Texas High Plains Vegetable & Weed Control Research Program

2003 Research Summary Report

Texas A & M University
Department of Horticultural Sciences
Texas Agricultural Experiment Station &
Texas Cooperative Extension

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INTRODUCTION:

This is the first Annual Research Summary Report for the Vegetable and Field-Grown Ornamentals Program conducted by Dr. Russ Wallace. The program is located at the Texas A & M University Research & Extension Center in Lubbock. The main objectives of the program are to evaluate herbicides and other weed control options for vegetable and ornamental production on the High Plains of Texas and to assist horticultural growers throughout the state. Other research trials may be incorporated into the program and include areas such as vegetable variety testing, crop production practices, evaluation of biological growth products and other alternative options in the horticulture industry.

This program would not have been nearly as successful without the support of many individuals, companies and volunteers. Many thanks to Bo Kesey, my research technician, and to our summer assistants Matt Pruner and Blake Westhoff for their field assistance throughout the season. The support I received from Jeff Koym, Potato Breeding Research Associate and from the farm crews at both the Lubbock and Halfway Research & Extension Centers was invaluable. Many thanks also to Wendy Durrett, Extension Secretary for all her support, and to all the Extension and Experiment Station personnel. Finally, thanks to those Lubbock Master Gardeners who volunteered their time to help out with the harvesting of several trials.

With 2003 being my first full year on the Texas High Plains, I have learned much about vegetable and ornamental crop production in this region of the world, and this experience has added to my respect for the horticulture growers in the area. Some of the trial summaries reported herein are incomplete due to a variety of reasons including but not limited to severe dust and hail storms, high winds, heavy rainfall, jack rabbits, viruses and other circumstances including just all around bad luck!

Note: This report is not intended to be a book of recommendations for using unregistered pesticides on vegetable or ornamental crops in Texas. Growers should always read and follow label directions.

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Listed below are those who financially and/or otherwise supported the program during 2003, who without their support this program would not be possible. Many thanks to all of you.

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Abbott & Cobb
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Dow AgroSciences
Gowan Company
J & D Produce
K.F. Thiel's
South Plains Compost
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COOPERATORS:

Texas A & M University Research & Extension Center - Halfway	Doug Nesmith (Farm Manager), Larry Vrubel, Andrew Hurt, Landon Walker
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Springlake Potatoes (Springlake)	Bruce Barrett
TAMU – Potato & Cowpea Breeding Program	Dr. Creighton Miller, Jeff Koym

LIST OF CHEMICALS FOR TRIALS

CHEMICAL	PRODUCT NAME	COMPANY
Acifluorfen-sodium	UltraBlazer 2EC	BASF
Bensulide	Prefar 4E	Gowan
Bentazon	Basagran 4L	Micro Flo
Bispyribac-sodium	Regiment 80WP	Valent
Carfentrazone-ethyl	Aim 2EC	FMC
Clethodim	Select 2EC	Valent
Clomazone	Command 3ME	FMC
Clopyralid	Stinger 3EC	Dow AgroSciences
Cloransulam-methyl	FirstRate 84WDG	Dow AgroSciences
DCPA	Dacthal W-75	AMVAC
Cycloate	Ro-Neet 6E	Helms Agro
Diflufenzopyr	Distinct 70WDG	BASF
Dimethenamid-P	Outlook 6E	BASF
Dithiopyr	Dimension 1EC	Dow AgroSciences
Ethalfluralin	Curbit 3EC	UAP
Ethalfluralin + Clomazone	Strategy 2.1EC	UAP
Flufenacet	Define 4SC	Bayer CropScience
Ethofumesate + Desmedipham + Phenmedipham	Progress 1.8EC	Bayer CropScience
Flumetsulam	Python 80WDG	Dow AgroSciences
Flumioxazin	Valor 51WDG	Valent
Fluroxypyr	Starane 1.5EC	Dow Agro Sciences
Halosulfuron-methyl	Sandea 75WDG	Gowan
Imazamox	Raptor 1AS	BASF
Imazapic	Plateau 23.6WG	BASF
Imazethapyr	Pursuit 2 EC	BASF
Isoxaben	Gallery 75DF	Dow AgroSciences
Isoxaflutole	Balance 75WDG	Bayer CropScience
Lactofen	Cobra 2EC	Valent
Linuron	Linex 50DF	Griffin
Mesotrione	Callisto 4SC	Syngenta
s-Metolachlor	Dual Magnum 7.62E	Syngenta
Oryzalin	Surflan 4AS	Dow AgroSciences
Paraquat	Gramoxone 2.5EC	Syngenta
Oxyfluorfen	Goal 2XL	Dow AgroSciences
Pendimethalin	Prowl 3.3EC	BASF
Phenmedipham	Spin-Aid 1.3EC	Bayer CropScience
Prodiamine	Barricade 4FL	Syngenta
Pyrithiobac-sodium	Staple 85WG	DuPont
Rimsulfuron	Matrix 25DF	DuPont
Sethoxydim	Poast 1.5EC	Micro Flo
Sulfentrazone	Spartan 75WDG	FMC
Thiobencarb	Bolero 8EC	Valent
Trifloxysulfuron	Envoke 75WDG	Syngenta
Trifluralin	Trifluralin HF 4EC	UAP

Evaluation of Herbicide Treatments on Weed Control and Yield in Cantaloupes: 2003

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Final Report

Objective: to evaluate and compare the efficacy of selected herbicide treatments on Palmer Amaranth (*Amaranthus palmeri*) control and crop injury and yield in cantaloupes (*Cucumis melo*).

Materials and Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center located in Lubbock on an Acuff clay loam with an average pH of 7.6 and 1.1% organic matter. The trial site was plowed in the fall and the soil prepared by applying a pre-plant fertilizer (50 lbs / A nitrogen) and then disking and listing furrows into the soil. Cantaloupe (var. "AChaparral") were seeded in the greenhouse on April 23 and transplanted into the field on May 17 at a spacing of 18" in plots measuring 6" x 15' (7 plants / plot). Supplemental fertilizer was broadcast on June 17 at 30 lbs N / A and irrigated in. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Application data can be found in Tables 1 and 2 below for the pre-transplant and postemergence treatments, respectively. Plots were furrow-irrigated as needed during the season. Plots were harvested 3 times during the trial period. Random rabbit feeding caused plant death in some plots, thus harvested yields were adjusted to the 7 plants / plot spacing. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Application Data for Pre-transplant Herbicides

Location	Lubbock	Wind speed / direction	0
Date	May 17, 2003	Crop	Cantaloupe
Time of day	11:00 a.m.	Variety	AChaparral
Type of application	Broadcast	Crop stage	2 – 3 leaves
Carrier	Water	Air temp. (°F)	79
Gas (if not CO_2)	CO_2	Soil temp. (°F)	72
GPA	20	Soil beneath	Semi-dry
PSI	30	Soil surface	Dry / cloddy
Nozzle tips	Teejet 8002VS	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 2. Application Data for Postemergence Treatments

Location	Lubbock	Wind speed / direction	5 – 10 mph / S
Date	June 7, 2003	Crop	Cantaloupe
Time of day	8:30 a.m.	Variety	AChaparral
Type of application	Broadcast	Crop stage	6 – 7 leaves
Carrier	Water	Air temp. (°F)	65
Gas (if not CO_2)	CO_2	Soil temp. (°F)	60
GPA	20	Soil beneath	Wet
PSI	30	Soil surface	Moist
Nozzle tips	Teejet 8002VS	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5' / 3.25'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Results: Significant crop injury was observed 25 and 47 days after treatment (DAT) in plots treated with pre-transplant applications of s-metolachlor (both rates), dimethenamid-P and sulfentrazone. Significant injury was also observed from POST treatments with pyrithiobac 27 DAT. Palmer amaranth control was generally good to excellent (> 80%) with all herbicide treatments. Adjusted cantaloupe yields were highly variable. Only the pre-transplant applied sulfentrazone applications significantly reduced yields in this trial. While significant crop stunting was observed in the dimethenamid-P treatment, yields were greatest in those plots and average 15% higher than the next highest yielding plot. Yields in s-metolachlor treated plots were reduced regardless of rate applied. Bensulide combined with trifluralin or flumioxazin applied Post-directed showed excellent weed control and yields.

Table 3. The effect of Herbicide treatments on Palmer Amaranth Control and Cantaloupe Injury and Yields

Chemical	Rate lbs a.i.	Timing	% Injury June 11	% Injury July 3	% Control Palmer Amaranth August 18	Adjusted Yield No. of Fruit / A	Adjusted Yield Total lbs / A	Adjusted Yield Lbs / Fruit
Untreated			0	0	0	9147	21758	3.1
Bensulide 4E + Trifluralin HF	6.0 1.0 pt	Pre-trans + Directed spray @ 3 – 4 leaves	10.0	3.8	99.0	6857	22950	3.3
Bensulide 4E + Flumioxazin 51WP	6.0 0.025	Pre-trans + POST - Row Middles	18.8	8.8	92.3	6835	24450	3.6
s-Metolachlor 7.62E	0.66	Pre-trans	16.3	38.8	88.8	4415	15860	2.7
s-Metolachlor 7.62E	1.32	Pre-trans	46.3	60.0	92.3	5012	16926	3.2
Dimethenamid-P 6E	0.75	Pre-trans	40.0	46.3	86.3	7509	28732	3.8
Sulfentrazone 75WDG	0.1875	Pre-trans	41.3	31.3	92.3	5680	22248	3.9
Sulfentrazone 75WDG	0.25	Pre-trans	70.0	80.0	95.8	3526	10437	2.2
Bensulide 4E	6.0	Pre-trans	2.5	12.5	92.3	3746	12754	3.7
Ethalfluralin + Clomazone 2.1EC (Strategy)	3.0 pts	Banded between rows after transplant	3.8	18.8	80.0	3884	15052	3.6
Trifluralin HF + Halosulfuron 75WDG	1.0 pt 0.048	Directed spray 3 – 4 leaves	6.3	23.8	97.0	5781	19945	3.5
Pyrithiobac	0.027	POST	11.3	31.3	94.5	4984	18909	3.6
LSD (0.05)			**18.0**	**26.6**	**9.0**	**4808**	**16133**	**1.7**

Evaluation of Herbicides for Crop Injury and Weed Control in Pumpkins: 2003

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Final Report

Objective: to evaluate the efficacy and phytotoxicity of preemergence and early postemergence applications of herbicides on Palmer amaranth (*Amaranthus palmeri*) control and pumpkin yields.

Materials and Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center located in Lubbock on an Acuff clay loam soil with an average pH of 7.6 and 1.1% organic matter. The trial site was plowed in the fall and the soil prepared in the spring by applying a pre-plant fertilizer (50 lbs / A nitrogen) and disking and listing furrows in the soil. Pumpkins (var. "Howden") were planted June 4 using a Monosem Vacuum Planter, and plants later thinned to a distance of 3' for a total of 10 plants/plot. Individual plots measured 13' x 30' and contained one row of pumpkins. Supplemental fertilizer was broadcast once at 30 lbs N / A, and irrigated in. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Application data can be found in Tables 1, 2 and 3 for the preemergence (PRE) and early postemergence (EPOST) treatments, respectively. Plots were furrow-irrigated as needed during the season. Insect and disease populations were maintained using standard chemical sprays. Pumpkins were harvested by hand during the first week of October, and weighed accordingly. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference (α = 0.05).

Table 1. Application Data for Preemergence Treatments

Location	Lubbock	Wind speed / direction	10 – 20 mph / E
Date	June 4, 2003	Crop	Pumpkins
Time of day	6:00 p.m.	Variety	Howden
Type of application	Broadcast	Crop stage	Seed
Carrier	Water	Air temp. (°F)	80
Gas (if not CO_2)	CO_2	Soil temp. (°F)	70
GPA	20	Soil beneath	Dry
PSI	30	Soil surface	Dry
Nozzle tips	Teejet 8002VS	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Overcast
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 2. Application Data for Postemergence Treatments

Location	Lubbock	Wind speed / direction	15 - 20 mph / S
Date	June 24, 2003	Crop	Pumpkins
Time of day	8:00 a.m.	Variety	Howden
Type of application	Broadcast / Post-Direct	Crop stage	3 – 5 leaves
Carrier	Water	Air temp. (°F)	82
Gas (if not CO_2)	CO_2	Soil temp. (°F)	75
GPA	20	Soil beneath	Wet
PSI	30	Soil surface	Wet
Nozzle tips	Teejet 8002VS	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5' / 3.25	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: Palmer amaranth (2 – 4")			

Table 3. Application Data for Post-Direct Treatment #17

Location	Lubbock	Wind speed / direction	0 mph
Date	July 3, 2003	Crop	Pumpkins
Time of day	6:15 a.m.	Variety	Howden
Type of application	Post-Direct	Crop stage	5 - 8 leaves
Carrier	Water	Air temp. (°F)	72
Gas (if not CO_2)	CO_2	Soil temp. (°F)	73
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Dry / compact
Nozzle tips	Teejet 8002VS	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	3.25'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: Palmer amaranth (3 – 5")			

Results: Percent crop injury (stunting) recorded on July 1 from applied herbicides was greatest with PRE + POST halosulfuron (27.5 – 47.5%) treatments regardless of rate, and these were significantly higher when compared to the handweeded control (Table 4). Increased crop injury was likely the result of excessive rainfall (1.5 – 2") that followed irrigation immediately after the PRE treatments were applied. Where halosulfuron treatments were applied EPOST at the 3 – 5 leaf stage following either bensulide or clomazone + ethalfluralin applications, there was only moderate pumpkin injury (12.5 – 21.3%). Regardless of the application rate, there was little to no injury recorded in plots treated PRE with s-metolachlor, dimethenamid-P, clomazone, or any of their combinations. By August 2 injury in all plots was reduced to levels of 18.8% or less. Only plots treated with PRE + EPOST applications of halosulfuron continued to have the highest degree of crop injury when compared to all other treatments, and this was significantly higher than the handweeded control. Additionally, treatments of PRE halosulfuron + EPOST-Direct trifluralin also had significant injury greater than 10%.

Control of Palmer amaranth recorded July 1 was 90% or better with all herbicide treatments and their combinations (Table 4). By August 2 weed control continued to remain 90% or above for all treatments except those treated PRE with clomazone (76.3%), clomazone + ethalfluralin (80.0%) or EPOST trifluralin (66.3%). An EPOST application of halosulfuron at the 3 – 5 leaf stage significantly improved control of Palmer amaranth when either clomazone + ethalfluralin or trifluralin were applied PRE.

The number of pumpkin fruit per acre was significantly reduced in the untreated plots or when PRE + EPOST halosulfuron was applied at the highest rate (35% reduction) when compared to the handweeded plots. On the contrary, average individual fruit weight was lowest in the handweeded plots when compared to all other treatments, though only significantly when compared to pumpkins treated with bensulide, metolachlor and dimethenamid-P alone or in combination. Finally, total pumpkin yields did not significantly differ between the handweeded controls when any of the herbicides or their combinations was used in this trial. However, some trends in the data were observed and deserve notice. A significant reduction occurred only when herbicides were not applied and when weeds competed with the crop. The highest yields were obtained in plots treated with PRE applications of s-metolachlor followed by dimethenamid-P (alone or in combination) and bensulide (alone or in combination). Where PRE herbicides were weak in controlling Palmer amaranth, an EPOST application of halosulfuron improved weed control and increased yields. However, two applications of halosulfuron (PRE + EPOST) increased crop injury and though not significant, lowered yields as the rate increased. Future research is needed to continue an evaluation of these and other herbicides for controlling Palmer amaranth and other weeds in pumpkins on the Texas High Plains.

Table 4. The Effect of Herbicide Applications on Pumpkins Grown on the Texas High Plains

Chemical	Rate (lbs a.i./A)	Timing	% Injury 7/01/03	% Injury 8/02/03	% Control Palmer Amaranth 7/01/03	% Control Palmer Amaranth 8/02/03	# Fruit / A	lbs / Fruit	Yield (lbs / A)
Untreated			0	0	0	0	1361.3	15.9	20291
Handweed			0	0	99.0	99.0	2668.1	13.7	36517
Halosulfuron 75WDG + *Halosulfuron 75WDG +* *0.25% NIS*	0.024 0.024	PRE POST 3 – 5 leaf	27.5	6.3	99.0	97.0	2640.8	16.0	31656
Halosulfuron 75 WDG + *Halosulfuron* 75 WDG + *0.25% NIS*	0.032 0.032	PRE POST 3 – 5 leaf	47.5	18.8	99.0	90.8	1933.0	15.0	28567
Halosulfuron 75 WDG + *Halosulfuron* 75 WDG + *0.25% NIS*	0.048 0.048	PRE POST 3- 5 leaf	43.8	17.5	99.0	98.0	1742.4	15.4	26580
Bensulide 4E	4.0	PRE	0	0	99.0	93.5	2450.3	14.9	36495
Bensulide 4E	6.0	PRE	3.8	0	99.0	94.5	2504.7	16.8	41578
Bensulide 4E + *Halosulfuron* 75 WDG + *0.25% NIS*	4.0 0.024	PRE POST 3 – 5 leaf	16.3	2.5	99.0	95.8	2178.0	17.1	37045
Bensulide 4E + *Halosulfuron* 75 WDG + *0.25% NIS*	6.0 0.024	PRE POST 3 – 5 leaf	12.5	2.5	99.0	99.0	2531.9	16.1	40723
Trifluralin 4EC	1.0	EPOST-DIRECT @ 1-3 TRUE LF	0	0	92.5	66.3	2096.3	16.2	33884
Halosulfuron 75 WDG + *Trifluralin 4EC*	0.032 1.0	PRE EPOST-DIRECT @ 1-3 TRUE LF	22.5	12.5	99.0	97.0	2150.8	15.7	34010
s-Metolachlor 7.62E	0.65	PRE	0	0	99.0	97.0	2858.6	15.3	44094
s-Metolachlor 7.62E	1.0	PRE	5.0	0	99.0	95.8	2504.7	17.2	42566
Clomazone 3ME	0.25	PRE	0	0	91.0	76.3	1933.0	15.6	29392

Table 4. The Effect of Herbicide Applications on Pumpkins Grown on the Texas High Plains (Continued)

Chemical	Rate (lbs a.i./A)	Timing	% Injury 7/01/03	% Injury 8/02/03	% Control Palmer Amaranth 7/01/03	% Control Palmer Amaranth 8/02/03	# Fruit/A	lbs / Fruit	Yield (lbs / A)
Clomazone + *Ethalfluralin 2.1E*	4.0 (pts)	PRE	2.4	0	99.0	80.0	2450.3	16.2	39574
Clomazone + *Ethalfluralin 2.1E +* *Halosulfuron 75 WDG +* *0.25% NIS*	4.0 (pts) 0.024	PRE POST 3 – 5 leaf	21.3	2.5	99.0	92.3	2640.8	14.2	37546
Ethalfluralin 3EC + *Carfentrazone 40EW +* *0.25% NIS*	1.5 0.012	PRE POST-direct	2.5	0	96.0	92.0	2649.8	14.4	38414
Dimethenamid-P 6E	0.75	PRE	5.0	0	99.0	98.0	2423.0	16.4	39667
Dimethenamid-P 6E + *Clomazone 3ME*	0.75 0.25	PRE	5.0	0	99.0	98.0	2314.1	16.5	37658
Dimethenamid-P 6E + *Ethalfluralin 3EC*	0.75 4.0 pts	PRE	0	3.8	99.0	99.0	2314.1	18.2	41028
		LSD (0.05)	**13.0**	**7.1**	**3.1**	**10.2**	**830.1**	**2.6**	**14124**

The Effect of Herbicide Treatments on Direct-Seeded Watermelons: 2003

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Final Report

Objective: to evaluate and compare the efficacy of postemergence herbicides combined with bentazon on crop injury and yield to blackeye peas (*Vigna unguiculata*) grown on the Texas High Plains.

Materials and Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center located in Halfway on a Pullman clay loam soil with an average pH of 7.6 and 1.0% O.M. The trial site was plowed and prepared by applying a pre-plant fertilizer (60 lbs/A nitrogen) and then disking the soil. Watermelon (var. "Legacy") seeds were planted by hand (3 – 4 seeds/hill) on May 21 at a distance of three feet in single row plots measuring 8' x 30'. Plants were later thinned to two plants per hill. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Plots were irrigated overhead as needed during the season, and plots were not handweeded during the season (except the handweeded control). All disease and insect management practices were followed as needed to maintain pests. The plots were harvested by hand on August 18 and weighed accordingly. The experimental design was a randomized complete block with 3 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Application Data for Preemergence Treatments

Location	Halfway	Wind speed / direction	5 – 10 mph / SW
Date	May 24, 2003	Crop	Watermelon
Time of day	10:00 a.m.	Variety	Legacy
Type of application	Broadcast	Crop stage	Seed
Carrier	Water	Air temp. (°F)	75
Gas (if not CO_2)	CO_2	Soil temp. (°F)	60
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Dry
Nozzle tips	8002VS	% Relative humidity	Moderate – High
Nozzle spacing	18"	Sky conditions	Partly cloudy
Boom width (")	6.5'	# Replications	3
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 2. Application Data for Postemergence Treatments

Location	Halfway	Wind speed / direction	0 – 10 mph / NE
Date	June 17, 2003	Crop	Watermelon
Time of day	2:30 p.m.	Variety	Legacy
Type of application	Post-Direct	Crop stage	2 –3 leaves
Carrier	Water	Air temp. (°F)	88
Gas (if not CO_2)	CO_2	Soil temp. (°F)	85
GPA	20	Soil beneath	Semi-moist
PSI	30	Soil surface	Dry compact
Nozzle tips	8002VS	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Mostly sunny
Boom width (")	6.5'	# Replications	3
Boom height (")	18"	Sprayed by	RWW
Weeds present: Palmer amaranth (2 – 6"); Common purslane (1 – 2")			

Results: Crop injury in the form of stunting recorded on June 19 was greatest in treatments of sulfentrazone (0.10 lb a.i.) and carfentrazone applied with a directed-hood spray. Sulfentrazone injury resulted from preemergence applications, while that of carfentrazone occurred as a result of post-directed sprays. The stunting associated with carfentrazone treatments was likely a result of the leaf necrosis that occurred soon after those treatments were applied. Leaf necrosis ratings recorded June 19 showed that carfentrazone treatments had significantly higher injury compared to all other treatments. The leaf necrosis likely occurred as a result of drift from under the hooded spray during periods of gusty winds.

Weeds present in the trial site included Palmer amaranth (*Amaranthus palmeri*) and common purslane (*Portulaca oleracea*). Control of Palmer amaranth was greatest (90% or better) in treatments that included bensulide + halosulfuron, s-metolachlor, dimethenamid-P, sulfentrazone (0.1 lb a.i.), and s-metolachlor + carfentrazone. Poor control was observed with PRE applications of ethalfluralin + clomazone, flufenacet, sulfentrazone (0.05 lb a.i.) and EPOST applications of trifluralin + halosulfuron, or ethalfluralin + clomazone (PRE) + halosulfuron. Control of common purslane generally followed the same trend as those treatments for Palmer amaranth with a few exceptions. Poor control of common purslane was observed with s-metolachlor applied alone, sulfentrazone, and trifluralin or trifluralin + halosulfuron treatments. No control was observed in plots treated PRE with flufenacet.

The yields (lbs/A) of watermelon were generally decreased in association with the rate of weed control by the herbicide treatment. Yields were lowest where no weeds were controlled in the untreated plots and greatest where handweeding occurred throughout the season. Where herbicides were applied, yields were significantly reduced an average 60% in plots treated with flufenacet (PRE) and trifluralin + halosulfuron (EPOST-Direct), most likely the result of poor weed control. Significant yield reductions also occurred in plots treated with bensulide (both rates) + halosulfuron (EPOST-Direct), and yields decreased an average 42%. It is not clear why yields were decreased in these plots as weed control was good to excellent and there was no significant injury recorded June 19. Trifluralin and trifluralin + halosulfuron (EPOST-Direct) applications failed to adequately control both weed species resulting in an average 51% reduction in yields.

Preemergence applications of s-metolachlor and dimethenamid-P gave good to excellent weed control in this study and yields were not significantly different from the handweeded control. Likewise, the combinations of ethalfluralin + clomazone (PRE) + halosulfuron (EPOST-Direct), bensulide or s-metolachlor (PRE) followed with carfentrazone (EPOST-Hooded) did not result in significant yield reductions, though a trend for reduced yields continued with bensulide (30% less). Finally, sulfentrazone treatments did not reduce watermelon yields even though significant stunting occurred with the high rate application.

The results of this trial indicate the potential of several new herbicides for use in watermelons including dimethenamid-P, sulfentrazone and carfentrazone (as long as care is taken with the hooded application). Flufenacet is another option and was safe to watermelons, but failed to adequately control Palmer amaranth and common purslane in this study. Perhaps a higher rate would have improved weed control without increasing injury potential. Bensulide, while giving good weed control reduced crop yields in this trial. More research is needed to evaluate these herbicides at selected rates and timings to improve weed control in direct-seeded watermelons.

Table 3. Effect of Herbicide Treatments on Direct-Seeded Watermelons on the Texas High Plains

Chemical	**Rate lbs a.i.**	**Timing**	**% Stunt 6/19**	**% Necrosis 6/19**	**% Control Palmer Amaranth 8/18**	**% Control Common Purslane 8/18**	**Yield Total # / A**	**Yield Total wt lbs / A**
Untreated			0	0	0	0	1936.0	9922
Handweed		All season	0	0	99.0	99.0	3388.0	28127
Bensulide 4E + Halosulfuron 75WDG + 0.25% NIS	4.0 0.02	PRE EPost-Direct	3.3	0	96.0	96.0	2480.5	16867
Bensulide 4E + Halosulfuron 75WDG + 0.25% NIS	6.0 0.02	PRE EPost-Direct	8.3	0	76.7	86.7	3025.0	15887
Trifluralin 4EC	1.0	EPost-Direct	3.3	0	45.0	43.3	2843.5	16613
Trifluralin 4EC + Halosulfuron 75WDG + 0.25% NIS	1.0 0.02	EPost-Direct	0	0	31.7	43.3	2480.5	11126
Ethalfluralin 3EC + Clomazone 3ME	0.8 0.25	PRE PRE	11.7	0	61.7	79.7	3025.0	22385
Ethalfluralin 3EC + Clomazone 3ME + Halosulfuron 75WDG + 0.25% NIS	0.8 0.25 0.02	PRE PRE EPost-Direct	0	1.7	70.0	93.3	3569.5	26372
s-Metolachlor 7.62E	0.65	PRE	8.3	0	94.7	61.7	3509.0	24442
Flufenacet 4SC	0.08	PRE	0	0	31.7	0	1936.0	10878
Dimethenamid-P 6E	0.75	PRE	5.0	0	96.0	94.7	3630.0	26227
Sulfentrazone 75WDG	0.10	PRE	30.0	0	94.7	61.7	3751.0	26069
Sulfentrazone 75WDG	0.05	PRE	6.7	5.0	71.7	61.7	3509.0	26263
Bensulide 4E + Carfentrazone 2EC + 0.25% NIS	4.0 0.01	PRE Post (hood)	25.0	15.0	86.3	90.0	3146.0	19844
s-Metolachlor 7.62E + Carfentrazone 2EC + 0.25% NIS	0.65 0.01	PRE POST (hood)	36.7	23.3	97.7	94.7	3993.0	22863
LSD (0.05)			**16.8**	**7.0**	**32.4**	**51.3**	**743.5**	**9443**

Preemergence Herbicides for Fall-Planted Spinach in the Wintergarden Area: 2002

Russell W. Wallace
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Texas A & M University – Lubbock

Final Report

Objective: To evaluate the effects of preemergence herbicides applied alone or in combination for weed control and spinach crop injury.

Materials & Methods: The trial was conducted at the Del Monte Ag Research Farm located northeast of Crystal City, TX on FM 1025. The soil was a clay loam (35% clay) with an average pH of 8.1 and less than 2% organic matter. Fertilizer was applied and disked in prior to planting at 80, 100, 0, 5, 7, 4 and 30 lbs./A for nitrogen, phosphorus, potassium, magnesium, zinc, manganese, and sulfur, respectively. Nitrogen was applied a second time at 50 lbs/A in early November. Del Monte seed, variety DMC 66-09 was planted October 3, 2002 using a standard gravity-feed spinach seeder at commercial spacing (8 seeds / linear foot) and depth. Spinach seed was double-row planted onto previously formed beds centered at 40-inches with a 15-inch distance between seeded rows.

Each plot measured 6.67 x 25 ft with two beds for a total of 4 rows of spinach. Immediately following planting, the preemergence herbicide treatments were applied to the plots using a CO_2-pressurized backpack sprayer and hand-held boom[1] equipped with four flat fan[2] nozzles that delivered 15 gallons per acre at 30 psi and at a speed of 3 mph.

Plots were planted utilizing a randomized complete block design (RCBD) with 30 treatments replicated 4 times. Percent weed control was recorded 25 days after treatment (DAT) and percent crop injury recorded 25 and 43 DAT from visual assessments in the field.

All standard crop management and pest control measures were utilized as needed during the growing season. Immediately following planting and herbicide application the trial area was irrigated with 1' of water, which was followed by additional periods of heavy rainfall throughout the trial. There was found to be widespread feeding from white grubs on the roots of spinach during October that reduced stands by 2.9%. An insecticide treatment was applied to reduce additional damage to the crop from this pest. However, on December 6 it was noted that the crop was severely infested with Beet Yellow Curly Top Virus, resulting in plant death and severe stunting making subsequent injury and yield data ratings invalid. The crop was destroyed immediately following this date.

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[1] R & D Sprayers, Opelousas, LA
[2] Tee Jet 8002 VS

The following table shows field and weather information recorded during the time of herbicide application at the Del Monte Research Farm.

Table 1. Field and weather information at the time of treatment application.

Application Data	Treatment 1
Date	October 4
Time of day	11:00 a.m.
Sky	15% cover
Relative humidity	High
Soil temperature (°F)	82
Soil surface	Cloddy, firm and compact
Soil beneath	Dry
Air temperature (°F)	88
Wind Speed (mph/direction)	0 – 5 / NW
Crop size	Just seeded
Weeds	Not present

Results and Discussion: Weed control was good to excellent for all herbicides applied in the study (see Table 2). Control of Pigweed (Careless weed) was 80% or greater for all herbicides alone and in combination. Common purslane control was 83% or better in all plots. The good to excellent weed control may have been a result of the relatively low weed populations present in these fields, even under normal conditions. Additionally, the rainfall associated with the trial immediately following herbicide application and for several weeks following likely helped with improved control from the preemergence herbicides.

Early crop injury 25 DAT varied from less than 20% (maximum allowable for marketability) to more than 60% with several of the preemergence herbicide treatments (see Table 3). By 43 DAT, most early injury at 20% or below was reduced to acceptable levels. However, early crop injury greater than 20% generally remained too high at the later date and would have resulted in significant yield and quality losses. Treatments associated with the herbicides Define and Linex at the higher rates generally had the most crop injury. However, lower rates of these herbicides may be allowable for use in spinach.

Applications of Ro-Neet, Dual Magnum, Linex and Outlook alone gave less injury in general than Define alone and when these herbicides were applied in combination, particularly when Define was included. Best combinations where spinach injury was least (less than 20%) included Ro-Neet + Outlook, Ro-Neet + Linex and Outlook + Linex. Future investigations with all these products are needed to evaluate additional rates and combinations that will allow acceptable weed control without significant crop injury.

Table 2. Effect of Preemergence Herbicides on Weed Control and Injury in Spinach

Treatment	Rate (lb a.i./A)	% Control Pigweed	% Control Purslane	% Injury (10/28)	% Injury (11/15)
Untreated		0.0 e	0.0 d	0.0 h	0.0 j
Ro-Neet 6E	3.0	82.5 cd	86.3 bc	17.5 efgh	6.3 ij
Ro-Neet 6E	4.0	90.0 abcd	88.8 abc	8.8 gh	3.8 ij
Dual Magnum 7.62E	0.65	93.5 abc	93.5 ab	10.0 gh	15.0 d - j
Define 60DF	0.15	90.0 abcd	93.8 ab	23.8 efg	17.5 d - i
Define 60DF	0.3	91.0 abcd	94.8 a	46.3 bcd	31.3 abcde
Linex 50DF	0.05	80.0 d	83.8 c	15.0 fgh	13.8 e - i
Linex 50DF	0.1	92.5 abc	88.8 abc	16.3 efgh	11.3 ghij
Outlook 6E	0.25	85.0 abcd	88.5 abc	12.5 fgh	12.5 f - j
Ro-Neet 6E + Dual Magnum 7.62E	3.0 0.65	91.3 abcd	92.5 ab	10.0 gh	7.5 hij
Ro-Neet 6E + Dual Magnum 7.62E	4.0 0.65	88.8 abcd	91.3 abc	20.0 efg	32.5 abcd
Ro-Neet 6E + Outlook 6E	3.0 0.25	87.5 abcd	91.3 abc	7.5 gh	3.8 ij
Ro-Neet 6E + Outlook 6E	4.0 0.25	93.8 abc	95.0 a	13.8 fgh	6.3 ij
Ro-Neet 6E + Define 60DF	3.0 0.15	91.3 abcd	93.8 ab	13.8 fgh	3.8 ij
Ro-Neet 6E + Define 60DF	4.0 0.30	90.0 abcd	93.8 ab	48.8 abc	32.5 abcd
Ro-Neet 6E + Linex 50DF	3.0 0.05	86.3 abcd	90.0 abc	12.5 fgh	18.8 e - i
Ro-Neet 6E + Linex 50DF	4.0 0.10	83.8 bcd	86.3 bc	15.0 fgh	18.8 e - i
Dual Magnum + Define 60DF	0.65 0.15	92.5 abc	96.0 a	33.8 cde	27.5 a - f
Dual Magnum + Define 60DF	0.65 0.30	94.8 ab	96.0 a	46.3 bcd	43.8 ab
Dual Magnum + Linex 50DF	0.65 0.05	91.0 abcd	94.8 a	28.8 def	32.5 abcd
Dual Magnum + Linex 50DF	0.65 0.10	91.3 abcd	91.3 abc	21.3 efg	32.5 abcd
Outlook 6E + Define 60DF	0.25 0.15	93.8 abc	95.0 a	30.0 def	25.0 c - h
Outlook 6E + Define 60DF	0.25 0.30	96.0 a	96.0 a	63.8 ab	47.5 a
Outlook 6E + Linex 50DF	0.25 0.05	89.8 abcd	91.0 abc	17.5 efgh	7.5 hij

Table 2. Effect of Preemergence Herbicides on Weed Control and Injury in Spinach (Continued)

Treatment	Rate (lb a.i./A)	% Control Pigweed	% Control Purslane	% Injury (10/28)	% Injury (11/15)
Outlook 6E + Linex 50DF	0.25 0.10	90.0 abcd	90.0 abc	18.8 efg	17.5 d - j
Define 60DF+ Linex 50DF	0.15 0.05	83.8 bcd	90.0 abc	28.8 def	18.8 d - i
Define 60DF+ Linex 50DF	0.30 0.05	82.5 cd	93.8 ab	65.0 a	47.5 a
Define 60DF+ Linex 50DF	0.15 0.10	80.0 d	90.0 abc	46.3 bcd	30.0 a - f
Define 60DF+ Linex 50DF	0.30 0.10	93.5 abc	93.5 ab	52.5 ab	41.3 abc
Outlook 6E + Define 60DF+ Linex 50DF	0.25 0.15 0.05	91.3 abcd	91.3 abc	52.5 ab	42.5 abc

Means followed by the same letter are not significantly different at LSD = (0.05)

Acknowledgement: The researcher wishes to thank the Wintergarden Spinach Producer's Board for financial support and Del Monte Research Farm for the use of land, field and staff support that was provided during the course of this trial.

Postemergence Herbicides for Fall-Planted Spinach in the Wintergarden Area: 2002

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Final Report

Objective: To evaluate the effects of postemergence herbicide combinations applied once or twice on spinach crop injury.

Materials & Methods: The trial was conducted at the Del Monte Ag Research Farm located northeast of Crystal City, TX on FM 1025. The soil was a clay loam (35% clay) with an average pH of 8.1 and less than 2% organic matter. Fertilizer was applied and disked in prior to planting at 80, 100, 0, 5, 7, 4 and 30 lbs./A for nitrogen, phosphorus, potassium, magnesium, zinc, manganese, and sulfur, respectively. Del Monte seed, variety DMC 66-09 was planted October 3, 2002 using a standard gravity feed spinach seeder at commercial spacing (8 seeds / linear foot) and depth. Spinach seed was double-row planted onto previously formed beds centered at 40-inches with a 15-inch distance between seeded rows. Each plot measured 6.67 x 25 ft with two beds for a total of 4 rows of spinach. Immediately following planting, an application of Dual Magnum was broadcast to the entire test site to minimize weed pressure. Nitrogen was applied a second time at 50 lbs/A in early November.

Herbicide treatments were applied to the plots using a CO_2-pressurized backpack sprayer and hand-held boom[3] equipped with four flat fan[4] nozzles that delivered 15 gallons per acre at 30 psi and at a speed of 3 mph. A standard crop oil concentrate was used where required by the label.

Plots were planted utilizing a randomized complete block design (RCBD) with 22 treatments replicated 4 times. Percent crop injury (7 and 24 days after treatment (DAT), and percent weed control ratings (7 and 24 DAT) were collected from visual assessments in the field.

All standard crop management and pest control measures were utilized as needed during the growing season. Immediately following planting and herbicide application, 3 - 4 inches of rain fell, and this was followed by additional periods of heavy rainfall throughout the trial. There was also found to be widespread feeding from white grubs on the roots of spinach during October that reduced stands by 2.9%. An insecticide treatment was applied to reduce additional damage to the crop from this pest. However, on December 6 it was noted that the crop was severely infested with Beet Yellow Curly Top Virus, resulting in plant death and severe stunting making subsequent injury and yield data ratings invalid. The crop was destroyed immediately following this date.

[3] R & D Sprayers, Opelousas, LA
[4] Tee Jet 8002 VS

The following table shows field and weather information recorded during the time of herbicide application at the Del Monte Research Farm.

Table 1: Field and weather information at the time of treatment application.

Application Data	Treatment 1	Treatment 2
Date	October 22	October 29
Time of day	3:00 p.m.	11:00 a.m.
Sky	Cloudy	Partly cloudy
Relative humidity	High	High
Soil temperature (°F)	76	72
Soil surface	Moist	Moist
Soil beneath	Moist	Wet
Air temperature	82	74
Wind Speed (mph/direction)	0 – 2 / E	0
Crop size	2 – 4 leaves	6 – 7 leaves
Weeds	Pigweed (cotyledon)	Pigweed (1 – 3 lvs) Wild carrot (2 lvs)

Results: Weed populations were extremely low in this trial due to a preemergence application of Dual Magnum that was broadcast immediately following planting. All plots had excellent preemergence weed control at 95% or better (data not shown). Thus, only percent crop injury ratings are reported.

In this trial percent crop injury was significantly less than reported in Trial #2 and ranged from 0 to 20% 7 days after treatment (DAT), and 0 to 24% at 24 DAT. This is opposite to that which occurred in Trial #2 where crop injury from the same herbicides was extremely higher. One explanation is that the rates of Starane were lowered after extreme injury in Trial 2 was observed (treatments were applied 24 hours before those in Trial 1). However, there was only a 2-day difference between planting dates for Trials 1 and 2; thus crop stage was likely not a factor in the differences between results. In Trial 2 a rainfall during the night followed the postemergence applications while no rainfall occurred within 24 hours following applications in Trial 1.

The results of this trial indicate good potential in using Dual Magnum or some other preemergence herbicide in combination with these postemergence herbicides for control of broadleaf weeds in spinach. However, more research is needed to evaluate timings and application rates to ensure that the extreme crop injury observed in Trial 2 is not typical.

Table 3. The Effects of Postemergence Herbicide Combinations and Rates on Spinach Crop Injury

Treatment	Rate (lb a.i./A)	Timing	% Injury 10/28	% Injury 11/14
Dual Magnum 7.62E	0.65	Preemergence	0.0 e	0.0 e
Progress 1.8EC	0.15	Early Post	7.5 bcde	0.0
Progress 1.8EC + Progress 1.8EC	0.15 + 0.15 +	Early Post + 7 Days Later	5.0 cde	12.5 abcde
Progress 1.8EC	0.30	Early Post	8.8 cde	6.3 cde
Progress 1.8EC + Progress 1.8EC	0.30 + 0.30	Early Post + 7 Days Later	7.5 bcde	22.5 ab
Progress 1.8EC + Stinger 3EC	0.30 + 0.08	Early Post	8.8 cde	8.8 bcde
Progress 1.8EC + Stinger 3EC	0.30 + 0.12	Early Post	13.8 ab	15.0 abcd
Progress 1.8EC + Starane 1.5EC	0.30 + 0.012	Early Post	20.0 a	23.8 a
Progress 1.8EC + Starane 1.5EC	0.30 + 0.018	Early Post	11.3 bc	18.8 abc
Progress 1.8EC + Poast + COC	0.30 + 0.28 + 1% v/v	Early Post	13.8 ab	3.8 de
Progress 1.8EC + Spin-Aid 1.3EC	0.30 + 0.4	Early Post + 7 Days Later	11.3 bc	18.8 abc
Spin-Aid 1.3EC	0.2	Early Post	0.0 e	0.0 e
Spin-Aid 1.3EC + Spin-Aid 1.3EC	0.2 + 0.2	Early Post + 7 Days Later	1.3 de	0.0 e
Spin-Aid 1.3EC	0.4	Early Post	0.0 e	0.0 e
Spin-Aid 1.3EC + Spin-Aid 1.3EC	0.4 + 0.4	Early Post + 7 Days Later	3.8 cde	10.0 abcde
Spin-Aid 1.3EC + Stinger 3EC	0.4 + 0.08	Early Post	7.5 bcde	2.5 de
Spin-Aid 1.3EC + Stinger 3EC	0.4 + 0.12	Early Post	2.5 de	16.3 abcd
Spin-Aid 1.3EC + Starane 1.5EC	0.4 + 0.012	Early Post	2.5 de	5.0 cde
Spin-Aid 1.3EC + Starane 1.5EC	0.4 + 0.018	Early Post	2.5 de	0.0 e
Spin-Aid 1.3EC + Poast 1.5EC + COC	0.4 + 0.28 + 1% v/v	Early Post	2.5 de	5.0 cde
Stinger 3EC + Stinger 3EC	0.08 + 0.08	Early Post + 7 Days Later	3.8 cde	6.3 cde
Dual Magnum 7.62E + Hand weed	0.65	Preemergence + As-needed	2.5 de	0.0 e

Means followed by the same letter are not significantly different at LSD = (0.05)

Acknowledgement: The researcher wishes to thank the Wintergarden Spinach Producer's Board for financial support and Del Monte Research Farm for the use of land, field and staff support that was provided during the course of this trial.

Evaluation of Progress® for Tolerance to Fall-Planted Spinach in the Wintergarden Area

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Fall 2002

Final Report

Objective: To evaluate the effects of increasing rates of postemergence-applied Progress (applied twice) on spinach crop injury.

Materials & Methods: The trial was conducted at the Del Monte Ag Research Farm located northeast of Crystal City, TX on FM 1025. The soil was a clay loam (35% clay) with an average pH of 8.1 and less than 2% organic matter. Fertilizer was applied and disked in prior to planting at 80, 100, 0, 5, 7, 4 and 30 lbs./A for nitrogen, phosphorus, potassium, magnesium, zinc, manganese, and sulfur, respectively. Del Monte seed, variety DMC 66-09 was planted October 3, 2002 using a standard gravity feed spinach seeder at commercial spacing (8 seeds / linear foot) and depth. Spinach seed was double-row planted onto previously formed beds centered at 40-inches with a 15-inch distance between seeded rows. Each plot measured 6.67 x 25 ft with two beds for a total of 4 rows of spinach. Immediate following planting, an application of Dual Magnum was broadcast to the entire test site to minimize weed pressure. Nitrogen was applied a second time at 50 lbs/A in early November.

Herbicide treatments were applied to the plots using a CO_2-pressurized backpack sprayer and hand-held boom[5] equipped with four flat fan[6] nozzles that delivered 15 gallons per acre at 30 psi and at a speed of 3 mph. A standard crop oil concentrate was used where required by the label.

Plots were planted utilizing a randomized complete block design (RCBD) with 8 treatments replicated 4 times. Percent crop injury (7 and 25 days after treatment (DAT) from visual assessments in the field.

All standard crop management and pest control measures were utilized as needed during the growing season. Immediately following planting and herbicide application, 3 - 4 inches of rain fell, and this was followed by additional periods of heavy rainfall throughout the trial. There was also found to be widespread feeding from white grubs on the roots of spinach during October that reduced stands by 2.9%. An insecticide treatment was applied to reduce additional damage to the crop from this pest. However, on December 6 it was noted that the crop was severely infested with Beet Yellow Curly Top Virus, resulting in plant death and severe stunting making subsequent injury and yield data ratings invalid. The crop was destroyed immediately following this date.

[5] R & D Sprayers, Opelousas, LA
[6] Tee Jet 8002 VS

The following table shows field and weather information recorded during the time of herbicide application at the Del Monte Research Farm.

Table 1: Field and weather information at the time of treatment application.

Application Data	Treatment 1	Treatment 2
Date	October 21	October 29
Time of day	4:00 p.m.	1:00 p.m.
Sky	95% Cloudy	Partly cloudy
Relative humidity	Moderately high	High
Soil temperature (°F)	76	74
Soil surface	Dry and compact	Moist
Soil beneath	Moist	Wet
Air temperature (°F)	83	80
Wind Speed (mph/direction)	5 – 10 / SW	0 – 2 / E
Crop size	2 – 4 leaves	6 – 7 leaves
Weeds	Pigweed (1 – 6 lvs) Purslane (2 – 4 lvs)	Pigweed (1 – 3 leaves) Wild carrot (2 leaves)

Results and Discussion: Progress is currently registered as an herbicide for the sugar beet market, and may have potential for spinach producers. The herbicide contains three separate active ingredients – phenmedipham (active ingredient in Spin-Aid), desmedipham and ethofumesate. A review of the 2002 trial data (Table 2) indicates that at 7 DAT, spinach crop injury was acceptable at rates of 0.15 lbs a.i. and below. Crop injury was marginal at the 0.20 and 0.30 lbs a.i rates. Progress applied at 0.40 lbs a.i. resulted in injury too high, even at the 7 DAT rating. When a second treatment was applied 7 days after the first, mid-November ratings indicated that spinach injury increased to greater than 20% (marginally acceptable) levels in all treatments except with the 0.05 lb a.i. rate. These results indicate that Progress may have potential as a spinach herbicide with a single application at rates of 0.15 and less, or with multiple applications at rates of 0.05 or slightly higher. However, further investigations are needed to evaluate the effects of multiple applications of this herbicide at low rates for both crop injury and weed control.

Table 2. The influence of increasing Progress herbicide rates on spinach injury.

Trt. #	Treatment	Rate (lb a.i./A)	Timing	% Spinach Injury 10/28	11/15
1	Progress	0.05	EPOST + 7 Days	7.5	8.8
2	Progress	0.075	EPOST + 7 Days	8.8	21.3
3	Progress	0.10	EPOST + 7 Days	6.3	22.5
4	Progress	0.15	EPOST + 7 Days	5.0	31.3
5	Progress	0.20	EPOST + 7 Days	22.5	48.8
6	Progress	0.30	EPOST + 7 Days	26.3	63.8
7	Progress	0.40	EPOST + 7 Days	40.0	61.3
8	Untreated	-----	-----	0.0	0.0
LSD (0.05)				13.2	22.0
R^2				0.57	0.67

Means followed by the same letter are not significantly different at LSD = (0.05)

Acknowledgement: The researcher wishes to thank the Wintergarden Spinach Producer's Board for financial support and Del Monte Research Farm for the use of land, field and staff support that was provided during the course of this trial.

Evaluation of Preemergence Herbicides on Crop Injury and Yield in Blackeye Peas: 2003

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Final Report

Objective: to evaluate and compare the efficacy of preemergence herbicides on weed control, crop injury and yield to blackeye peas (*Vigna unguiculata*) grown on the Texas High Plains.

Materials and Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center located in Halfway on a Pullman clay loam soil with an average pH of 7.6 and 1.0% O.M. The trial site was plowed and then prepared by applying a pre-plant fertilizer (40 lbs / A nitrogen) and then disking it into the soil. Blackeye peas (var. "8046") were planted on June 16 approximately ¾" deep with a Monosem Vacuum Planter on 36" rows with 2 rows per plot. Each plot measured 6' x 20' and was replicated 4 times. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. During the early season the plots were cultivated with a sand-fighter to break up the soil surface to prevent wind damage to the seedlings. Plots were irrigated overhead as needed during the season. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Application Data for Postemergence Treatments

Location	Halfway	Wind speed / direction	0 – 5 mph / S
Date	June 18, 2003	Crop	Black-eyes
Time of day	10:00 a.m.	Variety	8046
Type of application	Broadcast	Crop stage	Seed
Carrier	Water	Air temp. (°F)	76
Gas (if not CO_2)	CO_2	Soil temp. (°F)	77
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Dry / friable
Nozzle tips	Teejet 8002VS	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Clear & Sunny
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Results: Blackeye pea crop emergence (Table 2) was significantly reduced by applications of flumioxazin (both rates) when compared to the untreated control. While not significantly lower, plots treated with sulfentrazone at 0.4 lbs a.i./A had a 15% reduction in emergence. There was little to no injury observed with s-metolachlor and dimethenamid-P treatments, or only marginal injury from flufenacet at the high rate. Early crop injury (stunting) was greatest with flumioxazin, flumetsulam and sulfentrazone; however, by September 1, most injury was 15% or less except with the high rates of flumioxazin and sulfentrazone. Control of Palmer amaranth (*Amaranthus palmeri*) was excellent with all treatments. Finally, yields were only significantly reduced compared to the handweeded control in plots treated with the high rates of flumioxazin, flumetsulam, and sulfentrazone. The results indicate that these herbicides have potential for use in blackeye peas; however, further studies are needed to determine the appropriate preemergence use rates for flumioxazin, flumetsulam, flufenacet and sulfentrazone under conditions of the Texas High Plains.

Table 2. The Effect of Herbicide Treatment on Weed Control, Crop Injury and Yield in Blackeye Peas

Chemical	Rate (lbs a.i./A)	Timing	No. of Plants/20 ft row	% Injury 7/5/03	% Injury 9/1/03	% Control Palmer Amaranth 9/1/03	Dry Pea Yield (lbs/A)
Untreated			53.7	0	0	0	532.4
Handweed			58.5	0	0	99.0	624.0
s-Metolachlor 7.62E	0.65	PRE	54.7	0	0	94.8	641.6
s-Metolachlor 7.62E	0.95	PRE	57.5	1.3	0	97.0	649.5
Dimethenamid-P 6E	0.75	PRE	54.0	8.8	2.5	99.0	708.3
Dimethenamid-P 6E	1.0	PRE	51.0	17.5	2.5	96.0	649.5
Flumioxazin 51WDG	0.064	PRE	35.3	21.3	15.0	98.0	515.3
Flumioxazin 51WDG	0.095	PRE	17.2	61.3	35.0	86.0	331.6
Flumetsulam 80WDG	0.1	PRE	59.8	15.0	7.5	97.0	645.6
Flumetsulam 80WDG	0.15	PRE	58.0	22.5	15.0	99.0	386.5
Flufenacet 4SC	0.25	PRE	56.0	0	0	95.0	616.7
Flufenacet 4SC	0.50	PRE	50.8	13.8	5.0	98.0	538.8
Sulfentrazone 75WDG	0.2	PRE	54.5	31.3	8.8	98.0	511.4
Sulfentrazone 75WDG	0.4	PRE	45.5	72.5	43.8	99.0	156.8
LSD (0.05)			**9.6**	**13.4**	**12.7**	**6.1**	**167.9**

Evaluation of PRE & POST Halosulfuron Applications in Blackeye Peas: 2003

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Final Report

Objective: to evaluate and compare the efficacy of halosulfuron applications and rates on crop injury and yield to blackeye peas (*Vigna unguiculata*) grown on the Texas High Plains.

Materials and Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center located in Halfway on a Pullman clay loam soil with an average pH of 7.6 and 1.0% O.M. The trial site was plowed and then prepared by applying a pre-plant fertilizer (40 lbs / A nitrogen) and then disking it into the soil. Blackeye peas (var. "8046") were planted on June 16 approximately ¾" deep with a Monosem Vacuum Planter on 36" rows with 2 rows per plot. Each plot measured 6' x 20'. Herbicide treatments were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. During the early season the plots were cultivated with a sand-fighter unit to break up the soil surface to prevent wind damage from blowing sand to the emerging seedlings. Plots were overhead irrigated as needed during the season. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Application Data for Preemergence Treatments

Location	Halfway	Wind speed / direction	5 – 10 mph / SW
Date	June 17, 2003	Crop	Black-eyes
Time of day	11:30 a.m.	Variety	8046
Type of application	Broadcast	Crop stage	Seed
Carrier	Water	Air temp. (°F)	77
Gas (if not CO_2)	CO_2	Soil temp. (°F)	76
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Dry / Friable
Nozzle tips	Teejet 8002VS	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Clear / sunny
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 2. Application Data for Postemergence Treatments

Location	Halfway	Wind speed / direction	5 – 10 mph / SW
Date	July 5, 2003	Crop	Black-eyes
Time of day	9:00 a.m.	Variety	8046
Type of application	Broadcast	Crop stage	1 – 3 trifoliate
Carrier	Water	Air temp. (°F)	78
Gas (if not CO_2)	CO_2	Soil temp. (°F)	77
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Dry / compact
Nozzle tips	Teejet 8002VS	% Relative humidity	Low
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Results: Control of Palmer amaranth (*Amaranthus palmeri*) was 92% or better with all treatments in this study. Preemergence injury from halosulfuron applied at all three rates was only minor (< 8.0%). However, postemergence applications significantly increased crop injury (generalized stunting + leaf chlorosis) and this increased slightly as the rate of halosulfuron increased. However, by September 1 most treatments showed little or only minor crop injury (< 14.0%) resulting from the postemergence treatments. Yields tended to be lower where the PRE and POST applications of halosulfuron were made, though only significantly less where yields were below 456.0 lbs/A. The results do show that there is sufficient safety in using PRE applications of halosulfuron in blackeye peas, but more research is needed evaluating rates and timing of applications if POST treatments are to be made.

Table 3. Effect of Halosulfuron Treatments on Blackeye Pea Injury and Yields

Chemical	Form.	Rate lbs a.i.	Timing	% Injury 7/05	% Injury 7/11	% Injury 9/01	% Control Palmer Amaranth 9/01	Yield (lbs/A)
Untreated			All season	0	0	0	0	654.9
Handweed			All season	0	0	0	98.0	669.1
Halosulfuron	75 WDG	0.024	PRE	5.0	7.5	2.5	99.0	740.6
Halosulfuron	75 WDG	0.032	PRE	6.3	10.0	3.8	99.0	674.9
Halosulfuron	75 WDG	0.048	PRE	7.5	13.8	0	97.0	721.0
Halosulfuron + *0.25% NIS*	75 WDG	0.024	POST 1 – 3 Trifoliate	0	47.5	12.5	99.0	508.4
Halosulfuron + *0.25% NIS*	75 WDG	0.032	POST 1 – 3 Trifoliate	0	52.5	10.0	92.5	367.4
Halosulfuron + *0.25% NIS*	75 WDG	0.048	POST 1 – 3 Trifoliate	0	60.0	3.8	92.3	533.4
Halosulfuron + *Halosulfuron +* *0.25% NIS*	75 WDG 75 WDG	0.024 0.024	PRE POST 1 – 3 Trifoliate	0	52.5	8.8	98.0	447.2
Halosulfuron + *Halosulfuron +* *0.25% NIS*	75 WDG 75 WDG	0.032 0.032	PRE POST 1 – 3 Trifoliate	0	52.5	13.8	97.0	417.8
Halosulfuron + *Halosulfuron +* *0.25% NIS*	75 WDG 75 WDG	0.048 0.048	PRE POST 1 – 3 Trifoliate	0	60.0	11.3	98.0	491.8
s-Metolachlor + *Halosulfuron +* *0.25% NIS*	7.62 E 75 WDG	0.65 0.024	PRE POST 1 – 3 Trifoliate	0	57.5	11.3	98.0	498.6
s-Metolachlor + *Halosulfuron +* *0.25% NIS*	7.62 E 75 WDG	0.65 0.032	PRE POST 1 – 3 Trifoliate	0	60.0	8.8	98.0	456.0
s-Metolachlor + *Halosulfuron +* *0.25% NIS*	7.62 E 75 WDG	0.65 0.048	PRE POST 1 – 3 Trifoliate	0	52.5	11.3	98.0	488.3
LSD (0.05)				**3.6**	**8.1**	**10.4**	**4.1**	**265.4**

Evaluation of Postemergence Herbicides on Crop Injury and Yield in Blackeye Peas: 2003

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Final Report

Objective: to evaluate and compare the efficacy of postemergence herbicides combined with bentazon on crop injury and yield to blackeye peas (*Vigna unguiculata*) grown on the Texas High Plains.

Materials and Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center located in Halfway on a Pullman clay loam soil with an average pH of 7.6 and 1.0% O.M. The trial site was plowed and then prepared by applying a pre-plant fertilizer (40 lbs / A nitrogen) and then disking it into the soil. Blackeye peas (var. "8046") were planted on June 16 approximately ¾" deep with a Monosem Vacuum Planter on 36" rows with 2 rows per plot. Each plot measured 6' x 20' and was replicated 4 times. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. During the early season the plots were cultivated with a sand-fighter to break up the soil surface to prevent wind damage to the seedlings. Plots were irrigated overhead as needed during the season. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Application Data for Postemergence Treatments

Location	Halfway	Wind speed / direction	5 – 10 mph / SW
Date	July 5, 2003	Crop	Black-eyes
Time of day	10:30 a.m.	Variety	8046
Type of application	Broadcast	Crop stage	1 – 3 trifoliates
Carrier	Water	Air temp. (°F)	83
Gas (if not CO_2)	CO_2	Soil temp. (°F)	77
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Dry / compact
Nozzle tips	Teejet 8002VS	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Results: There was very little weed pressure in this trial. The greatest amount of crop injury recorded 6 days after treatment (DAT) occurred with cloransulam, carfentrazone and halosulfuron, while less injury (and more acceptable) occurred in plots treated with imazamox, imazethapyr and acifluorfen. By September 1 most crop injury was only slightly visible, with the exception of stunting in the cloransulam-treated plots. In this study, the addition of bentazon as a potential safener benefited only the application of carfentrazone. Yields were somewhat low compared to the state average, most likely due to low rainfall, even though the plots received additional irrigation. Yields were variable and not significantly different from the untreated or hand weeded plots except for cloransulam-treated plots. Consistently higher yields were recorded in plots treated with imazamox or acifluorfen, either alone or in combination with bentazon.

Table 2. Postemergence Herbicides for Blackeye Peas: 2003

Chemical	Rate (lbs a.i./A)	Timing**	% Injury 7/11/03	% Injury 9/1/03	Yield (lbs/A)
Untreated			0	0	617.1
Handweed		All season	0	0	541.7
Imazamox 1EC + 0.25% NIS	4.0 oz prod.	POST	21.3	0	670.1
Imazamox 1EC + Bentazon 4EC + 0.25% NIS	4.0 oz prod. 0.75	POST	5.0	0	683.8
Cloransulam 0.84EC + 0.25% NIS	2.0 oz prod.	POST	35.0	18.8	311.0
Cloransulam 0.84EC + Bentazon 4EC + 0.25% NIS	2.0 oz prod. 0.75	POST	35.0	20.0	466.3
Carfentrazone 2EC + 0.25% NIS	0.012	POST	45.0	6.3	605.4
Carfentrazone 2EC + Bentazon 4EC + 0.25% NIS	0.012 0.75	POST	33.8	3.8	528.0
Halosulfuron 75WDG + 0.25% NIS	0.036	POST	36.3	2.5	569.2
Halosulfuron 75WDG + Bentazon 4EC + 0.25% NIS	0.036 0.75	POST	40.0	3.8	466.8
Imazethapyr2EC + 0.25% NIS	2.0 oz prod.	POST	7.5	0	530.0
Imazethapyr 2EC + Bentazon 4EC + 0.25% NIS	2.0 oz prod. 0.75	POST	18.8	0	607.4
Acifluorfen-Na 2EC + 0.25% NIS	0.125	POST	17.5	0	633.8
Acifluorfen-Na 2EC + Bentazon 4EC + 0.25% NIS	0.125 0.75	POST	23.8	2.5	661.2
LSD (0.05)			**9.9**	**6.7**	**244.9**

** POST treatments applied at the 1 – 3 trifoliate stage.
Note: Preemergence *s*-metolachlor (0.65 lb a.i./A) applied June 17. There was no weed pressure in plots.

Evaluation of Postemergence Herbicides for Southern Peas
Bailey County Trial: 2002

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Final Report

Objective: To evaluate the effect of selected postemergence herbicide applications on crop injury in southern pea production for the Texas High Plains.

Treatment Information:

Crop variety: N/A
Date Planted:
Application date: 8/6/02
Carrier: H_2O @ 156 mls/plot
Plot size: 6' x 20'
No. rows/plot: 4
GPA: 15
PSI: 25
Nozzle tips: 80015
Nozzle spacing: 19"

Crop stage: 2 – 5 leaves
Air temp: 88 °F
Soil temp: 75 °F
Soil moisture: Moist
Soil surface: Somewhat moist
Wind speed/direction: 1-20 mph/SE
Humidity: 35%
Sky: Partly cloudy
Reps: 3
Weeds present: Volunteer wheat

Location:
Bailey County (west of Muleshoe), Farm owned by Alex Schuster.

Results: There was no significant weed pressure in the field used for evaluation (grower used a standard preemergence herbicide prior to the post treatment applications). Postemergence herbicides were applied to peas at the 2 – 5 leaf stage and some crop injury was observed within 4 days after treatment (DAT; data not shown). However, by 20 days DAT chlorosis (leaf yellowing) was 3% or less for all treatments. Leaf necrosis (treated leaf burn) was 11.7% or less in all treatments at that time. Greatest amount of leaf burn was associated with Reflex and UltraBlazer treatments. Crop injury was generally less with these and other herbicides when Basagran was tank-mixed included as part of the treatment, thus creating a safening effect. Crop injury results indicate that the herbicides and their combinations were considered generally safe on peas in this study.

The number of plants measured at harvest was not significantly different for any of the treatments evaluated. However, there was a significant difference in the percentage of flowers opened and visible on August 26, suggesting that one or several herbicides may have influenced flowering (delay in flowering), and this ultimately effected yields. Treatments of UltraBlazer + Basagran, Sandea alone, and Sandea + Reflex significantly reduced percent flowering compared to the highest percent flowering found in Raptor/Basagran mix or FirstRate/Basagran/Reflex three-way combinations. The delay in flowering from Sandea is likely a result from the added nitrogen (Dr. Robin Bellinder, Cornell; personal communication) and the use of COC instead of a non-ionic surfactant (Gowan Co., personal communication). As a result of delayed flowering, these treatments significantly lowered yields compared to the highest yields found in the Raptor/Basagran tank-mix. UltraBlazer, Reflex and Sandea treatments alone reduced yields, but when these herbicides were combined with Basagran, yields increased 6, 47 and 68%, respectively. These results indicate that Basagran is a good safener for these products in southern peas. The three-way treatment combinations did not increase crop injury to peas, nor did they assist much in increasing yields. Thus, economics would suggest that these treatments are impractical. However, the use of these herbicides, especially when combined with Basagran, should provide adequate weed control without causing significant injury to the southern pea crop. More research is needed and will be conducted during the 2003 growing season.

Table 1. Postemergence Herbicide Combinations on Crop Injury in Southern Peas in Bailey County in 2002

Treatment	Form.	Rate lbs ai/A	Chlorosis 20 DAT	Necrosis 20 DAT	Plants / 18.75 ft^2	% Flowering (8/26/02)	Yield (lbs / Acre)
Grower Standard			0.0 b	0.0 d	51.7 a	73.3 ab	4891.7 ab
Raptor + COC	1AS	4.0 oz 1% v/v	0.0 b	0.0 d	53.7 a	51.7 abcd	3514.0 def
Raptor + Basagran + Nitrogen + COC	1AS 4E 22-0-0	4.0 oz 0.75 0.5 gal 1% v/v	3.3 a	0.0 d	58.3 a	78.3 a	5000.0 a
Raptor + Basagran + UltraBlazer + Nitrogen + COC	1AS 4E 2E 22-0-0	4.0 oz 0.75 0.063 0.5 gal 1% v/v	0.0 b	3.3 bcd	55.7 a	70.0 ab	4659.3 abc
Raptor + Basagran + Reflex + Nitrogen + COC	1AS 4E 2SC 22-0-0	4.0 oz 0.75 0.063 0.5 gal 1% v/v	0.0 b	6.7 abc	48.0 a	60.0 abc	4644.0 abc
UltraBlazer + COC	2E	0.063 1% v/v	0.0 b	8.3 ab	49.3 a	66.3 abc	3204.0 ef
UltraBlazer + Basagran + Nitrogen + COC	2E 4E 22-0-0	0.063 0.75 0.5 gal 1% v/	0.0 b	3.3 bcd	55.0 a	50.0 bcd	3405.7 ef
Reflex + COC	2SC	0.063 1% v/v	0.0 b	11.7 a	55.7 a	73.3 ab	2554.0 f
Reflex + Basagran + Nitrogen + COC	2SC 4E 22-0-0	0.063 0.75 0.5 gal 1% v/	0.0 b	8.3 ab	54.7 a	56.7 abc	4767.7 abc
FirstRate + COC	84WDG	0.2 oz 1% v/v	1.7 ab	5.0 bcd	51.3 a	66.67 abc	4535.7 abcd

Table 1. Postemergence Herbicide Combinations on Crop Injury in Southern Peas in Bailey County in 2002 (Continued)

Treatment	Form.	Rate lbs ai/A	Chlorosis 20 DAT	Necrosis 20 DAT	Plants / 18.75 ft^2	% Flowering (8/26/02)	Yield (lbs / Acre)
FirstRate + Basagran + Nitrogen + COC	84WDG 4E 22-0-0	0.2 oz 0.75 0.5 gal 1% v/v	1.7 ab	1.7 cd	53.3 a	68.3 abc	4752.3 abc
FirstRate + Basagran + UltraBlazer + Nitrogen + COC	84WDG 4E 2E 22-0-0	0.2 oz 0.75 0.063 0.5 gal 1% v/v	3.3 a	1.7 cd	47.0 a	53.3 abcd	3173.3 ef
FirstRate + Basagran + Reflex + Nitrogen + COC	84WDG 4E 2SC 22-0-0	0.2 oz 0.75 0.063 0.5 gal 1% v/v	0.0 b	8.3 ab	54.7 a	78.3 a	4705.7 abc
Sandea + COC	75WDG	0.024 1% v/v	0.0 b	5.0 bcd	51.0 a	1.7 e	1393.3 g
Sandea + Basagran + Nitrogen + COC	75WDG 4E 22-0-0	0.024 0.75 0.5 gal 1% v/v	3.3 a	1.7 cd	49.7 a	28.3 de	4288.0 abcde
Sandea + Basagran + UltraBlazer + Nitrogen + COC	75WDG 4E 2E 22-0-0	0.024 0.75 0.063 0.5 gal 1% v/v	1.7 ab	8.3 ab	48.3 a	56.7 abc	3792.7 bcde
Sandea + Basagran + Reflex + Nitrogen + COC	75WDG 4E 2SC 22-0-0	0.024 0.75 0.063 0.5 gal 1% v/v	1.7 ab	3.3 bcd	54.7 a	41.7 cd	3761.7 cde
LSD (0.05)			3.2	5.9	12.9	28.0	1115.1

Evaluation of Preemergence Herbicides on Crop Injury in Pinto Beans: 2003

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Final Report

Objective: to evaluate and compare the efficacy of postemergence herbicide applications alone or combined with bentazon on crop injury and yield to pinto beans (*Phaseolis vulgaris L.*) grown on the Texas High Plains.

Materials and Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center located in Halfway on a Pullman clay loam with an average pH of 7.6 and 1% O.M. The trial site was plowed and then prepared by applying a pre-plant fertilizer (40 lbs/A nitrogen) and then cultivating it into the soil. Pinto beans (var. "Vision") were planted on May 27 approximately ¾" deep with a Monosem Vacuum Planter on 36" rows with 2 rows per plot. Each plot measured 6' x 20'. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. During the early season the plots were cultivated with a sand-fighter unit to break up the soil surface to prevent wind damage to the seedlings from blowing sand. Plots were overhead irrigated as needed during the season. No yield data was obtained in this trial due to extreme high temperatures (105 °F) during pod set that caused the majority of flowers to abort. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference (α = 0.05).

Table 1. Application Data for Preemergence Herbicide Treatments

Location	Halfway	Wind speed / direction	0 – 5 mph / S
Date	May 28, 2003	Crop	Pinto Beans
Time of day	8:00 a.m.	Variety	Vision
Type of application	Broadcast	Crop stage	Seed
Carrier	Water	Air temp. (°F)	65
Gas (if not CO_2)	CO_2	Soil temp. (°F)	60
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Semi-moist
Nozzle tips	Teejet 8002VS	% Relative humidity	Moderately high
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Results: There was very little weed pressure in this trial, even in the untreated plots. Crop emergence however, was significantly reduced in plots treated with flumioxazin (both rates) and with sulfentrazone and lactofen treatments. Crop injury (% stunting) was greatest in sulfentrazone-treated plots recorded July 5, but was 15% or less with all other treatments. By September 1, severe injury continued with sulfentrazone treatments, and also increased with treatments of flumetsulam and dimethenamid-P. While yield data is not available, it is likely that many of these treatments would have resulted in some decrease in yield; however, this can not be determined given the overall aborted flowers in this study.

Table 2. The Effect of Herbicide Treatment on Crop Injury in Pinto Beans

Chemical	Rate (lbs a.i./A)	Timing	No. of Plants/20 ft row	% Injury 7/5/03	% Injury 9/1/03
Untreated			53.8	0	0
Handweed			54.8	0	0
s-Metolachlor 7.62E	0.65	PRE	54.3	0	10.0
s-Metolachlor 7.62E	0.95	PRE	47.8	0	2.5
Dimethenamid-P 6E	0.50	PRE	50.3	10.0	21.3
Dimethenamid-P 6E	0.75	PRE	49.3	15.0	16.3
Flumioxazin 51WDG	0.064	PRE	38.0	8.8	10.0
Flumioxazin 51WDG	0.095	PRE	36.3	12.5	18.8
Flumetsulam 80WDG	0.1	PRE	50.0	8.8	40.0
Flumetsulam 80WDG	0.15	PRE	51.0	11.3	46.3
Flufenacet 4SC	0.30	PRE	46.8	2.5	15.0
Flufenacet 4SC	0.60	PRE	49.0	0	15.0
Sulfentrazone 75WDG	0.375	PRE	41.0	71.3	92.5
Lactofen 2EC	0.195	PRE	42.0	6.3	13.8
LSD (0.05)			**7.0**	**8.3**	**10.6**

Evaluation of Halosulfuron Tolerance in Pinto Beans: 2003

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Final Report

Objective: to evaluate and compare the efficacy of halosulfuron applied alone or combined post-emergence with bentazon on crop injury and yield to pinto beans (*Phaseolis vulgaris L.*).

Materials and Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center located in Halfway on a Pullman clay loam with an average pH of 7.6 and 1% O.M. The trial site was plowed and prepared by applying a pre-plant fertilizer (40 lbs/A nitrogen) and cultivating it into the soil. Pinto beans (var. "Vision") were planted on May 27 approximately ¾" deep with a Monosem Vacuum Planter on 36" rows with 2 rows per plot. Each plot measured 6' x 20'. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. During the early season the plots were cultivated with a sand-fighter unit to break up the soil surface to prevent wind damage to the seedlings from blowing sand. Plots were overhead irrigated as needed during the season. No yield data was obtained in this trial due to extreme high temperatures (105 °F) during pod set that caused the flowers to abort. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Application Data for Preemergence Treatments

Location	Halfway	Wind speed / direction	5 – 10 mph / SW
Date	May 28, 2003	Crop	Pinto Beans
Time of day	8:00 a.m.	Variety	Vision
Type of application	Broadcast	Crop stage	Seed
Carrier	Water	Air temp. (°F)	65
Gas (if not CO_2)	CO_2	Soil temp. (°F)	60
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Semi-moist
Nozzle tips	8002	% Relative humidity	Moderately high
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 2. Application Data for Postemergence Treatments

Location	Halfway	Wind speed / direction	10 - 15 mph / S
Date	6.25.03	Crop	Pinto Beans
Time of day	6:30 a.m.	Variety	Vision
Type of application	Broadcast	Crop stage	2 – 3 trifoliate
Carrier	Water	Air temp. (°F)	75
Gas (if not CO_2)	CO_2	Soil temp. (°F)	75
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Moist / compact
Nozzle tips	8002	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Partly cloudy
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: Purslane 6 – 10"; Pigweed 3 – 10"; Bindweed in plots 404 – 407, 411 – 13.			

Results: Two weeks (June 13) following preemergence applications, no crop injury was observed from halosulfuron treatments at any rate (Table 3). By June 30 however, postemergence applications of halosulfuron resulted in moderate crop injury (12.5 – 18.8%) when applied alone. When combined with 0.5 lb a.i. bentazon applied in combination, average halosulfuron injury decreased 7.0%. When applied with bentazon at a rate of 1.0 lb a.i., average crop injury remained the same. These results suggest that the addition of 0.5 lb a.i. bentazon may reduce potential injury from halosulfuron to pinto beans, however; doubling that rate to 1.0 lb a.i. will likely not reduce injury. Future research is needed to evaluate these treatments on late-season crop injury and potential yield.

Table 4. The Effect of Halosulfuron Applied Pre- or Post in Combination with Bentazon on Pinto Beans

Chemical	Rate (lbs a.i./A)	Timing	% Injury June 13	% Injury June 30
Untreated		All season	0	0
Handweed		All season	0	0
Halosulfuron 75WDG	0.024	PRE	0	0
Halosulfuron 75WDG	0.036	PRE	0	2.5
Halosulfuron 75WDG	0.048	PRE	0	1.3
Halosulfuron 75WDG + *0.25% NIS*	0.024	POST 2 – 3 Trif.	0	12.5
Halosulfuron 75WDG + *0.25% NIS*	0.036	POST 2 – 3 Trif.	0	15.0
Halosulfuron 75WDG + *0.25% NIS*	0.048	POST 2 – 3 Trif.	0	18.8
Halosulfuron 75WDG + Bentazon 4L + 0.25% NIS	0.024 0.50	POST 2 – 3 Trif.	0	8.8
Halosulfuron 75WDG + Bentazon 4L + 0.25% NIS	0.036 0.50	POST 2 – 3 Trif.	0	6.3
Halosulfuron 75WDG + Bentazon 4L + 0.25% NIS	0.048 0.50	POST 2 – 3 Trif.	0	10.0
Halosulfuron 75WDG + Bentazon 4L + 0.25% NIS	0.024 1.0	POST 2 – 3 Trif.	0	12.5
Halosulfuron 75WDG + Bentazon 4L + 0.25% NIS	0.036 1.0	POST 2 – 3 Trif.	0	16.3
Halosulfuron 75WDG + Bentazon 4L + 0.25% NIS	0.048 1.0	POST 2 – 3 Trif.	0	12.5
LSD (0.05)			**0**	**6.0**

Evaluation of Postemergence Herbicides on Crop Injury and Yield in Pinto Beans: 2003

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Final Report

Objective: to evaluate and compare the efficacy of postemergence herbicide applications alone or combined with bentazon on crop injury and yield to pinto beans (*Phaseolis vulgaris L.*) grown on the Texas High Plains.

Materials and Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center located in Halfway on a Pullman clay loam with an average pH of 7.6 and 1% O.M. The trial site was plowed and then prepared by applying a pre-plant fertilizer (40 lbs/A nitrogen) and then cultivating it into the soil. Pinto beans (var. "Vision") were planted on May 27 approximately ¾" deep with a Monosem Vacuum Planter on 36" rows with 2 rows per plot. Each plot measured 6' x 20'. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Post-direct applications were made with the same spray equip modified to only 2 nozzles. During the early season the plots were cultivated with a sand-fighter unit to break up the soil surface to prevent wind damage to the seedlings from blowing sand. Plots were overhead irrigated as needed during the season. No yield data was obtained in this trial due to extreme high temperatures (105 °F) during pod set that caused the flowers to abort. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference (α = 0.05).

Table 1. Application Data for Preemergence s-Metolachlor

Location	Halfway	Wind speed / direction	5 – 10 mph / SW
Date	May 28, 2003	Crop	Pinto Beans
Time of day	9:30 a.m.	Variety	Vision
Type of application	Broadcast	Crop stage	Seed
Carrier	Water	Air temp. (°F)	70
Gas (if not CO_2)	CO_2	Soil temp. (°F)	60
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Semi-moist
Nozzle tips	Teejet 8002VS	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 2. Application Data for Postemergence Treatments

Location	Halfway	Wind speed / direction	5 – 10 mph / SW
Date	June 25, 2003	Crop	Pinto Beans
Time of day	7:30 a.m.	Variety	Vision
Type of application	Broadcast/Dir.	Crop stage	2 – 3 trifoliates
Carrier	Water	Air temp. (°F)	78
Gas (if not CO_2)	CO_2	Soil temp. (°F)	75
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Moist / compact
Nozzle tips	Teejet 8002VS	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Partly cloudy
Boom width (")	6.5' / 3.25'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: Silverleaf Nightshade (4 – 10"), Careless Weed (2 – 8")			

Results: There was very little weed pressure in this trial. Significant postemergence injury from cloransulam, regardless of the addition of bentazon, occurred within 5 days after herbicide treatment (DAT), and was greatest compared to all other treatments. Crop injury from lactofen with or without bentazon was also significantly greater compared to the untreated, but was approximately 50% less than that of cloransulam treatments. Treatments of acifluorfen, imazethapyr and carfentrazone (applied post-directed) either alone or with bentazon injured the pinto beans by ratings of 12.5% or less, which although significantly different from the control, would likely not result in a yield loss. With all herbicides, the addition of bentazon to the mixture did not reduce herbicide injury in this study.

Table 3. Percent crop injury to pinto beans from postemergence herbicide treatments

Chemical	Formulation	Rate (lbs a.i./A)	Timing	% Crop Injury June 30
Untreated				0
Handweed				0
*Imazamox + NIS***	1 AS	4.0 oz prod.	POST	10.0
Imazamox + Bentazon + NIS	1 AS 4 EC	4.0 oz prod. 0.75	POST	8.8
Cloransulam + NIS	84 WDG	2.0 oz prod.	POST	42.5
Cloransulam + Bentazon + NIS	84 WDG 4 EC	2.0 oz prod. 0.75	POST	45.0
Carfentrazone + NIS	2 EC	0.012	POST-DIRECT	1.25
Carfentrazone + Bentazon + NIS	2 EC 4 EC	0.012 0.75	POST-DIRECT	0
Lactofen + NIS	2 EC	0.125	POST	22.5
Lactofen + Bentazon + NIS	2 EC 4 EC	0.125 0.75	POST	26.3
Imazethapyr + NIS	2 EC	2.0 oz prod.	POST	11.3
Imazethapyr + Bentazon + NIS	2 EC 4 EC	2.0 oz prod. 0.75	POST	11.3
Acifluorfen-Na + NIS	2 EC	0.125	POST	12.5
Acifluorfen-Na + Bentazon + NIS	2 EC 4 EC	0.125 0.75	POST	11.3
LSD (0.05)				6.9

** NIS applied at 0.25% v/v.

Note: Dual Magnum applied at 0.65 lbs a.i./A preemergence.

Evaluation of Herbicides on Crop Injury and Yield in Double-Cropped Snap Beans: 2003

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Final Report

Objective: to evaluate and compare the efficacy and phytotoxicity of selected herbicide treatments on Palmer Amaranth (*Amaranthus palmeri*) populations and snap beans (*Phaseolus vulgaris*).

Materials and Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center located in Lubbock on an Acuff clay loam soil with an average pH of 7.6 and 1.1% organic matter. The trial site was plowed in the fall and the soil prepared by applying a pre-plant fertilizer (50 lbs / A nitrogen) and then disking and listing furrows. Snap beans (var. "Bush Blue Lake 156") were seeded in the field using a Monosem vacuum planter on June 4 in 2-row plots measuring 6.67" x 20'. Herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Application data can be found in Tables 1 and 2 below for the pre- and postemergence treatments, respectively. Plots were furrow-irrigated as needed during the season. Snap beans were hand-harvested approximately 65 days after planting. Immediately following harvest, the plots were cultivated, and beds reshaped. Snap beans were again planted using the same procedure as mentioned above to evaluate potential carryover to the second crop. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference (α = 0.05).

Table 1. Application Data for Pre-transplant Herbicides

Location	Lubbock	Wind speed / direction	5 – 15 mph / S
Date	6.7.03	Crop	Snap Beans
Time of day	7:00 a.m.	Variety	BBL 156
Type of application	Broadcast	Crop stage	Seed
Carrier	Water	Air temp. (°F)	65
Gas (if not CO_2)	CO_2	Soil temp. (°F)	60
GPA	20	Soil beneath	Wet
PSI	30	Soil surface	Moist
Nozzle tips	8002	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 2. Application Data for Postemergence Treatments

Location	Lubbock	Wind speed / direction	0
Date	6.30.03	Crop	Snap Beans
Time of day	10:00 a.m.	Variety	BBL 156
Type of application	Broadcast	Crop stage	2 – 3 trifoliate
Carrier	Water	Air temp. (°F)	74
Gas (if not CO_2)	CO_2	Soil temp. (°F)	71
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Moist / compact
Nozzle tips	8002	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Comments: There was some reniform nematode stunting in field, but this was not consistent across all replications.

Results: There was very little weed pressure from Palmer amaranth populations in this study this year. As a result, no weed control data was collected and all effects on snap beans are primarily the result of herbicide influence.

Crop emergence was generally not significantly affected by herbicide treatment. The only significantly different comparison was between halosulfuron applied PRE and POST at 0.036 lbs a.i., however this was likely not an effect of herbicide treatment, but rather is considered an anomaly.

Crop injury ratings recorded on July 3 showed that POST treatments of halosulfuron applied at all three rates, and rimsulfuron applied POST had the most injury to snap beans. This injury was significantly greater than the untreated control. Preemergence applications of halosulfuron, while resulting in some crop stunting, were not higher than the POST treatments. All other PRE-applied herbicides (s-metolachlor, dimethenamid-P, clomazone, flufenacet and rimsulfuron) had only minor, transient injury. By July 16, crop injury from the POST applications of halosulfuron decreased to acceptable levels except where it was combined with bentazon (this remained at the same level), and with the POST-applied rimsulfuron. With POST applications of rimsulfuron, crop stunting and minor plant death occurred resulting in almost 70% injury ratings. Finally, injury ratings recorded August 2, just prior to harvest showed that all treatments had outgrown most herbicide-related injury symptoms with the exception of dimethenamid-P applied PRE, and the POST application of rimsulfuron. With dimethenamid-P, stunting appeared to increase to almost 14%, though it is not clear why this occurred. Rimsulfuron POST applications continued to result in significantly high percent injury to the snap beans.

Yields harvested on August 11 showed that even low weed pressures influenced snap beans as seen with data from the untreated plots. The highest yields were recorded in plots treated with dimethenamid-P, even though minor crop injury was observed 9 days previously. Overall yields were highly variable and this may have been an influence of the moderate nematode pressure present in parts of the trial area. However, rimsulfuron applied PRE appeared to be relatively safe on snap bean yields, while POST treatments resulted in significant yield reduction. PRE applications of halosulfuron were not significantly different from the highest yield plot, and only the highest rate of halosulfuron applied POST resulted in significantly lower yields. Overall, these results indicate that most PRE applied herbicide treatments were safe on snap beans and did not significantly influence crop yield. However, POST applications of halosulfuron at the highest rate may cause yield reductions, and POST-applied rimsulfuron is deadly to snap beans.

There were no differences between herbicide treatments on snap bean emergence for the second crop recorded 3 weeks after planting (data not shown). Additionally, crop injury was only 5% or less with the replanted snap beans, even with in the POST-applied rimsulfuron and dimethenamid-P treatments. Yield data was not recorded for the second planting.

The results of this study indicate that double-cropping snap beans with the herbicides evaluated in this test appears to be safe and non-injurious under conditions on the Texas High Plains. However, further research is needed to evaluate these and other herbicides for crop safety and weed control under differing soil and environmental conditions.

Table 3. Results of snap preemergence and postemergence herbicides treatments

Chemical	Rate lbs a.i. / A	Timing	Plants / 20' row	% Injury 7/03	% Injury 7/16	% Injury 8/02	Yield (lbs/A)	% Injury* to Replant
Untreated		All season	47.3	0	0	0	1023	0
Handweed		All season	52.3	0	0	0	2818	0
Halosulfuron 75WDG	0.024	PRE	49.0	8.8	0	0	4126	0
Halosulfuron 75WDG	0.036	PRE	54.0	8.8	11.3	2.5	2767	1.3
Halosulfuron 75WDG	0.048	PRE	48.3	13.8	11.3	5.0	2950	0
Halosulfuron 75WDG + NIS	0.024 0.25% v/v	POST 2 –3 Trifol.	48.5	16.3	11.3	3.8	2655	7.5
Halosulfuron 75WDG + NIS	0.036 0.25% v/v	POST 2 –3 Trifol.	43.8	16.3	5.0	3.8	3987	0
Halosulfuron 75WDG + NIS	0.048 0.25% v/v	POST 2 –3 Trifol.	45.3	22.5	6.3	3.8	1775	3.8
Halosulfuron 75WDG + Bentazon 4L + NIS	0.048 0.75 0.25% v/v	POST 2 –3 Trifol.	50.0	23.8	22.5	3.8	2220	5.0
s-Metolachlor 7.62E	0.95	PRE	52.3	7.5	0	0	3022	5.0
Dimethenamid-P 6E	0.75	PRE	50.3	5.0	6.3	13.8	4736	0
Clomazone 3ME	0.56	PRE	50.5	12.5	10.0	0	1824	0
Flufenacet 4SC	0.30	PRE	50.0	6.3	6.3	0	1562	2.5
Flufenacet 4SC	0.60	PRE	48.8	0	7.5	0	3698	2.5
Rimsulfuron 25DF	0.063	PRE	52.0	12.5	6.3	0	3123	2.5
Rimsulfuron 25DF + NIS	0.063 0.25% v/v	POST 2 – 3 trifol.	50.0	27.5	68.8	42.5	23	5.0
LSD (0.05)			7.7	10.4	16.3	9.5	2437	7.8

* Snap beans planted on June 4, and replanted August 12.
Preplant fertilizer @ 50 lbs N applied + side-dressed another 50 lbs N on July 3 due to wet conditions.

Evaluation of Herbicides on Crop Injury in Italian Flat Beans: 2003

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Final Report

Objective: to evaluate and compare the potential for phytotoxicity of selected herbicide treatments on Italian Flat snap beans (*Phaseolus vulgaris*).

Materials and Methods: The trial was conducted the farm of Gary Boyd located in Derby, TX on a sandy loam soil. The trial site was prepared according to standard grower practices by applying a pre-plant fertilizer, then disking and planting beans in 5-row beds. Snap beans (var. "Roma II") were seeded in the field at the end of August and plots measuring 6.67" x 20' were replicated throughout the field. Herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Application data can be found in Tables 1 and 2 below for the pre- and postemergence treatments, respectively. The field containing the plots was irrigated as needed by a center pivot system. However, over 20" of rain fell during the early trial period and this may have influenced the herbicides. The experimental design was a randomized complete block with 3 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Application Data for Pre-transplant Herbicides

Location	Derby, TX	Wind speed / direction	0 mph
Date	Aug. 23, 2003	Crop	Italian Flat Bean
Time of day	10:30 a.m.	Variety	"Roma II"
Type of application	Broadcast	Crop stage	Seed
Carrier	Water	Air temp. (°F)	87
Gas (if not CO_2)	CO_2	Soil temp. (°F)	81
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Moist
Nozzle tips	8002	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Partly cloudy
Boom width (")	6.5'	# Replications	3
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 2. Application Data for Postemergence Treatments

Location	Derby, TX	Wind speed / direction	0 mph
Date	Sept. 8, 2003	Crop	Italian Flat Bean
Time of day	8:30 p.m.	Variety	"Roma II"
Type of application	Broadcast	Crop stage	2 – 3 trifoliate
Carrier	Water	Air temp. (°F)	75
Gas (if not CO_2)	CO_2	Soil temp. (°F)	75
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Moist / compact
Nozzle tips	8002	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5'	# Replications	3
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Project Funded in part by: Allen Canning Company
The researcher wishes to thank Mr. Gary Boyd for allowing the use of his field for research.

Results: Phytotoxicity ratings recorded 15 days after treatment (DAT) on September 8 showed that crop injury (stunting) from the preemergence applications increased as the rate of rimsulfuron increased. A rate of 0.063 lbs a.i. / A is considered to be the 1X rate in this study. However, crop injury was not significantly higher from the untreated plots except for the highest (2X) rate, and this injury was considered somewhat acceptable. PRE applications of flufenacet and halosulfuron did not result in significant injury to snap beans in this study.

Data recorded on October 1, showed that crop injury from the PRE applications either remained the approximately the same (rimsulfuron) or increased in some treatments (flufenacet and halosulfuron). Only the highest applied rates of each herbicide had injury that was significantly greater than the untreated control. The increase in crop stunting was likely the result of the 20" of rain that occurred from the time of preemergence applications to the October 1 rating, and may not have occurred under dryer conditions. Additionally, POST applications of halosulfuron did not significantly increase crop injury by October 1 (23 DAT).

It was determined two weeks following the October 1 rating that there was very little difference in crop injury by herbicide treatments in the study (William Russell, Allen Canning Co., personal communication), and yields would likely not be different between treatments. Due to time constraints, the decision was made not to harvest the trial.

Table 3. Crop Injury Ratings on Italian Flat Snap Beans (var. Roma II)

Chemical	Rate lbs a.i. / A	Timing	% Injury 9/08	% Injury 10/01
Untreated			0	0
Rimsulfuuron 25DF	0.032	PRE	0	1.7
Rimsulfuron 25DF	0.063	PRE	5.0	6.7
Rimsulfuuron 25DF	0.095	PRE	10.0	8.3
Rimsulfuron 25DF	0.126	PRE	16.7	18.3
Flufenacet 4SC	0.3	PRE	8.3	13.3
Flufenacet 4SC	0.6	PRE	5.0	18.3
Halosulfuron 75WDG	0.024	PRE	0	6.7
Halosulfuron 75WDG	0.048	PRE	8.3	26.7
Halosulfuron 75WDG	0.024	POST	0	10.0
Halosulfuron 75WDG	0.048	POST	0	5.0
LSD (0.05)			13.0	18.0

Herbicide Screen Evaluation for Crop Injury in Field-Grown Cannas: 2003

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Final Report

Objective: to evaluate and compare the potential for phytotoxicity of PRE and POST herbicide applications on field-grown canna lilies (*Canna x generalis*) grown on the Texas High Plains.

Materials and Methods: The trial was conducted on land operated by Agri-Gold, Inc. (Pride of the Plains Bulb Farm) located in Olton, TX on a sandy loam soil. The trial site was previously planted to rye (*Secale cereale*) and this was allowed to grow as a windbreak during the winter and early spring. Cut canna segments (var. "Red President") were transplanted in April and preemergence herbicides were applied on April 28 to plots measuring approximately 6' x 20', with 2 rows of cannas per plot. Prior to crop emergence, the rye (6 – 18" tall) was killed with glyphosate (1 quart/A). Postemergence herbicide treatments were applied on June 17. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Plots were fertilized, cultivated, irrigated and hand weeded according to grower practices. Plots were overhead irrigated as needed during the season. Canna rhizomes were machine-harvested on December 8 and weights recorded. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference (α = 0.05).

Table 1. Application Data for Preemergence Treatments

Location	Olton, TX	Wind speed / direction	5 – 15 / NW
Date	April 28, 2003	Crop	Canna
Time of day	3:00 p.m.	Variety	"Red President"
Type of application	Broadcast	Crop stage	Seed
Carrier	Water	Air temp. (°F)	80
Gas (if not CO_2)	CO_2	Soil temp. (°F)	82
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Dry
Nozzle tips	8002VS	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Overcast
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 2. Application Data for Postemergence Treatments

Location	Olton, TX	Wind speed / direction	0
Date	June 17, 2003	Crop	Canna
Time of day	9:00 a.m.	Variety	"Red President"
Type of application	Broadcast	Crop stage	2 – 6 lvs; 8 – 12"
Carrier	Water	Air temp. (°F)	77
Gas (if not CO_2)	CO_2	Soil temp. (°F)	73
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Dry / Friable
Nozzle tips	8002VS	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Clear and sunny
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: Careless weed (4 – 12"); Russian Thistle (10")			

Project Funded in part by:
Pride of the Plains Bulb Farm

Table 3. List of Herbicides Evaluated in Canna Trial.

Active Ingredient	Product Name	Formulation
s-Metolachlor	Pennant Magnum	7.62E
Pendimethalin	Pendulum	3.3EC
Dimethenamid-P	Outlook	6E
Halosulfuron	Manage	75WDG
Clopyralid	Lontrel	3EC
Trifloxysulfuron	Envoke	75WDG
Mesotrione	Callisto	4SC
Cloransulam	FirstRate	84WDG
Imazamox	Raptor	1AS
Imazapic	Plateau	23.6WG
Fluroxypyr	Starane	1.5EC
Isoxaflutole	Balance	75WDG
Flumioxazin	Valor	51WP
Flumetsulam	Python	80WDG
Rimsulfuron	Matrix	25DF
Sulfentrazone	Spartan	75WG
Dithiopyr	Dimension	1EC

Results: Significant crop injury recorded on June 30 (see Table 5) resulted from PRE applications of imazapic (Plateau) and dithiopyr (Dimension), and POST treatments of halosulfuron (Manage), trifloxysulfuron (Envoke), mesotrione (Callisto), cloransulam (FirstRate), imazamox (Raptor), clopyralid (Lontrel) and fluroxypyr (Starane). Early season control of Palmer amaranth varied depending on herbicide treatment, with the greatest control observed in the grower's standard (s-metolachlor + pendimethalin) or dimethenamid-P combined PRE with isoxaben, pendimethalin or halosulfuron. Double application of s-metolachlor (PRE + POST) failed to adequately control Palmer amaranth prior to June 30. By August 12, crop injury continued to be significantly high in imazapic, trifloxysulfuron, cloransulam, halosulfuron (POST) and clopyralid treatments, but the degree of injury decreased in other treatments.

Yields of canna rhizomes were generally greatest where PRE herbicides were applied, especially when combined with plots where Palmer amaranth control was greater than 80%. Greatest yield occurred in plots treated with flumetsulam (Python), a non-registered material. The grower standard, a combination of s-metolachlor + pendimethalin had 18% less yield compared to flumetsulam. Most POST-applied herbicides reduced canna yields, with the exception of fluroxypyr or clopyralid applied alone. s-Metolachlor applied PRE + POST did not result in significant yield losses in this trial. These results indicate the potential for new herbicides to be incorporated into field-grown canna production for control of Palmer amaranth. However, more research is needed to evaluate crop safety and nutsedge control.

Table 4. Ranking of 10 Best Overall Treatments by Yield and Percent Weed Control

Herbicide Treatment	Yield (lbs/A)	Rank	Herbicide Treatment	% Weed Control
Python PRE	16613	1	Pennant Magnum + Gallery PRE	99.0
Callisto PRE	15755	2	Outlook + Pendulum PRE	98.0
Pennant Magnum PRE + Starane POST	15706	3	Outlook + Gallery PRE	97.0
Balance PRE	15208	4	Outlook PRE	94.5
Dimethenamid-P + Pendulum PRE	14841	5	Python PRE	94.3
Spartan PRE	14131	6	Pennant Magnum + Pendulum PRE	92.5
Pennant Magnum + Pendulum PRE + Manage POST	13919	7	Pennant Magnum + Pendulum PRE + Manage POST	92.5
Pennant Magnum + Pendulum PRE	13633	8	Outlook + Manage PRE	91.3
Pennant Magnum PRE + Pennant Magnum POST	13029	9	Spartan PRE	91.0
Valor PRE	13012	10	Pennant Magnum PRE + Manage POST	91.0

Table 5. The Effects of Herbicide Combinations on Field-Grown Cannas Crop Injury and Yield

Active Ingredient	Rate (lbs a.i. / A)	Timing	% Injury June 30	% Control Palmer Amaranth June 30	% Injury August 12	% Control Palmer Amaranth June 30	Yield lbs / A
Untreated			0	0	0	0	13519
Handweed			0	99.0	0	99.0	9274
s-Metolachlor	2.0 pts	PRE	0	56.3	8.8	86.3	12253
s-Metolachlor	3.0 pts	PRE	0	65.0	0	77.3	10302
Pendimethalin	4.8 qts	PRE	0	87.5	0	89.5	10923
s-Metolachlor + Pendimethalin	2.0 pts 4.8 qts	PRE	0	92.5	3.8	93.8	13633
s-Metolachlor + Isoxaben	2.0 pts 1.0 lb	PRE PRE	6.3	80.0	0	99.0	11910
Dimethenamid-P + Isoxaben	14.0 1.0 lb	PRE PRE	7.5	88.8	2.5	97.0	10833
Dimethenamid-P	14.0 oz	PRE	5.0	40.0	15.0	94.5	10106
Dimethenamid-P + Pendimethalin	21.0 oz 4.8 qts	PRE	6.3	87.5	0	98.0	14841
Halosulfuron	0.5 oz	PRE	3.8	61.3	13.8	85.0	9919
Halosulfuron	1.0 oz	PRE	3.8	57.5	6.3	83.8	10229
s-Metolachlor + Halosulfuron	2.0 pts 0.5 oz	PRE	5.0	73.8	7.5	90.0	12057
s-Metolachlor + Halosulfuron	2.0 pts 0.5 oz	PRE Post - 6 WAP	32.5	89.8	27.5	91.0	7535
s-Metolachlor + Pendimethalin + Halosulfuron	2.0 pts 21.0 oz 0.5 oz	PRE Post - 6 WAP	31.3	93.5	22.5	92.5	13919
s-Metolachlor + Halosulfuron + Clopyralid	2.0 pts 0.032 0.12	PRE Post - 6 WAP Post - 6 WAP	43.8	80.0	35.0	83.8	6653
Trifloxysulfuron	5.3 g a.i.	Post - 6 WAP	40.0	96.0	72.3	50.0	1110
Trifloxysulfuron	7.9 g a.i.	Post - 6 WAP	42.5	98.0	74.3	83.8	1265
s-Metolachlor + Trifloxysulfuron	2.0 pts 5.3 g a.i.	PRE Post - 6 WAP	46.3	95.5	94.3	83.5	2392
s-Metolachlor + Pendimethalin + Trifloxysulfuron	2.0 pts 5.3 g a.i.	PRE PRE Post - 6 WAP	47.5	99.0	99.0	87.5	433
s-Metolachlor Mesotrione	2.0 pts 3.0 oz	PRE Post - 6 WAP	47.5	86.3	22.5	84.8	7780

Table 5. The Effects of Herbicide Combinations on Field-Grown Cannas Crop Injury and Yield (continued)

Active Ingredient	Rate (lbs a.i. / A)	Timing	% Injury June 30	% Control Palmer Amaranth June 30	% Injury August 12	% Control Palmer Amaranth June 30	Yield lbs / A
s-Metolachlor Cloransulam	2.0 pts 0.3 oz	PRE Post - 6 WAP	45.0	87.5	56.3	20.0	3780
s-Metolachlor Imazamox	2.0 pts 6.0 oz	PRE Post - 6 WAP	30.0	94.5	51.3	33.8	7029
s-Metolachlor + s-Metolachlor	2.0 pts 2.0 pts	PRE Post - 6 WAP	2.5	62.5	12.5	89.8	13029
Imazapic	3.0 oz	PRE	87.5	73.3	94.5	40.0	3094
Imazapic	6.0 oz	PRE	86.3	94.5	95.0	76.3	1249
s-Metolachlor Fluroxypyr	2.0 pts 0.5 pts	PRE Post - 6 WAP	22.5	57.5	6.3	89.8	15706
s-Metolachlor Clopyralid	2.0 pts 0.67pts	PRE Post - 6 WAP	5.0	77.5	0	90.0	11633
Isoxaflutole	2.0 oz	PRE	3.8	81.3	7.5	82.5	15208
Flumioxazin	0.062	PRE	8.8	79.8	2.5	89.8	13012
Flumetsulam	1.0 oz	PRE	6.3	73.8	12.5	94.3	16613
Rimsulfuron	1.0 oz	PRE	13.8	65.0	20.0	83.8	10572
Mesotrione	6.0 oz	PRE	5.0	21.3	5.0	87.3	15755
Dimthenamid-P Halosulfuron	21.0 oz 1.0 oz	PRE	10.0	55.0	15.0	91.3	10212
Sulfentrazone	3.0 oz	PRE	0	45.0	5.0	91.0	14131
Dithiopyr	2.0 qts	PRE	18.8	50.0	11.3	67.5	7037
LSD (0.05)			**17.1**	**30.9**	**23.9**	**23.6**	**5485.3**

Herbicide Evaluation on Winter Annual Weeds & Crop Injury in Field-Grown Daylilies: 2003

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Final Report

Objective: to evaluate and compare flixweed [*Descurainia sophia* (L.) Webb. Ex Prantl] and London rocket (*Sisymbrium irio* L.) control, and the potential phytotoxicity of POST applications of herbicides on field-grown daylilies (*Hemerocallis spp.*).

Materials and Methods: The trial was conducted on land operated by Agri-Gold, Inc. (Pride of the Plains Bulb Farm) located in Olton, TX on a clay loam soil. Daylilies (var. "Jungle Princess") were transplanted in the fall of 2002 and no preemergence herbicides were applied at that time. Flixweed, a winter annual was found in high numbers in the field during early spring. On March 12, 2003 POST herbicide treatments were applied to evaluate flixweed control and crop phytotoxicity. Plots measured 6.67' x 20', with 4 rows of daylilies per plot. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Plots were fertilized, cultivated, irrigated and hand weeded according to grower practices. Plots were overhead irrigated as needed during the season. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Herbicide Application Data for POST treatments

Location	Olton, TX	Wind speed / direction	W / 5 – 15 mph
Date	March 12, 2003	Crop	Daylilies
Time of day	3:00 p.m.	Variety	Jungle Princess
Type of application	Broadcast	Crop stage	Emerging – 3"
Carrier	Water	Air temp. (°F)	80
Gas (if not CO_2)	CO_2	Soil temp. (°F)	58
GPA	20	Soil beneath	Semi-moist
PSI	30	Soil surface	Dry
Nozzle tips	8002	% Relative humidity	Low
Nozzle spacing	18"	Sky conditions	Partly cloudy
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Plot size	6' x 20'	# Rows/plot	4
Weeds present: Flixweed (Descurania Sophia (L.) Webb. Ex Prantl (DESSO);, London Rocket (Sisybrium irio L. (SSYIR)			

Results: Control of flixweed and London rocket was best when treated with POST applications of paraquat or the combination of paraquat + bentazon. Control of London rocket was approximately 10% better than that of flixweed by the paraquat or paraquat + bentazon treatments. Control of either weed species by imazamox, clopyralid or fluroxypyr was poor, though significantly better than the untreated for London rocket. Imazamox, clopyralid and fluroxypyr showed more activity on London rocket than on flixweed.

Crop injury was greatest with imazamox and clopyralid and was significantly higher than the untreated control. While not significantly greater, fluroxypyr injury to the daylilies was unacceptable. While there as evidence of slight chlorosis (yellowing) to the leaves of daylilies from the paraquat or paraquat + bentazon treatments, this did not cause any significant injury to the crop. These results indicate that paraquat and the combination of paraquat + bentazon may be used to control winter annual weeds like flixweed and London rocket in daylilies at the stage of emergence up to one or two leaves showing. the other herbicides caused significant injury and perhaps a lower rate may be useful, but the lack of acceptable control would like inhibit their use in daylilies.

Table 2. Results of Herbicide Treatments on Weed Control and Crop Injury

Chemical	**Trade Name**	**Rate / A**	**Application Timing**	**% Control London Rocket 3/21**	**% Control Flixweed 3/21**	**% Daylily Injury 6/10**
Paraquat + NIS	Gramoxone	3.0 pints	POST	91.3	83.8	0
Paraquat + Bentazon + NIS	Gramoxone Basagran	3.0 pints 2.0 pints	POST	95.0	85.0	10.0
Imazamox + NIS	Raptor	6.0 oz	POST	32.5	11.3	42.5
Clopyralid	Stinger	0.67 pint	POST	47.5	0	40.0
Fluroxypyr	Starane	0.5 pint	POST	67.5	13.8	27.5
Untreated				0	0	0
LSD (0.05)				**12.5**	**14.5**	**29.9**

Weed Control Programs for Field-Grown Daylilies: 2003

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Final Report

Objective: to evaluate and compare preemergence and postemergence herbicides for use in field-grown daylilies (*Hemerocallis spp.*).

Materials and Methods: The trial was conducted on land operated by Agri-Gold, Inc. (Pride of the Plains Bulb Farm) located in Olton, TX on an Olton clay loam soil. Daylilies (var. "Jungle Princess") were transplanted in the fall of 2002 by the grower and no preemergence herbicides were applied at that time. Plots measured 6.67' x 20', with 4 rows of daylilies per plot. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Plots were fertilized, cultivated, irrigated and hand weeded according to grower practices. Plots were overhead irrigated as needed during the season. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Herbicide Application Data for POST treatments

Location	Olton, TX	Wind speed / direction	SE / 10 – 20 mph
Date	May 12, 2003	Crop	Daylilies
Time of day	11:00 p.m.	Variety	Jungle Princess
Type of application	Broadcast	Crop stage	8 – 10 leaves
Carrier	Water	Air temp. (°F)	68
Gas (if not CO_2)	CO_2	Soil temp. (°F)	76
GPA	20	Soil beneath	Semi-moist
PSI	30	Soil surface	Dry / compact
Nozzle tips	8002	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Partly cloudy
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Plot size	6' x 20'	# Rows/plot	4
Weeds present: Flixweed (Descurania Sophia (L.) Webb. Ex Prantl (DESSO);, London Rocket (Sisybrium irio L. (SSYIR); Lakeweed, Prickly Lettuce			

Results: The entire test area was under significant drought stress during the early season and during time of herbicide applications, and this likely influenced weed control. Overall weed control was poor from the selected herbicide treatments (no data shown). Crop injury recorded 4 weeks after application showed that the combination of dimethenamid-P (high rate) + imazamox and all combinations of imazapic resulted in significant crop injury compared to the handweeded control. Due to extreme weed pressures following this date, the trial was abandoned. It is unknown whether the observed crop injury would have resulted in significant yield reductions in this test. Trials evaluating herbicide efficacy and crop injury in daylilies should be conducted in the future to examine compatible weed control programs for this important crop.

Table 2. Weed Control Programs for Nutsedge and Broadleaf Weeds in Field-Grown Daylilies.

Active Ingredient	Rate / A	Timing	% Crop Injury June 10
Untreated			0
Handweed			0
s-Metolachlor 7.62E + Imazamox 1AS	2.0 pts 6.0 oz	POST	10.0
Dimethenamid-P 6E + Imazamox 1AS	14.0 oz 6.0 oz	POST	17.5
Oryzalin 4AS + Imazamox 1AS	1.5 pts 6.0 oz	POST	5.0
Imazamox 1AS	6.0 oz	POST	2.5
s-Metolachlor 7.62E + Mesotrione 4SC	2.0 pts 3.0 oz	POST	13.8
Dimethenamid-P 6E + Mesotrione 4SC	14.0 oz 3.0 oz	POST	10.0
Oryzalin 4AS + Mesotrione 4SC	1.5 pts 3.0 oz	POST	5.0
Mesotrione 4SC	3.0 oz	POST	8.8
s-Metolachlor 7.62E + Flumioxazin 51WP	2.0 pts 2.0 oz	POST	12.5
Dimethenamid-P 6E + Flumioxazin 51WP	14.0 oz 2.0 oz	POST	5.0
Oryzalin 4AS + Flumioxazin 51WP	1.5 pts 2.0 oz	POST	6.3
Flumioxazin 51WP	2.0 oz	POST	2.5
s-Metolachlor 7.62E + Imazapic 23.6WG	2.0 pts 1.5 oz	POST	18.8
Dimethenamid-P 6E + Imazapic 23.6WG	14.0 oz 1.5 oz	POST	35.0
Oryzalin 4AS + Imazapic 23.6WG	1.5 pts 1.5 oz	POST	25.0
Imazapic 23.6WG	1.5 oz	POST	12.5
s-Metolachlor 7.62E	2.0 pts	POST	12.5
Dimethenamid-P 6E	14 oz	POST	11.3
Oryzalin 4AS	1.5 pts	POST	10.0
LSD (0.05)			14.4

Herbicide Screen Evaluation for Crop Injury in Field-Grown Irises: 2003

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Final Report

Objective: to evaluate and compare the potential for phytotoxicity of PRE and POST herbicide applications on field-grown irises (*Iris spp.*) grown on the Texas High Plains.

Materials and Methods: The trial was conducted on land operated by Agri-Gold, Inc. (Pride of the Plains Bulb Farm) located in Olton, TX on a clay loam soil. The trial site was plowed, disked and prepared in the fall of 2002 by the grower according to their standard practices. Cut iris rhizome segments (var. "Hurricane Lamp") were then transplanted and allowed to over-winter. In the spring, preemergence herbicides were applied on March 5 to irises in plots measuring approximately 6' x 20', with 2 rows of irises per plot. Postemergence treatments were applied to the irises on April 17. Herbicide treatments were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Plots were fertilized, cultivated, irrigated and hand weeded according to grower practices. Plots were overhead irrigated as needed during the season. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Application Data for Preemergence Treatments

Location	Olton, TX	Wind speed / direction	0 – 15 / SW
Date	March 5, 2003	Crop	Iris
Time of day	1:30 p.m.	Variety	"Hurricane Lamp"
Type of application	Broadcast	Crop stage	2 – 6", 1 – 4 leaves
Carrier	Water	Air temp. (°F)	61
Gas (if not CO_2)	CO_2	Soil temp. (°F)	53
GPA	20	Soil beneath	Dry
PSI	30	Soil surface	Dry
Nozzle tips	8002VS	% Relative humidity	Low
Nozzle spacing	18"	Sky conditions	Partly cloudy
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None, previously cultivated on Feb. 27			

Table 2. Application Data for Postemergence Treatments

Location	Olton, TX	Wind speed / direction	5 – 15 / NW
Date	April 17, 2003	Crop	Iris
Time of day	1:30 p.m.	Variety	"Hurricane Lamp"
Type of application	Broadcast	Crop stage	8 – 12"
Carrier	Water	Air temp. (°F)	70
Gas (if not CO_2)	CO_2	Soil temp. (°F)	60
GPA	20	Soil beneath	Dry
PSI	30	Soil surface	Dry
Nozzle tips	8002VS	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Overcast
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

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Table 3. List of Herbicide Treatments For Iris Trial

Active Ingredient	Product Name	Formulation
s-Metolachlor	Pennant Magnum	7.62E
Prodiamine	Barricade	4FL
Dimethenamid-P	Outlook	6E
Halosulfuron	Manage	75WDG
Clopyralid	Lontrel	3EC
Trifloxysulfuron	Envoke	75WDG
Mesotrione	Callisto	4SC
Cloransulam	FirstRate	84WDG
Imazamox	Raptor	1AS
Imazapic	Plateau	23.6WG
Fluroxypyr	Starane	1.5EC
Isoxaflutole	Balance	75WDG
Flumioxazin	Valor	51WP
Flumetsulam	Python	80WDG
Rimsulfuron	Matrix	25DF
Sulfentrazone	Spartan	75WG
Dithiopyr	Dimension	1EC
Bentazon	Basagran	4L

Results: The ten best treatments according to yield are found in Table 4. However, crop injury (see Table 5) from PRE applications evaluated 5 weeks after treatment (WAT) resulted in significant injury from halosulfuron, imazapic, rimsulfuron and sulfentrazone when compared to s-metolachlor (grower standard). By 23 WAT, only flufenacet had greater crop injury than s-metolachlor. Minor injury was observed from POST applications of halosulfuron recorded 16 WAT. Plant death occurred from PRE-applied imazapic and POST-applied trifloxysulfuron treatments. Harvested bulb fresh-weights were reduced for plots treated preemergence with halosulfuron, rimsulfuron, flufenacet, sulfentrazone and s-metolachlor, and with POST treatments of trifloxysulfuron when compared to the hand weeded controls. Although yields were reduced by several of the herbicides tested, lower yields were also observed with the grower standard (s-metolachlor) compared to the hand weeded check. Future research will evaluate several of these herbicides to determine less injurious rates and alternative timing of applications.

Table 4. Ranking of 10 Best Overall Herbicide Treatments by Iris Yield

Rank	Herbicide Treatment	Yield (lbs/A)
1	Pennant Magnum PRE + Pennant Magnum POST	3961.3
2	Dimension PRE	3920.5
3	Callisto PRE	3512.1
4	Valor PRE	3389.6
5	Outlook PRE	3062.9
6	Pennant Magnum PRE + Gallery PRE	3022.0
7	Pennant Magnum PRE + Barricade PRE	2940.4
8	Pennant Magnum PRE + Lontrel POST	2858.7
9	Pennant Magnum PRE + Manage/Basagran POST	2777.0
10	Pennant Magnum PRE + Starane POST	2613.7

Table 5. The Effects of Herbicide Combinations on Field-Grown Iris Crop Injury and Yield

Active Ingredient	Rate (lbs a.i. / A)	Timing	No. of Plants / Plot May 6	No. of Open Flowers at Peak May 6	% Injury April 17	% Injury Aug. 12	Yield lbs / A
Untreated			17.5	13.5	0	0	NA
Handweed			18.8	7.5	0	0	3267.1
s-Metolachlor	1.9	PRE	17.0	10.3	0	0	2940.3
s-Metolachlor	2.9	PRE	18.3	11.0	1.3	0	NA
Prodiamine	1.3	PRE	17.5	9.0	0	23.8	NA
s-Metolachlor + Prodiamine	1.9 1.3	PRE	17.5	11.3	6.3	10.0	2940.4
Isoxaben	0.75	PRE	16.8	8.8	6.3	30.0	2286.9
s-Metolachlor + Isoxaben	1.9 0.75	PRE	17.0	11.0	8.8	0	3022.0
Dimethenamid-P	0.65	PRE	18.8	13.3	0	0	NA
Dimethenamid-P	0.98	PRE	17.3	11.3	8.8	13.8	3062.9
Halosulfuron	0.024	PRE	17.0	12.5	27.5	26.3	1429.4
Halosulfuron	0.048	PRE	17.3	10.0	40.0	21.3	1796.9
s-Metolachlor + Halosulfuron	1.9 0.024	PRE	18.3	9.3	36.3	24.8	2041.9
s-Metolachlor + Halosulfuron + NIS	1.9 0.024 0.25% v/v	PRE Post - 6 Weeks	18.0	3.3	7.5	16.3	2082.8
s-Metolachlor + Prodiamine + Halosulfuron + NIS	1.9 0.65 0.024 0.25% v/v	PRE Post - 6 Weeks	18.3	4.8	6.3	7.5	NA
s-Metolachlor + Halosulfuron + Bentazon + NIS	1.9 0.024 1.0 0.25% v/v	PRE Post - 6 Weeks Post - 6 Weeks	16.8	4.8	2.5	13.8	2777.0
Trifloxysulfuron	0.012	Post - 6 Weeks	18.8	0.3	0	81.0	NA
Trifloxysulfuron	0.017	Post - 6 Weeks	17.3	0.3	0	71.0	NA
s-Metolachlor + Trifloxysulfuron	1.9 0.012	PRE Post - 6 Weeks	19.0	0.5	82.3	82.3	NA
s-Metolachlor + Prodiamine + Trifloxysulfuron	1.9 0.65 0.012	PRE Post - 6 Weeks	19.5	4.5	67.3	67.3	NA

Table 5. The Effects of Herbicide Combinations on Field-Grown Iris Crop Injury and Yield (continued)

Active Ingredient	Rate (lbs a.i. / A)	Timing	No. of Plants / Plot May 6	No. of Open Flowers at Peak May 6	% Injury April 7	% Injury Aug. 12	Yield lbs / A
s-Metolachlor Mesotrione + COC	1.9 0.09 1.0% v/v	PRE Post - 6 Weeks	19.0	6.0	3.8	41.3	NA
s-Metolachlor Cloransulam + NIS	1.9 0.015 0.25% v/v	PRE Post - 6 Weeks	18.8	6.0	3.8	61.0	NA
s-Metolachlor Imazamox + NIS	1.9 0.05 *0.25%*	PRE Post - 6 Weeks	17.3	2.8	8.8	82.3	NA
s-Metolachlor + s-Metolachlor	1.9 1.9	PRE Post - 6 Weeks	17.8	6.8	15.0	29.8	3961.3
Imazapic	0.04	PRE	18.0	0	71.3	99.0	NA
Imazapic	0.08	PRE	18.3	0	75.0	99.0	NA
s-Metolachlor Fluroxypyr	1.9 0.09	PRE Post - 6 Weeks	16.0	9.5	2.5	13.8	2613.7
s-Metolachlor Clopyralid	1.9 0.25	PRE Post - 6 Weeks	18.3	11.0	5.0	13.8	2858.7
Isoxaflutole	0.09	PRE	17.0	9.3	5.0	46.0	NA
Flumioxazin	0.1	PRE	18.0	8.3	5.0	34.8	3389.6
s-Metolachlor Imazapic	1.9 0.04	PRE	17.0	0	71.3	99.0	NA
Rimsulfuron	0.015	PRE	17.3	9.8	20.0	26.3	2246.1
Mesotrione	0.19	PRE	16.8	11.0	2.5	7.5	3512.1
Flufenacet	0.3	PRE	17.8	6.0	7.5	42.5	2205.3
Sulfentrazone	0.14	PRE	17.8	1.8	75.0	8.8	1633.6
Dithiopyr	0.5	PRE	18.0	12.8	0	0	3920.5
LSD (0.05)			**2.0**	**4.7**	**11.5**	**36.9**	**1166.8**

Evaluation of Herbicide Treatments on Crop Injury and Yield in Peppers: 2003

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Final Report

Objective: to evaluate and compare the phytotoxicity of selected herbicide treatments on the crop injury and yield of field-grown chili (var. Sonora), jalapeño (var. Grande) and bell (var. Giant Belle) peppers (*Capiscum annuum*).

Materials and Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center located in Lubbock on an Acuff clay loam soil with an average pH of 7.6 and 1.1% organic matter. The trial site was plowed in the fall and the soil prepared by applying a pre-plant fertilizer (50 lbs / A nitrogen) and then disking and listing furrows into the soil. Peppers were seeded in the greenhouse on March 31 and transplanted by hand into the field on May 29 in two-row plots at an in-row spacing of 18" and 40" between rows. Plot sized measured 6.67' x 15' and contained 12 plants of each variety per plot. Supplemental fertilizer was broadcast on June 17 at 30 lbs N / A, and then irrigated in. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Application data can be found in Tables 1, 2 and 3 below for the pre-transplant and postemergence treatments, respectively. Plots were furrow-irrigated as needed during the season. Peppers were harvested by hand at least 3 times during the growing season, and weighed accordingly. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Application Data for Pre-transplant Herbicides

Location	Lubbock	Wind speed / direction	0 – 5 mph / SW
Date	May 28, 2003	Crop	Peppers
Time of day	6:00 p.m.	Variety	3 types
Type of application	Broadcast	Crop stage	Transplants
Carrier	Water	Air temp. (^oF)	85
Gas (if not CO_2)	CO_2	Soil temp. (^oF)	65
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Dry – light crust
Nozzle tips	8002VS	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Clear & Sunny
Boom width (")	6.5"	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 2. Application Data for 2-Week Post Transplant Herbicides

Location	Lubbock	Wind speed / direction	0 – 10 mph / SW
Date	June 12, 2003	Crop	Peppers
Time of day	9:30 a.m.	Variety	3 types
Type of application	Broadcast / Post-Direct	Crop stage	6 – 12"
Carrier	Water	Air temp. (^oF)	75
Gas (if not CO_2)	CO_2	Soil temp. (^oF)	70
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Drying, crusty
Nozzle tips	8002VS	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5"	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 3. Application Data for 4-Week Post Transplant Herbicides

Location	Lubbock	Wind speed / direction	5 mph / N
Date	June 30, 2003	Crop	Peppers
Time of day	8:30 a.m.	Variety	3 types
Type of application	Broadcast	rop stage	12 – 18" w/ flow.
Carrier	Water	Air temp. (°F)	69
Gas (if not CO_2)	CO_2	Soil temp. (°F)	65
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Moist, compact
Nozzle tips	8002VS	% Relative humidity	High
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5"	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Results: There was very little weed pressure in this trial, thus no percent weed control data is available for this study. Crop injury from pre-transplant applications (Tables 1, 2 & 3) was observed on June 12 only in plots treated with sulfentrazone at 0.37 lbs a.i./A, and this was consistent across pepper types. There was no injury observed in the flufenacet and clomazone-treated plots. However, crop injury recorded 1 week following the postemergence and post-directed applications of halosulfuron showed that there was increased injury in the form of stunting and chlorosis with broadcast postemergence treatments when compared to post-directed applications. Sulfentrazone injury continued to remain the same or slightly increase at this timing. Treatments applied 4 weeks after transplanting and recorded on July 4 showed that crop injury decreased to acceptable levels in the broadcast postemergence and post-directed applications of halosulfuron. Postemergence treatments of pyrithiobac and bentazon at both the low and high rates generally resulted in less than 15% crop injury. However, sulfentrazone injury was rate responsive by July 4, and continued to increase in both treatments.

Pepper yields, compared to the untreated, handweeded plots were mainly influenced by the applications of sulfentrazone at the high rate that reduced yields significantly for the jalapeno and bell pepper crops (a reduction of 35 and 53%, respectively). Yields of all types in plots treated with the low rate of sulfentrazone were not reduced. Broadcast postemergence halosulfuron treatments had a trend to reduce yields as the rate of halosulfuron increased; however, this was not significantly different from the handweeded control. Yields in post-directed applications of halosulfuron, while not significantly different from the control, where generally higher than those treated over the top. Flufenacet-treated peppers had excellent yields that were essentially equal in all pepper types grown. Finally, yields in clomazone-treated plots plus either pyrithiobac or bentazon had no negative impacts on pepper yields in any of the types tested.

The results of this trial indicate that all herbicides evaluated have potential for use in pepper production. However, results from halosulfuron treatments indicate increased safety with post-directed applications and postemergence broadcast applications at the lowest rate. Flufenacet was safe on all types tested and sulfentrazone was safe at the low rate. Sulfentrazone applied at 0.37 lbs a.i./A was too injurious on all types of peppers. Finally, the combination of clomazone + pyrithiobac or bentazon was only slightly injurious to the peppers and had no deleterious effects on yields, regardless of the rate applied. Continued research is needed with these and other herbicides to obtain registrations for use in peppers.

Table 4. The Effect of Herbicides Applications on Jalapeño Peppers

Chemical	Rate (lbs a.i./A)	Timing	% Injury 6/12	% Injury 6/18	% Injury 7/04	Yield (lbs / A)
Untreated			0	0	0	34375
Handweed			0	0	0	35344
Halosulfuron 75 WDG + NIS	0.024	2-Wks Post	0	20.0	3.8	32189
Halosulfuron + NIS	0.032	2-Wks Post	0	31.3	6.3	29263
Halosulfuron + NIS	0.048	2-Wks Post	0	31.3	6.3	29714
Halosulfuron + NIS	0.032	2-Wks Post-Directed	0	7.5	0	35368
Halosulfuron + NIS	0.048	2-Wks Post-Directed	0	8.8	13.8	31768
Flufenacet 4SC	0.04	Pre-Trans	0	0	0	33222
Sulfentrazone 75WDG	0.18	Pre-Trans	2.5	0	18.8	38115
Sulfentrazone 75WDG	0.37	Pre-Trans	17.5	23.7	35.0	22850
Clomazone 3ME + *Pyrithiobac-Na 85SP + NIS*	0.75 0.033	Pre-Trans 4-Wks Post	0	2.5	8.8	30806
Clomazone 3ME + *Pyrithiobac-Na 85SP + NIS*	0.75 0.066	Pre-Trans 4-Wks Post	0	0	11.3	37095
Clomazone 3ME + *Bentazon 4L + NIS*	0.75 0.5	Pre-Trans 4-Wks Post	0	7.5	11.3	28366
Clomazone 3ME + *Bentazon 4L + NIS*	0.75 1.0	Pre-Trans 4-Wks Post	0	6.3	16.3	35961
LSD (0.05)			**3.1**	**8.4**	**7.4**	**10945**

Injury: 6/12 = stunting; 6/18 = stunting + chlorosis; 7/04 = stunting. Some reniform nematodes were present in the field and on pepper roots and may have influenced and reduced overall yields.

Table 5. The Effect of Herbicide Applications on Chili Peppers

Chemical	Rate (lbs a.i./A)	Timing	% Injury 6/12	% Injury 6/18	% Injury 7/04	Yield (lbs / A)
Untreated			0	0	0	19352
Handweed			0	0	0	23097
Halosulfuron 75 WDG + NIS	0.024	2-Wks Post	0	18.8	2.5	29580
Halosulfuron + NIS	0.032	2-Wks Post	0	15.0	18.8	19305
Halosulfuron + NIS	0.048	2-Wks Post	0	20.0	11.3	17738
Halosulfuron + NIS	0.032	2-Wks Post-Directed	0	7.5	0	24323
Halosulfuron + NIS	0.048	2-Wks Post-Directed	0	10.0	13.8	21459
Flufenacet 4SC	0.04	Pre-Trans	0	0	3.8	22970
Sulfentrazone 75WDG	0.18	Pre-Trans	7.5	0	15.0	21903
Sulfentrazone 75WDG	0.37	Pre-Trans	20.0	18.8	36.3	14044
Clomazone 3ME + Pyrithiobac-Na 85SP + NIS	0.75 0.033	Pre-Trans 4-Wks Post	0	0	8.8	24647
Clomazone 3ME + Pyrithiobac-Na 85SP + NIS	0.75 0.066	Pre-Trans 4-Wks Post	0	3.8	10.0	22717
Clomazone 3ME + Bentazon 4L + NIS	0.75 0.5	Pre-Trans 4-Wks Post	0	7.5	8.8	25825
Clomazone 3ME + Bentazon 4L + NIS	0.75 1.0	Pre-Trans 4-Wks Post	0	2.5	13.8	21047
LSD (0.05)			**4.3**	**7.4**	**7.4**	**9440**

Injury: 6/12 = stunting; 6/18 = stunting + chlorosis; 7/04 = stunting. Some reniform nematodes were present in the field and on pepper roots and may have influenced and reduced overall yields.

Preemergence Herbicide Effects on Weed Control and Crop Injury of Potatoes: 2003

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Final Report

Objective: to evaluate and compare the efficacy and phytotoxicity of selected preemergence herbicide treatments in potatoes (*Solanum tuberosum*).

Materials and Methods: Two trials were conducted in production fields maintained by Springlake Potatoes (Bruce Barrett, cooperator) in Springlake, TX on a sandy loam soils. The trial sites were prepared according to standard grower practices by applying a pre-plant fertilizer, then disking and planting potatoes. The potato seed pieces were planted in the field in early to mid-March and two row plots were created measuring 6' x 20'. Prior to crop emergence, delayed preemergence (DPRE) treatments were applied to individual plots. All herbicide treatments were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Application data can be found in Tables 1 and 2 for the individual trials. The fields were irrigated as needed, and plots maintained insect and disease-free by the grower. In both these studies, yields were not recorded due to various production situations with the grower. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference (α = 0.05).

Table 1. Application Data for Potatoes (var. Endora)

Location	Springlake, TX	Wind speed / direction	15 – 20 mph / SW
Date	April 29, 2003	Crop	Potatoes
Time of day	2:00 p.m.	Variety	Endora
Type of application	Broadcast	Crop stage	DPRE
Carrier	Water	Air temp. (°F)	90
Gas (if not CO_2)	CO_2	Soil temp. (°F)	68
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Dry
Nozzle tips	8002VS	% Relative humidity	Moderately High
Nozzle spacing	18"	Sky conditions	Partly cloudy
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 2. Application Data for Potatoes (var. Norkotah)

Location	Springlake, TX	Wind speed / direction	0 – 5 mph / SW
Date	April 30, 2003	Crop	Potatoes
Time of day	8:00 a.m.	Variety	Norkotah
Type of application	Broadcast	Crop stage	Ground crack
Carrier	Water	Air temp. (°F)	61
Gas (if not CO_2)	CO_2	Soil temp. (°F)	57
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Moist
Nozzle tips	8002VS	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 6. The Effect of Herbicide Applications on Bell Peppers

Chemical	Rate (lbs a.i./A)	Timing	% Injury 6/12	% Injury 6/18	% Injury 7/04	Yield (lbs / A)
Untreated			0	0	0	11366
Handweed			0	0	0	14841
Halosulfuron 75 WDG + NIS	0.024	2-Wks Post	0	17.5	3.8	18727
Halosulfuron + NIS	0.032	2-Wks Post	0	16.3	7.5	10785
Halosulfuron + NIS	0.048	2-Wks Post	0	22.5	8.8	11741
Halosulfuron + NIS	0.032	2-Wks Post-Directed	0	5.0	0	18226
Halosulfuron + NIS	0.048	2-Wks Post-Directed	0	6.3	13.8	10032
Flufenacet 4SC	0.04	Pre-Trans	0	0	7.5	14685
Sulfentrazone 75WDG	0.18	Pre-Trans	10.0	0	16.3	13436
Sulfentrazone 75WDG	0.37	Pre-Trans	17.5	27.5	32.5	7010
Clomazone 3ME + *Pyrithiobac-Na 85SP + NIS*	0.75 0.033	Pre-Trans 4-Wks Post	0	2.5	7.5	13676
Clomazone 3ME + *Pyrithiobac-Na 85SP + NIS*	0.75 0.066	Pre-Trans 4-Wks Post	0	2.5	13.8	16828
Clomazone 3ME + *Bentazon 4L + NIS*	0.75 0.5	Pre-Trans 4-Wks Post	0	3.8	7.5	11425
Clomazone 3ME + *Bentazon 4L + NIS*	0.75 1.0	Pre-Trans 4-Wks Post	0	1.3	12.5	14826
LSD (0.05)			**4.0**	**5.2**	**12.8**	**7532**

Injury: 6/12 = stunting; 6/18 = stunting + chlorosis; 7/04 = stunting. Some reniform nematodes were present in the field and on pepper roots and may have influenced and reduced overall yields.

Results: Crop emergence was not significantly affected by treatment when herbicides were applied to the yellow-fleshed variety "Endora". However, when applied to the russet variety "Norkotah", there was a significant reduction in potato emergence for those plots treated with flumetsulam (16%) and s-metolachlor + halosulfuron (23%) compared to the handweeded control.

Percent crop injury in the variety Endora recorded on May 14 was significantly greater (though still only moderate) in plots treated with flumioxazin (0.062 lb a.i.), dimethenamid-P + halosulfuron, s-metolachlor + halosulfuron or flumetsulam when compared to the handweeded plots. This injury response continued through ratings recorded on June 13. With Norkotahs, crop injury recorded May 14 was significantly higher from the control only when the potatoes were treated with s-metolachlor + halosulfuron. However, by June 13 crop injury remained significant in those plots as well as increased in plots treated with halosulfuron (0.024 lb a.i.), dimethenamid-P + halosulfuron and with flumetsulam. Crop injury for Norkotahs continued to remain moderate and significantly different from the control when observed on July 15.

Control of Palmer amaranth (*Amaranthus palmeri*) was good to excellent when applied under field conditions for the variety Endora. Control was 90% or better for all treatments except flumetsulam, which still averaged 85%. However, control of Palmer amaranth in the Norkotah field was not as good as that observed with the Endoras. Weed control was greater than 90% with applications of halosulfuron, dimethenamid-P and their combination, sulfentrazone (0.14 lb a.i.) and s-metolachlor + halosulfuron. All other treatments gave good to marginal control of Palmer amaranth. Sulfentrazone applied at the low rate gave poor control (67.5%).

The results indicate that in general, the herbicides evaluated are relatively safe to potatoes, though under some conditions moderate and transient stunting may occur. Flumetsulam applications resulted in the greatest injury, while the combinations of s-metolachlor or dimethenamid-P plus halosulfuron increased crop injury over the two acetanilides alone. Good to excellent control was achieved by all these herbicides at the location where Endoras were grown, but several failed to adequately control Palmer amaranth at the Norkotah location. This response may be a result of differences in rainfall or irrigation and other grower practices for the individual fields. More research is needed to evaluate these herbicides and others alone or in combination for weed control and crop injury response, and future tests should evaluate yield response as well.

Table 3. The Effect of Delayed Preemergence Herbicides on Potato Crop Injury and Palmer Amaranth Control in Potatoes: 2003

Chemical	Rate / A	Timing	No. Emerged / Plot	% Injury May 14	% Injury June 13	% Control Palmer Amaranth June 13	No. Emerged / Plot	% Injury May 14	% Injury June 13	% Injury July 15	% Control Palmer Amaranth July 15
			——— Variety "Endora" ———				——— Variety "Norkotah" ———				
Untreated		SEASON LONG	37.5	0	0	0	36.8	0	0	0	0
Handweed		SEASON LONG	38.8	1.3	0	99.0	39.3	0	0	0	99.0
s-metolachlor 7.62E	1.0	DPRE	39.8	0	0	98.0	34.3	6.3	7.5	0	92.3
Flumioxazin 51WP	0.031	DPRE	41.8	5.0	0	96.0	37.0	3.8	0	3.8	81.0
Flumioxazin 51WP	0.062	DPRE	38.3	10.0	7.5	97.0	36.5	0	0	0	85.0
Halosulfuron 75WDG	0.024	DPRE	39.8	5.0	2.5	91.3	36.5	10.0	18.8	0	92.3
Halosulfuron 75WDG	0.048	DPRE	37.8	0	5.0	95.0	36.5	0	7.5	0	99.0
Dimethenamid-P 6E	0.75	DPRE	39.3	2.5	3.8	93.5	35.5	7.5	5.0	0	90.0
Dimethenamid-P 6E + *Halosulfuron 75WDG*	0.75 0.024	DPRE DPRE	39.0	12.5	10.0	96.0	37.8	3.8	18.8	5.0	96.8
Sulfentrazone 75WDG	0.094	DPRE	38.0	0	0	93.8	36.0	5.0	5.0	0	67.5
Sulfentrazone 75WDG	0.14	DPRE	41.3	6.3	0	95.8	38.0	0	2.5	3.8	94.8
Flufenacet 60DF	0.3	DPRE	39.3	0	0	91.3	37.5	2.5	0	2.5	83.8
S-metolachlor 7.62E + *Halosulfuron 75WDG*	1.0 0.024	DPRE DPRE	39.5	10.0	10.0	96.0	30.0	16.3	18.8	15.0	97.0
Flumetsulam 80WDG	0.05	DPRE	40.5	11.3	12.5	85.0	32.8	8.8	21.3	11.3	77.5
LSD (0.05)			**4.1**	**9.9**	**7.5**	**4.1**	**5.8**	**12.3**	**8.0**	**7.9**	**11.7**

Note: No harvest data available.

Postemergence Herbicide Effects on Injury and Yield of Norkotah Potatoes: 2003

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Final Report

Objective: to evaluate and compare the efficacy and phytotoxicity of selected postemergence herbicide treatments potatoes (*Solanum tuberosum* var. *Norkotah*).

Materials and Methods: The trial was conducted land owned by Springlake Potatoes (Bruce Barrett, cooperator) in Springlake, TX on a sandy loam soil with an average pH of ( ) and less than 1% organic matter. The trial site was prepared according to standard grower practices by applying a pre-plant fertilizer, then disking and planting potatoes into 2-row plots. The potato seed pieces were planted in the field on March 21 in plots measuring 6' x 20'. Prior to crop emergence, a preemergence application of pendimethalin (0.62 lb a.i.) was applied by the grower through the center pivot irrigation system. Herbicide treatments were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Application data can be found in Table 1 below for the postemergence treatments. The field containing the plots was irrigated as needed, and plots maintained insect and disease-free by the grower. Potatoes were dug and harvested by hand on August 6. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference (α = 0.05).

Table 1. Application Data for Postemergence Herbicides

Location	Springlake, TX	Wind speed / direction	5 – 10 mph /SE
Date	May 18, 2003	Crop	Potatoes
Time of day	6:30 p.m.	Variety	Norkotah Russets
Type of application	Broadcast	Crop stage	12" – almost flowering
Carrier	Water	Air temp. (°F)	88
Gas (if not CO_2)	CO_2	Soil temp. (°F)	74
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Moist
Nozzle tips	8002VS	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Partly cloudy
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: Crabgrass (< 1"); Careless weed (1 – 2")			

Results: Significant crop injury (stunting + chlorosis) was observed June 9 in plots treated with flumioxazin (both rates) and mesotrione following postemergence applications. Moderate injury was observed with halosulfuron and trifloxysulfuron treatments. However, by July 1, crop injury was 7.5% or less for all treatments except where trifloxysulfuron and mesotrione were applied. Pendimethalin failed to adequately control either careless weed or crabgrass in this trial. Careless weed control was excellent (90% or better) when trifloxysulfuron, rimsulfuron and flumioxazin were applied, but was somewhat lower with treatments including halosulfuron. Control was poor where clethodim was applied alone or where mesotrione was used. Crabgrass control was also poor in halosulfuron plots (an indication that the weeds may have been to large at time of application), but improved to 85% or better with all other treatments except where pendimethalin was applied alone.

Potato yields were significantly reduced in plots treated with trifloxysulfuron (both rates) and those plots had the lowest weights of US No. 1's and highest weights of culls (misshapen tubers). Low yields were also observed with mesotrione, most likely a result of severe early injury. Plots treated with the high rate of halosulfuron also had reduced yields when compared pendimethalin alone. Finally, while low yields were observed when the low rate of flumioxazin was applied, the higher rate had yields not significantly different from the control plots, thus it is likely an anomaly and not an effect from the herbicide. The results of this study show that halosulfuron applied postemergence at 0.024 lb a.i. is safe on potatoes, though weed control may be somewhat reduced. Likewise, rimsulfuron applied with and without clethodim showed good safety and excellent postemergence weed control. Continued research is needed to further investigate postemergence options for weed control in potatoes grown on the Texas High Plains.

Table 2. The Effect of Postemergence Herbicide Treatment on Potatoes (var. Norkotah)

Chemical	**Rate lbs a.i. / A**	**Timing**	**% Injury June 9**	**% Injury July 1**	**% Control Careless Weed July 1**	**% Control Crab-grass July 1**	**Total Yield (Cwt/A)**	**US No. 1 (Cwt/A)**	**Culls (Cwt/A)**
Pendimethalin 3.3EC	0.62	PRE	0	0	0	0	204.6	182.5	2.9
Halosulfuron 75WDG	0.024	POST	10.0	7.5	88.8	75.0	194.4	160.3	1.9
Halosulfuron 75WDG + Clethodim 2EC	0.024 0.188	POST	0	2.5	81.3	76.3	187.9	156.9	1.5
Halosulfuron 75WDG	0.048	POST	0	7.5	85.0	68.8	151.8	123.0	1.7
Trifloxysulfuron 75WG	5.3 g	POST	7.5	13.8	96.0	88.8	108.9	21.8	75.1
Trifloxysulfuron 75WG	7.9 g	POST	8.8	22.5	93.5	93.5	96.6	16.2	65.4
Rimsulfuron 25DF	0.023	POST	0	0	93.8	92.5	165.4	135.1	8.0
Rimsulfuron 25DF + Clethodim 2EC	0.023 0.188	POST	0	0	96.0	97.0	194.9	173.1	1.9
Flumioxazin 51WDG	0.048	POST	16.3	2.5	95.0	89.8	115.5	93.7	3.6
Flumioxazin 51WDG	0.096	POST	21.3	3.8	98.0	88.8	169.2	147.2	0
Clethodim 2EC	0.188	POST	0	5.0	65.0	92.5	171.4	148.9	1.5
Mesotrione 4SC	0.094	POST	80.0	17.5	62.3	86.3	147.4	82.8	13.3
LSD (0.05)			**8.8**	**12.0**	**16.2**	**14.5**	**45.6**	**45.3**	**24.3**

Note: The entire trial had pendimethalin (0.62 lb a.i.) applied PRE through the center pivot after planting. A non-ionic surfactant (NIS) was applied at 0.25% v/v with all treatments.

Postemergence Herbicide Effects on Injury and Yield of Red LaSoda Potatoes: 2003

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Final Report

Objective: to evaluate and compare the efficacy and phytotoxicity of selected postemergence herbicide treatments potatoes (*Solanum tuberosum* var. *Red LaSoda*).

Materials and Methods: The trial was conducted land owned by Springlake Potatoes (Bruce Barrett, cooperator) in Springlake, TX on a sandy loam soil with an average pH of ( ) and less than 1% organic matter. The trial site was prepared according to standard grower practices by applying a pre-plant fertilizer, then disking and planting potatoes into 2-row plots. The potato seed pieces were planted in the field on March 21 in plots measuring 6' x 20'. Prior to crop emergence, a preemergence application of pendimethalin (0.62 lb a.i.) was applied by the grower through the center pivot irrigation system. Herbicide treatments were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Application data can be found in Table 1 below for the postemergence treatments. The field containing the plots was irrigated as needed, and plots maintained insect and disease-free by the grower. Potatoes were dug and harvested by hand on August 6. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Application Data for Postemergence Herbicides

Location	Springlake, TX	Wind speed / direction	5 – 10 mph /SE
Date	May 18, 2003	Crop	Potatoes
Time of day	6:30 p.m.	Variety	Red LaSoda
Type of application	Broadcast	Crop stage	12" – almost flowering
Carrier	Water	Air temp. (°F)	88
Gas (if not CO_2)	CO_2	Soil temp. (°F)	74
GPA	20	Soil beneath	Moist
PSI	30	Soil surface	Moist
Nozzle tips	8002VS	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Partly cloudy
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: Crabgrass (< 1"); Careless weed (1 – 2")			

Results: Significant crop injury (stunting + mild chlorosis) was observed June 9 in plots treated with flumioxazin (high rate) and mesotrione following postemergence applications. All other recorded injury from the herbicide treatments were not significant and were 7.5% or less. However, by July 1, crop injury increased slightly for treatments of trifloxysulfuron, and that of flumioxazin (high rate) and mesotrione were almost non-existent. Pendimethalin alone failed to adequately control either careless weed or crabgrass in this trial. Careless weed control was excellent (90% or better) in all plots except when clethodim and mesotrione were applied alone, and where clethodim + low rate halosulfuron were applied. Crabgrass control was excellent in all plots except where halosulfuron + clethodim was applied (though it was still good at 85%).

Total tuber yields were significantly reduced in plots treated with halosulfuron + clethodim and halosulfuron (high rate), trifloxysulfuron (high rate), flumioxazin (both rates), and mesotrione. Only the treatments of rimsulfuron applied alone or in combination with clethodim, halosulfuron alone and clethodim alone had no reduction in yields when compared to pendimethalin. While pendimethalin plots contained the most weeds, these were not competitive enough to reduce yields. The majority of crop injury ratings in this study were not significantly high, and weed control was generally considered good, thus, this indicates that Red LaSoda potatoes may be more sensitive to these herbicides applied postemergence than other varieties (e.g. Norkotah). Therefore, more research is needed to evaluate earlier timings and reduced rates of these herbicides if they are to be used in this particular potato variety.

Table 2. The Effect of Postemergence Herbicide Treatment on Potatoes (var. Red LaSoda)

Chemical	Rate lbs a.i. / A	Timing	% Injury June 9	% Injury July 1	% Control Careless Weed July 1	% Control Crab-grass July 1	Total Yield (Cwt/A)	US No. 1 (Cwt/A)	Culls (Cwt/A)
Pendimethalin 3.3EC	0.62	PRE	0	0	0	0	461.4	375.7	4.6
Halosulfuron 75WDG	0.024	POST	5.0	7.5	91.3	99.0	415.2	342.1	0
Halosulfuron 75WDG + Clethodim 2EC	0.024 0.188	POST	0	2.5	88.8	84.8	305.0	252.0	3.6
Halosulfuron 75WDG	0.048	POST	2.5	6.3	97.0	96.0	371.6	318.6	0
Trifloxysulfuron 75WG	5.3 g	POST	0	6.3	97.0	98.0	398.3	300.0	4.1
Trifloxysulfuron 75WG	7.9 g	POST	0	12.5	98.0	99.0	303.0	164.0	84.5
Rimsulfuron 25DF	0.023	POST	0	0	99.0	98.0	454.6	391.7	0
Rimsulfuron 25DF + Clethodim 2EC	0.023 0.188	POST	0	0	96.0	99.0	444.5	384.7	3.1
Flumioxazin 51WDG	0.048	POST	2.5	0	98.0	98.0	360.7	297.5	0
Flumioxazin 51WDG	0.096	POST	20.0	5.0	99.0	97.0	357.7	254.2	0
Clethodim 2EC	0.188	POST	7.5	0	74.8	99.0	397.6	344.4	0
Mesotrione 4SC	0.094	POST	55.0	1.3	81.3	96.0	289.3	165.6	1.7
LSD (0.05)			**11.3**	**6.2**	**11.3**	**9.9**	**88.5**	**95.0**	**12.8**

Note: The entire trial had pendimethalin (0.62 lb a.i.) applied PRE through the center pivot after planting. A non-ionic surfactant (NIS) was applied at 0.25% v/v with all treatments.

Evaluation of Herbicide Treatments on Crop Injury in Tomatoes: 2003

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Final Report

Objective: to evaluate and compare the phytotoxicity of selected herbicide treatments on the growth of tomatoes (*Lycopersicon esculentum*).

Materials and Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center located in Lubbock on an Acuff clay loam soil with an average pH of 7.6 and 1.1% organic matter. The trial site was plowed in the fall and the soil prepared by applying a pre-plant fertilizer (50 lbs / A nitrogen) and then disking and listing furrows into the soil. Tomatoes (var. "Homestead") were seeded in the greenhouse on March 31 and transplanted into the field on May 17 in single row plots at a spacing of 18". Plot sized measured 6" x 15' and contained 7 plants / plot. Supplemental fertilizer was broadcast on June 17 at 30 lbs N / A, and then irrigated in. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI. Application data can be found in Tables 1 and 2 below for the pre-transplant and postemergence treatments, respectively. Plots were furrow-irrigated as needed during the season. The test was discontinued after the first rating as curly top virus became widespread throughout the test site and the majority of plants died. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Application Data for Pre-transplant Herbicides

Location	Lubbock	Wind speed / direction	0
Date	May 17, 2003	Crop	Tomatoes
Time of day	11:00 a.m.	Variety	Homestead
Type of application	Broadcast	Crop stage	
Carrier	Water	Air temp. (°F)	79
Gas (if not CO_2)	CO_2	Soil temp. (°F)	72
GPA	20	Soil beneath	Semi-dry
PSI	30	Soil surface	Dry / cloddy
Nozzle tips	Teejet 8002VS	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Table 2. Application Data for Postemergence Treatments

Location	Lubbock	Wind speed / direction	5 – 10 mph / S
Date	June 7, 2003	Crop	Tomatoes
Time of day	8:30 a.m.	Variety	Homestead
Type of application	Broadcast	Crop stage	10 – 12"
Carrier	Water	Air temp. (°F)	65
Gas (if not CO_2)	CO_2	Soil temp. (°F)	60
GPA	20	Soil beneath	Wet
PSI	30	Soil surface	Moist
Nozzle tips	Teejet 8002VS	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Clear
Boom width (")	6.5' / 3.25'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

Results: Significant crop injury (compared to untreated) was observed on June 11 in plots treated with pre-transplant applications of trifloxysulfuron, flumioxazin, sulfentrazone and dimethenamid-P. Injury symptoms for trifloxysulfuron, sulfentrazone and flumioxazin included generalized stunting and slight curling of the leaves, while that for rimsulfuron and halosulfuron was a general yellowing of the leaves. The tomato trial was discontinued on June 25 due to severe curly top virus infections that were widespread throughout the trial area. There were very few weeds present at the rating on June 11, and no weed control data is available.

Table 3. Crop Injury Results for Pre- and Post-Applied Herbicides in Tomatoes

Trt #	Chemical	Rate lbs a.i. / A	Timing	% Crop Injury 6/11/03
1	*Untreated*			0
2	*Flumioxazin 51WP*	2.0 oz prod.	PRE-TRANS	23.8
3	*Halosulfuron 75WDG + NIS*	0.024	21-Day POST	8.8
4	*Halosulfuron 75WDG + NIS*	0.032	21-Day POST	12.5
5	*Trifloxysulfuron 75WG*	0.014	PRE-TRANS	35.0
6	*Trifloxysulfuron 75WG + NIS*	0.014	POST-DIRECT	17.5
7	*s-Metolachlor 7.62E*	0.95	PRE-TRANS	13.8
8	*s-Metolachlor 7.62E +* *Rimsulfuron25DF + NIS*	0.95 2.0 oz prod.	PRE-TRANS POST	15.0
9	*Dimethenamid-P 6E*	0.75	PRE-TRANS	22.5
10	*Dimethenamid-P 6E +* *Rimsulfuron + NIS*	0.75 2.0 oz prod.	PRE-TRANS POST	12.5
11	*Sulfentrazone 75WDG*	0.15	PRE-TRANS	22.5
12	*Sulfentrazone 75WDG + NIS*	0.02	POST	20.0
LSD (0.05)				**18.0**

Herbicide Screen Evaluation for Weed Control and Crop Injury in Sweet Potatoes: 2003

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Final Report

Objective: to evaluate and compare the effects of EPOST herbicide applications for control of Palmer amaranth (*Amaranthus palmeri*) and crop injury in sweet potatoes (*Ipomoea batatas*) grown on the Texas High Plains.

Materials and Methods: The trial was conducted on land operated by Mr. Dick Cade, cooperator and owner of Cade Country Vegetable Farm located in Slaton. The trial was conducted on a silt loam soil and the trial site was plowed, disked and bedded accorded to standard grower practice. Cut sweet potato segments (var. "Beauregard") were transplanted on July 5. Early POST treatments of preemergence herbicides were applied on July 14 to plots measuring 6.67' x 20', with 2 rows of sweet potatoes per plot. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed at a rate of 20 GPA at 30 PSI (Table 1). On the day of application, weeds were removed by hand in the s-metolachlor, dimethenamid-P, and clomazone plots, but were left to evaluate postemergence control in the halosulfuron and flumioxazin plots. Plots were fertilized, cultivated and furrow-irrigated according to grower practice. A mid- to late-season wiper application of glyphosate was applied to large escaped weeds in the field. Sweet potatoes were dug by machine and picked up by hand, and weights recorded. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Table 1. Application Data for EPOST Preemergence Treatments

Location	Slaton, TX	Wind speed / direction	5 – 15 mph / SE
Date	7.14.03	Crop	Sweet potatoes
Time of day	9:00 a.m.	Variety	Beauregard
Type of application	Broadcast	Crop stage	6 – 8" (10 lvs)
Carrier	Water	Air temp. (°F)	80
Gas (if not CO_2)	CO_2	Soil temp. (°F)	79
GPA	20	Soil beneath	Dry
PSI	30	Soil surface	Dry / Compact
Nozzle tips	8002VS	% Relative humidity	Moderate
Nozzle spacing	18"	Sky conditions	Partly cloudy
Boom width (")	6.5'	# Replications	4
Boom height (")	18"	Sprayed by	RWW
Weeds present: None			

The researcher wishes to thank Mr. Dick Cade for his cooperation, time and assistance with this herbicide evaluation on his farm.

Results: There was no significant effect of herbicide treatments on the numbers of plants per plot (see Table 2). Early injury ratings (August 5) indicated only slight injury to the sweet potatoes from and of the herbicide treatments. Only dimethenamid-P was significantly greater than the untreated plots. Control of Palmer amaranth was best in plots treated with clomazone (both rates), flufenacet and dimethenamid-P. Good control was achieved from s-metolachlor and the high rate of flumioxazin. Poor control was recorded in plots treated with both rates of halosulfuron and the low rate of flumioxazin. However, by August 27, crop injury became more severe (significant at the 5% level) in plots treated with halosulfuron and the low rate of flumioxazin. Percent weed control ratings recorded on August 27 generally remained consistent with the earlier ratings. Halosulfuron injury was likely the result of the EPOST treatments being applied too early following transplanting (9 days instead of 21 days as recommended by manufacturer). However, weeds present in the grower's field at the time of application were also too large (3 – 10 inches tall) to be controlled by the halosulfuron or flumioxazin treatments.

Sweet potato yields were highest in plots treated with clomazone, flufenacet, s-metolachlor and dimethenamid-P. Halosulfuron-treated plots had yields significantly lower than those from the highest yielding treatment (clomazone), and this was likely a result of both crop injury and reduced weed control. Flumioxazin treatments also had somewhat reduced yields, but this was likely a function of weed control and not crop injury in this trial. Future research is needed to evaluate other timings of halosulfuron and flumioxazin applications as well as additional rates and combinations of flufenacet, dimethenamid-P, s-metolachlor and clomazone.

Table 2. Evaluation of Herbicides on Sweet Potato Injury and Control of Palmer Amaranth

Herbicide	Rate lb a.i. / A	Timing**	No. Plants / Plot	% Crop Injury 8/5	% Control AMAPA 8/5	% Crop Injury 8/27	% Control AMAPA 8/27	Yield lbs / A
Untreated			20.0	0	0	0	0	12515
Clomazone 3ME	1.5 pts	EPOST	19.3	5.0	89.8	0	91.0	20066
Clomazone 3ME	2.5 pts	EPOST	21.8	8.8	91.3	3.8	92.0	17707
Flufenacet 4SC	0.3	EPOST	22.0	0	96.0	0	97.0	17968
s-Metolacholor 7.62E	2.0	EPOST	20.8	0	87.5	2.5	91.3	17617
Dimethanmid-P 6E	0.75	EPOST	20.3	10.0	92.3	2.5	88.5	18907
Halosulfuron 75WDG + NIS	0.024	EPOST	20.5	2.5	68.8	30.0	72.5	11519
Halosulfuron 75WDG + NIS	0.048	EPOST	22.8	0	30.0	56.3	50.0	7086
Flumioxazin 51WDG + NIS	0.064	EPOST	21.8	0	66.3	25.0	71.3	14425
Flumioxazin 51WDG + NIS	0.09	EPOST	20.8	3.8	80.0	8.8	86.3	15372
LSD (0.05)			3.8	9.6	22.1	13.8	14.7	6258.4

** Nine days after planting.

Evaluation of Watermelon Varieties Grown on the Texas High Plains

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Final Report

Objective: To evaluate variety characteristics and yield potential of watermelons grown on black plastic mulch on the Texas High Plains as part of the Statewide Watermelon Project.

Materials and Methods: The trial area was prepared according to standard practices by disking the soil, fertilizing, bed shaping and burying drip irrigation lines (approximately 6" deep) prior to laying plastic mulch. The beds measured approximately 36" wide on 80" centers, with plots measuring 8' x 30'. Sunflowers (Var. "Triumph") were planted along side and in between 4 rows of plastic to act as windbreaks during the early season. Watermelon varieties were grown in the greenhouse in soil-less media (Ball Growing On Mix) for approximately 3 weeks, and then transferred outside for hardening. Twenty-seven varieties were transplanted on May 16 using a single-row transplant unit that pressed holes into the plastic mulch at a distance of 3' between plants. The variety "Legacy" (Willhite) was planted randomly within the trial site to provide a source of pollen for the seedless varieties. Fungicide and insecticide maintenance sprays were applied using a CO_2 backpack sprayer equipped with a hand-held boom containing 4 hollow cone nozzles delivering 20 GPA at 40 PSI. Weeds were removed by hand from either the planted hole or from around the edge of the plastic. Dual Magnum (0.65 lb a.i./A) was sprayed to the non-crop area between the plastic. The trial was irrigated and fertilized as needed during the season. All watermelons were harvested and graded by hand on August 4. Comments for various varieties were noted and photographs of each variety were taken. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Results: No beehives were obtained for this trial during 2003 and this may have influenced yields this year, though bee activity was considered moderately good during most of the season. Sunflowers provided an excellent windbreak during the early season however, when flowering, the sunflowers were very attractive to the natural bee population, and thus they were mowed down during early July.

Watermelon variety yield, appearance and ranking can be found in Table 1. The top five yielding varieties for 2003 included Sweet Slice, a seedless, red-fleshed variety from Willhite; Sunny (Willhite), a yellow-fleshed seedless variety; Royal Sweet (Peto Seed), a red-fleshed hybrid; WX28 (Willhite), a seedless variety; and Palomar (Syngenta) a small, red-fleshed, seedless variety. Varieties that had the lowest yields during this trial included Vertigo and 5015 from Hazera, Sugar Slice and Rojo Grande from Willhite, and Summerflavor 800 from Abbott & Cobb. For further information on watermelon varieties and their performance across the state of Texas, please contact Texas Cooperative Extension.

Table 1. Yield, Ranking and Comments on Watermelon Varieties Grown in Lubbock

Variety	Type	Source	Comments	Yield (lbs/A)	Rank
Super Seedless 7167	T	A & C	10 – 12", light green w/ white stripes, light red flesh	42030	12
Super Seedless 7177	T	A & C	11 – 12", light green, wide stripes, thick rind, red flesh	44241	11
Super Seedless 7187	T	A & C		NA	NA
Summerflavor 810	T	A & C	18 – 20", dark green, dark red flesh, some seeds	32670	20
Summerflavor 800	T	A & C		29811	22
DRX 4040	H	De Ruiter		37775	17
Vertigo	T	Hazera	16 – 18", dark green w/ medium stripe, good red flesh color	18280	26
Dillion	T	Hazera	12", light green w/ wide stripes, dark red flesh, few seeds	45699	10
5015	T	Hazera		23958	25
Royal Sweet	H	Peto Seed	16", medium green w/ light green stripes, medium red flesh	55539	3
Tri-X 313	T	Syngenta	14", light green, wide stripes, nice red flesh, some seeds	50366	7
Carousel	T	Syngenta		NA	NA
Palomar	T	Syngenta	10 – 12", medium green w/ dark thin stripes, nice red flesh color	51387	5
Sweet Delight	T	Syngenta	12 – 13", light green, wide stripes, medium red flesh, good appearance	47984	9
Legacy	H	Willhite		38660	16
Legacy	H	Willhite		30628	21
Campeche		Shamrock	16 – 18", dark green w/ thin stripes, red flesh, seeded	33215	19
Samba	T	Shamrock	12 – 13", light green w/ wide stripes, light red flesh	50877	6
Dulce	H	Willhite	18 – 20", dark green w/ wide stripes, good red flesh, large seeds	49413	8
Gold Strike	H	Willhite	14 – 16", med. green w/ light stripes, few small seed, orange flesh	41518	13
Ole	H	Willhite	18", dark green w/ thin stripes, red flesh w/ large seeds	39204	14
Rojo Grande	H	Willhite	Small seed	28042	23
WX 264	H	Willhite	Large seed	33215	18
Sugar Slice	T	Willhite	10 – 12", light green, striped, red flesh	26317	24
Sunny	T	Willhite	14", dark green, thin striped, yellow flesh	57002	2
Sweet Slice	T	Willhite	12", light green, wide stripe, thin rind, good red color	63525	1
WX 28	T	Willhite		54110	4
Sugarheart	T	Zeraim Gedera	10 – 12", light green, med. stripe, red flesh, a few seeds	38932	15
			LSD (0.05)	**27992**	

Biological Seed and Soil Drench Treatments for Spinach in the Wintergarden Area: 2002

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Final Report

Objective: To evaluate the effects of biological seed and soil drench treatments applied once or twice on spinach crop growth and vigor (See Table 1 for list of biologicals used).

Materials & Methods: The trial was conducted at the Del Monte Ag Research Farm located northeast of Crystal City, TX on FM 1025. The soil was a clay loam (35% clay) with an average pH of 8.1 and less than 2% organic matter. Fertilizer was applied and disked in prior to planting at 80, 100, 0, 5, 7, 4 and 30 lbs./A for nitrogen, phosphorus, potassium, magnesium, zinc, manganese, and sulfur, respectively. Del Monte seed, variety DMC 66-09 was planted October 4, 2002 using a small plot gravity-fed cone seeder at commercial spacing (8 seeds / linear foot) and depth. Spinach seed was planted into single rows on previously formed beds centered at 40-inches apart and each plot measured 3.3 x 15 ft. Immediately following planting, an application of Dual Magnum was broadcast to the entire test site to minimize weed pressure. Nitrogen was applied a second time at 50 lbs/A in early November.

The biological seed treatments were applied to 3.0 grams of seed the previous day by placing seed and the appropriate amount of product into a plastic Ziploc bag and shaking until uniformly coated. Soil drench treatments were applied immediately after planting over the planted row in the plots using a single nozzle CO_2-pressurized backpack sprayer and hand-held boom[7] that delivered 100 gallons per acre at 15 psi and at a speed of 3 mph (Table 2). The entire test site was irrigated immediately following soil drench application with 1.0" of water.

The plots were planted in a randomized complete block design (RCBD) with 15 treatments (Table 3) replicated 10 times. Crop vigor ratings were recorded by treatment (24 and 43 days after initial treatment (DAT) from visual assessments in the field.

All standard crop production management and pest control measures were utilized as needed during the growing season. Periods of heavy rainfall followed planting and treatment application within 48 hours. This was followed by other periods of heavy rainfall during the duration of the trial. During October there was found to be widespread feeding from white grubs on the roots of the spinach that reduced stands by 2.9%. An insecticide treatment was applied to reduce additional damage to the crop from this pest. However, on December 6 it was also noted that the spinach crop was severely infested with beet yellow curly top virus. No further usable data were recorded from the test site area.

[7] R & D Sprayers, Opelousas, LA

Table 1. Description of Products Used for Spinach Biological Seed and Drench Applications

Products	**Description of active ingredient**
Thiram only	
T-22 HC	*Trichoderma harzianum* Strain T-22
G-41 / ABM 127	*Trichoderma* (formerly *Gliocladium*) *virens* Strain G-41
Taegro	*Bacillus subtilis* Strain FZB24
Actinovate Plus	*Streptomyces lydicus*
Companion	*Bacillus subtilis* Strain GB03
MycoStop	*Streptomyces griseoviridis*
PreStop	*Gliocladium catenulatum*
SC-27	Combination of species of *Bacillus* and *Streptomyces*
Vitazyme	Nutrient cocktail
SuperBio AgBlend	Nutrient and bacterial cocktail

** All seed treatments also contained Thiram as a manufacturer's chemical standard.

Table 2. Field and Weather Information at the Time of Application

Application Data	Treatment 1	Treatment 2
Date	October 4	November 14
Time of day	2:00 p.m.	11:00 a.m.
Sky	15% cloud cover	75% cloud cover
Relative humidity	High	Moderately high
Soil temperature (°F)	82	60
Soil surface	Firm, compact	Moist
Soil beneath	Dry	Wet
Air temperature (°F)	85	65
Wind Speed (mph/direction)	0 – 5 / NW	0 - 5
Crop size	Just seeded	6 – 7 leaves

Table 3. List of Treatments for Spinach Biological Seed and Drench Applications

Trt #	Product**	Timing	Rate
1	Thiram only	Manufacturer applied	Chemical Standard
2	T-22 HC	Seed treatment at planting	1.1 g/lb seed
3	G-41 / ABM 127	Seed treatment at planting	1.1 g/lb seed
4	T-22 HC + G-41/ABM 127	Seed treatment at planting	0.55 g/lb seed + 0.55 g/lb seed
5	T-22 HC + Taegro	Seed treatment at planting	1.1 g/lb seed + 4.0 g/lb seed
6	Taegro	Seed treatment at planting	4.0 g/lb seed
7	Actinovate Plus + Actinovate Plus	Banded at planting + Post soil drench	4.0 g/lb seed + 18.0 oz/A in 100 gal
8	Companion + Companion	Banded over the row at planting + Post soil drench	32.0 oz/A in 100 gal + 32.0 oz/A in 100 gal
9	MycoStop	Seed treatment at planting	2.3 g/lb seed
10	PreStop	Seed treatment at planting	4.0 g/lb seed
11	SC-27	Banded over the row at planting	16.0 oz/A in 100 gal
12	SC-27 + SC-27	Banded over the row at planting + Post soil drench	16.0 oz/A in 100 gal + 16.0 oz/A in 100 gal
13	Vitazyme	Seed soak 1 day prior to planting	5% soak for 15 minutes
14	Vitazyme + T-22 HC + Vitazyme	Seed soak 1 day prior to planting + Seed treatment at planting + Post soil drench	5% soak for 15 minutes + 1.1 g/lb seed + 13.0 oz/A in 100 gal
15	SuperBio AgBlend + SuperBio AgBlend	Banded over the row at planting + Post soil drench	1.0 gal/A in 100 gal + 1.0 gal/A in 100 gal

** All seed treatments also contained Thiram as a manufacturer's chemical standard.

Results and Discussion: Crop emergence evaluations by treatment recorded 24 days after planting (DAP) showed significant differences between treatments (see Table 4). The highest emergence rate was found with seeds treated with PreStop (43.7 plants/ 4 feet of row) and the soil drench treatment SuperBio AgBlend (43.5 plants/4-ft row). This resulted in an average 12% increase, though not significantly higher than the chemical treatment alone.

The majority of the biological treatments did not significantly affect spinach emergence compared to the standard chemical alone treatment. However, Vitazyme-treated seed that were soaked with the 5% v/v solution prior to planting had an average 18% reduction in emergence (significant at 0.05 level). This was more than likely due a washing-off of the chemical fungicide from the seed coat prior to biological seed treatment and planting that reduced its activity. This would not be a recommended method of treatment for spinach seed treated previously with a chemical.

Crop vigor ratings recorded 24 DAP showed that the addition of the biological treatments SuperBio AgBlend and Companion significantly increased vigor when compared to the chemical standard alone. All other biological treatments did not differ from the chemical standard, though Taegro, Vitazyme and Vitazyme + T-22 HC had ratings that were 22, 22 and 20%, respectively, less than the standard.

At 41 DAP Taegro alone treatments continued to show a reduction (24%) in crop vigor ratings compared to the chemical standard. Similarly, Vitazyme and Vitazyme + T-22 HC treatments gave a significant reduction in crop vigor by 29 and 25%, respectively. It is not known why Taegro treatments would reduce spinach crop vigor and further investigations are needed. Reduced crop vigor with Vitazyme treatments again is likely due to the washing off of the Thiram chemical seed treatment during the seed soak procedure.

An increase in spinach crop vigor and growth was observed with the SuperBio AgBlend at 41 DAP. This was the only treatment to significantly improve spinach vigor in this test. Spinach in Companion-treated plots 41 DAP did not continue to have a significant increase in growth compared to the chemical standard, but by this time had equivalent ratings. Further investigations are needed with these and other biological treatments to evaluate their potential use as seed and soil drench treatments in spinach, and to verify the consistency of results.

Table 4. Spinach Emergence and Crop Vigor Ratings for the Biological Seed and Soil Drench Treatments

Treatment**	# Emerged / 4 row ft 24 DAP	Vigor 24 DAP	Vigor 41 DAP
Chemical Standard	38.5 ab	1.73 cde	2.68 bc
T-22 HC	37.1 bc	2.00 abc	2.50 bcd
G-41 (ABM 127)	42.1 ab	1.93 abcd	2.65 bc
T-22 HC + G-41 (ABM 127)	37.6 bc	1.73 cde	2.65 bc
T-22 HC + Taegro	39.3 ab	1.78 bcde	2.63 bc
Taegro	38.7 ab	1.35 e	2.03 de
Actinovate Plus + Actinovate Plus	39.4 ab	1.93 abcd	2.45 bcd
Companion + Companion	41.4 ab	2.27 ab	2.65 bc
MycoStop	39.4 ab	1.93 abcd	2.90 ab
PreStop	43.7 a	1.95 abc	2.70 bc
SC-27	37.4 bc	1.73 cde	2.35 cde
SC-27 + SC-27	39.0 ab	1.88 abcde	2.73 bc
Vitazyme	32.6 cd	1.35 e	1.90 e
Vitazyme + T-22 HC + Vitazyme	30.5 d	1.40 de	2.0 de
SuperBio AgBlend + SuperBio AgBlend	43.5 a	2.35 a	3.38 a
Mean	38.6	1.82	2.55
LSD (0.05)	**5.4**	**0.54**	**0.53**

** All seed treatments also contained Thiram as a manufacturer's chemical standard.
Vigor Ratings: 0 = dead; 1 = poor; 2 = fair; 3 = good; 4 = excellent.

Observation Trial of Biologicals on Foliar Characteristics in Seedless Watermelon: 2003

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Final Report

Objective: Seedless watermelon transplants often lack vigor and have reduced root and foliar growth. Therefore, a trial was set up to observe and evaluate selected biological products on foliar growth in a seedless watermelon variety grown for transplants.

Materials and Methods: The trial was conducted in the greenhouse located at the Texas A & M University Research & Extension Center located in Lubbock. Watermelon seeds (var. ACX 5408) were planted (two seeds per pot) approximately ½" deep on April 15 into 4" pots containing a soil-less peat mixture (*Ball Growing On Mix*) and immediately drenched until run-off with solutions of the individual biological treatments. The pots were placed randomly on a greenhouse bench with an acclimatized atmosphere of 93/75 °F day/night temperatures. All pots were watered daily or as needed during the trial period. The experimental design was a randomized complete block with 8 replications. Data collected included average germination per pot, vine length and leaf number, and foliage dry-weight (5 weeks after planting). All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Results: There were no significant differences between biological treatments in regards to average seed germination per pot for this trial (Table 1). However, there was a significant increase in watermelon vine length for Actinovate Soluble when compared to the untreated control. All other biologicals, except for Taegro showed a trend for increased vine length (10.0%), but none were significant from the untreated control. Average leaf numbers per plant also significantly increased with Actinovate Soluble compared to the untreated control, MycoStop and PlantShield treatments. Analysis of dry-weight foliar growth also demonstrated that Actinovate Soluble significantly increased growth when compared to the untreated control and MycoStop treatments. The results of this study indicate that for the seedless watermelon variety ACX 5408, drenching Actinovate Soluble in the pots following seeding can increase transplant growth. All other biological treatments, while showing some tendency towards increasing growth, did not do so significantly at the 5% level. Finally, more research is needed to determine whether similar results will occur with other seedless varieties and perhaps more importantly, to determine any potential benefits of root growth enhancement and crop vigor for seedless watermelons when planted into the field.

Table 1. Effect of Biologicals on Seedless Watermelon Foliar Growth Characteristics

Product	Active Ingredient	Rate (g/L)	Average Seedling Germination per Pot	Average Vine Length / Plant (cm)	Average Leaf No. / Plant	Dry-Weight of Foliage (g/plant)
Untreated			1.88	40.2	11.3	3.58
Actinovate Soluble	*Streptomyces lydicus*	0.45	1.75	49.0	15.1	4.29
MycoStop	*Streptomyces griseovirides*	10.0 g / 100 m^2	1.63	45.9	12.8	3.50
PlantShield	*Trichoderma harzianum*	0.3	1.75	44.3	12.4	3.86
Taegro	*Bacillus subtilis*	0.2	1.88	40.4	13.1	4.02
LSD (0.05)			**0.52**	**6.4**	**2.2**	**0.53**

Evaluation of Fungicides for Control of Powdery Mildew in Cantaloupes Grown on the Texas High Plains

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Final Report

The objective of this research was to evaluate and compare the efficacy of currently available fungicides for control of powdery mildew (*Sphaerotheca fuliginea*) on yield of cantaloupes grown on black plastic mulch on the Texas High Plains.

Materials and Methods: The trial area was prepared according to standard practices by disking the soil, fertilizing, bed shaping and burying drip irrigation lines prior to laying plastic mulch. The beds measured approximately 36" wide on 80" centers, with plots measuring 8' x 25'. Cantaloupe (var. AChaparral, [*Abbott & Cobb]*), a moderately susceptible variety to powdery mildew was transplanted on May 30 using a single-row transplant unit that pressed holes into the plastic mulch at a distance of 3' between plants. Biweekly fungicide applications began on July 10 and ended September 22. Fungicides were applied using a CO_2 backpack sprayer equipped with a hand-held boom containing 4 hollow cone nozzles delivering 20 GPA at 40 PSI. Weekly harvesting began on August 11 and continued until September 26. The presence of powdery was first observed September 1 on the leaves of untreated plants. Only one efficacy rating (% green foliage – an indication of healthy, non-diseased leaf tissue) was taken during the harvesting period due to the late onset of disease symptomology. No other diseases were observed in this trial. In addition, a post-harvest rating and photographs were recorded on October 9, as visual differences were still discernable between fungicide treatments. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using SAS (SAS Institute Inc., Cary, NC), and means were separated using the Least Significant Difference ($\alpha = 0.05$).

Results: Foliage ratings recorded on September 17 (Table 1) showed that Bravo Weatherstik and Procure had the highest percent green foliage compared to plants in the untreated control (significantly different at the 0.05% level). Quadris, and the two rates of MilStop averaged 33.8% green foliage or less and were not significantly different from the untreated plots. This pattern continued with the post-harvest ratings with Procure having the greatest level of green foliage (at that time. Both Quadris and MilStop failed to adequately control powdery mildew in this study.

Table 1: Foliage Ratings

Treatment	Rate (Amt / A)	% Green Foliage (September 17)	% Green Foliage (October 9)
Untreated		8.8	12.5
MilStop	5.0 lbs	7.5	20.0
MilStop	2.5 lbs	26.3	7.5
Quadris	13.0 fl oz	33.8	26.3
Bravo Weatherstik	32.0 fl oz	81.3	51.3
Procure 50WS	8.0 oz	66.3	57.5
LSD (0.05)		34.8	35.3

Cantaloupe yields were separated into three groupings for statistical analysis: (1) August harvest, (2) September harvest, and (3) overall total yield for the season. Analyses showed that prior to the first observation of powdery mildew on September 1, total fruit number for Quadris and Bravo-treated plots were significantly lower (Table 2) compared to the control (plot had highest fruit number and weight). Cantaloupe weight was significantly lower only for Bravo-treated plots compared to Procure, MilStop (low rate) and the control plots.

Cantaloupe yields recorded in September were not significantly different although yields in the control plots were the lowest for that time period. This was likely due to high degree of variation between plots.

Table 2: Cantaloupe fruit number and weight for August and September.

Treatment	Rate (Amount / Acre)	Fruit (No. / A)	Fruit Weight (lbs / A)	Fruit (No. / A)	Fruit Weight (lbs / A)
		August Harvest		September Harvest	
Untreated		11326	64529	6697	34712
MilStop	5.0 lbs	9692	56002	7024	37745
MilStop	2.5 lbs	10182	63826	8440	44709
Quadris	13.0 fl oz	7079	41420	7133	35834
Bravo Weatherstik	32.0 fl oz	6371	33923	6697	38583
Procure 50WS	8.0 oz	9964	62373	7787	46255
LSD (0.05)		**4142**	**25997**	**4044**	**19563**

Table 3: Total cantaloupe fruit numbers and yields.

Treatment	Rate (Amount / Acre)	Fruit (No. / A)	Fruit Weight (lbs / A)	Average Fruit Weight
Untreated		18023	99241	5.51
MilStop	5.0 lbs	16716	93747	5.63
MilStop	2.5 lbs	18622	108535	5.83
Quadris	13.0 fl oz	14212	77254	5.41
Bravo Weatherstik	32.0 fl oz	13068	72506	5.64
Procure 50WS	8.0 oz	17751	108628	6.25
LSD (0.05)		**7461**	**40788**	**0.66**

Finally, total yields did not differ significantly between fungicide treatments in this test, but there were some apparent trends. The lack of differences may be contributed to the late occurring infections of powdery mildew within the plots. MilStop treatments averaged 25% more fruit weight when compared to the average of Quadris and Bravo WeatherStik yields. Procure treated plots had the highest average fruit weight compared to any of the treatments and average fruit size (lbs/fruit) was significantly greater in the Procure-treated plots compared to the untreated control (a 12% increase).

The overall results indicate that while MilStop did not effectively control powdery mildew in this trial, that this did not result in a loss of potential yield when compared with the other chemical fungicides. Additionally, while Quadris and Bravo WeatherStik had better control during the season, this did not result in higher yields. Only Procure showed consistent powdery mildew control combined with high yields and is considered the best viable option for cantaloupes in this trial.

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Evaluation of Fungicides for Control of Powdery Mildew in Pumpkins Grown on the Texas High Plains

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Final Report

Objective: to evaluate and compare the efficacy of currently available fungicides for control of powdery mildew (*Sphaerotheca fuliginea*) on yield of pumpkins grown on the Texas High Plains.

Materials and Methods: The trial area was prepared according to standard grower practices by disking the soil, fertilizing and shaping beds with plots measuring 8' x 25'. Pumpkins (var. "Howden"), a very susceptible variety to powdery mildew, were planted June 4, and plants thinned to a distance of 3' for a total of 8 plants/plot. Biweekly fungicide applications began on July 7 and continued until just prior to harvest. Fungicides were applied using a CO_2 backpack sprayer equipped with a hand-held boom containing 4 hollow cone nozzles delivering 20 GPA at 40 PSI. The presence of powdery mildew was first observed August 13. Two efficacy ratings (% green foliage – an indication of healthy, non-diseased leaf tissue) were taken during the growing season to estimate disease control. No other diseases were observed in this trial, however; initial growth of the plants may have been reduced from the presence of reniform nematodes found on the roots during the growing season. The experimental design was a randomized complete block with 4 replications. All data were subjected to ANOVA using PRM Statistical Program and means separated using the Duncan's New Multiple Range Test ($\alpha = 0.05$).

Results: Foliage ratings recorded on August 27 (Table 1) showed that both rates of Procure were best for control of powdery mildew, while that of Quadris and MilStop were not significantly different from the untreated control. While Bravo WeatherStik was significantly better than the untreated, it was not acceptable. By September 19, the heavy infestation of powdery mildew on the leaves was not significantly improved by the use of any of the products. Overall yields were low, possibly due to the presence of nematodes, but more likely the result of the severe infestation by powdery mildew. Average commercial yields in the region would have been 3 – 4 times higher. However, Procure-treated pumpkins had an average 38% higher yield compared to the untreated control, while those treated with MilStop had an average 18% less. Quadris treatments also slightly improved yields in those plots. The results from this test indicate that Procure, especially at the higher rate is an acceptable control for powdery mildew on pumpkins, while MilStop and Bravo WeatherStik failed to control the disease. Weekly applications of MilStop and Bravo WeatherStik may have increased disease control in pumpkins, but that is a costly and unlikely alternative for commercial pumpkin growers on the Texas High Plains.

Table 1: Foliage Ratings and Yield

Treatment	Rate (Amt / A)	% Green Foliage (August 27)	% Green Foliage (September 19)	Total Yield (lbs / A)
Untreated		10.0 d	8.8 a	7640.4 a
MilStop	5.0 lbs	11.3 d	11.8 a	5717.3 a
MilStop	2.5 lbs	13.8 d	8.0 a	6784.5 a
Quadris	13.0 fl oz	22.5 cd	15.0 a	9622.4 a
Bravo Weatherstik	32.0 fl oz	35.0 c	17.5 a	7477.1 a
Procure 50WS	8.0 oz	75.0 a	22.5 a	15060.9 a
Procure 50WS	6.0 oz	57.5 b	18.8 a	9293.5 a

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