edible Bean Specialities, Inc	PO Box 25 77 East 3rd St. Grafton, ND 58237	Ph: 701-352-1030 Fax: 701-352-3430 Email: pete.houdek@adm.com	Pinto
ADM Edible Bean Specialities, Inc	PO Box 437 Northwood, ND 58267	Ph: 701-587-5900 Fax: 701-587-5927 Email: jeff.ellingson@adm.com	Pinto, Navy
ADM Edible Bean Specialities, Inc	PO Box 149 215 22nd St. N. Olivia, MN 55277	Ph: 320-523-1637 Fax: 320-523-5683 Email: mitchell.lothert@adm.com	Navy
ADM Edible Bean Specialities, Inc	PO Box 255 557 Industrial Drive St. Thomas, ND 58276	Ph: 701-257-6721 Fax: 701-257-6577 Email: eugene.krueger@adm.com	Pinto, Navy

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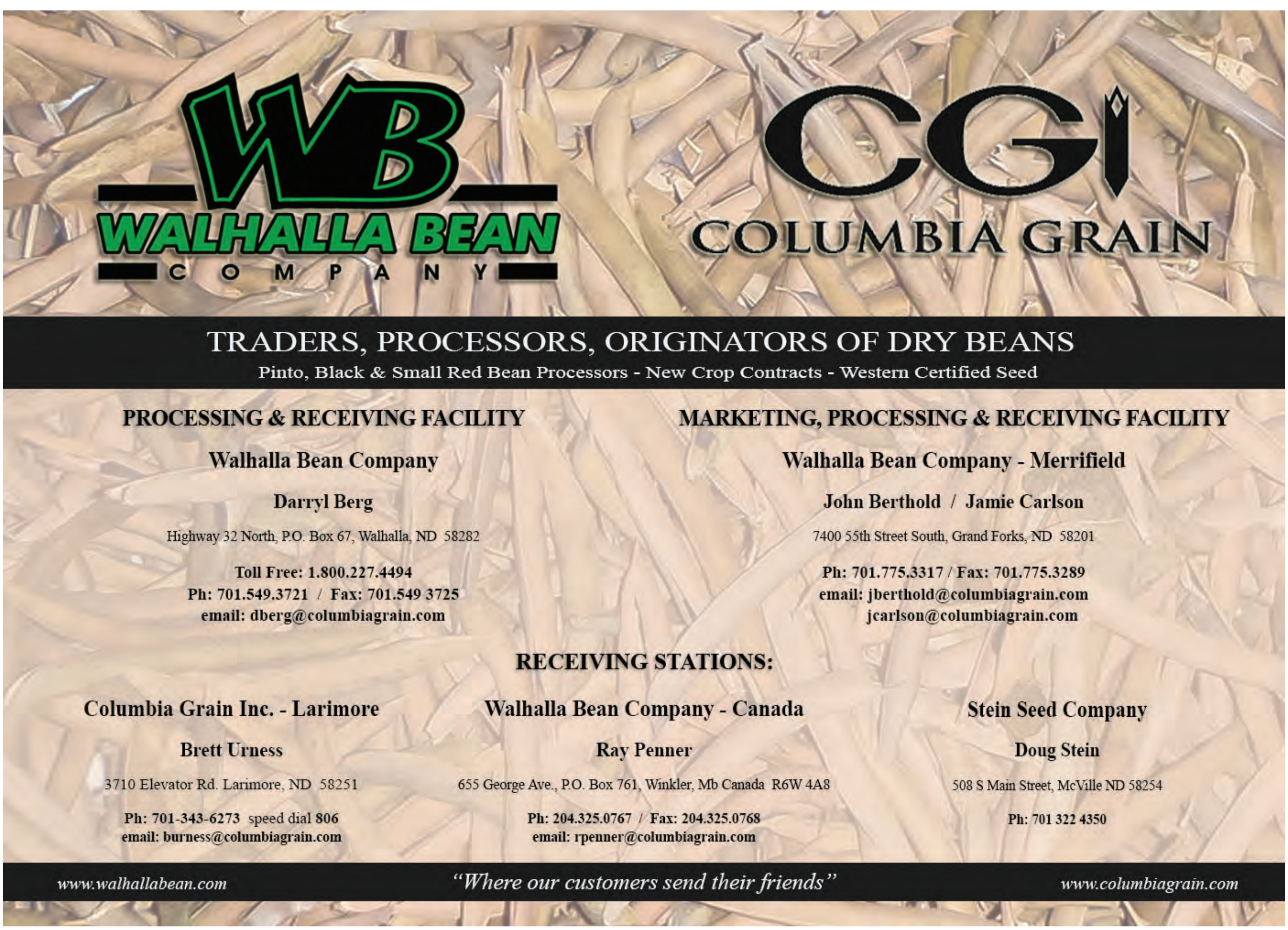
Company Name	Address	Ph/Fax/Email/Website	Beans
AGT Foods - Minot	625 42nd St NE Minot, ND 58703	Ph: 701-839-7530 Fax: 701-839-7532 Email: trade@agtfoods.com	Black, Pinto, Dark Red Kidney, Light Red Kidney, Navy
AGT Foods - Williston	505 26th Avenue NE Williston, ND 58801-6309	Ph: 701-572-4070 Fax: 701-572-4071 Email: trade@agtfoods.com	Black, Pinto, Dark Red Kidney, Light Red Kidney, Navy
Alliance Valley Bean, LLC	PO Box 566 111 Elevator Road Larimore, ND 58251	Ph: 701-343-6363 Fax: 701-343-2842	Black
Allied Energy dba Allied Grain	260 Elevator Road - Barlow, ND Carrington, ND 58421	Ph: 701-984-2617 Fax: 701-984-2616 Email: kathy@alliedag.com Web: www.alliedag.com	Pinto
American Bean LLC	105 Oak Street Oslo, MN 56744 Web: www.ambean.com	Ph: 218-695-3040 Fax: 218-695-1305 Email: craig@ambean.com julie@ambean.com	Black, Pinto, Cranberry, Pink, Small Red
American Bean LLC	101 1st Ave, P.O. Box 82 Petersburg, ND 58272 Web: www.ambean.com	Ph: 701-345-8264 Fax: 701-345-8263 Email: julie@ambean.com craig@ambean.com	Black, Pinto, Cranberry, Pink, Small Red

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B T R Farmers Co-op	6001 60th Ave NE Leeds, ND 58346	Ph: 701-466-2281 Fax: 701-466-2022 Email: btr@gondtc.com Web: btrfarmerscoop.com	Pinto
Bird Island Bean Co. LLC	PO Box 249 81591 East Hwy 212 & 400th St. Bird Island, MN 55310	Ph: 320-365-3070 Fax: 320-365-3811 Email: larryserbus@hotmail.com Web: www.bibcllc.com	Navy
Bollingberg Seeds Co.	5353 Highway 15 Cathay, ND 58422	Ph: 701-984-2486 Fax: 701-984-2485 Email: kurt@bollingbergseeds.com Web: www.vollingbergseeds.com	Pinto
Bonanza Bean LLC	PO Box 164 8 Industrial Blvd Morris, MN 56267	Ph: 320-585-2326 Fax: 320-585-2323 Email:cork.fehr@bonanzabean.com Web: www.bonanzabean.com	Black, Dark Red Kidney, Light Red Kidney
C and F Foods	PO Box 55 502 3rd Street Manvel, ND 58256	Ph: 701-696-2040 Fax: 701-696-2042 Web: www.cnf-foods.com	Black, Pinto
Cando Farmers Grain & Oil	Box 456 101 9th Street Cando, ND 58324	Ph: 701-968-4446 Fax: 701-968-4447 Email: candofarmers@gondtc.com	Pinto
Cavalier Bean Co.	PO Box 297 308 Industrial Park Cavalier, ND 58220	Ph: 701-265-8495 Fax: 701-265-8576 Email: cbc@polarcomm.com	Pinto

Seed Bean Suppliers & Commercial Buyers

Company Name	Address	Ph/Fax/Email/Website	Beans
Central Valley Bean Cooperative	401 Broadway PO Box 162 Buxton, ND 58218	Ph: 701-847-2622 Fax: 701-847-2623 Email: gary@centralvalleybean.com Web: www.centralvalleybean.com	Pinto
Chippewa Valley Bean Co., Inc	N2960 730th St. Menomonie, WI 54751	Ph: 715-664-8342 Fax: 715-664-8344 Email: cbrown@cvbean.com Web: www.cvbean.com	Dark Red Kidney, Light Red Kidney
Columbia Bean Co.	P.O. Box 67, 1920 Hwy 32 N. Walhalla, ND 58282	Ph: 701-549-3721 Fax: 701-549-3725 Email: Dberg@columbiagrain.com	Black, Pinto
Columbia Bean Co.	7400 55th Street, S. Grand Forks, ND 58201	Ph: 701-775-3317 Fax: 701-775-3289 Email: Jberthold@columbiagrain.com	Black, Pinto, Small Red
Diversified Bean Inc.	41744 US Hwy 75 SW Climax, MN 56523	Ph: 320-808-0891 Email: gbalgaard@gmail.com Web: www.diversifiedbean.com	Black, Pinto, Dark Red Kidney, Light Red Kidney, Small Red, Cranberry
Engstrom Bean & Seed	6131 57th Ave NE Leeds, ND 58346	Ph: 701-466-2398 Fax: 701-466-2076 Email: briane@engstrombean.com	Black, Pinto
Farmers Elevator Co. of Honeyford	2472 30th St. NE Gilby, ND 58235-9711	Ph: 701-869-2466 Fax: 701-869-2456 Email: fechoney@polarcomm.com Web: www.honeyford.com	Navy

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Fessenden Coop Assn.	PO Box 126 900 Railway St. Fessenden, ND 58438	Ph: 701-547-3354 Fax: 701-547-3574 Email: bstevens@fesscoop.com Web: www.fesscoop.com	Black, Pinto
Forest River Bean Co., Inc.	PO Box 68 600 Carpenter Ave Forest River, ND 58233	Ph: 701-248-3261 Fax: 701-248-3766 Email: brians@invisimax.com	Black, Pinto, Dark Red Kidney, Light Red Kidney, Pink, Small Red
Grafton Farmers Co-op Grain Company	129 E 6th Street Grafton, ND 58237	Ph: 701-352-0461 Fax: 701-352-0280	Pinto
Great Northern Ag	P.O. Box 128, 6373 39th St NW Plaza, ND	Ph: 701-497-3082 Fax: 701-497-3355 Email: micheller@greatnorthern.com	Pinto
Green Valley Bean	58473 St., Hwy 34 Park Rapids, MN 56470	Ph: 218-573-3400 Fax: 218-573-3434 Email: mhgvbllc@arvig.net	Dark Red Kidney, Light Red Kidney, Pink, White Kidney
Haberer Foods	41591 180th Street Morris, MN 56267	Ph: 320-795-2468 Fax: 320-795-2986 Email: randyh@runestone.net Web: Habererfoods.com	Black, Dark Red Kidney, Light Red Kidney

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JM Grain, Inc.	12 N Railroad Street PO Box 248 Garrison, ND 58540-0248	Ph: 701-463-7261 Fax: 612-435-4868	Pinto
Johnstown Bean Co.	PO Box 5 Gilby, ND 58235	Ph: 701-869-2680 Fax: 701-869-2692 Email: jbc@polarcomm.com	Black, Pinto
Joliette Ag Systems, Inc.	15866 Highway 5 Pembina, ND 58271	Ph: 701-454-6226 Fax: 701-454-6244 Email: jwarner@polarcomm.com	Black, Pinto
Kelley Bean Company	PO Box 99 703 Division Avenue So. Cavalier, ND 58220	Ph: 701-265-8328 Fax: 701-265-8533 Email: tsmith@kelleybean.com Web: www.kelleybean.com	Black, Pinto, Dark Red Kidney, Light Red Kidney, Navy, Pink
Kelley Bean Company	480 Hwy 18 NE Mayville, ND 58257-9001	Ph: 701-786-2997 Fax: 701-786-4214 Email: kflanagan@kelleybean.com Web: www.kelleybean.com	Navy
Kelley Bean Company	131 7th Ave. NE PO Box 253 Perham, MN 56573	Ph: 218-346-2360 Fax: 218-346-2369 Email: dmitchell@kelleybean.com Web: www.kelleybean.com	Dark Red Kidney, Light Red Kidney, Pink

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Kelley Bean Company	1328 Dakota Ave. Hatton, ND 58240	Ph: 701-543-3000 Fax: 701-543-4195 Email: dnelson@kelleybean.com Web: www.kelleybean.com	Black, Pinto, Navy, Pink
Kelley Bean Company	524 S. 7th St. PO Box 290 Oakes, ND 58474	Ph: 701-742-3219 Fax: 701-742-3520 Email: dmaasjo@kelleybean.com Web: www.kelleybean.com	Black, Pinto, Dark Red Kidney, Light Red Kidney, Navy
Kirkeide's Northland Bean Co.	4520 12th St. NE Fessenden, ND 58438	Ph: 701-547-3466 Fax: 701-547-3539 Email: knbc@gondtc.com	Black, Pinto, Navy
Klindworth Seed & Bean Co.	2139 Highway 30 Fessenden, ND 58438-9441	Ph: 701-547-3742 Fax: 701-547-2592 Email: ksb@stellarnet.com	Pinto
Larson Grain Co.	100 2nd Ave Englevale, ND 58033	Ph: 701-683-5246 Fax: 701-683-4233 Email: nick.shockman@larsongrain.com Web: www.larsongrain.com	Black, Pinto
Legume Matrix LLC	PO Box 1028 901 14th Ave SE Jamestown, ND 58402	Ph: 701-252-4757 Fax: 701-252-4757 Email: legume.matrix@gmail.com Web: legumematrix.com	Black

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Manvel Bean Co.	2875 18th St. NE Manvel, ND 58256	Ph: 701-696-2271 Fax: 701-696-8266	Pinto
Miller Elevator Company	Box 844 149 4th St. NE Valley City, ND 58072	Ph: 701-845-2013	Pinto
North Dakota Bean LLC	2120 North Washington Street Grand Forks, ND 58203	Ph: 701-203-8088 Fax: 701-203-8089 Email: brett@nebraskabean.com	Pinto
Northwood Bean Co. Inc.	301 Potato Road Northwood, ND 58267	Ph: 701-587-5206 Fax: 701-587-5650 Email: nbc@polarcomm.com	Black, Pinto
O'Brien Seed, Inc.	PO Box 505 945 3rd St. S.E. Mayville, ND 58257	Ph: 701-788-9118 Fax: 701-788-9119 Email: larry@obrienseed.com	Black, Pinto, Pink, Small Red
Scoular	P.O. Box 85, 415 Hwy. 32, So. St. Hilaire, MN 56754	Ph: 218-964-5407 Fax: 218-964-6415 Web: www.scoularspecialcrops.com	Black, Pinto, Cranberry, Dark Red Kidney, Great Northern

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SK Food International, Inc.	4666 Amber Valley Parkway Fargo, ND 58104	Ph: 701-356-4106 Fax: 701-356-4102 Email: skfood@skfood.com Web: www.skfood.com	Black, Pinto, Cranberry, Dark Red Kidney, Great Northern, Light Red Kidney, Navy, Small Red
SRS Commodities	411 2nd Avenue NE PO Box 386 Mayville, ND 58257	Ph: 701-786-3402 Fax: 701-786-3374 Email: rick@srscommodities.com	Black, Pinto
SRS Commodities Ltd-Falkirk	101 Main St. Washburn, ND 58577	Ph: 701-462-8111 Fax: 701-462-8112 Email: rick@srscommodities.com, adam@srscommodities.com Web: www.srscommodities.com	Pinto
Star of the West Milling Co.	4082 22nd Ave, NE Larimore, ND 58251	Ph: 701-397-5261 Fax: 701-397-5783 Email: sotwbean@polarcomm.com Web: www.starofthewest.com	Black, Pinto, Navy
Stony Ridge Foods Inc.	715 Atlantic Avenue Benson, MN 56215	Ph: 320-842-3401 Fax: 320-842-3403 Email: joe-jessica@stonyridgefoods.com or dhughes@stonyridgefoods.com	Black, Dark Red Kidney, Light Red Kidney, Navy
The Bean Mill	42631 450th Ave. Perham, MN 56573	Ph: 218-346-2151	Dark Red Kidney, Light Red Kidney, Pink
Thompsons USA Limited	PO Box 374 41703 Highway 2 SW East Grand Forks, MN 56721	Ph: 218-773-8834 Fax: 218-773-9809 Email: jvrolyk@thompsonslimited.com	Pinto, Dark Red Kidney, Navy
TMT Bean & Seed Farm	3718 67th Ave SE Cleveland, ND 58424	Ph: 701-763-6544 Fax: 701-763-6545 Email: terrytmtfarms@daktel.com	Pinto
Trinidad Benham	308 Front Ave Colgate, ND 58046	Ph: 701-945-2580 Fax: 701-945-2634 Email: mfranko@trinidadbenham.com Web: www.trinidadbenham.com	Black, Pinto, Great Northern, Navy, Pink
Tronson Grain Co.	115 W. 1st St. Doyon, ND 58327-2807	Ph: 701-398-3512 Fax: 701-398-3609	Pinto

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Northarvest Bean Growers Assn. (NHBGA)	50072 E. Lake Seven Road Frazee, MN 56544-8963	Ph: 218-334-6351
North Dakota Dry Bean Council	50072 E. Lake Seven Road Frazee, MN 56533-8963	Ph: 218-334-6351
Minnesota Dry Bean Research & Promotion Council	50072 E. Lake Seven Road Frazee, MN 56544-8963	Ph: 218-334-6351
California Bean Shippers Association (CBSA)	1521 I Street Sacramento, CA 95814	Ph: 916-441-2514
California Dry Bean Advisory Board (CDBAB)	531-D, N-Alta Dinuba, CA 93618	Ph: 559-591-4866
Colorado Dry Bean Administrative Committee (CDBAC)	31221 Northwoods Buena Vista, CO 81211	Ph: 219-395-3505
Idaho Bean Commission (IBC)	821 W State Street, Boise, ID 83720-0015	Ph: 208-334-3520
Idaho Bean Dealers Association	PO 641, Buhl, ID 83316	Ph: 208-731-1702
Michigan Bean Commission (MBC)	Joe Cramer 516 South Main Street, Suite D Frankenmuth, MI 48734	Ph: 989-262-8550 jcramer@ michiganbean.com
Michigan Bean Shippers Association (MBSA)	1501 North Shore Drive, Suite A East Lansing, MI 48823	Ph: 517-336-0223
Nebraska Dry Bean Commission (NeDBC)	4502 Avenue I, Scottsbluff, NE 69361	Ph: 308-632-1258
New York State Bean Shippers Assn. (NYSBSA)	Seneca Castle, NY 14547	Ph: 585-526-5427
North Central Bean Dealers Assn. (NCBDA)	PO Box 391, Thompson, ND 58278-0391	Ph: 701-335-3988
North Dakota Dry Edible Bean Seed Growers Assn.	PO Box 5607, Fargo, ND 58105	Ph: 701-231-8067
Rocky Mountain Bean Dealers Assn. (RMBDA)	Vickie Root 2074 Wimbleton Drive Loveland, CO 80538	Ph: 970-667-4949 RMBDA1@gmail. com
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United States Dry Bean Council (Government Relations)	Gordley Associates 600 Pennsylvania Ave, NE, Suite 320 Washington, D.C. 20003	Ph: 202-969-8900
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North Dakota Certified Bean Seed Growers

For a list of certified bean seed growers in North Dakota, visit **www.nd.gov/seed**, then click on "Field Seed Directory" on the top bar, then click on 2015 Field Bean.

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YOUR CHECKOFF DOLLARS AT WORK

2016 Dry Bean Research Update

REVISITING RECOMMENDATIONS FOR SELECTED PLANT ESTABLISHMENT FACTORS IN DRY BEAN

Greg Endres, Hans Kandel, Burton Johnson, Mike Ostlie and Blaine Schatz

Field trials were continued by North Dakota State University in 2015 to examine several dry bean plant establishment factors including planting date, row spacing and planting rates, and response to fertilizer.

PLANTING DATE: Normal North Dakota dry bean planting dates are the last 10 days in May through the first 10 days in June. Trials were conducted during 2012-15 to examine if early planting would provide advantages in seed yield or quality. In 2015, 'Lariat' pinto, 'Avalanche' navy and 'Eclipse' black bean were planted at the Carrington Research Extension Center on 1) May 13, 2) May 27, and 3) June 12. Averaged across market types, yield was 14.4, 17.5 and 16.9 cwt/acre with the early, normal and late planting dates, respectively. Cold and wet soil conditions, and crusted soil following the early planting date resulted in reduced stands and yield. Across locations and years of the trials, seed yield with early planting did not provide a yield advantage compared to later planting periods (Table). Also, seed quality (e.g. size, color, presence of disease) generally was similar among planting periods.

ROW SPACING AND PLANTING RATE: NDSU currently recommends an established stand of 90,000 plants/acre for small-seeded market types. This study is exploring if higher plant populations plus narrower row spacing (less than 30-inch rows) will economically increase yield. In 2015, 'Eclipse' black bean and 'Avalanche' navy bean were planted at Carrington in 14- and 28-inch rows, and at Prosper in 14-inch rows with targeted plant stands at both locations of 90,000, 110,000 and 130,000 plants/acre. At Carrington, averaged across planting rates, black and navy bean yield was similar between row spacings. Targeted stands were not achieved at Carrington or Prosper. Prior

study work in 2014 indicated row spacing showed more potential to increase yield compared to higher plant stands. The study will be continued in 2016.

Dry bean yield response to planting periods, Carrington and Prosper, 2012-15.

		Seed Yield (cwt/acre)		
		Planting Period[2]		
Market Type/Variety	Trial Number[1]	Early	Normal	Late
Pinto/Lariat	6	21.1	21.0	22.1
Navy/Avalanche	2	16.1	16.6	17.4
Black/Eclipse	3	19.8	20.3	18.6
average		19.0	19.3	19.4

[1]Pinto: Carrington=2012 (2 trials), 2013-2015; Prosper=2012.
Navy: Carrington=2014-15; Black: Carrington=2012, 2014-15.
[2]Early: May 11-24; Normal: May 22-June 5; Late: June 5-18.

RESPONSE TO FERTILIZER: Trials have been conducted to examine pinto bean response to various fertilizer rates, types, and placement methods. The 2015 trial was established at Carrington on a conventionally-tilled loam soil with 3.3% organic matter, 8.0 pH, low phosphorus (5 ppm Olsen) and low zinc (0.43 ppm). 'Lariat' was planted in 30-inch rows on May 28 with band (2- by 0-inch) or in-furrow (IF) liquid fertilizer. Fertilizer treatments included: 1) untreated check; 2) 10-34-0 preplant applied at 4.5 gpa and incorporated with a field cultivator plus harrow on May 27; 3) 10-34-0 preplant incorporated at 4.5 gpa followed by 10-34-0 band applied at 3 gpa; 4) 10-34-0 band applied at 3 gpa; 5) 10-34-0 IF applied at 3 gpa; 6) 6-24-6 (Gavilon) IF applied at 4.5 gpa; and 7) 10-34-0 IF applied at 3 gpa followed by MAX-IN Ultra ZMB (Winfield; 3.6% S, 0.1% B, 3% Mn and 4% Zn) at 32 fl oz/A plus Ascend (Winfield) applied at 4.5 fl oz/A at R2-5 plant stages on July 29.

Results from the 2015 trial indicated plant stand was similar among fertilizer treatments and the untreated check, with the trial averaging 61,600 plants/acre. Plant development (emergence, first flower and maturity) was also similar among treatments. Seed yield generally tended to be higher among fertilizer treatments compared to the untreated check.

Averaged over three years (2013-15), banded 10-34-0 resulted in greater yield (28.1 cwt/acre) versus yield with broadcast-applied 10-34-0 (24.1 cwt/acre) and the untreated check (23.1 cwt/acre). Averaged over two years (2014-15), IF-applied 6-24-6 yield (26.0 cwt/acre) tended to be greater compared to IF-applied 10-34-0 yield (24.9 cwt/acre) at similar P rates, though statistically the two treatments had similar yield each trial year. Averaged over two years (2014-15), the foliar application of the commercial nutrient mixture plus growth promoter following IF-applied 10-34-0 had slightly greater yield (25.6 cwt/acre) compared to only IF-applied 10-34-0 yield (24.9 cwt/acre), though statistically the two treatments had similar yield each trial year.

Similar fertilizer treatments as listed above will be tested in 2016 plus additional work with zinc and sulfur fertilizer.

DRY EDIBLE BEAN DISEASE RESEARCH

Principle investigators: Julie Pasche and Sam Markell

PROJECT GOALS: The overall goal of the NDSU dry bean pathology group is to identify and manage economically important diseases in the region. In 2015, the specific research objectives of the dry bean pathology project were to: 1) evaluate the importance of the level of anthracnose seed infection on disease development and yield under field conditions, 2) evaluate the efficacy of seed treatment and in-furrow applied fungicides for the management of root rot, 3) evaluate the efficacy of foliar fungicides to fungal pathogens, primarily rust and white mold, 4) evaluate NDSU breeding material for resistance to Common Bacterial Blight (CBB) to enhance the development of resistance varieties suited for Northarvest growing conditions and 5) monitor disease frequency and severity and pathogen populations for shifts in race structure.

IMPORTANCE OF DISEASES IN THE NORTHARVEST REGION: NDSU dry bean pathologists conducted field surveys for disease prevalence in August 2015. As in past years, CBB was the most prevalent disease, observed in all 36 fields evaluated. Halo blight and brown spot were also observed on a limited basis; however, this is not unexpected given that these diseases are more common under cooler conditions. We observed, and received numerous reports of, brown spot and halo blight earlier in the growing season. The best prevention of bacterial diseases is planting clean, certified seed. While the bacterium can enter a field on debris from last season's crop, inoculum and disease will typically be reduced by planting clean seed. No anthracnose was observed in the 36 fields evaluated in 2015, however, this does not ensure that the disease was not present in the region. In 2015, rust appeared earlier than it has in the past few years but in most cases, rust increased slowly, possibly due to fungicide applications for white mold or an unfavorable environment. However, by the end of the season, 60% of the fields evaluated in the survey had rust. The frequency of rust at the seasons' end should alert growers to scout for rust in the upcoming year. White mold also was found on a somewhat frequent basis, but this did not appear to be extremely damaging region-wide this season. We believe there are two reasons for this. First, the daytime high temperatures during bloom were warm (80^{o}F's); which reduces the likelihood of infection. Secondly, growers are doing an excellent job of managing the disease. Root rots continue to be important in nearly all dry bean fields to some degree. Scouting commercial dry bean fields every growing season allows us to monitor disease pressure across the region and to evaluate pathogen populations for changes in race structure or aggressiveness. Additionally, early identification of a potential disease problem allows us to alert growers while they still have time to manage the disease and before they have suffered yield loss. Lastly, frequent scouting helps us understand the challenges that face commercial growers so we can adjust our work to meet their needs; this is paramount to our mission of developing and implementing management strategies.

RESEARCH PROGRESS AND FINDINGS: Root Rots. Damage caused by root rotting organisms can be very difficult to quantify because it may not be readily visible, however, we know that root rot steals yield from growers every season. We continue to evaluate bio-stimulant products, seed treatment fungicides and the in-furrow application of fungicides for the control of root rot in dry beans. As in past evaluations, some products increase plant stands and decrease the amount of root rot, but we did not observe a significant increase in yield in this year's trials. We continue to recommend the use of seed-treatment fungicides to protect against the damage caused by root rotting organisms. Similar results were obtained with in-furrow fungicide trials in 2015. Data collected from four field trials indicated that the application of in-furrow fungicides reduced the severity of root rot, but did not significantly affect yield. Work in this area will continue with trials conducted in 2016. In addition to the management of root rot using chemical applications, we have begun working with Dr. Juan Osorno screening germplasm and breeding lines for resistance to important root rotting organisms.

Common Bacterial Blight. As supported by our field scouting over the past several seasons, CBB remains one of the most important diseases of dry beans in North Dakota and Minnesota. In an attempt to offer growers long-term management options for CBB, a total of 593 advanced and preliminary NDSU breeding lines were evaluated for resistance to CBB in the greenhouse. These evaluations indicate that the NDSU breeding program has advanced and preliminary lines with high levels of CBB resistance in the pipeline. This is particularly true for market classes important to North Dakota and Minnesota; pinto, black, kidney and navy beans. Lines with high levels of resistance have been forwarded to Juan Osorno for targeted breeding or advancement through the program. While these lines have been selected under North Dakota and Minnesota growing conditions, there is still much work to be done to determine if they will be well suited for commercial production based on agronomic and quality characteristics. These evaluations also indicate that current molecular markers are only moderately effective at identifying resistance. Going forward, these data will be used by the NDSU breeding program for variety development, but also in cooperation with the dry bean pathology and the dry bean genetics programs to attempt to develop new, more effective, molecular markers for resistance to CBB and possibly identify new genomic regions conveying resistance. Work in that area has been funded by the North Dakota Specialty Crop Block Grant Program based on these preliminary data made possible through the funding of this work.

Anthracnose. Anthracnose is a devastating seed-borne disease of dry beans causing substantial yield loss under conducive environmental conditions. Master's student Jessica Halvorson confirmed that race 73 remains the dominant race in North Dakota among isolates collected in 2012 and 2014. We did not observe anthracnose in 2013 or 2015. In addition to race identification, field trials were conducted in 2014 and 2015 in Morden, Manitoba to determine the effect the level of anthracnose infection in seed has on disease severity, yield and discoloration of seeds produced. Comparisons were made across certified seed, and three levels of seed produced in a field with known anthracnose infection, including seeds that had no visual symptoms of anthracnose and seeds with either slight or moderate discoloration (Fig. 1). Results from the 2014 trial demonstrated that planting seeds grown from infected plants, but displaying no visible symptoms, resulted in disease, but severity was less than when symptoms of anthracnose were visible on the seeds planted (Fig. 2A). Yield and the level of discolored seeds produced were not different than when certified seed was grown. In 2015, anthracnose severity in plants grown from symptomless seed was as high as when seeds with visual symptoms were planted (Fig. 2B). Yield and discoloration in produced seeds also was not different among the three seed categories produced from infected plants. These results had not been previously demonstrated under field conditions and provide a very vivid illustration of the dangers of planting seed that was produced in a field where anthracnose was present, even if the seed appears healthy. Ms. Halvorson completed her Master's degree in May, immediately accepted a position with Dr. Sam Markell as a research technician and continues to perform research on dry bean dis-

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FIGURE 1. *Four seed categories used to compare anthracnose disease severity under field conditions in 2014 and 2015 in Morden, Manitoba.*

eases.

Two potentially damaging fungal pathogens that can be managed with fungicides are rust and white mold. In 2015, rust and white mold fungicide nurseries were established in Fargo, ND and with a cooperator near Northwood, ND, respectively. In each case, twelve common fungicides were evaluated. Severe rust infection was observed in the rust nursery and excellent data were collected, but white mold severity was too low to differentiate chemical efficacy. The most effective fungicides for rust management continue to be strobilurins (Headline, Aproach, etc.) and triazoles (tebuconazole products, Proline, etc.). In general, fungicides that are more commonly applied for white mold did not perform as well against rust (Endura, Topsin, etc.).

ADDITIONAL COLLABORATIVE WORK: In addition to the work mentioned above, we continue to work with industry partners in order to provide growers in the Northarvest region with information on new and upcoming products to better manage dry bean diseases. In 2015, we worked with multiple chemical companies to screen new/novel candidate fungicides that are in the developmental phase. This work included foliar, seed and in-furrow applications to many different pathosystems, including; rust, white mold, soybean cyst nematode, and Rhizoctonia and Fusarium root rot.

PREVIEW OF 2016: The NDSU dry bean pathology programs continue to strive to develop and disseminate management strategies for diseases important to growers in the Northarvest region. The center of that research will remain focused on root rots, bacterial blights and fungicide efficacy, as well as a new project evaluating the rust pathogen for race diversity. We also will continue to work with the breeding program to enhance the development of cultivars resistant to diseases important to the regions' growers. The evaluation of chemicals and other products in collaboration with industry will also continue.

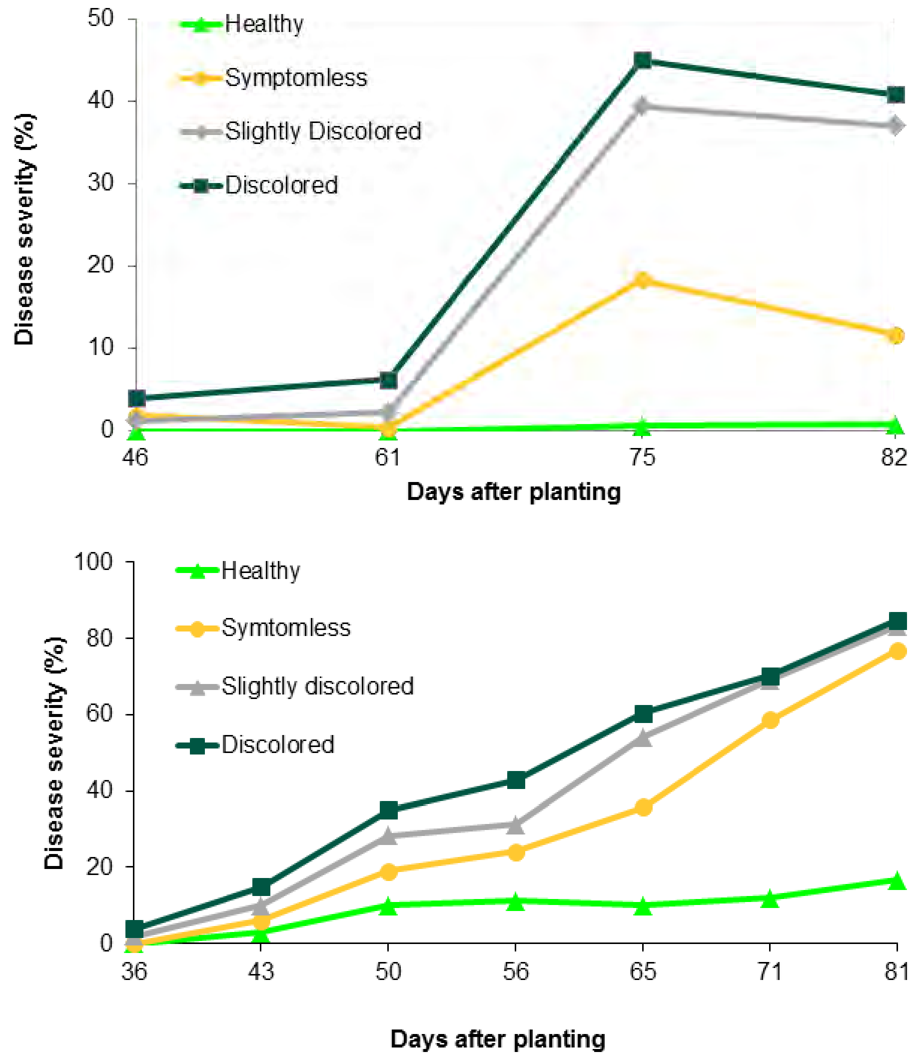

FIGURE 2. *Anthracnose disease severity under field conditions in 2014 (A) and 2015 (B) in Morden, Manitoba across four seed categories.*

ACKNOWLEDGEMENTS: We would like to thank Northarvest Bean Growers Association, the North Dakota Dry Edible Bean Seed Growers Association, the North Dakota Department of Ag Crop Protection Product Harmonization and Registration Board and Specialty Crop Block Grants, ND EPSCoR and our industry partners for funding this research. We would like to thank research specialists Robin Lamppa, Scott Meyer, Jessica Halvorson and Jim Jordahl, postdoctoral researchers Kristin Simons and Kim Zitnick-Anderson, graduate students Maniruzzaman, Chryseis Tvedt and Ryan Humann, and the many undergraduate students on our teams for their work on these projects. We also would like to thank Mark Dombeck for providing land for field research, Jared Hagert for providing land for field soil collections and Lionel Olsen for cooperating on field soil collection. Thank you also to our collaborators, Juan Osorno, Dry Bean Breeder and Michael Wunsch, Extension Plant Pathologist at the Carrington Research and Extension Center.

NORTHERN CROPS INSTITUTE TO USE DRY EDIBLE BEANS IN EXTRUDED FOOD FORMULATIONS

The Northern Crops Institute (NCI) would like to thank Northarvest Bean Growers Association for its financial contribution towards the purchase, installation and operation of a new Fluid Bed Dryer. The dryer is a vital component for the NCI's Wenger Twin Screw Extruder. NCI completed installation of its state-of-the-art Buhler OTW-50 Fluid Bed Dryer to complement NCI's Wenger twin screw extruder in November 2015. NCI has successfully produced a variety of quality snack food products through the use of superior food drying technology provided by the Buhler dryer.

Dryer in operation with snacks.

The combination of NCI's Wenger extruder and Buhler fluid bed dryer replicates processing capabilities of commercial operations. The Buhler fluid bed dryer employs high-velocity, heated air for consistent airflow, ensuring uniform product drying. Internally, the dryer conveying process gently agitates products with fluidized air. A high rate of thermal transfer results in exceptional product characteristics in terms of customized color, texture and size.

The NCI system can extrude and dry, toast, roast, puff or cool a wide range of food products produced from dry edible beans under conditions that replicate commercial operations. NCI's Buhler fluid bed dryer will be employed to produce extruded ready-to-eat breakfast cereals, snack foods, feeds, pet foods and specialized food ingredients for NCI clients, worldwide, in product development and course demonstration activities.

Northern grown dry edible beans are known for their quality, nutrition and versatility. NCI will employ dry edible beans in extruded food formulations where protein, fiber, vitamins and minerals from beans provide healthy ingredients for popular foods. Dry edible beans are natural, low glycemic, gluten-free and nutrient-dense foods that provide healthy choices for consumers of extruded food products. Once again, NCI is grateful for the financial contribution from Northarvest Bean Growers Association. This contribution has allowed NCI to greatly improve its dry edible bean product development capabilities.


Installed Buhler dryer.

DRY BEAN GROWER SURVEY

The 26th annual survey of dry bean growers was sent out in the fall of 2015; however, the results were still being compiled when this Special Edition went to print. Results of the 2014 grower survey are included.

The 2014 dry bean grower survey was the 25th annual survey of varieties grown, pest problems, pesticide use, and grower practices of the Northarvest Bean Growers Association. Research and Extension faculty at North Dakota State University and the directors of the Northarvest Bean Growers Association developed the survey form, which was mailed to all Northarvest bean growers.

A total of 171 growers responded to the survey, representing 13.2 percent of last year's total planted acreage.

The two most popular varieties by class were:

- Black: 1.Eclipse 2. Zorro
- Great Northern: 1. Aries 2. Taurus
- Kidney: 1. Montcalm 2. Red Hawk
- Navy: 1. HMS Medalist 2. T 9905
- Pinto: 1. La Paz 2. Windbreaker

Nearly 74 percent of the growers who responded ranked excess water as their worst dry bean production problem in 2014. Weeds and diseases ranked as the second and third-worst production problems, respectively.

Sixty-four percent of the growers said they direct harvested some of their edible beans last year, including 41 percent who said they direct combined all their dry beans. Thirty-six percent of the growers did no direct harvesting in 2014. 35 percent of the growers who direct harvested estimated yield losses of one to five percent, while another 45 percent had yield losses of six to ten percent.

Some other highlights from the 2014 grower survey:

- 93 percent of respondents used nitrogen on their dry beans
- 20 percent used site-specific nutrient management
- 77 percent used a soil test
- Only 17.7 percent used Rhizobium inoculants on their dry bean fields
- 26.5 percent of the dry bean growers did not use a dessicant
- 44 percent of growers reported spraying Sharpen as a dessicant; 25 percent sprayed with glyphosate
- 37 percent of the growers responding use a 2-year rotation; 30.5 percent use a 3-year rotation, and 24 percent use a 5-year rotation
- 55 percent of growers reported no insect problem in 2014; 19.5 percent listed leafhoppers as their top insect problem
- 88 percent did not apply foliar insecticide. Asana XL was the top choice among growers that did.
- 38 percent of the dry bean growers responding used Cruiser Maxx insecticide seed treatment. 25 percent of growers did not use a seed treatment last year
- 54 percent of growers said white mold was their worst disease problem last year; Only nine percent of growers reported no disease problems
- Topsin broadcast and Endura were the two most-used foliar and banded fungicide treatments.

Apron Maxx was by far the most popular fungicide seed treatment, used by more than 52 percent of the growers who responded

The worst weed problems in 2014 were lambsquarters, kochia, and waterhemp, followed closely by ragweed, biennial wormwood and wild mustard. Raptor and Rezult were the most commonly used herbicides by dry bean growers last year.

A grant from the Northarvest Bean Growers Association funded the survey which can be found at www.ag.ndsu.edu/publications/landing-pages/crops/2014-dry-bean-survey-e-1750

RELATING DICAMBA INJURY AND RESIDUE TO YIELD REDUCTION IN DRY EDIBLE BEAN.

Principle Investigators: Theresa Reinhardt, Masters Student and Dr. R. Zollinger Extension Specialist in Weed Science, Dept. Plant Sciences, North Dakota State University

OBJECTIVE: Create a predictive model for dry bean growers to evaluate injury due to dicamba drift.

PROJECT DURATION: Two year field study initiated summer 2014

JUSTIFICATION: New technology will allow dicamba to be applied in soybean. Increased dicamba usage has renewed interest and concern for the tolerance of other susceptible crops in North Dakota. Foliar injury from dicamba can be due to drift, volatilization, and tank contamination. Past research has quantified the susceptibility of soybean to dicamba but not dry bean. This research plans to relate quantity of dicamba found in newest leaf tissue to yield reduction as a predictive model for growers that experience dicamba injury in their dry beans.

METHODS: First and second year of research was conducted south of Thompson, ND. The experiment was set up in a Randomized Complete Block Design of 10 treatments replicated 3 times. Plots were 10 x 40 ft, planted with navy bean in 22 in. row spacing. Simulated dicamba drift was applied at V6, just before flowering. We wished to imitate the new dicamba-glyphosate formulation ratio of two parts glyphosate to one part dicamba and then each component of the tank-mix separately. Herbicides were applied with TT11001 nozzels at 40 psi and 8.5 gal A-1 at rates expressed in Table 1.

Plots were sprayed July 23 and July 15 in 2014 and 2015, respectively, with the above rates and evaluated 10 and 20 days after treatment (DAT). Visible symptoms of the crop were rated on a scale of 0-100 for severity, 0 was no injury and 100 was total death. Figure 1 shows the visible injury ratings by treatment and by evaluation timing. Dicamba and glyphosate are translocated, therefore injury increased over time. However, new growth improved substantially after 20 days.

Sampling methods: Plant tissue of the newest growth was taken from plants evenly spaced within the plot. 2 rows that were sprayed were not taken to yield and so we took destructive sampling at 10 and 20 DAT. About 15 plants were pulled per row and the newest baby leaves were plucked- up to two trifoliates per node and any pods present. The tissue samples were collected in labeled paper sandwich bags, kept cool, and delivered to South Dakota Agriculture Laboratories in Brookings, South Dakota, where they were analyzed for glyphosate and dicamba residue. Each plot, regardless of treatment, was analyzed for dicamba and glyphosate to assure there was no drift from other plots or fields. For this reason, each plot required 80 g of plant ma-

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Table 1. Experimental treatments and rates sprayed at V6

Treatment	Herbicide	Rate in fl oz/A
1	Untreated Check	NA
2	Clarity	0.005
3	Clarity	0.05
4	Clarity	0.5
5	Touchdown Total	0.01
6	Touchdown Total	0.1
7	Touchdown Total	1.0
8	Clarity + Touchdown Total	0.005 + 0.01
9	Clarity + Touchdown Total	0.05 + 0.1
10	Clarity + Touchdown Total	0.5 + 1.0

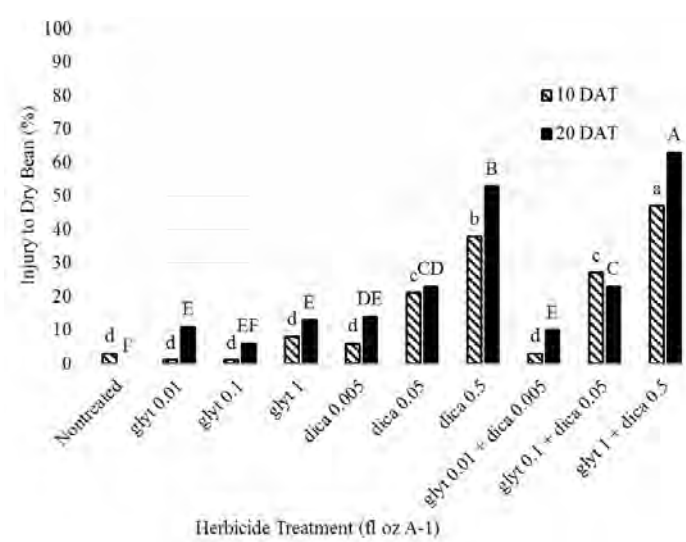

FIGURE 1. *Visible injury to dry bean due to rates of dicamba and glyphosate evaluated 10 and 20 days after treatment (DAT). Means with the same letter within evaluation day are not significantly different ($p \leq 0.05$) (lowercase = 10 DAT, uppercase = 20 DAT)*

terial: 40 g for each test. Due to the small size of dry beans, 80 g will require at least 15-30 plants' new growth. Since it doesn't matter if the weight is over, we took no less than 15 plants.

YIELD: At maturity, plot center rows were harvested, threshed, and beans were weighed to estimate yield in bu A-1. In drift studies evaluating increasing rates of dicamba and glyphosate drift, injury differed by treatment (Figure 1). At 10 DAT, injury did not differ from the nontreated until applied with 0.5 fl oz A-1 dicamba or higher. At 20 DAT increasing rates of glyphosate alone could not be separated from each other, but the highest rate of glyphosate and dicamba combined was greater than the injury of any rate of dicamba alone. This is not necessarily synergistic, possibly additive.

The total impact of this injury was difficult to estimate at the time of symptoms, but as harvest approached clear differences were observed in physiological maturity (Figure 2.) While the lowest rates of herbicide applied were maturing similarly to the nontreated, the treatments with 0.05 fl oz A-1 dicamba and 1 fl oz A-1 Touchdown Total were still green filling pods, and treatements with 0.5 fl oz A-1 dicamba were still trying to put on flowers. Because of this descrepency, we waited as long as we could, but eventually had to dessicate the plots still green in order to harvest all the plots on the same day.

Despite the injury seen overall, the yield was only reduced from the nontreated in the plots treated with 0.5 fl oz A-1 Clarity (Figure 3.). As implied, yield did not directly correlate to injury. Yield also could not be correlated to ppm found in leaf tissue because translocated dicamba is too dependent on environmental factors to give a clear threshold for yield loss. This research demonstrates that even low rates of dicamba can impact physiological maturity and potentially yield. Lab testing may not give an adequate picture to determine yield impact at this time, but we should all use best management practices to avoid misapplication and drift on susceptible crops.

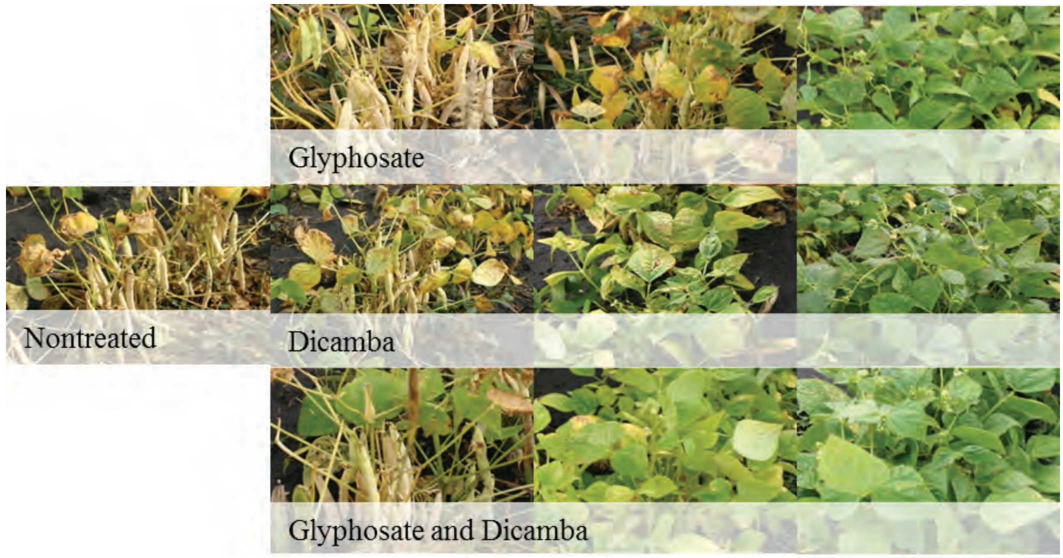

FIGURE 2. *Visual differences in delay of physiological maturity. Pictures were taken September 9, 2014.*

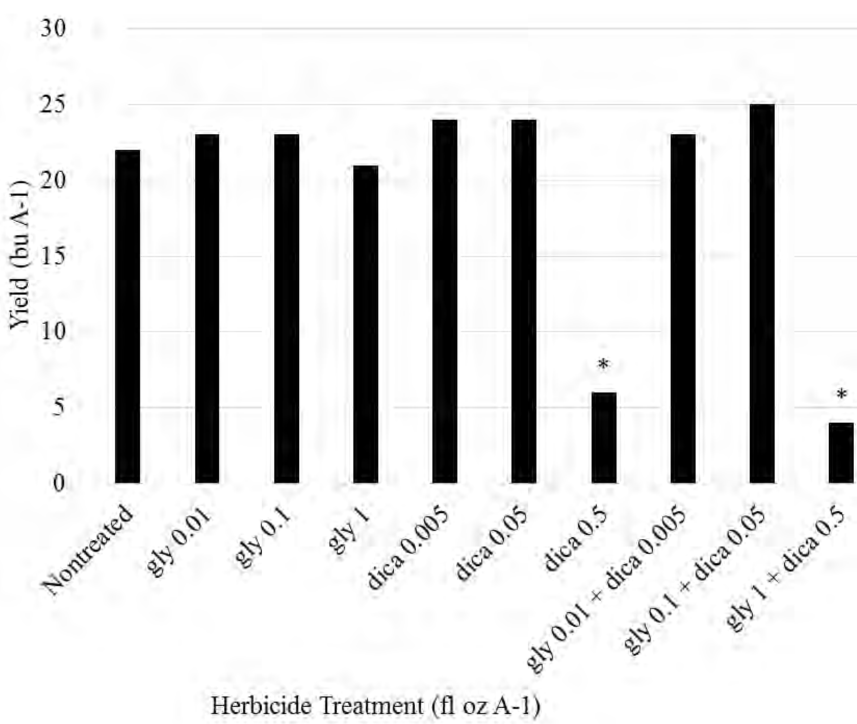

FIGURE 3. *Yield averaged across 2014 and 2015 as rates of dicamba and glyphosate increase. Means different from the nontreated are denoted by *.*

IMPROVING SEED VIGOR AND EARLY SEEDLING ESTABLISHMENT FOR CLIMATE RESILIENCE IN DRY BEANS

Principle Investigator: Dr. Kalidas Shetty, Professor Dept. of Plant Sciences, NDSU. Co-investigator: Dr. Juan Osorno, Professor Dept. of Plant Sciences, NDSU, Dr. Dipayan Sarkar, Research Associate, Dept. of Plant Sciences, NDSU. Graduate Student worked in this project: Jordan Orwat. MS Student. Cereal Science Program

BACKGROUND: Improved resilience to climate change and early stage crop growth adaptation is critical for seedling emergence and establishment. This is essential for crop productivity facing increased extremes of climate change coupled with soil salinity and waterlogging problems. Both salinity and waterlogging significantly reduce the productivity of crops, including dry beans, depending on the choice of cultivars and growth stages. Germination and early emergence in spring is the most critical period, when soil salinity and waterlogging possess maximum threat in different pockets of North Dakota. Higher germination percentage, better seed vigor and healthy seedlings are essential for uniform stand and high productivity, especially under such constantly varying abiotic stresses. Oxidation, linked cellular breakdown and its metabolic control, is one of the key regulators of seed emergence and viability. The improvement of these oxidation-linked metabolic responses through natural elicitor treatments help seed vigor and associated crop productivity increases under extremes of salinity and waterlogging stress. The improvement of these early seed vigor responses through control of oxidative processes (redox balance), and higher root surface area also help to improve overall metabolic adjustment and structural biology of dry bean contributing to both yield and quality improvement.

OBJECTIVE 1: To improve seed vigor, early emergence, establishments and seedling stress resilience in edible dry beans under salinity and constantly varying waterlogging stress.

OBJECTIVE 2: To improve abiotic stress resilience in edible dry beans during seed germination and early establishments through stimulation of plant's endogenous defense responses with natural bioprocessed elicitors.

ROLE OF PENTOSE PHOSPHATE PATHWAY TO IMPROVE RESILIENCE: It is well known that generation of reactive oxygen species (ROS) due to oxidative stress and breakdown of cellular homeostasis is common mechanism through which abiotic stress factors including salinity and waterlogging exerts harmful effects on cells and tissues of plants. To counter such oxidative stresses it is important to induce plant's endogenous defense responses early in growth stages through up regulation of critical systems-based defense related pathways involving pentose phosphate pathway (PPP). This PPP is critically coupled with redox-linked protective metabolic function linked to oxidative stress associated with breakdown in resilience. Therefore overall as plants being highly evolved eukaryotic autotrophic systems, oxidation –linked cellular breakdown and its metabolic control through PPP is one of the key regulators for seed emergence, viability and overall stress resilience, including adapting to climate change. Use of external natural elicitors that can improve oxidation-linked metabolic adjustment through system-based critical pathways such as PPP can be targeted to improve seed vigor and overall resilience by directly mobilizing the protective bioactive phytochemicals within the crop seed early in growth phase. Soluble chitosan oligosaccharide (COS) and bioprocessed marine peptide (Gro-Pro) have been used in this study as viable seed treatments to improve seed vigor, early establishments, stress resilience and associated crop productivity increases in edible dry beans. This strategy concurrently also induces endogenous defense responses by stimulating antioxidant defense responses. The induction of systemic defense responses by natural elicitors to counter abiotic stresses potentially involves energy efficient metabolic regulation such as up regulation of PPP with increased biosynthesis of protective secondary metabolites and anabolic pathways and this has potential to enhance resilience of seed germination and vigor and better prepare crops for climate change adaptation.

RESEARCH ACTIVITIES: Salinity experiment: One of the initial goals of the salinity experiment was to set up and maintain a constant electrical conductivity in pots for screening cultivars of edible dry beans and to check the optimum salinity tolerance of dry beans. For this study different ranges of electrical conductivity (0, 2, 4, 6, 8,

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10, & 12 ds/M) were established and maintained for extended periods as a preliminary experiment. To simulate the salt sources of North Dakota soil, four different salts (NaCl, MgSO4, Na2SO4, & CaSO4) as 1:1:1:1 ratio and as 1 molar concentration were used for treatments. Only distilled water was used for control and for salt treatments. Both potting mix and soils from the field (Clay County) were tried initially. In this preliminary study dry edible bean performed better (better germination and early establishments) in potting mix and was selected for further investigations. Five cultivars from each market class and four market classes of edible dry beans were used for salinity screening (Table 1). Dry edible plants were germinated separately and then transferred in saline soil 8-10 days after germination.

Table 1. Cultivars from four edible dry bean market classes for salinity experiment.

Edible Dry Bean Market Class			
Black	Pinto	Navy	Kidney
Eclipse	Windbreaker	Medalist	Montcalm
Zorro	LaPaz	T9905	Redhawk
Loretto	Lariat	Ensign	Pink Panther
Zenith	Stampede	Vista	Roise
T-39	Monterrey	Avalanche	Talon

NATURAL BIOPROCESSED ELICITORS SEED TREATMENTS: In a separate experiment germination percentage, seed vigor, and resilience of edible dry beans were tested with natural bioprocessed elicitors as seed treatments (COS 1, 2, 5, 10 gm/L & Gro-Pro 1, 2, 5, 10 ml/L) to optimize the doses. Dry bean seeds were incubated for eight hours under room temperature with natural bioprocessed treatments and then were planted. From this experiment 1gm/L COS, and 1ml/L Gro-Pro was selected as optimum dose for seed treatment. Different parameters for endogenous defense responses involving biochemical regulation and structural adjustments of dry bean plants after germination were determined for four weeks.

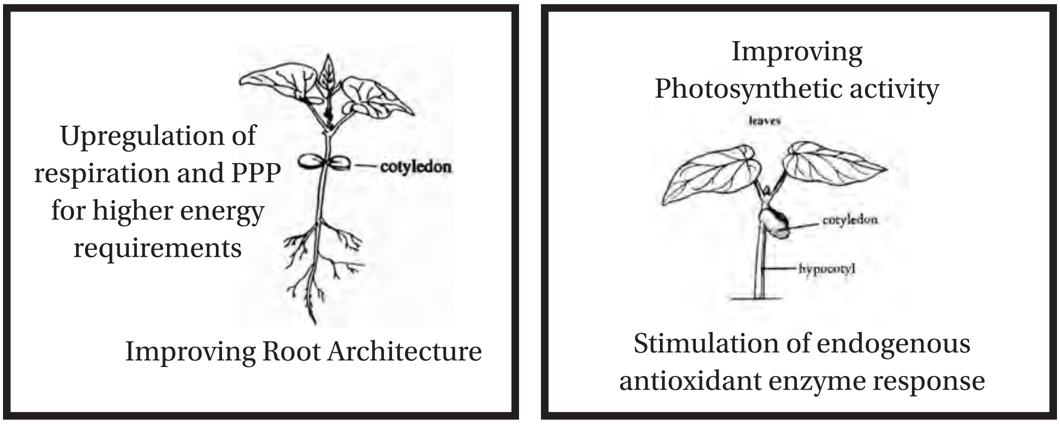
WATERLOGGING EXPERIMENT: Our team collaborated closely with Dr. Juan Osorno and his team and selected tolerant and susceptible Mesoamerican dry bean genotypes after screening under waterlogging stress. In this trial, plants were germinated under well drained condition and at the start of V2 phenological stage plants were exposed to flooding stress. Flooding stress was applied for ten days (4-5 cm water above the soil level) and then stress plots were drained. Tolerant and susceptible genotypes were identified based on their survival along with photosynthetic activity and root scores. For further investigations with natural elicitor seed treatments three susceptible genotypes and three tolerant genotypes (Mesoamerican genotypes) from each market class were selected (Table 2).

PRELIMINARY FINDINGS: No edible dry bean plants could survive more than 6 ds/M electrical conductivity in the greenhouse experiment. The optimum salinity tolerance level for most edible dry bean plants were varied between 2-3 ds/M. For further investigations 0, 3, & 6 ds/M electrical conductivity was selected to screen and determine tolerant and susceptible edible dry bean genotypes. Improved seed vigor and early establishment of dry edible bean were observed with natural bioprocessed elicitors as seed treatments (COS & Gro-Pro). Gro-Pro improved the adventitious root formation and early establishment while COS enhanced the photosynthetic efficiency and higher shoot growth during first four weeks after germination (Figure 1). Higher antioxidant enzyme responses (superoxide dismutase & catalase) through up-regulation of critical PPP mediated metabolic control was observed with COS seed treatments. Gro-Pro seed

Table 2.Cultivars from Mesoamerican dry bean market classes for waterlogging experiment.

	Edible Dry Bean Market Class					
	Pinto	Great Northern	Pink	Red	Black	Navy
Tolerant	CDC Camio Arapaho Chase	Sawtooth BelNeb-RR_1 Emerson	SO8418 Roza AC_Early_Rose	USRM_20 UI-228 Amadeus_77	Ac black diamond Shiny crow CDC Jet	Schooner Morales Verano
Susceptible	JM-126 Jackpot Croissant	Belmineb_1 JM_24 Matterhorn	CDC_Rosalee Harold Pink_Floyd	TARS09_RR004 UI-37 CENTA_Pupil	ICB_3 Raven Aifi_Wuriti	Midland Huron Albion

Figure 1. Different mechanisms for improving germination, early establishments and resilience in dry beans during early growth stages with Gro-Pro and COS seed treatments.



Gro-Pro induced seed vigor and early establishment improvements in dry beans

Mechanism for COS induced stimulation of endogenous defense responses in dry beans

treatments also improved antioxidant enzyme responses by upregulating both respiration (Kreb's Cycle) and PPP regulation. Stimulation of endogenous defense responses of dry bean were more prominent with COS seed treatment while seed vigor and early establishment improvement in Gro-Pro treated plants were mostly due to structural adjustments.

RESEARCH PROGRESS: Based on the preliminary findings we are continuing both salinity and waterlogging experiments in the greenhouse with specific genotypes from edible dry bean market classes (Table 1& 2). Both salinity and waterlogging experiments will be repeated for two times with four replications. Recovery and performance of all dry bean genotypes from salinity experiments will be studied until maturity (harvest) stage, while for the waterlogging experiment, recovery and performance of dry bean genotype will be studied one month after withdrawal of flooding stress. Different biochemical parameters, photosynthetic activity, root and shoot weight, root architecture and dry bean quality will be determined.

ACKNOWLEDGEMENT: The support from the Northarvest Bean Growers Association is fundamental for this dry bean climate resilience study. We are also thankful to Dr. Juan Osorno as both salinity and waterlogging experiments were conducted in close collaborations with his team. Dr. Ali Soltani (Dept. of Plant Sciences, NDSU) conducted the preliminary waterlogging genotype screening trial in the greenhouse. Dr. Amitava Chatterjee (Dept. of Soil Science, NDSU) helped to collect soil for the salinity trial and also to standardize electrical conductivity experiments. We are also grateful for the continuous support we have received from the College of Agriculture, Food Systems, and Natural Resources (Dean's office, NDSU) and AES greenhouse manager Julie Hochhalter and staffs. We also want to thank the ND Department of Agriculture, and the Specialty Crop Block Grant Award for providing us support to continue the research on dry bean bioactive enrichments for human health applications.

NIH GRANTS $1.7 MILLION FOR BEAN RESEARCH

Dry Bean Health Research Program (DBHRP) award winner Dr. Elizabeth Ryan of Colorado State University will receive nearly $1.7 million in funding from the National Institutes of Health (NIH). Her study, which will run through November of 2020, will identify dietary biomarkers of bean intake. DBHRP, a Northarvest Bean Growers Association program, provides qualified researchers with incentive awards to apply to NIH and USDA for larger funding for bean health research. Since the program was founded by Northarvest in 2008, $485,000 in DBHRP awards have yielded nearly $7 million in research grants from NIH, USDA, and other sources.

DRY BEAN IMPROVEMENT FOR THE NORTHERN PLAINS

Juan M. Osorno, Project Leader; Research Specialists: A. Jody Vander Wal and Michael Kloberdanz; Research Assistants: Stephan Schroder and Ali Soltani; Graduate Students: Kiran Ghising, Jose Vasquez, Katelynn Walter, Luz Montejo, Carlos Maldonado, Daniel Restrepo.

OBJECTIVES: The objective of the dry bean breeding program at NDSU is to develop high yielding, high quality dry bean genotypes adapted to the northern Great Plains. This involves many characteristics of dry beans and different disciplines of research (e.g. genetics, pathology, physiology, soils, nutrition, etc.). The main priority is to improve pinto, navy, and black market classes, but also great northern, kidney, red and pink. Crosses involve adapted cultivars grown in the Northern Plains, breeding lines developed at NDSU, and germplasm possessing desirable traits from other breeding programs. Each year, the breeding program evaluates material from around the world as possible sources of resistance to white mold, rust, root rot, anthracnose, virus, and bacterial blights, among others. As shown in the 2014 grower's survey, approximately 15% of the MIN-DAK region devoted to pinto bean production used NDSU varieties. Also, 83% of the black bean acreage was planted with Eclipse.

2015 SEASON: The beginning of the growing season started with above-normal precipitation during the months of May and June, which caused the loss of a few trials at Johnstown and Hatton. During flowering and pod filling stages, the most common diseases observed were of bacterial origin (mostly common bacterial blight and halo blight), as well as rust at the end of the growing season, which actually helps in the drying down of the plants as defoliation is one of the defense mechanisms of the plant. The dry conditions during flowering did not allow for development of severe white mold conditions, with the exception of our locations located in Traill and Grand Forks counties. Dry conditions during harvest allowed the timely collection of the data from our field trials. The only with exception is the slow darkening trials which are left in the field 2-3 months beyond optimal harvest date in order to test the ability of the lines with the slow darkening (sd) gene to withstand the extreme weather conditions during the delayed harvest.

2015 RESEARCH ACTIVITIES: The Dry Bean Variety Trials grown at more than 8 locations in North Dakota and two in Minnesota include all the public and private varieties plus a few breeding lines at final stages of testing. This is a great decision tool not only for growers but for public and private breeding programs when deciding about a new variety release. The NDSU dry bean breeding program continues to test and screen every year thousands of early generation genotypes, hundreds of preliminary and advanced breeding lines, commercial cultivars, and other genotypes. This breeding pipeline is grown in field experiments across five locations in North Dakota and two locations in Minnesota. During the 2015 growing season, the program had 40 acres (10,046 total plots) of field experiments distributed across the entire region. In addition, variety testing is made in collaboration with the NDSU Research and Extension Centers (REC) across the state, so bean growers have a better idea of how each available cultivar may perform in their own region.

Breeding activities mainly involved selection at early generations, yield testing of preliminary and advanced breeding lines, and some genetic/agronomic studies. Breeding targets include high seed yield and quality, disease resistance, early maturity, plant architecture for efficient mechanical harvest, and canning quality, among others. Greenhouse activities complement the field work by doing disease screening (bean rust, common bacterial blight, BCMV, anthracnose, among others), crossings, and seed increases. Inoculum for disease screening is provided by the Plant Pathology Dept. (Dr. Julie Pasche). The crossing block in the new greenhouse facilities involved approximately 275 new parental combinations. Winter nurseries were made at Florida (954 rows), Puerto Rico (1611), and New Zealand (309 rows), in order to speed up the breeding process, especially at the early generations. The results and new findings were always reported in peer-reviewed journals, grower meetings, field days, bulletins, magazines, phone calls, and informal conversations with all the stakeholders. Greenhouse screening for disease resistance has allowed the identification of some genotypes with improved resistance to some of the most important pathogens in the area, especially for rust, white mold, common bacterial blight, and anthracnose. Moreover, few breeding lines appear to have combined, multiple disease resistance.

Talon dark red kidney and Rosie light red kidney were officially released last year given their high seed yield and quality, intermediate resistance to the root rot complex and common bacterial blight, and agronomic performance. The data from 2015 keeps confirming the superior performance of these two kidney varieties that will have significant economic impact in the region. The 2016 growing season is the first year that there will be commercial fields of these two improved varieties. The long-term economic support from the dry bean commodity groups, such as the Northarvest Bean Growers Association, has been of key importance for the success of this breeding program.

Additional research conducted by graduate students and postdoctoral scientists focuses on seed coat slow darkening and plant architecture (in collaboration with USDA-ARS), crop modeling and genotype by environment interactions (in collaboration with the Univ. of Florida), genetic resistance to halo blight, multiple disease resistance (in collaboration with USDA-ARS) common bacterial blight, anthracnose, rust, white mold, and bean common mosaic virus, as well as genetic resistance to root rots in large-seeded types (kidney). Just this last year, new potential sources of resistance have been identified for waterlogging tolerance, root rots, halo blight, common bacterial blight, white mold, and anthracnose through some of these studies. Additional research is also underway (in collaboration with Dr. Berlin Nelson) on genetic resistance to soybean cyst nematode (details on a separate report in this magazine). In collaboration with Dr. Phil McClean, studies are focused on the use of molecular markers to improve the efficiency of selection within the breeding program such as Genome-Wide Association Mapping (GWAS) and Genotyping by Sequencing (GBS) methods.

ACKNOWLEDGEMENTS: The support from the Northarvest Bean Growers Association, NDSU, and the North Dakota Dry Edible Bean Seed Growers Association (NDDEBSGA) has been fundamental for the long-term success of the dry bean breeding program at NDSU and the growers of the Northarvest region. Other funding agencies include USDA-ARS, USDA-NIFA, National Science Foundation (NSF), ND Department of Agriculture, and the United States Agency for International Development (USAID).

Last but not least, we want to thank the following growers for allowing us to do research trials on their farms: Paul Johanning (Park Rapids,MN), Mark Dombeck (Perham,MN), Jim Karley (Johnstown,ND), Brian Schanilec (Forest River,ND), Tim Skjoiton (Hatton,ND), and Mark/Jim Sletten (Hatton,ND).

GENETICS OF RESISTANCE IN DRY BEAN TO SOYBEAN CYST NEMATODE

Principal Investigators: Dr. Berlin D. Nelson, Dept. Plant Pathology, Dr. Juan M. Osorno, Dry Bean Breeder, Dept. Plant Sciences, and Dr. Shalu Jain, post-doctoral scientist, Plant Pathology, NDSU, P.O. Box 6050, Fargo, ND 58108.

OBJECTIVES: Conduct a preliminary genetic analysis to understand the mode of inheritance of soybean cyst nematode (SCN) resistance in common bean.

PROJECT DURATION: Three year project initiated in July 2012.

Soybean cyst nematode (SCN; Heterodera glycines) is the most important disease of soybeans in the USA. SCN is widely distributed in all major soybean producing areas of the United States and has been detected in southern and central Minnesota, South Dakota and North Dakota. SCN can cause substantial yield loss without obvious above ground symptoms. SCN has a wide host range, but only soybean and dry bean are susceptible field crops in our region [1, 2]. The results from previous research indicate that SCN can effectively reproduce on dry bean and can cause severe yield loss in this region. Some common bean genotypes are considered excellent hosts for H. glycines [3]. Averaged over a selection of genotypes, Poromarto and Nelson [3] reported that kidney beans are highly susceptible, navy and pinto beans are moderately susceptible and black beans are moderately resistant with the average SCN female index 110, 41, 39 and 16, respectively. There are no known commercial bean varieties with high levels of resistance to SCN in the three major bean classes, i.e. pinto, navy and kidney, grown in this area. The reduction of plant growth and seed yield in three different bean classes (pinto, kidney and navy) from HG 0 under field conditions indicated a potential threat to the dry bean industry [4]. There is serious concern that SCN could become a major problem for common bean production in the North Dakota-Minnesota region. Due to this potential threat of SCN to dry bean production in North Dakota, breeding efforts at North Dakota State University were initiated to incorporate SCN resistance into bean germplasm for eventual production of SCN- resistant varieties.

The eggs of SCN are stored in bodies of dead females called cysts and can survive in soil for several years. Chemical and biological control of SCN is neither currently feasible nor recommended. The primary management of SCN in soybean and dry bean could be achieved through the use of resistant cultivars and crop rotation with non-host crops to reduce nematode populations in the soil. Genetic information about SCN resistance in dry bean will help initiate the breeding efforts for the development of SCN resistant varieties. Resistance to SCN is multigenic in soybean and quantitative trait loci (QTL) were identified on chromosomes 18 (rhg1) and 8 (Rhg4) in many soybean cultivars [5]. There are differences in virulence within the SCN population with virulent types termed HG types. An HG Type is a description of an SCN population based on the ability of the nematode to develop on resistant soybean lines. In North Dakota and northern Minnesota the predominant virulent type is HG 0, previously known as race 3. HG type is also important to dry bean because we have discovered sources of resistance in dry bean that only are effective against certain HG types.

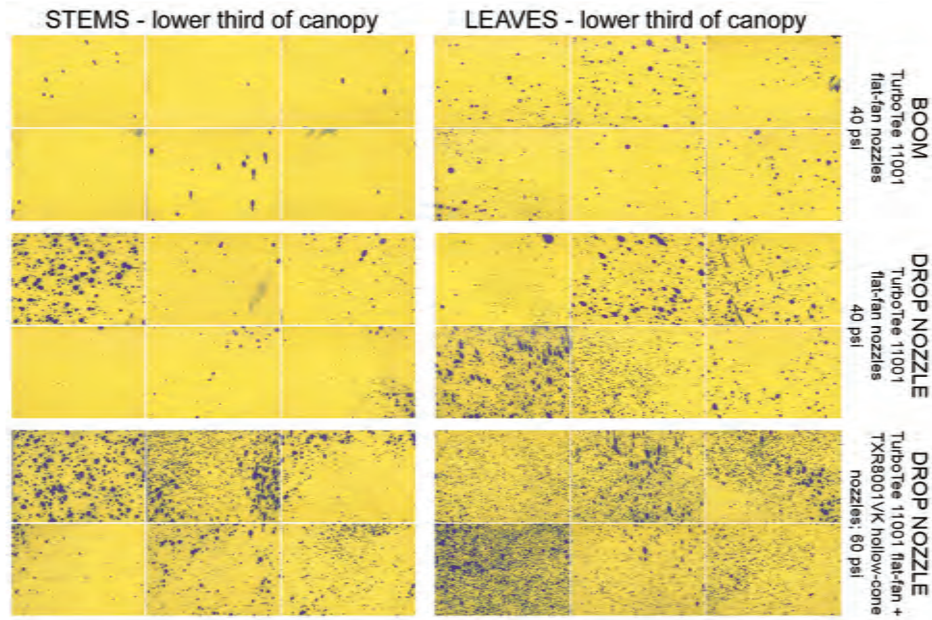
This project was initiated to understand the genetic basis of resistance to SCN HG 0 in three classes of dry bean. For this purpose, three dihybrid crosses were made in kidney bean, pinto bean and black bean between resistant and susceptible parents. The kidney bean variety Red Hawk and pinto bean variety GTS 900 were susceptible and black bean variety T39 was moderately susceptible to SCN infection. Among the plant introduction (PI) lines used as resistant parents in the crosses, PI 313837 (kidney) and PI 310669 (black) were highly resistant while PI 533561 (pinto) was moderately resistant. These PI lines were selected among other resistant bean lines because of their good agronomic qualities when tested in a ND field. A large number of F2 seed was generated from each cross for development of mapping populations which was screened for SCN resistance (HG type 0) in 2013-2014 using the procedure described by Poromorto and Nelson [3]. The Schmitt and Shannon scale was used to categorize the resistance of dry bean plants based on a female index using the susceptible soybean Barnes as a positive check on disease: Female Index (FI) <10 resistant; FI 10-30 moderately resistant; FI 31-60 moderately susceptible; and FI >60 susceptible. Seeds produced by F2 plants were used to advance the generations using a single seed descent method. Screening of 248 kidney bean F2 plants was completed during 2014 and development of the mapping populations was completed in 2015. We are currently conducting the genetic analysis. Likewise, approximately 300 F2 seeds from the pinto bean

Continued on Next Page

IMPROVING SCLEROTINIA MANAGEMENT IN DRY EDIBLE BEANS WITH APPLICATION TECHNOLOGY RESEARCH

Michael Wunsch, Ph.D., plant pathologist, NDSU Carrington Research Extension Center

Sclerotinia management in dry edible beans is limited by the difficulty of achieving satisfactory fungicide coverage to the lower canopy, where most Sclerotinia infections begin. Using standard application practices, most of the fungicide is intercepted by the upper canopy, and fungicide applications often only reduce disease levels by approximately half. This project investigated whether the shift toward upright dry bean varieties might make it feasible to use drop nozzles to deliver fungicides directly into the mid and lower canopy, improving fungicide coverage and increasing disease control.



The use of drop nozzles facilitated increased fungicide deposition to leaves and stems in the lower third of the dry bean canopy. Pictured are results from water-sensitive spray cards placed in the canopy immediately prior to applying fungicides at the R3 growth stage; where fungicides were deposited, the color turned blue. Spray cards were placed on two plants in each of three replicates of the experiment.

GENETICS OF RESISTANCE • *From Page 37*

cross were used to develop the mapping populations through the single seed descent method. This population is still in development due to limited greenhouse space. Our initial attempt to develop a mapping population in pinto bean was unsuccessful and we had to repeat part of the research. Screening of black bean F2 lines indicated that the population was not segregating for resistance and susceptibility, therefore the black bean population was not advanced further. Screening results from F2 kidney cross suggest that resistance to SCN in dry bean is likely controlled by multiple genes or quantitative trait loci, the same as in soybean.

Future work in this research involves development of genetic maps and resistance screening of these populations. The results of this research will help us understand the genetics of resistance and can be used by the dry bean breeding program to incorporate SCN resistance into future dry bean genotypes. The use of resistant varieties will allow growers to manage SCN and avoid yield loss from this nematode plus lower populations of SCN in the soil.

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A field trial was conducted under overhead irrigation in Carrington, ND. A heavy-duty drop nozzle manufactured by the 360 Yield Center (Morton, IL) was utilized in the trial; the drop nozzle features two side ports and two rear ports for mounting spray nozzles and has a design that makes it also an effective canopy opener. Four fungicides were tested on 'Lariat' and 'Windbreaker' pinto beans: 3.0 oz/ac Quash (metconazole; Valent Corp.), 8.0 fl oz/ac Omega (fluazinam; Syngenta Corp.), 8.0 oz/ac Endura (boscalid; BASF Corp.), and 30 fl oz/ac Topsin (thiophanate-methyl; United Phosphorous Inc.). For each fungicide, standard fungicide applications in which nozzles were mounted directly to the boom were tested against applications in which nozzles were mounted to the side and upper rear ports of drop nozzles manufactured by the 360 Yield Center. All applications were made in 20 gal water/ac using a tractor-mounted boom. The pinto beans were seeded at 85,000 pure live seeds/ac in rows 21 inches apart on June 5.

Sustained strong winds averaging 20-30 miles an hour with gusts up to 50 miles-per-hour over a 14-hour period when the dry beans were in full bloom on July 28 and 29, caused significant damage to the crop, and the dry bean canopy never fully closed.

The lack of canopy closure in this trial made it difficult to rigorously test the drop nozzles. The open canopy limited disease development, reduced differences in fungicide coverage between standard boom-mounted nozzles and drop nozzles, and precluded an assessment of crop damage that could result from using the drop nozzles in a dense canopy. However, results from the study, while not conclusive, were promising; the drop nozzles facilitated improved fungicide deposition to lower leaves and stems and, even under low disease pressure, were associated with a consistent trend towards improved disease control. Additional field testing is planned for 2016.

RESULTS: *Across all fungicides tested and both pinto bean varieties, the use of drop nozzles was consistently associated with a trend towards improved Sclerotinia control relative to boom-mounted nozzles. Combined results across all fungicides and 'Lariat' and 'Windbreaker' pintos are presented. Due to a lack of canopy closure, Sclerotinia disease pressure was low, and Sclerotinia was not an important determinant of yield.*

	Nozzle Placement	Spray Nozzles (TeeJet Technologies, Inc.)	Application Timing	Application Pressure	Droplet Size	Sclerotia Stem Rot: Incidence, R7 Growth Stage, %		Sclerotia Stem Rot: Severity Index, R7 Growth Stage, %		Yield, 13.5% Moist., lbs/ac	
1	Non-treated control					4.5	b*	2.4	b*	2612	a*
2	Boom	TurboTee 11001 flat-fan	mid-R1 + R3	40 psi	medium	2.9	ab	1.4	ab	2771	a
3	Drop nozzle	TurboTee 11001 flat-fan (side ports and upward rear port)	mid-R1 + R3	40 psi	medium	2.3	a	1.0	a	2636	a
4	Boom	TurboTee 11001 flat-fan	late R1 + R3	40 psi	medium	2.5	ab	1.1	a	2670	a
5	Drop nozzle	TurboTee 11001 flat-fan (side ports and upward rear port)	late R1 + R3	40 psi	medium	1.8	a	0.8	a	2737	a
6	Drop nozzle	TT 11001 flat-fan (side port) + TXR8001VK hollow-cone (upward rear port)	late R1 + R3	60 psi	very fine	1.6	a	0.7	a	2670	a
				F:		4.36		4.75		1.79	
				P>F:		0.0009		0.0004		0.1155	
				CV:		96.3		119.2		11.7	

Sclerotinia stem rot: Sclerotinia incidence and severity were assessed at the R7 growth stage. In each plot, 45 plants (15 plants in each row of each 3-row plot) were individually assessed for the percent of the plant exhibiting symptoms of Sclerotinia stem rot. Within each row, 15 sequential plants beginning at an arbitrarily selected location within each row were evaluated.

* Within-column means followed by a different letter are statistically significant (Tukey multiple comparison procedure; $P < 0.05$).

North Dakota Dry Bean Variety Trial Results for 2015

Compiled by Hans Kandel, NDSU Extension Agronomist

Information about dry bean variety performance can be accessed on the Web at www.ag.ndsu.edu/varietytrial, which is the site with all variety trial data from all NDSU Research Extension Centers for all crops. The agronomic data presented in this article are from replicated research plots using experimental designs that enable the use of statistical analysis. The LSD (least significant difference) numbers beneath the columns in tables are derived from the statistical analyses and only apply to the numbers in the column in which they appear. If the difference between two varieties exceeds the LSD value, it means that with 90 or 95 percent probability (0.10 and 0.05 level, respectively), the higher-yielding variety has a significant yield advantage. If the difference between two varieties is less than the LSD value, then the variety yields are considered similar. The abbreviation NS is used to indicate no significant difference for that trait among any of the varieties. The CV is a measure of variability in the trial. The CV stands for coefficient of variation and is expressed as a percentage. Large CVs mean a large amount of variation that could not be attributed to differences in the varieties.

In the tables, the "mean" indicates the average of the observations in the column. Only compare values within the table and look for trends for the desired trait among different experimental sites and years. In the tables, the dry bean varieties are arranged in alphabetical order within market class. Footnotes provide more detailed information about data in the table under which they appear. Characteristics to evaluate for selecting a dry bean variety include marketing class, yield potential in your area, test weight, reaction to problematic diseases and maturity date.

Choose a high-quality variety that, on average, performs the best at multiple locations near your farm during several years.

This article summarizes dry bean variety performance at the various North Dakota State University Research Extension Centers and is based on research conducted by the following North Dakota Agricultural Experiment Station scientist: Juan Osorno, Jody VanderWal and Michael Kloberdanz (NDSU Main Station); Leonard Besemann and Heidi Eslinger (Oakes Irrigation Site); Mike Ostlie, Blaine Schatz, and Greg Endres (Carrington Research Extension Center); Bryan Hanson, Travis Hakanson and Lawrence Henry (Langdon Research Extension Center); John Rickertsen and Rick Olson (Hettinger Research Extension Center); Eric Eriksmoen, James Tarasenko and Joe Effertz (North Central Research Extension Center, Minot); Tyler Tjelde and Justin Jacobs (Williston Research Extension Center).

Research specialists and technicians helped

Table 1. North Dakota Dry Edible Bean Planted Acreage, 2003 to 2015.

Year	Acreage
2003	540,000
2004	560,000
2005	620,000
2006	670,000
2007	690,000
2008	660,000
2009	610,000
2010	800,000
2011	410,000
2012	700,000
2013	510,000
2014	650,000
2015	660,000

Table 2. North Dakota Dry Edible Bean Production by Commercial Class, 2003 to 2014.

Year	Pinto (Cwt)	Navy (Cwt)
2003	5,864,000	1,164,000
2004	3,573,000	650,000
2005	6,584,000	1,343,000
2006	4,988,000	1,585,000
2007	7,606,000	1,611,000
2008	6,660,000	2,087,000
2009	5,950,000	1,255,000
2010	7,543,000	1,958,000
2011	2,709,000	1,125,000
2012	7,610,000	2,215,000
2013	4,765,000	1,299,000
2014	5,677,000	1,622,000

Source: North Dakota Agricultural Statistics Service – USDA.

with the field work and data compilation. The assistance given by many secretaries in typing respective portions of this document is very much appreciated. We want to express our thanks to dry bean growers who assisted with the on-farm variety testing. Presentation of data for the varieties tested does not imply approval or endorsement by the authors or agencies conducting the tests.

2015 Pinto Bean Variety Trial - Prosper, and Forest River Hatton, N.D. (NDSU) - Authors, J. Osorno, J. VanderWal and M. Kloberdanz.

Variety	Days to Flowering (DAP)[1]	Plant Height (inch)	Days to Maturity (DAP)[1]	100 Seed Weight (gram)	Seed Yield (lb/a)
Prosper (Cass County)					
Buster	46	18	93	35.5	3,050
El Diablo Fu	47	21	89	36.2	2,660
GTS-904	47	19	95	36.4	2,870
GTS-907	46	18	92	33.4	2,280
La Paz	48	22	98	34.5	2,590
Lariat	47	20	103	35.4	2,630
Marmot	40	13	85	38.8	1,770
Maverick	47	17	95	35.5	2,510
Monterrey	48	20	98	33.9	2,910
ND-307	47	19	101	36.3	2,620
Santa Cruz	48	23	99	33.9	3,170
Sinaloa	47	23	102	37.0	3,080
Stampede	47	21	93	32.0	1,880
SV6139GR	47	21	91	32.4	2,950
SV6533GR	47	20	89	35.2	2,020
Windbreaker	47	17	94	37.3	3,270
Mean	47	19	95	35.2	2,641
CV %	2	9.0	3	4.9	13.7
LSD 0.05	1	2.8	4	2.4	500
LSD 0.10	1	2.3	3	2.0	420
Hatton (Traill County)					
Buster	49	16	96	37.0	3,630
Centennial	50	21	105	37.0	3,150
El Diablo Fu	48	19	92	38.9	3,120
Eldordo	50	19	103	38.8	3,240
GTS-904	51	18	100	39.9	3,300
GTS-907	49	16	94	37.0	3,240
La Paz	51	20	99	33.5	3,370
Lariat	51	18	102	36.5	3,160
Marmot	45	12	80	41.3	1,570
Maverick	50	17	102	37.5	3,200
Hatton (Traill County) - *CONTINUED*					
Monterrey	51	22	100	34.5	3,190
ND-307	50	18	101	38.2	3,120
Othello	48	16	92	37.1	2,850
Santa Cruz	51	22	97	32.7	3,070
Sinaloa	50	22	96	36.9	3,420
Stampede	49	20	96	34.9	3,120
SV6139GR	50	20	96	33.1	3,500
SV6533GR	50	19	93	38.3	2,700
Windbreaker	49	18	94	37.1	3,060
Mean	50	18	97	36.9	3,106
CV %	3.0	13.0	3.0	4.3	10.7
LSD 0.05	2	3.5	4	2.2	450
LSD 0.10	2	3.0	3	1.8	380
Forest River (Walsh County)					
Buster		16	93	30.5	2,100
El Diablo Fu		21	93	34.8	1,710
GTS-904		18	94	34.1	2,510
GTS-907		19	94	30.0	2,070
La Paz		20	94	34.0	2,450
Lariat		22	96	33.8	2,230
Maverick		17	94	33.4	1,840
Monterrey		21	95	33.8	2,340
ND-307		20	96	33.6	2,060
Santa Cruz		22	94	30.9	2,390
Sinaloa		20	94	33.4	2,470
Stampede		22	94	32.3	2,210
Windbreaker		19	93	32.5	2,210
Mean		20	94	32.9	2,199
CV %		9.0	2.0	4.1	12.6
LSD 0.05		2.8	2.0	1.9	3.9
LSD 0.10		2.3	1.7	1.6	3.3

PROSPER - Planted: June 1. Previous crop: small grain.
HATTON - Planted: May 26. Previous crop: sugarbeet.
FOREST RIVER - Planted: May 31. Previous crop: small grain.
[1]Days after planting.

2015 Navy Bean Variety Trial - Prosper, Hatton, and Forest River, N.D. (NDSU) - Authors, J. Osorno, J. VanderWal and M. Kloberdanz.

Variety	Days to Flowering (DAP)[1]	Plant Height (inch)	Days to Maturity (DAP)[1]	100 Seed Weight (gram)	Seed Yield (lb/a)
Prosper (Cass County)					
Bolt	42	20	96	19.7	2,190
Ensign	47	19	101	19.4	2,190
Fathom	42	19	102	20.0	2,450
IG-10M	45	20	95	19.1	2,060
Medalist	48	21	101	15.8	2,430
Mist	48	20	107	18.2	2,640
Nautica	48	19	99	14.8	1,940
OB-1723-03	47	19	101	15.5	2,170
OB-3739-03	49	19	100	16.9	1,690
OB-3970-03	47	17	101	16.9	2,080
Rexeter	43	19	107	17.6	2,260
SV1893GH	48	19	98	17.2	2,200
T9905	46	20	100	18.6	2,320
Vigilant	47	21	97	17.2	2,050
Vista	47	19	102	16.9	2,140
Mean	46	20	100	17.6	2,187
CV %	4.0	8.0	3.0	4.7	12.0
LSD 0.05	3	2.4	4	1.1	370
LSD 0.10	3	2.0	3	0.9	310
Hatton (Traill County)					
Alpena	51	24	98	18.1	2,430
Bolt	48	22	93	21.8	2,040
DS105W0	52	22	100	19.0	3,040
Ensign	51	20	97	18.6	2,570
Fathom	50	20	100	19.0	2,650
IG-10M	49	21	95	21.3	2,160
Medalist	51	23	99	16.6	2,650
Mist	50	20	101	18.9	2,330
Nautica	51	22	98	15.7	2,210
OB-1723-03	51	21	100	15.2	2,630
OB-3739-03	55	19	104	17.7	2,150
OB-3970-03	51	17	101	16.8	2,030
Rexeter	49	22	102	18.4	2,320

Variety	Days to Flowering (DAP)[1]	Plant Height (inch)	Days to Maturity (DAP)[1]	100 Seed Weight (gram)	Seed Yield (lb/a)
Hatton (Traill County) *CONTINUED*					
T9905	50	20	97	19.6	2,580
Vigilant	50	23	99	17.3	2,040
Vista	50	23	100	15.9	2,460
Mean	51	21	99	18.2	2,395
CV %	2.0	11.0	2.0	4.3	14.1
LSD 0.05	2	3.1	3	1.1	470
LSD 0.10	2	2.6	3	0.9	390
Forest River (Walsh County)					
Bolt		21	93	18.2	1,790
DS105W0		22	97	18.2	2,140
Ensign		19	94	17.2	1,740
Fathom		19	97	17.3	1,940
IG-10M		22	93	18.0	1,940
Medalist		20	93	14.9	1,810
Mist		18	98	16.8	1,870
Nautica		19	96	15.2	1,890
OB-1723-03		20	98	14.1	1,960
OB-3739-03		19	100	17.5	1,650
OB-3970-03		19	97	15.9	1,860
Rexeter		20	100	16.2	1,730
T9905		21	93	18.2	2,280
Vigilant		20	93	16.1	1,810
Vista		21	95	14.8	2,070
Mean		20	96	16.6	1,899
CV %		9.0	2.0	3.6	15.8
LSD 0.05		NS	3	0.8	NS
LSD 0.10		NS	3	0.7	NS

PROSPER: Planted: Previous crop: small grain. **HATTON:** Planted: May 26. Previous crop: sugarbeets. **FOREST RIVER -** Planted: May 31. Previous crop: small grain. [1]Days after planting.

2015 Kidney Bean Variety Trial - Park Rapids and Perham , Minn. (NDSU) - Authors, J. Osorno, J. VanderWal and M. Kloberdanz.

Variety	Market Class	Plant Height (inch)	Days to Maturity (DAP)[1]	100 Seed Weight (gram)	Seed Yield (lb/a)
Park Rapids, MN (Hubbard County)					
Dynasty	Dark Red Kidney	20	102	57.1	3,000
Majesty	Dark Red Kidney	19	96	55.7	2,080
Montcalm	Dark Red Kidney	20	104	51.7	2,880
Red Rover	Dark Red Kidney	20	90	46.2	2,100
Redhawk	Dark Red Kidney	19	92	43.1	2,180
Talon	Dark Red Kidney	19	94	46.0	2,860
Big Red	Light Red Kidney	19	91	55.4	3,010
Cabernet	Light Red Kidney	19	93	47.1	2,640
Celrk	Light Red Kidney	17	90	54.2	2,530
Foxfire	Light Red Kidney	19	91	50.1	2,810
Inferno	Light Red Kidney	23	104	51.4	3,360
Pink Panther	Light Red Kidney	19	94	57.1	3,190
Rosie	Light Red Kidney	20	104	46.5	3,080
Silver Cloud	White Kidney	21	105	54.2	2,030
Snowdon	White Kidney	17	88	55.8	3,030
Yeti	White Kidney	22	101	50.2	2,890
Mean		19	96	51.4	2,729
CV %		8.0	2.0	4.8	11.4
LSD 0.05		2.0	3	3.4	440
LSD 0.10		1.6	3	2.8	370
Perham, MN					
Cabernet	Dark Red Kidney	18	95	46.9	1,780
Dynasty	Dark Red Kidney	24	101	54.4	1,990
Montcalm	Dark Red Kidney	20	102	50.0	1,720
Red Rover	Dark Red Kidney	19	91	46.5	1,600
Redhawk	Dark Red Kidney	19	95	44.2	1,270
Talon	Dark Red Kidney	20	98	46.5	1,690
Big Red	Light Red Kidney	20	94	51.2	2,080
Foxfire	Light Red Kidney	21	94	49.3	1,930
Inferno	Light Red Kidney	21	105	47.3	2,100
Pink Panther	Light Red Kidney	21	95	52.0	2,290
Rosie	Light Red Kidney	24	105	45.0	1,770
Silver Cloud	White Kidney	22	104	48.5	900
Mean		21	98	48.5	1,760
CV %		11.0	3.0	5.1	12.1
LSD 0.05		3.1	4	3.4	310
LSD 0.10		2.6	3	2.8	260

PERHAM: Planted: June 3. Previous crop: corn. PERHAM: Planted: June 1. Previous crop: potato. [1]Days after planting.

2015 Dry Bean Variety Trial - Park Rapids, Minn. (NDSU) - Authors, J. Osorno, J. VanderWal and M. Kloberdanz.

Variety	Market Class	Plant Height (inch)	Days to Maturity (DAP)[1]	100 Seed Weight (gram)	Seed Yield (lb/a)
Park Rapids, Minn.					
Eclipse	Black	24	93	18.0	3,630
GTS-1103	Black	20	95	17.8	3,250
Loreto	Black	20	100	17.7	2,780
Zorro	Black	22	93	17.7	2,620
Bolt	Navy	19	94	21.5	3,320
Fathon	Navy	17	101	20.9	3,870
IG-10M	Navy	21	94	20.1	3,190
Medalist	Navy	21	93	15.5	3,540
Mist	Navy	22	102	19.1	3,860
Nautica	Navy	24	96	16.5	3,030
OB-1723-03	Navy	20	99	15.5	3,490
OB-3739-03	Navy	19	99	16.4	2,430
OB-3970-03	Navy	20	100	15.7	2,480
Rexeter	Navy	19	104	18.8	3,220
T9905	Navy	21	97	19.0	3,710
El Diablo Fu	Pinto	19	91	34.1	3,430
GTS-904	Pinto	19	97	35.6	3,660
GTS-907	Pinto	17	92	34.3	3,350
La Paz	Pinto	21	94	32.0	3,380
Lariat	Pinto	19	98	36.2	3,640
Monterrey	Pinto	20	94	32.4	3,020
Sinaloa	Pinto	20	95	33.6	3,400
Stampede	Pinto	21	94	31.8	2,910
Windbreaker	Pinto	17	93	37.2	4,150
Mean		20	96	24.1	3,307
CV %		8.0	2.0	4.6	9.6
LSD 0.05		2.4	2	1.6	440
LSD 0.10		2.0	2	1.3	370

PARK RAPIDS - Planted: June 3. Previous crop: corn.
[1]Days after planting.

2015 Dry Bean Variety Trial - Perham, Minn. (NDSU) - Authors, J. Osorno,J. VanderWal and M. Kloberdanz.

Variety	Market Class	Plant Height (inch)	Days to Maturity (DAP)[1]	100 Seed Weight (gram)	Seed Yield (lb/a)
Perham, Minn.					
Eclipse	Black	20	97	17.6	2,000
GTS-1103	Black	20	102	18.4	2,400
Loreto	Black	20	105	18.3	2,250
Zorro	Black	23	97	16.7	1,660
Bolt	Navy	22	98	21.7	2,360
Fathon	Navy	21	101	20.0	1,970
IG-10M	Navy	21	100	22.5	2,530
Medalist	Navy	19	103	16.7	2,140
Mist	Navy	21	105	19.8	2,270
Nautica	Navy	22	102	16.1	2,060
OB-1723-03	Navy	20	102	14.8	1,910
OB-3739-03	Navy	17	104	16.8	1,520
OB-3970-03	Navy	20	104	16.9	1,880
Rexeter	Navy	24	105	19.5	2,100
T9905	Navy	20	102	20.4	2,170
El Diablo Fu	Pinto	17	96	31.6	2,050
GTS-904	Pinto	19	100	34.1	1,800
GTS-907	Pinto	18	97	32.1	1,970
La Paz	Pinto	20	101	30.0	2,140
Lariat	Pinto	20	98	31.7	1,730
Monterrey	Pinto	21	101	29.2	2,000
Sinaloa	Pinto	20	98	31.6	2,210
Stampede	Pinto	21	97	33.3	1,670
Windbreaker	Pinto	16	97	36.1	2,350
Mean		20	101	23.6	2,048
CV %		12	1.0	5.1	9.1
LSD 0.05		3.1	2	1.8	260
LSD 0.10		2.6	2	1.5	220

PERHAM - Planted: June 1. Previous crop: potato.
[1]Days after planting.

2015 Dry Bean Variety Trial – Dryland - Carrington – Authors, M. Ostlie, B. Schatz, and G. Endres.

Variety	Market Class	Maturity (DAP)[1]	Growth Habit[2] (1-9)	Direct Harvest[3] (%)[1]	Seeds/ Pound (lb/a)	100 Seed Weight (gram)	Seed Yield 2015 (lb/a)	Seed Yield 3-yr. Avg.[5] (lb/a)
Eclipse	Black	93	6.8	85	1,903	23.9	1,629	2,498
Loreto	Black	98	8.0	95	1,935	23.5	1,548	2,108
Zorro	Black	94	7.8	90	1,802	25.2	2,093	2,653
Montcalm	Dark Red Kidney	98	7.0	81	793	57.3	1,515	--
Talon	Dark Red Kidney	94	6.5	75	848	53.6	1,693	--
Pink Panther	Light Red Kidney	83	7.3	90	831	55.8	1,398	--
Rosie	Light Red Kidney	99	7.0	83	833	54.5	1,778	--
Avalanche	Navy	94	5.3	80	1,979	22.9	1,804	2,213
Ensign	Navy	95	6.3	69	1,791	25.3	1,717	2,442
HMS Medalist	Navy	97	6.5	88	2,097	21.7	1,813	2,353
T9905	Navy	97	6.3	84	1,807	25.1	2,104	2,564
Vista	Navy	97	6.5	79	2,074	21.9	1,860	2,360
La Paz	Pinto	91	6.0	85	1,002	45.4	2,297	2,858
Lariat	Pinto	91	4.8	90	996	45.7	2,380	2,774
Maverick	Pinto	86	4.5	80	1,020	44.6	2,075	2,561
ND-307	Pinto	89	5.3	80	984	46.2	1,805	2,579
Stampede	Pinto	88	5.8	83	976	46.6	2,273	2,678
Windbreaker	Pinto	88	4.0	80	918	49.5	2,321	2,661
Merlot	Small Red	94	5.8	90	1,007	45.1	1,922	2,268
Rio Rojo	Small Red	92	6.0	94	1,284	35.4	1,857	--
Mean		93	6.2	84	1,344	38.5	1,894	2,505
CV %		2.3	15.6	4.9	4	5.9	11.9	--
LSD 0.10		3	1	6	73	3.3	321	--
LSD 0.05		3	1.1	4.8	61	2.7	268	--

PLANTED: May 27. Harvested: Sept. 9. PREVIOUS CROP: spring wheat.
[1]Days after planting.
[2]Growth Habit: Scored on scale of 1 to 9; 1 = longer vine, low stature plant, pods lower to ground; 9 = very upright plant stature, pods held well off ground.
[3]Direct Harvest: A relative score to estimate the percent of beans that would be successfully harvested in a direct/straight harvest system.
[4]Three-year average is for 2012, 2013, and 2015 as no data is available for 2014.

2015 Dry Bean Variety Trial – Irrigated - Carrington – Authors, M. Ostlie, B. Schatz, G. Endres.

Variety	Market Class	Maturity (DAP)[1]	Growth Habit[2] (1-9)	Direct Harvest[3] (%)[1]	White Mold[4] (%)	Seeds/ Pound (lb/a)	100 Seed Weight (gram)	Seed Yield 2015 (lb/a)	Seed Yield 3-yr. Avg.[5] (lb/a)
Eclipse	Black	88	8.5	91	14	2,366	19.2	1,818	2,812
Loreto	Black	90	4.5	91	5	2,140	21.2	2,095	2,693
Zorro	Black	89	7.0	95	8	2,294	19.8	2,039	2,822
Montcalm	Dark Red Kidney	94	4.3	76	4	847	53.7	2,062	--
Talon	Dark Red Kidney	93	3.8	73	6	913	49.8	2,069	--
Pink Panther	Light Red Kidney	83	4.5	74	10	756	60.4	2,151	--
Rosie	Light Red Kidney	98	4.3	83	5	864	52.6	1,716	--
Avalanche	Navy	90	5.3	88	10	2,246	20.2	2,235	2,770
Ensign	Navy	90	4.0	83	9	2,075	21.9	2,246	3,112
HMS Medalist	Navy	91	6.3	88	9	2,415	18.8	1,792	3,238
T9905	Navy	92	5.0	89	6	2,139	21.2	2,072	3,305
Vista	Navy	93	5.5	85	8	2,437	18.6	2,064	2,853
La Paz	Pinto	89	4.0	81	15	1,252	36.3	2,775	3,471
Lariat	Pinto	90	2.8	73	8	1,209	37.7	2,990	3,659
Maverick	Pinto	84	1.0	53	19	1,117	40.7	3,101	3,091
ND-307	Pinto	89	2.8	78	45	1,053	43.2	2,801	2,926
Stampede	Pinto	84	2.5	74	14	1,187	38.4	2,813	3,408
Windbreaker	Pinto	84	3.0	80	13	1,109	41.0	3,135	3,615
Merlot	Small Red	89	2.0	73	30	1,144	39.7	2,421	2,661
Rio Rojo	Small Red	86	4.3	91	8	1,588	28.6	2,530	--
Mean		89	4.3	81	12.1	1,557	34.2	2,346	3,096
CV %		1.1	14.8	5.3	68.3	3.6	4.7	8.8	--
LSD 0.10		1	0.8	6	12	75	2.3	299	--
LSD 0.05		1	0.7	5	10	63	2.0	250	--

PLANTED: June 1. HARVESTED: Sept. 9. Previous crop: spring wheat.
[1]Days after planting.
[2]Growth Habit: Scored on scale of 1 to 9; 1 = longer vine, low stature plant, pods lower to ground; 9 = very upright plant stature, pods held well off ground.
[3]Direct Harvest: A relative score to estimate the percent of beans that would be successfully harvested in a direct/straight harvest system.
[4]White Mold: An assessment of the incidence of plants that expressed some level of white mold (sclerotinia).
[5]Three-year average is for 2012, 2013, and 2015 as no data is available for 2014.

2015 Black Bean Variety Trial - Prosper, Hatton and Forest River, N.D. (NDSU) - Authors, J. Osorno, J. VanderWal and M. Kloberdanz.

Variety	Days to Flowering (DAP)[1]	Plant Height (inch)	Days to Maturity (DAP)[1]	100 Seed Weight (gram)	Seed Yield (lb/a)
Prosper (Cass County)					
Black Cat	48	23	95	15.4	1,550
Eclipse	48	18	93	16.6	1,640
GTS-1103	50	20	101	17.6	2,070
Loreto	47	19	102	17.5	2,050
SV6894GB	47	20	92	18.5	1,390
T-39	48	18	94	16.8	1,450
Zorro	48	21	95	17.3	1,410
Mean	48	20	96	17.1	1,651
CV %	2.0	8.0	3.0	5.0	16.8
LSD 0.05	1	2.4	4	1.2	420
LSD 0.10	1	2.0	3	1.0	350
Hatton (Traill County)					
Black Cat	53	24	99	17.1	1,900
Eclipse	53	20	96	17.2	1,720
GTS-1103	54	20	104	17.7	2,220
Jet	53	22	103	18.9	2,160
Loreto	52	20	101	18.6	2,280
Super Jet	49	19	101	19.6	2,180
SV6894GB	52	21	99	20.0	1,740
T-39	53	18	103	17.9	2,040
Zenith	51	21	100	18.3	1,880
Zorro	51	20	100	17.6	1,470
Mean	52.1	20	101	18.3	1,959
CV %	2.0	12.0	3.0	6.1	21.7
LSD 0.05	2	3.5	4	1.5	NS
LSD 0.10	2	3.0	3	1.3	NS
Forest River (Walsh County)					
Black Cat		25	91	15.9	1,820
Eclipse		22	89	17.3	1,690
GTS-1103		20	101	17.9	1,690
Jet		21	92	16.9	1,370
Loreto		19	99	17.7	1,850
Super Jet		20	90	16.8	1,660
T-39		18	93	16.9	1,370
Zorro		19	88	16.6	1,270
Mean		20	93	17.0	1,590
CV %		14.0	3.0	3.4	22.8
LSD 0.05		NS	4	0.8	NS
LSD 0.10		NS	3	0.7	NS

PROSPER - Planted: June 1. Previous crop: small grain.
HATTON - Planted: May 26. Previous crop: sugarbeet.
FOREST RIVER - Planted: May 31. Previous crop: small grain.
[1]Days after planting.

2015 Dry Bean Variety Trial - Prosper, Hatton and Forest River, N.D. (NDSU) - Authors, J. Osorno, J. VanderWal and M. Kloberdanz.

Variety	Market Class	Days to Flower (DAP)[1]	Plant Height (inch)	Days to Maturity (DAP)[1]	100 Seed Weight (gram)	Seed Yield (lb/a)
Prosper (Cass County)						
Montcalm	Dark Red Kidney	47	19	109	43.8	1,660
Talon	Dark Red Kidney	47	19	99	39.3	1,380
Matterhorn	Great Northern	47	19	92	26.9	1,620
Powderhorn	Great Northern	47	21	91	27.0	1,120
Pink Panther	Light Red Kidney	37	17	90	43.1	820
Rosie	Light Red Kidney	47	22	109	42.2	1,970
Floyd	Pink	43	13	91	27.9	1,340
Ruby	Small Red	49	20	101	27.7	2,260
Mean		46	19	98	34.7	1,521
CV %		3.0	8.0	3.0	4.9	15.6
LSD 0.05		2	2.0	4	2.2	390
LSD 0.10		2	1.6	3	1.8	330
Hatton (Traill County)						
Montcalm	Dark Red Kidney	49	19	103	46.0	1,780
Talon	Dark Red Kidney	50	18	100	37.9	1,430
Desert Song	Flor de Mayo	49	15	88	28.6	2,200
Gypsy Rose	Flor de Mayo	56	21	104	23.2	2,500
Aries	Great Northern	49	20	95	33.4	2,010
Draco	Great Northern	50	19	99	31.0	2,390
Matterhorn	Great Northern	48	22	90	28.8	1,860
Orion	Great Northern	49	15	93	30.6	2,210
Powderhorn	Great Northern	47	21	85	31.6	2,010
Taurus	Great Northern	50	19	97	32.4	2,350
Pink Panther	Light Red Kidney	46	17	91	49.7	1,610
Rosie	Light Red Kidney	48	20	108	38.5	1,640
Floyd	Pink	47	16	90	31.5	1,930
Ruby	Small Red	54	20	101	25.5	2,400
Mean		49	19	96	33.5	2,023
CV %		3.0	13	3.0	5.0	14.6
LSD 0.05		2	4	4	2.3	430
LSD 0.10		2	3	3	1.9	360
Forest River (Walsh County)						
Montcalm	Dark Red Kidney		20	101	38.6	1,430
Talon	Dark Red Kidney		19	93	34.2	1,470
Matterhorn	Great Northern		20	90	29.7	2,110
Powderhorn	Great Northern		21	87	29.2	1,890
Pink Panther	Light Red Kidney		20	90	44.6	1,540
Rosie	Light Red Kidney		20	102	35.6	1,700
Floyd	Pink		15	86	28.4	1,530
Ruby	Small Red		21	99	25.4	2,060
Mean			19	94	33.2	1,716
CV %			13.0	3.0	5.9	17.3
LSD 0.05			3.5	3	2.6	460
LSD 0.10			3.0	3	2.2	385

PROSPER - Planted: June 1. Previous crop: small grain. **HATTON** - Planted: May 26. Previous crop: sugarbeet.
FOREST RIVER - Planted: May 31. Previous crop: small grain. [1]Days after planting.

2015 Dry Bean Variety Trial - Irrigated - Oakes (Carrington REC) - Authors, L. Besemann and H. Eslinger.

Variety	Market Class	Maturity (DAP)[1]	Seeds/ Pound (seeds)	100 Seed Weight (gram)	Test Weight (lb/bu)	Seed Yield (lb/ac) 2015	Seed Yield (lb/ac) 3-yr. Avg.
La Paz	Pinto	83	1,227	37.1	61.8	3,198	3,251
Lariat	Pinto	89	1,068	42.6	59.1	3,982	3,617
Maverick	Pinto	85	1,094	41.6	59.0	3,104	3,088
ND-307	Pinto	86	995	45.7	56.7	4,147	--
Stampede	Pinto	79	1,081	42.0	58.5	3,582	3,216
Windbreaker	Pinto	81	1,020	44.5	58.4	3,666	3,488
Mean		84	1,081	42.2	58.9	3,613	3,332
CV %		1.5	4.1	4.2	1.4	9.4	--
LSD 0.05		2	63	2.6	1.2	501	--
LSD 0.10		2	52	2.2	1.0	415	--
HMS Medalist	Navy	89	2,251	20.2	63.2	3615	3,270
Avalanche	Navy	87	2,012	22.6	64.3	3,346	2,774
Ensign	Navy	82	2,002	22.7	64.4	3,345	3,139
Vista	Navy	87	2,270	20.0	64.6	3,365	3,159
T9905	Navy	87	2,095	21.8	64.1	3,446	3,550
Mean		86	2,126	21.5	64.1	3,423	3,178
CV %		1.2	3.1	3.0	0.8	5.4	--
LSD 0.05		2	102	1.0	0.8	287	--
LSD 0.10		1	83	0.8	0.7	235	--
Eclipse	Black	83	2,113	21.5	62.4	3529	3,113
Loreto	Black	89	2,156	21.1	61.8	3,844	3,100
Zorro	Black	85	2,037	22.3	63.3	3,834	--
Montcalm	Dark Red Kidney	94	802	56.6	57.6	3,393	--
Talon	Dark Red Kidney	86	870	52.2	58.2	3,355	--
Pink Panther	Light Red Kidney	84	714	63.5	55.1	3,903	--
Rosie	Light Red Kidney	98	887	51.2	57.2	3,005	--
Merlot	Small Red	94	1,113	40.8	59.9	3,687	3,042
Rio Rojo	Small Red	86	1,288	35.2	63.5	3,897	3,456
Mean		89	1,331	40.5	59.9	3,605	3,178
CV %		1.45	3.13	2.3	1.0	8.0	--
LSD 0.05		2	61	1.4	0.9	423	--
LSD 0.10		2	50	1.1	0.7	351	--

Planted: May 27. Harvested: Sept. 2-8. Previous crop: sugarbeet or spring wheat.
[1]Days after planting.

2015 Dry Bean Variety Trial - Langdon - Authors, B. Hanson, T. Hakanson and L. Henry.

Variety	Market Class	Maturity (DAP)[1]	100 Seed Weight (gram)	Seed Yield 2013	2014	2015 (lb/a)	2-yr. Avg.	3-yr. Avg.
Eclipse	Black	94	17.4	2,568	2,415	1,932	2,173	2,305
Loreto	Black	97	15.7	2,332	1,944	1,607	1,776	1,961
Zorro	Black	96	18.7	2,580	2,275	1,933	2,104	2,263
Dynasty	Dark Red Kidney	99	50.1	--	--	1,670	--	--
Montcalm	Dark Red Kidney	100	44.2	--	1,672	1,529	1,601	--
Talon	Dark Red Kidney	96	42.3	--	1,754	1,681	1,717	--
Inferno	Light Red Kidney	102	47.3	--	--	1,927	--	--
Pink Panther[2]	Light Red Kidney	98	50.5	--	1,849	1,532	1,690	--
Rosie	Light Red Kidney	100	41.6	--	1,607	1,823	1,715	--
Avalanche	Navy	96	20.0	1,952	2,101	1,923	2,012	1,992
Bolt	Navy	95	21.3	2,008	--	1,857	--	--
Ensign	Navy	96	20.4	2,852	2,703	2,087	2,395	2,547
Fathom	Navy	98	20.9	--	--	1,851	--	--
HMS Medalist	Navy	96	16.1	2,292	2,286	1,724	2,005	2,101
Mist	Navy	99	18.3	2,192	--	1,606	--	--
Nautica	Navy	96	14.5	2,372	1,944	1,660	1,802	1,992
Rexeter	Navy	98	16.2	2,424	1,995	1,904	1,950	2,108
T9905	Navy	99	21.0	2,616	2,571	2,168	2,369	2,452
Vista	Navy	94	16.3	2,584	2,513	2,129	2,321	2,409
23ST27	Pinto	97	37.2	--	2,524	2,376	2,450	--
La Paz	Pinto	94	29.4	3,324	2,900	2,151	2,525	2,792
Lariat	Pinto	92	31.2	2,832	2,445	2,133	2,289	2,470
Maverick	Pinto	91	36.9	2,860	2,848	2,090	2,469	2,599
ND-307	Pinto	95	35.6	2,792	3,113	2,029	2,571	2,645
SF103-8	Pinto	97	35.6	--	2,297	2,188	2,242	--
Stampede	Pinto	94	27.1	2,720	3,020	1,877	2,449	2,539
Windbreaker	Pinto	94	33.0	2,328	2,822	1,930	2,376	2,360
Merlot	Small Red	97	34.0	2,224	2,180	1,544	1,862	1,983
Rio Rojo	Small Red	96	26.0	2,252	2,656	1,406	2,031	2,105
Mean		96	28.9	2,505	2,351	1,874	2,121	2,312
C.V. %		2.6	--	11.9	9.3	10.4	--	--
LSD 0.05		4.2	--	398	388	320	--	--
LSD 0.10		3.5	--	477	470	266	--	--

Planted: May 22. Harvested: Sept. 16.
[1]Days after planting.
[2]Pink Pather had some preharvest shatter in 2015.

2015 Dry Bean Variety Trial - Cavalier - (Langdon REC) - Authors, B. Hanson, T. Hakanson and L. Henry.

Variety	Market Class	100 Seed Weight (gram)	Seed Yield 2013	2014	2015 (lb/a)	2-yr. Avg.	3-yr. Avg.
Eclipse	Black	17.0	3,436	1,655	2,077	1,866	2,389
Loreto	Black	17.8	3,392	1,472	1,841	1,657	2,235
Zorro	Black	19.3	3,576	1,131	1,876	1,504	2,194
Dynasty	Dark Red Kidney	49.1	--	--	1,994	--	--
Montcalm	Dark Red Kidney	43.7	--	795	1,732	1,263	--
Talon	Dark Red Kidney	39.4	--	726	1,470	1,098	--
Inferno	Light Red Kidney	47.8	--	--	2,101	--	--
Pink Panther[1]	Light Red Kidney	44.9	--	646	1,655	1,151	--
Rosie	Light Red Kidney	42.9	--	976	2,018	1,497	--
Avalanche	Navy	17.6	3,440	1,493	2,345	1,919	2,426
Bolt	Navy	21.6	3,208	--	2,185	--	--
Ensign	Navy	20.5	3,728	1,426	1,964	1,695	2,373
Fathom	Navy	16.9	--	--	1,945	--	--
HMS Medalist	Navy	16.7	3,420	1,793	1,452	1,622	2,222
Mist	Navy	19.2	3,492	--	1,963	--	--
Nautica	Navy	15.5	3,204	1,419	2,038	1,729	2,220
Rexeter	Navy	17.8	3,516	1,655	2,118	1,887	2,430
T9905	Navy	19.8	3,484	1,697	2,001	1,849	2,394
Vista	Navy	20.2	3,432	1,773	1,950	1,861	2,385
23ST27	Pinto	36.1	--	1,442	2,740	2,091	--
La Paz	Pinto	32.8	3,820	2,039	2,961	2,500	2,940
Lariat	Pinto	35.9	3,460	1,790	2,725	2,257	2,658
Maverick	Pinto	37.6	3,456	1,783	2,185	1,984	2,475
ND-307	Pinto	38.1	3,540	1,947	2,833	2,390	2,773
SF103-8	Pinto	35.2	--	1,415	2,555	1,985	--
Stampede	Pinto	34.5	3,348	1,579	2,519	2,049	2,482
Windbreaker	Pinto	42.2	3,392	1,812	3,130	2,471	2,778
Merlot	Small Red	36.0	2,968	1,558	2,106	1,832	2,211
Rio Rojo	Small Red	27.8	2,972	1,890	1,771	1,830	2,211
Mean			3,395	1,528	2,151	1,833	2,433
CV %			6.9	12.3	14	--	--
CV %			319	262	496	--	--
LSD 0.10			382	315	413	--	--

Planted: May 28. Harvested: Sept. 22. [1]Pink Pather had some preharvest shatter in 2015.

2015 Dry Bean Variety Trial - Hettinger - Authors, J. Rickertsen and R. Olson.

Variety	Type	Plant Height (inch)	Plant Lodge (0-9)[2]	Test Weight (lb/bu)	Yield	
					2015 (lb/a)	3-yr. Avg. (lb/a)
Eclipse	Black	24	0	60.0	1,791	2,045
Loreto	Black	23	0	57.5	1,618	1,888
Zorro	Black	22	0	59.9	1,986	--
Montcalm	Dark Red Kidney	21	3	51.4	1,404	--
Talon	Dark Red Kidney	23	3	51.1	1,505	--
Pink Panther	Light Red Kidney	23	1	51.2	1,705	--
Rosie	Light Red Kidney	22	2	52.8	1,586	--
Avalanche	Navy	24	0	56.3	1,614	1,923
Ensign	Navy	24	3	56.9	1,710	2,057
HMS Medalist	Navy	23	0	57.3	1,597	1,939
T9905	Navy	22	1	55.9	1,744	2,246
Vista	Navy	23	0	57.0	1,619	1,807
23ST27	Pinto	24	5	56.7	1,923	--
La Paz	Pinto	22	0	57.2	2,024	2,314
Lariat	Pinto	21	3	54.9	2,021	2,224
Maverick	Pinto	27	5	54.8	1,714	1,897
ND-307	Pinto	24	2	52.9	1,735	2,147
SF103-8	Pinto	25	2	53.9	1,809	--
Stampede	Pinto	24	2	54.3	2,028	2,167
Windbreaker	Pinto	26	3	53.1	1,699	1,916
Merlot	Small Red	25	2	56.9	1,802	1,838
Rio Rojo	Small Red	26	1	59.3	1,823	2,149
Mean		23	2	55.4	1,746	2,037
C.V. %		9	48	1.7	7	--
LSD 0.05		3	1	1.3	181	--
LSD 0.10		3	1	1.1	151	--

Planted: May 19. Harvested: Aug. 31. Previous crop: oat. [1]Days after planting. 0 = no lodging, 9 = lying flat on ground.

2015 Pinto Bean Variety Trial - Minot - Authors, E. Eriksmoen, J. Tarasenko and J. Effertz.

Variety	Plant Height (inch)	Lodging[1] (0-9)	100 Seed Weight (gram)	Yield 2012 (lb/a)	2014 (lb/a)	2015 (lb/a)	3-yr. Avg. (lb/a)
LaPaz	17.1	5.3	36.5	3,008	1,574	2,940	2,507
Lariat	16.5	6.0	38.3	2,827	1,440	3,293	2,520
Maverick	16.1	6.8	38.2	2,486	1,085	2,474	2,015
Stampede	17.3	6.3	38.0	2,632	1,416	2,222	2,090
Windbreaker	15.8	5.8	42.2	2,574	1,437	3,002	2,338
Mean	16.6	6.0	38.6	2,705	1,390	2,786	2,294
C.V. %	11.2	15.3	5.1	5.1	10.1	7.4	--
LSD 0.05	NS	1	2.9	200	203	287	--
LSD 0.10	NS	1	2.4	161	166	238	--

Planted May 26. Harvested Sept 30. Previous crop was spring wheat.
[1]Lodging: 0 = none, 9 = lying flat on the ground
NS = no statistical difference between varieties

2015 Dry Bean Variety Trial - Minot - Authors, E. Eriksmoen, J. Tarasenko and J. Effertz.

Variety	Plant Height (inches)	Lodging[1] (0-9)	100 Seed Weight (gram)	Yield 2015 (lb/a)	2-yr. Avg. (lb/a)
Black					
Eclipse	18.2	2.0	20.4	2,430	2,460
Loreto	18.0	3.3	19.0	2,239	2,622
Zoro	17.3	2.0	21.1	2,443	2,553
Small Red					
Merlot	16.9	6.3	38.5	2,109	2,243
Rio Rojo	17.4	4.8	30.8	1,950	--
Light Red Kidney					
Pink Panther	13.7	3.5	54.4	1,442	--
Rosie	15.0	5.8	47.3	2,057	--
Dark Red Kidney					
Montcalm	12.2	4.0	52.1	1,302	--
Talon	16.2	6.0	46.1	1,940	--
Mean	16.0	4.0	36.6	1,990	2,470
C.V. %	6.5	29.0	2.9	8.1	--
LSD 0.05	2	2	1.5	234	--
LSD 0.10	1	1	1.3	194	--

Planted May 26. Harvested Sept 30. Previous crop was spring wheat.
[1]Lodging: 0 = none, 9 = lying flat on the ground

2015 Pinto Bean Variety Trial - Irrigated - Williston - Authors, J. Jacobs and T. Tjelde.

Variety	Maturity (DAP)[1]	Canopy Height (inch)	Test Weight (lb/bu)	100 Kwt (gram)	Seeds/Pound (seeds)	Seed Yield (lb/a)
La Paz	95	18.2	62.9	31.4	1,447	3,457
Lariat	97	12.1	60.7	36.8	1,233	3,903
Maverick	93	13.5	60.5	37.1	1,223	3,381
ND-307	93	18.2	57.4	38.1	1,194	2,549
Stampede	91	17.3	60.0	34.9	1,301	3,421
Windbreaker	88	11.2	58.3	35.1	1,294	2,664
Mean	93	15.1	60.0	36.6	1,282	3,229
C.V. %	3.9	16.7	1.1	3.7	3.7	17.8
LSD 0.05	6	3.6	0.9	1.9	69.2	835
LSD 0.10	5	3.0	0.8	1.6	57.4	692

2015 Navy Bean Variety Trial - Irrigated - Williston - Authors, J. Jacobs and T. Tjelde.

Variety	Maturity (DAP)[1]	Canopy Height (inch)	Test Weight (lb/bu)	100 Kwt (gram)	Seeds/Pound (seeds)	Seed Yield (lb/a)
Avalanche	95	16.1	65.1	18.2	2,490	2,821
Ensign	102	12.8	64.8	20.3	2,235	2,744
HMS Medalist	102	15.8	64.7	19.4	2,340	2,851
T9905	99	14.2	65.6	20.7	2,191	3,302
Vista	100	16.4	64.9	18.6	2,445	2,783
Mean	99	15.1	65.0	19.5	2,340	2,900
C.V. %	3.0	12.6	0.8	2.6	2.7	20.4
LSD 0.05	1	0.9	0.2	0.2	28.6	267
LSD 0.10	2	1.1	0.3	0.3	35.0	327

2015 Dry Bean Variety Trial - Irrigated - Williston - Authors, J. Jacobs and T. Tjelde.

Variety	Market Class	Maturity (DAP)[1]	Canopy Height (inch)	Test Weight (lb/bu)	100 Kwt (gram)	Seeds/Pound (seeds)	Seed Yield (lb/a)
Eclipse	Black	93	19.5	63.6	17.9	2,533	2,803
Loreto	Black	97	17.3	65.0	19.3	2,348	3,172
Zorro	Black	95	21.4	65.0	19.2	2,368	2,781
Montcalm	Kidney Bean	104	15.9	59.2	50.6	897	2,342
Pink Panther	Kidney Bean	97	15.3	58.0	56.2	808	2,312
Rosie	Kidney Bean	104	16.7	61.8	44.6	1,016	3,364
Talon	Kidney Bean	103	13.8	59.8	48.0	945	2,309
Merlot	Small Red	96	20.4	62.0	34.0	1,337	3,051
Rio Rojo	Small Red	92	18.9	63.6	26.9	1,691	3,323
Mean		98	17.7	62.0	35.2	1,549	2,829
C.V. %		2.2	10.3	0.6	2.8	3.5	18.4
LSD 0.05		3	2.7	0.6	1.5	78.4	652
LSD 0.10		3	2.2	0.5	1.2	65.0	541

Planted: June 8. Harvested: Oct. 16. Previous crop: barley.
[1]Days after planting.

Northarvest Bean Growers Association
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