

2011 Dry Bean Research Report

Assessment of Narrow Row Technology



**Michigan Dry Edible Bean Production
Research Advisory Board**

The Michigan Bean Commission was awarded a grant from the MDA Speciality Crop Block Grant Program-Farm Bill

The title of this project is "Assessment of Narrow Row Technology for the Michigan Dry Bean Industry".

Expected outcomes from this project are:

1. Identification of adaptable dry bean cultivars.
2. Identification of two new fungicides for control of white mold disease.
3. Identification of approved herbicides and plant desiccants with no adverse food safety implications.
4. Knowledge of row spacing and plant density impact to enable sound recommendations to growers.
5. Understanding and quantification of the economic benefits and improved management strategies associated with narrow row technology.

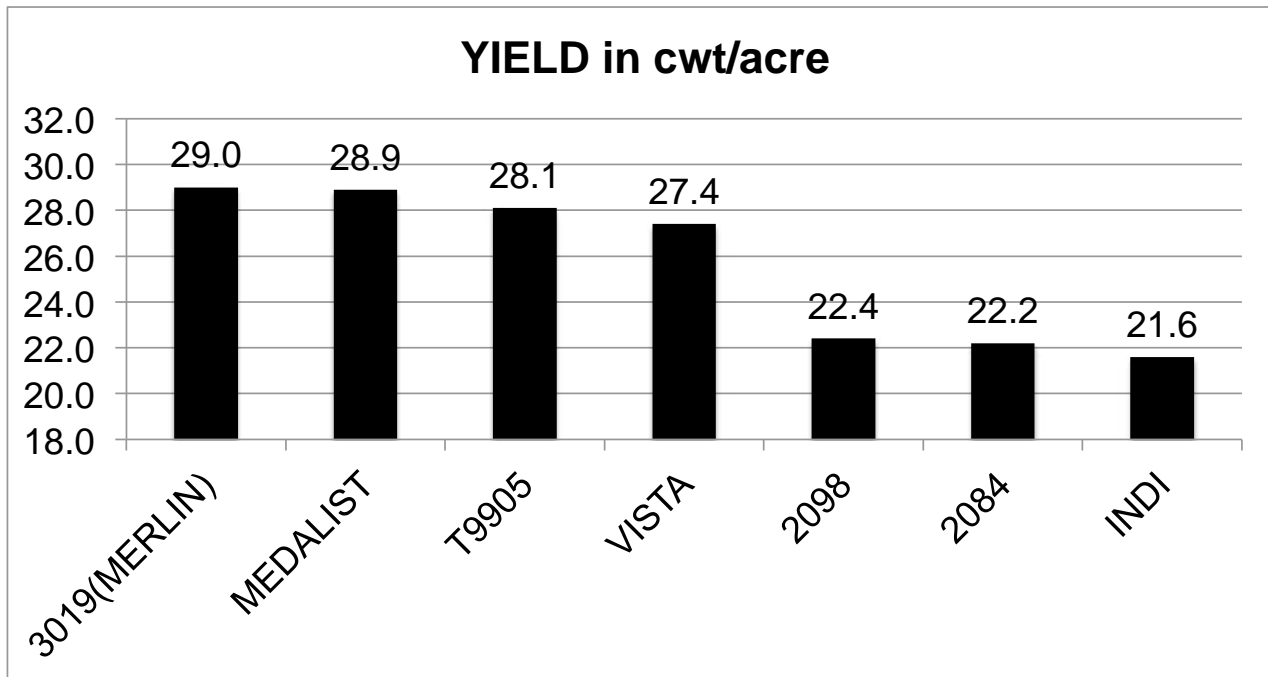
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**NAVY BEAN VARIETY STRIP TRIAL-15 INCH ROWS
GREENFIELD FARMS INC. PIGEON, MICHIGAN**

VARIETY	YIELD	LODGE	PICK%	MOISTURE	HEIGHT	POPULATION	Seeds/lb
3019(MERLIN)	29.0	2.5	2.4	17.6	17.3	124,291	2172
MEDALIST	28.9	2	1.8	16.6	17.5	127,776	2347
T9905	28.1	2.5	1.8	17.4	17.1	116,160	1837
VISTA	27.4	2.5	2.1	17.2	17.5	135,907	2118
2098	22.4	2.5	3.5	17.5	17.7	137,069	2279
2084	22.2	2	2.3	17.4	17.9	127,776	2099
INDI	21.6	1	3.6	17.2	18.1	123,123	2328

Planted: June 6
 Harvested: October 10 126 days after planting
 Lodge rating is 1=erect, 5=flat
 Pick %=FM+Pick
 Planting Population= 128,000
 Fertilization=18 gallons of 28%+2 gallons thiosol (AMS)
 Herbicides=PPI 1 pt Treflan+1pt Dual+1 qt. Eptam
 Post= 8 oz Basagran+3 oz Raptor+4 oz Reflex
 Fungicides=8 oz Omega
 Insecticide=applied with herbicide and fungicide
 Harvest Aid=1 quart of Roundup



NAVY BEAN VARIETY STRIP TRIAL-22 INCH ROWS

SCHINDLER FARMS

KAWKAWLIN, MICHIGAN

VARIETY	YIELD	PICK	MOISTURE	LODGE	HEIGHT	POPULATION	Seeds/lb
MEDALIST	30.0	1.9	17.7	2.5	19.4	111,632	2252
3019(Merlin)	29.4	2.2	17.9	2.5	21	114,840	2147
VISTA	26.9	2.4	18	2.5	19.2	119,196	2237
T9905	26.7	1.7	17.7	2	20.3	115,236	1935
2098	25.5	1.9	18.3	3	20.2	116,424	2387
2084	25.4	2.1	17.5	3	19.5	121,572	2135
INDI	25.0	2.1	17.1	1.5	20.5	113,652	2274

Planted: June 18

Harvested: October 5 109 days after planting

Lodge rating is 1=erect, 5=flat

Pick %=FM+Pick

Planting Population= 120,000

Fertilization=20 gallons of 28%

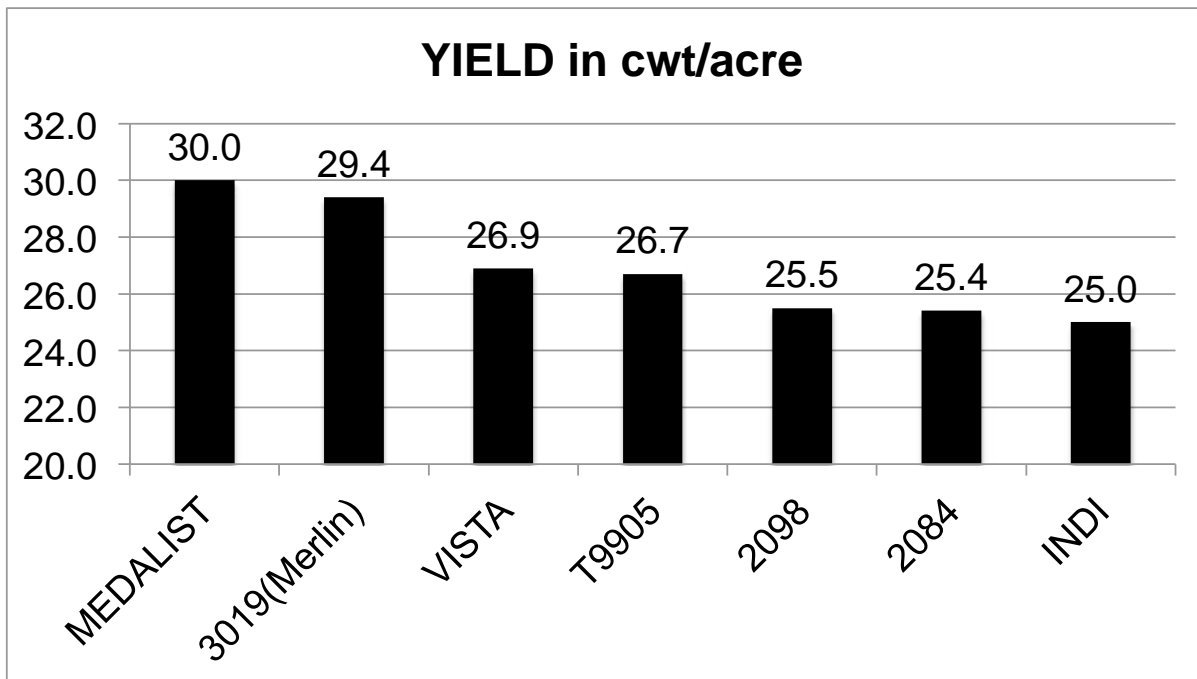
Herbicides=PPI 1 pt Treflan+1pt Dual

Post= 8 oz Basagran+3 oz Raptor+4 oz Reflex

Fungicides=None

Insecticide=applied with herbicide and fungicide

Harvest Aid=1.5 pints Gramoxone + 1 oz AIM + Dynamic 1/4%



**BLACK BEAN VARIETY STRIP TRIAL-20 INCH ROWS
LAKKE EWALD FARMS, INC.**

VARIETY	YIELD	LODGE	HEIGHT	POPULATION
Zorro	27.7	2	22.8	117,612
Shania	27.7	2	23.5	116,741
Black Velvet	27.3	2	24.6	112,385
Loreto	26.7	3	19.9	114,127
COOP 06252	25.9	2	21.6	128,066

Planted: June 7

Harvested: October 6

Lodge rating is 1=erect, 5=flat

Planting Population= 120,000

Fertilization=48 pounds Nitrogen, 2% Mn, 2% Zn

Herbicides=PPI 39 oz Eptam + 14 oz Outlook

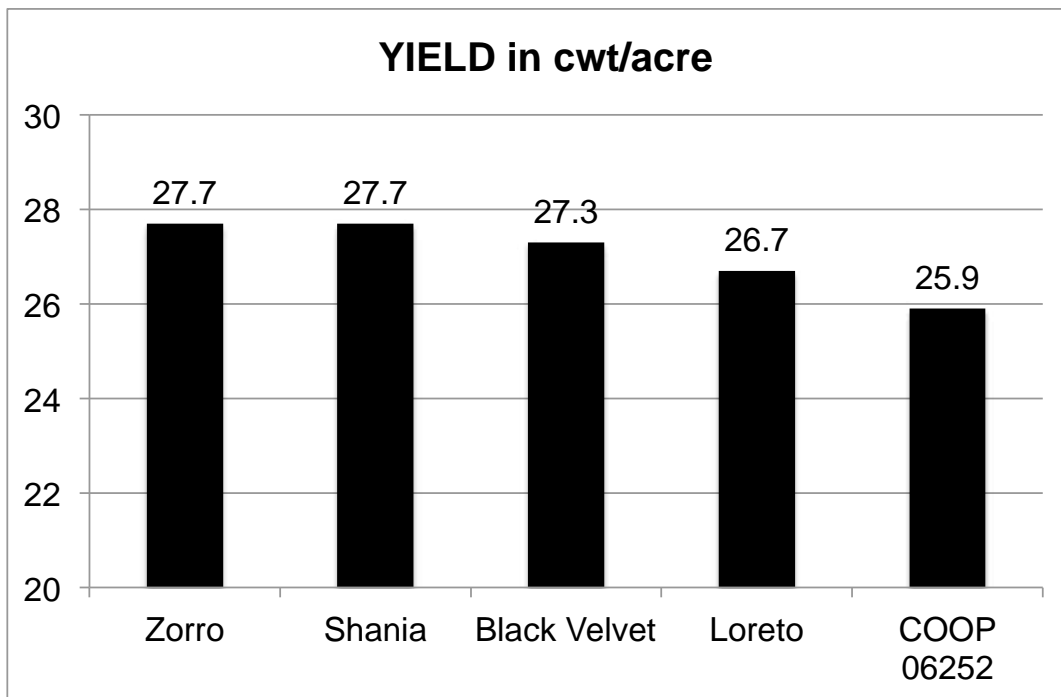
Post= 8 oz Basagran+ Raptor + Reflex

Fungicides=8 oz Endura

Insecticide=applied with herbicide and fungicide

Harvest Aid=1.5 pints Gramoxone + 1.5 oz AIM

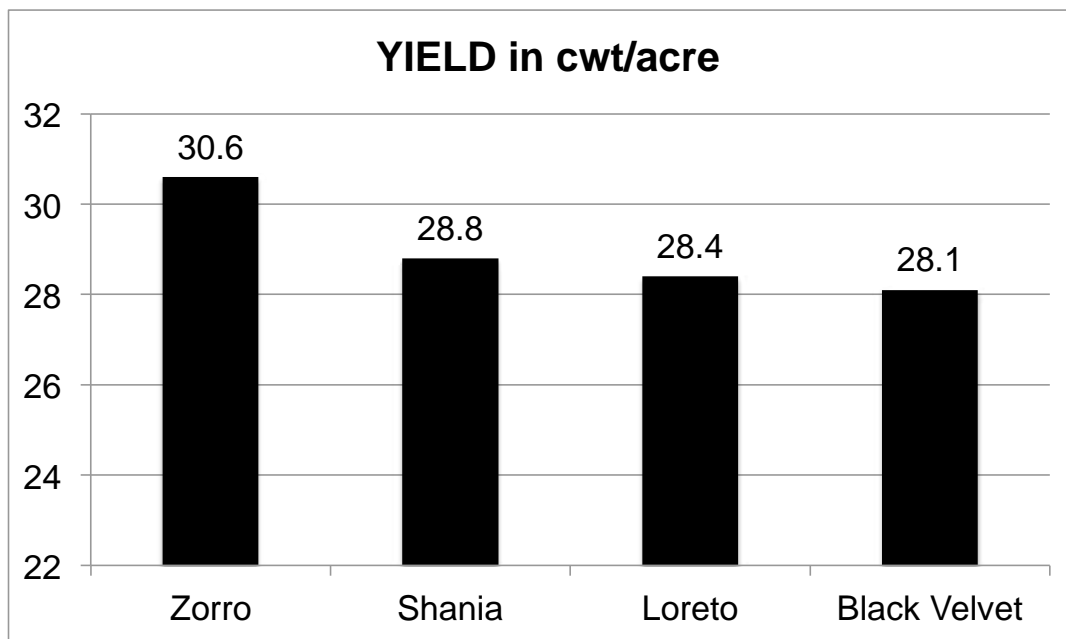
Acres per Variety = 2.75



BLACK BEAN VARIETY STRIP TRIAL-20 INCH ROWS
STOUTENBURG FARMS SANDUSKY, MICHIGAN

VARIETY	YIELD	LODGE	PICK %	MOISTURE	HEIGHT	POPULATION
Zorro	30.6	2	1.8	16.4	21.3	144,184
Shania	28.8	3	2.2	17.3	22.9	133,729
Loreto	28.4	3	2.2	16.6	20.8	141,134
Black Velvet	28.1	3	2.4	17.2	23.8	135,472

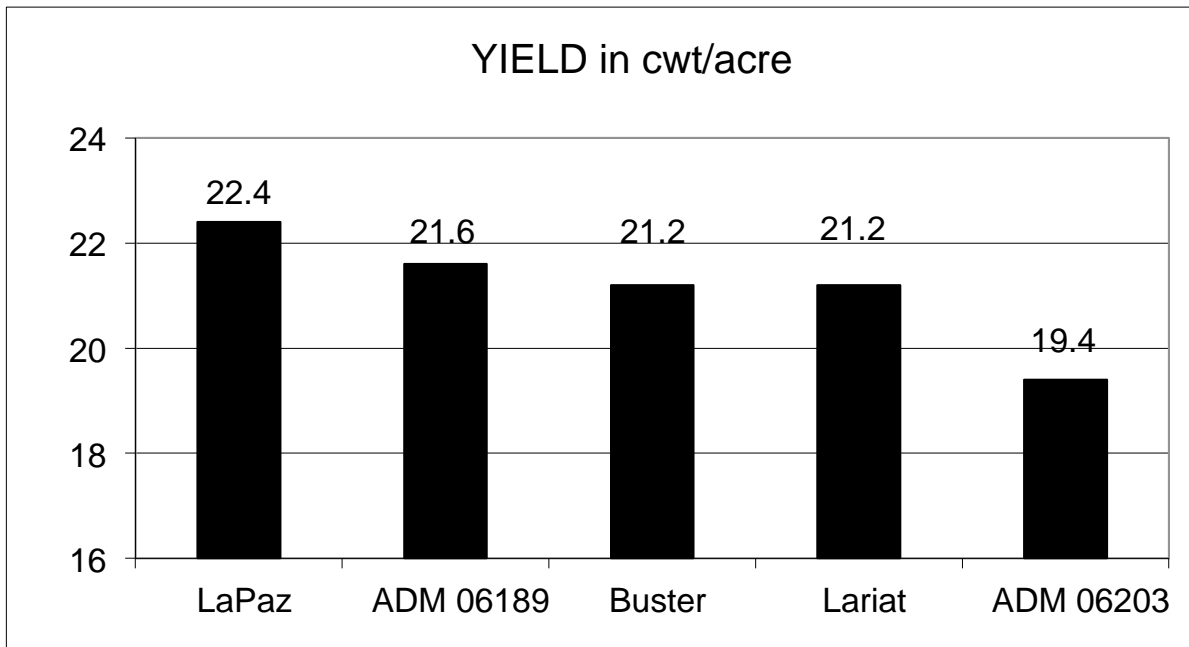
Planted: June 9
Harvested: October 9 122 days after planting
Lodge rating is 1=erect, 5=flat
Pick %=FM+Pick
Planting Population= 138,000
Fertilization=55 pounds Nitrogen, 16 gal 10-34-0
Previous crop=wheat
Harvest area=1.23 Acres
Fungicides=8 oz Endura-Two applications
Insecticide=applied with herbicide and fungicide
Harvest Aid=1.5 pints Gramoxone



**PINTO BEAN VARIETY STRIP TRIAL-22 INCH ROWS
SCHINDLER FARMS KAWKAWLIN, MICHIGAN**

VARIETY	YIELD	LODGE	PICK %	MOISTURE	HEIGHT	POPULATION
LaPaz	22.4	2	1.8	16.1	21.5	85,140
ADM 06189	21.6	2	2.4	16.1	20.4	92,664
Buster	21.2	3	4.2	16.7	17.2	90,288
Lariat	21.2	2	2.9	16.9	18.8	85,140
ADM 06203	19.4	1	2.7	15.9	21.2	85,932

Planted: June 6
 Harvested: September 17 103 days after planting
 Lodging rating is 1=erect, 5=flat
 Pick %=FM+Pick
 Planting Population= 95,000
 Fertilization=20 gallons of 28%
 Herbicides=PPI 1 pt Treflan+1pt Dual
 Post= 8 oz Basagran+3 oz Raptor+4 oz Reflex
 Fungicides=None
 Insecticide=applied with herbicide and fungicide
 Harvest Aid=1.5 pints Gramoxone + 1 oz AIM + Dynamic 1/4%



**DRY BEAN NITROGEN STRIP TRIAL-22 INCH ROWS
D&B FARMS, BRIAN KARG, HARBOR BEACH**

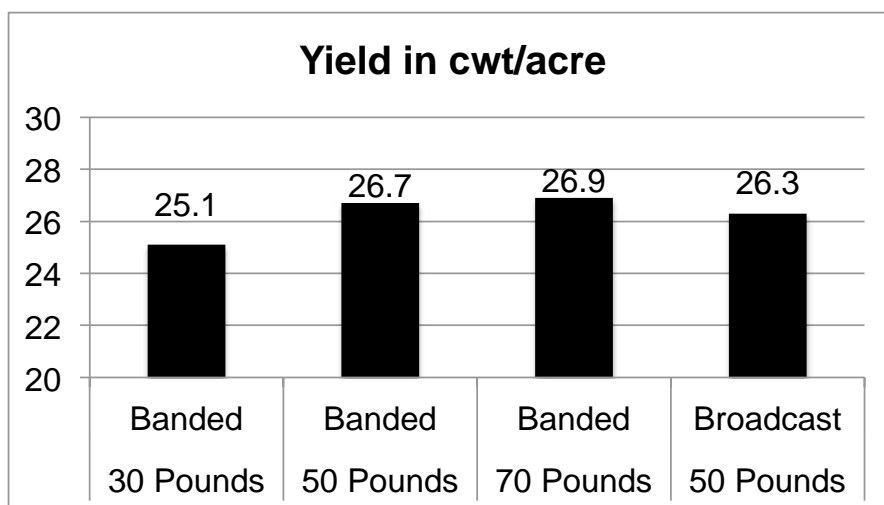
Nitrogen Amount/Acre	Fertilizer Placement	Yield in Cwt/Acre	Seeds Per Pound
30 Pounds	Banded	25.1	1935
50 Pounds	Banded	26.7	1934
70 Pounds	Banded	26.9	1973
50 Pounds	Broadcast	26.3	1976
		LSD=3.25	LSD=47
		C.V.=6 %	C.V.=1 %

Zorro Black Beans, 22 inch Rows, Direct Harvested.

Previous Crop: Sugar Beets

Planting Date: June 9

Harvest Date: October 4



Summary for Saginaw Valley Research and Extension Center and Stoutenburg Farms
These trials were grown in small plot replicated designs. Data is shown on the next 9 pages.

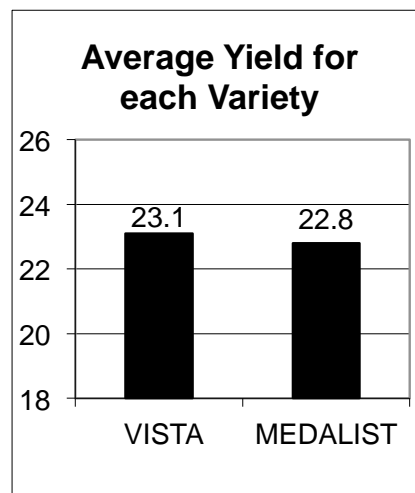
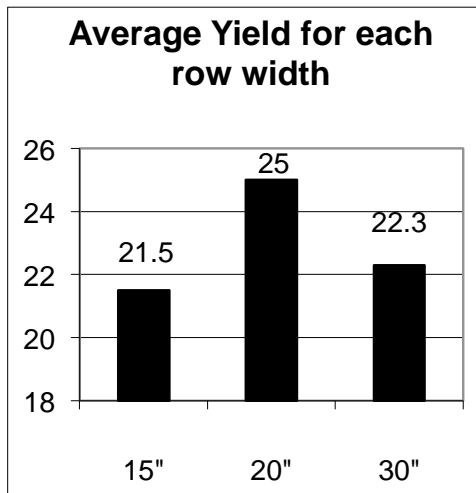
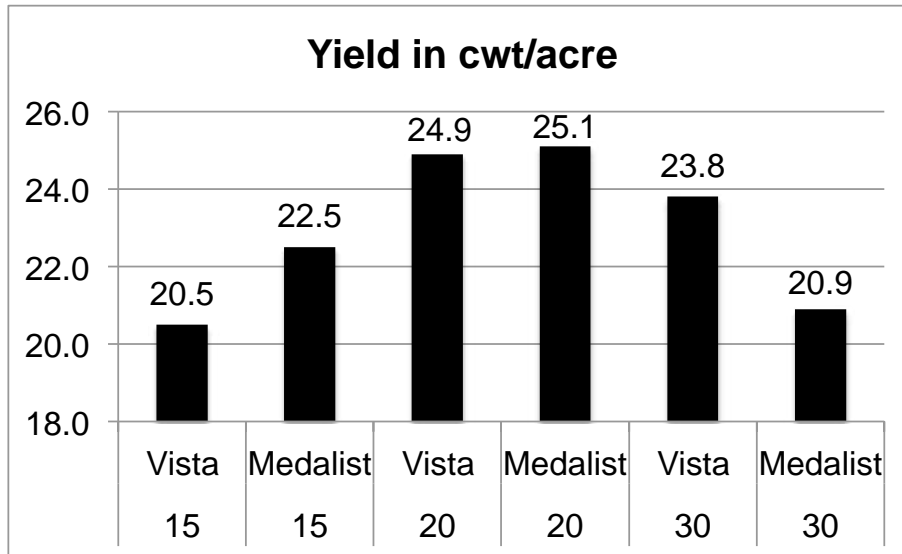
	<u>SVREC</u>	<u>Stoutenburg Farms</u>
Soil Type	Londo Loam	Parkhill loam
Previous Crop	Corn	Wheat
Planting Date	June 5	June 9
Harvest Date	September 23	October 9

**Navy Row Width
MSU Saginaw Valley Research and Extension Center
Frankenmuth, MI**

Row width	Variety	Yield	Height	Population
15	Vista	20.5	20.8	137,069
15	Medalist	22.5	21.4	126,614
20	Vista	24.9	21.2	119,354
20	Medalist	25.1	21.6	117,612
30	Vista	23.8	22.4	102,802
30	Medalist	20.9	22.6	104,544

LSD=3.87

C.V.= 11%

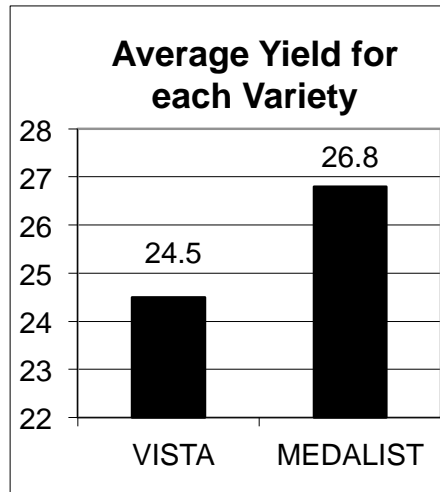
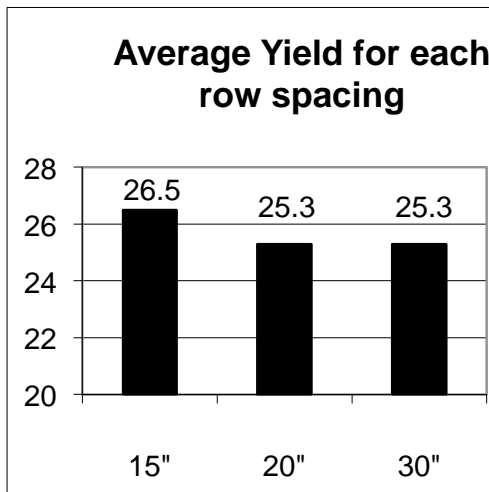
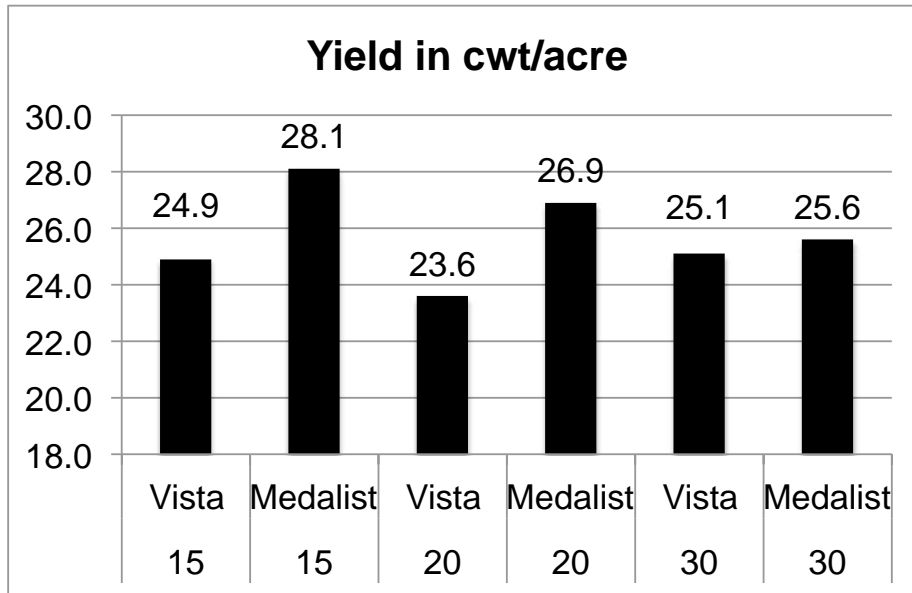


**Navy Row Width
Stoutenburg Farms
Sandusky, MI**

Row width	Variety	Yield	Height	Population
15	Vista	24.9	21.7	135,907
15	Medalist	28.1	22.2	139,392
20	Vista	23.6	22.2	122,186
20	Medalist	26.9	22.4	112,385
30	Vista	25.1	22.1	101,495
30	Medalist	25.6	21.3	97,139

LSD=1.44

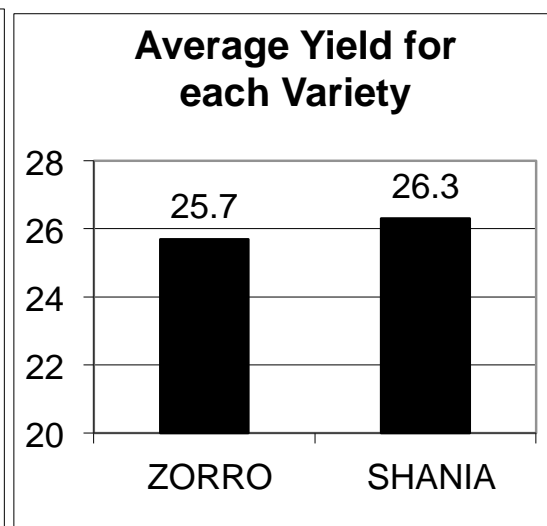
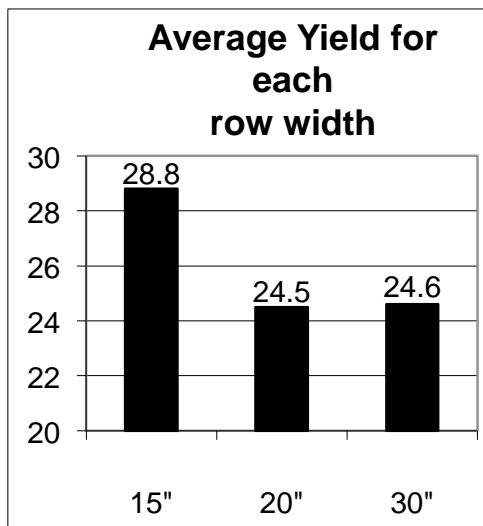
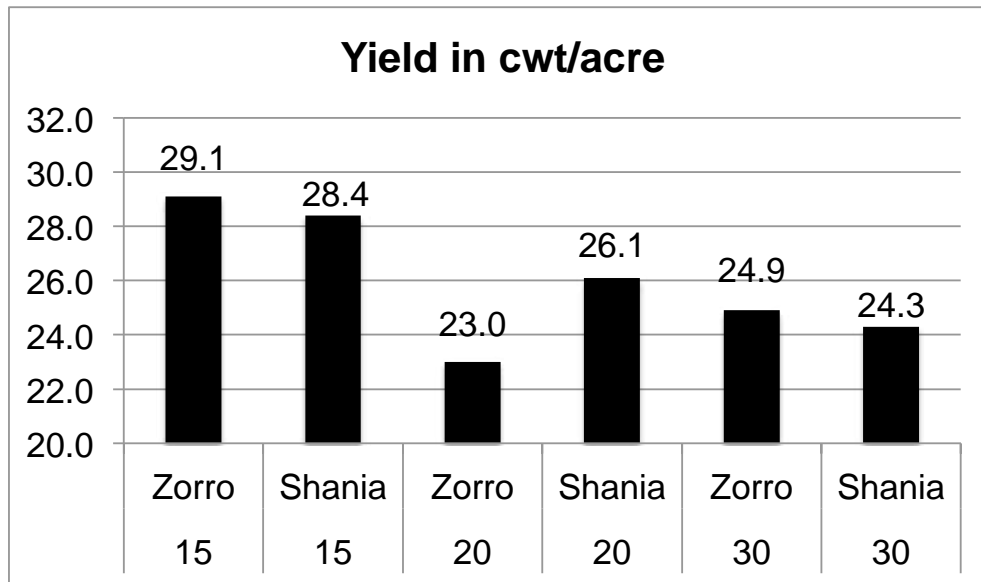
C.V.= 4%



Black Row Width
MSU Saginaw Valley Research and Extension Center
Frankenmuth, MI

Row width	Variety	Yield	Height	Population
15	Zorro	29.1	20.2	130,099
15	Shania	28.4	20.6	130,099
20	Zorro	23.0	21.0	117,612
20	Shania	26.1	21.1	114,998
30	Zorro	24.9	21.8	102,802
30	Shania	24.3	22.1	97,574

LSD=2.50
C.V.=6%

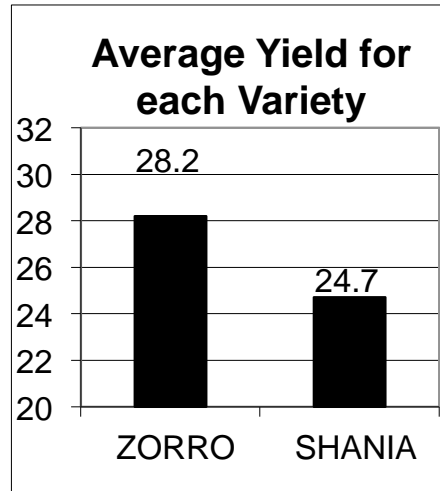
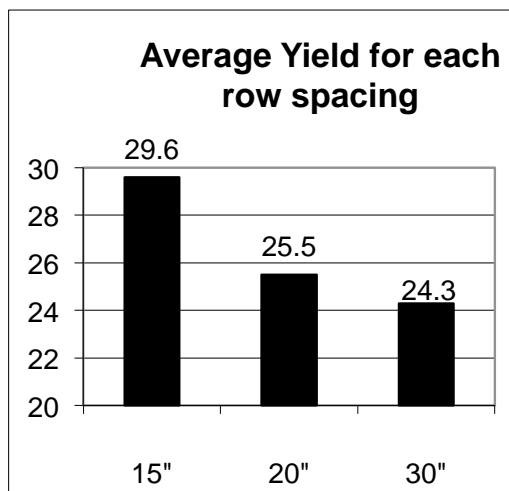
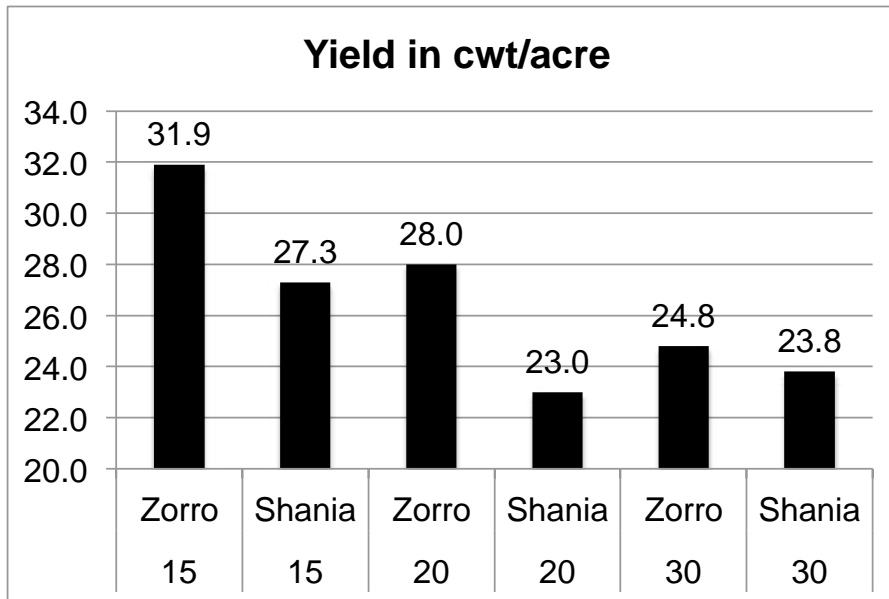


**Black Row Width
Stoutenburg Farms
Sandusky, MI**

Row width	Variety	Yield	Height	Population
15	Zorro	31.9	17.4	142,006
15	Shania	27.3	19.2	127,195
20	Zorro	28.0	17.1	122,839
20	Shania	23.0	17.8	118,919
30	Zorro	24.8	17.8	100,188
30	Shania	23.8	18.6	95,396

LSD=2.60

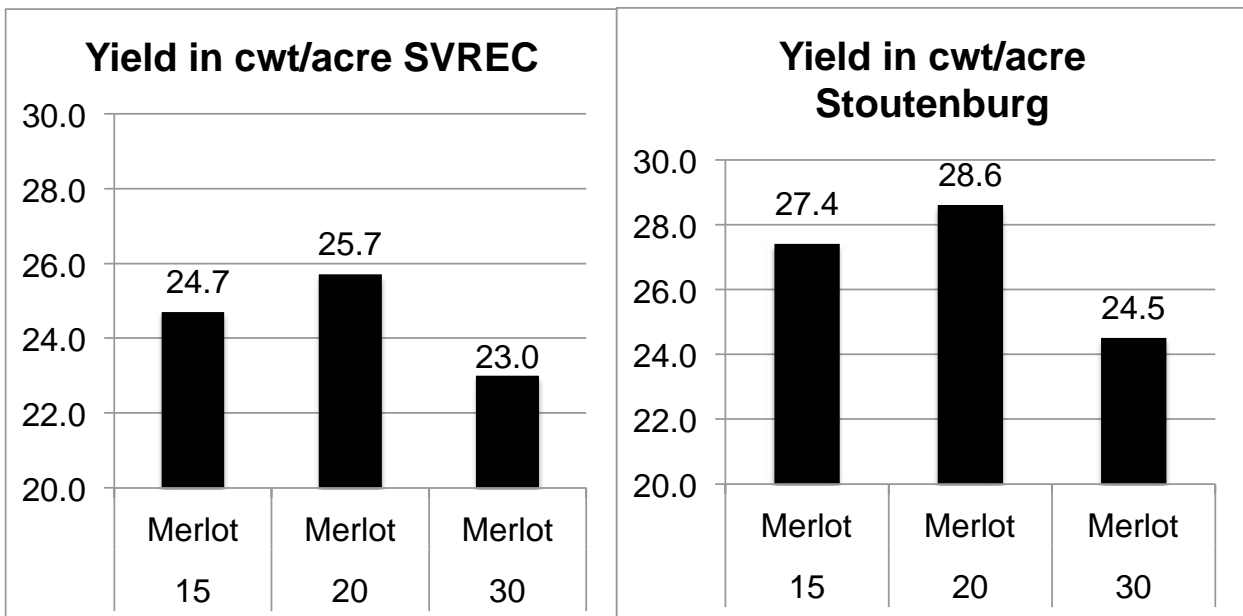
C.V.=7%



**Small Red Row Width
MSU Saginaw Valley Research and Extension Center
Frankenmuth, MI**

Row width	Variety	Yield	Height	Population
15	Merlot	24.7	24.6	117,322
20	Merlot	25.7	25.2	101,930
30	Merlot	23.0	25.9	84,215

LSD=1.89
C.V.=4%



**Small Red Row Width
Stoutenburg Farms
Sandusky, MI**

Row width	Variety	Yield	Height	Population
15	Merlot	27.4	23.8	120,225
20	Merlot	28.6	23.9	105,851
30	Merlot	24.5	25.5	84,942

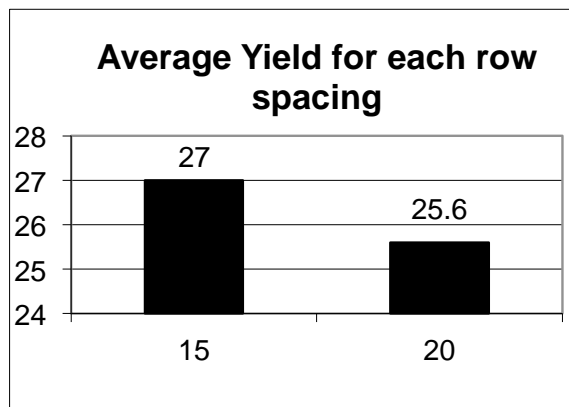
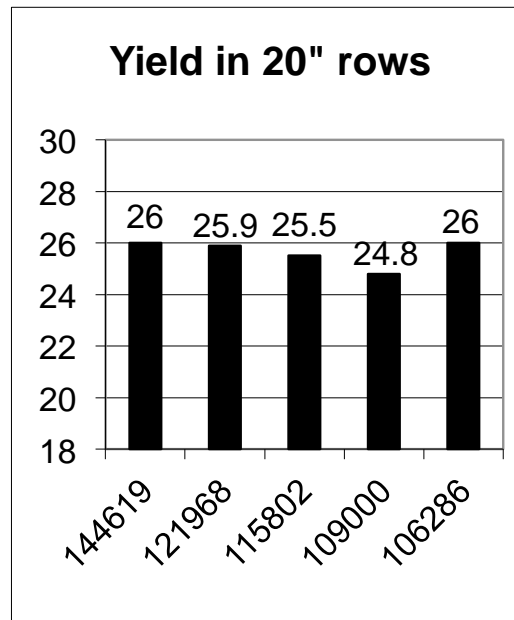
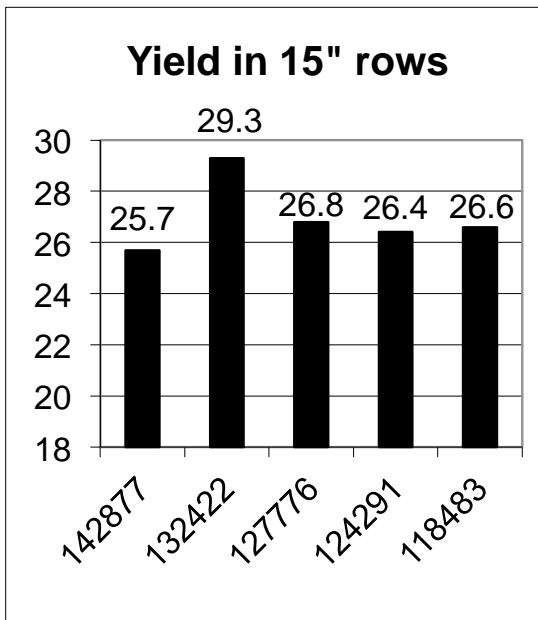
LSD=3.68
C.V.=9%

Black Row Width/Population
MSU Saginaw Valley Research and Extension Center
Frankenmuth, MI

Row width	Variety	Yield	Height	Population
15	Zorro	25.7	17.9	142,877
15	Zorro	29.3	18.1	132,422
15	Zorro	26.8	18.2	127,776
15	Zorro	26.4	18.4	124,291
15	Zorro	26.6	18.5	118,483
20	Zorro	26.0	18.3	144,619
20	Zorro	25.9	18.8	121,968
20	Zorro	25.5	18.7	115,802
20	Zorro	24.8	19.1	109,000
20	Zorro	26.0	19.4	106,286

LSD=3.74

C.V.=10%

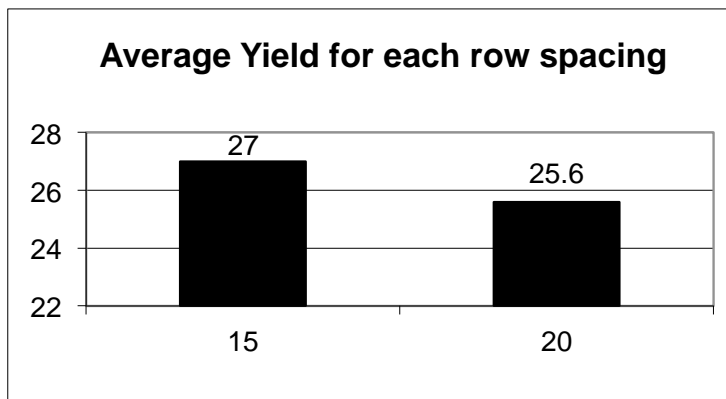
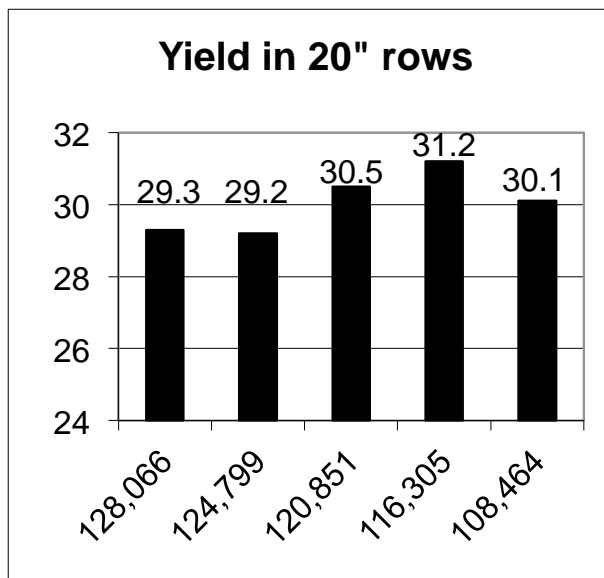
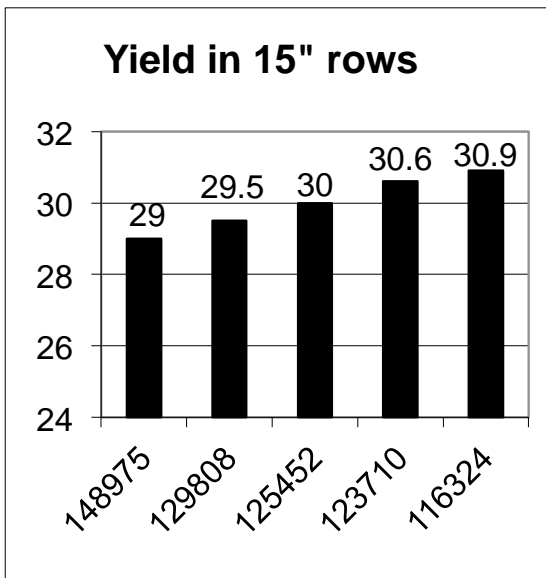


**Black Row Width/Population
Stoutenburg Farms
Sandusky, MI**

Row width	Variety	Yield	Height	Population
15	Zorro	29.0	17.7	148,975
15	Zorro	29.5	19.0	129,808
15	Zorro	30.0	18.5	125,452
15	Zorro	30.6	20.0	123,710
15	Zorro	30.9	20.6	116,324
20	Zorro	29.3	19.3	128,066
20	Zorro	29.2	20.6	124,799
20	Zorro	30.5	21.6	120,851
20	Zorro	31.2	20.5	116,305
20	Zorro	30.1	20.8	108,464

LSD=2.32

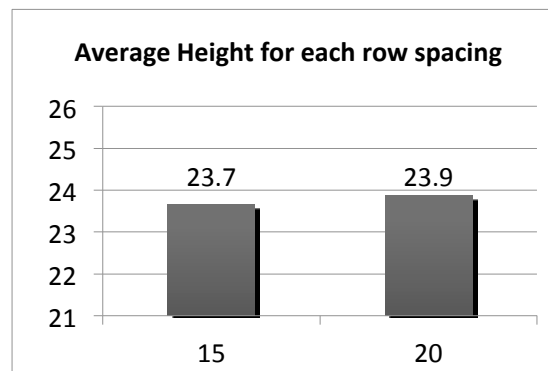
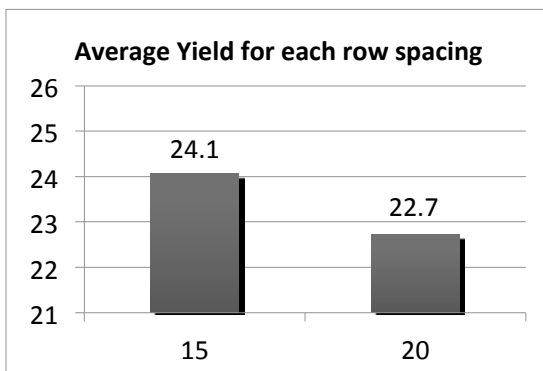
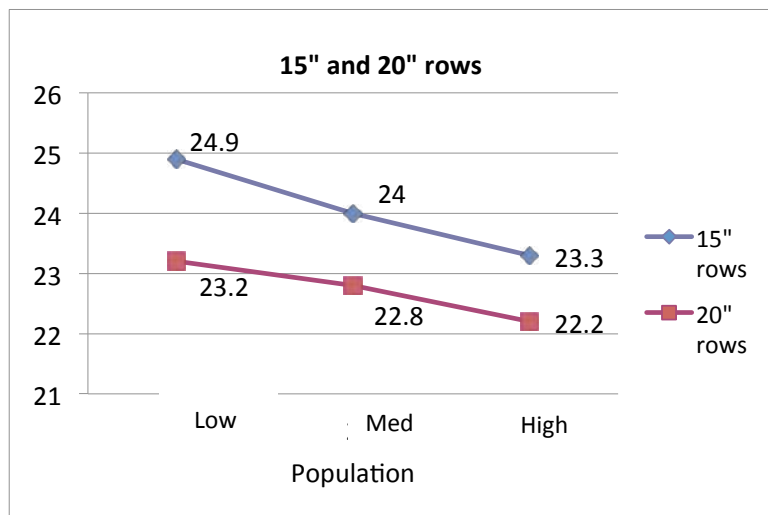
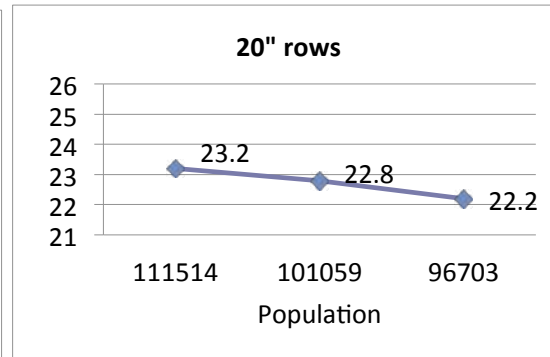
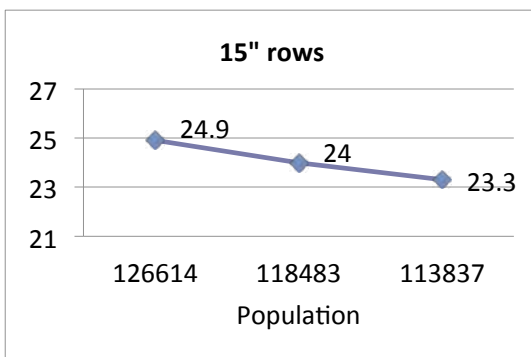
C.V.=5%



Small Red Row Width/Population
MSU Saginaw Valley Research and Extension Center
Frankenmuth, MI

Row width	Variety	Yield	Height	Population
15	Merlot	24.9	23.6	126614
15	Merlot	24	23.9	118483
15	Merlot	23.3	23.5	113837
20	Merlot	23.2	23.6	111514
20	Merlot	22.8	24.2	101059
20	Merlot	22.2	23.8	96703

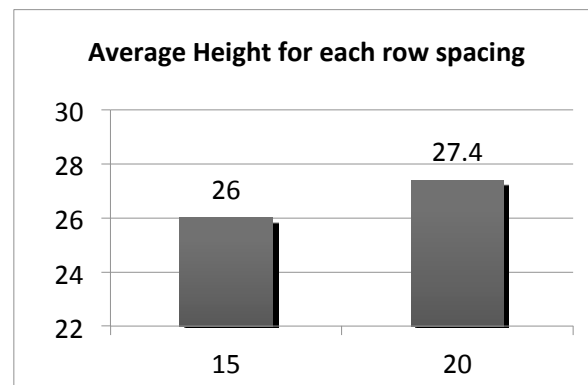
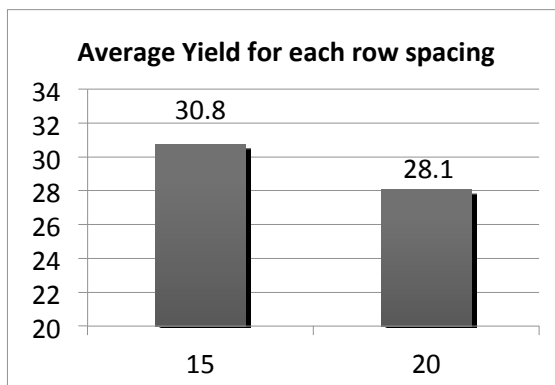
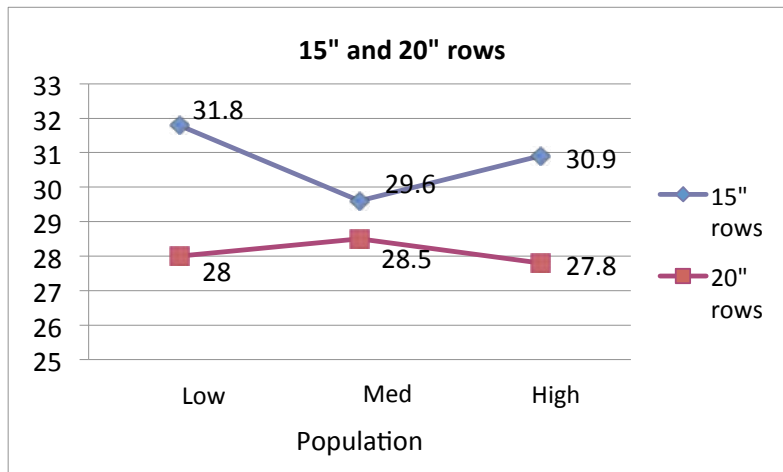
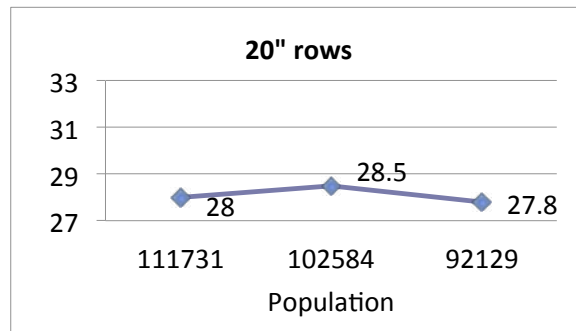
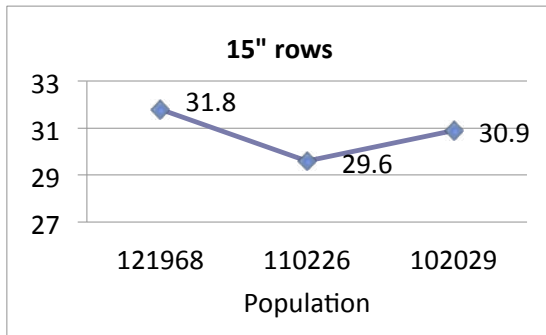
LSD=3.17
C.V.=9%



Small Red Row Width/Population
Stoutenburg Farms Sandusky, MI

Row width	Variety	Yield	Height	Population
15	Merlot	31.8	24.7	121,968
15	Merlot	29.6	27.1	110,226
15	Merlot	30.9	26.2	102,029
20	Merlot	28.0	27.9	111,731
20	Merlot	28.5	26.1	102,584
20	Merlot	27.8	28.2	92,129

LSD=4.31
 C.V.=10%



2011 White Mold Fungicide Trial
 Montcalm Research Farm, Entrican, Michigan

Treatment	Rate	Application Code	% Pick	Incidence %infection	Severity %severity	YIELD	BU/AC
UTC			3.3	54	38	2747	45.8
Omega	13.7 oz	AB	1.8	33	21	3236	53.9
Endura	8 oz	AB	2.2	35	21	2978	49.6
Omega	8 oz	AB	2.3	38	24	3202	53.4
PROPULSE+INDUCE	8.6 oz	A	2.1	29	16	3413	56.9
PROPULSE+INDUCE	8.6 oz	AB	2.5	25	16	3126	52.1
PROPULSE+INDUCE	10.3 oz	A	2.6	25	15	3071	51.2
PROPULSE+INDUCE	10.3 oz	AB	2.3	24	13	3265	54.4
PROLINE+INDUCE	5.7 oz	A	2.8	32	21	2899	48.3
PROLINE+INDUCE	5.7 oz	AB	3	27	17	2875	47.9
APPROACH+INDUCE	9 oz	AB	2.9	42	28	2974	49.6
		LSD@.05	0.6			400	6.7
		C.V. Value	18.50%			9.30%	9.30%

Application Code:A=100% or first bloom, B=7 days after 100% bloom
 Rating - % infection "rating" on September 26, % Incidence, %severity
 Merlot Small Red Beans planted in 20" rows. Irrigation of two .5 inch per week
 Planted:June 15 Harvested: October 7
 First Spray: July 30 Second Spray: August 6 Approach: August 9
 Sprayed with 4 row bicycle-wheel CO2 sprayer using 36 gpa at 65 psi.
 Twin-Jet nozzle placed directly over the row.
 Plot size sprayed was 4 Rows by 30 feet.
 Harvest area was middle 2 Rows by 15 feet.

EXPERIMENT 1101 STANDARD NAVY YIELD TRIAL

PLANTING DATE: 6/2/11

Dr. James D. Kelly and Evan Wright, Crops and Soil Sciences, Michigan State University

ENTRY	PEDIGREE/NAME	YIELD CWT 100 SEED		DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
		/ACRE	WT. (g)					
I11264	COOP 03019, MERLIN	29.2	22.0	42	105	2.0	54.5	5.0
N09174	N05311/B05055	27.1	28.0	43	103	2.0	49.5	4.5
N08003	N00844/N02237	26.9	24.0	44	104	2.0	52.5	5.0
N08004	N00844/N02237	25.4	22.5	44	102	2.0	49.0	4.5
I10103	OAC 7-2, REXETER	25.3	24.9	42	106	2.5	48.0	4.0
I92002	C-20*3//0801/Seaf, VISTA	24.1	22.1	44	105	3.0	48.5	4.0
N10102	N05319//N05311/N04109	23.6	24.9	41	105	2.0	54.5	5.0
I06271	ND012103, AVALANCHE	23.5	22.4	43	103	2.0	52.0	4.5
N10103	N05319//N05311/N04109	23.4	24.8	42	104	1.5	56.5	5.5
N08002	N00844/N02237	23.1	23.2	44	103	2.0	52.0	5.0
N09104	N05311/B05055	23.0	21.6	45	105	2.0	51.5	4.0
N10109	B05055/N05324	22.9	21.4	44	104	2.0	51.5	5.0
N10108	N05311/B04587	22.4	27.2	44	105	2.5	51.5	4.5
N09175	N05311/B05055	21.8	28.6	44	105	2.0	49.5	4.0
N09021	N05319/B04316	21.3	22.1	42	104	2.0	52.0	4.0
N05324	N00838/N00809//N00792	21.3	24.5	43	104	2.5	51.5	4.5
N07007	N03614/N00844	20.9	18.2	44	103	2.0	50.5	5.5
N09046	B04554/N05357	20.8	20.5	44	105	2.5	49.0	4.5
N06702	N00809//B95556*2/I93154	20.7	21.9	44	105	2.0	50.0	4.5
N09045	N05311/B05034	20.5	23.4	44	106	2.5	49.5	3.5
N08007	N01792/N03614	20.3	20.3	44	101	1.5	53.0	6.0
I08902	HYLAND T9905	20.2	26.0	44	105	3.0	47.5	4.0
I08958	Mayflow/Avan, MEDALIST	20.2	22.1	43	105	2.0	54.5	4.5
N11999		20.1	22.4	43	101	1.0	51.0	5.0
N09044	N05311/X06121	19.7	21.0	44	105	2.0	53.0	4.5
N09020	N05319/B04316	19.6	23.4	43	105	2.5	49.5	4.5
N10107	N05346/N05311	19.4	22.0	44	104	3.0	49.0	4.0
N09050	N04154/N00833	19.3	21.0	43	102	2.0	49.5	4.5
N10104	N05319//N05311/N04109	19.3	25.3	42	104	1.5	50.5	4.0
N09056	N04152/N05346	19.1	20.8	44	103	2.5	47.5	4.0
N07009	N03614/N00844	17.8	23.4	44	105	2.5	48.5	4.0
N09054	N04152/N05346	17.3	21.1	44	105	2.0	50.0	4.0
N10101	N04109/B05044	16.5	16.3	42	105	2.0	50.5	4.0
N10105	N05324//N05319/B05044	16.3	23.9	44	105	2.5	48.5	3.5
N09055	N04152/N05346	15.8	20.8	44	106	2.5	46.5	4.0
N09059	N04141/N05317	15.8	21.1	45	106	2.5	49.5	3.5
MEAN(36)		21.2	22.8	43	104	2.2	50.6	4.4
LSD (.05)		3.0	1.5	1	1	0.7	2.5	0.9
CV (%)		9.9	4.8	1	1	16.5	2.4	10.1

EXPERIMENT 1102 STANDARD BLACK YIELD TRIAL

PLANTING DATE: 6/2/11

Dr. James D. Kelly and Evan Wright, Crops and Soil Sciences, Michigan State University

ENTRY	PEDIGREE/NAME	YIELD CWT 100 SEED		DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
		/ACRE	WT. (g)					
I10102	Mackinac/Jaguar, LORETO	29.9	23.0	43	103	2.0	55.0	3.5
B09175	N05311/B05055	29.3	29.7	45	103	2.0	53.5	5.0
B09210	B04644/B04588	28.2	23.5	44	104	2.0	52.0	4.0
I07116	T-39/Midnight, SHANIA	27.8	23.2	45	105	2.0	53.0	4.0
B09183	B04349/B05001	27.6	19.1	43	101	2.0	50.0	5.0
B09184	B04349/B05001	27.5	18.6	45	105	2.5	49.0	4.0
B09174	N05311/B05055	27.1	28.7	44	104	2.0	54.0	5.0
I08907	Midnight/Blackhawk, BLACK VELVET	27.1	25.8	46	106	2.0	53.5	4.0
B09128	B05055/B05044	27.0	18.8	45	102	2.0	52.5	5.0
B09208	B04644/B04588	27.0	23.1	42	102	1.5	53.0	5.0
B09198	B05055/B04587	27.0	21.8	45	103	1.5	51.5	4.5
B95556	B90211/N90616, JAGUAR	26.7	22.5	45	102	1.0	51.0	4.5
B09166	B04554/B04587	26.5	21.7	45	104	2.0	54.0	5.0
B04554	B00103//B00103/X00822, ZORRO	26.2	20.4	44	104	2.0	53.0	5.0
B09202	B04444/B04588	26.0	21.2	44	105	2.0	55.0	4.5
B09209	B04644/B04588	26.0	23.1	45	102	1.0	51.5	5.5
B09197	B05055/B04588	25.6	22.8	45	103	1.5	48.5	4.0
B09130	B05055/B04587	25.5	20.4	45	102	1.0	51.0	4.5
B09170	B04554/B04587	25.3	21.6	45	101	2.0	52.5	3.5
B09119	B04554/X06127	25.3	21.2	45	103	2.0	52.0	4.5
B09171	B04554/B04587	25.3	20.5	45	102	2.0	54.0	4.5
B09204	B05054/B04588	25.1	23.1	44	100	1.0	49.0	4.5
B09194	B05055/B05044	24.7	18.5	45	102	2.5	47.0	4.0
B00101	PHANTOM/BLACKJACK, CONDOR	24.2	24.6	44	103	2.0	47.5	4.0
I81066	SEL-BTS,T39	24.1	26.3	45	103	3.0	41.5	3.0
B09165	B04554/B04587	24.1	21.7	45	102	1.5	51.5	4.5
B09129	B05055/B04587	23.4	22.1	44	102	1.0	47.5	4.0
B09135	B04316/B05040	23.2	21.4	45	101	2.0	52.0	4.0
I03390	ND9902621-2, ECLIPSE	23.2	23.0	43	100	1.0	49.5	4.0
B08102	B01792/B02549	22.9	23.4	42	103	1.5	53.5	4.5
B09136	B04316/B05040	22.9	23.7	44	100	1.0	48.5	4.0
B09224	B05054/B04588	22.4	25.8	45	100	1.0	50.5	5.0
B09201	B04444/B05044	21.7	17.4	44	102	2.0	53.5	5.0
B09188	B05054/B04588	21.2	23.1	45	104	2.0	53.0	4.0
B09203	B05054/B04588	21.1	23.8	44	101	1.0	48.0	4.0
I10132	AIFI WURITI	18.4	27.0	43	104	2.0	46.0	3.0
MEAN(36)		25.2	22.7	44	102	1.7	51.1	4.3
LSD (.05)		3.2	1.8	2	1	0.5	2.4	0.9
CV (%)		9.1	5.5	2	0	14.6	2.3	9.7

**Effect of row width, population, and herbicide treatment on dry bean yield
(Saginaw Valley Research and Extension Center – 2011)**

Ryan Holmes, Christy Sprague, and Gary Powell, Michigan State University

Location: Richville (SVREC)	Tillage: Conventional
Planting Date: June 6, 2011	Herbicides: see tables
Soil Type: Clay loam	Replicated: 4 times

Table 1. Black bean yield was not affected by row width, bean population, or herbicide treatment.

‘ZORRO’ BLACK BEANS					
ROW WIDTH EFFECT		POPULATION EFFECT		HERBICIDE EFFECT	
	— cwt/A —	— seeds/A —	— cwt/A —		— cwt/A —
15-inch	27.1	79,500	26.0	Weed-free	26.0
20-inch	26.0	106,000	26.6	POST^a	26.5
30-inch	25.8	132,500	26.3		
LSD _{0.05}	N.S. ^b		N.S.		N.S.

^a Raptor (4 fl oz) + Basagran (8 fl oz) + COC (1%) + AMS (2.5 lb) applied to 2-4" weeds.

^b Means in each column followed by the same letter are not significantly different at $P \leq 0.05$. N.S. = not significant.

Table 2. Small red bean yield was affected by row width, but not by population or herbicide treatment.

‘MERLOT’ SMALL RED BEANS					
ROW WIDTH EFFECT		POPULATION EFFECT		HERBICIDE EFFECT	
	— cwt/A —	— seeds/A —	— cwt/A —		— cwt/A —
15-inch	23.1 A ^b	60,000	21.5	Weed-free	21.4
20-inch	22.7 A	79,500	22.2	POST^a	23.0
30-inch	20.8 B	106,000	22.9		
LSD _{0.05}	1.3		N.S.		N.S.

^a Raptor (4 fl oz) + Basagran (8 fl oz) + COC (1%) + AMS (2.5 lb) applied to 2-4" weeds.

^b Means followed by the same letter are not significantly different at $P \leq 0.05$. N.S. = not significant.

Summary: This trial was conducted to determine the effect of row width and bean population on yield of two classes of dry bean. This trial was conducted at two different locations. At this location, the Saginaw Valley Research and Extension Center, conditions were mildly dry but otherwise favorable, resulting in average yields of 26.2 cwt/A for black beans and 22.2 cwt/A for small red beans. Black bean yield was not significantly affected by row width, bean population or herbicide treatment (Table 1). However, small red bean yield was significantly higher in narrow rows (15- and 20-inch) compared with 30-inch rows (Table 2). There was not a significant difference in yield between small red bean populations. In both classes, 15-inch rows suppressed weed growth after the POST herbicide treatment. In black beans, the 20-inch rows weed suppression was similar to the 15-inch rows, but this was not the case for the small red beans. In some cases, narrow rows also reduced *Alternaria* and western bean cutworm feeding severity. This research has been conducted for the past two years at two different locations, while yield of both classes of beans has not always benefited from planting in narrow rows, the majority of times there has been a yield advantage, and suppression of late season weed growth has been a benefit. This research was supported by Project GREEN and Michigan Dry Bean Commission funding from the Michigan Department of Agriculture Specialty Crops grant.

**Effect of row width, population, and herbicide treatment on dry bean yield
(MSU Agronomy Farm East Lansing – 2011)**

Ryan Holmes, Christy Sprague, and Gary Powell, Michigan State University

Location: East Lansing	Tillage: Conventional
Planting Date: June 8, 2011	Herbicides: see tables
Soil Type: Loam	Replicated: 4 times

Table 1. Black bean yield was affected by row width and herbicide treatment, but not bean population.

‘ZORRO’ BLACK BEANS				
ROW WIDTH EFFECT	POPULATION EFFECT		HERBICIDE EFFECT	
— cwt/A —	— seeds/A —	— cwt/A —	— cwt/A —	— cwt/A —
15-inch	40.0 A ^b	79,500	37.7	Weed-free 39.3 A
30-inch	34.8 B	106,000	36.6	POST^a 35.5 B
		132,000	37.9	
LSD _{0.05}	1.4		N.S.	1.4

^a Raptor (4 fl oz) + Basagran (8 fl oz) + COC (1%) + AMS (2.5 lb) applied to 2-4" weeds.

^b Means followed by the same letter are not significantly different.

Table 2. Small red bean yield was affected by row width and herbicide ($p < 0.05$) and population ($p < 0.1$).

‘MERLOT’ SMALL RED BEANS				
ROW WIDTH EFFECT	POPULATION EFFECT		HERBICIDE EFFECT	
— cwt/A —	— seeds/A —	— cwt/A —	— cwt/A —	— cwt/A —
15-inch	29.7 A ^b	60,000	26.3 B	Weed-free 28.4 A
30-inch	25.2 B	79,500	27.2 AB	POST^a 26.5 B
		106,000	28.7 A	
LSD _{0.05}	1.6		1.7 ^c	1.5

^a Raptor (4 fl oz) + Basagran (8 fl oz) + COC (1%) + AMS (2.5 lb) applied to 2-4" weeds.

^b Means followed by the same letter are not significantly different. N.S. = not significant.

^c Significance level $p < 0.1$

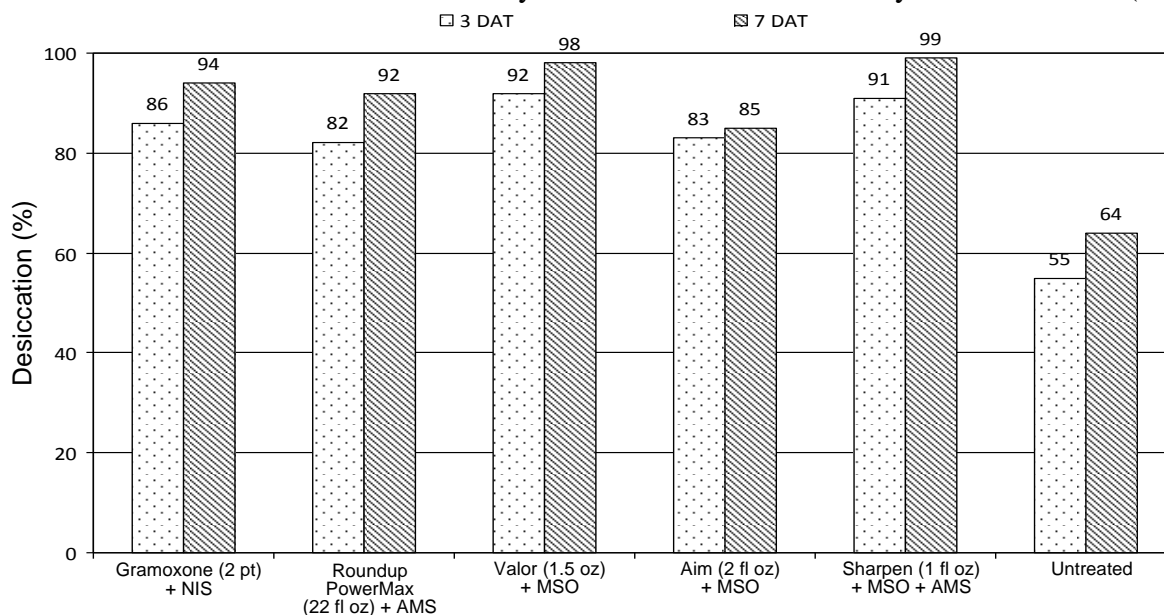
Summary: This trial was conducted to determine the effect of row width and population on yield of two dry bean classes. This trial was conducted at two different locations. At this location, East Lansing, moisture was abundant, resulting in average yields of 37.4 cwt/A in black beans and 27.4 cwt/A in small red beans. Yield was higher in narrow rows in both classes. Yield was also higher in weed-free treatments than in POST treatments in both classes. In black beans, population did not have a significant impact on yield. In small red beans, yield was marginally higher at high population than at low population with medium population intermediate. In black beans, and at high population in small red beans, narrow rows greatly reduced weed biomass compared with wide rows. Narrow rows also reduced *Alternaria* and cutworm feeding severity. This research has been conducted for the past two years at two different locations, while yield of both classes of beans has not always benefited from planting in narrow rows, the majority of times there has been a yield advantage, and suppression of late season weed growth has been a benefit. This research was supported by Project GREEN and Michigan Dry Bean Commission funding from the Michigan Department of Agriculture Specialty Crops grant.

Evaluation of preharvest desiccants in dry edible beans (Saginaw Valley Research and Extension Center – 2011)

Christy Sprague and Gary Powell, Michigan State University

Location: Richville (SVREC)	Tillage: Conventional
Planting Date: June 10, 2011	Variety: ‘Jaguar’ black beans
Preharvest Application Date: August 29, 2011	Row width: 20-inch
Soil Type: Clay loam	Replicated: 4 times

Figure 1. Preharvest treatment effects on dry bean desiccation 3 and 7 days after treatment (DAT).



Summary: This study was conducted to examine various preharvest treatments for dry edible bean desiccation. At the 3 DAT evaluation, Valor (1.5 oz/A) + MSO and Sharpen (1 fl oz/A) + MSO + AMS provided significantly higher ($p \leq 0.05$) dry bean desiccation than Gramoxone Inteon, Roundup PowerMax, or Aim. However by 7 DAT, all treatments except Aim alone provided greater than 90% dry bean desiccation. Higher rates of Valor (2 oz/A) or Sharpen (2 fl oz/A) did not improve dry bean desiccation. Additional treatments in this study included various combinations of the above treatments. The addition of Aim to Sharpen or Gramoxone Inteon did not improve dry bean desiccation over any of these treatments alone. The combination of Valor and Roundup PowerMax also was not different than Valor alone. Additional treatments examined two potential new products, Reglone and a Reglone premixture at various rates. The 7 DAT results with these products look promising. From these results and those from previous years there are several effective desiccation products. However, each of these products has specific precautions and limitations that need to be considered. Information on these restrictions and how to best use these products can be found in chapter 5 of the 2012 MSU Weed Control Guide for Field Crops (E-434). This research was supported by various companies and Michigan Dry Bean Commission funding from the Michigan Department of Agriculture Specialty Crops grant.

2011 MICHIGAN DRY BEAN TRIALS

Compiled by Gregory V. Varner, Bean Research Director

COUNTY & COOPERATOR: BAY-Meylan Farms lodge rating
 GRATIOT-Hrabal Farms; HURON-Leonard Knoblock Farm; MONTCALM-Brian Stratton Farm direct-cut
 SANILAC-J-ROD Farms; TUSCOLA-Mark Bauer Farm Huron

PLANTING DATES	JUNE 4	JUNE 11	JUNE 8	JUNE 13	JUNE 3	JUNE 14	2011 AVE			
<u>VARIETY-NAVY</u>	<u>DAYS</u>	<u>ORIGIN</u>	<u>BAY</u>	<u>GRATIOT</u>	<u>HURON</u>	<u>MONTCALM</u>	<u>SANILAC</u>	<u>TUSCOLA</u>	<u>3-5 LOC</u>	<u>Sanilac & Tuscola</u>
VISTA	100-104	GTS	1937	2771	2325	3006	2348	2976	2550-2685	2.5-2-2.5
RELIANT	100-103	GTS		2623	2218		2478	2614	2437	3.0-2-3.0
HYLAND T9905	98-103	HYLAND	1052	3027	2224	3122	2368	3122	2571-2773	2-2--2.5
MEDALIST	99-106	COOP	1217	3058	2438	3469	2489	2802	2576-2851	2.5-1.5-2
INDI	98-102	ADM	1461	2537	2134	3024	2393	3069	2532-2631	1--1-1.5
MERLIN-coop 03019	100-102	COOP			2433		2365	3233	2677	2--2-2
ADM N5039540	96-102	ADM	1496	2591	1882	3043	2076	2866	2275-2492	1.5-1.5-2
ADM N5023584	98-102	ADM	1378	2678	1933	2590	2562	2690	2395-2491	2-1.5-2
GTS 544	96-102	GTS			2621		2240	2767	2543	2.5-2-3.5
GTS 564	100	GTS			1848		2211	2745	2268	2.5-2-2.5
GTS ob5551-99	105-108	GTS	1261		2722		2473	2651	2615	3.5-2-3.5
HYLAND T154-051	102-103	HYLAND		2503	2143		2504	2536	2394	3.5-3-3.5
ADM N4018056	98-101	ADM	1406		2243			2723		1.5-na-2
ADM N4020061	99-100	ADM	1526		2272			2846		1.5-na-2.5
ADM N4020077	99-101	ADM	1610		1946			2579		2-na-2.5
ADM N6007127	100-102	ADM	1183		1890			2567		3.5-na-3.5
ADM N7046482	101-102	ADM	1167		2238			2845		2.5-na-3
COOP 02084	96-98	COOP			2363		2514	3144	2674	1.5-1.5-2
COOP 99039-3	102-103	COOP			2538		2368	3160	2689	3-2.5-3
COOP 03036	96-99	COOP			1957		2060	3510	2509	2-2-2.5
COOP 06063	98-103	COOP			2275		2539	2895	2570	2-2-2.5
COOP 07073	97-98	COOP			2291		2705	2950	2649	1.5-1-2
COOP 08070	94-97	COOP			1986		2527	3159	2557	2-2-2.5
COOP 08072	96-102	COOP			2306		1975	3054	2445	1.5-1.5-2
COOP 06060	98-99	COOP			1958		2519	3221	2566	3.5-2.5-3.5
SEM NAVC6V-1200	99-100	SEMINIS			2403			3039		1.5-na-2
SEM NAVC6V-1246	94-96	SEMINIS			2410			2883		1.5-na-2
OAC LIGHTNING	98-99	OAC			1856			2694		1.5-na-2.5
OAC REXETER	101-103	OAC			2069			2945		2.5-na-3
HR 199	103-105	AAFC			2467			2603		3-na-3.5
MSU N09046	101-102	MSU	1072		2164			2731		2-na-2.5
MSU N09174	100-101	MSU	1855		1858			2443		2-na-2.5
MSU N09175	97-98	MSU	1646		1860			2723		2-na-2.5
MSU N10104	99-100	MSU			1906			2675		1.5-na-2.5
MSU N10108	101-102	MSU			1947			2919		1.5-na-2

LSD=352 LSD=366 LSD=518 LSD=502 LSD=353 LSD=362
 CV=17.4% CV=9.8% CV=17.0% CV=11.0% CV=10.5% CV=9.0%

<u>BLACK</u>	<u>DAYS</u>	<u>ORIGIN</u>	<u>BAY</u>	<u>GRATIOT</u>	<u>HURON</u>	<u>MONTCALM</u>	<u>SANILAC</u>	<u>TUSCOLA</u>	<u>2011AVE</u>	<u>direct-cut</u>
ZORRO	99-100	MSU	1453	2712	2255	2947	2273	3485	2681-2734	2-1.5-2
SHANIA	102-104	ADM	1532	2532	2193	3346	2391	2989	2526-2690	2-2-2.5
BLACK VELVET	104-105	SEMINIS	1728	2367	2378		2058	3151	2489	2-2-2.5
LORETO	98-103	COOP-PRO	1880	2647	2218		2288	2891	2511	1.5-2.5-3
JAGUAR	97-97	MSU	1069	2357			2414	2977		na-1-1.5
CONDOR	100	MSU	1151				2281	2779		na-2.5-3
T-39	96-99	CAL	1276				2372	2873		na-3-4
ECLIPSE	94-95	NDSU	1454				1899	3230		na-1-1.5
MIDNIGHT	103-104	NYC	1665				1960	2852		na-1.5-2.5
DOMINO	100-104	MSU	1558				2249	3102		na-2.5-3
BL 05222	100-101	COOP-PRO			2596		1921	2719		2-2--3

<u>BLACK...continued</u>	DAYS	ORIGIN	BAY	GRATIOT	HURON	MONTCALM	SANILAC	TUSCOLA	2011AVE	<u>direct-cut</u>
BL 04352	97-98	COOP-PRO			2310		2285	2678		1.5-1.5-2
BL 06252	99-101	COOP-PRO			2141		2216	2785		2.5-2-2.5
ADM B6017225	102-104	ADM	1237		1950			2837		2-na-2.5
ADM B6020035	100-101	ADM	1419		1822			3104		2-na-2.5
ADM B5054545	96-97	ADM	1101		1939			2513		1.5-na-2
GTS 1103	98-100	GTS			2369		2184	2667		2.5-2-2.5
GTS 2159-00 XX	102-103	GTS			2256			2960		2.5-na-3
SEM BKBC6V1312	100-101	SEMINIS			2263			3021		1.5-na-2
MSU B09174	99-101	MSU	1607				2412	3150		na-2-2.5
MSU B09175	98-100	MSU	1814				2231	3093		na-1.5-2.5
MSU B09197	99-100	MSU	1533				2193	2937		na-1.5-2
MSU B09244	100-101	MSU	1688				2333	2928		na-1.5-2.5

LSD=515 LSD=375 LSD=514 LSD=425 LSD=386
CV=24.5% CV=14.0% CV=16.2% CV=13.5% CV=9.3%

TEBO

TEBO	93-108	JAPAN		2618			1989			
FUJI	89-104	MSU		2494			2012			
<u>SMALL RED</u>	DAYS	ORIGIN	BAY	GRATIOT	HURON	MONTCALM	SANILAC	TUSCOLA	3 LOC	
MERLOT	95-103	USDA/MSU	2034		2012		2080	2384	2159	
SR 06233	92-96	PROVITA			2076		1932	2227	2078	
SR 09305	91-102	PROVITA			2314		2425	2737	2492	
SR 07264	95-104	PROVITA			3053		2164	2525	2581	
SR 09303	88-101	PROVITA			2627		2684	2994	2768	
SR 09304	88-98	PROVITA			2652		2377	2871	2633	
MSU R08516	90-103	MSU			1955		2243	2548	2249	

LSD=611 LSD=376 LSD=349
CV=16.5% CV=11.1% CV=9.0%

PINTO

<u>PINTO</u>	DAYS	ORIGIN	BAY	GRATIOT	HURON	MONTCALM	SANILAC	TUSCOLA	3-6 LOC
OTHELLO	84-86	USDA	2055	3558			2436		2683
SANTA FE	92-96	MSU	1925	2828		2710	1734		2162
LA PAZ	94-96	PROVITA	2426	3374			2429		2743
GTS 904	90-98	GTS		2925			2104		
GTS cob 2824-99	87-94	GTS		2975			1753		
GTS cob 816-03	92-99	GTS		2458			2243		
LARIAT	89-98	NDSU	2587	3155		3334	2111		2618
MSU P07863	99-102	MSU	2731	3863	2404	3495	2491	2958	3028-2990
MSU P09420	89-90	MSU	2496	2532		2803			
MSU P10502	91-92	MSU	1912	2787		2589			

LSD=498 LSD=571 LSD=478 LSD=360
CV=14.9% CV=13.1% CV=10.4% CV=11.3%

GREAT NORTHERN

MATTERHORN	88-90	MSU					1756	2094	
MSU G08263	90-91	MSU					1726	2378	
MSU G09303	90-91	MSU					1612	2384	
COYNE	89-90	UN					1747	1989	

LSD=372 LSD=402
CV=13.6% CV=11.4%

PINK

SEDONA	91-98	MSU			2129		2294	2212	
MSU S08409	92-100	MSU			2105		2210	2495	
MSU S08418	94-102	MSU			2031		2148	2273	
MSU S08419	94-102	MSU			1764		1900	2432	

LSD=352 LSD=231 LSD=433
CV=11.5% CV=6.8% CV=11.5%

<u>CRANBERRY</u>	DAYS	ORIGIN	BAY	GRATIOT	HURON	MONTCALM	SANILAC	TUSCOLA
SVM TAYLOR	88-89	ADM				2416		
CAPRI	91-93	MSU		1966		2391		
ETNA	88-90	SEMINIS		1622		2398		
ADM C213259	89-91	ADM		2138		2135		
KRIMSON	91-93	BASIN		1817		2059		
CHIANTI vine	100-101	SEMINIS		1768		2210		
BELLAGIO vine	103-104	MSU		1832		2279		
MSU C07411	90-94	MSU		2138		2191		
				LSD=838		LSD=500		
<u>LIGHT RED KIDNEY</u>				CV=28.0%		CV=14.9%		
CHINOOK 2000	104-110	MSU		2249		2344		
CALIF ELRK	86-90	CAL		1875		1955		
PINK PANTHER	90-92	SEMINIS		2172		2242		
CLOUSEAU	90-93	SEMINIS		2251		2652		
OAC INFERNO	105-110	OAC		2611		2843		
MSU K06619	99-101	MSU		2180		2664		
				LSD=384		LSD=652		
				CV=11.5%		CV=17.7%		
<u>DARK RED KIDNEY</u>	DAYS	ORIGIN	BAY	GRATIOT	HURON	MONTCALM		
RED HAWK	97-98	MSU		2082		2319		
MONTCALM	100-102	MSU		2020		2121		
RED ROVER	96-98	SEMINIS		2436		2873		
MSU K08222	100-103	MSU		1877		2457		
MSU K08228	100-102	MSU		1981		2644		
				LSD=563		LSD=386		
				CV=17.3%		CV=9.8%		
<u>ALUBIA-W. KID.</u>								
BELUGA	101-104	MSU		1768		2271		
MSU K08961	92-94	MSU		1815		1995		
MSU K10902	99-101	MSU		1417		1848		
				LSD=568		LSD=580		
				CV=18.7%		CV=16.5%		
<u>YELLOW</u>								
SEM 08560863	101-108	SEMINIS		2486		2392		
MYASI	99-105	ADM		2302		1985		
<u>YELLOW EYE</u>								
GTS 1701	98-102	GTS				2368		
<u>ADZUKI</u>								
ERIMO	100-102	JAPAN		1554				

ORIGIN KEY
MSU=MICHIGAN STATE UNIVERSITY
GTS=GEN-TEC SEEDS LIMITED
SEMINIS-SEMINIS SEEDS
ADM==ARCHER DANIELS MIDLAND
HYLAND=HYLAND SEEDS, LIMITED
COOP=COOPERATIVE ELEVATOR-PROVITA
CAL=UNIVERSITY OF CALIFORNIA-DAVIS
NYC=CORNELL UNIVERSITY-NEW YORK
USDA=UNITED STATES DEPT. OF AGRIC.ARS
NDSU=NORTH DAKOTA STATE UNIVERSITY
OAC===UNIVERSITYofGUELPH
PROVITA=PROVITA SEEDS
AAFC==AAFC GPCRC HARROW
BASIN==BASIN SEED COMPANY
UN=UNIVERSITY OF NEBRASKA

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Maturity days = planting until harvest in 2011
Direct -Cut Lodging Ratings = 1-erect, 5-laying flat on ground.
White Mold Rating = 1-10% mold, 5-100% mold.
No White Mold to Rate in 2011.

Huron, Sanilac and Tuscola were direct harvested.
Bay, Gratiot and Montcalm navies and blacks were direct
harvested and colored beans were hand pulled and harvested.

Greg Varner, Michigan Dry Edible Bean Production Research Advisory Board														
Variety	Class	Plant Type	Maturity	Origin	BCMV	Anthracnose		Canning Quality	White Mold	Halo Blight	Common Blight	Rust	Air Pollution	Direct Cut-Rating
						73	7							
Vista	N	USV	F	GEN	R-I	S	R	2	2	R	S	T	T	2
Medalist	N	USV	F	COOP	R-I	S	R	3	2	R	S	T	T	2
GTS 544	N	USV	F	GEN	R-I	S	R	2	4	T	S	T	T	2
Reliant	N	USV	F	GEN	R-I	S	R	3	2	R	S	T	T	2
Hyland T9905	N	USV	M	HYLAND	R-I	S	R	2	2	R	S	T	T	2
Merfin	N	USV	M-F	COOP	R-I	S	R	3	2	R	S	T	T	2
Indi	N	USV	M-F	ADM	R-I	S	R	3	2	R	S	T	T	1
Othello	P	V	E	USDA	R	S	S	4	3	T	S	S	S	5
Buster	P	USV	M	SEMINIS	R-I	S	S	2	3	T	S	R	T	4
Santa Fe	P	USV	M	MSU	R-I	S	R	3	2	T	S	R	T	3
La Paz	P	USV	M	ADM	?	S	?	3	2	T	S	R	T	2
Lariat	P	USV	M	NDSU	?	S	?	3	2	T	S	R	T	3
Condor	B	USV	F	MSU	R-I	R	R	5	2	R	S	T	T	2
T-39	B	SV	F	UCD	R-I	S	S	3	3	R	S	T	T	4
Midnight	B	USV	F	CUNY	R-I	S	S	4	3	R	S	T	T	2
Domino	B	USV	F	MSU	R-I	S	S	4	2	R	S	T	T	2
Jaguar	B	USV	F	MSU	R-I	R	R	5	2	R	S	T	T	3
Black Velvet	B	USV	F	SEMINIS	R-I	S	R	4	3	R	S	T	T	2
Zorro	B	USV	F	MSU	R-I	S	R	5	2	R	S	T	T	2
Eclipse	B	USV	M	NDSU	R-I	S	R	4	2	R	S	T	T	2
Shania	B	USV	F	ADM	R-I	S	?	3	3	R	S	T	T	2
Loreto	B	USV	F	COOP/ADM	R-I	R	R	3	2	R	S	T	T	2
Chinook 2000	LRK	B	F	MSU	R-I	R	R	3	2	R	S	T	T	6
Calif. ELRK	LRK	B	E	UCD	R-I	R	S	3	2	S	S	T	T	6
Clouseau	LRK	B	M	SEMINIS	R-I	R	S	3	2	S	S	T	T	6
Pink Panther	LRK	B	M	SEMINIS	R-I	R	S	3	2	S	S	T	T	6
Montcalm	DRK	B	F	MSU	R-I	R	S	4	2	R	T	T	T	6
Red Hawk	DRK	B	F	MSU	R-I	R	R	4	2	T	S	T	T	6
Red Rover	DRK	B	F	SEMINIS	R-I	R	R	4	2	S	S	T	T	6
SVM Taylor	C	B	E	ADM	R-I	R	S	2	3	S	S	T	T	6
Etna	C	B	E	SEMINIS	R-I	R	S	2	2	S	S	T	T	6
Chianti	C	SV	M	SEMINIS	R-I	S	S	5	3	S	S	T	T	6
Capri	C	B	M	MSU	R-I	R	S	3	3	S	S	T	T	6
Hooter	C	B	F	SEMINIS	R-I	S	S	2	3	S	S	T	T	6
Merlot	SR	USV	M	MSU/USDA	R	S	S	4	2	R	S	T	T	2
Matterhorn	GN	USV	E	MSU	R-I	S	S	3	4	T	S	R	T	3
Tebo	W	B	M	JAPAN	S	R	S	2	3	T	S	S	S	4
Fuji Tebo	W	B	M	MSU	R-I	R	S	3	3	T	S	S	S	4
Beluga	WK-AL	B	F	MSU	R-I	R	S	3	3	S	S	T	T	6
Aurora	SW	SV	M	CUNY	R-I	S	S	3	3	R	S	R	S	4

Plant Type: B=Bush, SV=Short Vine, USV=Upright Short Vine, V=Vine
Maturity: E=Early (less than 88 days), M=Mid-Season (89-95 days), F=Full Season (96-102 days), L=Late Full Season (greater than 102 days)
Canning Quality: 1=Poor, 2=Fair, 3=Good, 4=Above Average, 5=Excellent
White Mold: 1=Less than 10% Infection, 2=Less than 20% Infection, 3=20-40% Infection, 4=40-60% Infection, 5=Greater than 60% Infection
Direct Cut Rating: 1=Very erect, 2=lodging, pods off ground, 3=lodging, pods close to ground, 4=high yield loss, 5=severe yield loss, 6=not recommended

2012 Weed Control Guide for Field Crops

Dr. Christy Sprague, Department of Crop and Soil Science, Michigan State University

TABLE 5B – Dry Edible Bean Herbicides – Remarks and Limitations

Dry Edible Beans — Preplant Incorporated Only

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses	EPTC (<i>Eptam</i>)	2.25	1.25 qt 7EC	<ul style="list-style-type: none"> • Apply preplant incorporated only. • Refer to Table 5A for weed control and crop tolerance ratings. • Incorporate immediately after application. • <i>Eptam</i> suppresses common ragweed and wild mustard. • Prowl (pendimethalin), trifluralin, or Sonalan should be tank mixed with <i>Eptam</i> for additional broadleaf control, including lambsquarters. • <i>Pursuit</i> (2 oz) can be added to tank mixes with <i>Prowl</i>, <i>trifluralin</i>, or <i>Sonalan</i> for nightshade control. • <i>Pursuit</i> (2 oz) may also be applied preemergence after preplant incorporated applications of <i>Eptam</i> tank mixed with <i>Prowl</i>, <i>trifluralin</i>, or <i>Sonalan</i>. See remarks for <i>Pursuit</i>. • A postemergence application of <i>Basagran</i>, <i>Pursuit</i> or <i>Raptor</i> may be necessary for additional broadleaf control. • DO NOT use on adzuki beans. • Refer to label and Table 12 for crop rotation restrictions.
Annual grasses Annual broadleaves	alachlor (<i>IntRRo</i>) OR (<i>Micro-Tech</i>)	2	2 qt 4EC OR 2 qt 4ME	<ul style="list-style-type: none"> • Apply preplant incorporated only. • Refer to Table 5A for weed control and crop tolerance ratings. • Alachlor should be incorporated in the top 2 inches of soil to minimize the danger of bean injury. • DO NOT use on sands or sandy loam soils – injury can occur. • Alachlor provides better nightshade and pigweed control than metolachlor products. • <i>Prowl</i>, <i>trifluralin</i> or <i>Sonalan</i> can be tank-mixed for lambsquarters control. • <i>Pursuit</i> (2 oz) can be tank mixed for nightshade and additional broadleaf control. • A postemergence application of <i>Basagran</i>, <i>Pursuit</i> or <i>Raptor</i> may be necessary for additional broadleaf control. • DO NOT use on adzuki beans. • Refer to label and Table 12 for crop rotation restrictions.
	pendimethalin (<i>Prowl</i>) OR (<i>Prowl H₂O</i>)	0.75	1.8 pt 3.3EC OR 1.6 pt 3.8CS	<ul style="list-style-type: none"> • Apply preplant incorporated only. • Refer to Table 5A for weed control and crop tolerance ratings. • Incorporate immediately after application. • <i>Prowl</i> provides better velvetleaf control than <i>trifluralin</i> or <i>Sonalan</i>. • Prowl should be tank mixed with <i>Eptam</i>. Other measures may need to be taken for additional broadleaf control. • Refer to label and Table 12 for crop rotation restrictions.

(Continued on next page)

Dry Edible Beans — Preplant Incorporated Only (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
<i>(continued)</i>				
Annual grasses Annual broadleaves	mazethapyr + pendimethalin <i>(Pursuit Plus)</i>	0.47	20 oz 2.9EC	<ul style="list-style-type: none"> • Apply preplant incorporated only. • Refer to Table 5A for weed control and crop tolerance ratings. • DO NOT use on sands or loamy sand soils. • DO NOT apply <i>Pursuit Plus</i> if cold and/or wet conditions are present or predicted to occur within one week of application. • Delayed maturity may result from applications of <i>Pursuit Plus</i>. DO NOT apply if planting is delayed and frost is likely to occur prior to maturity. • 20 oz of <i>Pursuit Plus</i> contains 1.1 pt of <i>Prowl</i> 3.3EC, which may not be adequate grass control under heavy infestations. • On heavy soils with greater than 2% organic matter and heavy weed pressure, 30 oz of <i>Pursuit Plus</i> may be applied. • Dry bean varieties vary in their sensitivity to <i>Pursuit Plus</i>. Use ONLY on navy, black turtle, pinto, kidney and cranberry beans. DO NOT use on DOMINO black or OLATHE pinto beans. • DO NOT apply within 60 days of harvest. • DO NOT use if SUGAR BEETS, CUCUMBERS, CANOLA or TOMATOES are in the rotation; requires 40 months and a soil bioassay. • Refer to label and Table 12 for crop rotation restrictions.
	ethalfluralin <i>(Sonalan)</i>	0.75	2 pt 3EC	<ul style="list-style-type: none"> • Apply preplant incorporated only. • Refer to Table 5A for weed control and crop tolerance ratings. • Incorporate immediately after application. • Sonalan should be tank mixed with Eptam. Other measures may need to be taken for additional broadleaf control. • Refer to label and Table 12 for crop rotation restrictions.
	trifluralin <i>(many)</i>	0.5	1 pt 4EC	<ul style="list-style-type: none"> • Apply preplant incorporated only. • Refer to Table 5A for weed control and crop tolerance ratings. • Incorporate immediately after application. • <i>Trifluralin</i> provides better pigweed control than <i>Prowl</i> or <i>Sonalan</i>. • Trifluralin should be tank mixed with Eptam. Other measures may need to be taken for additional broadleaf control. • Refer to label and Table 12 for crop rotation restrictions.

Dry Edible Beans — Soil Applied

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Annual grasses	s-metolachlor (<i>Dual Magnum</i>) OR (<i>Dual II Magnum</i> , <i>Cinch</i>)	1.27	1.33 pt 7.62EC OR 1.33 pt 7.64EC	<ul style="list-style-type: none"> • May be applied preplant incorporated or preemergence. • Refer to Table 5A for weed control and crop tolerance ratings. • PREPLANT INCORPORATED <i>Dual Magnum</i> minimizes the danger of bean injury. • DO NOT apply if soil is cracking and beans are in the crook stage. • Reduce <i>Dual Magnum</i> rate to 1 pt/A on coarse-textured soils with low organic matter. • Preemergence applications require rainfall for incorporation. Rotary hoe if no rainfall occurs within 7 days. • <i>Dual Magnum</i> provides better yellow nutsedge control than <i>alachlor</i> or <i>Outlook</i>. • <i>Prowl</i>, <i>trifluralin</i> or <i>Sonalan</i> can be tank mixed preplant incorporated for lambsquarters control. • <i>Pursuit</i> (2 oz) can be tank mixed for nightshade and additional broadleaf control. • A postemergence application of <i>Basagran</i>, <i>Pursuit</i> or <i>Raptor</i> may be necessary for additional broadleaf control. • DO NOT apply <i>Dual Magnum</i> within 60 days of harvest. • DO NOT use on adzuki beans. • Refer to label and Table 12 for crop rotation restrictions.
	dimethenamid-P (<i>Outlook</i>)	0.66	14 oz 6L	<ul style="list-style-type: none"> • May be applied preplant incorporated or preemergence. • Refer to Table 5A for weed control and crop tolerance ratings. • PREPLANT INCORPORATED <i>Outlook</i> minimizes the danger of bean injury. • DO NOT apply if soil is cracking and beans are in the crook stage. • Reduce <i>Outlook</i> rate to 12 oz/A on coarse-textured soils with low organic matter. • Navy and black beans are more sensitive to <i>Outlook</i> applications than to <i>Dual Magnum</i>. • Preemergence applications require rainfall for incorporation. Rotary hoe if no rainfall occurs within 7 days. • <i>Outlook</i> provides better pigweed and nightshade control than <i>Dual Magnum</i>. • <i>Prowl</i>, <i>trifluralin</i>, or <i>Sonalan</i> can be tank mixed preplant incorporated for lambsquarters control. • <i>Pursuit</i> (2 oz) can be tank mixed for nightshade and additional broadleaf control. • A postemergence application of <i>Basagran</i>, <i>Pursuit</i>, or <i>Raptor</i> may be necessary for additional broadleaf control. • DO NOT apply <i>Outlook</i> within 70 days of harvest. • DO NOT use on adzuki beans. • Refer to label and Table 12 for crop rotation restrictions.
	metolachlor (<i>Parallel PCS</i>)	1.3	1.33 pt 8EC	<ul style="list-style-type: none"> • May be applied preplant incorporated or preemergence. • <i>Parallel PCS</i> is a mix of the R and S-isomers of metolachlor. Limited research has shown that 1.33 pt/A of these products provide similar activity to s-metolachlor products at 1.33 pt/A. However, <i>Parallel PCS</i> may not provide the consistency, length of control or performance on more difficult to control weeds. Rates would need to be increased to 2.0 pt/A to provide the same amount of s-metolachlor (the more active isomer) in the 1.33 pt/A rate of <i>Dual Magnum/ Dual II Magnum/Cinch</i> (s-metolachlor). • Refer to Table 5A for weed control and crop tolerance ratings. • See remarks and limitations for <i>Dual Magnum</i>. • DO NOT use on adzuki beans. • Refer to label and Table 12 for crop rotation restrictions.

(Continued on next page)

Dry Edible Beans — Soil Applied (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
<i>(continued)</i>				
Annual grasses	glyphosate + s-metolachlor (<i>Sequence</i>) + ammonium sulfate	1.64	3 pt 2.25L + 17 lb/100 gal	<ul style="list-style-type: none"> • May be applied preplant or preemergence. • <i>Sequence</i> contains 0.9 lb a.e./A of glyphosate and 1.2 pt/A of <i>Dual Magnum</i>. • <i>Sequence</i> is best used to control existing vegetation prior to planting no-till dry beans with the residual control of <i>Dual Magnum</i>. • Refer to Table 5A for residual weed control and crop tolerance ratings. • DO NOT apply to emerged dry bean – severe injury will occur. • DO NOT apply more than 3.5 pt/A on coarse textured soils or 4 pt/A on medium and fine textured soils. • Apply only one application per crop year. • Refer to label and Table 12 for crop rotation restrictions.
Annual broadleaves	halosulfuron (<i>Permit/Sandea</i>)	0.023	0.67 oz 75DG	<ul style="list-style-type: none"> • May be applied preplant incorporated or preemergence. • Refer to Table 5A for weed control and crop tolerance ratings. • Reduce the rate of <i>Permit/Sandea</i> to 0.5 oz/A on lighter textured soils with low organic matter. • <i>Permit/Sandea</i> can cause injury under cool and wet growing conditions. • Delayed maturity may result from applications of <i>Permit/Sandea</i>. • Dry bean varieties and classes vary in their tolerance to <i>Permit/Sandea</i>. From MSU research, CAUTION should be taken when applying <i>Permit/Sandea</i> to kidney and black beans. • <i>Permit/Sandea</i> can be tank mixed with <i>Eptam</i> for grass and additional lambsquarters control. • <i>Permit/Sandea</i> can be tank mixed with metolachlor products or <i>Outlook</i> for annual grass control. • <i>Permit/Sandea</i> will not control ALS-resistant weed species. • DO NOT plant SUGAR BEETS within 21 months of a <i>Permit/Sandea</i> application. • Refer to label and Table 12 for crop rotation restrictions.

(Continued on next page)

Dry Edible Beans — Soil Applied (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
<i>(continued)</i>				
Annual broadleaves	imazethapyr <i>(Pursuit)</i>	0.031	2 oz 2L	<ul style="list-style-type: none"> • May be applied preplant incorporated or preemergence. • Refer to Table 5A for weed control and crop tolerance ratings. • DO NOT use on sands or loamy sand soils. • DO NOT apply <i>Pursuit</i> if cold and/or wet conditions are present or predicted to occur within 1 week of application. • Delayed maturity may result from applications of <i>Pursuit</i>. DO NOT apply if planting is delayed and frost is likely to occur prior to maturity. • On heavy soils with greater than 2% organic matter and heavy weed pressure, 3 oz of <i>Pursuit</i> may be applied. • <i>Pursuit</i> can be tank mixed and applied preplant incorporated with <i>Eptam</i> plus <i>trifluralin</i>, <i>Prowl</i>, or <i>Sonalan</i>; or <i>alachlor</i>, <i>Dual Magnum</i> or <i>Outlook</i>; or preemergence with <i>Dual Magnum</i> or <i>Outlook</i>. <i>Pursuit</i> in these mixes will control eastern black nightshade. • Preemergence applications require rainfall for incorporation. Rotary hoe if no rainfall occurs within 7 days. • <i>Pursuit</i> will NOT control common ragweed. • Dry bean varieties vary in their sensitivity to <i>Pursuit</i>. Use ONLY on navy, black turtle, pinto, kidney, and cranberry beans. DO NOT use on DOMINO black or OLATHE pinto beans. • DO NOT apply within 60 days of harvest. • DO NOT use if SUGAR BEETS, CUCUMBERS, CANOLA or TOMATOES are in the rotation; requires 40 months and a soil bioassay. • Refer to label and Table 12 for crop rotation restrictions.
	fomesafen <i>(Reflex)</i>	0.25	1 pt 2L	<ul style="list-style-type: none"> • May be applied preplant surface or preemergence. • Refer to Table 5C for weed control and crop tolerance ratings. • <i>Reflex</i> will provide 4-5 weeks of control and/or suppression of broadleaf weeds. • Rainfall that splashes treated soil onto newly emerged seedlings can cause temporary crop injury. • Tank mixtures or sequential herbicide applications are needed to broaden the spectrum of weed control. • <i>Reflex</i> can be applied only in the Lower Peninsula of Michigan. • DO NOT apply <i>Reflex</i> to the same field in CONSECUTIVE years. • The maximum use rate of <i>Reflex</i> per field is 1 pint per acre. • Refer to Table 12 for crop rotation restrictions.

Dry Edible Beans — Postemergence

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Grasses	quizalofop-P-ethyl (<i>Assure II/Targa</i>)	0.044	7 oz 0.88L	<ul style="list-style-type: none"> • Refer to Table 5A for weed control and crop tolerance ratings. • Treat actively growing grasses (annual grasses up to 4 inches). • DO NOT apply to grasses under stress — poor weed control will result. • DO NOT cultivate within 5 days prior to and 7 days following application. • Allow 30 days between <i>Assure II/Targa</i> application and dry bean harvest. • <i>Assure II/Targa</i> can be tank mixed with <i>Basagran</i> for foxtails and barnyardgrass. Increase the <i>Assure II/Targa</i> rate by 2 oz. • Tank mixes with <i>Pursuit</i> and <i>Raptor</i> are not recommended — grass antagonism will occur. • <i>Assure II/Targa</i> (10 oz/A) plus crop oil concentrate (1% v/v) or nonionic surfactant (0.25% v/v) will control quackgrass 6-10 inches tall. A sequential application of 7 oz/A may be needed 14-21 days later. • Refer to label and Table 12 for crop rotation restrictions.
	+		+	
	crop oil concentrate		1%	
	OR		OR	
	surfactant		0.25%	
	fluzifop-P-butyl (<i>Fusilade DX</i>)	0.188	12 oz 2L	<ul style="list-style-type: none"> • Refer to Table 5A for weed control and crop tolerance ratings. • Apply 6 oz/A of <i>Fusilade DX</i> to control volunteer corn. • Allow 60 days between <i>Fusilade DX</i> application and dry bean harvest. • Two applications 7-14 days apart are usually needed for control of perennial grasses. • Tank mixes with <i>Pursuit</i> and <i>Raptor</i> are not recommended — grass antagonism will occur. • DO NOT apply more than 48 oz/A of <i>Fusilade DX</i> per season. • Refer to label and Table 12 for crop rotation restrictions.
	+		+	
	crop oil concentrate		1%	
	sethoxydim (<i>Poast</i>)	0.19	1 pt 1.5SC	<ul style="list-style-type: none"> • Refer to Table 5A for weed control and crop tolerance ratings. • Reduced rates of <i>Poast</i> (12 oz/A) may be used when barnyardgrass, green and giant foxtail, and fall panicum are less than 4 inches tall and the target species. • DO NOT apply to grasses under stress — poor weed control will result. • DO NOT cultivate within 5 days prior to and 7 days following application. • Allow 30 days between <i>Poast</i> application and dry bean harvest. • <i>Poast</i> is generally less effective than other postemergence grass herbicides for perennial grass control. • Tank mixes with <i>Pursuit</i> and <i>Raptor</i> are not recommended — grass antagonism will occur. • Refer to label and Table 12 for crop rotation restrictions.
	+		+	
	crop oil concentrate		1 qt	
	+		+	
	ammonium sulfate		2.5 lb	

(Continued on next page)

Dry Edible Beans — Postemergence (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
<i>(continued)</i>				
Grasses	clethodim (<i>Select/Arrow</i>)	0.094	6 oz 2EC	<ul style="list-style-type: none"> • Refer to Table 5A for weed control and crop tolerance ratings. • Reduced rates of <i>Select/Arrow</i> (4-5 oz/A) or <i>Select Max</i> (6-8 oz/A) may be used when some grass species are small. • The addition of ammonium sulfate at 2.5 to 4 lb/A has been shown to improve control of difficult to control weeds, e.g., quackgrass, rhizome Johnsongrass, volunteer cereals, and volunteer corn. • DO NOT apply to grasses under stress — poor weed control will result. • DO NOT cultivate within 7 days prior to and 7 days following application. • Allow 30 days between application and dry bean harvest. • <i>Select/Arrow</i> or <i>Select Max</i> can be tank mixed with <i>Basagran</i>. Increase the <i>Select/Arrow</i> rate to 8-10 oz/A and the <i>Select Max</i> rate to 12 oz/A and apply with crop oil concentrate (1% v/v). • Tank mixes with <i>Pursuit</i> and <i>Raptor</i> are not recommended — grass antagonism will occur. • <i>Select/Arrow</i> (8-16 oz/A) plus crop oil concentrate (1% v/v) plus ammonium sulfate (2.5 lb/A) will control quackgrass 4-12 inches tall. A sequential application of 8 oz/A may be needed 14-21 days later. Sequential applications of <i>Select Max</i> (12 + 12 oz/A) are needed to control 4 to 12 inch quackgrass. • Refer to label and Table 12 for crop rotation restrictions.
	+ crop oil concentrate OR (<i>Select Max</i>) + surfactant + ammonium sulfate	0.068	9 oz 0.97EC + 0.25% + 2.5 lb	
Annual Broadleaves	bentazon (<i>Basagran</i>) + crop oil concentrate	0.75	1.25 pt 4L + 1 qt	<ul style="list-style-type: none"> • Refer to Table 5A for weed control and crop tolerance ratings. • Most effective on small weeds. Check <i>Basagran</i> dry bean label for specific rate and proper weed growth stage. • Beans MUST HAVE one fully expanded trifoliolate before application. • Use a minimum of 20 gal. water/A for adequate coverage. • DO NOT apply if dry beans are under stress from herbicide injury, cold or dry weather, or hail damage. • For improved velvetleaf control 28% liquid nitrogen (2-4 qt/A) or ammonium sulfate (2.5 lb/A) can be used INSTEAD OF crop oil concentrate. However, if common ragweed and common lambsquarters are present, a crop oil concentrate must also be included. • Split applications of <i>Basagran</i> (1 pt + 1 pt) plus crop oil concentrate (1 pt + 1 pt) can be used for more consistent common ragweed and lambsquarters control. Make the first application when weeds are less than 1 inch tall, and make second application 10-14 days later. • For CANADA THISTLE and YELLOW NUTSEDGE control, apply sequential applications of <i>Basagran</i> (1.5 pt + 1.5 pt) plus crop oil concentrate (1 qt + 1 qt) when Canada thistle is 6-8 inches tall and yellow nutsedge is 4-6 inches. Make second application 7-10 days later. • Allow 30 days between <i>Basagran</i> application and dry bean harvest. • DO NOT use on adzuki beans. • Refer to label and Table 12 for crop rotation restrictions.

(Continued on next page)

Dry Edible Beans — Postemergence (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
<i>(continued)</i>				
Annual Broadleaves	imazethapyr (<i>Pursuit</i>) + surfactant	0.031	2 oz 2L + 0.25%	<ul style="list-style-type: none"> • Refer to Table 5A for weed control and crop tolerance ratings. • Most effective on small weeds (less than 2 inches). • Beans MUST HAVE one fully expanded trifoliolate before application. • DO NOT apply if dry beans have begun to flower. • Apply <i>Pursuit</i> with non-ionic surfactant (0.25% v/v). • DO NOT add 28% liquid nitrogen (2.5% v/v) or ammonium sulfate (2.5 lb/A) unless at least 8 oz of <i>Basagran</i> is added to "safen" this application. • Increase the rate of <i>Basagran</i> (16 oz) when tank mixed with <i>Pursuit</i> to control common cocklebur and jimsonweed. • Delayed maturity may result from applications of <i>Pursuit</i>. DO NOT apply if planting is delayed and frost is likely to occur prior to maturity. • DO NOT tank mix with postemergence grass herbicides — grass antagonism will occur. • Dry bean varieties vary in their sensitivity to <i>Pursuit</i>. Use ONLY on navy, black turtle, pinto, kidney, and cranberry beans. DO NOT use on DOMINO black or OLATHE pinto beans. • DO NOT apply within 60 days of harvest. • DO NOT use if sugar beets, cucumbers, canola or tomatoes are in the rotation; requires 40 months and a soil bioassay. • DO NOT use on adzuki beans. • Refer to label and Table 12 for crop rotation restrictions.
	imazamox (<i>Raptor</i>) + bentazon (<i>Basagran</i>) + crop oil concentrate + ammonium sulfate	0.032 0.25	4 oz 1L + 8 oz 4L + 1% + 2.5 lb	<ul style="list-style-type: none"> • Refer to Table 5A for weed control and crop tolerance ratings. • Most effective on small weeds (less than 2 inches). • Beans MUST HAVE one fully expanded trifoliolate before application. • DO NOT apply if dry beans have begun to flower. • DO NOT apply if planting is delayed and frost is likely to occur prior to maturity. • Apply <i>Raptor</i> with crop oil concentrate (1% v/v) or a non-ionic surfactant (0.25% v/v). • At least 8 fl oz of <i>Basagran</i> must be tank mixed with <i>Raptor</i>, if ammonium sulfate (12-15 lb/100 gal) or 28% liquid nitrogen (2.5% v/v) are added. <i>Basagran</i> "safens" this application. • Increase the rate of <i>Basagran</i> (16 oz) when tank mixed with <i>Raptor</i> to control common cocklebur and jimsonweed, and to provide good control of common lambsquarters (less than 2 inch tall). • DO NOT tank mix with postemergence grass herbicides — grass antagonism will occur. • DO NOT apply within 60 days of harvest. • DO NOT use the combination of <i>Raptor</i> + <i>Basagran</i> on adzuki beans. <i>Basagran</i> causes significant injury to adzuki beans. • Refer to label and Table 12 for crop rotation restrictions.

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Dry Edible Beans — Postemergence (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
<i>(continued)</i>				
Annual Broadleaves	fomesafen (<i>Reflex</i>) + surfactant	0.25	1 pt 2L + 0.25%	<ul style="list-style-type: none"> • Refer to Table 5A for weed control and crop tolerance ratings. • Most effective on small weeds; common ragweed 4-inches or less and eastern black nightshade 2-inches or less. • Common ragweed less than 4-inches will be controlled with 0.5 pt/A of <i>Reflex</i>. • Beans MUST HAVE one fully expanded trifoliolate before application. • A non-ionic surfactant at 0.25-0.5% v/v or a crop oil concentrate at 0.5-1.0% v/v must be included for effective control. • <i>Reflex</i> can be tank-mixed with <i>Basagran</i>, <i>Raptor</i>, or <i>Pursuit</i>. Include a COC when tank-mixing <i>Reflex</i> + <i>Basagran</i>. ONLY include a non-ionic surfactant when tank-mixing with <i>Raptor</i> or <i>Pursuit</i>. DO NOT add AMS or 28%N. • <i>Reflex</i> can be applied only in the Lower Peninsula of Michigan. • DO NOT apply <i>Reflex</i> to the same field in CONSECUTIVE years. • DO NOT apply within 45 days of harvest. • Refer to Table 12 for crop rotation restrictions.

Table 5C – Preharvest Treatments in Dry Edible Beans

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
Preharvest	glyphosate (many) + ammonium sulfate	0.75 lb a.e.	See Table 10 + 17 lb/100gal	<ul style="list-style-type: none"> • Glyphosate should ONLY be used to control weeds that hinder harvest. • Not all glyphosate products are labeled for Preharvest application in dry edible beans. Consult product labels for legal applications. <i>Roundup</i> branded products, <i>Duramax</i>, <i>Durango DMA</i>, <i>Touchdown Total</i> and <i>Traxion</i> are some glyphosate products that are currently labeled. • DO NOT use glyphosate for vine desiccation — residues of glyphosate have been found in harvested beans if applications are made too early. • Glyphosate should be applied when beans are in the hard dough stage (30% moisture or less). • Glyphosate applications should be made at least 7 days before harvest. • ONLY one application should be made per year. • DO NOT apply glyphosate to beans grown for seed. • DO NOT feed treated vines and hay from these crops to livestock.
	paraquat (<i>Gramoxone Inteon</i>) + surfactant	0.3-0.5	1.2–2 pt 2SL + 0.25%	<ul style="list-style-type: none"> • <i>Gramoxone Inteon</i> is a restricted-use pesticide. • Apply when crop is mature, at least 80% of the pods are yellowing and mostly ripe and no more than 40% (bush-type beans) or 30% (vine-type beans) of the leaves are still green. • Always add a non-ionic surfactant at 0.25% v/v or a crop oil concentrate at 1% v/v. • Apply by air in 5 gal water/A or by ground in 20-40 gal of water/A. • If growth is lush and vigorous, make either a single application of the higher rate of <i>Gramoxone Inteon</i>, or split applications at the lower rates. Split applications may improve vine coverage. DO NOT exceed 2.0 pt/A of <i>Gramoxone Inteon</i>. • Do not harvest within 7 days of application.
	paraquat (<i>Parazone</i>) + surfactant	0.5	1.33 pt 3SL + 0.25%	<ul style="list-style-type: none"> • <i>Parazone</i> is a restricted-use pesticide. • <i>Parazone</i> contains the same active ingredient as <i>Gramoxone Inteon</i> (paraquat), but is at a different concentration. • See the Remarks and Limitation section for <i>Gramoxone Inteon</i>.
	saflufenacil (<i>Sharpen</i>) + methylated seed oil + ammonium sulfate	0.023	1 oz 2.85L + 1% + 17 lb/100 gal	<ul style="list-style-type: none"> • Apply when crop is mature – at least 80% of the pods are yellowing and mostly ripe and no more than 40% (bush-type beans) or 30% (vine-type) beans of the leaves are still green. • <i>Sharpen</i> can be applied at rates up to 2 oz/A. • Dry beans can be harvested 2 days after application. However, it generally takes 7 days to reach maximum desiccation activity. • <i>Sharpen</i> is an effective desiccant. • DO NOT apply to beans grown for seed. • DO NOT graze or feed desiccation-treated hay or straw to livestock. • Refer to label and Table 12 for crop rotation restrictions.

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Preharvest Treatments in Dry Edible Beans (continued)

Weed Controlled	Herbicide	Rate lb/A a.i.	Formulation/A	Remarks and Limitations
<i>(continued)</i>				
Preharvest	flumioxazin (<i>Valor</i>) + methylated seed oil	0.05	1.5 oz 51WG + 1 qt	<ul style="list-style-type: none"> • Apply when crop is mature – at least 80% of the pods are yellowing and mostly ripe and no more than 40% (bush-type beans) or 30% (vine-type beans) of the leaves are still green. • <i>Valor</i> can be applied at rates up to 2 oz/A. • Dry beans can be harvested 5 days after <i>Valor</i> application. However, it generally takes 7 to 14 days to reach maximum desiccation activity. • Dry bean desiccation is similar to that from <i>Gramoxone</i> and glyphosate; however, the spectrum of weed control is not as broad. • <i>Valor</i> provides residual activity that may reduce winter annual growth. • Follow sprayer clean-up instructions — residues of <i>Valor</i> can be trapped in poly-tanks and hoses if not adequately cleaned. • Crop rotation restrictions are dependent on rainfall, <i>Valor</i> use rate and tillage. • Rotation restrictions for 2 oz or less of <i>Valor</i> are 1 month with 1 inch of rain for corn and winter wheat. Dry bean and barley may be planted after 3 months, and alfalfa, oats and sugar beets may be planted after 4 months if the ground is tilled prior to planting or 8 months if no tillage is performed. Note: In Michigan research trials, planting sugar beet no-till the spring following a <i>Valor</i> preharvest treatment resulted in major sugar beet stand reduction. Tillage reduced the effect of <i>Valor</i> on sugar beet; however, slight injury may occur on sandier soils. • Refer to label and Table 12 for crop rotation restrictions.

TABLE 5A – Weed Response to Herbicides in Dry Edible Beans*

SITE OF ACTION	CROP TOLERANCE**	ANNUAL BROADLEAVES										ANNUAL GRASSES								PERENNIALS					
		COCKLEBUR	JIMSONWEED	LAMBSQUARTERS	NIGHTSHADE (E. BLACK)	PIGWEEED	RAGWEED (COMMON)	SMARTWEED	VELVETLEAF	WILD MUSTARD	BARNYARDGRASS	CRABGRASS	GIANT FOXTAIL	GREEN FOXTAIL	YELLOW FOXTAIL	FALL PANICUM	WITCHGRASS	SANDBUR	BINDWEED (FIELD)	BINDWEED (HEDGE)	CANADA THISTLE	QUACKGRASS	YELLOW NUTSEDEGE		
Preplant Incorporated																									
DUAL MAGNUM/PARALLEL	15	2	N	N	P	F	G	P	P	N	P	E	E	E	E	E	G	G	F	N	N	N	N	G	
EPTAM	8	2	P	P	G	F	F	F	F	F	F	E	E	E	E	E	E	E	G	N	N	N	F	F	
INTRRO	15	3	N	N	P	G	G	P	P	N	P	E	E	E	E	E	G	G	F	N	N	N	N	F	
OUTLOOK	15	3 ^a	N	N	P	G	G	P	P	N	P	E	E	E	E	E	G	G	P	N	N	N	N	F	
PROWL H ₂ O/PROWL	3	1	N	N	G	P	F	P	P	F	P	E	E	E	E	E	E	E	G	N	N	N	N	N	
PURSUIT	2	3	F	F	P	E	E	P	F	F	G	P	P	F	F	F	P	P	P	N	N	N	N	F	
PURSUIT PLUS	2/3	3	F	F	G	E	E	P	F	G	G	E	E	E	E	E	E	E	G	N	N	N	N	F	
SONALAN	3	1	N	N	G	F	G	P	P	N	P	E	E	E	E	E	E	E	G	N	N	N	N	N	
TRIFLURALIN	3	1	N	N	G	N	G	N	P	N	P	E	E	E	E	E	E	E	G	N	N	N	N	N	
Preemergence																									
DUAL MAGNUM/PARALLEL	15	2	N	N	P	F	G	P	P	N	P	E	E	E	E	E	G	G	F	N	N	N	N	F	
OUTLOOK	15	3 ^a	N	N	P	G	G	P	P	N	P	E	E	E	E	E	G	G	P	N	N	N	N	F	
PERMIT/SANDEA	2	3	F	F	F	P	E	G	P	G	E	N	N	N	N	N	N	N	N	N	N	N	N	F	
PURSUIT	2	3	P	P	P	E	E	P	F	P	G	P	P	F	F	F	P	P	P	N	N	P	N	F	
REFLEX	14	2	P	P	G	E	E	G	G	P	E	N	N	N	N	N	N	N	N	N	N	N	N	N	
SEQUENCE ^b	9/15	2	N	N	P	F	G	P	P	N	P	E	E	E	E	E	G	G	F	N	N	N	N	F	
Postemergence																									
ASSURE II/TARGA	1	1	N	N	N	N	N	N	N	N	N	G	G	E	E	G	E	E	E	N	N	N	E	N	
BASAGRAN ^c	6	2	E	G	F	P	P	F	E	G	E	N	N	N	N	N	N	N	N	N	N	G	N	G	
FUSILADE DX	1	1	N	N	N	N	N	N	N	N	N	E	G	E	E	E	E	E	E	N	N	N	G	N	
POAST	1	1	N	N	N	N	N	N	N	N	N	E	G	E	E	E	E	E	E	N	N	N	F	N	
PURSUIT ^d	2	3	F	P	P	E	E	P	F	F	E	P	P	F	P	P	P	P	P	N	N	P	N	F	
PURSUIT ^d + BASAGRAN	2/16	2	E	G	F	E	E	F	G	G	E	P	P	F	P	P	P	P	P	N	N	G	N	G	
RAPTOR ^d	2	3	F	F	F	E	E	P	F	G	E	F	P	F	P	P	P	P	P	N	N	P	N	P	
RAPTOR ^d + BASAGRAN (8 oz)	2/6	2	G	F	F	G	E	E	F	G	G	E	F	P	F	P	P	P	P	P	N	N	F	N	F
RAPTOR ^{de} + BASAGRAN (16 oz)	2/6	2	E	G	G	E	E	F	E	G	E	P	P	F	P	P	P	P	P	N	N	G	N	F	
REFLEX	14	2	P	F	P	G	G	E	P	P	E	N	N	N	N	N	N	N	N	N	N	N	N	N	
REFLEX + BASAGRAN	6/14	2	E	G	F	G	G	E	E	G	E	N	N	N	N	N	N	N	N	N	N	F	N	G	
REFLEX + RAPTOR ^e	2/14	3	F	F	F	E	E	E	F	G	E	F	P	F	P	P	P	N	N	N	N	P	N	P	
SELECT/SELECT MAX/ARROW	1	1	N	N	N	N	N	N	N	N	N	E	G	E	E	E	E	E	E	N	N	N	G	N	

Herbicide Site of Action: The site of action key is located on pages 16-17.

Herbicide Effectiveness: P = Poor; F = Fair; **G** = Good; **E** = Excellent; N = None

* The above ratings are a relative comparison of herbicide effectiveness. Weather conditions greatly influence the herbicide's effectiveness, and weed control may be better under favorable conditions or poorer under unfavorable conditions.

** Crop Tolerance: 1 = Minimal risk of crop injury; 2 = Crop injury can occur under certain conditions (soil applied — cold, wet; foliar applied — hot, humid); 3 = Severe crop injury can occur. Follow precautions under Remarks and Limitations and on the label; 4 = Risk of severe crop injury is high.

^a Crop tolerance for navy and black beans = 3. For other bean classes, crop tolerance = 2. Preplant incorporation will increase tolerance of navy and black beans to *Outlook*.

^b Sequence is a premixture of *Dual Magnum* and glyphosate and should be used to control existing vegetation prior to planting dry beans. See Remarks and Limitations section.

^c Control of **hairy nightshade** with *Basagran* is good.

^d Control of **hairy nightshade** with *Pursuit* and *Raptor* is excellent.

^e **Common lambsquarters** will be controlled with this tank mixture **if** the weeds are less than 2 inches tall and **not** under drought stress.

